APPENDIX A CHAPTERS 1 TO 5

A.1: Environmental Scoping Document

ENVIRONMENTAL SCOPING DOCUMENT

HOPE DOWNS 2 PROPOSAL

1. Introduction

The Environmental Protection Authority (EPA) has determined that the above Proposal is to be assessed under Part IV of the *Environmental Protection Act 1986* (EP Act).

The purpose of the Environmental Scoping Document (ESD) is to define the form, content, indicative timing and procedure of the environmental review, required by s. 40(3) of the Act.

Hamersley HMS Pty Limited (the Proponent) has prepared this draft ESD according to the procedures in the EPA's *Procedures Manual*.

The EPA requires the Proponent to undertake the environmental review according to the procedures in the EPA's *Administrative Procedures* and *Procedures Manual*, and the *Instructions and Template: How to prepare an Environmental Review Document*.

Table 1: General Proposal and Proponent information

Proposal information	
Proposal name:	Hope Downs 2 Proposal
Proponent:	Hamersley HMS Pty Limited
Assessment number:	2316
Location:	The Hope Downs 2 Proposal is located approximately 80 km north-west of the township of Newman in the Pilbara region of Western Australia
Local Government Area:	Shire of East Pilbara
Public review period:	Environmental Review Document – 2 weeks
EPBC reference no:	EPBC 2021/9035

1.1. Indicative timing of the environmental review

Table 2 sets out the indicative outline of the timing of the environmental review (indicative timeline) agreed between the EPA and the Proponent.

Table 2: Indicative outline of the timing of the environmental review (indicative timeline)

Key Assessment Milestones	**Completion Date**
EPA approves Environmental Scoping Document	October 2022
Proponent submits first draft Environmental Review Document (ERD)	November 2022
EPA provides comment on draft Environmental Review Document (including Department of Climate Change, Energy, the Environment and Water [DCCEEW] comments) *(6 weeks from receipt of ERD)*	January 2023

Key Assessment Milestones	Completion Date
Proponent submits revised draft Environmental Review Document	March 2023
EPA authorises release of Environmental Review Document for public review *(2 weeks from EPA approval of ERD)*	April 2023
Proponent releases Environmental Review Document for public review for 2 weeks	May 2023
Close of public review period	May 2023
EPA provides Summary of Submissions *(3 weeks from close of public review period)*	June 2023
Proponent provides Response to Submissions	December 2023
EPA reviews the Response to Submissions (includes DCCEEW review) *(4 weeks from receipt of Response to Submissions)*	January 2024
EPA finalises Assessment Report (including two-week consultation on draft conditions) and gives report to Minister. Assessment Report (which includes draft Ministerial Statement) to be provided to DCCEEW *(6 weeks from completion of assessment)*	July 2024

1.2. Commonwealth Government approvals

The Proposal has been referred and was determined to be a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* on 21 December 2021 (EPBC 2021/9035) and is being assessed under an accredited process under section 87 of that Act. The relevant Matters of National Environmental Significance (MNES) for this Proposal include (at time of being determined a controlled action), but are not limited to, the following listed threatened species (s18 and 18A):

- Northern Quoll (*Dasyurus hallucatus*);
- Night Parrot (*Pezoporus occidentalis*);
- Ghost Bat (*Macroderma gigas*);
- Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia* [Pilbara Form]);
- Pilbara Olive Python (*Liasis olivaceus barroni*); and
- Grey Falcon (*Falco hypoleucos*).

This draft ESD includes work required to be carried out and reported on in the Environmental Review Document in relation to MNES. The Environmental Review Document will also address the matters in Schedule 4 of the *Environmental Protection and Biodiversity Conservation Regulations 2000* and will include consideration of relevant Commonwealth standards, policy and guidance (and justification provided where this guidance is not followed)

MNES that may be impacted by the Proposal will be identified and the potential impacts on these matters addressed within each relevant preliminary environmental factor identified in Table 3. Proposed offsets to address significant residual impacts on MNES will also be discussed in the Environmental Review Document.

2. Form and content (required work)

The EPA requires that the form of the report on the environmental review required under section 40 of the EP Act is in accordance with the *Instructions and Template: How to prepare an Environmental Review Document*.

The EPA requires that the content of the Environmental Review Document (ERD) is in accordance with the *Instructions and Template: How to prepare an Environmental Review Document*.

The EPA also requires that the environmental review includes the Proposal specific additional content outlined in Section 2.

The work required to inform the environmental review will be conducted in accordance with the requirements of EPA Environmental Factor Guideline and Technical Guidance for each preliminary key environmental factor.

2.1. Preliminary key environmental factors

The preliminary key environmental factors to be addressed in the ERD are:

1. Flora and Vegetation
2. Terrestrial Fauna
3. Subterranean Fauna
4. Inland Waters
5. Social Surroundings
6. Greenhouse Gas Emissions

2.2. Specific additional work required for assessment of Proposal

The general form and content of the ERD will be in accordance with the *Instructions and Template: How to prepare an Environmental Review Document*.

Table 3 outlines the Proposal specific additional work required as it relates to preliminary key environmental factors.

A Mine Closure Plan will be submitted with the ERD, which includes consideration of final landforms and rehabilitation, consistent with the *Statutory guideline for mine closure plans* (DMIRS, March 2020) and *Mine Closure Plan Guidance – How to Prepare in Accordance with Part 1 of the Statutory Guidelines* (DMIRS, March 2020).

Table 3: Proposal specific additional required work

Flora and Vegetation	
Required work	1. Determine and quantify any significant residual impacts by applying the Residual Impact Significance Model and WA Environmental Offsets Guidelines (2014, or any subsequent revisions). Where significant residual impacts remain, propose an appropriate draft offsets package with due consideration to the WA Environmental Offsets Policy and Guidelines (or any subsequent revisions). 2. Where a contribution to the Pilbara Environmental Offsets Fund is proposed to offset the significant residual impacts, provide an impact reconciliation procedure prepared in accordance with the Instructions on how to prepare *Environmental Protection Act 1986* Part IV Impact Reconciliation Procedures and Impact Reconciliation Reports and the Template for *Environmental Protection Act 1986* Part IV Reconciliation Procedures (or any subsequent revisions).
Terrestrial Fauna	
Required work	1. Prepare an Environmental Management Plan, in accordance with the requirements of EPA *Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans* (2020 or any subsequent revisions), that describes any proposed management and/or monitoring plans that will be implemented pre- and post-construction to ensure residual impacts (direct and indirect) are not greater than predicted. Where a buffer zone is proposed, discussion should include an evaluation of the appropriateness of the proposed buffer in terms of the size of the buffer and the relevant characteristics of the buffer area as it relates to significant species. 2. Determine and quantify any significant residual impacts by applying the Residual Impact Significance Model and WA Environmental Offsets Guidelines (2014, or any subsequent revisions). Where significant residual impacts remain, propose an appropriate draft offsets package with due consideration to the WA Environmental Offsets Policy and Guidelines (or any subsequent revisions). 3. Where a contribution to the Pilbara Environmental Offsets Fund is proposed to offset the significant residual impacts, provide an impact reconciliation procedure prepared in accordance with the Instructions on how to prepare *Environmental Protection Act 1986* Part IV Impact Reconciliation Procedures and Impact Reconciliation Reports and the Template for *Environmental Protection Act 1986* Part IV Reconciliation Procedures (or any subsequent revisions). 4. Where significant residual impacts to MNES remain and contributions to the Pilbara Environmental Offsets Fund are not proposed, include a discussion of the consideration of the *EPBC Environmental Offsets Policy*
Subterranean Fauna	
Required work	1. Determine and quantify any significant residual impacts by applying the Residual Impact Significance Model and WA Environmental Offsets Guidelines (2014, or any subsequent revisions). Where significant residual impacts remain, propose an appropriate draft offsets package with due consideration to the WA Environmental Offsets Policy and Guidelines (or any subsequent revisions). 2. A consolidated report of the surveys undertaken including the integrated results of the surveys (one consolidated report for stygofauna and another for troglofauna). If previous surveys are relied on for context, justification will be provided to demonstrate they are relevant and consistent with EPA guidance. 3. Provide 2D habitat modelling. 4. If new/alternative habitat modelling techniques are used, a peer review will be undertaken and provided.
Inland Waters	
Required work	1. Provide a detailed description of the design and location of the Proposal as it relates to potential impacts to surface or groundwater.

	2. Provide an assessment of water supply options (including water sources external to the Proposal) to determine suitability of options. 3. Provide a hydrogeological assessment for the Proposal (including groundwater modelling) to assess potential impacts to groundwater dependent ecosystems, including Ben's Oasis.
Social Surroundings (Aboriginal heritage and culture)	
Required work	1. Provide evidence and details of consultation with relevant stakeholders, including outcomes of those consultation. Demonstrate how issues raised through consultation have been addressed and specify how the Proponent will minimise impacts to social, cultural and heritage values within and directly adjacent to the Development Envelope. 2. Prepare a draft Social, Cultural and Heritage Management Plan (SCHMP) for each Traditional Owner group, in consultation with each group, where potential significant impacts to cultural social values related to the environment require management. The SCHMP is to describe the social, cultural and heritage values within the relevant country and specifies the measures that will be taken to avoid and minimise impacts to social, cultural and heritage values on that land during the implementation of the Proposal. Apply the mitigation hierarchy and discuss proposed objectives/outcomes, monitoring, management and mitigation measures where necessary to be implemented to appropriately minimise impacts to social surroundings. 3. Conduct investigations, including ethnographic and archaeological surveys in consultation with the Traditional Owners, to determine the significance of potential impacts to social surroundings as a result of this Proposal.
Greenhouse Gas Emissions	
Required work	1. Prepare a Greenhouse Gas Management Plan which will demonstrate: • The Proponents' contribution towards the State's aspiration of net zero emissions by 2050, in relation to Scope 1 GHG emissions as outlined in the State GHG Policy and Guideline • The intended reduction in Scope 1 emissions, via interim and long-term targets that reflect an incremental reduction in Scope 1 emissions over the life of the Proposal • Emissions intensity benchmarking and consideration of best practice for Scope 1 GHG emissions reductions • Strategies that demonstrate that all reasonable and practicable measures have been applied to avoid, reduce and offset the Scope 1 emissions over the life of the Proposal

2.3. Cumulative impact assessment – scoping of activities, boundaries and environmental values for relevant environmental factors

For all preliminary environmental factors, a summary of the activities associated with the Proposal, boundaries (of the cumulative impact assessment) and environmental values that will be considered for the cumulative impact assessment will be provided in relation to each preliminary key environmental factor.

The ERD will include cumulative impact assessment to assess the following:

- Flora and vegetation: Describe and assess the extent of any cumulative impacts within local, regional and State contexts, as appropriate. Use the assessment to describe and quantify the potential cumulative residual impacts to identified environmental values that may occur following implementation of the Proposal after considering and applying avoidance and minimisation measures.
- Vertebrate fauna:
  - Describe and assess the cumulative impacts to terrestrial fauna and the following (but not limited to) MNES species: Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia* [Pilbara Form]); Ghost Bat (*Macroderma gigas*); Pilbara Olive Python (*Liasis olivaceus barroni*); Oriental Plover (*Charadrius*

veredus) and Northern Quoll (*Dasyurus hallucatus*,) and the significance of associated fauna habitats.

- Describe and quantify the extent of cumulative impacts and potential cumulative residual impacts that may occur following implementation of the Proposal after considering and applying avoidance and minimisation measures.

- Subterranean fauna: Describe and quantify the extent of cumulative impacts and potential cumulative residual impacts that may occur following implementation of the Proposal after considering and applying avoidance and minimisation measures. as a result of implementation of the Proposal during both construction and operations to subterranean fauna, taking into consideration the significance of subterranean fauna and fauna habitat.
- Inland waters: describe and assess potential cumulative groundwater and surface water impacts, including changes in groundwater levels, surface water flows within the relevant catchments, and potential impacts to groundwater dependent vegetation within the Weeli Wolli Spring PEC, including Ben's Oasis. Assess the nature, extent and duration of the potential impacts.
- Social surroundings: describe and assess the potential cumulative impacts to social surroundings as a result of changes to the environment from the Proposal giving consideration to Traditional Owners and Pastoral Stations and their activities on the land.
- Greenhouse gas: the Greenhous Gas Management Plan is to provide context and where relevant, information is provided on the entire Hope Downs 1 (including Baby Hope) and the Proposal operations, including a summary of the estimated peak, annual average and total GHG emissions from Hope Downs 1 (including Baby Hope) and the Proposal.

3. Decision-making authorities

The Proponent has identified the decision-making authorities listed in Table 4 for this Proposal. Additional decision-making authorities may be identified during the course of the assessment.

Table 4: Decision-making authorities and processes

Decision-making authority	Legislation or Agreement regulating the activity	Approval required (and specify which Proposal element the approval is related to)	Whether and how statutory decision-making process can mitigate impacts on the environment? (Yes/No and summary of reasons)
Minister for Aboriginal Affairs	*Aboriginal Heritage Act 1972*	Disturbance of sites of Aboriginal heritage significance: s.16 authorisation to enter, excavate, examine or remove anything on an Aboriginal site. s.18 consent for impact on an Aboriginal site. Relates to the potential for the Proposal to impact on the Social Surroundings environmental factor.	Yes – this process is for assessing and authorising impacts on sites of Aboriginal heritage significance.
Minister for State Development	*Iron Ore (Hope Downs) Agreement Act 1992*	State Agreement Proposal for approval under the *Iron Ore (Hope Downs) Agreement Act 1992.*	No – not a process that manages environmental impacts.
Minister for Water	*Rights in Water and Irrigation Act 1914*	Abstraction of groundwater for use during construction and operation: - Section 5C licence to take water. - Section 26D licence to construct or alter a well. Relates to the potential for the Proposal to impact on the Inland Waters environmental factor.	Yes – licences manage the location and volume of groundwater abstracted for water supply. Requires monitoring and reporting against licence requirements.
Minister for Environment	*Biodiversity Conservation Act 2016* (BC Act)	Impacts to threatened flora and fauna species are managed under the BC Act: - Authorisations to take threatened flora species - Authorisations to take or disturb threatened fauna species	Yes - this process is for assessing impacts to threatened flora and fauna species and provides authorisations to take threatened flora and fauna species.
Minister for Transport, Planning, Ports	*Main Roads Act 1930*	Relates to the Great Northern Highway re-alignment aspects of the Proposal.	Unlikely – process unlikely to manage environmental impacts.
Chief Executive Officer, Department of Water and Environmental Regulation	*Environmental Protection Act 1986* – Part V	Licence to operate. Relates to the emissions aspects of the Proposal (to air, land and water).	Yes – licences manage emissions to air, land and water, including water quality and volume, emissions released to the environment. Requires monitoring and reporting against licence requirements.
Minister for Mines and Petroleum	*Mining Act 1978*	Mine Closure Plan (MCP). Mine closure and rehabilitation	Yes - responsibility for assessing Mine Closure Plans (MCP) which specify closure and rehabilitation actions and outcomes. A MCP will be submitted with the ERD.

A.2: EPBC Checklist

OTHER MATTERS REQUIRED BY SCHEDULE 4 OF THE EPBC REGULATIONS

Matters to be addressed by the draft public environment report and environmental impact statement as set out in Schedule 4 of the *Environment Protection and Biodiversity Conservation Regulations 2000* are detailed in Table 1.

Table 1: Matters to be addressed by the ERD

Regulation Reference	Description	Report Section/Information
1 General information	1.01 The background of the action including:	
	(a) the title of the action.	Table 2-1
	(b) the full name and postal address of the designated Proponent.	Table 1-1
	(c) a clear outline of the objective of the action.	Table 2-1
	(d) the location of the action.	Table 2-1; Figure 2-1
	(e) the background to the development of the action.	Section 2.1
	(f) how the action relates to any other actions (of which the Proponent should reasonably be aware) that have been, or are being, taken or that have been approved in the region affected by the action.	Section 3.2
	(g) the current status of the action.	Section 3.1
	(h) the consequences of not proceeding with the action.	The consequence of not proceeding with the Proposed Action would be Rio Tinto's inability to maintain the current iron ore production level from Greater Hope Downs mining hub and fully use existing infrastructure and processing facilities. The Proposed Action would extend the life of mine at Greater Hope Downs operations and is critical to the Proponent's business activities in the Pilbara region.
2 Description	2.01 A description of the action, including:	
	(a) all the components of the action.	Table 2-2 and Section 2.1
	(b) the precise location of any works to be undertaken, structures to be built or elements of the action that may have relevant impacts.	Table 2-2; Figure 2-2; Figure 2 3; Figure 2-4
	(c) how the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts.	Section 2.1
	(d) relevant impacts of the action.	Sections 13.6.7, 13.7.7, 13.8.7 and 13.9.7, supported by Section 7.6
	(e) proposed safeguards and mitigation measures to deal with relevant impacts of the action.	Section 13.5 supported by Section 7.5

Regulation Reference	Description	Report Section/Information
	(f) any other requirements for approval or conditions that apply, or that the Proponent reasonably believes are likely to apply, to the proposed action.	Sections 13.2, 13.6.9, 13.7.9, 13.8.9 and 13.9.9
	(g) to the extent reasonably practicable, any feasible alternatives to the action, including: (i) if relevant, the alternative of taking no action (ii) a comparative description of the impacts of each alternative on the matters protected by the controlling provisions for the action (iii) sufficient detail to make clear why any alternative is preferred to another	Section 2.2
	(h) any consultation about the action, including: (i) any consultation that has already taken place (ii) proposed consultation about relevant impacts of the action (iii) if there has been consultation about the proposed action—any documented response to, or result of, the consultation	Section 4
	(i) identification of affected parties, including a statement mentioning any communities that may be affected and describing their views	Section 4
3 Relevant impacts		
	(a) a description of the relevant impacts of the action	Sections 13.4, supported by Section 7.4
	(b) a detailed assessment of the nature and extent of the likely short term and long term relevant impacts	Sections 13.6.7, 13.7.7, 13.8.7 and 13.9.7, supported by Section 7.6
	(c) a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible.	Relevant impacts to EPBC-listed matters are addressed in Section 13. Impacts are generally well understood from previous similar projects in the Pilbara. Clearing has been assessed as an irreversible impact, and offsets are proposed where there is a loss of critical (high significance and moderate significance) habitat for MNES. Monitoring is proposed to confirm that the outcomes are as predicted.
	(d) analysis of the significance of the relevant impacts.	Sections 13.6.8, 13.7.8, 13.8.8 and 13.9.8, supported by Section 7.6
	(e) any technical data and other information used or needed to make a detailed assessment of the relevant impacts.	Appendix C.1 to C.6
4 Proposed safeguards and mitigation measures	4.01 Information given under paragraph 2.01(e) must include:	
	(a) a description, and an assessment of the expected or predicted effectiveness of, the mitigation measures.	Section 13.5

Regulation Reference	Description	Report Section/Information
	(b) any statutory or policy basis for the mitigation measures.	Sections 13.2, 13.6.9, 13.7.9, 13.8.9 and 13.9.9
	(c) the cost of the mitigation measures.	The cost of mitigation measures is part of the Proposal's overall cost.
	(d) an outline of an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action, including any provisions for independent environmental auditing.	Appendix A.9
	(e) the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program.	DWER is responsible for approving mitigation measures and monitoring programs relating to protected fauna. However, DWER may seek technical advice and/or endorsement from other agencies, e.g. DBCA and DCCEEW. DWER is responsible for compliance with conditions that prescribe monitoring and mitigation requirements as part of approvals given under the EP Act.
	(f) a consolidated list of mitigation measures proposed to be undertaken to prevent, minimise or compensate for the relevant impacts of the action, including mitigation measures proposed to be taken by State governments, local governments or the Proponent.	A consolidated list of mitigation measures has been included in the Executive Summary. Mitigation measures will be the responsibility of the Proponent.
5 Other approvals and conditions	5.01 Information given under paragraph 2.01(f) must include:	
	(a) details of any local or State government planning scheme, or plan or policy under any local or State government planning system that deals with the proposed action, including: (i) what environmental assessment of the proposed action has been, or is being, carried out under the scheme, plan or policy (ii) how the scheme provides for the prevention, minimisation and management of any relevant impacts	Not applicable
	(b) a description of any approval that has been obtained from a State, Territory or Commonwealth agency or authority (other than an approval under the Act), including any conditions that apply to the action	Section 3.2
	(c) a statement identifying any additional approval that is required	Section 3.2
	(d) a description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to the action.	Appendix A.9

Regulation Reference	Description	Report Section/Information
6 Environmental record of person proposing to take the action	6.01 Details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against:	
	(a) the person proposing to take the action	Not applicable
	(b) for an action for which a person has applied for a permit, the person making the application.	Not applicable
	6.02 If the person proposing to take the action is a corporation—details of the corporation's environmental policy and planning framework	Appendix A.9
7 Information sources	7.01 For information given in a draft public environment report or environmental impact statement, the draft must state:	
	(a) the source of the information	Sections 7.3 and 13.3
	(b) how recent the information is	Sections 7.3 and 13.3
	(c) how the reliability of the information was tested	Tables 7-2 and 13-3
	(d) what uncertainties (if any) are in the information	Sections 7.3 and 13.3

A.3: Proposal Content Document

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Proposal Content Document

Table 1: Summary of the Proposal

Component	Referred Description	Proposed Amendment Description
Proposal title	Hope Downs 2 Proposal	No change
Proponent name	Hamersley HMS Pty Ltd	No change
Short description	The Proposal is to develop and operate an above water table (AWT) iron ore mine and associated infrastructure approximately 80 km north-west of Newman in the Pilbara region of Western Australia. The Proposal is on the traditional lands of the Nyiyaparli, Ngarlawangga and Banjima people. The Proposal includes, but is not limited to the following: • Development and operation of AWT iron ore deposits: BHT and HD2. • Activities required to facilitate mining which may include, but are not limited to, the following: • Mineral waste management infrastructure: includes waste rock landforms, landbridges, low grade ore dumps, and topsoil and sub-soil stockpiles. • New processing infrastructure: including dry processing facilities at HD2 and/or BHT deposits. • Support facilities: including workshops, hydrocarbon storage areas, ANFO facilities, laydown areas, turkeys nests, transfer pads and offices. • Linear infrastructure: including heavy and light vehicle access roads, railway crossing, conveyors, pipelines, power distribution network (including sub-stations), communications distribution network and associated communications infrastructure. • Realignment of approximately 6 km of the Great Northern Highway. • Infrastructure for surface water management: including Pebble Mouse Creek crossings, diversion drains, levees and culverts. • Infrastructure for water supply: including abstraction of groundwater and/ or use of surplus water from local sources and adjacent operations. • Accommodation: including installation of a new construction camp may be required to support the implementation of the HD2 Proposal.	The Proposal is to develop and operate an above water table (AWT) iron ore mine and associated infrastructure approximately 80 km north-west of Newman in the Pilbara region of Western Australia. The Proposal is on the traditional lands of the Nyiyaparli, Ngarlawangga and Banjima people. The Hope Downs 2 Proposal (the Proposal) includes but is not limited to the following: • Development and operation of two AWT iron ore deposits: HD2 and BHT. • Mineral waste management infrastructure: including waste rock landforms, landbridges, low grade ore stockpiles, and topsoil and sub-soil stockpiles. • New processing infrastructure: including dry processing facilities at HD2 and/or BHT deposits. • Support facilities: including workshops, hydrocarbon storage areas, Ammonium Nitrate Fuel Oil (ANFO) facilities, laydown areas, turkey's nests, transfer pads and offices. • Linear infrastructure: including heavy and light vehicle access roads, railway crossing, conveyors, pipelines, power distribution network (including sub-stations), communications distribution network and associated communications infrastructure. • **Renewable energy: including renewable energy generation, energy storage, and associated ancillary infrastructure.** • Realignment of **up to** 6 km of the Great Northern Highway. • Infrastructure for surface water management: including Pebble Mouse Creek crossings, diversion drains, levees and culverts. • Infrastructure for water supply: including abstraction of groundwater and/ or use of surplus water from local sources and adjacent operations. • Accommodation: including installation of an upgrade of existing accommodation and/or new construction camp.

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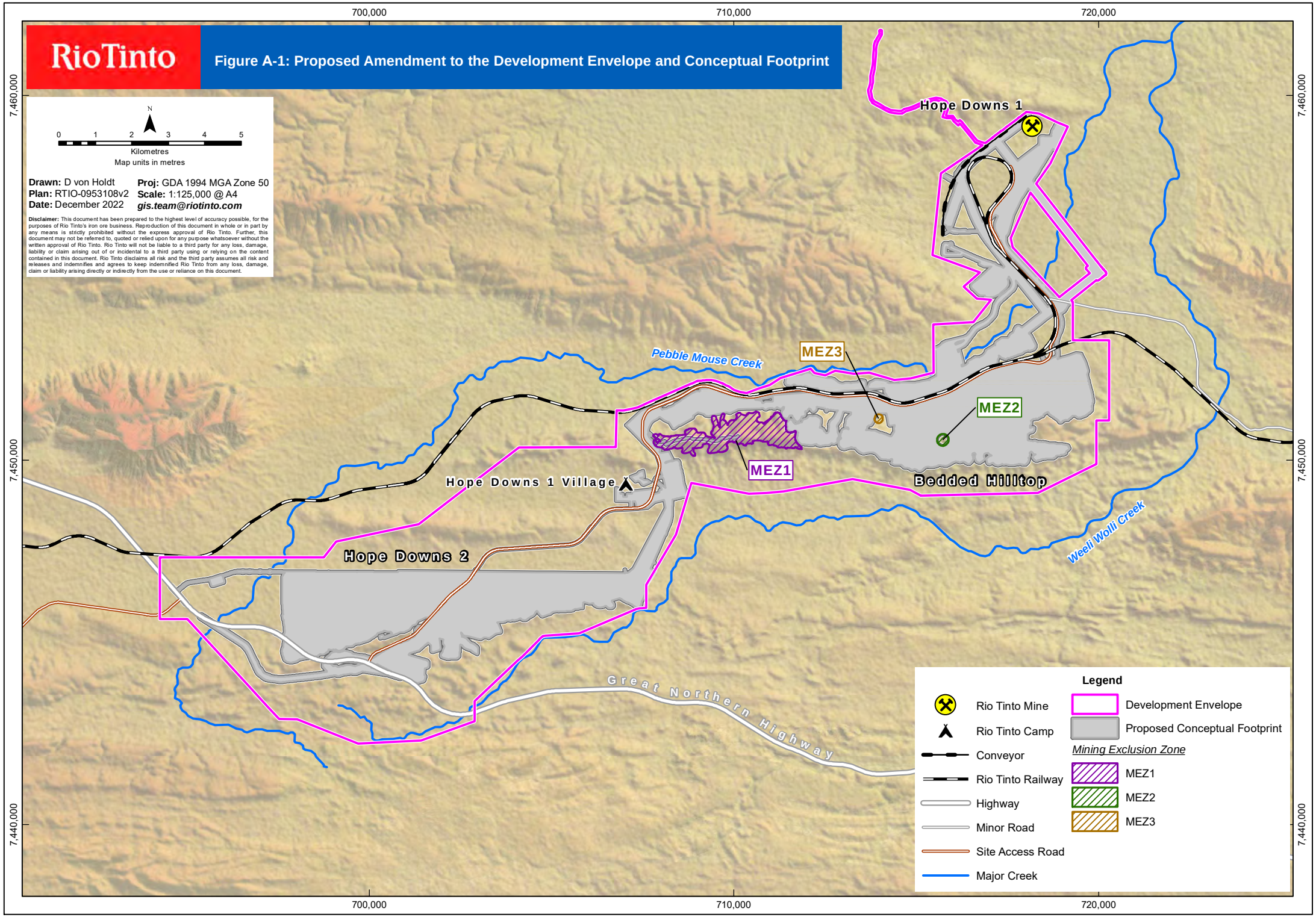
Table 2: Proposal key characteristics

Element	Location	HD2 Referred Proposal Extent	Proposed Amendment	HD2 Proposal Amendment Extent
Physical Elements				
Mine and associated infrastructure	Figure A-1	Clearing of up to approximately 4,700 ha within a Development Envelope of approximately 14,085 ha.	Reduction by 1,675.5 ha to the Development Envelope and increase in clearing by 200 ha.	Clearing of up to **4,900 ha** within a **12,409.5 ha** Development Envelope.
Mining Exclusion Zones	Figure A-1	-	Introduction of Mining Exclusion Zones[1] 1, 2 and 3	Mining Exclusion Zones[1] 1, 2 and 3.
Operational Elements				
Water supply		Abstraction of up to 3 GL per annum or use of surplus water from adjacent operations	No change from Referred Proposal	Abstraction of up to 3 GL per annum or use of surplus water from adjacent operations
Proposal Elements with Greenhouse Gas Emissions				
Scope 1[2]	Diesel and land clearing – no more than 200,518 tonnes of carbon dioxide equivalent (tCO_2-e) per annum			
Scope 2[2]	Electricity generation – no more than 6,330 tCO_2-e per annum			
Scope 3[3]	382 Mt CO2-e			
Rehabilitation and Closure				
The key closure outcome of this Proposal will be a safe, stable and non-polluting landscape consistent with the post-mining land use and consider environmental and cultural heritage values.				
Other Elements that affect extent of effects on environment				
Proposal time	Maximum operational project life	Estimated 15 years		

[1] Mining Exclusion Zone (MEZ): Refers to an area within the Development Envelope where no mining excavation will occur, and only low impact activities associated with environmental and cultural heritage monitoring and management may be implemented. MEZ1 contains existing communications infrastructure that is to be maintained. No more than 5% of the total area covered by the MEZ can be cleared for low impact activities. There is to be no clearing of critical MNES habitat (Gorge/gully and Breakaway types), no impact to Ghost Bat caves and no clearing of P2 flora within MEZ.

[2] Predicted peak annual emissions include forecast existing operations and new activities associated with the Amended Proposal

[3] Attributable to this Proposal


RioTinto
Figure A-1: Proposed Amendment to the Development Envelope and Conceptual Footprint
N
0 1 2 3 4 5
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: RTIO-0953108v2
Date: December 2022
Proj: GDA 1994 MGA Zone 50
Scale: 1:125,000 @ A4
gis.team@riotinto.com
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700,000
710,000
720,000
7,460,000
7,450,000
7,440,000
Hope Downs 1
Pebble Mouse Creek
MEZ3
MEZ2
MEZ1
Hope Downs 1 Village
Bedded Hilltop
Hope Downs 2
Weeli Wolli Creek
Great Northern Highway
Legend
Rio Tinto Mine
Rio Tinto Camp
Conveyor
Rio Tinto Railway
Highway
Minor Road
Site Access Road
Major Creek
Development Envelope
Proposed Conceptual Footprint
Mining Exclusion Zone
MEZ1
MEZ2
MEZ3

A.4: Hope Downs 2 Draft Mine Closure Plan

Hope Downs 2 Mine Closure Plan

October 2023



IMS #	RTIO-1025466
Environmental Group Name	Hope Downs 1
Environmental Group Code	S0019112
Mineral Field Numbers	47 – West Pilbara
Proponent	Hamersley HMS PTY LTD ABN 51 115 004 129 Level 18, Central Park, 152-158 St Georges Terrace, Perth WA 6000 T: +61 (08) 9327 2000

Tenement	Tenement Holder	Environmental Group Site
ML282SA Sections 001 and 002 (or part thereof);	Hope Downs JV	Hope Downs 1

Disclaimer and Limitation

This Mine Closure Plan (MCP) has been prepared by Rio Tinto's Iron Ore group (Rio Tinto) on behalf of Hamersley HMS Pty Ltd (the Proponent) to support a Part IV (*Environmental Protection Act 1986*) application for the Hope Downs 2 Proposal (the Proposal).

Closure Plan Submission History		
Date	**Purpose**	**Status**
July 2022	Support the submission of the Environment Review Document for the Proposal.	Draft
April 2023	Support the submission of the Environment Review Document for the Proposal.	Draft
August 2023	Support the submission of the Environment Review Document for the Proposal.	Final Draft
October 2023	Final version for Public Review	Final

Acknowledgement of Country

Rio Tinto would like to acknowledge the Nyiyaparli, Banjima and Ngarlawangga people as the Traditional Custodians of the country upon which the Proposal is located.

We would like to pay our respects to their Elders: past and present.

Rio Tinto is committed to working in collaboration with the Nyiyaparli, Banjima and Ngarlawangga people and their representatives towards a responsibly designed proposal that minimises impacts to the environment, social, cultural and heritage values.

EXECUTIVE SUMMARY

The Hope Downs 2 (HD2) Proposal (the Proposal) is in the Pilbara region of Western Australia, approximately 80 km north-west of the township of Newman in the Shire of East Pilbara and is located predominantly on the traditional lands of the Nyiyaparli people, with smaller portions located on land held by the Banjima and Ngarlawangga people. The Proposal is made on behalf of the Hope Downs Joint Venture (HDJV), which is an unincorporated joint venture (50:50) between Hope Downs Iron Ore Pty Ltd (a member of Hancock Prospecting Group) and Hamersley WA Pty Ltd (a member of the Rio Tinto Group). The HDJV is managed by Hamersley HMS Pty Ltd (HHMS), a Rio Tinto Group company.

The Proposal is being assessed under Part IV of the *Environmental Protection Act 1986* (EP Act) and Part 6 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Subject to approval, the Proposal will comprise open cut mining utilising conventional drill-and-blast and ore haulage. Iron ore mined from the deposits will be transported by truck or conveyor to the adjacent Hope Downs 1 (HD1) operations and then transported by train to Rio Tinto's coastal export facilities. The Proposal comprises Above Water Table (AWT) mining of the HD2 and Bedded Hilltop (BHT) deposits with an operational life of 15 years and completion of mining currently scheduled for 2040. The current mine plan includes a production rate of 26.0 Mt/ annum in 2027 and then 31.4 Mt/ annum from 2028 onwards.

The closure boundary for the HD2 proposal includes infrastructure from HD1, including HD1S ROM and associated infrastructure. The closure boundary shows overlap of Baby Hope waste dumps at HD1 due to the HD2 Proposal use of the BH haul roads to transport ore to HD1 infrastructure as mentioned above. Once HD2 is approved, this HD1 infrastructure will be reassigned as HD2 infrastructure. The MCP text will be reviewed and amended to clarify this.

Mineral waste generated by the Proposal will be placed in permanent external waste rock landforms and used for the construction of temporary and permanent landbridges. The site is expected to encounter some highly erodible material which will be placed in external waste rock landforms with appropriate final parameters. The site has been assessed as having a low geochemical risk, with no Potentially Acid Forming (PAF) or fibrous mineral wastes expected to be encountered in the pits. No pit lakes are expected to form post-closure due to mining activities being AWT only.

Scope

This HD2 Mine Closure Plan (MCP) is applicable to mine developments and all associated infrastructure at HD2 and BHT deposits and is required to be submitted with the environmental review document (ERD) to support the environmental impact assessment of the Proposal. The MCP is anticipated to be reviewed and updated every three years (unless otherwise agreed) following issue of a Ministerial Statement.

This MCP excludes:

- unapproved future mine developments, mainline railway infrastructure and rail corridor disturbance areas beyond those within the defined MCP scope;
- infrastructure beyond the closure boundary that is covered under the HD1 2020 MCP; and
- infrastructure beyond the closure boundary that is connected to an integrated network (e.g., power, communications).

Closure outcomes

The following closure outcomes are proposed for the Proposal:

1. Cultural heritage values have been preserved where possible, in consultation with stakeholders.
2. Public health and safety hazards have been appropriately managed.
3. Infrastructure has been appropriately managed.
4. The final landform is stable, and its design considers hydrological and ecological factors.

5. Contamination risks have been appropriately managed and do not preclude the agreed post-mining land use(s).
6. Vegetation on rehabilitated land is self-sustaining native species and compatible with the post-mining land use.
7. Conservation significant flora and fauna habitat is not significantly impacted by closure activities.

Risk assessment

The first full closure risk assessment for the Proposal was conducted in 2020 and has been updated in support of drafting this MCP. The current Proposal closure risk profile includes twelve active risks. Of these, one is a Class IV (critical) risk, nine are Class III (high) risks, and two are Class II risks.

The causes, impacts, existing controls, evaluation rationale and actions of all risks associated with closure of the Proposal are appended to this MCP as the Closure Risk Register and the Closure Action Register.

Post-mining land use

The HD2 closure boundary is on land the subject of three different Native Title Determinations:

- The Nyiyaparli section covers the majority of the proposed closure boundary, including the entirety of HD2 and BHT deposits and associated mineral waste management infrastructure. Nyiyaparli lands generally extend to the south and east from the proposed closure boundary.
- Banjima land lies to the north and intersects proposed infrastructure areas north of Pebble Mouse Creek, adjacent to the existing rail loop and access corridor connecting the Proposal with HD1 operations.
- A narrow part of the southwestern end of the proposed closure boundary, including the Great Northern Highway (GNH) alignment and realignment option, coincides with Ngarlawangga land, which extends west and south from the proposed closure boundary.

These determinations recognise each Traditional Owner groups' non-exclusive right to continue to access, use and enjoy their country.

Other significant land use within the closure boundary includes public and private infrastructure (including roads and railways) and Unallocated Crown Land (UCL). Within the broader Proposal region, mining related activities are the primary commercial land use, as well as pastoral activities.

As above, Nyiyaparli, Banjima and Ngarlawangga Traditional Owners have ongoing native title rights to access, use and enjoy the land within their respective Native Title Determinations. Consultation has been undertaken, and is ongoing, with all groups to understand the key social, cultural and environmental values associated with the Proposal, to inform project design and options to avoid, minimise and manage impacts to these values.

Post-mining land use options in the Pilbara are generally limited due to the remote location. Subject to the Native Title Determinations noted above and ongoing use of the land by Traditional Owners, the main underlying land use within the closure boundary of the Proposal is Unallocated Crown Land (UCL). The proposed post-mining land use assumes that the site will be rehabilitated to create a safe, stable, and non-polluting landscape revegetated with native species, to maintain environmental and cultural heritage values and ensure the site does not adversely impact current surrounding land use. The post-mining land use will be determined in consultation with key stakeholders, including Traditional Owners.

Due to the nature of the mining activity undertaken, some closure landforms will be visually and structurally different to the pre-mining landscape, including waste rock landforms and large voids. Some voids will remain at closure and these will be unlikely to support land use by Traditional Owners or other post mining land uses due to safety considerations. The post-closure land use will need to consider the native title rights of Traditional Owners as well as their previous, ongoing, and desired future use of the area. Post-closure land use will also need to consider that surrounding areas are likely to remain subject to pastoral activity. While pastoralism is not proposed for the site, closure outcomes need to consider that livestock from surrounding areas are likely to access the site inadvertently.

Post-mining land use will also be informed by the Australian Land Use Management Classification system (ALUM). Areas will be classified by either ALUM 1.3.4 (Rehabilitation), ALUM 1.3.3 (Residual Native Cover) or ALUM 5.8.4 (Extractive Industry – not in use). ALUM 1.3.4 (Rehabilitation) and ALUM 1.3.3 (Residual Native Cover) will remain consistent with the surrounding area's land use of UCL, including access and use for traditional indigenous uses as well as re-establishment of traditional owner values and uses. Areas such as pit voids, which are unlikely to support safe access and use for traditional indigenous uses, will be designated 'Extractive Industry – not in use' (Extractive Industry – not in use).

Closure strategy

To manage risks associated with closure of the Proposal, the following closure strategies will be implemented:

- Alignment with the HD2 Social Cultural Heritage Management Plans (SCHMP) and the HD2 Aboriginal Cultural Heritage Management Plan (ACHMP) to ensure agreed social and cultural heritage values and sites are protected, and adequate post-mining land access is facilitated.
- Placement of abandonment bunding to manage risks associated with inadvertent public access post-closure.
- Ongoing engagement with internal and external stakeholders to ensure that closure outcomes and completion criteria are considered and incorporated, where appropriate, into life of mine and closure planning and decision-making processes.
- Removal of relevant infrastructure at closure unless otherwise agreed with relevant stakeholders, as required under the *Iron Ore (Hope Downs) Agreement Act 1992*.
- Rehabilitation of ex-pit waste landforms, with design informed by waste characterisation, ecological and hydrological factors to ensure long term stability and minimise the risk of erosion.
- Revegetation of disturbed areas, including the spreading of topsoil, where available, the ripping and seeding with local native (local provenance) species.
- Implementation of progressive rehabilitation (landform reshaping to final closure design and revegetation) to make disturbed areas compatible with the post-mining land use as soon as possible, including during operations where feasible. Monitoring of progressive rehabilitation to inform closure planning, closure outcomes and refinement of completion criteria.
- Explore opportunities to partner with Traditional Owners to implement, maintain and monitor rehabilitation, where possible. Surface water and groundwater modelling to inform operations, closure planning and design to ensure no unacceptable impacts to sensitive receptors.
- Maintenance of exclusion zones and management plans implemented for environmentally and culturally significant values.

Corporate endorsement:

I hereby certify that to the best of my knowledge, the information within this Hope Downs 2 (HD2) Mine Closure Plan is true and correct and addresses the relevant requirements of the *Statutory Guidelines for Mine Closure Plans* approved by the Director General of Mines, Industry Regulation and Safety.



Sarah Carroll

General Manager – Studies, Rehabilitation and Closure

Date: 20 October 2023

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Abbreviations

ABA	Acid Base Accounting
ACHMP	Aboriginal Cultural Heritage Management Plan
AEP	Annual Exceedance Probability
AGM	Alternative Growth Media
ALUM	Australian Land Use Management
AMD	Acid and Metalliferous Drainage
ANC	Acid Neutralising Capacity
ANFO	Ammonium Nitrate Fuel Oil
ANZMEC	Australian and New Zealand Minerals and Energy Council
AWT	Above Water Table
BIF	Banded Iron Formation
BHT	Bedded Hill Top
BOM	Bureau of Meteorology
BWT	Below Water Table
CKB	Closure Knowledge Base
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAWE	Department of Agriculture, Water and the Environment
DISER	Department of Industry, Science, Energy and Resources
DMIRS	Department of Mines, Industry Regulation and Safety (Formerly DoIR and DMP)
DMP	Department of Mines and Petroleum (now DMIRS)
DoIR	Department of Industry and Resources (now DMIRS)
DWER	Department of Water and Environmental Regulation (including EPA Services, Water and Environmental Regulation)
ENSO	El Niño Southern Oscillation
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESP	Exchangeable Sodium Percentage
FMMP	Fibrous Minerals Management Plan
GNH	Great Northern Highway
GDE	Groundwater Dependent Ecosystem
GHG	Greenhouse Gas
GRM	Global Climate Model
HD1	Hope Downs 1
HD2	Hope Downs 2
HD4	Hope Downs 4
ha	Hectares
HHMS	Hamersley HMS Pty Ltd
IBRA	Interim Biogeographic Regionalisation for Australia
ICMM	International Committee for Mining and Minerals
ILUA	Indigenous Land Use Agreements
IOD	Indian Ocean Dipole
IODMS	Iron Ore Document Management System
LG	Low Grade
LEM	Landform Evolution Modelling

LoM	Life of Mine
JTSI	Department of Jobs, Tourism, Science and Innovation
m	Meters
MCA	Minerals Council of Australia
MCP	Mine Closure Plan
MEZ	Mining Exclusion Zone
mRL	Metres above Relative Level (Sea Level)
NTA	Native Title Agreement(s)
NVCP	Native Vegetation Clearing Permit
NAF	Non-acid Forming
P1	Priority 1 species
P2	Priority 2 species
PA	Participation Agreement
PAF	Potentially Acid Forming
PCO	Present Closure Obligation
PE	Potential Evaporation
PEC	Priority Ecological Community
PMC	Pebble Mouse Creek
PRG	Pilbara Rehabilitation Group
PSD	Particle Size Distribution
PUPEZ	Potentially Unstable Pit Edges Zone
RCP	Representative Concentration Pathways
Rio Tinto	Rio Tinto Iron Ore
RORB	Run Off Routing on Burroughs model
RUSLE	Revised Universal Soil Loss Equation
RQA	Rehabilitation Quality Assessments
SCARD	Spontaneous Combustion and Acid Rock Drainage
SCHMP	Social and Cultural Heritage Management Plan
SME	Subject Matter Expert
TPC	Total Projected Closure
TUFLOW	Two-dimensional Unsteady FLOW model
UCL	Unallocated Crown Land
UWA	University of Western Australia
WABSI	Western Australian Biodiversity and Science Institute
WD	Waste rock landform/ Waste Rock Dump
WEPP	Water Erosion Prediction Program
WWC	Weeli Wolli Creek
WWTP	Wastewater Treatment Plant
WWS	Weeli Wolli Spring
UCL	Unallocated Crown Land

1 Purpose and Scope

1.1 Mine Closure Plan Purpose

Planning for closure of a site is a critical business process that demonstrates the proponent's commitment to sustainable development. This Mine Closure Plan (MCP) follows the format and content requirements for MCPs as required in the Department of Mines, Industry Regulation and Safety (DMIRS) *Mine Closure Plan Guidance - How to prepare in accordance with Part 1 of the Statutory Guidelines for Mine Closure Plans* (2020) and *Statutory Guidelines for Mine Closure Plans* (2020a)

This MCP has been prepared to achieve the following goals:

- Reflect the current knowledge and requirements for closure of the Hope Down 2 (HD2) Proposal (the Proposal) (including stakeholder feedback to date) and identify the future requirements to continue to progress towards a planned and managed closure, including future opportunities for consultation.
- Support environmental assessment of the Proposal comprising of the HD2 and BHT deposits.
- Inform key stakeholders on how Rio Tinto plans to meet its mine rehabilitation and closure requirements for the Proposal.
- Meet the requirements in the DMIRS Statutory Guidelines to meet the internal requirements of the Rio Tinto Closure Standard (2021) mandated for all Rio Tinto Assets.
- To inform the development of closure provisions.

1.2 Mine Closure Plan Scope

This MCP covers the development of the Proposal within a defined closure boundary (Figure 1). Tenure within the closure boundary is listed below and presented in Figure 2. This MCP is applicable to areas, infrastructure and mine development features including:

- State Agreement Mining Lease 282 Sections 1 and 2 (or part thereof); and
- the most eastern extent of Miscellaneous Licence 47/52 (L47/52), granted under the *Mining Act 1978 (WA (the Mining Act)* (Road/Pipe/AC 1)[1].

This MCP excludes the following:

- Potential future deposits within the area, subject to relevant approvals these may be subsequently incorporated into future updates of this MCP.
- Other Rio Tinto mines in the Hope Downs area (e.g., Hope Downs 1 [HD1] and Hope Downs 4 [HD4]) which are subject to separate MCPs.
- The Rio Tinto rail network across the Pilbara (covered in a separate closure planning process).
- Rio Tinto exploration areas and exploration infrastructure.
- Ri Tinto infrastructure currently in use at HD1 mining operations including primary crushing and processing facilities, roads and utilities. This infrastructure liability will transfer across to this MCP once the Proposal is approved,
- Rio Tinto infrastructure that is connected to an integrated network (e.g., power, communications).

[1] L47/52 is considered part of the scope of the Rio Tinto West Angelas Closure Plan. The re-alignment of the Great Northern Highway will not be constructed under the L47/52 tenure, rather a Miscellaneous Licence or similar will be sought. Once the realignment route is finalised, this tenure may be removed from the scope in future updates to this MCP as new tenure will be acquired to address this.

1.3 Mine Closure Plan review and update

This is the first MCP completed for the Proposal. This MCP was prepared to support the Part IV environmental assessment of the Proposal. MCPs are generally updated every three years in line with the DMIRS *Statutory Guidelines for Mine Closure Plans* (2020), or a Ministerial Statement condition.

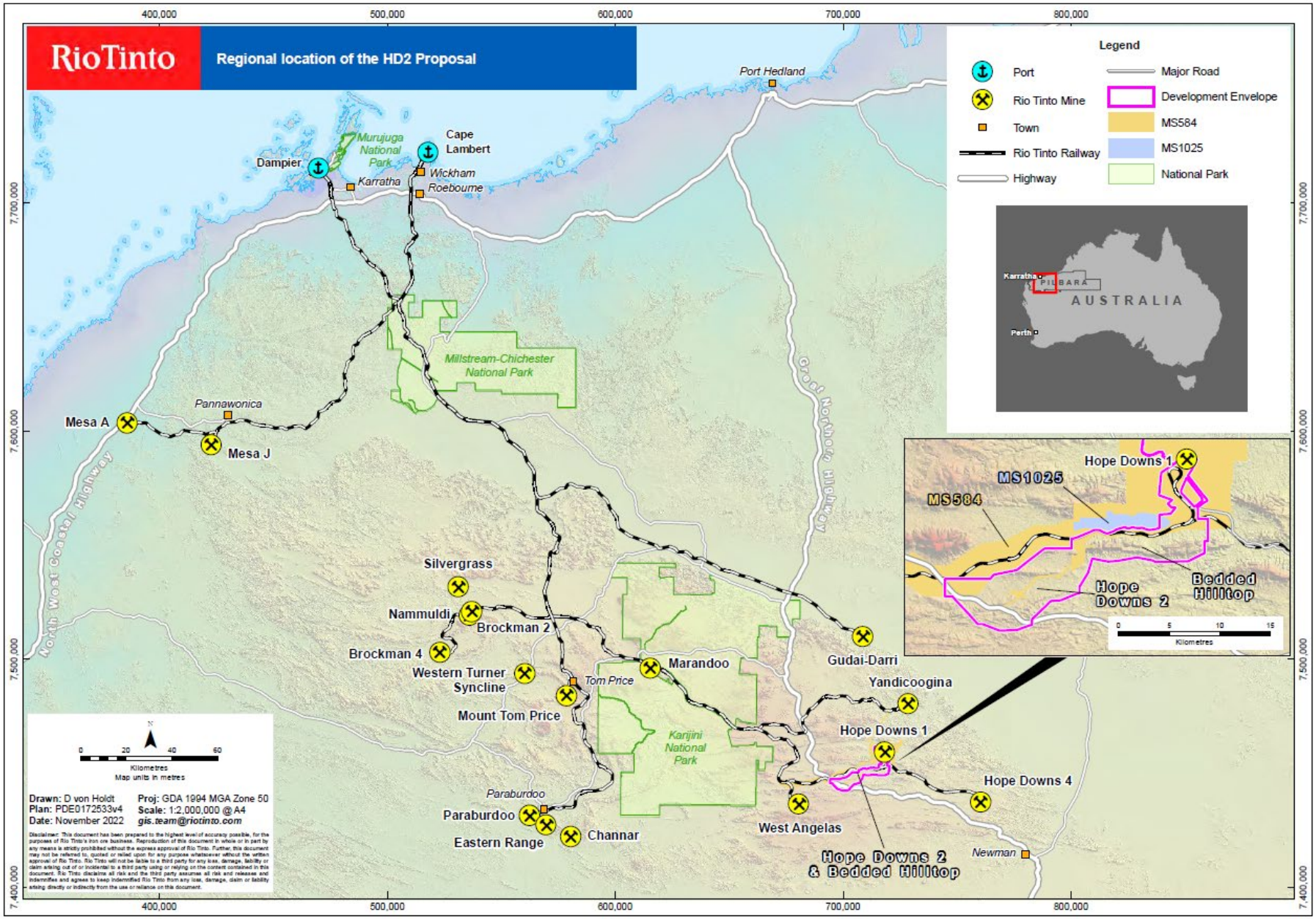


Figure 1: Regional location of Hope Downs 2

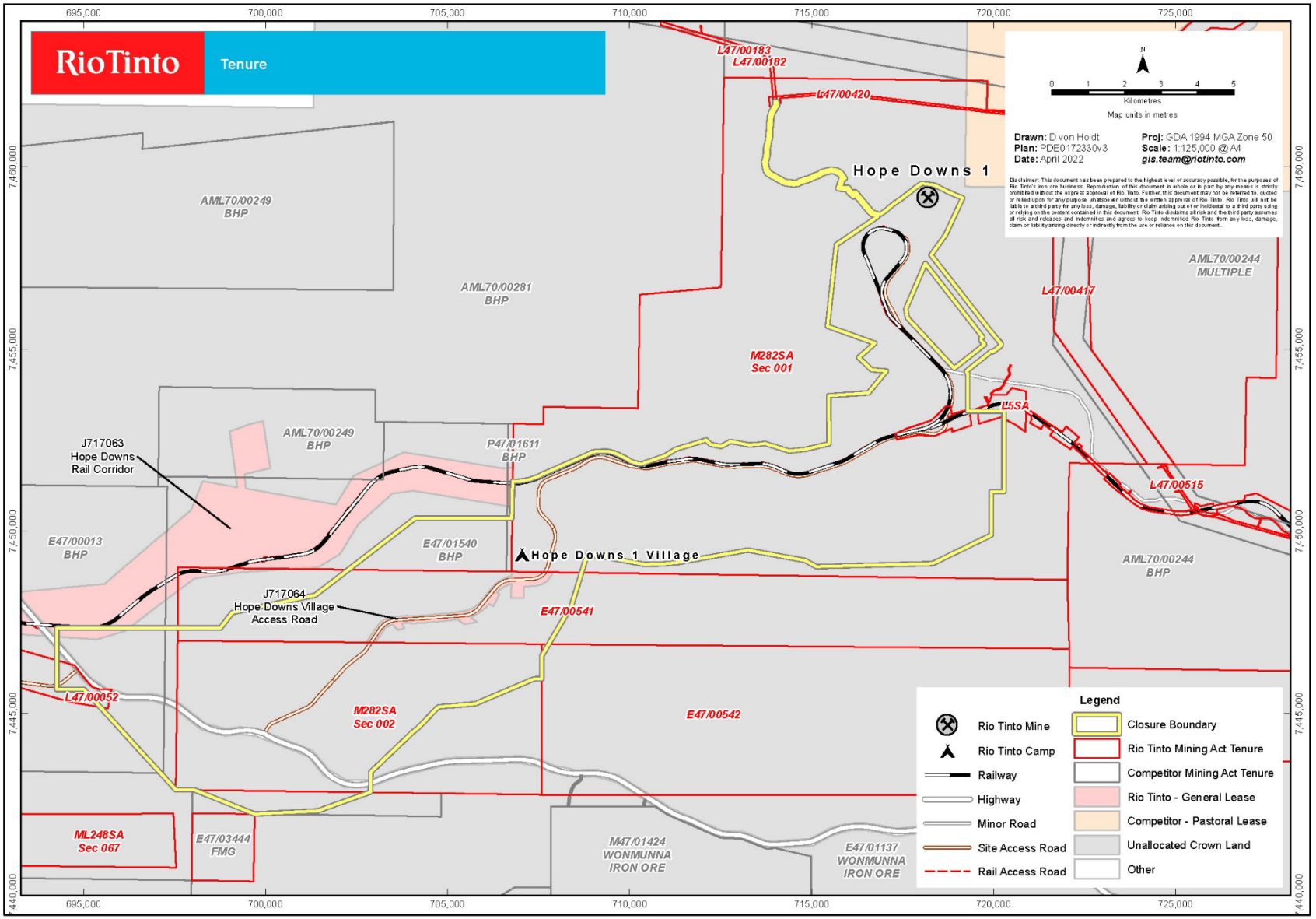


Figure 2: Tenure

2 Project Summary

2.1 Proponent information

The Proposal is made on behalf of the Hope Downs Joint Venture (HDJV), which is an unincorporated joint venture (50:50) between Hope Downs Iron Ore Pty Ltd (a member of Hancock Prospecting Group) and Hamersley WA Pty Ltd (a member of the Rio Tinto Group). The HDJV is managed by Hamersley HMS Pty Ltd (HHMS), a Rio Tinto Group company. For the purposes of this MCP the proponent will be referred to as Rio Tinto.

2.2 Location

The Proposal closure boundary covers 12,410 ha of land in the Pilbara region of Western Australia and is approximately 80 km northwest of the township of Newman.

The closure boundary is in the Shire of East Pilbara (Figure 1), a sparsely populated region with approximately 11,000 residents living in an area of around 372 km^2 (ABS 2020, Shire of East Pilbara 2020). Newman is the administrative centre and largest town in the Shire, with a population of approximately 7,000 (ABS 2020). Site access to the Proposal is via the Great Northern Highway (GNH) (Figure 1).

The Proposal closure boundary is located predominantly on land the subject of the Nyiyaparli People Native Title determination (WCD2018/008), with two small portions intersecting land the subject of the Banjima People Native Title determination (WCD2014/001) to the north and land the subject of the Ngarlawangga People Native Title determination (WCD2016/007) to the south west (refer Figure 3 and Section 5.1.1). Other Aboriginal communities near to the Proposal are:

- Parnpajinya, part of the Newman townsite;
- Youngaleena, approximately 90 km northwest;
- Innawonga, approximately 100 km west;
- Irrugadji (Five Mile) near Nullagine, approximately 140 km northeast; and
- Jigalong and associated satellite communities, approximately 160 km east. Jigalong is the largest of these Aboriginal communities, with a population of approximately 300 (ABS, 2020).

The GNH intersects the southern end of the Proposal, providing public access between the towns of Newman and Port Hedland and tourist access to Karijini National Park, approximately 30 km to the west of the Proposal at its nearest point. The GNH forms part of the National Highway Network and provides a strategic freight link between Perth and the state's north as well as Darwin and the Northern Territory. The GNH is the region's major road, and most other public roads outside town areas, of which there are few, are unsealed, reflecting the 'remote' and sparsely populated character of the region.

2.3 Land Use

Land use within the region is constrained by the remote location, with historical and current land uses differing significantly.

There is a long history of Aboriginal People interacting with the land within the closure boundary. In addition to the respective Native Title Determinations recognising each Traditional Owner group's non-exclusive right to continue to access, use and enjoy country (refer Section 5.1.1), this area is also one of the main ways to access Weeli Wolli Creek (WWC) and Weeli Wolli Spring (WWS), which are of environmental, social and cultural significance in the region.

Recent land use associated with the Proposal continues to include traditional and customary uses but now also includes industrial, agricultural and tourism land uses.

Land tenure associated with the Proposal has been issued on UCL and includes State Agreement, miscellaneous and exploration tenure (refer Figure 2). There is no pastoral activity in the immediate vicinity of the mine, with Marillana Station (N050368) the nearest pastoral station lease, approximately 2 km east of the northern boundary section. Marillana Station lease is owned and operated by Broken Hill Proprietary Limited (BHP Limited).

More recently, the vicinity has been targeted for its mineral resources. Current mining projects in the region, in addition to the Proposal, include:

- Rio Tinto – HD1 Iron Ore Mine (including Baby Hope), immediately north;
- Rio Tinto – West Angelas Iron Ore Mine, approximately 10 km southwest;
- Rio Tinto – Yandicoogina Iron Ore Mine, approximately 25 km northeast;
- BHP Limited – Area C Southern Flank Iron Ore Mine, approximately 12 km north-northwest;
- Rio Tinto – Hope Downs 4 Iron Ore Mine, approximately 42 km southeast;
- BHP Limited – Yandi Iron Ore Mine, approximately 25 km north-northwest; and
- Wonmunna Mining Area and Wonmunna Copper Mine, approximately 15 km to the south.

Tourism is also an important part of the regional economy, accounting for 14.3% of jobs in the Shire of East Pilbara (DPIRD 2020). A lookout and rest area are located at Mt Robinson, 5.5 km northwest of the closure boundary along the GNH. With a variety of facilities, it is described as 'busy' by caravanning and camping websites. WWS, 16 km to the north-east of the closure boundary, is a local tourist destination and Weeli Wolli Pool, to the northeast of the closure boundary, is listed on the Shire of the East Pilbara municipal inventory of significant places (Heritage Council of Australia, 2020).

2.4 Environmental, social, and cultural values

The Proposal is close to the following sensitive environmental receptors, or social and cultural heritage values:

- The Priority 1 WWS Priority Ecological Community (PEC) buffer is located approximately 6 km northeast of the BHT deposit and approximately 20 km northeast of the HD2 deposit. The cultural and environmental significance of this PEC is discussed further in Sections 5.1 and 5.12.2, respectively.
- Groundwater Dependent Ecosystems (GDEs) and permanent pools have significant environmental and/or cultural value:
    - Ben's Oasis (a permanent pool) is located approximately 2 km south of the BHT deposit and 15 km east of the HD2 deposit. Preliminary hydrogeology investigations suggest that the surface water present is likely groundwater fed but sourced from a southern catchment and therefore not in hydraulic connection with the catchment in which the proposed HD2 mine is located.
    - New locations of conservation significant Priority 1 (P1) and Priority 2 (P2) flora have been recorded at BHT and are discussed further in 5.13.1.
- To date, two sites of particularly high cultural significance have been identified by Nyiyaparli Traditional Owners within the Proposal closure boundary and the mine design has been amended to avoid direct impacts to these sites, being:
    - a heritage complex (HOPE4-07) which is located immediately east of the HD2 deposit, but outside of the Proposal conceptual footprint; and
    - a rock shelter containing rock art (BDH16-03) which is located 300 m from the edge of a proposed a BHT pit.

  These sites are discussed in more detail in Section 5.1.2 and heritage surveys and consultation are ongoing and may identify additional heritage sites and places or identify known sites and places that are of high cultural significance.
- Vertebrate fauna of conservation significance (Northern Quoll, Ghost Bat, and Western Pebble-mound Mouse) that have been recorded within the closure boundary. Several caves identified as potential diurnal roosts for the Pilbara Leaf-nosed Bat and Ghost Bat have been recorded at the BHT and HD2 deposits. Conservation significant fauna and habitat are discussed further in 5.14.3.

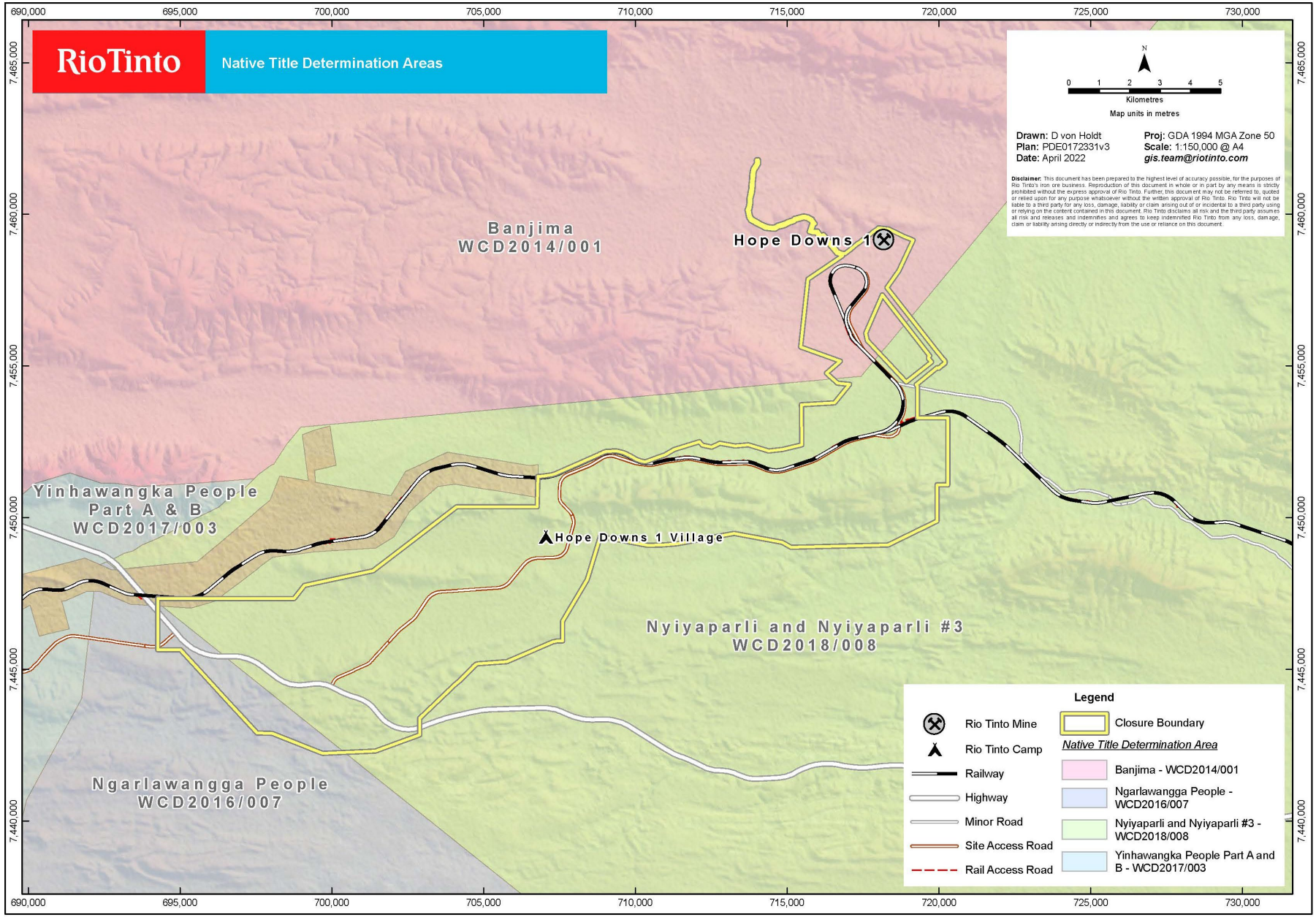


Figure 3: Native Title Determination Areas

2.5 Mine operations

Subject to approvals, construction of the Proposal is planned to commence in 2025, with mining expected to occur between 2027 and 2040. Traditional open pit, drill-and-blast and load-and-haul methods will be used to mine the BHT and HD2 deposits.

Mine planning schedules are continuously revised to maximise efficiencies and incorporate proposed new deposits. Several scenarios are still under evaluation, each of which would result in changes to the projected commencement and cessation dates of various deposits and pits. The mine schedules and plans are subject to regular review to ensure optimised performance of the operations and are therefore subject to change.

Iron ore mined from the deposits will be transported by truck or conveyor to the adjacent HD1 operations and then transported by train to Rio Tinto's coastal export facilities. The current mine plan includes a production rate of 26.0 Mt/ annum in 2027 and then 31.4 Mt/ annum from 2028 onwards during an operational life of nine years, with completion of mining currently scheduled for 2040 (Table 2-1).

Table 2-1: Indicative mining schedule

Pit	Commencement	Completion	Description
HD2 West	2026	2040	AWT
HD2 Centre	2026	2040	AWT
HD2 East	2026	2040	AWT
BHT West	2027	2040	AWT
BHT Centre	2027	2040	AWT
BHT East	2027	2040	AWT

Note: * The mining period end date is indicative and is subject to change based on the mine plan.

The orebody consists of six AWT pits, across two deposits (HD2 and BHT), spanning an area of approximately 25 km. Mineral waste generated by the Proposal will be placed in permanent external waste rock landforms and used for the construction of temporary and permanent landbridges. Opportunities for progressive backfill of pits will be investigated as mine planning becomes further advanced. The conceptual mine layout is presented in Figure 4.

Waste rock landforms and associated infrastructure cover an area of up to 4,900 ha within a 12,409.5 ha closure boundary. This area constitutes the Proposal conceptual footprint, and the sum of disturbance associated with the Proposal. The Proposal utilises existing ore handling and processing infrastructure at HD1, supported by the construction and utilisation of the following:

- Dry crushing and screen processing facilities at HD2 and/or BHT deposits
- Run of mine (ROM) pads
- Ore stockpile.

No wet processing of ore is proposed, as deposits are AWT. The support facilities include some existing facilities from HD1 but will largely consist of new facilities constructed at HD2 and BHT deposits that may include but not be limited to:

- Heavy and light vehicle workshops and fixed plant workshops
- Hydrocarbon storage areas,
- ANFO facilities,
- Laydown areas,
- Turkey's nests,
- Transfer pads,
- Roads and haul roads,
- Offices.

The accommodation for the operational workforce will result in the upgrade or expansion of the existing HD1 accommodation and/or the installation of an additional camp within the Proposal conceptual footprint. These camps may also be developed to support the construction crew. The key landforms associated with the Proposal are listed in Table 2-2.

Once HD2 is approved, infrastructure currently associated with HD1 in list above will be reassigned as HD2 infrastructure recognising that the operational life of HD2 will extend beyond that at HD1.

Table 2-2: Mining landform inventory

Landform	Type	Footprint (ha)	Status	Indicative completion
HD2 West	Pit	965.89	Proposed	2040
HD2 Centre	Pit			
HD2 East	Pit			
BHT West	Pit			
BHT Centre	Pit			
BHT East	Pit			
HD2 DP_NW (Goanna)	Waste rock landform (WRL)	939.24	Proposed	
HD2 DP_NC (LG) (Tortoise)	WRL			
BHT DP_NEWD	WRL			
BHT DP_NELG	WRL			
BHT LB_Central 3	Landbridge	62.88	Proposed	
BHT LB_Central	Landbridge			
BHT LB_East 6	Landbridge			
BHT LB_East	Landbridge			
BHT LB_West	Landbridge			
Infrastructure	Heavy and light vehicle workshops and fixed plant workshops Hydrocarbon storage areas, ANFO facilities, Laydown areas, Turkey's nests, Transfer pads, Roads and haul roads, Offices.	2932.14	Proposed	

It should be noted that there is the potential for further ongoing development of additional deposits subject to future approvals. Should these exploration areas eventually be developed, mining at the Proposal could continue significantly longer than indicated in Table 2-1. The addition of new deposits would also significantly affect the mining sequence and schedules for currently approved or proposed deposits.

The HD2 deposit intersects the GNH, north of the HD1 mine access road and south of the West Angelas mine access road (Figure 4). The Proposal includes realignment of approximately 6 km of the Highway off

tenure to access the ore body below. Preliminary consultation with Main Roads Western Australia, BHP, the Shire of East Pilbara and the Ngarlawangga Traditional Owners have commenced and will continue through Life of Mine (LoM) (Section 4) to agree an appropriate reinstatement approach with stakeholders. All future design updates will be included in subsequent updates to this MCP.

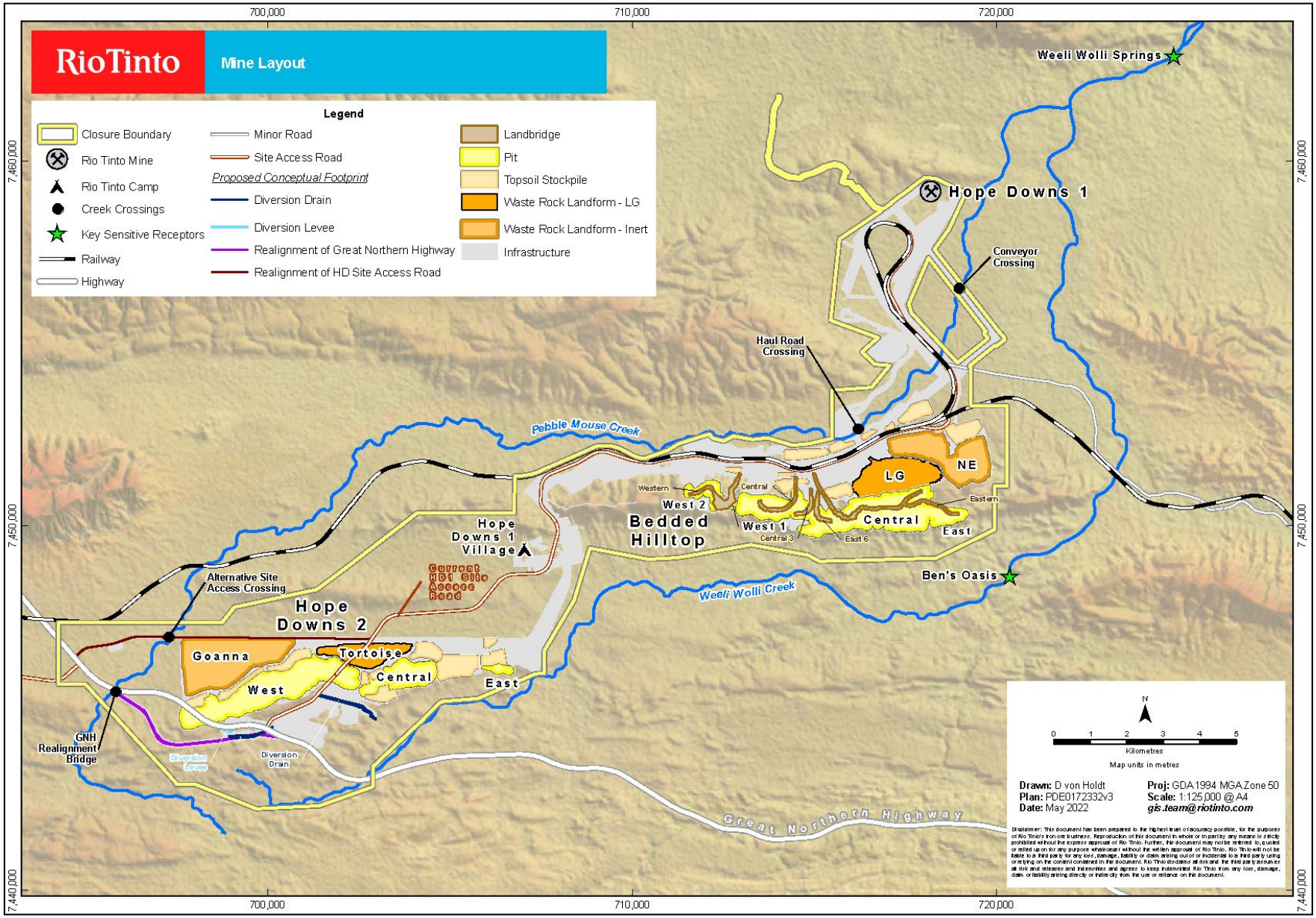


Figure 4: Mine layout

3 Identification of Closure Obligations and Commitments

The Australian mining industry has a well-established commitment to ensure that mine operations are closed with safe, stable, non-polluting landforms which are sympathetic to the surrounding landscape and that will require minimal (preferably no) ongoing maintenance post-closure.

Australian State and Territory Governments are responsible for the regulation and management of mine closure requirements for the mining industry (ANZMEC and MCA, 2000).

This section details the relevant Commonwealth, State and local requirements pertaining to the closure of the Proposal.

3.1 Commonwealth

The Commonwealth EPBC Act has established a consistent framework for environmental assessment of new proposals and variations to existing projects. Mining proposals that have the potential to significantly impact on matters of national environmental significance (MNES) are assessed for approval under this legislation. Issues related to mine closure are considered during the assessment process. Approved projects that have the potential to impact on MNES are declared a Controlled Action under the EPBC Act and are required to meet conditions of approval provided in a Decision Notice.

The Proposal was referred to the Department of Agriculture, Water, and the Environment (DAWE) to determine if assessment under the EPBC Act was required. DAWE advised on the 22 December 2021 that the Proposal would be a Controlled Action. The Proposal is being assessed via the accredited assessment process with the Western Australian Environmental Protection Authority (EPA).

3.2 Western Australia

Department of Mines, Industry, Resources and Safety (DMIRS) is the lead regulatory agency and decision-making authority for mining projects in Western Australia under the *Mining Act* 1978 (Mining Act). DMIRS also has an advisory role in relation to the environmental management aspects of mines which are regulated under the Mining Act, State Agreement Acts and the EP Act.

Department of Water and Environment Regulation (DWER) is the lead regulator and decision-making authority under the EP Act. The EPA is the State's Government's chief advisor on environmental issues and is responsible for carrying out environmental impact assessments of significant proposals under Part IV of the EP Act.

The Department of Biodiversity, Conservation and Attractions (DBCA) protects and conserves the State's natural environment on behalf of the people of Western Australia under the *Biodiversity Conservation Act 2016* (BC Act).

Department of Jobs, Tourism, Science and Innovation (JTSI) is the lead regulator for all mining and associated activities conducted under Rio Tinto's various State Agreement Acts. The State Agreements set out the obligations of the parties in relation to mining and associated activities, including closure. The State Agreements specifically contemplate the Western Australian Government's entitlements to certain assets at closure.

3.2.1 Primary legislation

3.2.1.1 State Agreement

A State Agreement is a contract held between a mining company and the Western Australian Government that has been ratified by Parliament to become legislation. A State Agreement sets out the terms, conditions, rights and obligations of the parties in relation to the development and ongoing operation of a mining project and associated activities. The Proposal will be undertaken pursuant to the *Iron Ore (Hope Downs) Agreement Act 1992* (WA).

3.2.1.2 Mining Act

The Mining Act regulates the terms and conditions upon which exploration and mining for minerals can be undertaken within Western Australia. In 2010, amendments to the Mining Act provided for the requirement of an MCP to be submitted to DMIRS for approval as part of a Mining Proposal and in any other circumstances as outlined in Section 84AA of the Mining Act.

3.2.1.3 Environmental Protection Act

The EP Act outlines environmental management requirements for mining projects in Western Australia. Under Part IV the EP Act any proposal that may result in a significant impact to the environment must be referred under Section 38 (s38) to DWER, who set the level of assessment, undertake assessment of the proposal, and prepare a report and recommendations for the Western Australian Minister for the Environment. If approved, the Minister will issue a Ministerial Statement (MS) granting approval to implement the proposal subject to the conditions prescribed in the MS, including the requirement and timing for submission of MCPs to DMIRS, DWER and other relevant stakeholders. DMIRS is the primary agency responsible for reviewing MCPs.

The Proposal was referred under Part IV of the EP Act on 24 August 2021 and a Public Environmental Review (PER) level of assessment was determined by the EPA on 29 October 2021.

3.2.1.4 Aboriginal Heritage Legislation

The *Aboriginal Heritage Act 1972* (AH Act) protects all Aboriginal heritage sites in Western Australia, whether or not they are registered with the Department of Planning, Lands and Heritage (DPLH).

Consent is required from the Minister for Aboriginal Affairs under s. 18 of the AH Act for any activity which will adversely impact Aboriginal heritage sites. Authorisation can also be granted under s. 16 to enter, excavate, examine or remove anything on an Aboriginal heritage site (e.g., for archaeological purposes). Sites within the closure boundary are discussed in Section 5.1.2.

3.2.1.5 Native Title

The Commonwealth *Native Title Act 1993* (NT Act) recognises the rights and interests of Aboriginal and Torres Strait Islander people in land and waters according to their traditional laws and customs. Native Title includes areas where title holders have exclusive rights and interests as well as areas where non-exclusive rights and interests exist. Traditional Owner rights recognised under the NT Act within non-exclusive areas generally include the right to:

- access, remain and move about, and camp and erect shelters and structures for that purpose;
- hunt and fish, gather and use traditional resources, and take and use water;
- engage in cultural activities and transmit knowledge;
- visit, care and protect places of cultural and spiritual importance; and
- conduct ceremonies and rituals.

The Proposal closure boundary intersects non-exclusive areas of the relevant Native Title Determinations.

3.2.2 Primary guidelines

3.2.2.1 Guidelines for Preparing Mine Closure Plans

DMIRS developed the industry guidance document *Statutory Guidelines for the Preparation of Mine Closure Plans*. This guideline was originally released in June 2011, revised in May 2015, and subsequently became a statutory guideline in March 2020.

The guideline adopts the objectives and principles of the Strategic Framework, whilst providing further description of how MCPs in Western Australia can meet the objectives and principles. It also outlines a planning process that aims at ensuring that a mine can be closed, decommissioned and rehabilitated in an

ecologically sustainable manner, consistent with agreed post-mining outcomes and land-uses, without unacceptable liability to the State.

All Mining Proposals for new projects need to be accompanied by an MCP.

The EPA and DMIRS undertake parallel assessment of MCPs if the Proposal requires approvals under Part IV of the EP Act and the Mining Act.

3.2.2.2 Other guidelines and industry standards

This MCP has been prepared in consideration of the relevant aspects from the following closure guidelines and industry standards:

- Mine Closure: Leading Practice Sustainable Development Program for the Mining Industry (2016a) (Department of Industry, Science, Energy and Resources (DISER).
- Mine Closure and Completion Handbook (DISER, 2016b).
- Preventing Acid and Metalliferous Drainage Handbook (DISER, 2016c).
- Mine Rehabilitation Handbook (DISER, 2016d).
- DRAFT Guidance Note – Environmental Risk Assessment for Mining Proposals and Mine Closure Plans (DMIRS, 2019).
- Guidance – How to prepare a Mine Closure Plan in accordance with Part 1 of Statutory Guidelines for Mine Closure Plans in Western Australia (DMIRS, 2020).
- Environmental Objectives Policy for Mining in Western Australia (DMIRS, 2020b).
- Guideline for safety bund walls around abandoned open pit mines (Department of Industry and Resources (DoIR), 1997).
- Integrated Mine Closure: Good Practice Guide (2019). International Council of Mining and Metals, International Committee of Mining and Minerals (ICMM).
- Mine Rehabilitation in the Australian Minerals Industry (2015). Mineral Council of Australia (MCA).
- A Framework for Developing Mine-site Completion Criteria in Western Australia (Western Australian Biodiversity Science Institute, Young *et al*., 2019).
- A review of mine rehabilitation condition setting in Western Australia. The Western Australian Biodiversity Science Institute, Kragt *et a*l (2019).

3.3 Legal obligations

A Proposal closure obligations register was compiled in 2021 and is presented in Appendix 1. It contains details of legal obligations from the following instruments:

- *Iron Ore (Hope Downs) Agreement Act 1992* (WA);
- Miscellaneous Licence issued under the Mining Act pursuant to the *Iron Ore (Hope Downs) Agreement Act 1992*; and
- special leases and easements issued under the *Land Administration Act 1997 (WA*) pursuant to approval under the *Iron Ore (Hope Downs) Agreement Act 1992 (WA)*.

The register also identifies legislation, standards and guidelines that may not apply to this site specifically, but that may be relevant to closure of mine sites generally.

This MCP has been prepared to support an environmental impact assessment for the Proposal and any additional obligations that may arise through this process. All new obligations will be documented in the next update of this MCP, and then as applicable, in each subsequent update.

A Health, Safety, Environmental and Quality Management System (HSEQMS) will assure compliance with legal obligations throughout LoM operations. At this stage it is assumed that the HSEQMS process utilised during operations will continue to be employed to govern closure implementation and the post-closure monitoring period prior to relinquishment.

The Proposal is located on land the subject of the Nyiyaparli, Banjima and Ngarlawangga Native Title Determinations (refer Section 5.1.1). Rio Tinto has registered Indigenous Land Use Agreements (ILUAs) with the Nyiyaparli, Banjima, and Ngarlawangga Traditional Owners in respect of this area, and is committed to ongoing consultation regarding the assessment, operation, progressive rehabilitation, and the ultimate closure of the Proposal.

4 Stakeholder Engagement

4.1 Consultation program

Rio Tinto recognises that regular and ongoing stakeholder engagement is a key part of mine closure planning as it ensures that the views and expectations of stakeholders are understood by the mine operator, and that these are considered and managed during the operational phase and through to the planning and implementation phases of closure. The ability to build relationships and to work collaboratively and transparently with Traditional Owners of the land on which we operate, and our host communities is critical to Rio Tinto's long-term success regarding rehabilitation and closure.

Rio Tinto has commitments for consultation with stakeholders, these are embedded in both the Rio Tinto's *Mine Closure Standard* (2021) and *Community and Social Performance Standard* (2015). These standards are aligned with principles from the Australian and New Zealand Minerals and Energy Council and the Minerals Council of Australia (ANZMEC/MCA, 2000). Consultation commences at appropriate times during the early stages of exploration planning and will continue until the final relinquishment of the site.

As part of this process all likely impacted stakeholders are identified and recorded in a register, a summary of which is shown below in Table 4-1. This register is used to ensure relevant and timely communications are held with stakeholders across a broad range of topics relevant to the mining operations, including closure. Regular consultation is conducted with key stakeholders via a variety of forums, for example various State and Local Government agency briefing meetings and Traditional Owner consultation forums (Section 5.1). The level of closure specific content and detail will increase as closure approaches.

A closure consultation register for the Proposal is maintained and a copy as at the time of writing is included in Appendix 2. This register is used to ensure stakeholder feedback is tracked and monitored to ensure that appropriate actions are taken to address these issues in a timely manner.

Table 4-1: Proposal key stakeholder list

Category	Stakeholder
Commonwealth	• Department of Agriculture, Water and the Environment (DAWE)
State	• Department of Water and Environmental Regulation (DWER) • Department of Mines, Industry Regulation and Safety (DMIRS) • Department of Jobs, Tourism, Science and Innovation (JTSI) • Department of Biodiversity Conservation and Attractions (DBCA) • Department of Planning, Lands and Heritage (DPLH) • Department of Primary Industries and Regional Development (DPIRD) • Department of Health (DOH)
Traditional Owners	• Karlka Nyiyaparli Aboriginal Corporation (representing the Nyiyaparli people) • Banjima Native Title Aboriginal Corporation (representing the Banjima people) • Ngarlawangga Aboriginal Corporation (representing the Ngarlawangga people)
Local	• Shire of the East Pilbara • WA Police – Pilbara • Main Roads Western Australia • Pilbara Development Commission • Pilbara Regional Council • Pilbara Inland Chamber of Commerce and Industry
Non-government	• Joint Venture partners • BHP
Community	• Pilbara Aboriginal Businesses

Category	Stakeholder
	• Regional communities, including Newman • Marillana pastoral station
Internal	• Rio Tinto iron ore employees and contractors

4.2 Closure Stakeholder Engagement strategy

An overview of the closure stakeholder engagement to be undertaken throughout the life of the site is presented in Table 4-2.

The focus of this consultation will be to:

- Identify the key issues and concerns regarding rehabilitation and closure of the Proposal.
- Where practicable, address key issues and concerns in the project planning and design stage, to avoid, reduce or manage impacts.
- Establish agreed management actions through SCHMP and other management plans to inform operations and ongoing closure planning and consultation.
- Where practicable, allow for adjustments to the design and/or management of proposed rehabilitation and closure activities to address concerns or issues raised by key stakeholders.
- Provide information to key stakeholders regarding the progress of progressive rehabilitation and closure planning.
- Identify expectations for, and progress towards, agreement on post-mining land use(s) and closure outcomes.

Table 4-2: Closure engagement strategy for key stakeholders

Stakeholder	Engagement Forum and Timing	Focus
Traditional Owners; Karlka Nyiyaparli Aboriginal Corporation (KNAC); Banjima Native Title Aboriginal Corporation (BNTAC); Ngarlawangga Aboriginal Corporation (NAC);	Local Implementation Committee (LIC) meetings (twice a year). Life of Mine Planning (LOMP) meetings (twice a year) Dedicated Cultural Heritage meetings (several times per year) Ad hoc meetings: to discuss matters of priority or concern. Meetings as required.	Consultation to support the drafting of the initial mine closure plan to accompany the ERD. Consultation to support compliance driven closure plan updates. Progressive rehabilitation and technical studies updates. Targeted closure planning engagement to support and further refine: • closure strategies and completion criteria; • post-mining land use and closure outcomes; • outline potential business opportunities linked to closure.
JTSI, DWER, DMIRS;	Rio Tinto Closure Regulator Engagement Forum, meetings held three to four times per year. Meetings as required.	Consultation to support three yearly updates to MCPs. Agenda may include: • progressive rehabilitation. • technical studies updates; and • completion criteria.
DBCA, DPLH;	DBCA have requested targeted consultation to be held when closure planning impacts their areas of responsibilities. Meetings as required.	Targeted closure planning engagement to commence during Order of Magnitude (OoM) closure studies to support further refinement of closure strategies and completion criteria.

Through a range of forums, including forums established under the Native Title Agreements (NTA), consultation with each of the Traditional Owner groups in respect of land access; Proposal development; heritage surveys; environmental management; and other issues relevant to the Proposal will be undertaken.

These forums and meetings include, but are not limited to:

- Local Implementation Committee (LIC) meetings which involve face to face meeting to discuss key issues and reach decisions on a range of topics relevant to Traditional Owners. This forum includes company senior leaders, invited subject matter experts, and Traditional Owner representatives and advisors.
- Life of Mine Planning (LOMP) meetings which involve face to face meeting to discuss and provide updates to Traditional Owners on exploration, studies/projects, mining, and closure activities. Key topics include management of water and the environment.
- Dedicated Cultural Heritage meetings which involve face to face meetings to discuss, in detail, cultural heritage identification, management and approvals.
- Environmental monitoring and management, including on-ground consultation to participate in monitoring and management activities.
- Ad hoc meetings: to discuss matters of mutual priority and concern. These meetings often take place 'on-country' with support from internal and external Subject Matter Experts (SME), Traditional Owner Elders and Aboriginal Corporation staff.

Additional requirements for consultation with KNAC are included in Table 11 of the Social and Cultural Heritage Management Plan (SCHMP) developed in collaboration with Nyiyaparli for the Proposal (Rio Tinto 2023). One of the SCHMP objectives is to "ensure mine design, rehabilitation and closure incorporates Nyiyaparli People's social surroundings values and preserves, protects and manages those values in the area in cooperation with Nyiyaparli People". The SCHMP details specific management actions, monitoring and timing to achieve this objective. Refer to Table 11 of the SCHMP for more information.

4.3 Targeted stakeholder consultation

As this is the first MCP for the Proposal, engagement regarding closure of the site has been limited. However, engagement with Traditional Owners and key stakeholders regarding the deposits, the conceptual mine layout, highway realignment and other topics have occurred and will be ongoing as part of Social Surroundings consultation with relevant Traditional Owner groups and other community stakeholders to inform the environmental impact assessment for the Proposal.

Main Roads WA, BHP Limited, and other Government agencies have also been engaged regarding the Proposal (Appendix 2). Rio Tinto will continue these consultations with key stakeholders over the life of the Proposal with closure remaining an ongoing point of discussion.

Ongoing engagement with Traditional Owners regarding the Proposal and the closure strategy and outcomes is required to ensure a shared understanding of the planned Proposal as well as the key social and cultural values within the vicinity of the Proposal which will require protection and management during its planning, operation, and closure.

Key areas for consultation include:

- project design and closure planning;
- identification and protection of social and cultural heritage values;
- repatriation of salvaged artefact material;
- land access during and after closure;
- consideration of retaining or re-purposing infrastructure;
- consideration of plant species selection for rehabilitation; and
- business and employment opportunities.

5 Baseline Closure Data and Analysis

This section provides a summary of relevant baseline and operational studies, surveys and data, with key knowledge base reports appended. Rio Tinto will use this information to assist in the development and on-going refinement of completion criteria and effective mitigation and management of identified risks leading up to, and during, the closure implementation phase.

The HD2 closure knowledge database (Appendix 3) is a record of all the baseline studies, models and interpretations, which have been completed for the development of the Proposal that are relevant to closure planning. The knowledge may be specific to the site or generally applicable to the Pilbara region; and includes information on the performance of closure-related trials completed at other Pilbara mining operations (when appropriate).

Identified closure knowledge gaps are identified in each section and summarised in Section 6. The knowledge gaps are aligned with the Closure Risk Register (Appendix 4) and associated actions captured in the Closure Action Register (Appendix 5).

SOCIAL SETTING

5.1 Aboriginal culture and heritage

Rio Tinto recognises and respects the significance of Australia's cultural heritage, and in particular the cultural heritage of Aboriginal people who have traditional ownership of, and/or cultural connections to, the land on which it operates.

Extensive archaeological and ethnographic surveys have been undertaken within the closure boundary, along with dedicated Social Surroundings consultation to understand broader social and cultural values. This work has informed Rio Tinto's understanding of the social and cultural values of the area. The ongoing consultation with Traditional Owner groups has also informed the Proposal design to avoid impacts to significant social and cultural values, sites, and places, as well as identify options to reduce and manage impacts through the implementation, operation rehabilitation and closure phases of the Proposal. Closure works consider issues such as post-closure access requirements to culturally significant sites and appropriate storage and return of any materials salvaged during mining operations.

5.1.1 Native Title determinations

The closure boundary is on land subject to three Native Title determinations (Figure 3), being:

- Nyiyaparli People Native Title determination (WCD2018/008), covering the majority of the Development Envelope (the Nyiyaparli section), which is administered by Karlka Nyiyaparli Aboriginal Corporation (KNAC) on behalf of the Nyiyaparli People. KNAC holds determined native title rights on behalf of the Nyiyaparli People.
- Banjima People Native Title determination (WCD2014/001), which relates to two discrete portions in the north of the Development Envelope (the Banjima section). The Banjima Native Title Aboriginal Corporation (BNTAC) holds determined native title rights on behalf of the Banjima People.
- Ngarlawangga People Native Title determination (WCD2016/007), which relates to a portion in the southwest of the Development Envelope (the Ngarlawangga section), which is managed by the Ngarlawangga Aboriginal Corporation (NAC) on behalf of the Ngarlawangga People (see **Figure 3** for comparative area sizes).

The long history of Aboriginal land use within the closure boundary reflects the deep cultural significance of this area to Nyiyaparli, Banjima and Ngarlawangga people. These Traditional Owner groups have a shared responsibility to protect and care for this country, and the respective Native Title Determinations recognise each Traditional Owner group's non-exclusive right to continue to access, use and enjoy country.

Rio Tinto has entered into Native Title Agreements with each of these three Traditional Owner groups in respect of the use of the land the subject of the Proposal. In addition, Rio Tinto has registered Indigenous Land Use Agreements (ILUAs) with the Nyiyaparli, Banjima and Ngarlawangga People in respect of the land

subject to the Proposal (and more broadly) which address the Future Acts provisions of the *Native Title Act 1993*.

5.1.2 Ethnographic and archaeological values

Archaeological and ethnographic surveys have been undertaken for the Proposal, with the participation and involvement of the relevant Traditional Owner groups, who have identified sites and made recommendations on the significance and management of each site. Surveys to date have recorded archaeological and ethnographic sites in the region including artefact scatters; quarries; rock shelters; scarred trees; rock art and other significant cultural values. There are 113 known archaeological and ethnographic sites within the HD2 closure boundary, 29 of which have been registered or lodged for assessment under the *Aboriginal Heritage Act* 1972.

As surveys continue, additional cultural and heritage places are likely to be identified. Archaeological and ethnographic surveys and consultations are ongoing and will continue during the assessment of the Proposal and beyond, which will add to the existing knowledge of heritage and cultural values within the area.

A summary of the ethnographic and archaeological values located within the Proposal closure boundary and relevant to closure of the Proposal is provided below:

- The Proposal closure boundary is located within a storied landscape that is active in Banjima, Ngarlawangga, and Nyiyaparli culture. Nyiyaparli Law (mangun) explains how the hills, plains, rivers, and waterholes as well as people, plants and animals were created by the ancestral spirits in the Kukutpa, the Dreamtime. The area holds a deep cultural significance to Nyiyaparli, Banjima and Ngarlawangga people and they are responsible for the land.
- The Djadjiling Range, which stretches along the northern edge of the Proposal closure boundary, is associated with a number of song lines important within Nyiyaparli, Banjima and Ngarlawangga culture. Rock shelters in the Djadjiling Range such as Jundaru and to a lesser extent Djadjiling Rock shelter (HS-A1 and HD07-3A-PAD13) preserve unusually dense and diverse archaeological assemblages from the period of initial occupation, between 50,000 to 35,000 years ago (Cropper and Law 2018b). The archaeological assemblage from this period indicates that people visited these shelters intermittently and only for short periods.
- Facing Djadjiling Range on the opposite side of the broad valley containing Pebble Mouse Creek (PMC) is BHT. In the upper gullies and hidden rock shelters of this range are walled cavities. These difficult-to-reach places were used to store sacred implements and objects or as burial sites.
- Near the northern portion of the Proposal, a series of sinkholes have been identified. They are linked through dreamtime stories to sinkholes associated with Wirlawarli (Weeli Wolli Spring).
- Other sites of particularly high significance within the HD2 closure boundary include a large heritage complex (HOPE4-07) and a rock shelter (BDH16-03) with unique archaeological features such as hand stencils and incised rock art.
- Water is at the centre of Traditional Owner life, culture and spirituality and is recognised by Traditional Owners as a critical element of country, and cultural and ecological landscapes. Within the Proposal closure boundary, water flows through Pebble Mouse Creek to the north where it terminates in the WWC north of the HD1 operation. The WWC headwaters are located south of the HD2 deposit, within the Proposal closure boundary, and flow northwards towards the Fortescue River 60 km to the northeast.
- WWC is a highly significant waterway that runs through the southern portion of the Proposal closure boundary. Evidence of past human occupation (in the form of material remains such as stone tools and evidence of stone quarrying) along this section of WWC has been found and recorded as part of archaeological and ethnographic surveys.

- On the southern edge of the Proposal closure boundary, on an upper tributary of Weeli Wolli Creek near a semi-permanent waterhole, is the Wonmanna Rock Art site (DPLH ID 11917), a significant collection of engravings recognised as a Protected Area under the *Aboriginal Heritage Act* (1972) and on the Register of the National Estate (ID 016192). Figure 5 displays the current Registered Aboriginal Sites and Other Heritage Places within the Proposal closure boundary (DPLH 2021).
- Social and cultural heritage values for Nyiyaparli are documented in the HD2 SCHMP (Rio Tinto 2023). Developed in collaboration with Nyiyaparli for the Proposal, the SCHMP's purpose is to describe management for Nyiyaparli People's social and cultural values with the potential to be impacted by the Proposal. Additionally, ACHMPs will be developed with Traditional Owner groups where direct impacts to Special Places including heritage sites are identified as being significantly impacted. Refer to Section 5.1.6 for more information.

5.1.3 Closure implementation affecting heritage sites

Management of cultural heritage values will be conducted through processes established under the relevant Native Title Agreements. Closure planning considers how salvaged artefacts will be managed long term. Consultation will be ongoing with Traditional Owner throughout the life of the Proposal to identify cultural heritage sites and places, determine which sites should be preserved in situ, and which sites may be impacted and will require salvage, and the appropriate process for this.

While cultural heritage sites and places will be considered during landform design and planning (which includes rehabilitation designs), there is potential for heritage sites to be impacted because of closure implementation i.e., footprint encroachment, resulting from landforms such as waste rock landforms being reshaped to final design parameters or being located within the potentially unstable pit edge zone (PUPEZ) and therefore inaccessible due to being within abandonment bunds. As options on engineering and rehabilitation designs are narrowed as the site approaches closure, any potential for sites to be impacted will be identified and managed in consultation with the relevant Traditional Owner groups and in accordance with appropriate procedures. Heritage surveys, and any future assessments or clearances that are required to facilitate closure implementation will be conducted in collaboration with the Traditional Owner groups.

5.1.4 Heritage management

As detailed in Section 5.5.3, safety bunding is required around potentially unstable pit edge zone for pits. An assessment has not been undertaken to determine if the conceptual bund locations would impede access to key heritage site post-closure. Consultation is ongoing with Traditional Owner groups to identify the cultural heritage sites and places which are to be preserved in situ and to which access is required, during the life of the project. This work will inform assessments in future stages of closure planning to ensure acceptable and safe access is available where possible. Discussions with Traditional Owner groups around the placement of development infrastructure will also be on-going during all phases of the project to ensure site access requirements are continually considered and updated in closure planning.

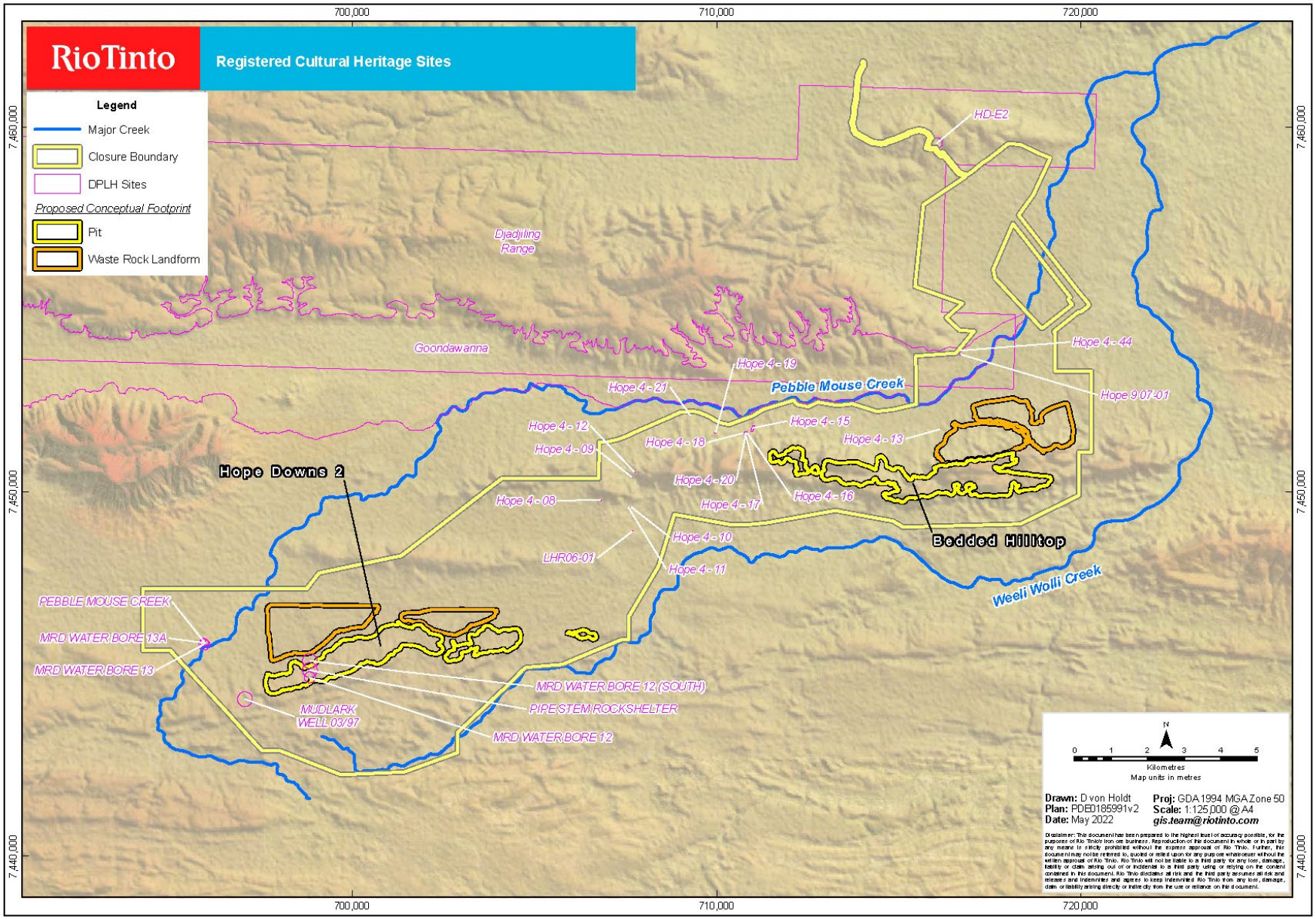


Figure 5: Registered Cultural Heritage Sites

5.1.5 Social surroundings

Aboriginal social and cultural heritage can include tangible values embodied in the landscape and specific places and sites, as well as intangible values related to cultural associations Traditional Owner have with an area – which may include, for example, traditional hunting and gathering activities, learning, teaching, ceremony, healing activities and enjoyment of country. Understanding places and cultural associations with country which are particularly important and help to prioritise areas to be avoided where possible and inform the design of other mitigation strategies.

Consultations during the development of the Proposal have considered social surroundings factors required under the EP Act. These consults included identifying important social and cultural values, work to develop options to avoid, reduce or manage impacts to these values and closure planning discussions regarding the proposed closure strategy and planning, closure outcomes and the MCP.

These consultations were undertaken with representatives of the Nyiyaparli, Banjima and Ngarlawangga Traditional Owner groups. Additional consultations were undertaken with Nyiyaparli as the majority of the Proposal is located on land that falls within the Nyiyaparli People's Native Title Determination.

Concerns expressed by the Traditional Owner groups to date relate to the practical, spiritual and cultural value of water, the potential impacts of dust and noise, restricted access to country, and the cumulative impacts of mining operations in the vicinity of the Proposal and across each Traditional Owners country. Some of the key concerns identified by the Traditional Owner in respect of these values are summarised below:

- **Water management and water quality** including the effects of diversions, groundwater drawdown and use for dust control, and cumulative impacts of water abstraction on local aquifers and changes to water flows within the WWC catchment. The Traditional Owners identify WWC and WWS as places of extremely high spiritual and cultural value. The potential effects of the proposed HD2 creek diversion and HD2 waste dumps on WWC have been raised as concerns. In particular, the effects of dust from the waste dumps, other activities associated with the Proposal on creeks and waterholes, as well as the use of water for dust suppression, are also significant concerns.
- The **impacts of dust** accumulating in water features and along drainage lines. Concern also exists about the effect of dust emissions on amenity, animals, plants and people.
- **Access to country**, particularly heritage sites and places and other areas of importance such as WWC. Access needs to be easy, year-round and unrestricted (i.e., by permit systems, fences, gates etc.). Related concerns include the condition, location and safety of the current road to WWC, and some hunting and camping areas becoming inaccessible.
- **Cumulative effects** of the Proposal with other mining operations has been raised by Traditional Owner groups. This concern relates to effects on water, including cultural responsibilities that apply in maintaining water flows between neighbouring groups' lands, as well as cumulative impacts to country as are result of pit voids, waste rock landforms and other impacts which will remain after closure.

Other points raised in consultation by Traditional Owners to date include:

- the desire for impacts to country (including through infrastructure, pit voids and waste rock landforms) to be reduced as much as possible;
- an interest in rehabilitation and the rehabilitation process; and
- business and employment opportunities during rehabilitation and closure activities.

Broadly, these groups seek to ensure these values are considered during closure, and that their country is returned to them in a way which reinstates social, cultural and environmental values as much as possible. Further consultation and surveys are planned to continue to build understanding and appreciation of social and cultural values for the Proposal and how to incorporate them into closure planning.

Additional social and cultural heritage values for Nyiyaparli are documented in the SCHMP. One of the objectives is to ensure mine design, rehabilitation and closure considers Nyiyaparli People's social surroundings values and as far as practicable preserves, protects and manages those values in the area in cooperation with Nyiyaparli People.

5.1.6 Management of heritage sites and social and cultural values

There are several highly significant heritage sites and important social and cultural values that will require management during operations and closure implementation, and which will be considered as part of the closure planning process. These include:

- PMC is an upper tributary of WWC, and as such any development which impacts either waterway or their catchment areas are included in consultations for the Proposal. The Proposal will include construction of two crossings over a section of this creek to link with the current HD1 operation, as well as two potential additional new crossings for the potential realignment of GNH and a new mine access road. Ongoing consultation with Traditional Owners regarding potential impacts to PMC will provide an opportunity for stakeholders to recommend culturally appropriate management measures.
- The highly significant HOPE4-07 and BDH16-03 heritage sites are located within the Proposal, and the conceptual mining footprint has been altered to avoid direct impacts these sites. Geotechnical assessments at relevant features will occur during operations to assess and manage susceptibilities to vibrational impacts associated with blasting. Implementation of a 100m buffer around BDH16-03 will minimise indirect impacts from the mine associated with dust. Access to these sites will made available post-closure. The HOPE4-07 heritage complex is located to the north of WWC, southwest of the HD2 deposit. Consultation with Nyiyaparli Traditional Owners is ongoing in respect of this complex to inform additional management measures.
- The main hill at the BHT deposit, which has intrinsic aesthetic value, providing a sense of place, and the southern façade of the hill will be retained to reduce impacts to visual amenity including from WWC.

Ongoing consultation with each Traditional Owner group regarding heritages sites and social and cultural values will inform the design of the Proposal and inform closure strategies and outcomes.

The SCHMP, jointly developed with the Nyiyaparli people, includes agreed processes and commitments in respect of the management of broader social and cultural values. Given all mining activities (mine pits and waste rock landforms) are located on Nyiyaparli country, significant impacts have been assessed for Nyiyaparli country. Closure planning will be completed in reference to the SCHMP for additional information and management of these values. The SCHMP is expected to complement, not replace, or duplicate the management and monitoring of significant impacts to factors. The SCHMP addresses social surroundings in so far as to meet the requirements of Part IV of the EP Act. The SCHMP does not replace or duplicate this MCP. The next major update of the MCP will include additional consideration of Special Places as mentioned in the SCHMP and the ACHMP, once available, to inform closure planning.

Significant impacts to Ngarlawangga country would relate to the re-alignment of GNH. Once final alignment of the GNH is determined, an SCHMP will be co-developed with the Ngarlawangga people if the re-alignment impacts Ngarlawangga country.

No SCHMP has been developed for Banjima Country given the part of the Proposal located on Banjima country is limited to infrastructure located on areas of existing disturbance associated with HD1, predominantly transport, ore handling and ancillary (such as power and communications). ACHMPs will be developed with Traditional Owner groups where direct impacts to Special Places, including heritage sites, are identified as being significantly impacted. Where Aboriginal heritage sites cannot be avoided heritage surveys will be used to support a transitional section 18 application under the AH Act and/or an Aboriginal Cultural Heritage Management Plan (ACHMP) subject to the requirements ACH Act section 10-10-5. The purpose of an ACHMP is to manage heritage sites and places with each group and in accordance with the relevant legislation. A Proposal specific ACHMP will be developed in consultation with the Nyiyaparli People

which identifies processes to be followed with regards to Special Places including heritage sites to be avoided.

As no significant impacts have been identified for Banjima, no ACHMP is required for HD2 impacts to Banjima Country.

Heritage sites and social and cultural values of high significance will be managed *in situ* where possible, with Blast Management Plans implemented where required to prevent indirect impacts such as those associated with vibrations and fly-rock.

To ensure appropriate management of risk associated with these social values, the risk title “696240 - Implementation of the closure strategy does not achieve the required cultural heritage outcomes.” will be amended to include social values. The risk will be evaluated to ensure that causes, consequence, controls and actions are suitable to reflect the change, and will be included in the next major update of the MCP.

Consultation and collaboration with the Nyiyaparli, Banjima and Ngarlawangga Traditional Owners will be maintained in established forums throughout the life of the operation to ensure that proposed closure strategies address cultural requirements, and that closure outcomes for the site remain appropriate.

5.1.7 Closure access management

Post-closure access to culturally significant sites and places and repatriation of any materials salvaged during mining operations need to be considered as part of closure planning. The repatriation of artefacts following closure of the Proposal has not yet been discussed with the Banjima, Ngarlawangga or Nyiyaparli Traditional Owners but will be included in ongoing consultation. Whilst this MCP does not include specific strategies for maintaining or restoring cultural values, it does recognise that post-closure access to some sites will be required and that where possible these areas will need to be made safe for this purpose. Specific strategies have not yet been developed in recognition that detailed consultation on closure has not yet occurred with Banjima for Rio Tinto to understand their priorities, to inform closure options and align and manage closure expectations.

Sites situated within zones of instability or abandonment bunds will be managed to avoid inadvertent post-closure impacts or isolation through lack of access. Where sites are unable to be appropriately managed in-situ, further consultation and mitigation will be undertaken with Traditional Owners and the relevant governmental departments.

As part of closure planning, detailed consultation will occur with Traditional Owners, for Rio Tinto to understand their priorities, to inform closure options and align and manage closure expectations. Consultation is intended to include:

- the repatriation of salvaged artefacts;
- management and protection of heritage sites during closure implementation;
- how to facilitate meaningful and beneficial post-mining land access and use by Traditional Owner, including the proposed placement of pit abandonment bunds; and
- how to promote meaningful opportunities to include Traditional Owners, Pilbara Aboriginal People and Pilbara Aboriginal Businesses in closure related work.

Specific engagement with each Traditional Owner group will occur to communicate access restrictions to certain areas of the site due to the potential for geotechnical instability associated with pit crests. Site access will be determined in consultation with Traditional Owners and communicated in a post-closure site access plan to ensure that areas of geotechnical instability associated with pit voids are well understood.

Post-closure access for Nyiyaparli People is addressed in Table 11 of the SCHMP, and states that the MCP is to include provision for installation and/or maintenance of access to Special Places, sites and places of social and cultural importance post-closure, wherever safe and practicable.

These consultations will continue as the site progresses through operations towards closure and be further defined in each iteration of the MCP.

5.1.8 Implications for closure and knowledge gaps

The locations of culturally significant sites and places are considered in closure planning in terms of landform closure strategies and final footprints, water management, and post-closure access requirements. Post-closure monitoring also includes monitoring of culturally significant sites and places were relevant and appropriate. Culturally significant plant species are also a consideration in development of rehabilitation seed mixes.

Closure implications associated with Aboriginal cultural heritage (Section 5.1) include:

- Management of potential mining and closure impacts of water, dust, noise, access to country, culturally significant plants and animals and cumulative impacts that can continue to affect the post-closure land use.
- Restricted access to cultural heritage sites that potentially impact intergenerational cultural heritage.
- Long-term indirect impacts to cultural heritage sites from changes to geotechnical stability, surface water movement and sediment transport require consideration in development of closure strategies.
- Additional social and cultural heritage values for Nyiyaparli are documented in the HD2 SCHMP Closure planning should be completed with reference to the SCHMP for additional information and management of these values.

Closure knowledge gaps associated with Aboriginal cultural heritage impacts, as summarised in Table 6-1, include:

- Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, hydrogeological, hydrological, flora and fauna knowledge and assessments.
- Stakeholder engagement strategy and communications plan to be prepared for community, regulators, and internal audience.
- Undertake specific closure stakeholder engagement to determine social and cultural heritage values to be maintained at the closure of the HD2 and BHT deposits, include salvage and repatriation of sites.
- Undertake visual impact assessment of HD2 and BHT deposits final landform configuration and visibility from GNH and other key vantage points or points of cultural heritage importance.
- Develop seed mix(es) HD2 and BHT deposits in line with progressive rehabilitation targets and consultation with stakeholders.
- Develop consultation tools to assist in communicating closure strategy with stakeholders.
- Schedule consultation with stakeholders over the life of asset to consult on closure strategy options and opportunities.
- Consultation with Traditional Owners on key heritage locations and access requirements post-closure to contribute to the final closure landform or landscape.
- Consultation on closure outcomes, completion criteria and measurement tools.
- Consultation on the final closure landform or landscape and opportunities for Traditional Owners to get involved in closure planning and/ implementation.
- Social and cultural heritage values regarding Special Places for Nyiyaparli, as documented in the HD2 SCHMP, will be incorporated in the next major update of the MCP.

The risk title regarding cultural heritage will be reworded and evaluated to ensure that closure outcomes consider social values in the next major update of the MCP.

5.2 Socio-economic aspects

Broader socio-economic aspects which will need to be considered in closure planning include impacts to the amenity of the general population. As the region is sparsely populated and there are no town sites and communities in the immediate vicinity of the Proposal, consideration of amenity will be largely restricted to the effect on users of the GNH and tourists and locals accessing higher nearby viewpoints.

Approximately 900 people are anticipated to work at the Proposal which will operate solely as Fly-In Fly-Out (FIFO) utilising the privately-owned airstrip situated at Rio Tinto's West Angelas iron ore mine. Personnel will be housed in a fully serviced accommodation facility at HD1 Village that is covered in the scope of the HD1 MCP, which will also cover any additional facilities installed as an extension to the village. As a result, there is little direct social interaction between the workforce and any surrounding communities.

Mining activities are anticipated to continue at a similar rate within the wider region after the mine ceases to operate. Thus, employment opportunities and mine related services are not anticipated to be significantly impacted by closure of the mine.

Closure of the Proposal will have minimal impact on the Newman town site, therefore the Newman town site is not considered further in this MCP.

Work required for the implementation of closure has the potential to provide economic benefits for local communities including Traditional Owner groups. A closure strategy for HD2 is to "Explore opportunities to partner with Traditional Owners to implement, maintain and monitor rehabilitation, where possible." This may include work such as rehabilitation of disturbed areas, seed collection for rehabilitation and monitoring of rehabilitation sites (refer to Sections 11 and 12 for more information). These opportunities will be considered as part of the Closure engagement strategy for key stakeholders (Table 4-2).

In the SCHMP developed in collaboration with Nyiyaparli, Table 11 indicates that where possible RTIO will invite KNAC to collaborate on the identification and development of opportunities to support Nyiyaparli engagement in closure activities including: seed collection; research and knowledge sharing; and monitoring.

5.2.1 Implications for closure and knowledge gaps

Closure implications associated with the socio-economic setting include:

- GNH users may be impacted by the closure of the Proposal, particularly as a result of changes to landforms and visual amenity.
- Local communities may be impacted by closure of the Proposal, particularly regarding cessation of opportunities for employment and business opportunities.
- Mining activities are anticipated to continue at a similar rate within the wider Pilbara region after operation of the Proposal ceases, however, Rio Tinto will implement strategies to manage any workforce impacts.
- Closure consultation with Traditional Owners throughout the life of the mine will explore opportunities to partner with Traditional Owners to implement, maintain and monitor rehabilitation, where possible

Closure knowledge gaps associated with socio-economic impacts, as summarised in Table 6-1, include:

- Potential social and economic impacts to be assessed including amenity, public health associated with closure activities, loss of employment and business opportunities.
- Consult with stakeholders to address any potential socio-economic impacts post-closure.
- Undertake visual impact assessment of HD2 and BHT deposits final landform configuration and visibility from GNH and other key vantage points or points of cultural heritage importance.
- Investigate opportunity to allow safe access for viewing/observation of post-closure landform to deter unauthorised access to site.

- Develop consultation tools to assist in communicating closure and potential socio-economic impacts with stakeholders.

PHYSICAL ENVIRONMENT

5.3 Climate

5.3.1 Local climatic conditions

The closest official Bureau of Meteorology (BOM) weather recording station is at Newman Aerodrome (Station 007176). Climatic information has been captured from this site since 1971 and provides a long-term climate record for the local region. In addition to this, an automatic weather station is maintained at the nearby HD1 operation.

The regional climate can be characterised as arid tropical with two distinct seasons: a hot, wet summer (October – April) and a mild, dry winter (May – September) (BoM 2022). Mean daily maximum temperatures range from 40°C in summer to 22°C in winter Figure 6).

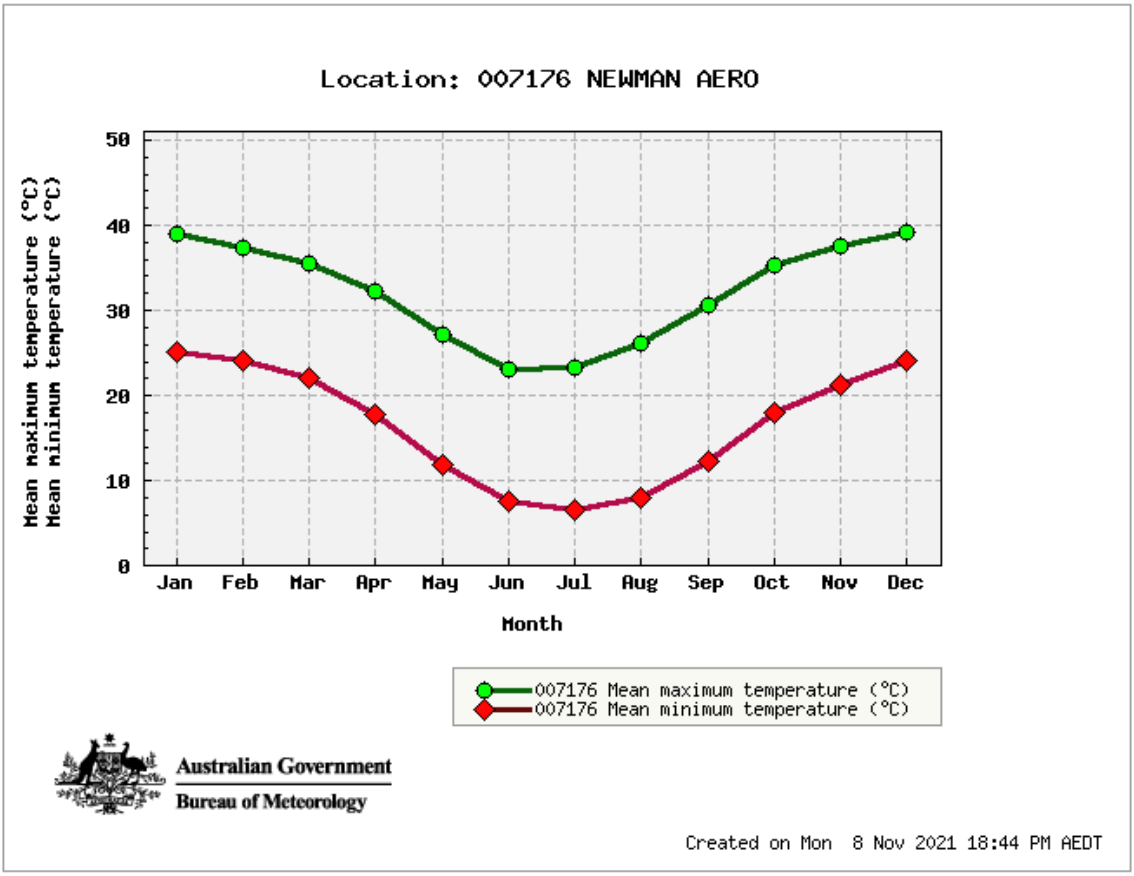


Figure 6: Mean monthly temperatures Newman Aerodrome (1996 – 2021)

Precipitation is driven by summer cyclonic activity, with the lowest average rainfall typically occurring between August and October, with the highest average rainfall falling between December and February (Figure 7).

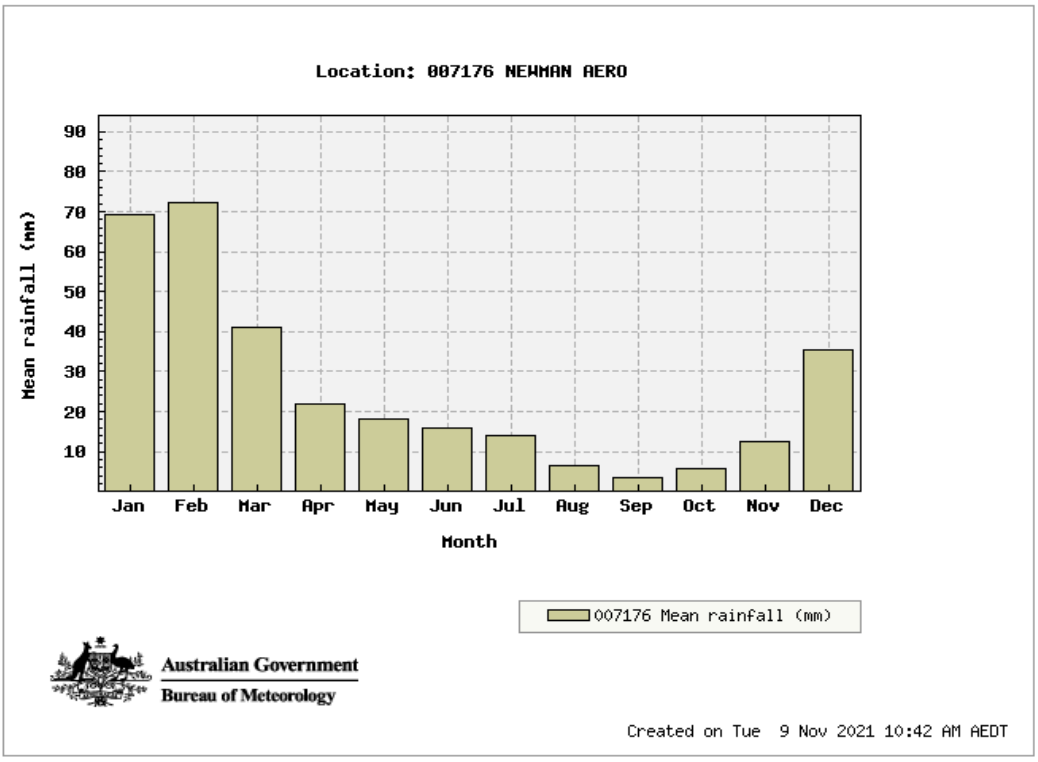


Figure 7: Mean, median and 2021 monthly rainfall at Newman Aerodrome (1971 to 2021)

Precipitation is highly variable throughout the Pilbara, with adjacent areas often receiving varying rainfall volumes throughout the wet season. Annual rainfall records also show significant variation, being driven by the number and intensity of cyclones affecting the region (Figure 8).

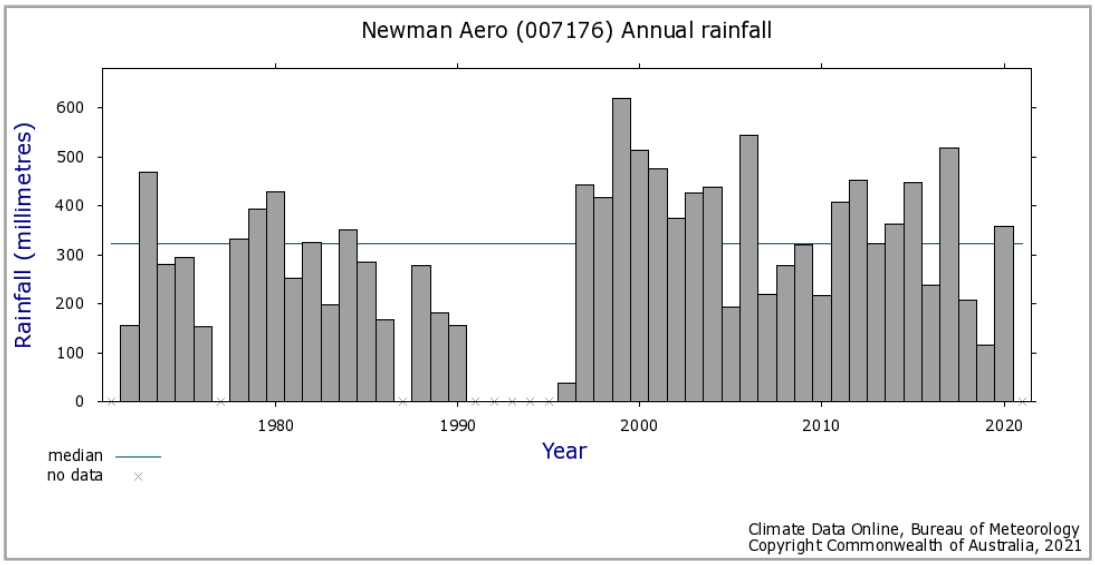


Figure 8: Historical annual rainfall at Newman Aerodrome (1971 – 2020)

The north and north-western coastline of Australia has experienced more tropical cyclones than elsewhere on mainland Australia. Tropical cyclones occur between November and April, with most observed during the late summer. Tropical cyclones can produce damaging wind gusts in excess of 150 km per hour, with heavy rains resulting in regional flooding. Seven tropical cyclones are typical off the Pilbara coast each year, with three expected to make landfall.

Evaporation rates in the region greatly exceed rainfall, which is typical for similar climate conditions around Australia. Average annual pan evaporation rate is 3200-3600 mm/year.

5.3.2 Climate change

Rio Tinto accepts the current view of the Intergovernmental Panel on Climate Change's (IPCC) that global warming is unequivocal, human influence is clear and physical impacts are unavoidable (IPCC, 2022). Rio Tinto understands that climate change will amplify existing risks in mining, port and rail operations in the Pilbara region and recognises a responsibility to act by focusing on a reduction in greenhouse gas emissions (particularly with the use of low emissions technology); and increasing resilience to physical climate change impacts.

For the Pilbara region, climate conditions for 2030 and 2090 are forecast by the Commonwealth Scientific and Industrial Research Organisation (Watterson et al., 2015) to be:

- hotter (both averages and extremes) and drier e.g., in 2030 forecast warming of 0.6°C to 1.5°C;
- potential evapotranspiration will increase in all seasons as warming progresses;
- higher sea levels;
- tropical cyclones may decrease in number, but increase in intensity and duration over the same period; and
- more unpredictable characteristics of other climate-related hazards, including flooding, storm surges and wildfires.

Climate change is a complex issue, with inherent uncertainty about the timing, pace, and severity of possible impacts. Based on climate change projections rainfall reduction will be relatively small in the Pilbara, however, an increase in intensity of extreme rainfall events coupled with the expected rise in temperatures and potential evaporation may have a large impact on the hydrology of the Pilbara region (Charles et. al., 2015).

Risks from climate change to the stability of landforms, mobilisation of contaminants and re-vegetation are some of the identified vulnerabilities. The materialisation of these climate projections is likely to make successful rehabilitation in the Pilbara more challenging.

5.3.3 Implications for closure and knowledge gaps

Closure implications associated with climate include:

- Optimal timing of rehabilitation works to maximise germination following seeding.
- Waste Rock Landform design to consider the intensity of rainfall events, climatic variation, and the potential for extreme rainfall events.

Closure knowledge gaps associated with climate include:

- Landform evolution modelling will be required to confirm the optimal final Waste Rock Landform design, including physical waste characterisation.
- Flood modelling of the closure landform to consider climatic variation and the potential for extreme rainfall events.
- Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, hydrogeological, hydrological, flora and fauna knowledge and assessments.
- Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits.

5.4 Biogeographic setting

5.4.1 Bioregions

Bioregions for the Australian content have been created as part of a national classification of ecosystems. There are currently 89 bioregions and 419 sub-regions in Australia. Each region is based on similarities in climate, geology, landform, native vegetation and species information.

The Proposal lies within the Pilbara Craton, a bioregion defined by the Interim Biogeographic Regionalisation for Australia (IBRA). The Pilbara bioregion is divided into four subregions: Chichester, Fortescue Plains, Hamersley and Roebourne Plains.

The Proposal is in the Hamersley sub-region (Hamersley PIL03), which is described as "*Mountainous area of Proterozoic sedimentary ranges and plateaus, dissected by gorges (basalt, shale and dolerite). Mulga low woodland over bunch grasses on fine-textured soils in valley floors, and Eucalyptus leucophloia over Triodia brizoides on skeletal soils of the ranges. The climate is semi-desert tropical, average 300 mm rainfall, usually in summer cyclonic or thunderstorm events. Winter rain is not uncommon. Drainage into either the Fortescue River (to the north), the Ashburton River to the south, or the Robe River to the west*" (Kendrick 2001).

5.4.2 Land systems

Land systems of the Western Australian rangelands have been mapped and described by the department of Agriculture and Food outing the distributions and providing comprehensive descriptions of biophysical resources, including soil and vegetation condition. A total of 102 land systems occur in the Pilbara bioregion covering 181,723 km^2. Nine land systems associated with the Pilbara Bioregion occur within the HD2 closure boundary, with the Newman land system the most common, accounting for approximately 39% of the total area (Astron, 2019). The land systems present within the HD2 closure boundary are presented in Figure 9.

5.4.3 Implications for closure and knowledge gaps

Closure implications associated with landscape include:

- Final landforms will be designed to be sympathetic with the aesthetic values of the surrounding landscape.

There are currently no known closure knowledge gaps associated with land systems.

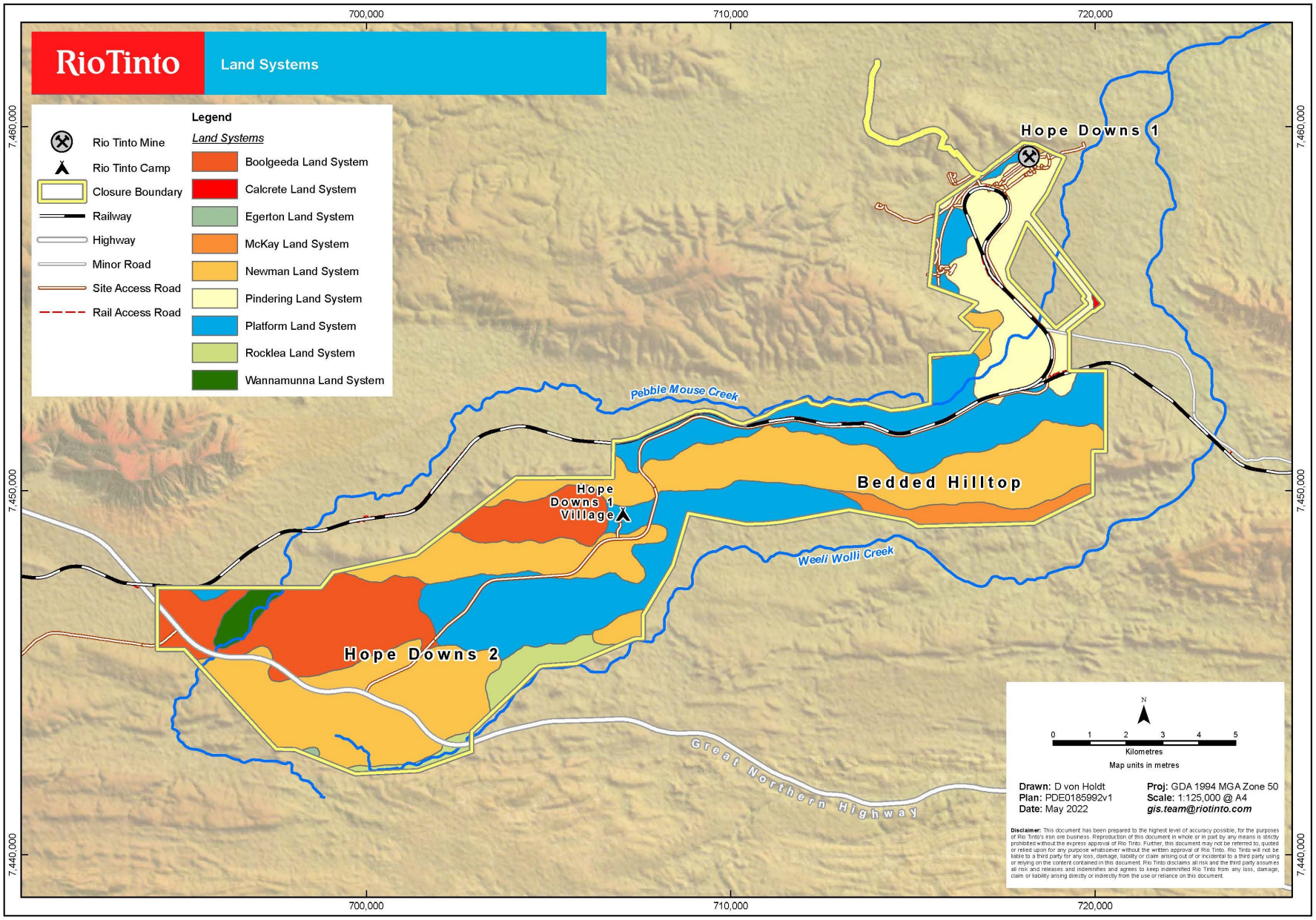


Figure 9: Land systems

5.5 Geology

The Proposal is situated at the south-eastern corner of the Pilbara Craton. The cratonic basement comprises Archean granite-greenstone and is overlain by the Archean-Proterozoic rocks of the Hamersley Basin. These rocks can be divided into three stratigraphic groups: the Fortescue, Hamersley and Turee Creek groups, with the Hamersley Group forming the outcrop at the Proposal.

The Hamersley Group is a sedimentary sequence comprising Banded Iron Formations (BIF), shales and dolomites, with minor felsic volcanic and extensive dolerite dykes and sills. The group contains the Brockman Iron Formation and the Marra Mamba Iron Formation, which together, host most of the known major iron ore deposits in the Pilbara.

The HD2 deposit is a Marra Mamba type ore deposit lying directly adjacent and beneath the GNH, approximately 3 km east of the West Angelas mine turn-off. It consists of east to west trending Marra Mamba Iron Formation, which is mineralised in two places, separated by approximately 2 km. Mineralisation is predominantly contained in the Newman Member but also includes detrital and West Angelas Shale units.

HD2 deposit mineral waste material is contained in the following units:

- Detritals;
- West Angelas Shale;
- Newman;
- MacLeod; and
- Nammuldi.

The BHT deposit is a Brockman type ore deposit in contrast to the other Marra Mamba deposits in the area. The deposit is an east to west striking Brockman Iron Formation ridge. The geology is typically flat throughout the hilltop with some gentle folding. Mapped synforms and antiforms can be seen immediately north of the range front, and the buried Brockman mineralisation extends to >200 m in places, overlain by a detrital sequence containing some mineralised material. Figure 10 shows the dominant geological units and general landscape position for the HD2 deposit, with BHT detailed in Figure 11.

BHT deposit mineral waste material is contained in the following units:

- Detritals;
- Whaleback Shale;
- Dales Gorge;
- Footwall Zone;
- Mount McRae Shale;
- Mount Sylvia; and
- Wittenoom Formation.

Mineral waste generated at the Proposal is subsequently categorised with respect to the geological origins of the material. More detail on the erodibility of these materials is discussed in Section 5.7.

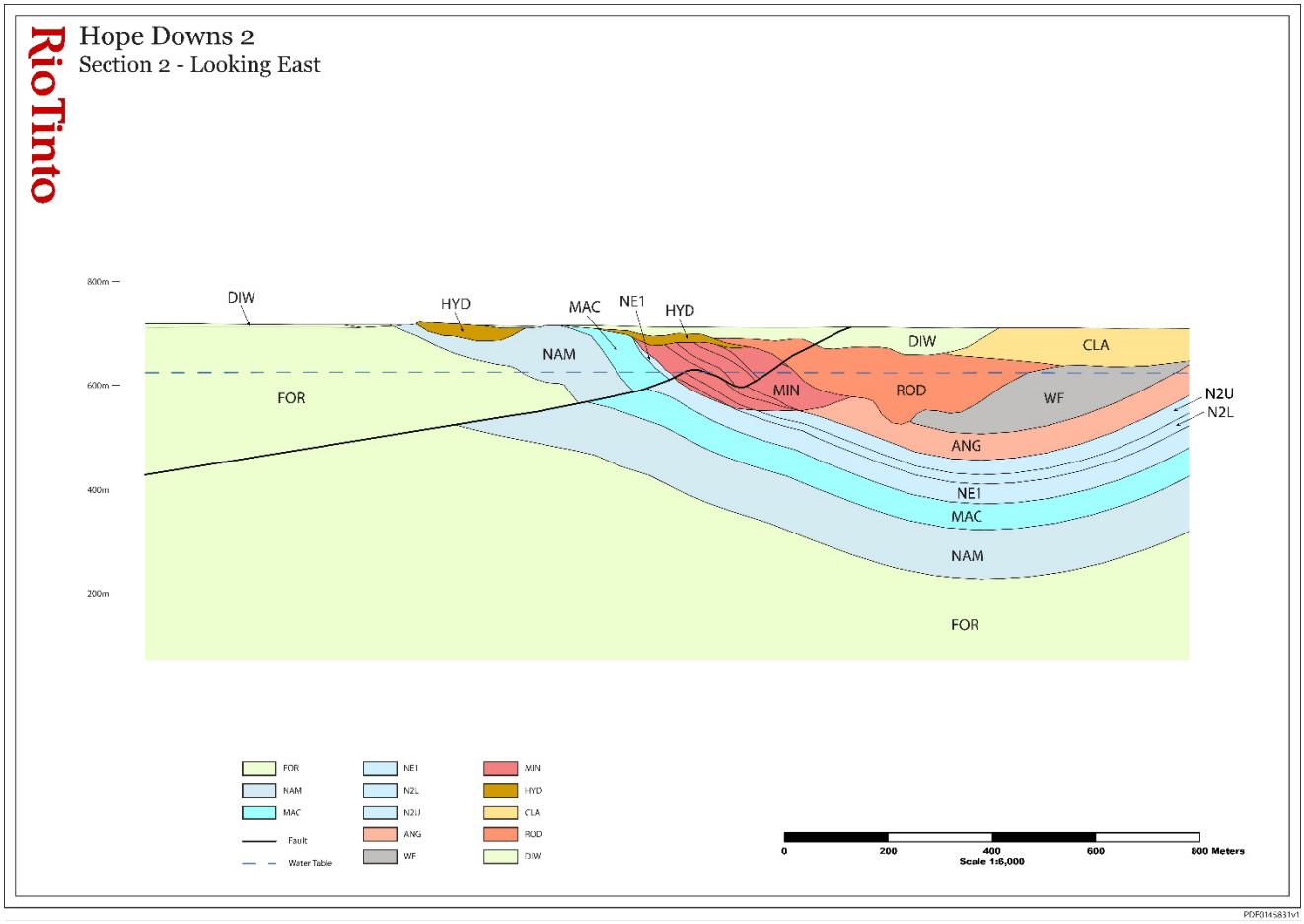


Figure 10: HD2 cross section (looking east)

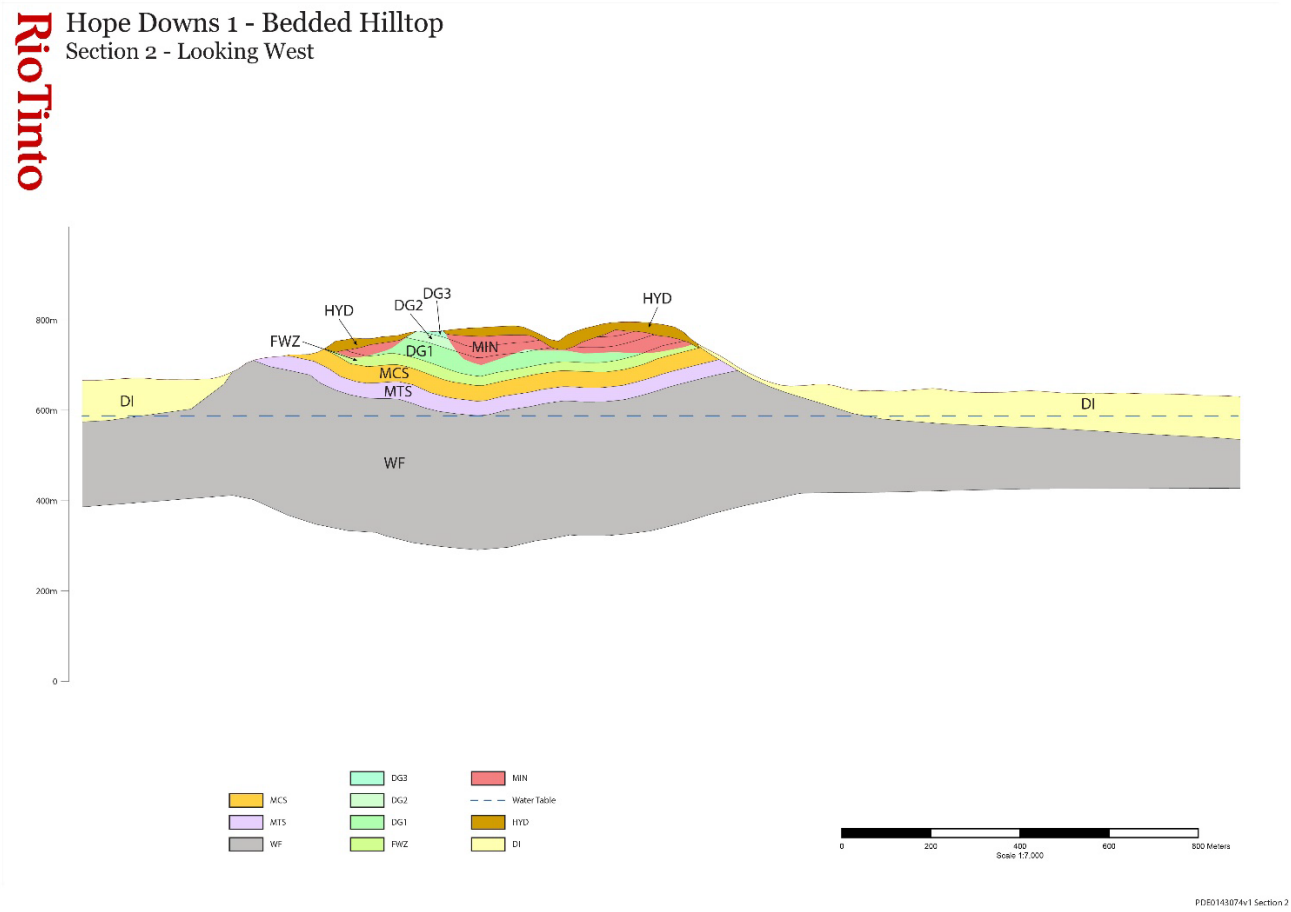


Figure 11: BHT cross section (looking west)

5.5.1 Geotechnical stability

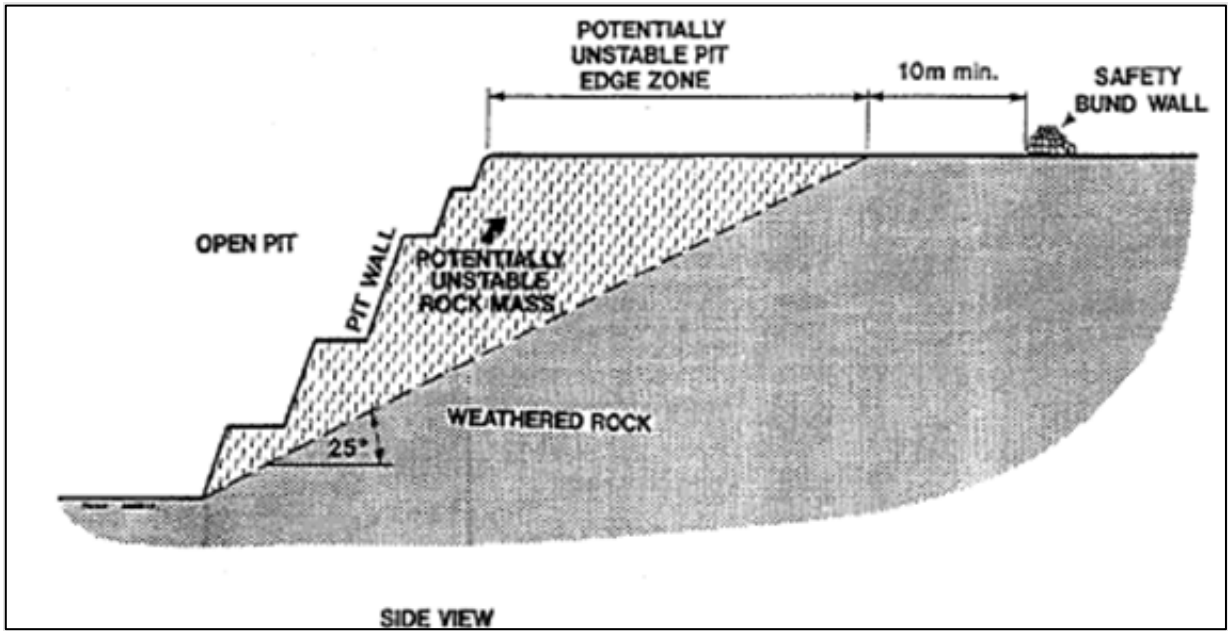
There is no intent to reshape or rehabilitate in-pit areas at HD2 and BHT deposits, and the remaining pit walls will be retained in the same configuration as when mining ceases.

Whilst opportunistic backfill of pits may occur, pit voids will remain after closure. As the pits are AWT, permanent pit lakes will not form, although water may pool temporarily at the base of the voids following heavy rainfall. It is recognised that there will be some degree of geotechnical instability, and that walls will have the potential to collapse in some areas. These areas of potential instability are referred to as the Potentially Unstable Pit Edge Zone (PUPEZ).

5.5.2 Potentially Unstable Pit Edge Zone

Determination of the PUPEZ is based on the angle method described in the former Department of Industry and Resources (now DMIRS) guideline *Safety Bund Walls Around Abandoned Open Pit Mines* (DoIR, 1997). The rock mass units spanning all of Rio Tinto Pilbara operations are categorised in general, as 'weathered' from this guideline, using the conservative assumption that all pit walls are embedded into weathered rock.

A 25° line from the pit toe or decoupling berm is projected to the surface topography. Where backfilling occurs, the pit toe may be considered from the surface of the backfilled area. In addition to this, a 10 m offset from the 25° projection line on the surface is included, plus a 5 m wide and 2 m high abandonment bund. The point at which this projection line intersects the topography back to the pit crest, is termed the potentially unstable pit edge zone (PUPEZ). Figure 12 illustrates the zone of instability methodology used for all pits, adopted from the guideline. The PUPEZ is refined over time with pit design, backfill design and mine plan changes.



Ref: DoIR, Safety Bund Walls Around Abandoned Open Pit Mines, 1997

Figure 12: Example of zones of instability

Potential zones of geotechnical instability have been identified around the conceptual HD2 and BHT deposit pits covered within the scope of this MCP (Figure 13 and Figure 14). All waste rock landform and stockpile positions will be located outside the PUPEZ boundary to maximise waste rock landform and pit crest stability post-closure. Geotechnical assessments for wall stability and PUPEZ are conducted as part of mine design reviews, however, it is recognised that the true nature of the geology will only be understood once mining has been completed, and this could influence the stability of the pit wall. Geotechnical instability will be assessed throughout the life of the operation and site-specific assessments will be conducted to inform closure strategy and abandonment bund alignments for closure implementation.

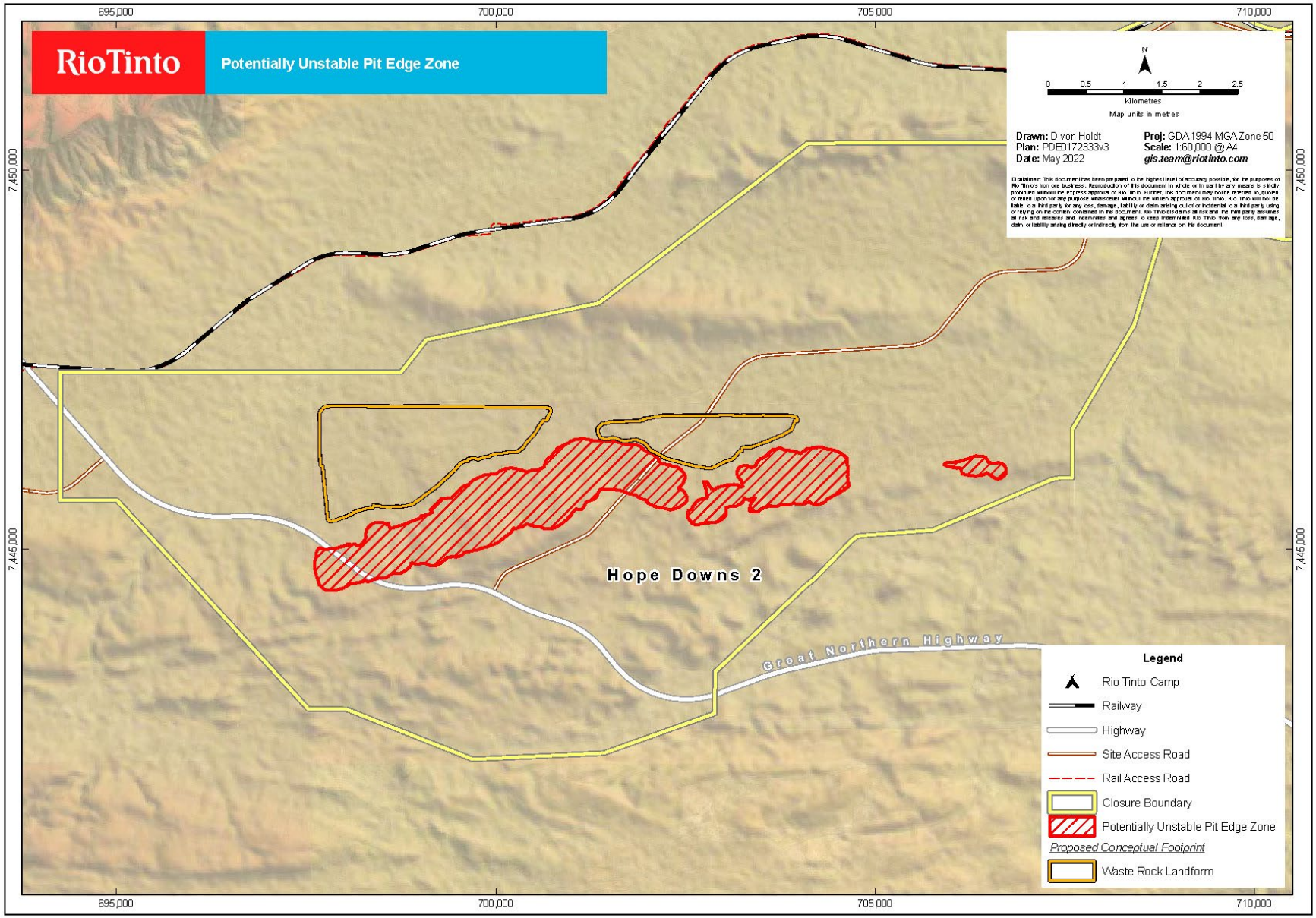


Figure 13: HD2 deposit potentially unstable pit edge zone

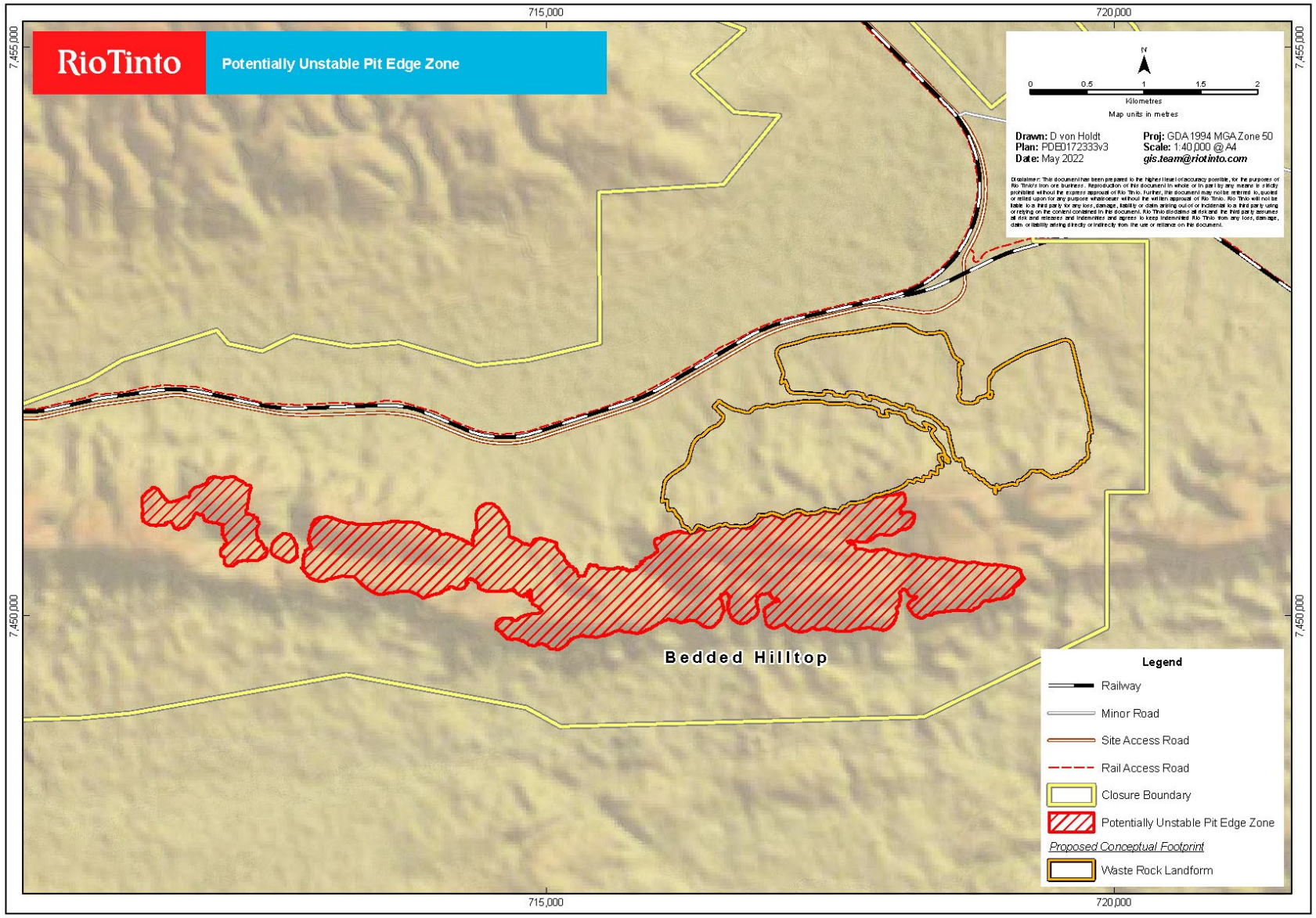


Figure 14: BHT deposit potentially unstable pit edge zone

5.5.3 Implications for closure and knowledge gaps

Closure implications associated with geotechnical stability include:

- Consideration of geotechnical stability risks in the development of closure strategies.
- Rehabilitated waste rock landform footprints will need to be located outside the predicted PUPEZ.
- Development of post-closure access plans, abandonment bund location and designs are informed by the predicted PUPEZs.
- Abandonment bunds will be established outside of the PUPEZ to limit access to pit voids.
- Abandonment bunds will require adequate volumes of competent low erodibility mineral waste which will need to be segregated and stockpiled during LoM.

Closure knowledge gaps associated with geotechnical stability, as summarised in Table 6-1, include:

- Evaluate planned post-closure pit wall stability for HD2 and BHT deposits pits to determine if mitigation is required to prevent wall collapse and PMC creek capture.
- The zone of geotechnical instability or PUPEZ will be revised and updated for HD2 and BHT deposits in each iteration of the MCP to reflect any changes to the mine plan, understanding of the closure landscape and to address any updated flood modelling.
- The location of the proposed pit abandonment bunds for the HD2 and BHT deposits will be revised and updated in each iteration of the MCP to reflect any changes to the mine plan, understanding of the closure landscape and to address any updated flood modelling.
- Develop a rehabilitation materials inventory for HD2 and BHT deposits for low erodibility waste to be utilised for capping and abandonment bunding where required.
- Undertake landform evolution modelling for HD2 and BHT landforms to further inform and verify final landform design and rehabilitation parameters.
- Site specific geotechnical assessments will be completed for rehabilitation designs of final closure landforms for HD2 and BHT deposits to confirm closure landform safety and stability.
- Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, soils, contaminated sites, hydrogeological, hydrological, conservation, flora and vegetation, fauna knowledge and assessments.
- Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits.

5.6 Public access

5.6.1 Risk of inadvertent access

The issue of public safety is mainly related to potential for members of the public to inadvertently access pit voids (or areas of potential instability surrounding pits) post-closure. Open pits are designed to be stable during the life of the mining operations but may not be stable in the long term as materials weather and erode, leading to instability of sections of the pit walls. These failures would pose significant risks to people if they were to access these areas in vehicles or on foot. As with waste landforms, designs for restricting public access need to be developed on a case-by-case basis after considering a range of factors such as:

- Accessibility of the site (e.g., proximity to towns/major roads/areas of interest).
- Nature of the surrounding landscape (e.g., pits abutting steep natural slopes, floodplains, water courses).
- The availability of suitable material to construct structures (e.g., material for abandonment bunds/ rock structures).
- Pit geology and geometry (e.g., natural stability of the pit, pit backfill).
- The post-closure land use (e.g., preventing cattle from surrounding pastoral leases inadvertently accessing pit voids).
- The location of heritage sites (e.g., sites which may require access post-closure).

The HD2 deposit straddles the GNH, which is proposed to be realigned to allow mining, and therefore, considered a heightened risk in relation to community and/or tourist attention.

Access will also need to be maintained to:

- WWS and WWC;
- third party tenure; and
- significant heritage/cultural sites.

5.6.2 Abandonment bunds

A review of all planned pit and waste rock landform interactions at HD2 and BHT deposits was undertaken to check compliance to the angle method described in the guideline (DoIR, 1997). The purpose of the guideline is to reduce the likelihood of injury or fatality should a person inadvertently access the pit in a vehicle. These guidelines require a 5 m wide by 2 m high abandonment bund be placed at a minimum distance of 10m around a completed pit outside the PUPEZ.

Using this approach, conceptual abandonment bund locations (in yellow) around the PUPEZ (in blue) have been developed and are presented in Figure 15, Figure 16 and Figure 17.

- For the HD2 deposit conceptual abandonment bunds surround all pit areas, due to flat terrain.
- For the BHT deposit, which is positioned within a range, most of the pit wall is elevated between 50 and 100 m, and slopes are greater than 27 degrees in most instances. As such, terrain around the range is very steep, resulting in the pit crest being inaccessible and abandonment bunds unmanageable around the majority of the pit crest. For the purposes of conceptualisation, bunds have only been nominally located to restrict access in areas where terrain is not a significant barrier.

These conceptualisations are high level, and site-specific geotechnical assessments and consultation with key stakeholders will need to be undertaken to identify the appropriate abandonment bund locations for both deposits. Tasks have been included in the closure task register (Appendix 5) to complete geotechnical assessments, consult with stakeholders and confirm appropriate abandonment bund locations once mining commences.

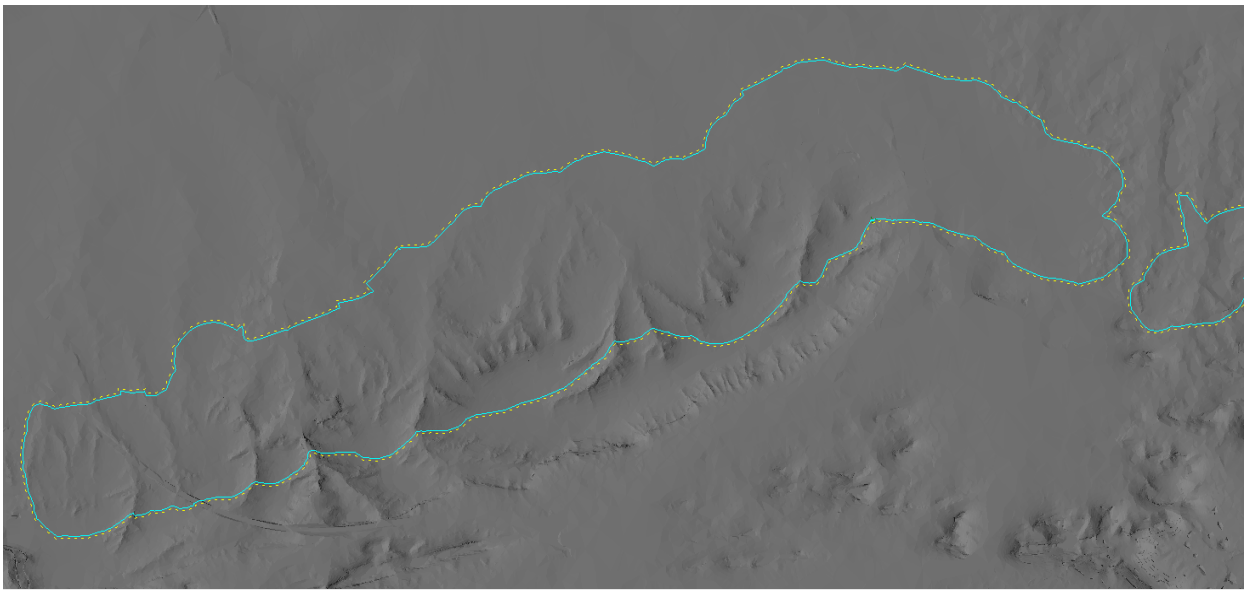


Figure 15: Conceptual HD2 deposit (west and central pits) abandonment bund locations

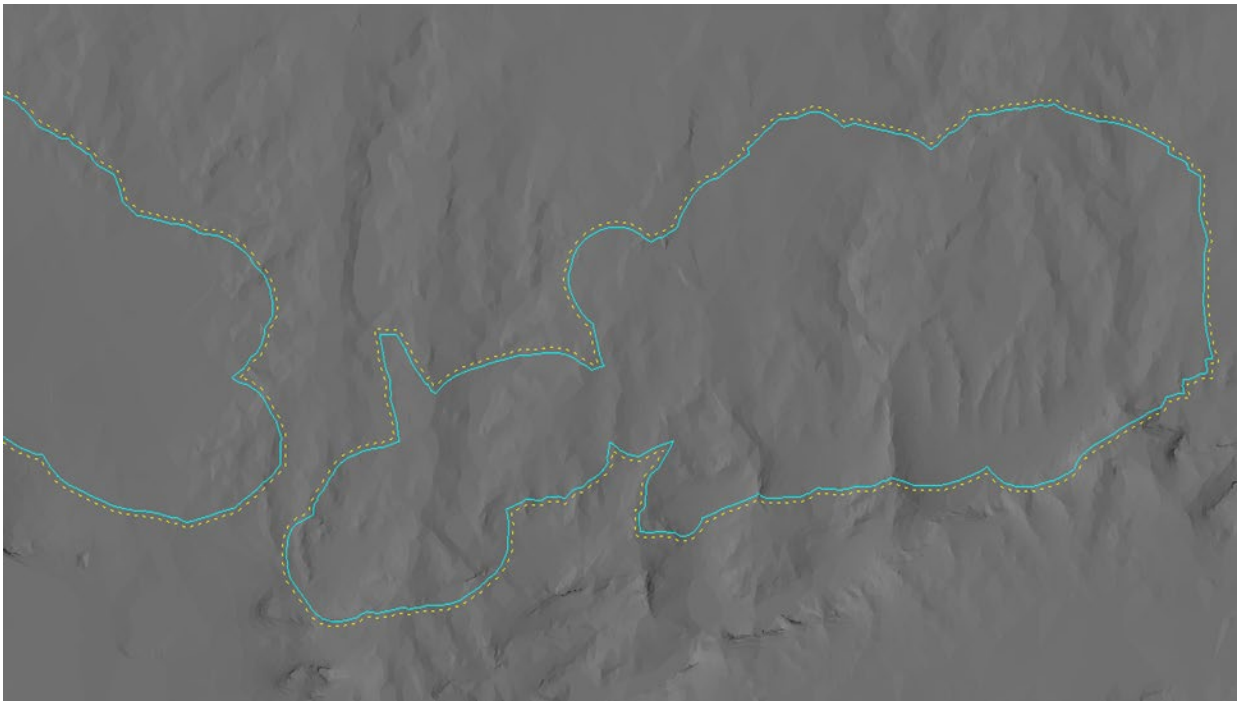


Figure 16: Conceptual HD2 deposit (east pit) abandonment bund locations

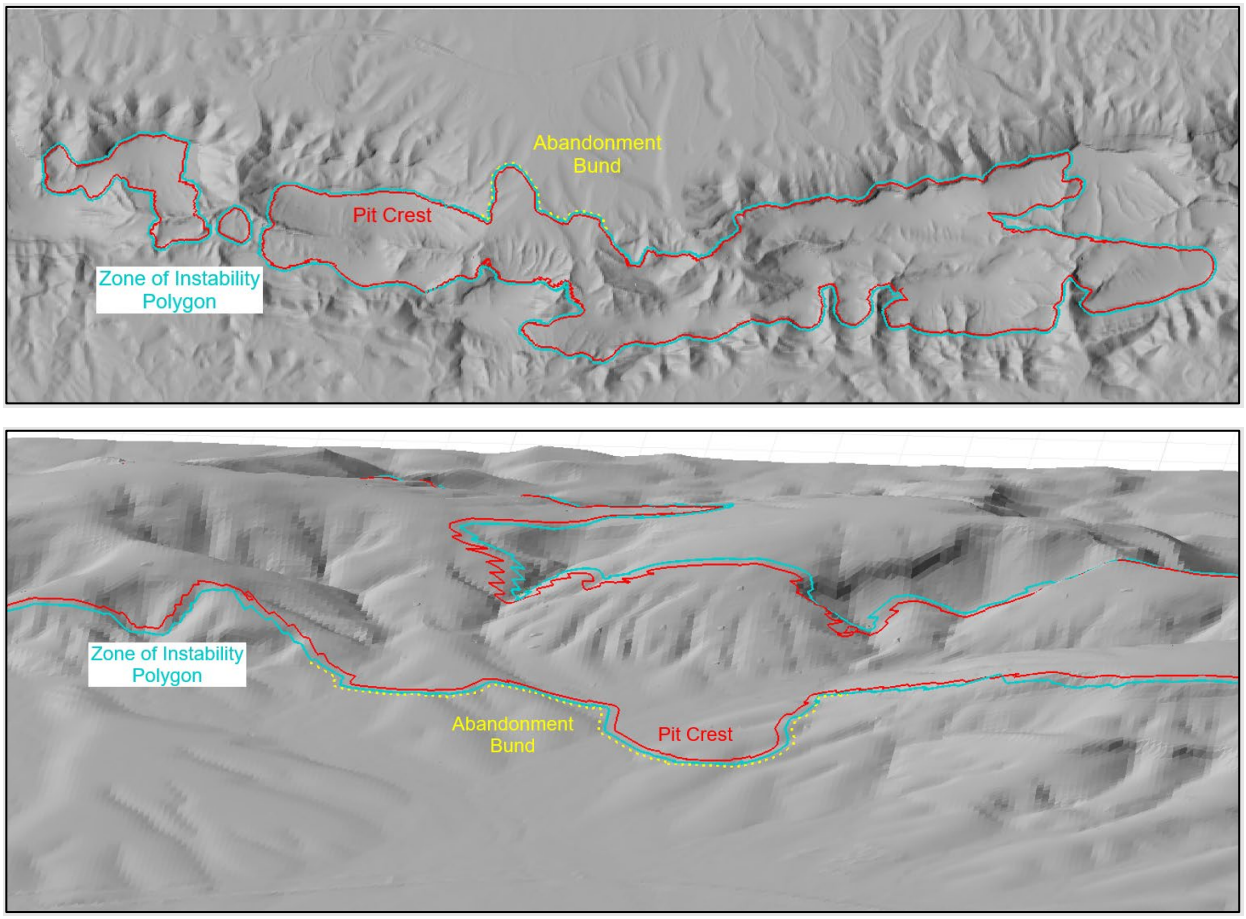


Figure 17: Conceptual BHT deposit abandonment bund locations (in yellow)

5.6.3 Implications for closure and knowledge gaps

Closure implications associated with inadvertent access include:

- Abandonment bunds will only be placed in areas with potential access exposure and in conjunction with the following additional methods for limiting access to pits:
  - remove or block roads where appropriate (e.g., windrows);
  - use of large, competent rocks to prevent vehicular access but allowing surface water flows;
  - enable safe access to specific areas where required (e.g., sites of cultural heritage significance);
  - install gates along roads that need to be accessed (e.g., to facilitate monitoring); and/or
  - install appropriate signage.
- Abandonment bund location and construction will consider creek flood inundation zones and surface water flows to ensure long-term post-closure stability.
- Abandonment bund location and construction will consider cultural heritage locations and public access routes to ensure long-term post-closure access.
- Rehabilitation of tracks that are not required for monitoring and/or maintenance post-closure, and installation of physical barriers (e.g., earthen bunds / windrows) where appropriate to prevent access.
- Installation of a locked gate on the main access road (and the alternative unsealed access road if it is required to remain post-closure) for the duration of the post-closure monitoring and maintenance period.

- Rehabilitation of all access roads prior to relinquishment and installation of physical barriers (e.g., earthen bunds / windrows), unless the State wishes the roads to remain accessible for whatever reason.

Closure knowledge gaps associated with inadvertent access, as summarised in Table 6-1, include:

- Consultation with Traditional Owners on key heritage locations and access requirements post-closure to contribute to the final closure landform or landscape.
- Consultation with the State on preferences with regards to final closure landform and public access to the post-closure landscape. This will be determined through ongoing consultation during the life of the operation.
- Assess opportunities to allow safe access for viewing/observation of the post-closure landform near the highway to deter unauthorised access to site. If this is considered appropriate to key stakeholders, details will be included in further updates to this MCP.
- Assess the expected post-closure access to the site, and include the installation of additional control measures, where appropriate.
- Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, soils, contaminated sites, hydrogeological, hydrological, conservation, flora and vegetation, fauna knowledge and assessments.
- Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits.

5.7 Mineral waste characteristics and inventory

Developing a comprehensive understanding of the types and volumes of materials that will remain at the completion of mining of the Proposal is critical for the effective design, construction and rehabilitation of the closure landforms. Rio Tinto has a well-developed process for the collection, analysis and characterisation of different material types, throughout the life of the asset. Long-term material behaviour can also be predicted through characterisation of representative waste types and correlation to similar waste materials present at other sites.

5.7.1 Physical characteristics

The key physical property of mineral waste material that is applicable to the closure landform design is its susceptibility to erosion, commonly described as the material's erodibility.

Erodibility can be defined in different ways depending on the erosion prediction tool; however, Rio Tinto considers erodibility of mineral waste using the following two means:

- Erodibility ranking using the Revised Universal Soil Loss Equation (RUSLE), which broadly classifies mineral waste units by erosion risk - low, medium or high.
- Erodibility modelling using the Water Erosion Prediction Project (WEPP) runoff simulation and erosion model to define material-specific landform designs for each mineral waste unit.

5.7.2 Erodibility ranking

The RUSLE seeks to broadly rank mineral waste types into one of three levels of erodibility – low, medium, or high. The RUSLE is an empirical equation that calculates long-term annual erosion rates using five factors that are multiplied together. Two of these factors, erodibility (K-factor) and cover (C-factor), are specifically related to the material. The remaining three describe the rainfall and slope conditions. The K-factor describes the erodibility of the fines fraction (<2 mm diameter) excluding the coarse fraction (>2 mm). The C-factor describes the impact that different surface conditions have on erosion. For this ranking system, surface rock cover is a surface condition that reduces erosion potential.

The RUSLE erodibility ranking system was developed by considering the particle size distribution (PSD) of the fines fraction and the rain-armoured rock cover levels for 36 mineral waste samples from across the Pilbara mine sites. These samples had a wide range of PSD and rock cover levels. Results of this analysis showed that K-factors for the materials assessed are consistent with highly and very highly erodible materials. By themselves, they do not explain the observed differences in erosion potential of the waste materials being managed at the mine sites. However, when the impact of rock cover was included using the C-factor, it was shown that rock cover strongly influenced material erodibility and could explain the observed differences in erosion potential between materials. Mineral waste materials that had rock cover levels >70% were ranked as low erodibility and had an erodibility factor (K-factor multiplied by C-factor) of <0.0009. Waste materials with rock cover levels of 30-70% were ranked as medium erodibility and had an erodibility factor ranging from 0.006-0.0009. Waste materials with rock cover levels <30% were ranked as high erodibility and had an erodibility factor >0.006, as summarised in Table 5-1.

Table 5-1: Erodibility classification of mineral waste

Material classification	Rock Cover Level	K factor (fine fraction <2mm erodibility)	Erodibility factor (K-factor x C-factor)
Low	>70%	High	<0.0009
Medium	30-70%	High	0.0006-0.0009
High	<30%	High	>0.006

The RUSLE ranking system is used to broadly guide rehabilitation planning. For example, materials ranked as low erodibility contain appreciable competent, hard rocks suitable for placement on the outer surface of waste landforms to provide long term erosion protection. Waste materials ranked as medium erodibility can also be placed on the outer surface, however, there are likely more limitations in terms of the batter shapes (e.g., lower lift heights and/or batter angles) that are needed to ensure acceptable erosion rates are met. High erodibility ranked waste materials, where present in large proportions, require the application of conservative rehabilitation design parameters (e.g., low lift heights and/or gradients) or selective placement of more erosion resistant waste to prevent unacceptable erosion.

5.7.3 Erodibility modelling

Although the RUSLE ranking system provides broad guidance, it is not used to define the landform designs that are adopted. This is done through physical measurement of the erodibility parameters that are used in conjunction with site-specific climate data within the WEPP runoff/erosion model. The Rio Tinto Pilbara WEPP model predicts runoff, erosion, and deposition for hillslopes and catchments, using inputs generated from rainfall stimulation plots using waste rock lithologies and a 100-year climate sequence developed from BoM weather stations, from sixteen Rio Tinto Pilbara mines.

The outputs of the WEPP model are compared to acceptable long-term soil erosion rates. Work completed by Landloch Pty Ltd (2018), on behalf of the Pilbara Rehabilitation Group, established an acceptable long-term erosion rate of 6t/ha/yr. which is consistent with the rates of soil renewal and naturally occurring erosion, and consistent with a surface with a low tendency for rill and gully erosion.

5.7.4 Erosion ranking

The erodibility potential of waste types for the Proposal have been assessed using extrapolation from equivalent material at similar sites, most specifically from HD1. Several materials specifically sourced from HD1 stockpiles were recently tested, including a Detrital sample, a Limonite (a type of Detrital) sample, and two samples of Mount Newman Member rock-type. Previous testing for a Hydrated Zone waste and two other samples of Detrital also exist for HD1. Three examples of Dales Gorge material are available from Tom Price and Western Turner Syncline, and two examples of West Angelas Shale and one Detrital example is also available from West Angelas and Marandoo. These materials broadly characterise 84% of the waste types identified at the HD2 and BHT deposits. Table 5-2 lists the HD2 and BHT deposits and

overall Proposal waste material types and percentages of total mineral waste predicted to be generated during operations along with erodibility characterisations. These materials will be used to are used to inform rehabilitation parameters adopted across the Proposal.

A portion of the material to be contained within waste rock landforms is characterised as low erodibility (competent), although within individual waste rock landforms, varying proportions of medium to high erodibility material are expected to occur. For the Proposal, 58% of waste material is of low erodibility (competent), with 37% characterised as high erodibility (soft) and 5% medium or undefined erodibility. The erodibility characterisation for the HD2 and BHT deposits varies considerably.

- HD2 deposit has 69% of waste material characterised as high erodibility (soft), with 23% characterised as low erodibility (competent) and 8.5% currently characterised as medium or undefined erodibility.
- BHT deposit is conversely comprised of 90% low erodibility (competent), 8% high erodibility (soft) and 2% medium or undefined erodible waste material.

The erosion classification of individual landforms is included in Appendix 6 and the material characterisation report (Landloch, 2020) for the Proposal can be found in Appendix 7.

The materials characterisation work completed specifically for the Proposal (2020) notes that generally material types at HD1 and HD2 perform similarly to those across the Pilbara, with the following exceptions:

- Detritals geological unit can achieve a uniform gradient of 20 degrees and height of 7 m.
- Some detrital strands are more erosion resistant, specifically Colluvium detritals and, Rounded detritals (col and di) geozones and Limonite detritals achieving maximum stable heights of 15 m at 20 degrees.
- Newman member materials are more erosion resistant and are stable at geometries of 20 degrees at 15 m lift heights.
- Hydrated material is more erosion resistant than average, stable at geometries of 20 degrees at 20 m lift heights.

Current landform designs are based on waste material characterisation and additional findings (Appendix 6). Further work is planned to understand the strand-specific characteristics of detritals, prior to updating landform designs accordingly. Landform design is further discussed in Section 5.7.

The parameters for waste and soil samples derived from HD1 sampling are consistent with parameters measured from reference soil sites located across other Rio Tinto mine sites; WEPP-predicted erosion for site-specific material was found to be similar to erosion predicted using Pilbara-wide parameter values more commonly used to determine landform designs. Therefore, it is concluded that batter geometries generated using the Pilbara-wide erodibility parameters will be suitable for use across the Proposal. Details of mineral waste present across the Proposal are summarised in Table 5-2 and Table 5-3.

Table 5-2: Waste material erodibility characterisation by type (HD2 and BHT deposits)

Waste Type	Unit	Erodibility	HD2 deposit	HD2 deposit	BHT deposit	BHT deposit	Proposal	Proposal
		High - Low	(kt)	%	(kt)	%	(kt)	%
West Angelas Shale	ang	High	58,848,388	24	0	0	58,848,388	11
Detritals - Clay	cla	High	10,761,129	4	0	0	10,761,129	2
Detritals - poorly unconsolidated	di	High	56,790,523	23.5	2441805	1	59,232,328	11
Detritals - moderate unconsolidated	dm	High	2,187,343	1	2140889	1	4,328,232	1
Detritals	li	High	1,813,770	<1	3965283	1	5,779,053	1
Mount McRae Shale	mcs	High	0	0	6979056	3	6,979,056	1
Detritals - pisoliths	pi	High	0	0	5180946	2	5,180,946	1
Red Ochre Detritals	rod	High	39,992,407	16.5	0	0	39,992,407	8
Whaleback Shale	WS	Medium	0	0	1,247,637	<1	1,247,637	<1
Detritals - Cemented	ca	Low	72,699	<1	2804473	1	2,877,173	1
Dales Gorge Member	dg	Low	0	0	210,275,696	77	210,275,696	41
Footwall Zone	fwz	Low	0	0	32837768	12	32,837,768	6
MacLeod Member	mac	Low	17,484,930	7	0	0	17,484,930	3
Newman Member lower	n2l	Low	5,838,414	2.5	0	0	5,838,414	1
Newman Member upper	n2u	Low	7,964,493	3	0	0	7,964,493	2
Nammuldi Member	nam	Low	5,497,420	2	0	0	5,497,420	1
Newman Member	ne1	Low	19,853,867	8	0	0	19,853,867	4
Undefined	rock	Undefined	14,531,765	6	4729015	2	19,260,780	4
Wittenoom Formation	wf	Undefined	343,105	<1	0	0	343,105	<1
Mt Sylvia Formation	mts	Undefined	0	0	128739	0	128,739	<1
Fortescue Group	for	Undefined	400,701	<1	0	0	400,701	<1
Total			**242,380,956**	**100**	**272,731,307**	**100**	**515,112,263**	**100**

Table 5-3: Waste material erodibility characterisation summary (HD2 and BHT deposits)

Erodibility	Total waste (kt)*	Total waste (%)
Low	302,049	58%
Medium	841	<1%
High	142,742	37%
Currently undefined	69,479	5%
Total	**515,111**	**100%**

*Minor difference between the kt totals in Table 5-3 and Table 5-4 is due to rounding.

5.7.5 Batter selector tool

Rio Tinto and Landloch Pty Ltd undertook an extensive project in 2010-2012, along with several detailed studies since that time, to source erodibility data for a range of materials across Rio Tinto's Pilbara mine sites. The establishment of a database defining the erosion characteristics of the predominant mineral waste units has defined stable landform batter geometries used to directly inform waste rock landform design and rehabilitation planning.

The Batter Selector Tool (BST) uses these erosionally stable batter geometries to develop 3D rehabilitation landform designs that considers long-term erosional stability. The batters within the BST are predicted to have long-term average annual erosion rates (averages over the entire batter) of <5t/ha/y, and long-term peak erosion rates (at any point on the slope) of <10 t/ha/yr. These values are set such that the potential for rill initiation is limited, therefore significantly reducing the occurrence and development of more significant erosion features, such as gullies. In addition to height, gradient and profile shapes, the BST sets minimum berm widths and back sloping angles that have been developed from WEPP predictions of runoff and erosion to determine the required berm catchment capacities.

The BST provides individual waste rock landform design options that would result in stable slopes that meet the Rio Tinto landform design guidelines, by considering site specific rainfall and the waste types within an individual WRL. The preliminary closure designs, using the BST, for WDs and LG stockpiles at the Proposal are presented in Appendix 6. These designs will be refined and updated once physical characterisation of mineral waste units from the Proposal have been completed.

5.7.6 Principles of waste rock landform design

Mineral waste rock landforms and landbridges located on mine sites that are operated by Rio Tinto are designed and rehabilitated in accordance with Rio Tinto's Landform Design Guidelines, which provides guidance on the objectives of waste rock landform design, which is to achieve dumps that are:

- safe;
- stable;
- vegetated;
- non-polluting;
- compatible with the agreed post-mining land use;
- progressively rehabilitated;
- appropriate surface treatments; and
- links to other relevant internal and external guidance material.

These Guidelines are updated on a regular basis to incorporate lessons from research, studies and rehabilitation implementation projects. The most significant update occurred in 2012, to provide design

criteria for waste rock landforms and landbridges based on the specific waste types present. This was the result of several years of materials testing and landform evolution modelling studies of wastes typically found in the Pilbara, with design recommendations based on the assumption that an average erosion rate of 5t/ha/year (with a maximum of 10 t/ha/year) will be acceptable. Further studies have since been undertaken on additional waste types, and this resulted in further minor updates in 2014, 2016 and 2019. An ongoing sampling campaign commenced in 2020/21 to further refine material characterisation across Rio Tinto' Pilbara sites. This work will inform closure planning for the Proposal and final landform design. Any changes to landform design for the Proposal will included in subsequent MCP submissions. This work will also inform The Landform Design Guidelines and updates will be made as required.

A comprehensive summary of materials characterisation for the Proposal and across the Pilbara is presented in Section 5.7 (Appendix 7). Ongoing materials characterisation work will continue as the site commences operations and progresses towards closure. It should be noted that erosion modelling is conducted on the conservative assumption that slopes are not vegetated, however, vegetation is expected to establish on all slopes, thereby further reducing the erosion potential.

5.7.7 Erodible mineral waste management

As outlined in Section 5.7, a significant faction of the mineral waste across the Proposal is comprised of geological units that are generally classified as being of high erodibility (e.g., detritals, shales) with the more competent BIF geology that is common elsewhere in the Pilbara present in lower proportions. However, there is a significant proportion of hydrated material available, particularly associated with the BHT deposit, which is classified as having low erodibility. An action is included in the closure task register (Appendix 5) to undertake further waste characterisation to better define dump erosion potential.

The primary landform design approach proposed for both the HD2 and BHT deposits is the batter and berm style landform. The slope angle, berm width and batter height proposed is based on the expected erodibility and physical characteristics of the dominant waste type/s within the landform.

The Landform Design Guidelines (RTIO, 2020) indicate that if competent material (i.e. low or medium erodibility) is present in appreciable volumes within a waste landform, or is used to cap the outer surface, then a linear berm and batter design with specifications as presented in Table 5-4 will ensure the HD2 and BHT deposit waste rock landforms and landbridges are appropriately stable post-closure. Management options have been reviewed with respect to the mine sequence, considering frequency of occurrence of highly erodible waste material, availability of pits for in-pit backfill, availability of materials for capping and stockpile requirements for capping.

One or more of the following closure management approaches will be employed for highly erodible waste:

- selective handling to ensure encapsulation of more erodible waste;
- placement of material into exhausted pits;
- placement of low erodibility material on the outer surface of the landform (wrapping); and/or
- appropriate landform design parameters (including shallower batter angles and wider berms, lower lift heights).

The proportion of high (high to moderate detritals) erodibility material varies across the Proposal with some areas having a higher proportion of competent material present (HD2 deposit waste has a higher content of highly erodible material compared with BHT deposit waste). It should be noted that the current landform design for the HD2 deposit waste rock landforms consider erosion resistant detritals as described in Section 5.7.4, with designs favouring a conservative approach of maximum 7 m lift heights where a high (>50%) percentage of highly erodible material is present (Table 5-4). Erodibility studies to date indicate that where West Angeles Shale is included in high proportions a maximum of 5 m lifts is recommended, however this material is not present in significant quantities at HD2 or BHT deposits. Further work is underway to understand the strand-specific characteristics of detritals and the geological units prior to updating landform designs accordingly (Appendix 6Appendix 6).

Table 5-4: Waste rock landforms rehabilitation berm and batter design specifications

Design specifications	Low erodibility material	High erodibility material
Maximum slope angle of lift	20°	20°
Maximum height of lifts	20 m	7 m
Minimum berm width	10 m	10 m
Minimum berm angle	11° (back sloping)	11° (back sloping)

Inert waste rock landforms at the HD2 deposit have significantly higher quantities of highly erodible material; 69% of waste material is characterised as high erodibility (soft), with 23% characterised as low erodibility (hard) and 8.5% currently characterised as medium or undefined erodibility. Conceptual waste rock landform designs have been based on high erodibility landform design criteria (Table 5-4) and known materials characterisation, further work is required once the HD2 deposit commences operations to characterise waste and identify appropriate storage. Table 5-5 outlines the conceptual rehabilitation parameters of the HD2 deposit waste rock landform at closure.

Table 5-5: HD2 deposit rehabilitation parameters

Landform name	Waste volume (Mm^3)	Slope angle (º)	Lift height (m)	Berm width (m)	Berm slope (º)	Footprint (ha)
HD2 DP_NW (Goanna)	174	20	7	10	3	269
HD2 DP_NC (Tortoise)	34	20	7	10	3	77

Inert waste landforms at the BHT deposit are conversely comprised of 90% low erodibility (hard), 8% high erodibility and 2% medium or undefined erodible waste material. The conceptual dump designs have been based on low erodibility landform design criteria (Table 5-4) and known materials characterisation, further work is required once BHT commences operations to characterise waste and identify appropriate storage. Table 5-6 outlines the conceptual rehabilitation parameters of BHT deposit waste rock landforms at closure.

Table 5-6: BHT deposit rehabilitation parameters

Waste landform name	Waste volume (Mm^3)	Slope angle (º)	Lift height (m)	Berm width (m)	Berm slope (º)	Footprint (ha)
BHT DP_NELG	125	20	20	10	11	207
BHT DP_NEWD	83	20	20	10	11	206

Waste rock landform designs have been derived based on slope design parameters from the Landform Design Guidelines, taking into consideration material characteristics and recommendations as specified in Appendix 6. All external landforms that remain at closure will conform to the Rio Tinto Landform Design Guidelines including active management of water infiltration and/or shedding from both upper and lower surfaces, and perimeter bunding to prevent ponding of water at the toe. There may be changes to final landforms in future iterations of the MCP due to future changes in the LoM Plan, backfilling requirements, abandonment bunds and material characteristic testing; these designs are therefore subject to change.

No rehabilitation of in-pit waste rock landforms or in-pit landbridges is proposed where the waste landform has no potential to impact on the ex-pit environment (i.e., any sediment generated will be fully contained

within an internally draining pit) and contains only inert material. No re-profiling of pit walls or rehabilitation of pit floors is proposed. Rehabilitation of the final surface of landbridges planned to remain at closure will occur in accordance with standard procedures, as per the requirements for inert waste rock landforms. Landbridges for the Proposal is a key waste landform risk for the BHT closure landform. Rio Tinto has commissioned landform evolution modelling (LEM) to review the technical challenges associated with these landforms. Further work in landbridge and closure landform design is planned prior to the next submission of the MCP. Therefore, conceptual landbridge rehabilitation strategy is presented in Table 5-7 and rehabilitation parameters in Appendix 6, and presented in Figure 46. A task to complete LEM and update closure landform designs has been added to the closure task list in Section 6.

Table 5-7: BHT landbridge rehabilitation strategy

Landbridge name	Waste volume (Mm^3)	Rehabilitation strategy	Footprint (ha)
BHT LB_West	6.0	The majority of this landbridge is in pit and does not require a rehabilitation design, portions of the landbridge located within pit areas will be reclaimed into the adjacent pit areas or shaped to maintain surface water flows where possible.	38.6
BHT LB_CEN	0.7	This landbridge is in pit and does not require a rehabilitation design as will be fully removed at closure.	12.5
BHT DP_Central 3	0.9	The majority of this landbridge is in pit and does not require a rehabilitation design, portions of the landbridge located within pit areas will be reclaimed into the adjacent pit areas or shaped to maintain surface water flows where possible.	8.2
BHT LB_East 6	1.6	The majority of this landbridge is in pit and does not require a rehabilitation design, portions of the landbridge located within pit areas will be reclaimed into the adjacent pit areas or shaped to maintain surface water flows where possible.	10.1
BHT LB_East	1.67	The majority of this landbridge is in pit and does not require a rehabilitation design, portions of the landbridge located within pit areas will be reclaimed into the adjacent pit areas or shaped to maintain surface water flows where possible.	38.6

Low grade ore will be stockpiled in a separate location (see Figure 4) on-site for future use; however, market conditions change over time and there is potential that the stockpiles will remain in-situ at the completion of mining. Therefore, Rio Tinto will manage the stockpiles as if they are waste rock landforms and plan to rehabilitate them if required. These stockpiles have been included in the material inventory presented in Section 5.8.3.

Conceptual closure landform rehabilitation design criteria are detailed in Appendix 6, based on site-specific assessment of materials. A multi-disciplinary pit and waste rock landform design sign-off process is conducted, which considers landform design guidelines and provides rehabilitation designs where appropriate. Performance of rehabilitation designs will be reviewed during the life of the mine.

5.7.8 Geochemical characteristics

Rio Tinto has undertaken an extensive program of geochemical testing over several years to understand the risks associated with the exposure of various waste units common to mining operations in the Pilbara (Rio Tinto 2008), including low Sulphur materials that have traditionally been considered to present a low Acid and Metalliferous Drainage (AMD) risk but may pose a Neutral Metalliferous Drainage (NMD) risk. This knowledge has been used to develop a geochemical risk assessment process (Green and Borden, 2011), which:

- identifies materials commonly associated with geochemical risks (materials characterisation);

- establishes Sulphur content as an indicator of acid generation potential;
- undertakes static testing of materials to identify materials with AMD potential (e.g., acid base accounting, multi-element analysis); and
- undertakes kinetic testing of materials identified as having AMD potential.

This information is used in combination with the position of the material relative to the proposed final pit shell to estimate the amount of potentially reactive material per block of material mined to determine an overall geochemical risk for the deposit.

An AMD risk assessment has been completed for the Proposal in 2020 (Appendix 9) which includes all relevant waste lithologies present at the site, and analyses have been completed in accordance with the Rio Tinto standards and processes. Test work has included Acid Base Accounting (ABA), total Sulphur and multi-element analysis, mapping the black Mount McRae Shale against the final pit designs and mining models and mapping the position of samples relative to the water table.

5.7.9 Total Sulphur and geochemical characterisation

To date 151,258 waste samples have been analysed for sulphur content; with 89,006 samples (including 29,978 in pit samples) analysed at the HD2 deposit and 62,252 samples (including 21,786 in pit samples) analysed at the BHT deposit (Appendix 9 and Appendix 10). Of these, majority of the samples located at depth below the approved pit shells (i.e., in below water table, BWT deposits) contain Sulphur with concentrations >0.3%. The proposed AWT mining activities will not disturb these materials and therefore there is no requirement to manage AMD/NMD risks from these high Sulphur materials. It should be noted that the pit shells might change over time and updates to the geological and mining models will be made; therefore, closure strategies regarding this aspect may change to maintain the environmental outcome.

As detailed in Appendix 8 and Appendix 9, subsequent to the total Sulphur analysis, geochemical characterisation (acid base accounting) has been undertaken on 96 drill hole waste rock samples from 10 different stratigraphic units (53 samples from the BHT deposit and 43 samples from the HD2 deposit) to date (Appendix 9). Of these, 10 samples were lignite material, which showed the greatest potential for acid generation and metal release, with all samples classed as Potentially Acid Forming (PAF). For the remaining 86 samples, two samples, one from the Dales Gorge Member and one from the Footwall Zone, were classed as PAF in a low capacity (<5kg H_2SO_4/t) to generate acidity. The 20 Wittenoom Formation samples were all classed as Non-Acid Forming (NAF) and had considerable Acid Neutralising Capacity (ANC). The remaining 64 samples were classified as NAF or Uncertain.

Following the ABA testing, a total of 25 samples, including 4 PAF lignite samples, were subjected to a static 2:1 DI (de-ionised) water leach test. All the PAF samples generated acidic leachates (pH ~2.4) with the highest Electroconductivity (EC) range (2,610 – 24,900 µS/cm) and solute concentrations. The NAF samples generated circum-neutral leachates with low solute concentrations and most of the other metals and metalloids recorded levels at or slightly above the limits of detection. It should also be noted that leach testing results can't be directly correlated with the conditions experienced when mining of these materials, as the solid to liquid ratios are likely to vary as a result of climatic factors and material volumes (Appendix 8).

The geochemical characterisation therefore indicates that the AMD risk for the Proposal overall is expected to be low. Any changes to the mine plan over time will require a re-evaluation of this risk and appropriate actions to ensure it remains low. Further testing of BHT (detrital) lignite materials is required once mining commences.

5.7.10 PAF operational management

Although the AMD risk posed by mining landforms and pit voids for the Proposal is considered low, where the black Mount McRae Shale is unexpectedly intersected during mining, PAF management may be required. Rio Tinto operations comply with the *Spontaneous Combustion and Acid Rock Drainage (SCARD)*

Management Plan, Rio Tinto 2021b V7 (Appendix 11) in the event PAF is identified during mining operations.

The *SCARD Management Plan* (Rio Tinto, 2021a) outlines the process for ongoing assessment of waste rocks to identify PAF rock types that have not been previously flagged during ore block modelling, and the procedures for PAF material segregation, storage, and operational accountabilities for PAF material management to avoid environmental, safety and health risks.

5.7.11 Fibrous minerals

Naturally occurring fibrous minerals can be found in many parts of Western Australia but are particularly prominent in the BIF of the Pilbara. At Rio Tinto's Pilbara operations, fibrous minerals are generally encountered in waste material from BWT Marra Mamba Iron Formation but have also been encountered in other stratigraphic units including the Brockman and Joffre Iron formations. Fibrous minerals may also occur as clasts found within overlying alluvium cover. Fibrous minerals pose a risk when fibres of a respirable size become airborne and are inhaled. The *Rio Tinto Iron Ore (WA) Fibrous Minerals Management Plan* (FMMP) (Rio Tinto, 2020a) describes guidelines for the management of fibrous minerals encountered during mine production and at closure, such as the encapsulation of intersected fibrous mineral waste in non-fibrous mineral waste within a waste rock landform.

Riebeckite is the most common mineral associated with fibrous minerals encountered at the Proposal. Riebeckite is usually found in fresh (unweathered) BIF. The asbestiform variety of riebeckite is crocidolite, or blue asbestos. The presence of riebeckite does not necessarily pose a fibrous mineral risk, but it is a precursor mineral to crocidolite, therefore, there exists a likelihood of encountering crocidolite. If present, crocidolite seams would primarily occur within the unmineralised Marra Mamba Iron Formation. In addition, crocidolite may also occur in BIF clasts found within the overlying alluvium cover.

Fibrous mineral waste is not expected to be exposed during operations based on the current life of mine plan at the HD2 or BHT deposits.

5.7.12 Implications for closure and knowledge gaps

Closure implications associated with mineral waste characteristics and inventory include:

- Final landform designs will be based on the physical characteristics of the waste material. Based on the volume of high erodibility waste rock at the HD2 deposit, stockpiling of rock armouring material will be required. In addition, abandonment bund material will be incorporated into mine design reviews to ensure this material is stockpiled and available at closure.
- The geochemical assessment of waste rock will be reviewed and updated periodically or following changes to the pit design.
- Based on the low risk of both PAF, metal-enriched and fibrous mineral waste, it is not currently anticipated that stockpiling of rehabilitation materials with specific characteristics to enable encapsulation will be required.

Closure knowledge gaps associated with mineral waste characteristics and inventory, as summarised in Table 6-1, include:

- Site specific physical waste characterisation will be progressively undertaken when each mineral waste unit becomes available during mining operations.
- Include HD2 and BHT deposit materials in updates of the BST.
- Undertake further testing of BHT (detrital) lignite materials when geological units become available during mining operations as per the SCARD management plan.
- Undertake landform evolution modelling for HD2 and BHT landforms to further inform and verify final landform design and rehabilitation parameters.

- Revise waste rock landform rehabilitation and overall closure landform designs based on physical waste characterisation, BST parameters, hydrological and ecological factors and stakeholder consultation as required.
- Develop a rehabilitation materials inventory for HD2 and BHT deposits for low erodibility waste to be utilised for capping and abandonment bunding where required.
- Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, soils, contaminated sites, hydrogeological, hydrological, conservation, flora and vegetation, fauna knowledge and assessments.
- Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits.

5.8 Soils

Topsoil is an important factor in achieving high quality rehabilitation results. Characterisation of properties provides an indication of their potential impacts on vegetation establishment, growth and landform stability; although it is important to recognise soils may be altered as part of mining processes. Appropriate characterisation can also help ensure soils with adverse properties are avoided in rehabilitation.

In the Pilbara, hills and rock ridges which represent the surface expression of the Marra Mamba Iron Formation, have extensive areas without soil cover and the soils that do occur are shallow and skeletal. Rocks of this formation weather very slowly, and any soil which does form tends to be transported into the surrounding valleys and plains due to the sparse vegetation cover and erosion force of heavy rains derived from thunderstorms and cyclones.

The soils on slopes, although having had more time to develop than the soils of the adjacent ridges, are still influenced by the parent rock and may be shallow and stony sands or loams. On pediments, older pediplains and alluvial plains, hard alkaline red loamy soils tend to be dominant, and may be considered as the regional mature soil type. The surface of these areas may contain a layer of small gravel, derived from the more resistant rocks in the area.

In 2021 a topsoil soils assessment was conducted for soils collected as part of exploration drilling locations for both the HD2 and BHT deposits; the assessment collected a total of 38 samples (23 and 15 respectively) across both deposits (Landloch 2022). The assessment analysed the physical and chemical properties of the soils for the purposes of rehabilitation post-closure.

Soils collected at the HD2 deposit reside within the Newman, Platform, and Boolgeeda land systems, while those identified at the BHT deposit are located only within the Newman land system. Soils within these land systems are broadly characterised below:

- Newman land system soils are predominantly classified as stony soils, with smaller proportions of red shallow loams and red shallow sands.
  - Stony soils tend to be shallow with physical rooting depths no more than 0.5m. They have circum-neutral pHw, low salinity, loam to clay loam textures, and very high coarse fragment abundance.
  - The red shallow loams have similar properties except for low coarse fragment abundance. The red shallow sands are similar except for low coarse fragment abundance and a loamy sand to clayey sand texture.
- Platform land system soils are predominantly stony soils (similar to those of the Newman system) and red loamy earths. The red loamy earths are similar to the stony soils except they tend to be deeper and have low coarse fragment abundance.
- Boolgeeda land system soils are commonly red shallow loams or red/brown non-cracking clays.

- Red shallow loams tend to be shallow with physical rooting depths no more than 0.5m. They have circum-neutral pHw, low salinity, sandy loam to clay loam textures, and low to moderate coarse fragment abundance.
- The red/brown cracking clays also have a shallow rooting depth due to increased clay content and chemical limitations in soils deeper than ~0.3m. They have neutral to alkaline pHw, low salinity, and low coarse fragment abundance. Surface soils have a sandy clay texture, with subsoils becoming light to medium clays. Sodicity increases with depth in the non-cracking clays and becomes high in soils deeper than ~0.3m.

The soils present at HD2 and BHT can be summarised as follows:

- Circum-neutral to alkaline pHw.
- Low salinity.
- Loam to clay loam textures, with loamy sand and clay textured soils also present but less common.
- Variable coarse fragment abundance, with stony soils have >90% coarse fragments and the loam and clay textured soils within the Boolgeeda land system having <10% coarse fragments.
- Clay subsoils within the Boolgeeda land system may be sodic and prone to dispersion. This is a potential issue for HD2 only as the Boolgeeda system is not present at BHT.

The results of the physical and chemical soils analysis completed for the HD2 and BHT deposits is provided in Table 5-8. The soils are non-sodic and typically acid to neutral in the upper 200mm (defined as topsoil) of the profile with subsoils being neutral to alkaline. Trace element analysis does not indicate any potential deficiency or toxicities. Results are represented here as a range; further soils assessments will be conducted during construction and operational phases of the project as required. The soils analysis report is available in Appendix 8.

Table 5-8: Comparison between soils from HD2 and BHT deposits

Analysis		Unit	HD2 deposit	BHT deposit
Physical	Soil texture (<2 mm soil fraction)	NA	Sand, clay, loam	Stony soils loam
	Coarse material content (%)	%	10 - 79	42 - 70
	Fine Fraction	%	17 - 90	42 - 77
	Coarse Sand	%	19.7 - 44.8	21 - 58
	Fine Sand	%	33.8 - 57.9	23.6 - 42.3
	Silt	%	4.7 - 14.1	33.3 - 53.7
	Clay	%	13.1 - 28.3	1.5 - 6.9
	Plant Available Water (PAW adjusted)	mm/m	60 - 180	10 - 21.2
	Plant Available Water (PAW adjusted)	mm/m	17 - 148	75 - 120
	Saturated hydraulic conductivity (Ksa)t	mm/hr	4 - 29	22 - 60
Chemical	pHw	pH units	4.61 - 7.95	5.08 - 7.16
	pHCa	pH units	3.81 - 7.15	4.75 - 7.37
	EC 1:5	dS/m	0.1 - 0.9	0.01 - 0.33
	Exchangeable Sodium Percentage (ESP)	%	1.0 - 10	1.8 - 8.9
	Exchangeable Magnesium Percentage (EMP)	%	14 - 32	17 - 41
	Chloride (Cl)	mg/kg	12.6 - 656	16.6 - 126
	Electrochemical Stability Index (ESI)	NA	00 - 0.1	0.00 - 0.03

Analysis		Unit	HD2 deposit	BHT deposit
	Total Nitrogen (N)	mg/kg	131 - 1252	664 - 1004
	Ammonium – (NH4)	mg/kg	<0.2 - 10.4	<2 -13.2
	Nitrate – (N03)	mg/kg	1.06 - 232	1.46 - 7.13
	Organic Carbon (C)	%	0.5 - 1.5	0.4 - 1.7
	Total Phosphorous (P) P	mg/kg	225 - 601	329 - 654
	Average Phosphorous (P) P	mg/kg	8.5 - 42.2	13.3 - 30.2
	Average Potassium (K)	mg/kg	67.5 - 302	63.3 - 105
	Average Sulphur (S)	mg/kg	6.5 - 23	3.7 - 41
	Trace Copper (Cu)	mg/kg	0.8 - 3.7	0.4 - 1.3
	Trace Manganese (Mn)	mg/kg	Dec-59	8.5 - 49
	Trace Zinc (Zn)	mg/kg	0.5 - 4.1	0.5 - 0.9
	Extracted Calcium (Ca)	mg/kg	1.8 - 7.4	1.2 - 4.6
	Extracted Magnesium (Mg)	mg/kg	0.7 - 2.7	0.7 - 1.7
	Extracted Potassium (K)	mg/kg	0.1 - 1.2	0.1 - 0.3
	Extracted Sodium (Na)	mg/kg	0.1 - 0.4	0.1 - 0.7
	Extracted Aluminium (Al)	mg/kg	0.0 - 0.3	0.0 - 0.2
	Effective Cation Exchange Capacity (ECEC)	mg/kg	1.8 - 7.4	2.4 - 7.3

A summary of suitability of the material as growth media is provided in Table 5-9, further detail is provided in Appendix 8. Further work will be undertaken throughout the LoM to assess and manage soils.

Table 5-9: Summary of suitability of topsoil as growth medium

Property	HD2 deposit	BHT deposit
pHw, pHCa	Suitable, though there are a significant amount of low pH materials that may reduce nutrient availability and biological activity. This reduction did not reduce fertility to unsuitable levels.' Field/pot trials to confirm this is recommended. Lime could be used to increase pH if shown by trials to be needed.	Suitable. Only 1 of 15 samples had slightly low pH and 1 of 15 samples had slightly high pH.
Salinity, chloride	Suitable	Suitable
Structural stability	Often unstable (52% of samples)	Infrequently unstable (27% of samples)
Fertility	Often low total N Often low available K	Very often low total N Sometimes low available K
Plant available water	Suitable	Suitable
Saturated hydraulic conductivity	Suitable	Suitable

5.8.1 Soil inventory

Topsoil is a limited resource in the Pilbara with topsoil recovery often being restricted due to the nature and terrain of the landscape. The objective of soil management is to maximise the collection of topsoil and

subsoil, and to store it in such a way as to maximise its viability and productivity for subsequent use in rehabilitation.

Topsoil and subsoil are managed in accordance with the *Rio Tinto Iron Ore Soil Resource Management Work Practice* (Rio Tinto 2020b) to ensure appropriate volumes are available for rehabilitation activities. Where practical, a minimum of 200 mm of topsoil and up to 600 mm of subsoil is collected when new ground is disturbed. Long-term locations for soil stockpiles have been identified and incorporated into the mine plan (Figure 4) with stockpile height limited to 2 m high to maintain viability.

Where practical, a minimum of 200 mm of topsoil and 600 mm of subsoil is collected (where possible) when new areas are disturbed. Reconciliations of topsoil volumes are undertaken to confirm that sufficient material is available to spread across the rehabilitated area, assuming a spreading depth of 200 mm.

Current collection rates at HD1 (a suitable proxy for soil collection at HD2 and BHT) show that approximately 30% of the expected volume is recovered and stockpiled, with the remainder unrecoverable due to terrain restricting accessibility or the unavailability of soil on outcropping rock formations. Table 5-10 provides projected soil inventory for HD2 (as of December 2019), assuming recovery rates of 30% remain consistent over time.

Table 5-10: Predicted LoM soil balances for the HD2 (BHT and HD2 deposits)

Topsoil parameters	Future predicted clearing and recovery
Topsoil volume (m^3)	2,716,800
Subsoil volume (m^3)	4,370,400
Total soil volume (m^3)	7,087,200
Total disturbance area (ha)	4,900.01
Pit areas not rehabilitated (ha)	965.89
WRL requiring rehabilitation (ha)	939.24
Landbridges requiring rehabilitation (ha)	62.88
Infrastructure area requiring rehabilitation (ha)	2932.14
Completed rehabilitation (ha)	NA
Area requiring topsoil (ha)	3,934.11
Soil volume required 200mm (m^3)	7,035,000
Soil Surplus (m^3)	52,200
Soil Surplus (%)	0.7%

The HD2 and BHT deposits are predicted to have sufficient soil resources to complete rehabilitation works at closure; however, alternative growth media (AGM) may need to be considered (Section 5.8.2) if recovery rates fall below the 30% factor applied due to anticipated topographic constraints.

Broadly, to maximise prospects of successful outcomes each progressive rehabilitation project is assessed to determine the type and amount of soil (or alternative media) used. This assessment could include:

- soil inventory at the time of rehabilitation.
- landform and rehabilitation type.
- potential for trials.
- distance to soil stockpiles; or
- potential upcoming rehabilitation projects.

5.8.2 Alternative growth media

In 2010, a study was commissioned by Rio Tinto into the use of mine waste materials as an AGM for rehabilitation. The study reviewed soil, tailing and mineral waste characteristics from select Pilbara mining operations, to identify material combinations that may be suitable as a topsoil substitute or supplement in cases where topsoil may be insufficient for rehabilitation requirements. In these cases, topsoil would be applied to high priority areas such as waste landforms and lower priority areas such as laydown areas may receive AGM.

The study showed plant-available nutrients held within the waste materials, although variable, was characteristically low and comparable to natural soils in the region. Most of the waste materials had macro- and micro-nutrient concentrations within the range or above the levels measured in benchmark Pilbara topsoil and rehabilitated soils. The pH and phosphorus-buffering index of most waste materials were also comparable to that of the benchmark topsoil materials.

In general, Pilbara mineral wastes were non-saline and non-sodic, with no sample presenting above the 15% threshold for exchangeable sodium percentage (ESP), the indicator of high sodicity. The soil structure of waste materials was relatively stable, with only slight or no dispersion upon re-moulding, indicating a relatively stable structure that is not easily degraded, and were not prone to hard setting. However, estimated plant available water content of the waste materials ranged from <3% to >25%.

Subsoil samples from HD1 (expected to have soils analogous to the Proposal) were within acceptable ranges to be used as AGM when compared to Pilbara soils except for gravel content. While gravel content was found to be lower than typical Pilbara topsoils, it was very similar to HD1 topsoil samples (both between 0-5%). It was concluded that subsoil sample particle size distribution was very similar to the topsoil parameters measured, and therefore, considered suitable for use as AGM. A lower gravel content may also offer benefits with regards to soil water holding capacity.

Whilst rehabilitation areas have generally performed better with topsoil application, absence of topsoil does not necessarily mean that rehabilitation will fail, or that completion criteria will not be achieved. AGM trials have been conducted on waste rock landforms rehabilitation without topsoil application (for example the Channar 84 East 5 trial completed in 2021) and are performing strongly against most success indicators. Further trials using detrital waste material as an AGM have begun at Tom Price (MMW4 waste rock landform and Section 5.15). Initial observations indicate stability and early growth.

As discussed in Section 5.8.1, it is predicted there will be adequate topsoil and subsoil resources available for rehabilitation of the HD2 deposit, but further work may be needed to explore the use of AGM at the BHT area due to topographic factors potentially affecting soil recoveries. Therefore, investigations will continue to be undertaken to support rehabilitation efforts at the HD2 and BHT deposits.

5.8.3 Rehabilitation materials inventory

Often during rehabilitation activities, erodible, fibrous and PAF materials are planned to be encapsulated as part of making the site safe and stable. The materials required for these encapsulation purposes often require specific characteristics described below. Many of the external waste rock landforms contain a high proportion of erodible material, which has been accounted for in proposed landform design parameters (Section 5.7.7). Competent material with low erodibility will be stockpiled in low-grade (LG) waste rock landforms at the HD2 and BHT deposits, which can be rehandled at closure if capping of external waste rock landforms is required. Materials suitable for armouring (Table 5-11) at HD2 and BHT deposits will be segregated and stockpiled during operations for rehabilitation purposes. Preliminary calculations have been completed including rock armouring of HD2 waste rock landforms slopes and abandonment bunds, further work is required once mining commences, an action is listed in Table 6-1 and Appendix 5.

Table 5-11: Rehabilitation materials (competent rock)

Waste type	Use	Location	Volume (Mm3)
Newman Member	Armouring of erodible waste rock landforms	Tortoise HD2	1.4
Dales Gorge	Armouring of erodible waste rock landforms	NW_LG BHT	210

5.8.4 Implications for closure and knowledge gaps

Closure implications associated with soils include:

- The predicted soil balance indicates a surplus if all available topsoil can be harvested. In the event the predicted volume is not realised, Rio Tinto will consider the suitability of subsoil as an AGM.
- Rehabilitation materials inventory is necessary to support long-term landform stability and progressive rehabilitation.

Closure knowledge gaps associated with soils, as summarised in Table 6-1, include:

- Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, hydrogeological, hydrological, flora and fauna knowledge and assessments.
- Update the topsoil balance for estimated topsoil recovery annually once mining commences.
- Complete subsoil characterisation work when vegetation clearing commences as required.
- Develop a rehabilitation materials inventory for HD2 and BHT deposits for low erodibility waste to be utilised for capping and abandonment bunding where required.
- Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits.

5.9 Contaminated sites

Rio Tinto maintains registers for potentially contaminating activities and known or suspected contaminated sites which have been formally reported under s11 of the *Contaminated Sites Act 2003* (WA). The registers are informed by regular review of operations and where required preliminary or detailed site investigations to assess contaminants associated with such activities and assess their risk of harm to human health, the environment and environmental values. Potentially contaminating activities and land uses as described in the 2014 (former) Department of Environmental Regulation guideline '*Assessment and management of contaminated sites'* (DoE, 2014*)*, that may be associated with mining activities onsite include, but not limited to:

- automotive repair workshops (light and heavy machinery);
- substations and transformers;
- fertiliser and explosives storage;
- landfill sites;
- mineral processing, mining, screening and crushing facilities;
- rail transport corridors;
- hydrocarbon storage, handling and dispensing facilities;
- sewage wastewater treatment plants and irrigation areas; and
- disturbance of potentially acid forming materials during mining.

All potentially contaminating activities and land uses identified on the site register are managed as part of the ongoing mining operation. Prior to closure as part of the decommissioning process, a contaminated site assessment will be undertaken. Based on this assessment, specific plans will be developed to remediate or manage contaminants, where required, to support the final land use.

No locations within the HD2 closure boundary have been reported under the *Contaminated Sites Act 2003* (WA), as would be expected for a greenfield development.

5.9.1 Implications for closure and knowledge gaps

Closure implications associated with contaminated sites include:

- Ensuring that contamination risks have been assessed prior to the closure of the Proposal.

Closure knowledge gaps associated with contaminated sites, as summarised in Table 6-1 include:

- Undertake Preliminary Site Investigation 5 years prior to closure.
- Undertake Detailed Site Investigation 2 years prior to closure.
- Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, soils, contaminated sites, hydrogeological, hydrological, conservation, flora and vegetation, fauna knowledge and assessments.
- Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits.

These knowledge gaps are required to be addressed to inform post-mining land use planning and understanding of any required remediation activities.

5.10 Hydrogeology

The HD2 and BHT deposits are associated within two distinct aquifers, referred to as the HD2 and BHT aquifers (Figure 18 through to Figure 22). These aquifers are localised and conceptually understood to be compartmentalised at HD2 where groundwater availability is primarily limited by the vertical extent (thickness) of the aquifer, and as bounded, and 'bathtub-like' at BHT.

These aquifers can be grouped into two main types:

- HD2 aquifer - the Wittenoom aquifer type comprising the karstic dolomite within the Bee Gorge and Paraburdoo Members of the Wittenoom Formation and the mineralised and/or fractured zones of the underlying Mount Newman Member of the Marra Mamba Iron Formation; and
- BHT aquifer - the Brockman Iron Formation aquifer type comprising the mineralised zones of the Dales Gorge Member and Joffre Member where fractures are encountered.

In general, Wittenoom Formation aquifers are typically regional in scale and variably connected while Brockman Iron Formation aquifers are typically local scale and most often association with iron ore enrichment (Rio Tinto, 2022).

At the HD2 deposit the Marra Mamba Formation abuts the regionally extensive Wittenoom Formation (Figure 19 and Figure 21). The water table is located within both these formations and generally below the detrital deposits. Groundwater in the Marra Mamba Iron Formation (Mount Newman Member) is expected to be in hydraulic connection with the adjacent Wittenoom Formation effectively forming a single aquifer.

At the BHT deposit, the aquifer is located within the mineralised Dales Gorge Member of the Brockman Iron Formation, which hosts a localised and predominantly isolated aquifer. The Mount McRae Shale forms an aquitard around the majority of the Mineralised Brockman Iron Formation isolating the groundwater held in the BHT area from the regional Wittenoom aquifer. It is considered that a small area in the north of the deposit is connected to the regional aquifer due to eroding of the Mount McRae Shale at this location (Figure 19 and Figure 21). Compartmentalisation is observed at the eastern boundary of the aquifer by a 44 m head difference occurring across a pair of dykes to the east of the Baby Hope (HD1SW) area of the HD1 operation (Rio Tinto, 2022).

The direction of groundwater flow across the Proposal is predominately to the northeast, essentially mimicking the surface water drainage system that occurs in this area. Groundwater recharge is expected to occur at surface drainage features following rainfall and creek flow events.

The depth to groundwater ranges between approximately 50m and 100m throughout most of the Proposal area, depending on topography (Figure 18 to Figure 20). These depths are generally greater than those which would typically support groundwater dependent vegetation (>15 m below ground level). The depth to

groundwater is shallower (approximately 40 m) below ground surface along WWC and PMC where they cross the eastern boundaries of the aquifer. A high level of compartmentalisation occurs within the fractured rock Wittenoom aquifer. Head changes between 13 m (south-eastern boundary) and 38 m (western boundary) have been observed either side of restricted flow boundaries present within the aquifer.

The HD2 deposit pre-mining groundwater elevations range from 629mAHD to 625mAHD (Wittenoom aquifer). A pre-mining groundwater elevation of 625 m AHD is considered as appropriate for the deposit. At the BHT deposit, groundwater gradients are relatively flat across the aquifer with the groundwater elevation ranging between 595mAHD in the west and 593mAHD in the east. A pre-mining groundwater elevation of 594mAHD is considered appropriate for the deposit (Rio Tinto, 2022).

5.10.1 Groundwater dependent hydrology

The surface water present at Ben's Oasis is understood to be groundwater fed. The source of the groundwater is likely to be predominantly from a southern catchment, disconnected from the HD2 deposit area and local storage associated from the immediate sub-catchment geology that surrounds Ben's Oasis. Ben's Oasis is interpreted as a zone of outcropping Wittenoom Formation of negligible primary permeability, forcing groundwater to discharge at surface. As outlined above, groundwater in the BHT deposit area (held in the Mineralised Brockman Formation) is hydraulically isolated from the surrounding Wittenoom aquifer and from Ben's Oasis (Figure 18).

Groundwater flow within the Wittenoom Formation is impeded between HD2 deposit and Ben's Oasis by a southwest trending dyke near the HD1 village (Figure 19). A 13 m head difference on either side of the dyke has been observed, indicating a restricted flow boundary. Groundwater levels near to Ben's Oasis have been measured at 618mAHD (July and December 2021) and therefore approximately four metres higher than groundwater levels measured in monitoring bores immediately to its west.

This conceptual understanding of the groundwater underlying the Proposal suggests it is unlikely that changes to the HD2 and BHT aquifers from borefield extraction for operational supply will impact Bens Oasis. Monitoring of Bens Oasis will be ongoing throughout operations to ensure abstraction activities do not impact the groundwater dependent ecosystem (GDE) (Rio Tinto, 2022).

WWS is also not considered to be connected to the aquifers at the HD2 deposit due to the presence of a southeast trending dyke located to the east of the BHT area (Figure 18) (Rio Tinto, 2022).

5.10.1 Groundwater quality

The groundwater is fresh; with salinity is typically about 1000 µS/cm EC, and slightly alkaline. Salinity (as EC) ranges from approximately 183 to 2,960 µS/cm, pH ranges from 6.54 to 8.9. Parameters tested for are within Australian Drinking Water Guidelines (NHMRC, NRMMC, 2011) excepting Arsenic (As) concentrations of 0.011 and 0.017 mg/L and Manganese (Mn) concentrations of up to 0.703 mg/L have been recorded. Water quality data ranges for the HD2 and BHT aquifers, obtained from groundwater sampling and laboratory analyses (Rio Tinto, 2022) are included in Table 5-12.

Table 5-12: Groundwater quality ranges for Proposal

Groundwater Quality Parameter	HD2 aquifer	BHT aquifer
Alkalinity CaCO3 (mg/L)	90 - 337	160 - 378
Cond EC LAB (uS/cm)	666 - 2960	183 - 346
Hardness (CaCO3) (mg/L)	411 - 1240	341 - 421
pH (pH Units)	6.54 - 8.69	741 - 815
Dissolved Oxygen (O2) (% Sat)	49 - 98.2	33.5 - 92.5
Total Dissolved Solids (TDS) (mg/L)	496 - 2300	474 - 856

Groundwater Quality Parameter	HD2 aquifer	BHT aquifer
Total Suspended Solids (TSS) (mg/L)	<5 - 280	<5 - 6190
Antimony (An) (mg/L)	<0.001 - 0.001	<0.001
Arsenic (As) (mg/L)	<0.001 - 0.001	<0.001 - 0.017
Barium (Ba) (mg/L)	0.001 - 0.01	0.218 - 0.426
Beryllium (Be) (mg/L)	<0.001 - 0.001	< 0.001
Boron (B) (mg/L)	0.2 - 0.31	0.19 - 0.33
Bromide (Br) (mg/L)	<0.05 - 0.762	0.356 - 1.08
Cadmium (Cd) (mg/L)	<0.05 - 0.00224	<0.001
Chloride (Cl) (mg/L)	78 - 240	78 - 232
Chromium (Cr) (mg/L)	<0.001 - 0.001	<0.001
Cobalt (Co) (mg/L)	<0.001 - 0.029	<0.001 - 0.003
Copper (Cu) (mg/L)	<0.001 - 0.001	<0.001
Fluoride (Fl) (mg/L)	0.2 - 0.4	0.3 - 0.7
Iron (Fe) (mg/L)	<0.05 - 3.11	<0.05 - 4.19
Lead (Pb) (mg/L)	<0.001 - 0.001	<0.001
Magnesium (Mg) (mg/L)	42 - 164	47 - 61
Manganese (Mn) (mg/L)	0.001 - 0	0.006 - 0.703
Mercury (mg/L)	0.001 - 0.004	<0.00004
Molybdenum (Mo) (mg/L)	<0.001 - 0.001	<0.001
Nickel (Ni) (mg/L)	<0.001 - 0	<0.001 - 0.002
Nitrate (NO3) (mg/L)	<0.01 - 5.22	<0.01 - 0.07
Nitrite (NO2) (mg/L)	<0.01 - 0.01	<0.01
Total Nitrogen (TN) (mg/L)	0.3 - 0.9	<0.1 - 0.4
Total Phosphorous (TP) (mg/L)	<0.01 - 0.27	<0.01 - 0.19
Potassium (K) (mg/L)	8 - 31	10 - 14
Selenium (Se) (mg/L)	<0.01 - 0.01	<0.01
Sodium (Na) (mg/L)	47 - 216	41 - 104
Sulphate (SO4) (mg/L)	60 - 1320	1 - 115
Zinc (Zn) (mg/L)	<0.005 - 4.25	<0.005 - 0.131

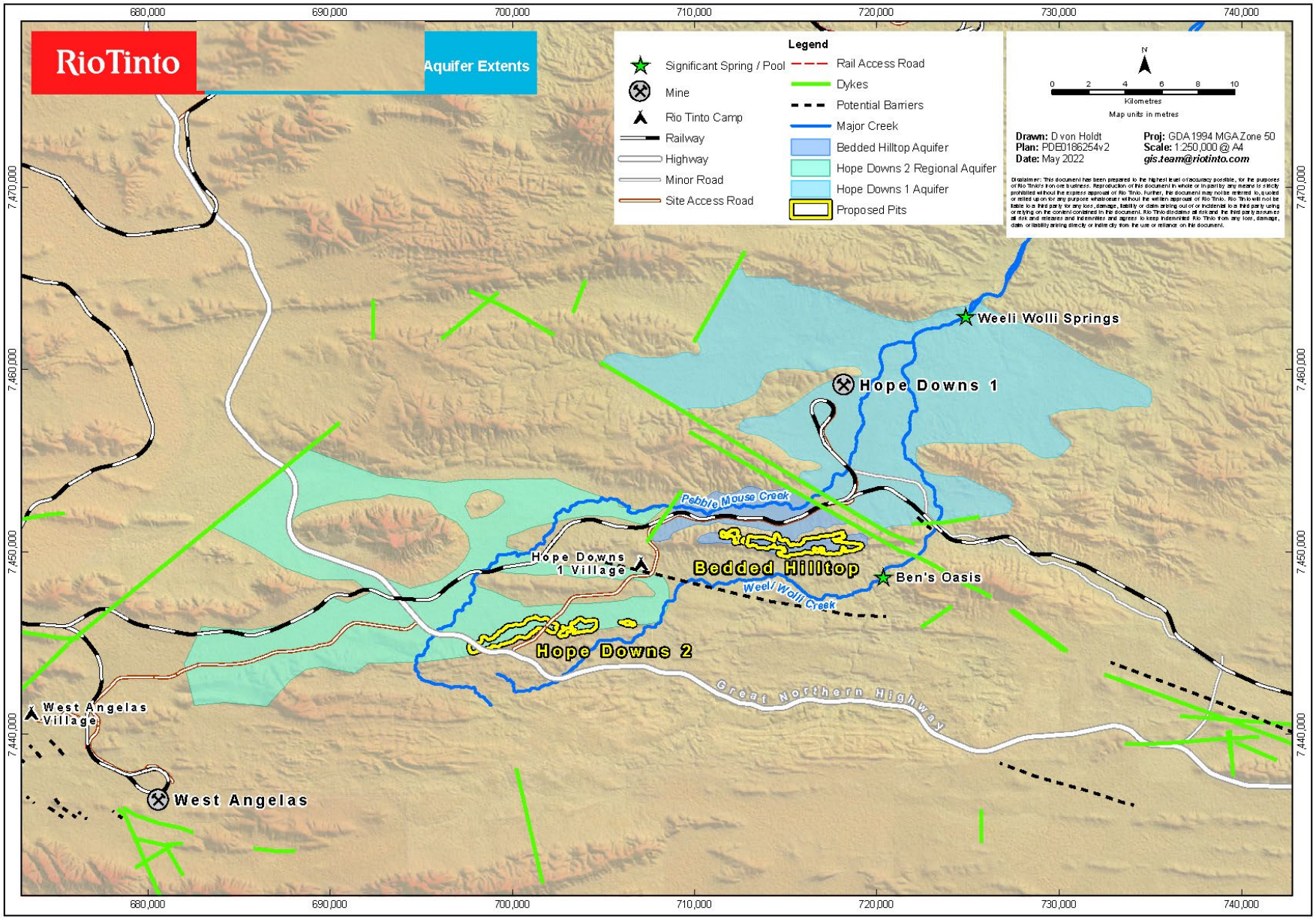


Figure 18: Proposal groundwater aquifer extents

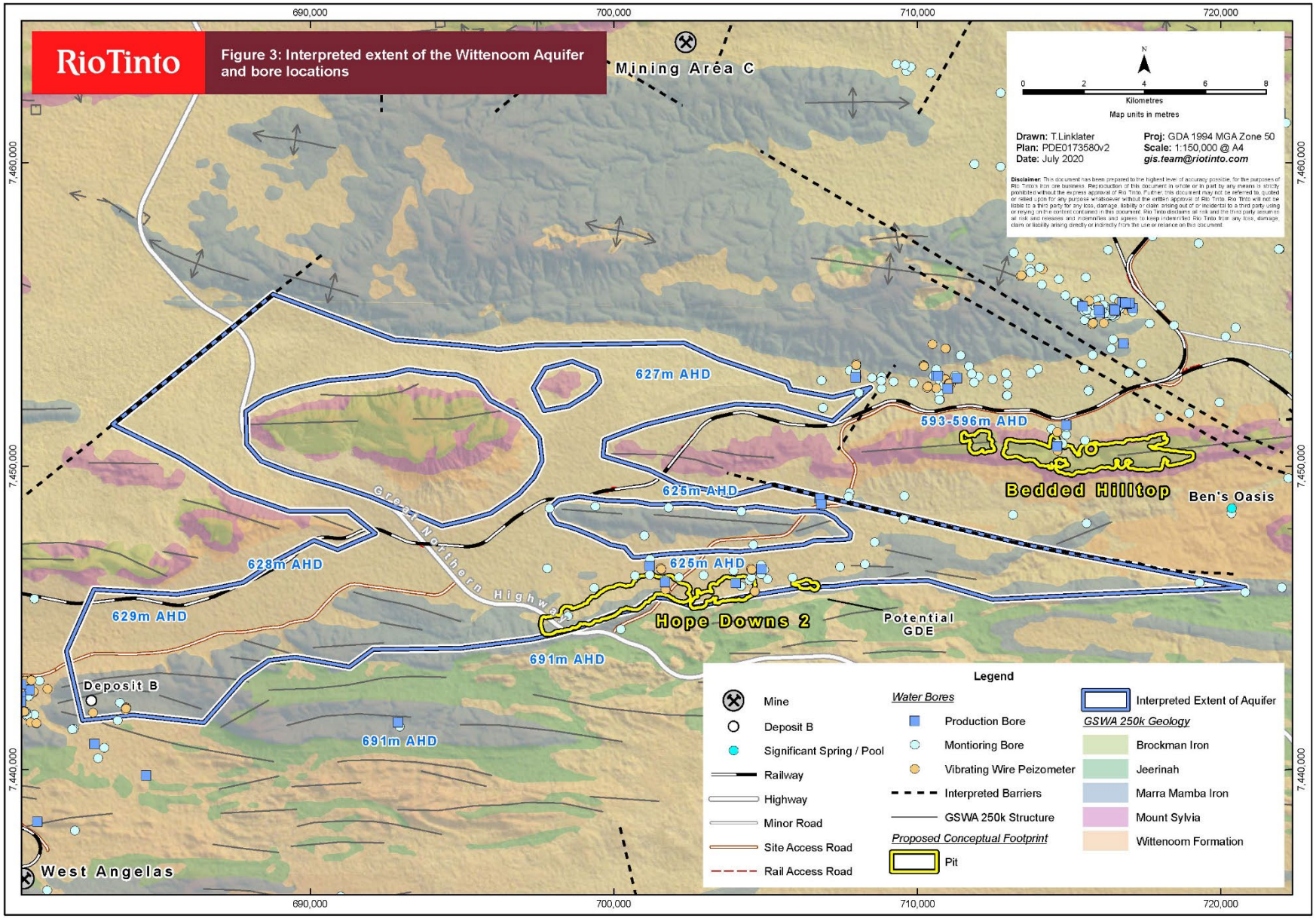


Figure 19: HD2 aquifer and water levels (mAHD, 2020)

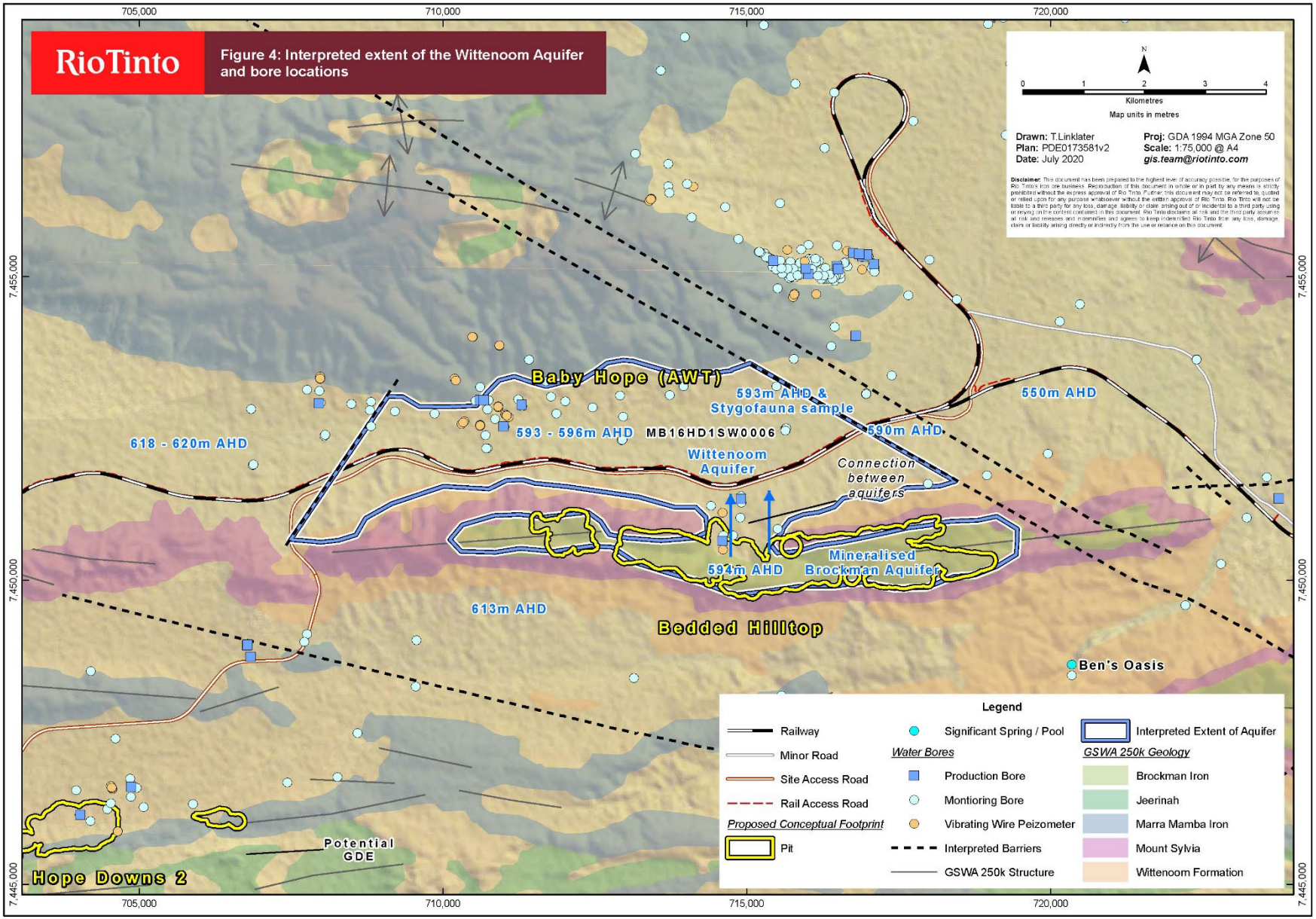


Figure 20: BHT aquifer and water levels (mAHD, 2020)

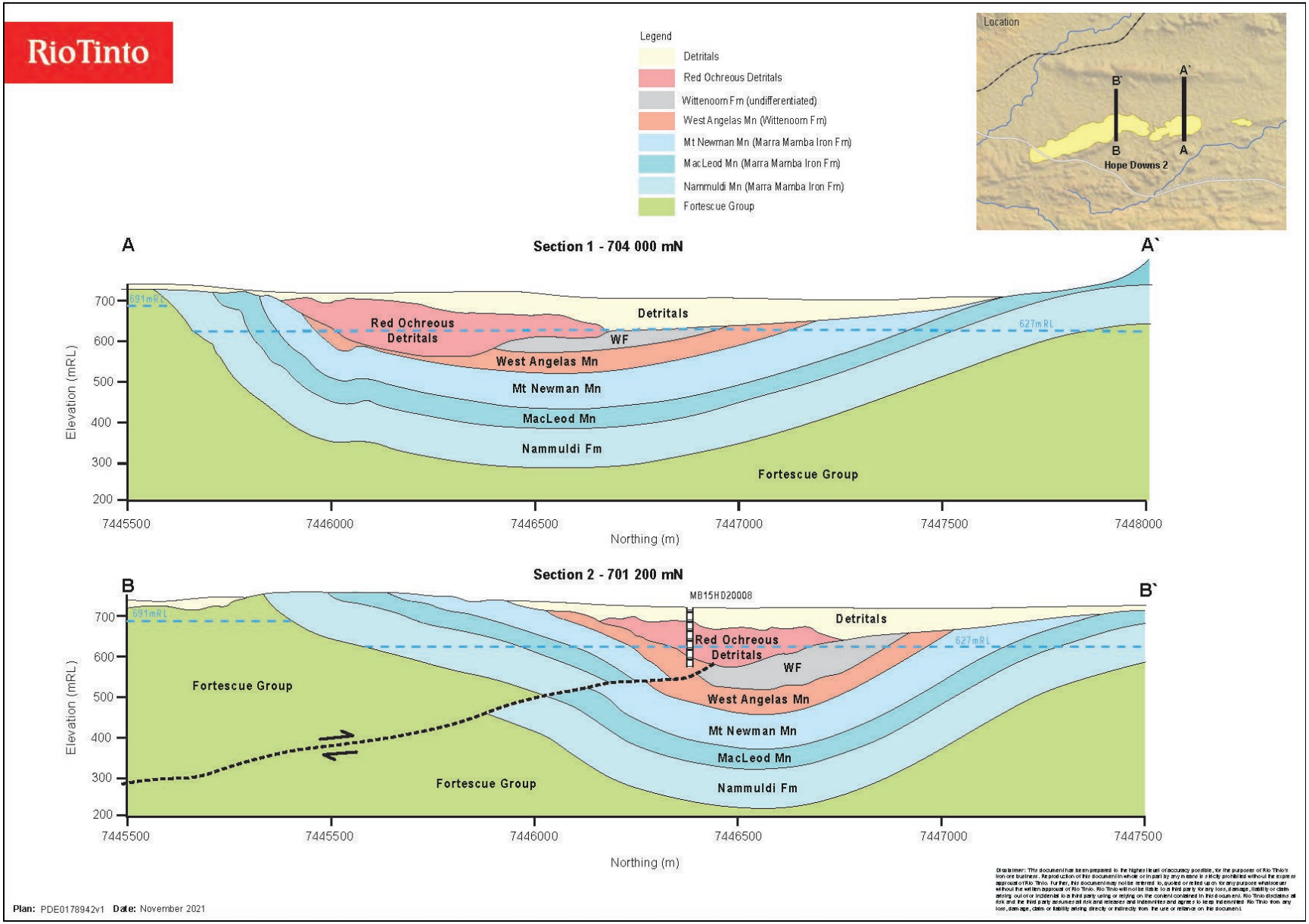


Figure 21: HD2 hydrogeological cross sections

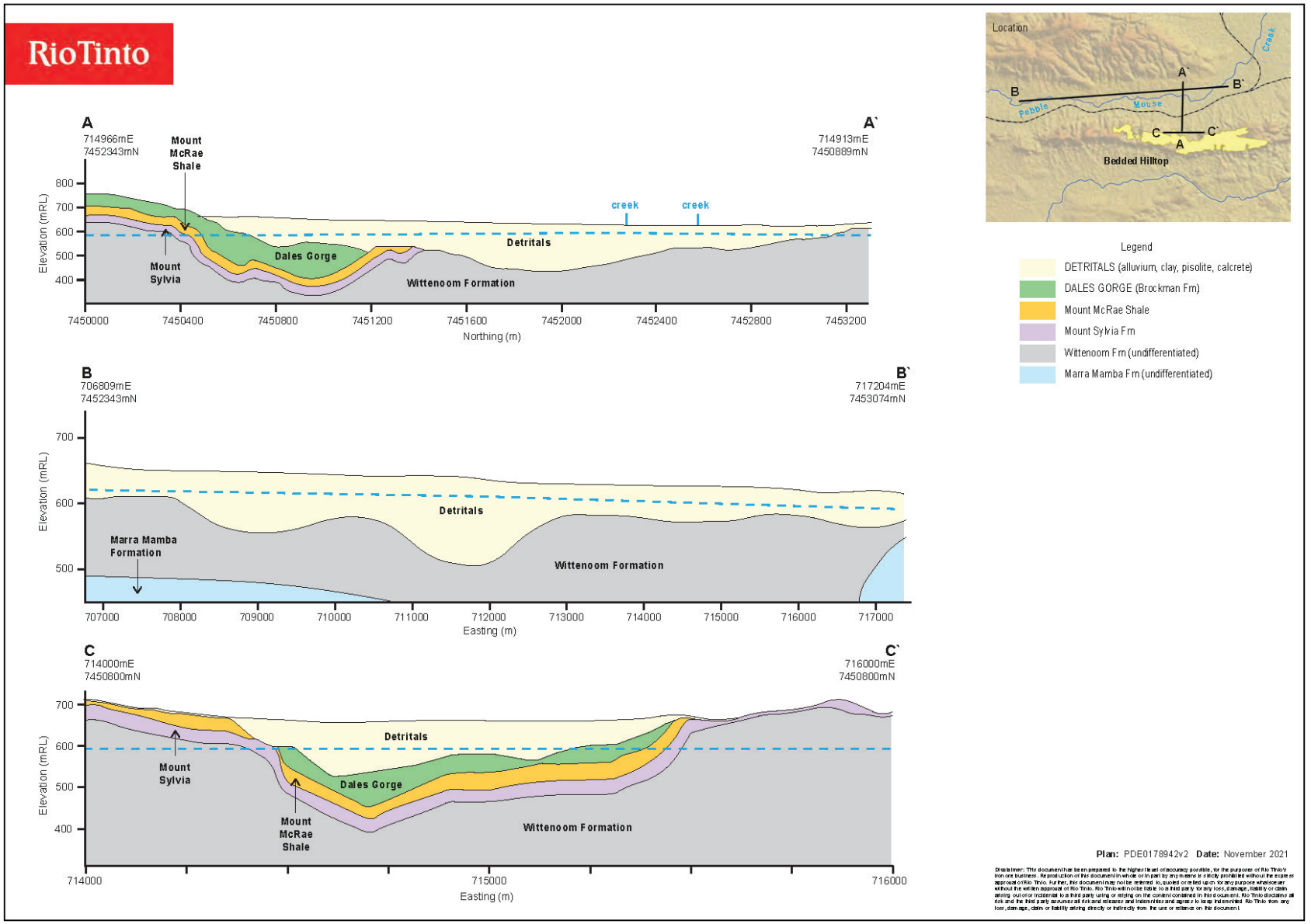


Figure 22: BHT hydrogeological cross sections

5.10.2 Groundwater use

Groundwater abstraction to dewater pits for mining (dewatering) is not required for the Proposal. Groundwater abstraction is assessed only for the purpose of providing a project water supply. Groundwater abstraction is not expected to impact areas beyond the local aquifer extents due to the presence of definable aquifer boundaries; namely structural groundwater flow barriers (regional and local dykes) and low permeability units (the Mount McRae Shale, the Fortescue Group and high silica zones such as the area between the HD2 and BHT aquifers). Abstraction of groundwater for construction and operational purposes is required, including dust suppression. Hydrogeological investigations have been undertaken in the Proposal area between 2015 and 2021.

To meet mine water demand, groundwater is to be sourced from existing and future production bores local to the HD2 deposit and bores currently used to supply the HD1 Village (potable water supply). Production water may also be sourced from dewatering at the HD1 operation.

Groundwater is currently abstracted from the Wittenoom aquifer to supply water for the HD1 Village. The abstraction bores for this camp are located approximately 2.5 km north of the closest part of the BHT deposit and are located within the same aquifer. Abstraction from these bores commenced in 2006, the total annual abstraction is generally close to the annual licence allocation of 500,000 kL (GWL No. 161143 (6)).

Groundwater levels recorded approximately 200 m south of the abstraction bores have declined by around 2 m over the 12-year period of abstraction, indicating a relatively minor and localised effect. Dewatering carried out at Deposit B (West Angelas), located approximately 10.6 km southwest of HD2 closure boundary has caused localised drawdown within the aquifer which extends approximately 2 km north of Deposit B.

Groundwater abstraction from these sources is not expected to impact areas beyond the local aquifer extents due to the presence of the definable aquifer boundaries (Figure 18). Additional monitoring bores have been installed across the surrounding area. Rio Tinto (2022) details the impact of groundwater abstraction for the Proposal.

The catchment created by the mine voids will serve to focus rainfall runoff and thus recharge, resulting in localised ponding at their base following heavy rainfall, which will dissipate via infiltration and evaporation shortly after the event.

5.10.3 Implications for closure and knowledge gaps

Closure implications associated with groundwater include:

- Drawdown of the aquifers due to groundwater supply abstraction over the LoM may result in changes to hydrogeological regimes, groundwater quality and subterranean fauna habitat and may require management in the post-mining period.

Closure knowledge gaps associated with groundwater, as summarised in Table 6-1, include:

- Complete final options assessment for water source and impacts for HD2 and BHT deposits.
- Update closure hydrogeological model with new conceptualisations for HD2 and BHT deposits water supply options.
- Complete closure hydrogeological water quality model for HD2 and BHT deposits once water supply options are agreed with stakeholders.
- Update the conceptual hydrogeological model for HD2 and BHT deposits final closure landform 5 years from closure.
- Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits.
- Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, soils, contaminated sites, hydrogeological, hydrological, conservation, flora and vegetation, fauna knowledge and assessments.

5.11 Hydrology

The Proposal is located within the upper reaches of the WWC catchment that forms part of the Fortescue River Region (Figure 23). WWC has a total catchment area of approximately 4,770 km^2 to Waterloo Bore gauging station and drains north into the Fortescue Marsh. The upper reaches of the WWC catchment include Pebble Mouse Creek (PMC), a major tributary of WWC with a catchment of 340 km^2. The HD2 and BHT deposits are both located between PMC to the north and the main channel of WWC to the south. The creek lines both intersect the edges of HD2 tenure, with PMC headwaters commencing south of the HD2 deposit and the creek line skirts the west of the HD2 deposit, heading north-east. WWC headwaters commence to the south of the HD2 deposit and head north-east towards BHT deposit and then north toward WWS (Figure 23). The creek lines both intersect the edges of HD2 tenure and there are several areas where the Proposal infrastructure footprint crosses PMC.

Modelling of the WWC catchment in 2021 (Appendix 12) identified that the development of the Proposal will reduce the WWC catchment area by approximately 45 km^2, based on the proposed placement of the pits and waste rock landforms. This is equivalent to 3.5% of the contributing catchment area to WWC and this percentage of flows is not considered a significant impact to the WWC catchment. Surface water management within the closure boundary of the Proposal is discussed in Section 5.11.3.

5.11.1 Surface water quality

Surface water quality sampling has not yet been undertaken for the PMC and WWC waterways adjacent to the Proposal. Seasonal inundation is ephemeral, and no flowing water has been recorded in PMC or WWC recently during surveys of the area. This has been identified as a closure knowledge gap and will be rectified, an action is listed in Section 5.11.6 and Table 6-1.

5.11.2 Weeli Wolli Spring and Ben's Oasis

The management of downstream flows is key to minimising impacts to sensitive receptors. Two sensitive environmental receptors have been identified in proximity to the Proposal, WWS and Ben's Oasis (Figure 23).

WWS is located approximately 7 km downstream of the confluence of PMC and WWC, to the northeast of the Proposal (Figure 23). The Spring was naturally groundwater fed (pre-mining) due to a geological barrier where high permeability rock units meet low permeability rock units, forcing groundwater to rise to the ground surface. WWS is currently maintained by discharge of surplus water from dewatering at the HD1 operation. Upstream of the permanent flowing portion of the spring are several permanent and semi-permanent pools scattered over 2 km. WWS also receives surface flows as it is within the main channel of the WWC. These catchment flows would reach WWS only in rare flood events associated with cyclones and are unlikely to have a significant impact on WWS. Mining is AWT avoiding pit dewatering and surplus water management. No other impact to WWS is anticipated.

Ben's Oasis is a significant environmental feature on WWC, which is located approximately 2 km from the BHT area and 15 km east of the HD2 area of the HD2 deposit (Figure 23). It is understood that Ben's Oasis is supported via groundwater expression (refer to Section 5.10.1) but also receives surface flows as it is within the main channel of the WWC. Ben's Oasis is in an area where the Wittenoom Formation is interpreted to outcrop allowing the discharge of groundwater at surface. Based on modelling completed in 2021 the estimated area of the WWC catchment contributing surface water flows to Ben's Oasis is approximately 420 km^2. The HD2 pits and waste rock landforms will reduce the catchment reporting to Ben's Oasis by approximately 6 km^2. However, the proposed HD2 levee and diversion drains (Figure 25) would contribute an additional 5 km^2 of catchment to Ben's Oasis (Section 5.11.3). Therefore, the net contributing catchment area is expected to be reduced by 1 km^2, equivalent to 0.2% of the total catchment.

Modelling completed in 2021 indicates that catchment reductions due to the Proposal mining activities will result in small reductions in surface water runoff (1% at WWS and 1.1% at Ben's Oasis) and are expected to have an insignificant impact on the flow regime at either of these locations. Assessment of the potential for sediment to be transported from the Proposal to WWC, indicates that sediment is likely to concentrate

at the culverts which will limit transport of sediment further downstream; therefore, the Proposal is considered unlikely to impact water quality at WWS. Further information is detailed in Appendix 12 and Appendix 13.

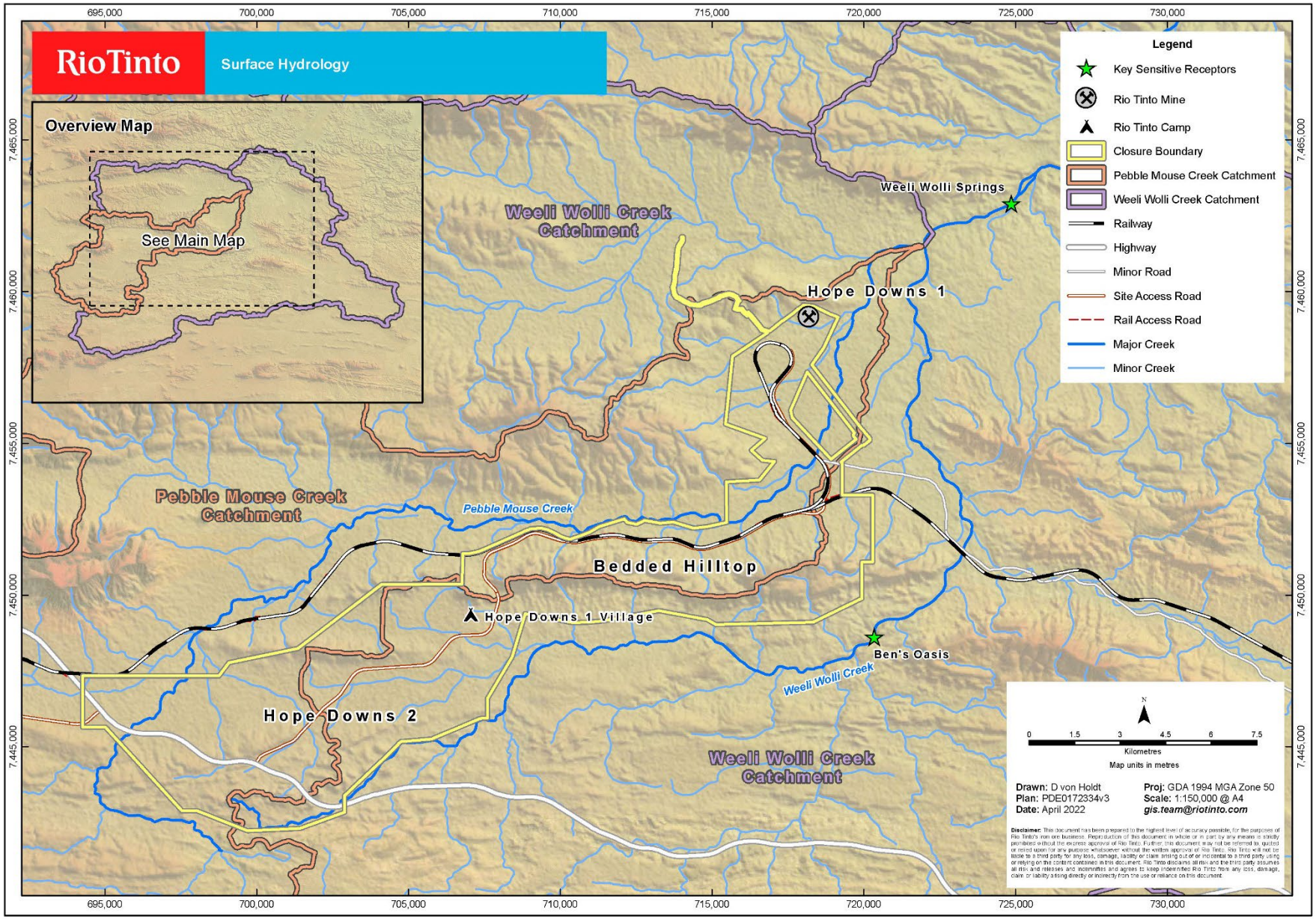


Figure 23: Surface Hydrology of Proposal

5.11.3 Surface water management

To manage the flow of surface water within the WWC catchment, several surface water management structures have been proposed. These include several PMC crossings during operations, and a diversion drain and levee to maintain flows post-closure.

During operations an engineered crossing of PMC will be constructed to connect the Proposal to the crushing facilities at HD1, referred to as the haul road crossing (Figure 24). This crossing comprises a haul road with culverts to ensure low flows are not impeded and has been designed for the modelled flow rate of 1:20 Annual Exceedance Probability (AEP) with final engineering designs for construction shown in Figure 24. Three further crossings (a conveyor crossing and two alternative access crossings) may be added to the project scope; however, these are proposed for removal at closure if constructed, and have not been included in the flood modelling completed on the closure landform. Flood modelling (Appendix 12) predicted effects on these watercourses included a slight loss of runoff which is expected to have little effect on the flow regime at either WWS or Ben's Oasis and is therefore not expected to have significant impact on the environmental and heritage values of these features during operations.

The attenuation of surface water upstream of the PMC crossing is predicted to result in an increase of flood depths of 1 m immediately upstream of the culverts in a 1:100 AEP event. Flow in this area would quickly disperse and is not expected to cause a significant change in the hydrological regime of the creek. Removal of this crossing at closure will reinstate flows closely to the natural system conditions.

To manage surface water flows during operations and post-closure a permanent diversion levee and two permanent diversion drains (Figure 25) will be installed to divert flow from a tributary in the PMC catchment towards WWC. This will maintain the catchment flows to WWC and prevent flows from being captured within the HD2 closure boundary. These have presently been designed to convey flows up to 1:100 AEP flows during operations. Flood modelling has been conducted on the proposed operational and closure landforms to inform flood risk and priority locations (Section 5.11.5). Assessment of the final landforms (i.e., using the post-closure landscape) is required in future updates to this closure plan to ensure that the surface water management structures are appropriate to manage flow post-closure. This is addressed as an action in the closure risk assessment and task list (Appendix 4 and Appendix 5).

The rare (1:100 AEP) and extreme (1:10,000 AEP) flood risks associated with the closure of HD2 and BHT are considered relatively low (Section 5.11.5). Conceptual closure landform designs have been generated to support this MCP; however detailed designs for rehabilitation are yet to be developed. As part of future closure planning Rio Tinto will design, upgrade and/or construct landforms which will improve landform stability over closure time frames (Appendix 10). Where post-closure surface water management structures remain, detailed engineering designs that are safe, stable and non-polluting and based on appropriate flood events will be completed as part of closure studies.

To enable safe mining (e.g., pit development), drainage works will be required to permanently divert surface water flow that would normally drain into PMC to WWC. Physical design and construction of major surface water management structures is guided by the Rio Tinto Environmental Design Principles for Permanent Facilities and the Rio Tinto Standard Specification for Stormwater Drainage. These principles aim to:

- ensure the long-term safety and stability of engineered landforms;
- ensure local drainage is reinstated so that impacts on local hydrology is limited; and
- ensure the latest design practice and monitoring evidence are used to guide design.

Minor drainage works will be required at closure to reinstate natural flow paths through disturbed areas prior to revegetation. This includes:

- removing culverts;
- reinstating minor surface water flow systems, preferable along pre-disturbance flow paths;
- undertaking minor landscaping to recreate appropriate creek bed slopes and banks; and

- implementing localised surface water controls on large flat disturbed areas, to manage incident rainfall and local catchment run-on / run-off.

In general, re-instated and constructed drainage will be designed in accordance with the following guidelines:

- The final profile of the constructed drainage line will consist of a flat base and sloped banks to allow for free drainage.
- The channel width will be determined based on the estimated volume of water anticipated to flow down the channel. In areas where friable, easily erodible material exists, or where there is the potential for high flow velocities, it may be necessary to cover the base of the constructed channel with competent rock.
- Where possible, the channel will be designed to meander so constructed channels have characteristics like the surrounding region, e.g., are not all linear features.
- The constructed channel will be blended in with any natural drainage lines.

5.11.4 Principles of landform location

Constructed landforms will consider the surrounding hydrology of the area, as they can have an impact on catchments both upstream and downstream of their location. Waste rock landforms and other landforms can act as a diversion or dam for upstream surface water, reducing flow to the downstream catchment. Likewise, these landforms can erode with surface water flow, destabilising the landform and impacting the downstream environment with sediment.

Landform design and location guidelines have been adopted when completing new designs. Waste rock landforms and other landforms are generally built outside the 1:100 AEP floodplain, consider material characterisation and often include surface water management structures such as diversions, bunds, and surface water retention cells. Ponding at the landform toe during rain events can be managed using rock armouring at the base of the landform. Bunding at the landform toe will also mitigate water ponding and divert water over a greater area increasing infiltration. The impacts of the final landform design on surface drainage flows at a site level will require assessment prior to final closure planning.

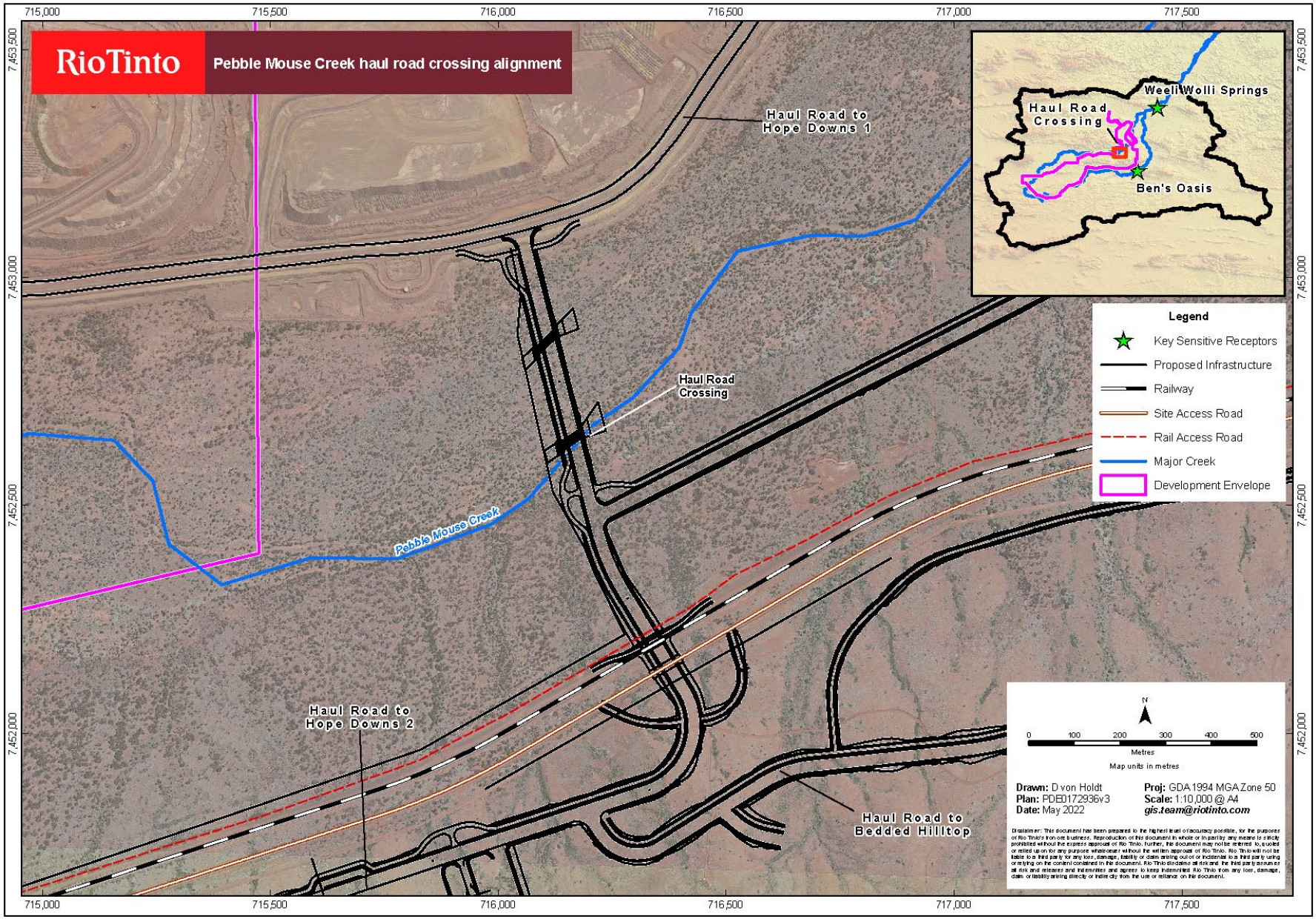


Figure 24: PMC Floodway alignment (PMC crossing)

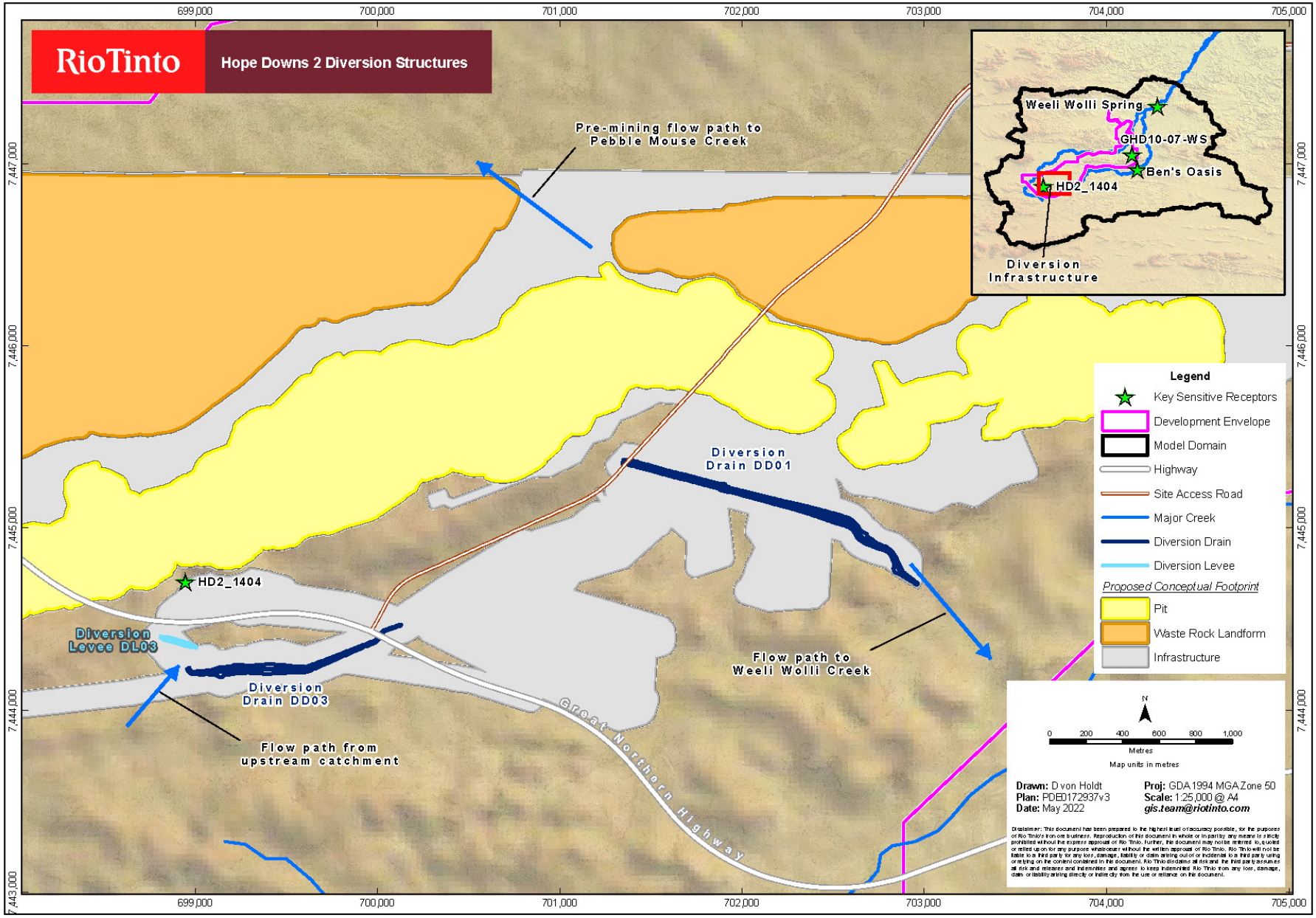


Figure 25: HD2 diversion levee and drains

5.11.5 Hydraulic Flood Modelling

The methodology and results from the most recent flood modelling for the Proposal is detailed in Appendix 12. When considering the flood hazard associated with rare to extreme events, it is important to recognise the uncertainty and limitations in estimating flood events with a very low probability of occurrence. The uncertainties involved with the flood estimation process increase with increasing size of the flood. Events of between 1:100AEP and 1:10,000AEP are termed “very rare” but are considered within the range of largest direct observations and the credible limit of extrapolation (limit of plausible extrapolation from other sources of information). Extreme events are in the range between 1:10,000AEP event and the Probable Maximum Flood (PMF) and represent the range of floods which borders on the ‘unknowable’, where even a high level of expertise cannot substantially reduce the level of uncertainty.

The PMF is a design concept that notionally represents the upper limit on flood magnitude but for which an AEP cannot be readily assigned. Although it is possible to produce an estimate of the PMF and simulate the associated flood hydraulics, this needs to be viewed in an appropriate context. There is no precedent for events of this magnitude in a catchment of this size in Australia or globally. Furthermore, the probability of the Probable Maximum Precipitation (PMP) event occurring in a catchment this size (1,340 km^2) is 1:1,000,000; however, the probability of the PMF cannot be reliably estimated as it requires both the PMP rainfall and extremely wet antecedent catchment conditions to coincide. Furthermore, it is possible that a catchment may change its behaviour when subjected to extreme rainfalls, with geomorphological mechanisms and changes in storage and routing behaviour possible. Extreme floods can be landscape altering even in the natural (undeveloped) environment which can in turn alter the magnitude of the flood flows. Typically, estimates of the PMF would only be applied in very limited circumstances, for example, in the design of spillways for water or tailings dams which fall into a high-risk category.

The situation of the Proposal, being of higher elevation, upstream of a flood plain and outside the floodplains of either creek (WWC and PMC), reduces the overall flood risk significantly. The flood risk associated with the Proposal is very low, no impacts to downstream flows and low risk of creek capture by the remaining HD2 pit void are expected due to surface water management structures. Because of the reasons described above, it is suggested that the following events are appropriate for use in assessing performance of operational flood protection and inform closure planning:

- The 1:100AEP flood can be reliably estimated using the methods adopted and is appropriate for use in floodplain assessments for operational infrastructure.
- The 1:1,000AEP flood is considered a rare event, however it is a realistic event to use when identifying risks associated with greater than design flood events for closure, as it falls within the credible limit of extrapolation, and below the world maximum flood envelope curve (for WWC catchment).
- The 1:10,000AEP flood is considered a very rare event. As an extreme case, the 1:10,000AEP flood event may be considered, as this event is at the upper end of the credible limit of extrapolation and falls just above the envelope curve. However, as the Proposal is located upstream of sensitive receptors and flood management controls are required to manage surface water and maintain long term catchment flows, the 1:10,000AEP is a minimum requirement for assessing the risks associated with the management of surface water.

Using methods outlined in Australian Rainfall and Runoff (ARR, 2019), flood estimation of the upper WWC catchment was undertaken to provide site-wide estimates of design floods for rare to very rare events for the HD2 and BHT deposits at closure (Appendix 12).

A two-dimensional hydraulic model was developed using “TUFLOW” software to characterise the surface water flow regime of WWC and PMC in reference to the surrounding landscape. Modelling results, presented in Figure 26 through to Figure 28 (HD2 deposit) and Figure 29 through to Figure 31 (BHT deposit), show that the deposits are not subject to riverine flooding or within the 1:100AEP or 1:1000AEP flood plain for PMC or WWC. Catchment hydrological modelling (RORB) was combined with the 2D hydraulic modelling (TUFLOW) to characterise the surface water flow regime across tenure at the HD2 and BHT

deposits. Design flood quantiles were developed for the 1:2 AEP through to 1:100 AEP event during operations and then the 1: 100AEP up to the 1:10,000AEP events for the closure landform using a flood frequency analysis (FFA) at DWER Tarina flow gauge and Monte Carlo simulation applied to a RORB model, which was calibrated to streamflow records at the same gauging station. Only the modelling results are presented for the closure landform, are presented in Figure 26 through to Figure 28 (HD2 deposit) and Figure 29 through to Figure 31 (BHT deposit).

Initial modelling for the safe operation of the Proposal (1:2 AEP through to 1:100 AEP completed in 2020) (Rio Tinto 2020) indicated that the attenuation of surface water upstream of the PMC crossing is predicted to result in an increase of flood depths of above 1m immediately upstream in the major events. These flood waters will quickly disperse and are not expected to cause a significant change in the hydrological regime of the creek during operations. The crossing is planned to be removed at closure to allow the natural flow regime to return to PMC. These modelling results also indicated that during operations there would be little or no risk to topsoil stockpile storage locations from significant flooding and little to no risk to pit or landform stability even for the rare event (1:100AEP). This modelling also highlighted PMC catchment flows entering the pit at the HD2 deposit during the rare event (1:100AEP), however because of the diversion levee and drain proposed, the risk is reduced during operations and post-closure.

Modelling of flood risks for the closure landform across both deposits (shown in Figure 26 through to Figure 31), considered rare (1:100AEP) through to very rare (1:10,000AEP) events. This modelling showed that the HD2 diversion levee and drains, designed to direct flows from a tributary creek of PMC to WWC, will overtop in the 1:1000AEP and 1:10,000AEP event scenarios (Figure 26 through to Figure 28). These drainage structures will need to be designed to withstand a minimum 1:1000AEP event at closure, to avoid the loss of flows from the WWC catchment and maintain the integrity of the diversion levee and drains. Further work is required in modelling flows to understand if these flows would negatively affect the WWC downstream and sensitive receptors within the creek line, namely WWS.

Modelling of flood risks for the closure landform also highlighted relatively low flood risks associated with the pit and waste rock landform closure designs at the HD2 and BHT deposits. Ponding against the DP_NW (Goanna) waste landform at HD2 deposit is likely to infiltrate quickly across the toe of the waste landform (Figure 26 through to Figure 28), however some capping of the landform may be required at closure to manage erosion. Ponding is also visible on the top of the BHT waste rock landform, against the BHT pit wall in all three event scenarios (1:100AEP through to 1:10,000AEP). The waste material within this landform is unlikely to be affected by this ponding, as the material is competent or of low erodibility. Landform evolution modelling (LEM) of these landforms is planned for the HD2 and BHT deposits and the results of this modelling will be used to inform rehabilitation and management of surface water at closure.

Understanding water and drainage systems and their significance to the Traditional Owner's is an ongoing focus within Rio Tinto to ensure the successful management of cultural heritage values. Outcomes from this ongoing work may influence future revisions of this MCP. Post-closure management is discussed in Section 5.11.3.

5.11.6 Implications for closure and knowledge gaps

Closure implications associated with surface water include:

- Surface water flows for the Proposal will require post-closure management to ensure closure outcomes minimise impacts and support the closure strategy.
- Flood modelling indicates that some areas of the pits in each deposit will intercept surface flows under flood conditions, as well as landforms impeding flows, referring to operational 1:100 AEP.
- Topsoil stockpile areas are placed outside the 1:100 AEP flood inundation zone.
- Flood management structures will be implemented to enable the HD2 deposit to be mined safely and maintain downstream flows into WWC in the long term.
- Surface water quality for PMC and WWC to inform closure strategy.

Closure knowledge gaps associated with surface water, as summarised in Table 6-1, include:

- Undertake hydrological water quality sampling of PMC and WWC prior to commencing mining of the HD2 and BHT deposits.
- Update surface water modelling for PMC creek diversion in line with changes to landform design and closure strategy for HD2 deposit (1:100AEP, 1:1000AEP and 1:10,000AEP).
- Upgrade of drainage designs for permanent closure drainage structures (PMC) where required, in line with flood risk assessments (1:100AEP, 1:1000AEP and 1:10,000AEP).
- Undertake landform evolution modelling for HD2 and BHT landforms to further inform and verify final landform design and rehabilitation parameters.
- Undertake hydrological modelling (1:100AEP, 1:1000AEP and 1:10,000AEP) of updated landbridge closure strategy and designs.
- Undertake hydrological modelling of abandonment bund alignment and final closure landform for HD2 and BHT deposits (1:100AEP, 1:1000AEP and 1:10,000AEP).
- Determine required engineering flood mitigation structures for HD2 and BHT deposit’s closure landforms.
- Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits.
- Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, soils, contaminated sites, hydrogeological, hydrological, conservation, flora and vegetation, fauna knowledge and assessments.

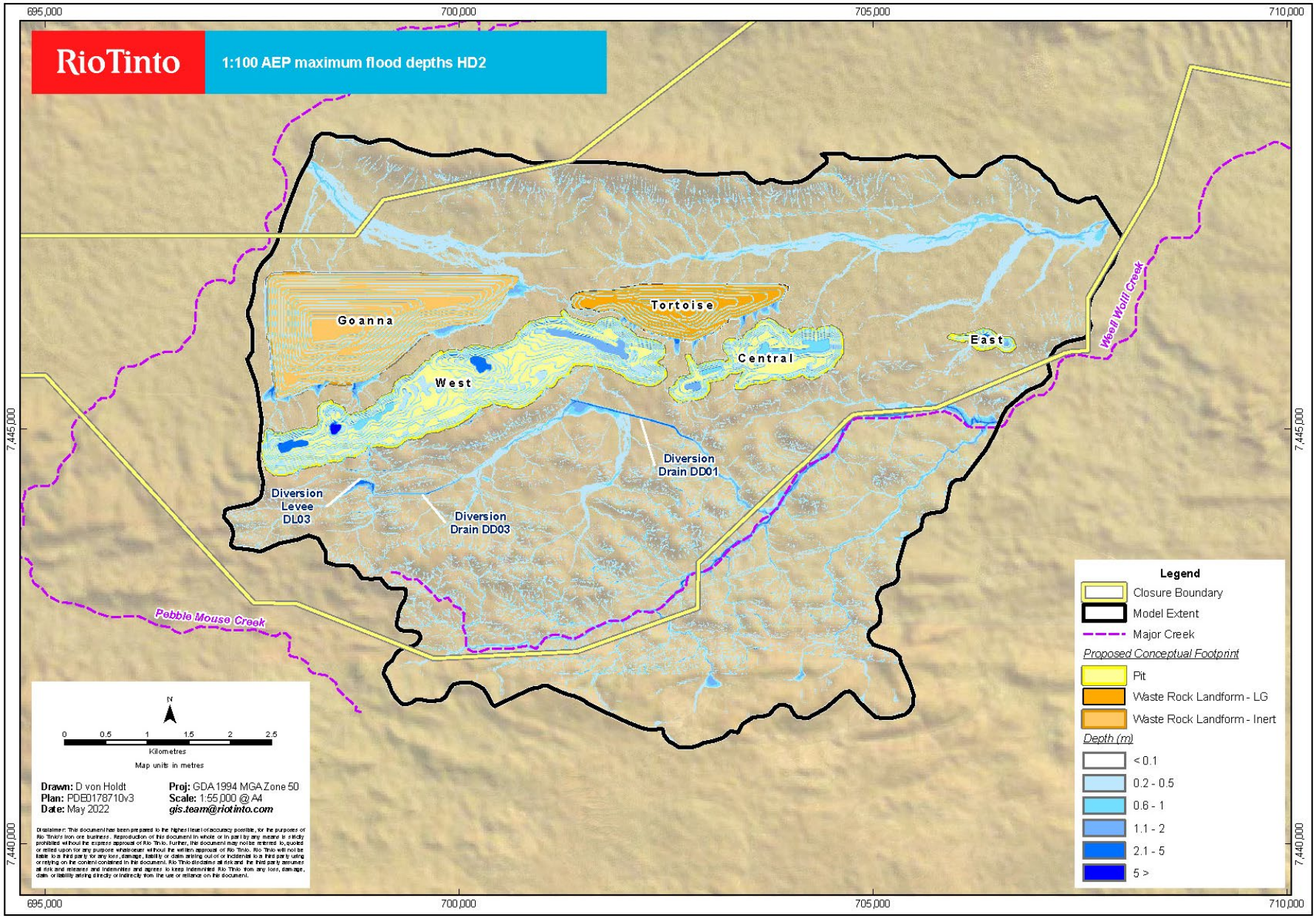


Figure 26: 1:100 AEP maximum flood depths HD2

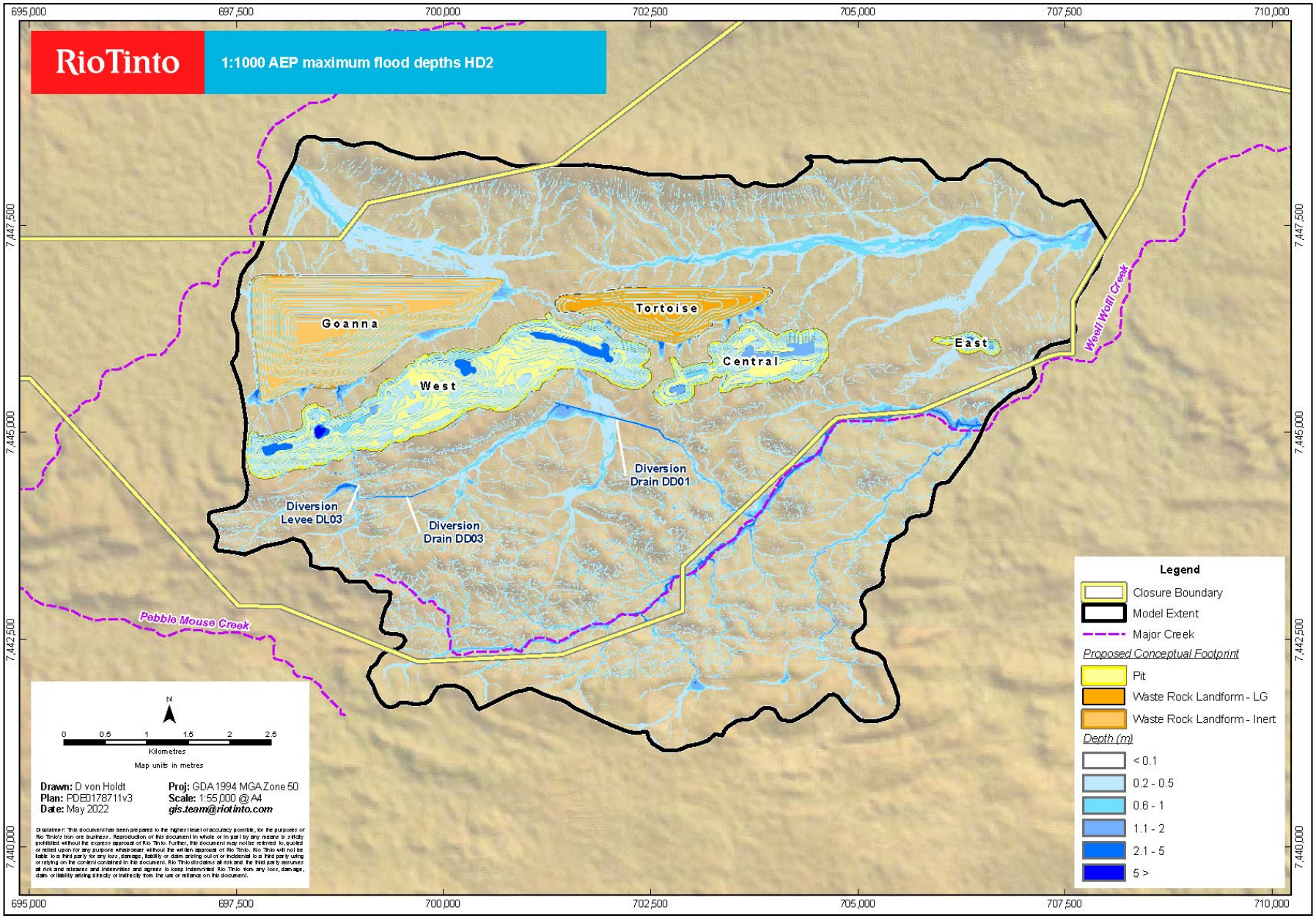


Figure 27: 1:1000 AEP maximum flood extents HD2

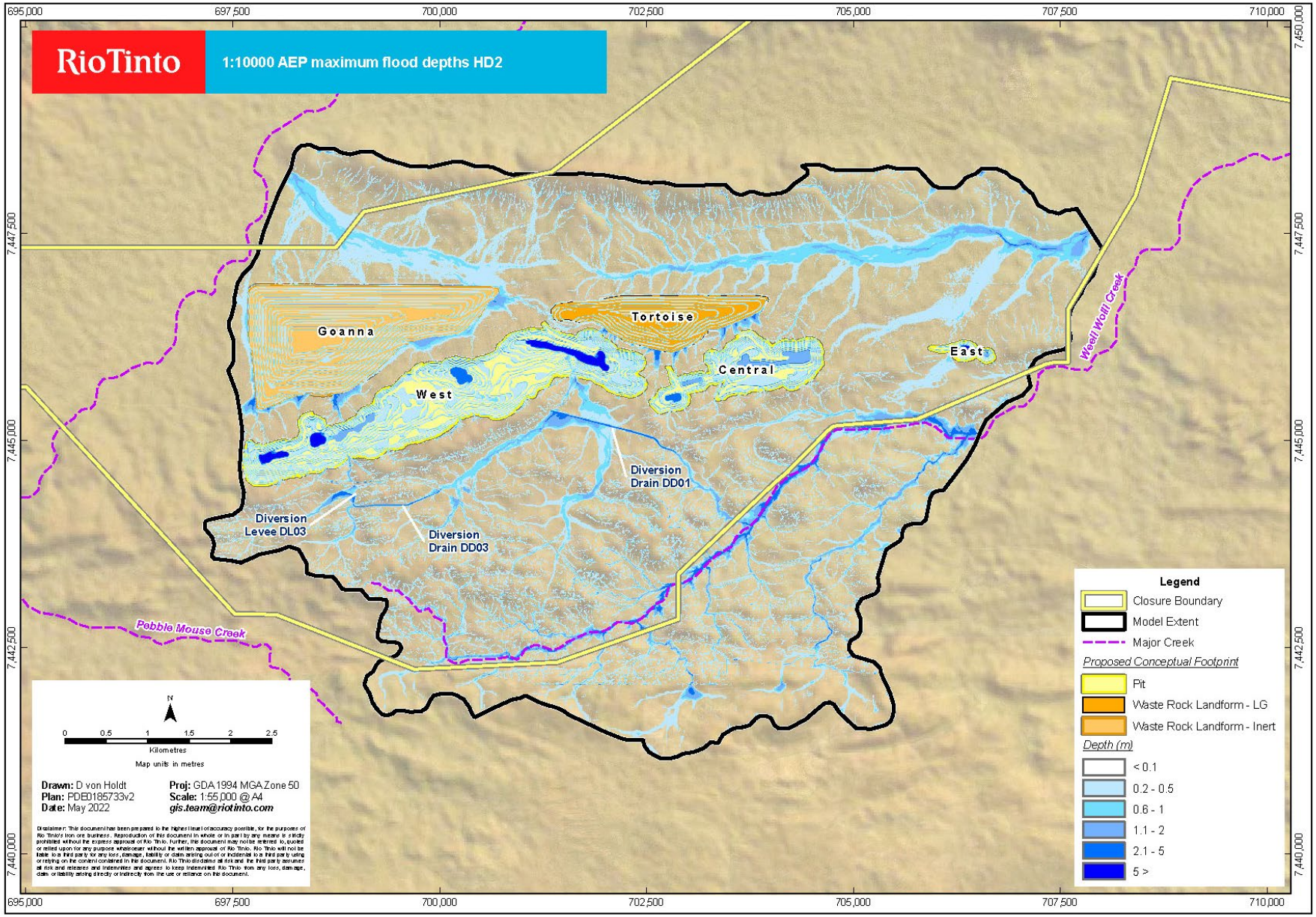


Figure 28: 1:10,000 AEP maximum flood depths HD2

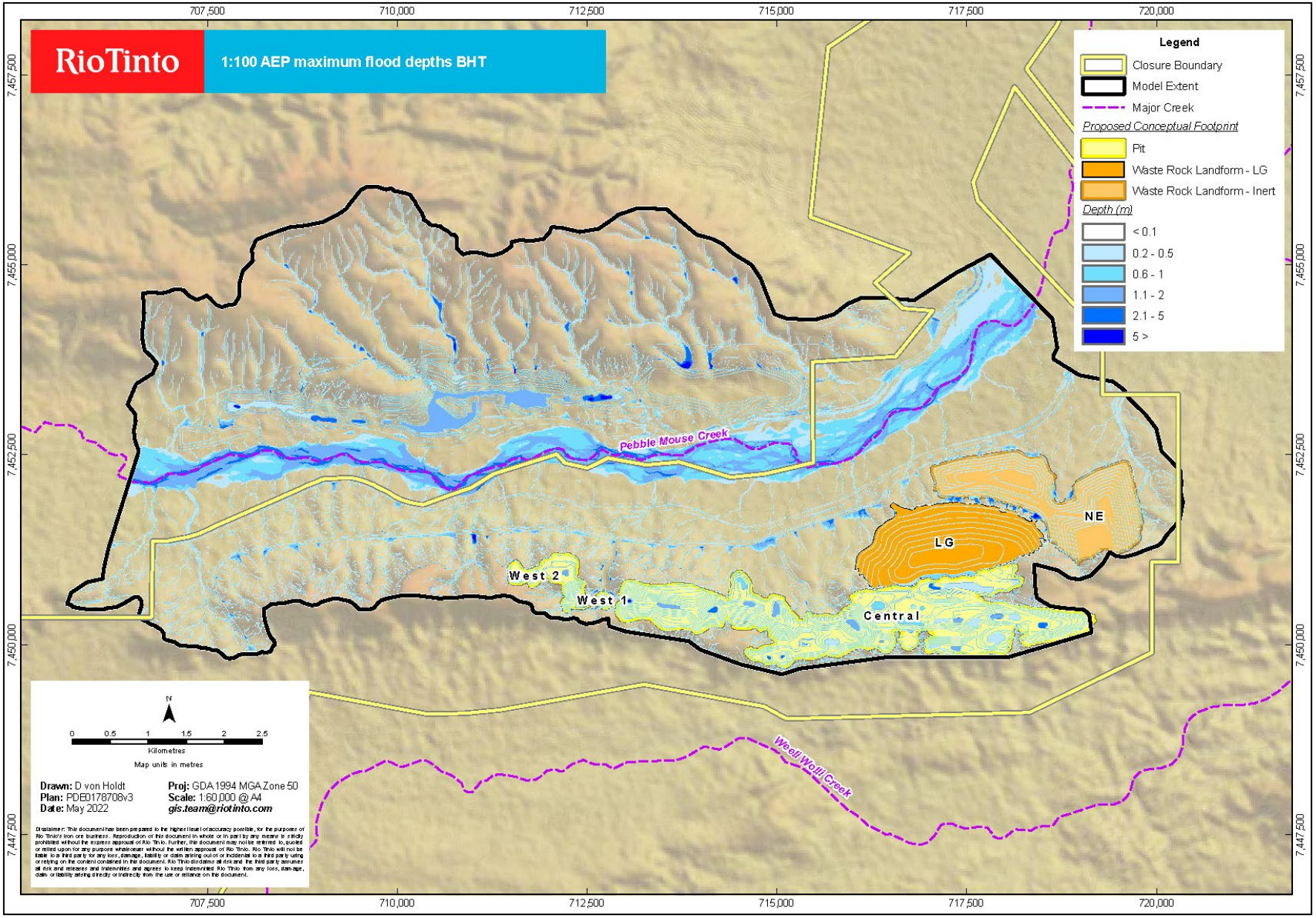


Figure 29: 1:100 AEP maximum flood depths BHT

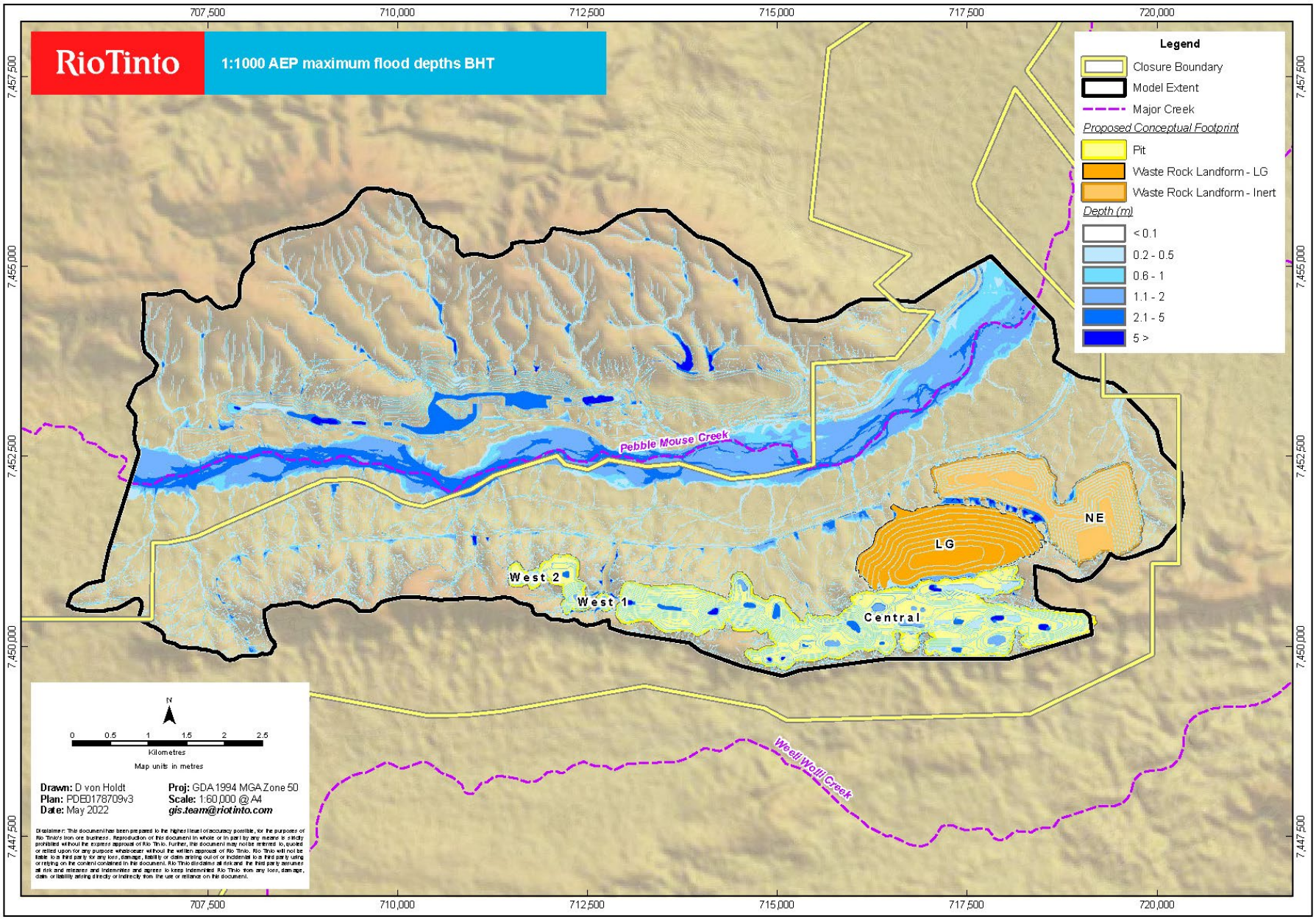


Figure 30: 1:1000 AEP maximum flood depths BHT

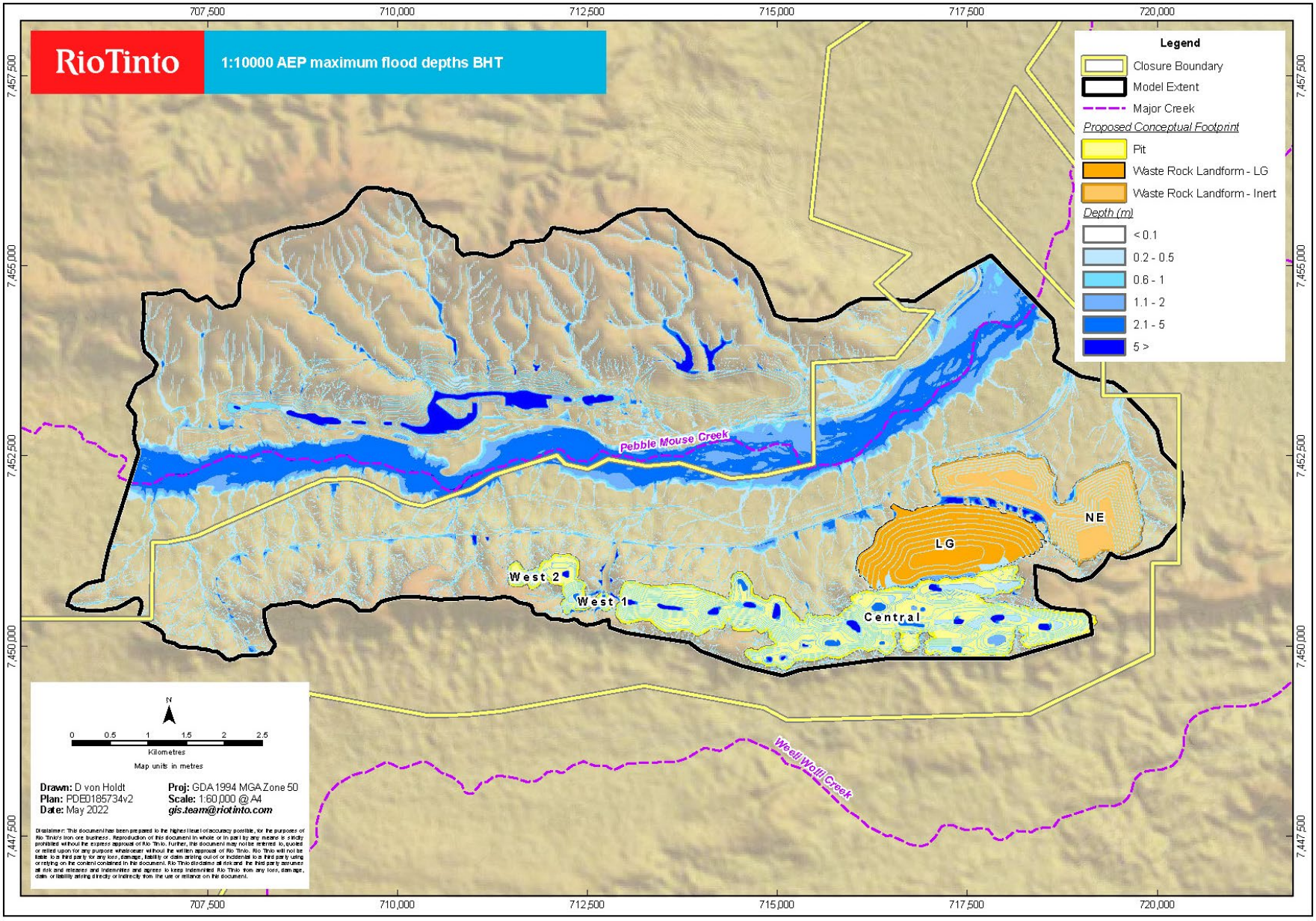


Figure 31: 1:10,000 AEP maximum flood depths BHT

BIOLOGICAL ENVIRONMENT

5.12 Conservation significant areas

5.12.1 National Parks

The nearest major conservation reserves to the Proposal closure boundary include:

- Karijini National Park (KNP), the eastern portion of which is approximately 25 km northwest of the Proposal closure boundary, while portions of the Western Rail Corridor are located adjacent to the KNP.
- Proposed Fortescue Marsh National Park, approximately 64 km north of the Proposal closure boundary.
- Mungaroona Range Nature Reserve, approximately 72 km to the north-west of the Proposal closure boundary.
- Millstream-Chichester National Park, approximately 156 km to the north-west of the Proposal closure boundary.

5.12.2 Threatened and Priority Ecological Communities

There are no Threatened or Priority Ecological Communities (TEC / PECs) located within the Proposal closure boundary, although the following PEC is in proximity.

- WWS Community (P1) the buffer is located approximately 9.7 km northeast of BHT deposit and approximately 23.7 km of HD2 deposit.

The Proposal is not expected to impact the conservation status of any flora or fauna species, populations, or fauna habitat. This includes changes to abundance, species diversity, geographic distribution and / or productivity of flora at species or ecosystem levels.

5.12.3 Implications for closure and knowledge gaps

Closure implications associated with conservation significant areas include:

- Exclusion zones around conservation significant areas will be maintained through the decommissioning and closure implementation phases.
- Conservation significant areas are key values in the landscape and factor into closure planning related to post-closure land use, access to the landscape and closure outcomes.

Closure knowledge gaps associated with flora and vegetation, as summarised in Table 6-1, include:

- Conservation significant areas will be considered in closure planning with reference to post-closure land use, access to the landscape and closure outcomes.
- Conservation significant areas will be considered in closure planning with reference to post-closure land use, access to the landscape and closure outcomes.
- Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits.
- Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, soils, contaminated sites, hydrogeological, hydrological, conservation, flora and vegetation, fauna knowledge and assessments.

5.13 Flora and vegetation

Astron (2019a) completed a detailed flora and vegetation survey including three phases of survey from 2017 to 2019. Flora survey coverage is shown in Figure 32.

5.13.1 Priority flora

A total of 411 native flora taxa from 161 genera, belonging to 52 families have been recorded within the Proposal closure boundary with *Acacia* (37 taxa) the dominant genus with others *Eremophila* (16 taxa) and *Senna* (16 taxa) (Astron, 2019).

Table 5-13 lists the Threatened and Priority flora that have been identified at the Proposal and which have high biodiversity value based on their conservation status. No Threatened flora species listed under the Commonwealth EPBC Act, or the State BC Act have been recorded within the Proposal closure boundary. The species distribution is presented in Figure 32 through to Figure 35.

While mining activities may directly impact individuals of these species, it is not expected they will affect any given species, considering the regional distribution. Seeding of Priority species is not currently considered in rehabilitation planning, as discussed further within this MCP.

Table 5-13: Significant flora identified at the Proposal

Flora taxon	Conservation status WA	Habitat comments
Eremophila sp. West Angelas (S. van Leeuwen 4068)	P2	Very steep hillslopes, base of breakaways. High in the landscape
Aristida lazaridis	P2	Plains, drainage lines, associated flood out areas.
Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708)	P2	Near summit of hills, high in landscape, gorges. gullies
Acacia subtiliformis	P3	On rocky calcrete plateaux, rocky slopes.
Eremophila naaykensii	P3	High in the landscape, cliff tops, gorge tops, steep rocky slopes.
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727)	P3	Calcrete flats and rises
Grevillea saxicola	P3	Low rocky hills and associated slopes, foot slopes and drainage features.
Rhagodia sp. Hamersley (M. Trudgen 17794)	P3	Mulga plains, south facing slopes of ironstone hills.
Triodia sp. Mt Ella (M.E. Trudgen 12739)	P3	Amongst rocks and outcrops, east and southeast facing gorge slopes, south facing breakaways.
Acacia bromilowiana	P4	Rocky hills, breakaways, scree slopes, gorges, creek beds.
Lepidium catapycnon	P4	Hill top, slopes and drainage features.
Ptilotus mollis	P4	Stony hills and screes, hillslopes below small breakaways.

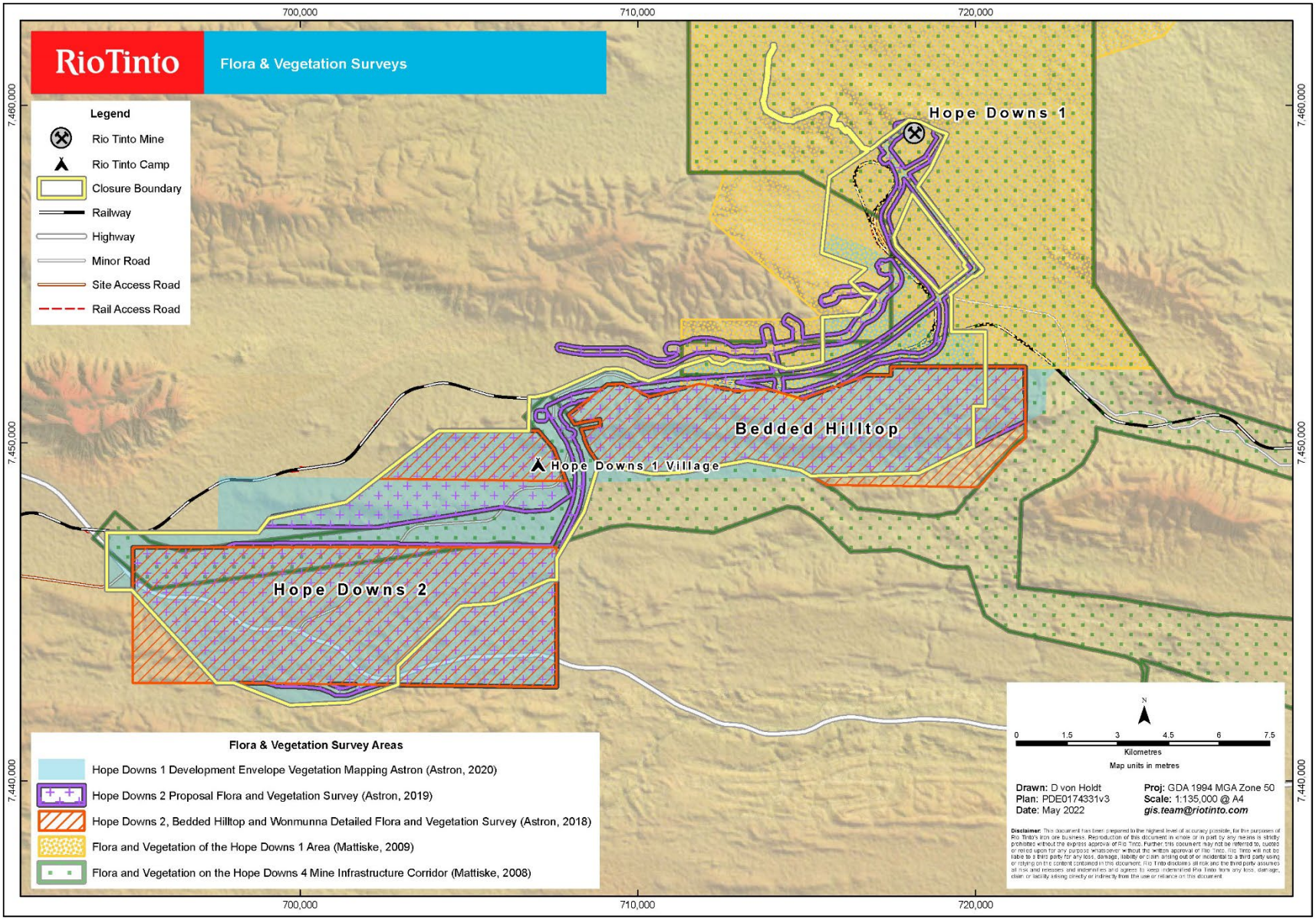


Figure 32: Flora and vegetation surveys

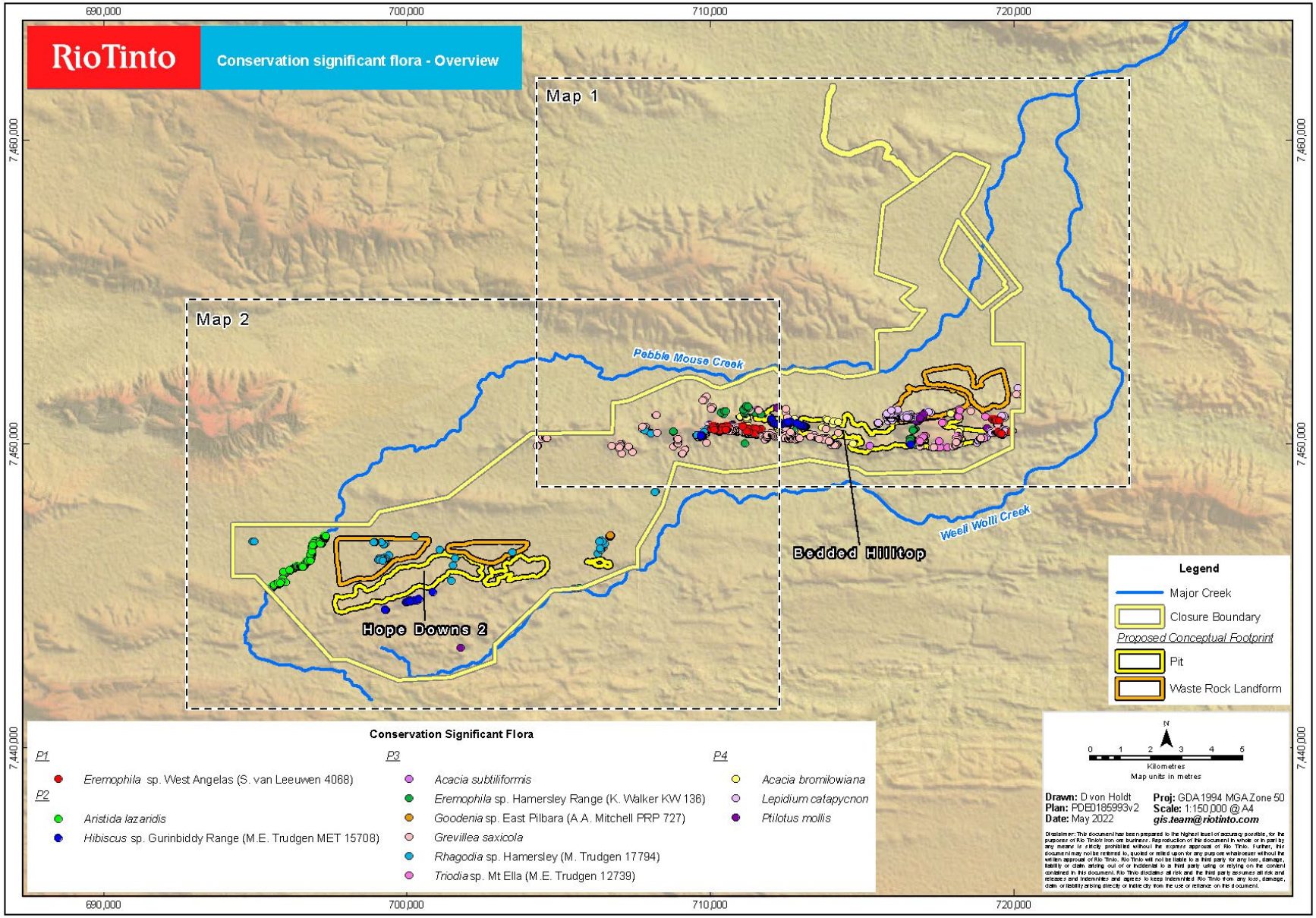


Figure 33: Significant flora records - Overview

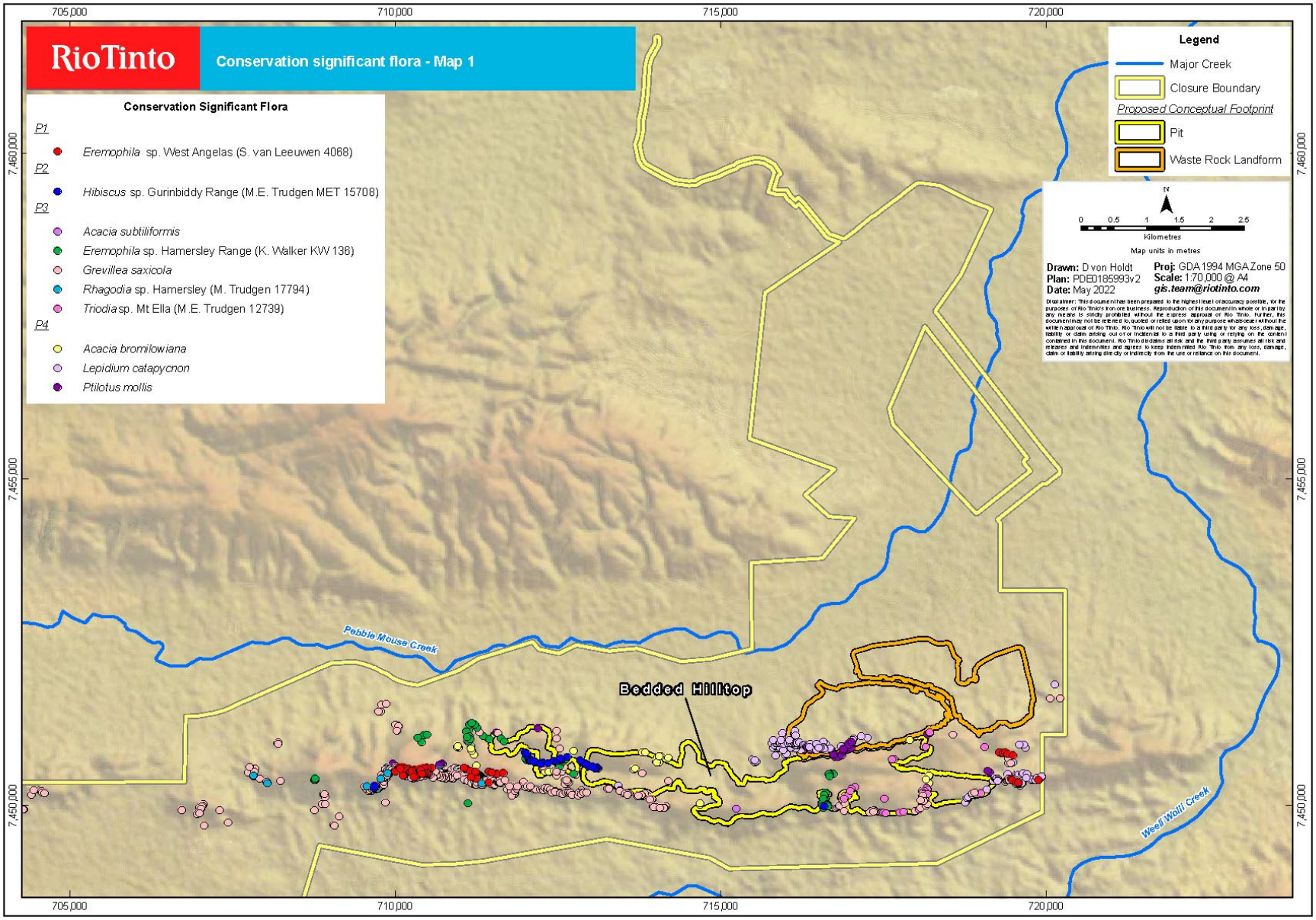


Figure 34: Significant flora (map 1)

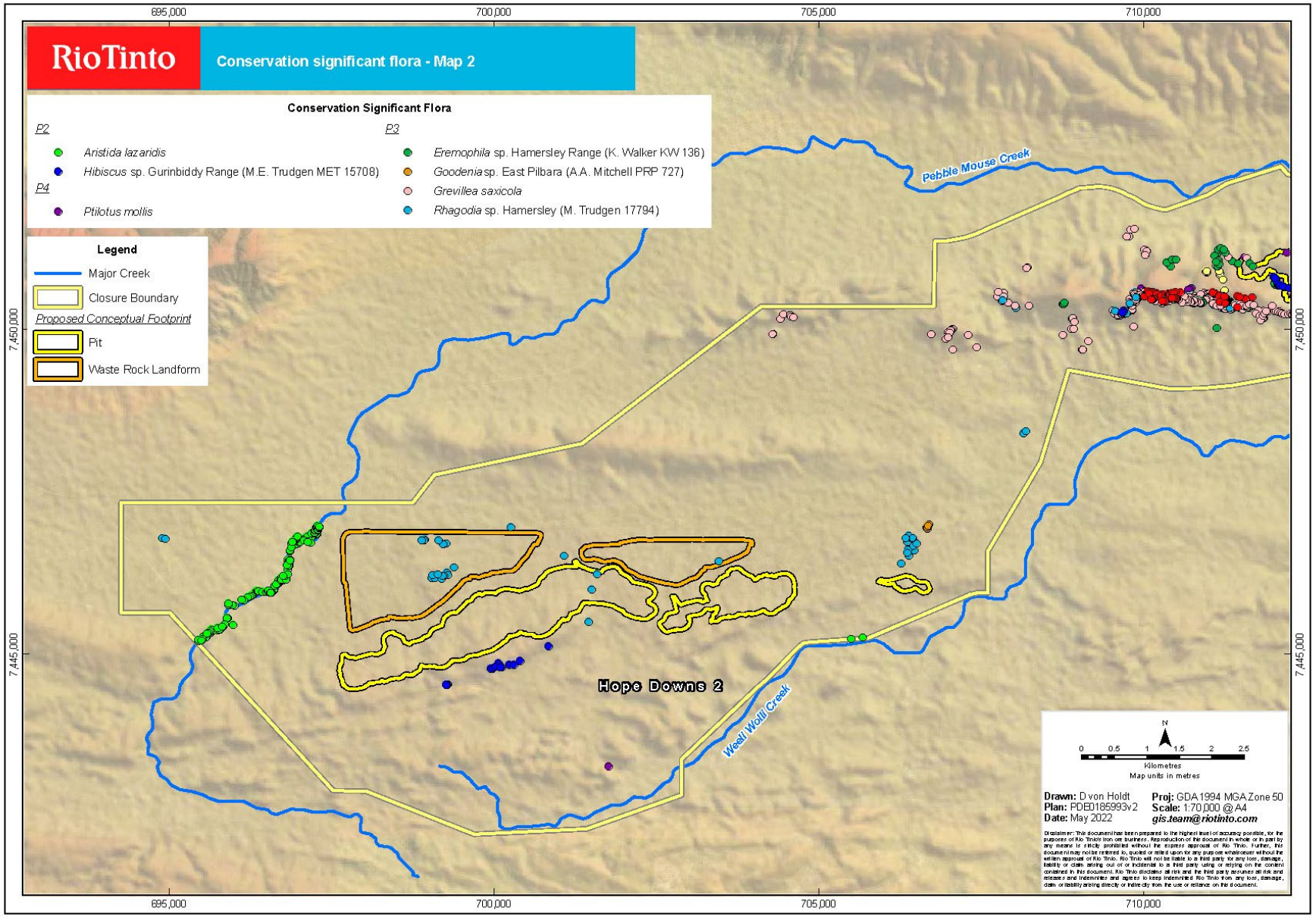


Figure 35: Significant flora (map 2)

5.13.2 Vegetation communities

Two vegetation units, H2 (associated with hill tops and hill slopes) and D4 (associated with drainage line habitat), within the Proposal were rated as of high local significance (Astron 2019).

- H2 (Hills and Slopes #2) occurs on the south-facing upper slopes of BHT and supports Priority flora in relatively dense populations, in particular P2 *Eremophila* sp. West Angelas (S. van Leeuwen 4068) and P3 *Eremophila naaykensii* (Astron, 2019a). The vegetation was found to be in Very Good to Excellent condition and largely unaffected by recent fires, indicating the unit may act as refuge habitat for conservation significant flora, as such it may also be threatened by fire, which kills mulga stands and/or prevents regeneration. The unit also has an affinity with the ecosystem at risk 'lower-slope mulga', further supporting its high local conservation significance rating (Astron, 2019).
- D4 (Drainage #4) occurs on larger drainage lines, including at Pebble Mouse Creek and supports the facultative phreatophyte species *Eucalyptus camaldulensis* subsp. *obtusa* and *E. victrix*. The vegetation was assessed as Good to Very Good condition and in some of the upper reaches of Weeli Wolli and Pebble Mouse Creeks, supports an additional conservation significant flora taxa, P2 *Aristida lazaridis* (Astron, 2019a). Riparian vegetation equivalent to the D4 unit is generally well represented within the locality, and the Hamersley sub-region. The high local significance is predominantly attributed due to this unit representing the larger drainage habitats of the Proposal as well as the key habitats potentially supporting potential GDEs. Furthermore, a significant portion of the significance rating attributed to this unit by Astron (2019a) is afforded due to it supporting the P2 species *Aristida lazaridis* in some areas. *A. lazaridis* is only detected in association.

Nine vegetation units, D7, D8, P1, P2, P3, P4, H1, H6 and H7 (associated with drainage line, plains, and hills and slopes habitat), were considered to be of moderate local significance (Astron, 2019). The justification for this classification is as follows:

- D7 (Drainage #7) supports populations of *Aristida lazaridis* (P2).
- D8 (Drainage #8) is likely to represent the regional 'Valley Floor mulga' which is considered to be an EAR, and also supports a small population of *Rhagodia* sp. Hamersley (M. Trudgen 17794).
- P1 (Plains #1) is likely to represent the 'grove/inter-grove mulga, Eastern Hamersley Range', which is considered an EAR.
- P2 (Plains #2) occurs on cracking clays and alluvial plains and supports several populations of *Aristida lazaridis* (P2).
- P3 (Plains #3) supports populations of *Aristida lazaridis* (P2) and is likely to represent the regional 'Valley Floor mulga' vegetation community which is considered to be an EAR.
- P4 (Plains #4) likely to represent with the regional 'Valley Floor mulga' which is considered to be an EAR.
- H1 (Hills and Slopes #1) supports the presence of numerous Priority flora taxa, including *Eremophila naaykensii, Grevillea saxicola* and *Triodia* sp. Mt Ella (M.E. Trudgen 12739)
- H6 (Hills and Slopes #6) is likely to represent the 'Lower-Slope Mulga', which is an EAR in the Hamersley subregion due to frequent fires.
- H7 (Hills and Slopes #7) supports high number of *Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708) (P2) being recorded within the vegetation type.

5.13.3 Invasive flora

Flora and vegetation surveys within the Proposal closure boundary have recorded a total of 17 introduced flora species (weeds) pre-disturbance (Table 5-14). The most frequently recorded weed species throughout the Proposal was *Bidens bipinnata* (Bipinnate beggartick), associated with creeks, Mulga-dominated vegetation and hillslopes. None of these species are listed as Weeds of National Significance or declared plants for the Pilbara region under the *Biosecurity and Agriculture Management Act 2007* (WA).

The DBCA Weed Species Ranking considers the potential distribution, current distribution, ecological impact, invasiveness and feasibility of control to derive a final broad qualitative weed species ranking corresponding to specific management actions.

Weeds are managed during operations in accordance with internal procedures and guidelines and includes strategies such as periodic spraying and equipment hygiene.

Table 5-14: Weed species recorded at the Proposal

Scientific name	Common name	Ecological impact	Invasiveness
Bidens bipinnata	Bipinnate Beggartick	Unknown	Rapid
Brassica tournefortii	Mediterranean Turnip	High	Rapid
Cenchrus ciliaris	Buffel Grass	High	Rapid
Cenchrus setiger	Birdwood Grass	High	Rapid
Chloris virgata	Feathertop Rhodes Grass	high	Rapid
Conyza bonariensis	Flax leaf Fleabane	No rating	No rating
Cynodon dactylon	Couch	High	Rapid
Datura leichhardtii subsp. leichhardtii	Native Thornapple	Unknown	Unknown
Flaveria trinervia	Speedy Weed	No rating	No rating
Lactuca serriola	Prickly Lettuce	No rating	No rating
Malvastrum americanum	Spiked Malvastrum	High	Rapid
Rumex vesicarius	Ruby Dock	No rating	No rating
Setaria verticillata	Whorled Pigeon Grass	High	Rapid
Sigesbeckia orientalis	Indian Weed	Unknown	Rapid
Solanum nigrum	Black Berry Nightshade	Low	Rapid
Sonchus oleraceus	Common Sow thistle	Low	Rapid
Vachellia farnesiana	Mimosa Bush	High	Rapid

5.13.4 Implications for closure and knowledge gaps

Closure implications associated with flora and vegetation include:

- Exclusion zones around conservation significant flora species will be maintained through the decommissioning and closure implementation phases.
- The selection of reference / analogue sites and the development of revegetation completion criteria (species richness, percentage cover and percentage weed cover) to assess the performance of progressive rehabilitation.
- Optimal seed selection of rehabilitation seed mix is crucial to progressive rehabilitation and successful achievement of rehabilitation completion criteria targets.
- Undertaking rehabilitation of waste rock landforms and disturbed areas progressively, reduces the monitoring and maintenance post-closure and overall closure implementation timeframes and costs.

Closure knowledge gaps associated with flora and vegetation, as summarised in Table 6-1, include:

- Seed mixes have not been developed for the Proposal, to facilitate progressive rehabilitation. Considering the short mine life for the Proposal, flora species recorded in baseline surveys will be

used to inform rehabilitation seed mix(es). Seed mixes will be developed in consultation with stakeholders.

- The selection of reference / analogue sites and the development of revegetation completion criteria (species richness, percentage cover and percentage weed cover) have not yet been undertaken. Vegetation mapping completed for the Proposal will be used to inform the selection of reference / analogue sites and inform the development of revegetation completion criteria (species richness, percentage cover and percentage weed cover) and monitor against progressive rehabilitation
- Select reference / analogue sites for HD2 and BHT deposits to inform revegetation criteria and progressive rehabilitation.
- Implement progressive closure and rehabilitation of waste rock landforms and disturbed areas as soon as possible to reduce closure liabilities.
- Develop seed mix(es) in line with progressive rehabilitation targets and consultation with stakeholders.
- Conduct closure research and rehabilitation trials to demonstrate methodologies.
- Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits.
- Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, soils, contaminated sites, hydrogeological, hydrological, conservation, flora and vegetation, fauna knowledge and assessments.

5.14 Fauna

A series of fauna surveys were conducted within the Proposal closure boundary to inform the Part IV environmental impact assessment process, the results of which have been consolidated into an integrated report (Astron, 2019). Fauna survey coverage is presented in Figure 36.

5.14.1 Terrestrial fauna habitat

There are eight broad fauna habitat types identified within the Proposal area prior to mining, shown in Figure 37. These habitats include Gorge and Gully, Breakaway, Minor Drainage, Rocky Hill, Low Hills and Slopes, Alluvial Plain, Mulga Woodland and Stony Plain. These habitat types are expected to be represented in undisturbed areas after closure. Characteristics of these habitat types are provided in Table 5-15.

Table 5-15: Description of pre-mining habitats identified at the Proposal

Landform	Basic description
Gorge and Gullies	Represented by deep often rocky gorges, sometimes with ephemeral or semi-permanent pools, after significant rainfall events, particularly in the BHT area. These habitats are high value providing significant shelter sites and supports a diversity of fauna species. Microhabitats include overhangs, crevices, caves, tree hollows, ephemeral, semi-permanent water. Vegetation is dominated by scattered low Mallee over tall open scrub, scattered shrubs and scattered *Triodia* hummock grasses.
Breakaway	Features breakaways or ridge lines, falling away to steep scree slope or drainage. This landscape is of high value to a low diversity of fauna species that are likely to reside in Breakaway habitats. Microhabitats include caves (roost/feed caves), cracks and crevices and sheltered leaf litter. Vegetation is typically *Eucalyptus* and *Corymbia* low open woodland over tall open shrubland and very open *Triodia* hummock grassland to open *Triodia* tussock grassland.

Landform	Basic description
Minor Drainage	Moderate value habitat characterised by open drainage areas on stony soils, with water bodies only present during times of heavy inundation. The landform supports a moderate diversity of microhabitats, with some tree hollows and woody debris, thick ground cover/vegetation and deep leaf litter. The vegetation commonly associated with this habitat is *Eucalyptus* low woodland, with scattered low trees and tall open shrubland and open tussock grassland.
Rocky Hill	Represented by stony hills on high ranges with dissected valleys and gorges. Rocky Hill habitat is of moderate value to a low diversity of fauna species that are rocky habitat specialists. Microhabitats include shallow overhangs, boulders and crevices. Vegetation is dominated by *Eucalyptus* low open woodland and low open shrubland over open *Triodia* hummock grassland.
Low Hill and Slopes	Extends over low stony hills and slopes with dissected valleys and drainage on stony soils. These habitats are of low value for a wide spectrum of fauna species. Microhabitats include termite mounds, *Triodia* hummocks, minimal leaf litter Vegetation typically consists of low open *Eucalyptus* woodland and tall shrubs over *Triodia* hummock grassland.
Alluvial Plain	Flood plain surrounding drainage areas. This habitat is of low value to a wide spectrum of fauna species. Microhabitats include dense leaf litter, termite mounds and spinifex clumps, cracking clays. Vegetation association of alluvial plains is composed of tall open *Acacia* and *Eremophila* shrubland over low open shrubland and tussock grassland.
Mulga Woodland	Represented by stands of Mulga groves on clay based stony plains. This habitat is of low value to a wide spectrum of fauna species. Microhabitats include termite mounds and minimal leaf litter. Vegetation consists of tall *Acacia* shrubland over scattered tall shrubs, open shrubland and very open *Triodia* hummock grassland.
Stony Plain	Spans broad flat low-lying plains to undulating plain on soft loamy soils. This habitat is of low value to a wide spectrum of fauna species. Microhabitats include limited leaf litter, termite mounds and spinifex clumps. The dominant vegetation is low open *Eucalyptus* woodland over scattered tall *Acacia* shrubs and *Triodia* hummock grassland.

The Gorge/Gully and Breakaway habitats are of high value as they contain microhabitats such as caves, cracks and crevices which provide refuge and foraging opportunities. These habitat types are the most restricted of the habitat types present; however, they are not considered unique to the Proposal and are typical of the Hamersley sub-region of the Pilbara. Most of the other habitat types (excluding Mulga Woodland) are relatively common and widespread throughout the Pilbara.

Areas of cleared habitat are prevalent throughout the Proposal closure boundary because of drilling programs. Fauna habitats adjacent to these disturbed areas show evidence of edge effects including lack of connectivity, grazing and dust deposition. Elsewhere, fauna habitat condition is affected to some extent by grazing and trampling by cattle and feral camels in localised areas such as drainage lines and associated plains but is otherwise generally considered to be in Good to Excellent condition.

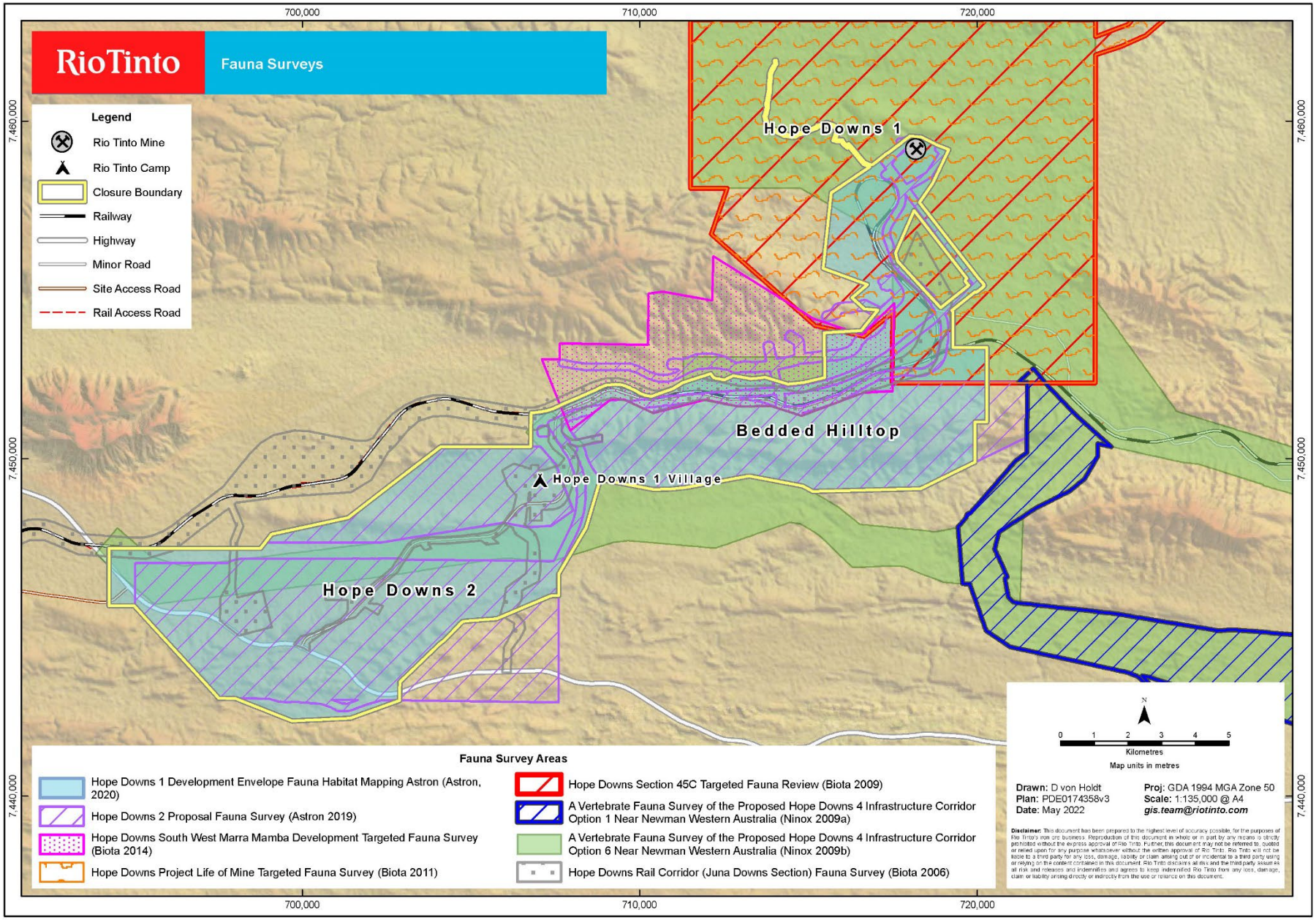


Figure 36: Fauna survey areas

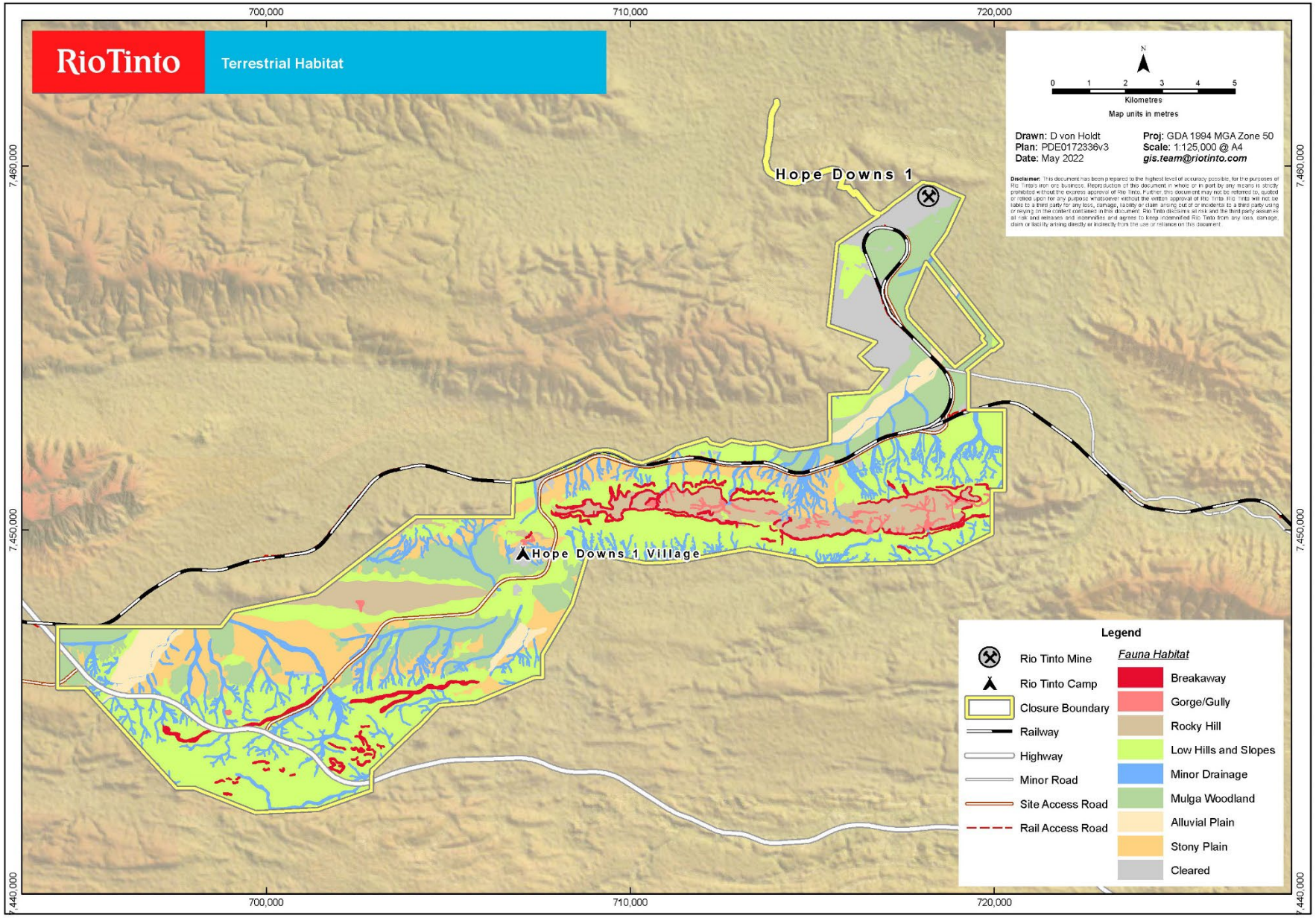


Figure 37: Terrestrial fauna habitats

5.14.2 Fauna reintroduction

The re-introduction or translocation of fauna into rehabilitated areas is not proposed as part of this MCP.

Instead, natural migration of fauna species into rehabilitated land is encouraged by creating habitats with similar composition to pre-mining communities in appropriate locations and with consideration of the post-closure soil and landforms design. Habitat elements that are considered as part of the closure landform design includes:

- vegetation known to provide preferred food or shelter preference;
- retaining and replacing woody debris;
- rapid generation and retention of leaf litter using small-scale topography (e.g., furrows created from ripping);
- introducing or leaving rocky features such as oversized waste burden or scree slopes;
- creating greater depths of friable soil (or suitable mineral wastes) for burrowing fauna;
- preserving connectivity with unmined areas, and maintaining the quality of these habitats; and
- managing feral predators and herbivores across both reference and rehabilitated areas.

Species associated with plains, drainage line or disturbed habitats have the potential to benefit from the rehabilitation of mine, due to returned or expanded habitat post-closure.

5.14.3 Significant fauna

Seven species of significance have been recorded within the Proposal closure boundary (Table 5-16). Fauna habitat and conservation significant fauna records are presented in Figure 37 through to Figure 39. A Mining Exclusion Zone (MEZ) has been added at BHT deposit to protect 233 ha of significant fauna habitat and 8.3 ha around a cave utilised by Ghost Bats. All efforts will be made leading up to and during closure to protect and maintain areas of significance in line with regulatory guidelines.

Table 5-16: Significant fauna and its relationship to habitat across the Proposal

Fauna species	Scientific Name	Conservation status WA	EPBC Act status	Habitat occurrence
Northern Quoll	*Dasyurus hallucatus*	Endangered	Endangered	Recorded within closure boundary. Most records (ten) were recorded at the BHT deposit, with four in the HD2 deposit. The records were generally within Gorge/Gully and Breakaway habitat types.
Pilbara Leaf-nosed Bat	*Rhinonicteris aurantia*	Vulnerable	Vulnerable	Recorded at low activity levels at three out of the 23 bat detector locations. All calls were recorded from foraging individuals in Gorge/Gully and Breakaway habitats at least three hours after dusk. These records are not consistent with the presence of a permanent roost cave nearby.
Ghost Bat	*Macroderma gigas*	Vulnerable	Vulnerable	Evidence of Ghost Bat activity within the closure boundary has been recorded on multiple occasions over three survey phases, through acoustic recordings, scat recordings in nocturnal feed caves and an individual Ghost Bat sighted during spotlighting within the closure boundary. Four of these records occurred within the BHT deposit, four within the HD2 deposit and one record from the Wonmunna area, situated between the two deposits. Ten caves (including one potential maternity roost, two potential diurnal roosts and two confirmed nocturnal feeding roosts) were recorded within the closure boundary. All recorded roosts are located within the Gorge/Gully and Breakaway habitat types.
Oriental Plover	*Charadrius veredus*	Migratory	Migratory	Not recorded. However, a single individual Oriental Plover was opportunistically recorded northeast of the HD2 deposit at the HD1 camp soccer pitch. Given the species is a non-breeding visitor to Australia, no habitats present in the closure boundary support breeding of this species. Habitat types within the closure boundary likely represent suitable foraging habitat for the species, particularly when water is available after significant rainfall.
Unpatterned Robust Lerista (Robertson Range)	*Lerista macropisthopus remota*	Priority 2	-	One individual of the species has been recorded within the closure boundary. The individual was found within a Mulga Woodland habitat, with the species expected to also occur within the Alluvial Plain and Minor Drainage fauna habitats.
Letter-winged Kite	*Elanus scriptus*	Priority 4	-	One individual was recorded within the closure boundary which represents a new record for the local area, with the nearest record to Proposal being approximately 120 km north. This record is expected to reflect the species habits of translocating across landscapes in response to increased foraging resources.
Western Pebble-mound Mouse	*Pseudomys chapmani*	Priority 4	-	Three individuals were recorded within the closure boundary. Five pebble mounds were recorded within the Stony Plain, Rocky Hill and Mulga Woodland habitats.

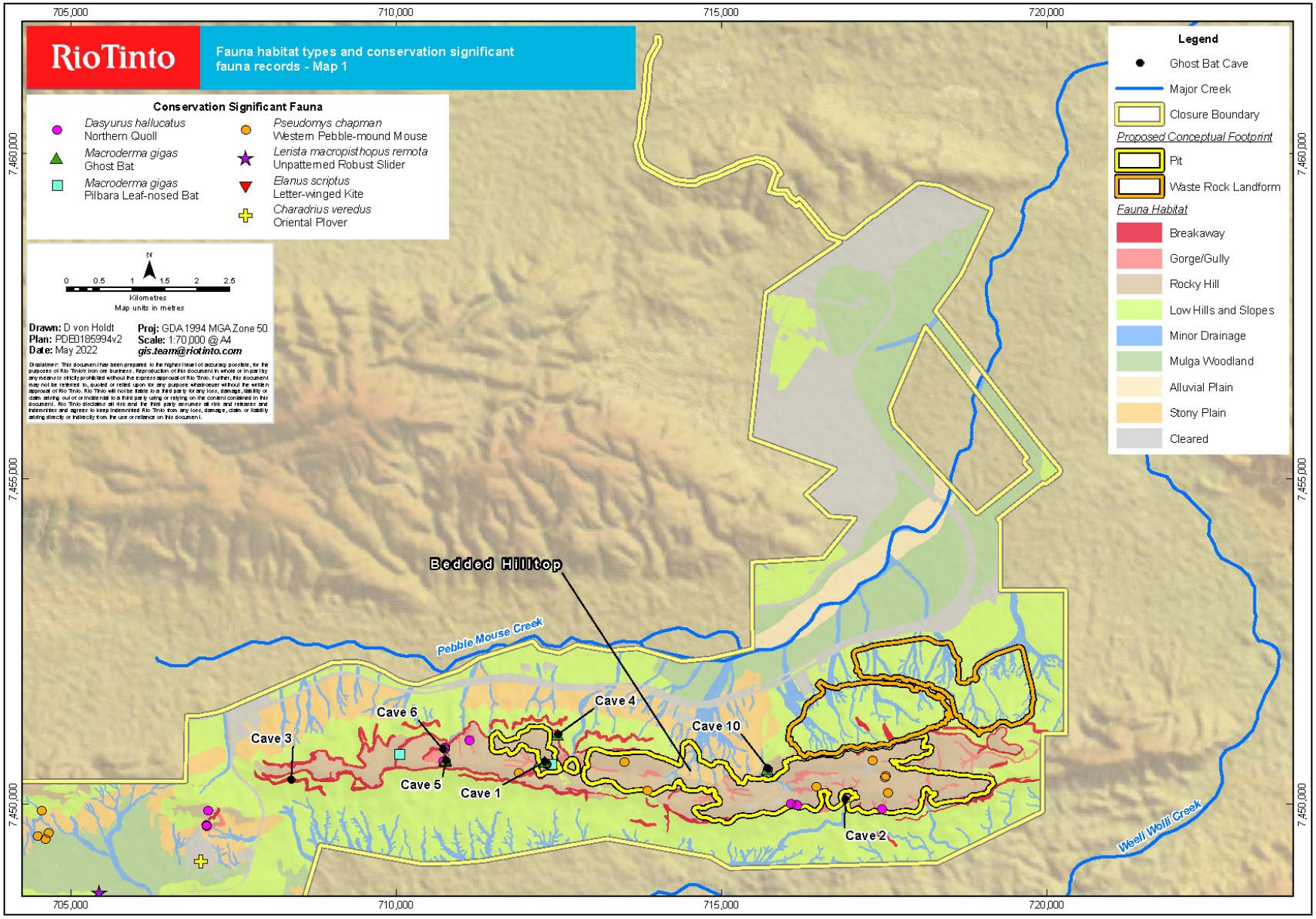


Figure 38: Fauna habitat types and significant fauna records (map 1)

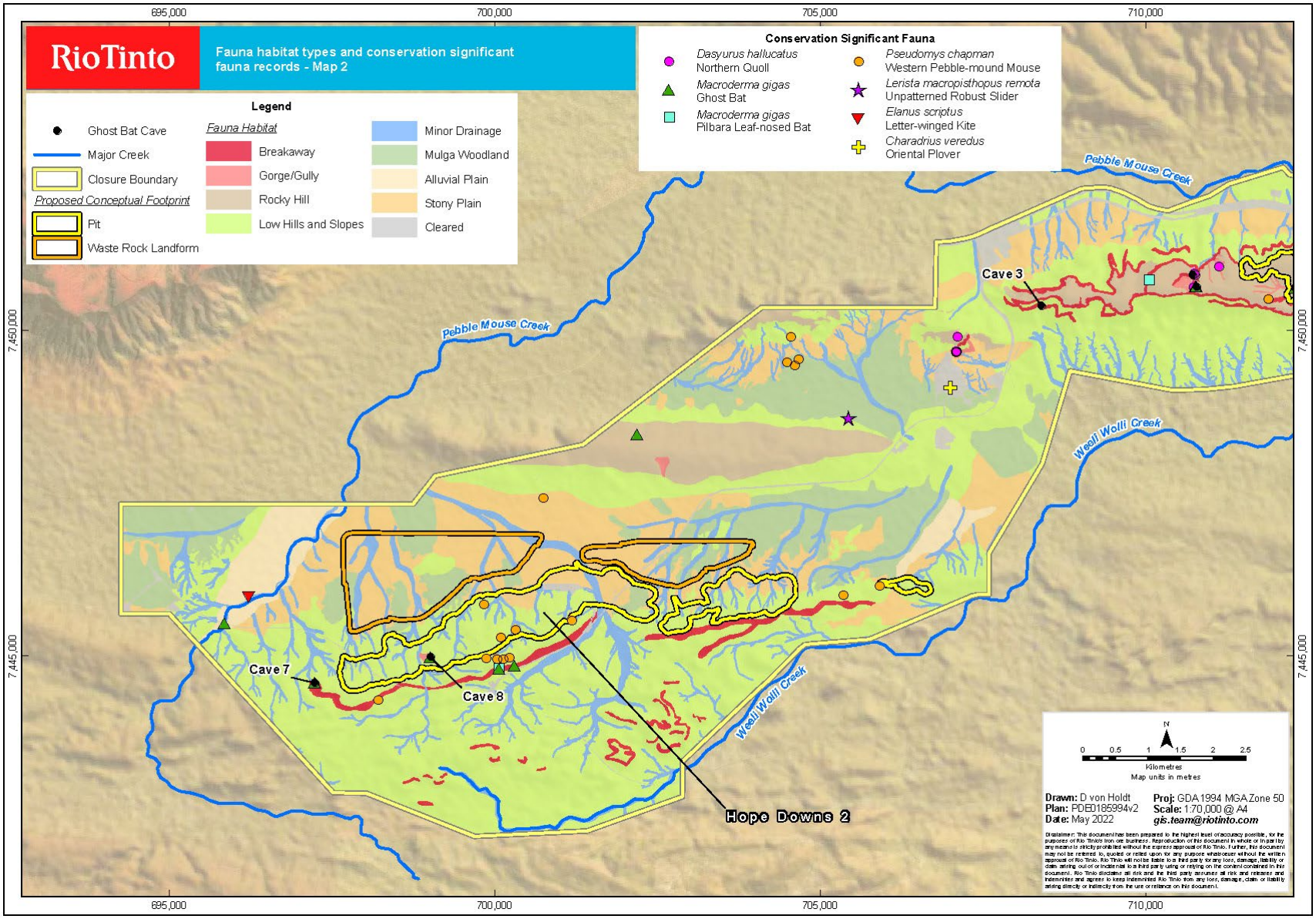


Figure 39: Fauna habitat types and conservation significant fauna records (map 2)

5.14.4 Short range endemic fauna

Short Range Endemic (SRE) fauna, which includes species of insects, arachnids, myriapods and crustaceans, have highly restricted distributions (less than 10,000 km^2) because of poor dispersal, slow growth, low fecundity or specific habitat preferences, confinement to discontinuous habitats, and highly seasonal activity patterns. The following broad fauna habitat types identified within the Proposal area have been identified as being favourable for SREs:

- Breakaway - High;
- Mulga Woodland - Moderate;
- Minor Drainage - Moderate;
- Gorge/Gully - High; and
- Rocky Hill - High.

Most of the above listed habitats are associated with an isolated east-west running ridge, resulting in most of the breakaways and rocky slopes being southward-facing, which is typically most favourable for SREs (Astron, 2019c). Although SRE suitability of the Alluvial Plain habitat was considered to be low overall

A number of surveys for SRE fauna have been conducted within the Proposal area since 2014 (Biota 2014, Astron 2019) as well as a troglofaunal survey that recorded a potential SRE (Biota 2015). In total, three Confirmed and 35 Potential SRE invertebrate taxa have been recorded within the Proposal area. Of these, 19 Potential SRE taxa are known only from within the Proposal area, ten of which are currently only known from within the proposed footprint. Only one confirmed SRE species, *Karaops banyjima* was recorded within the Proposal area (Astron 2019b).

The confirmed SRE taxon *Karaops banyjima*, was recorded from three localities in the Proposal area (Astron, 2019c), including two within Gorge/Gully habitat (being a suitable prospective habitat for SRE species) and one from within Rocky Hill habitat. All three records were outside of the Proposal conceptual footprint.

An additional taxon, *Troglarmadillo* sp. is considered a likely SRE. One record of this taxa was recorded from Gorge/Gully habitat from within the Proposal closure boundary, but outside of the Proposal conceptual footprint.

5.14.5 Subterranean fauna

Subterranean fauna encompasses troglofauna (terrestrial subterranean fauna) and stygofauna (aquatic subterranean fauna). They both have ecological importance due to their species richness, evolutionary history and adaptation to their environment. The Proposal includes AWT mining only, therefore will not result in a significant alteration to the water table and thus stygofauna are not expected to be significantly impacted and not discussed further.

Assessment of the prospective suitability of habitat to support troglofauna has been undertaken within, and in proximity to, the Development Envelope. The extent, thickness, and connectivity of local geological habitats above water table was mapped by Rio Tinto based upon geological models. The mapping identified high confidence modelled (medium and high suitability) habitat for troglofauna comprising colluvium, Mt McRae Shale / Mt Sylvia Formation, Wittenoom Formation, Brockman Iron Formation and Marra Mamba Iron Formation.

Large areas of BHT and HD2 troglofauna habitat will remain in their in situ natural state after the development of the Proposal. At the BHT deposit, the Brockman Iron Formation will be significantly reduced in volume within the Proposal area (approximately 35% of the surface extent will remain, based on mapped surface geology), noting that suitable troglofauna habitat in the form of the Mount McRae Shale, Mount Sylvia and Wittennoom formations extend at depth and surrounding the deposits. While the connectivity of modelled habitat within BHT will decline due to the volume and location of habitat removed, this is not expected to significantly affect the persistence of the troglofauna community.

At the HD2 deposit, habitat removal resulting from mining is also not expected to be significant. Twenty three percent of habitat in the area of this deposit is predicted to be lost; however, the connectivity of habitat remaining will be similar to pre-mining conditions. Assessment of impacts to subterranean fauna habitat was undertaken within the extent of Development Envelope using a 2D approach validated by preliminary 3D habitat modelling. As a significant proportion of available habitat will remain, the ecological integrity of the troglofauna habitat is not expected to be significantly affected.

Seventeen of the 22 taxa recorded during the baseline surveys are considered unlikely to be impacted by the Proposal on the basis that their recorded distribution is outside of, or extends beyond, the proposed pits. For the remaining five taxa, all are singletons and have so far only been recorded from within the proposed pit shells. The five taxa are:

- *Eukoenia* ‘sp. OES2’ (Troglobite)
- *Lagynochthonius PSE96* (Troglobite)
- *Tyrannochthonius* ‘sp. Biologic-PSEU001’ (Troglobite)
- *Scolopendromorpha* 'sp. Biologic-CHIL001' (Troglophile)
- *Trinemura* ‘sp. OES11’. (uncertain dependence on subterranean habitats).

All five troglofauna taxa listed above are expected to occur outside the proposed impact area, due to suitable habitat connectivity. There is evidence of connection between troglofauna habitats, which provides opportunity for species dispersal.

Habitat reconstruction for subterranean fauna will not be specifically targeted as part of closure implementation and rehabilitation activities, when considering closure planning for the Proposal.

5.14.6 Introduced fauna

Feral carnivores (e.g., cats, dogs, foxes) can create locally increased predation pressure on native fauna as well as increase competition with native species for resources such as space (territory), water and food. Feral herbivores (e.g., cattle, camels, donkeys, rabbits) can also have a significant impact in Rangeland areas, such as the Pilbara. In dry times, grazing pressure reduces the abundance of palatable native species, impacting biodiversity and can create conditions that encourage weeds to grow. Foot traffic impacts the soil conditions, and in combination with over grazing, can encourage erosion. Foot traffic has also been the cause of damage to cultural landmarks and Aboriginal sites. Overgrazing and damaged soils has a flow-on effect to native fauna species that rely on this vegetation for food and shelter. Astron (2019) recorded seven species of feral mammals including:

- Cat (*Felis catus*);
- Dog/Dingo (*Canis familiaris*);
- European Cattle (*Bos Taurus*);
- Camel (*Camelus dromedaruis*);
- Donkey (*Equus asinus*);
- Rabbit (*Oryctolagus cuniculus*); and
- House Mouse (*Mus musculus*).

5.14.7 Implications for closure and knowledge gaps

Closure implications associated with fauna and habitat values include:

- All exclusion zones will be maintained through the decommissioning and closure implementation phases.
- Progressive rehabilitation of disturbed areas, no longer required for operational purposes, will be undertaken to re-establish native self-sustaining vegetation and habitat for fauna species.

- Monitoring programs of the Pilbara Ghost Bat and Northern Quoll will be refined during operations and continue through the decommissioning and closure implementation phases.
- Considering fauna habitat values will be required to ensure closure landforms align with exclusion areas and fauna habitat values.

Closure knowledge gaps associated with fauna and habitat values, as summarised in Table 6-1 include:

- Complete fauna habitat assessment of the final closure landform for HD2 and BHT deposits 5 years from closure.
- Undertake review of final closure landform and completion criteria to determine the functional habitats likely to be present post-closure.
- Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits.
- Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, soils, contaminated sites, hydrogeological, hydrological, conservation, flora and vegetation, fauna knowledge and assessments.

RESEARCH & TRIALS

5.15 Rehabilitation trials, research and development

Lessons learnt from other Pilbara mining sites are used to inform and update our standard rehabilitation management practices. Implementation of such advances includes:

- Landform specific rehabilitation designs based on mineral waste characterisation and site-specific climatic conditions.
- Rehabilitation requirements considered when determining landform placement.
- Survey control of rehabilitation earthworks to the rehabilitation design.
- Improved soil and seed management practices (viability testing and pre-treatment).
- Targeted research and development scopes.
- Development of guidance documentation and management procedures.
- Development of databases to house raw rehabilitation monitoring data.
- Production of close out reports and sharing of learnings across the Pilbara mining operations.

Although rehabilitation outcomes are largely variable, with success highly dependent on the climatic conditions and rehabilitation methods associated with works, these advances have resulted in an overall improvement in rehabilitation quality seen across the company's Pilbara operations and continue to contribute to the refinement of rehabilitation management develop successful outcomes.

Rio Tinto undertakes research and development to increase its understanding of the local natural ecosystem, optimise its rehabilitation techniques and be at the forefront of technological advances; with the over-arching goal of continually improving the rehabilitation quality it can achieve. Research and development projects range from opportunistic on ground trials, to large scale multi-partner federally funded research programs. Rehabilitation monitoring data is reviewed regularly to identify opportunities to refine rehabilitation techniques i.e., rates of recruitment from sown seed. A selection of recent research and development initiatives is summarised below.

5.15.1 Eco-Engineering solutions to improve mine-site rehabilitation outcomes

Both Rio Tinto and BHP Western Australia Iron Ore are partners in a federally funded research program investigating the rapidly developing field of Restoration Engineering, with a focus on the mining-intensive

Pilbara region of Western Australia. This Global Innovation Linkages project is led by the Kings Park Science research team and has additional partners from the University of Western Australia (UWA), Greening Australia, University of California, Brigham Young University, the University of Nevada, and Natural Resource Conservation LLC (a private US-based consultancy).

The Restoration Engineering approach partner's ecological research, focussed on best practice use of seeds from a recruitment biology point of view, with innovative ecologically guided engineering solutions focussed on the invention and modification of seeding equipment needed to deliver native seeds at scale. This project hosted a workshop in 2018, bringing together a team of local and international research scientists and industry professionals involved in the advancement of UWA's recent 'flash flaming' invention and direct seeding machine development. The project aims to:

- Critically evaluate the field limitations of current mechanised seeding techniques used in large-scale rehabilitation efforts to guide engineering modifications or new designs required to improve precision-delivery of native seeds in adverse rocky, uneven and sloped landforms.
- Design, construct, and field test prototype seed enhancement and direct seeding machines that can accommodate and efficiently deliver a wide range of seeds including those that differ in shape, size, and weight, and enhanced (primed, pelleted and coated) seeds, at broad acre scales.
- Quantify seed placement, seedling recruitment and rehabilitation performance using the engineered direct seeding machines across different mining growth media and soil types.
- Disseminate this research through peer-reviewed publications, on-ground field demonstrations on active mine sites or degraded lands and multiple conference and workshop avenues.

Whilst some knowledge within the project remains confidential in the early research phase, there have been aspects incorporated into Rio Tinto's progressive rehabilitation trial areas. These include the use of flamed seed preparation rehabilitation, spinifex pre-treatment trials and the evaluation of several new species for flaming treatment. Work has also included an engineering trial to optimise the placement of seeds under the soil surface for increased germination results. Several trials are underway in a lab testing environment and may be phased into field trials in the future.

Opportunities to incorporate research trials into the company's progressive rehabilitation projects are undertaken where possible and incorporated into the rehabilitation monitoring program. Learnings are then incorporated into seed management and rehabilitation procedures.

5.15.2 Pilbara seed provenance

Appropriate strategies for collecting seeds as the raw genetic material for restoration activities are an important consideration for revegetation programs. Traditional approaches regarding seed collection follow a precautionary principle that advocates a narrowed definition of 'local provenance' seed. This approach has been adopted by DWER, the DMIRS and other regulatory agencies in mining-related environmental approvals in the Pilbara, where approval owners are required to use 'locally' sourced seed. This 'local' restriction often relates to geographic distance and does not take into consideration other factors related to biogeographical setting or relevant plant ecology and seed biology.

The Pilbara Seed Provenance Study was a collaboration between industry and DWER, undertaken to genetically delineate local provenance and provide clarity with respect to delimiting seed provenance zones for a suite of Pilbara species used in mine site rehabilitation and other revegetation initiatives.

Nuclear genotyping for six species *Petalostylis labicheoides, Indigofera monophylla, Corymbia hamersleyana, Acacia hilliana, Acacia pruinocarpa* and *Senna glutinosa* subsp. *glutinosa* across the Pilbara was completed. The results were finalised in 2017 and showed that several species exhibited strong patterns of population structure, indicating that each require seed to be collected from specific provenance zones, whilst others showed little to no delineation between populations, allowing for seed collection to occur across the full geographic range of the species. This knowledge contributed to addressing the uncertainty regarding seed provenance.

6 Closure Knowledge Gaps

This section provides a summary of all current closure knowledge gaps identified during the Proposal closure planning and development of the closure strategy. The Proposal closure knowledge base also informs the closure risk assessment (Section 7 and Appendix 4) and the Proposal closure action register (Appendix 5). Each iteration of this MCP will include a review and refinement of the closure knowledge gaps, which will be progressively addressed through the Rio Tinto risk management process.

Table 6-1: Current Proposal closure knowledge gaps

Factor	Closure knowledge gap	Timing / Progress	Associated closure risk assessment action/s
Aboriginal culture and heritage	Agreement on key heritage locations and access requirements post-closure, final site closure outcomes, completion criteria and measurement tools. Schedule for future closure consultations over the life of Proposal.	To be progressively addressed through on-going engagement with Traditional Owners and consideration of the mine plan.	• Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, hydrogeological, hydrological, flora and fauna knowledge and assessments. • Stakeholder engagement strategy and communications plan to be prepared for community, regulators, and internal audience. • Undertake specific closure stakeholder engagement to determine social and cultural heritage values to be maintained at the closure of the HD2 and BHT deposits, include salvage and repatriation of sites. • Undertake visual impact assessment of HD2 and BHT deposits final landform configuration and visibility from GNH and other key vantage points or points of cultural heritage importance. • Develop seed mix(es) HD2 and BHT deposits in line with progressive rehabilitation targets and consultation with stakeholders. • Develop consultation tools to assist in communicating closure strategy with stakeholders. • Schedule consultation with stakeholders over the life of asset to consult on closure strategy options and opportunities. • Complete consultation with Traditional Owners on key heritage locations and access requirements post-closure to contribute to the final closure landform or landscape • Complete consultation on closure outcomes, completion criteria and measurement tools. • Complete consultation on the final closure landform or landscape and opportunities for Traditional Owners to get involved. • Social and cultural heritage values regarding Special Places for Nyiyaparli, as documented in the HD2 SCHMP, will be incorporated in the next major update of the MCP.

Factor	Closure knowledge gap	Timing / Progress	Associated closure risk assessment action/s
			• The risk title regarding cultural heritage will be reworded and evaluated to ensure that closure outcomes consider social values in the next major update of the MCP.
Socio-economic	Potential social and economic impacts including amenity, public health associated with closure activities, loss of employment and business opportunities.	To be progressively addressed through on-going engagement with Traditional Owners, communities, personnel and consideration of the mine plan.	• Potential social and economic impacts to be assessed including amenity, public health associated with closure activities, loss of employment and business opportunities. • Consult with stakeholders to address any potential socio-economic impacts post-closure. • Undertake visual impact assessment of HD2 and BHT deposits final landform configuration and visibility from GNH and other key vantage points or points of cultural heritage importance. • Investigate opportunity to allow safe access for viewing/observation of post-closure landform to deter unauthorised access to site. • Develop consultation tools to assist in communicating closure and potential socio-economic impacts with stakeholders.
Climate	Closure landform designs in consideration of climate change.	This knowledge gap will be reviewed in each triennial revision of the MCP.	• Complete landform evolution modelling to confirm the optimal final Waste Rock Landform design, including physical waste characterisation. • Flood modelling of the closure landform to consider climatic variation and the potential for extreme rainfall events. • Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, hydrogeological, hydrological, flora and fauna knowledge and assessments. • Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits.
Geotechnical	PUPEZ associated with final pit voids, abandonment bund locations and surface water management implications. Inventory of rehabilitation materials (low erodibility waste) to be utilised for capping and abandonment bunding where required.	This knowledge gap will be reviewed in each triennial revision of the MCP.	• Evaluate planned post-closure pit wall stability for HD2 and BHT deposits pits to determine if mitigation is required to prevent wall collapse and PMC creek capture. • The zone of geotechnical instability or PUPEZ will be revised and updated for HD2 and BHT deposits in each iteration of the MCP to reflect any changes to the mine plan, understanding of the closure landscape and to address any updated flood modelling. • The location of the proposed pit abandonment bunds for the HD2 and BHT deposits will be revised and updated in each iteration of the MCP to reflect any changes to the mine plan, understanding of the closure landscape and to address any updated flood modelling.

Factor	Closure knowledge gap	Timing / Progress	Associated closure risk assessment action/s
			• Develop a rehabilitation materials inventory for HD2 and BHT deposits for low erodibility waste to be utilised for capping and abandonment bunding where required. • Undertake landform evolution modelling for HD2 and BHT landforms to further inform and verify final landform design and rehabilitation parameters. • Site specific geotechnical assessments will be completed for rehabilitation designs of final closure landforms for HD2 and BHT deposits to confirm closure landform safety and stability. • Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, soils, contaminated sites, hydrogeological, hydrological, conservation, flora and vegetation, fauna knowledge and assessments. • Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits.
Public access	Abandonment bund locations and surface water management implications. Access to the landscape and the management of inadvertent access to PUPEZ.	This knowledge gap will be reviewed in each triennial revision of the MCP.	• Complete consultation with Traditional Owners on key heritage locations and access requirements post-closure to contribute to the final closure landform or landscape • Complete consultation with the State on preferences with regards to final closure landform and public access to the post-closure landscape. This will be determined through ongoing consultation during the life of the operation. • Assess opportunities to allow safe access for viewing/observation of the post-closure landform near the highway to deter unauthorised access to site. If this is considered appropriate to key stakeholders, details will be included in further updates to this MCP. • Assess the expected post-closure access to the site, and include the installation of additional control measures, where appropriate. • Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, soils, contaminated sites, hydrogeological, hydrological, conservation, flora and vegetation, fauna knowledge and assessments. • Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits.
Mineral waste	Erodibility of HD2 mineral waste.	Complete waste characterisation progressively as geological units become available during operations. Landform designs to be updated as required.	• Site specific physical waste characterisation will be progressively undertaken when each mineral waste unit becomes available during mining operations. • Include HD2 and BHT deposit materials in updates of the BST. • Undertake further testing of BHT (detrital) lignite materials when geological units become available during mining operations as per the SCARD management plan.

Factor	Closure knowledge gap	Timing / Progress	Associated closure risk assessment action/s
		Identify materials to be stockpiled for abandonment bunds and rehabilitation activities.	• Undertake landform evolution modelling for HD2 and BHT landforms to further inform and verify final landform design and rehabilitation parameters. • Revise waste rock landform rehabilitation and overall closure landform designs based on physical waste characterisation, BST parameters, hydrological and ecological factors and stakeholder consultation as required. • Develop a rehabilitation materials inventory for HD2 and BHT deposits for low erodibility waste to be utilised for capping and abandonment bunding where required. • Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, soils, contaminated sites, hydrogeological, hydrological, conservation, flora and vegetation, fauna knowledge and assessments. • Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits.
Soils	Soil inventory and topsoil recovery strategy and volumes.	Incorporate topsoil soils review and update annually. Undertake topsoil suitability assessment within completion criteria work (next 5 years).	• Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, hydrogeological, hydrological, flora and fauna knowledge and assessments. • Update the topsoil balance for estimated topsoil recovery annually once mining commences. • Complete subsoil characterisation work when vegetation clearing commences as required. • Develop a rehabilitation materials inventory for HD2 and BHT deposits for low erodibility waste to be utilised for capping and abandonment bunding where required. • Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits.
Contaminated sites	Knowledge and database of potentially contaminating activities register for Proposal.	Complete PSI and DSI contaminated sites assessments 5 years from closure date.	• Undertake Preliminary Site Investigation 5 years prior to closure. • Undertake Detailed Site Investigation 2 years prior to closure. • Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, soils, contaminated sites, hydrogeological, hydrological, conservation, flora and vegetation, fauna knowledge and assessments. • Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits.
Hydrogeology	Suitability and accuracy of hydrogeological	On-going verification and refinement of the hydrogeological	• Complete final options assessment for water source and impacts for HD2 and BHT deposits.

Factor	Closure knowledge gap	Timing / Progress	Associated closure risk assessment action/s
	conceptualization and water source options.	conceptualisation of groundwater model throughout LoM, to be updated in each triennial revision of this MCP.	• Update closure hydrogeological model with new conceptualisations for HD2 and BHT deposits water supply options. • Complete closure hydrogeological water quality model for HD2 and BHT deposits once water supply options are agreed with stakeholders. • Update the conceptual hydrogeological model for HD2 and BHT deposits final closure landform 5 years from closure. • Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits. • Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, soils, contaminated sites, hydrogeological, hydrological, conservation, flora and vegetation, fauna knowledge and assessments.
Hydrology	Finalisation of hydrological closure strategy for pit voids, landbridges, waste landforms, abandonment bunds and surface water management structures based on refinement of flood modelling and surface water management structure designs. Surface water quality sampling is yet to be undertaken.	Surface water model to be refined throughout LoM and updated in each triennial revision of this MCP. Landbridge closure strategy to be provided in the 2024 revision of this MCP. Surface water modelling of final post-closure surfaces to be included in the MCP five years from planned closure.	• Update surface water modelling for PMC creek diversion in line with changes to landform design and closure strategy for HD2 deposit (1:100AEP, 1:1000AEP and 1:10,000AEP). • Upgrade of drainage designs for permanent closure drainage structures (PMC) where required, in line with flood risk assessments (1:100AEP, 1:1000AEP and 1:10,000AEP). • Undertake hydrological water quality sampling of PMC and WWC prior to commencing mining of the HD2 and BHT deposits. • Undertake landform evolution modelling for HD2 and BHT landforms to further inform and verify final landform design and rehabilitation parameters. • Undertake hydrological modelling (1:100AEP, 1:1000AEP and 1:10,000AEP) of updated landbridge closure strategy and designs. • Undertake hydrological modelling of abandonment bund alignment and final closure landform for HD2 and BHT deposits (1:100AEP, 1:1000AEP and 1:10,000AEP). • Determine required engineering flood mitigation structures for HD2 and BHT deposit’s closure landforms. • Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits. • Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, soils, contaminated sites, hydrogeological, hydrological, conservation, flora and vegetation, fauna knowledge and assessments.

Factor	Closure knowledge gap	Timing / Progress	Associated closure risk assessment action/s
Conservation Significant Areas	Exclusion zones around conservation significant flora species will be maintained through the decommissioning and closure implementation phases.	Assessment of the conservation significant flora and fauna status to be updated within this MCP. Conservation significant areas to be considered as part of closure planning and access for closure.	• Conservation significant areas will be considered in closure planning with reference to post-closure land use, access to the landscape and closure outcomes. • Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits. • Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, soils, contaminated sites, hydrogeological, hydrological, conservation, flora and vegetation, fauna knowledge and assessments.
Flora and Vegetation	Optimal seed selection of rehabilitation seed mix. The selection of reference / analogue sites and the development of revegetation completion criteria (species richness, percentage cover and percentage weed cover) to assess the performance of progressive rehabilitation.	Locations of reference sites to be determined at least 8 years prior to planned closure.	• Seed mixes have not been developed for the Proposal, to facilitate progressive rehabilitation. Considering the short mine life for the Proposal, flora species recorded in baseline surveys will be used to inform rehabilitation seed mix(es). Seed mixes will be developed in consultation with stakeholders. • The selection of reference / analogue sites and the development of revegetation completion criteria (species richness, percentage cover and percentage weed cover) have not yet been undertaken. Vegetation mapping completed for the Proposal will be used to inform the selection of reference / analogue sites and inform the development of revegetation completion criteria (species richness, percentage cover and percentage weed cover) and monitor against progressive rehabilitation • Select reference / analogue sites for HD2 and BHT deposits to inform revegetation criteria and progressive rehabilitation. • Implement progressive closure and rehabilitation of waste rock landforms and disturbed areas as soon as possible to reduce closure liabilities. • Revise seed mix(es) in line with progressive rehabilitation targets and consultation with stakeholders. • Conduct closure research and rehabilitation trials to demonstrate methodologies. • Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits. • Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, soils, contaminated sites, hydrogeological, hydrological, conservation, flora and vegetation, fauna knowledge and assessments.
Fauna	Representative fauna habitats likely to be present within the final closure landform.	This knowledge gap will be addressed as the site nears planned closure.	• Complete fauna habitat assessment of the final closure landform for HD2 and BHT deposits 5 years from closure. • Undertake review of final closure landform and completion criteria to determine the functional habitats likely to be present post-closure.

Factor	Closure knowledge gap	Timing / Progress	Associated closure risk assessment action/s
			• Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits. • Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, soils, contaminated sites, hydrogeological, hydrological, conservation, flora and vegetation, fauna knowledge and assessments.

7 Closure Risk Assessment

Risk assessment and management is an integral component of Rio Tinto's business framework and approach to closure planning. The objectives of risk management are to improve execution and reduce risk exposure. To achieve these objectives, Rio Tinto manages all business risks using the RSA Archer Integrated Risk Platform which provides the business with a consolidated and clear view of risks, including version and history tracking and unique identification of risks, controls and actions for tracking purposes.

Risk assessments are undertaken to qualitatively and semi-quantitively guide the selection of closure options, assess specific risk and identify controls for the design and execution of closure. Successful management of risks requires the implementation of a clear risk management strategy supported by adequate resources, a strong risk-aware culture, and maintaining an up-to-date risk register that is regularly reviewed.

7.1 Risk assessment process

All Rio Tinto closure risk assessments are facilitated by competent personnel, involving a range of technical and subject matter experts.

The aims of the closure risk assessment process are to:

- Identify potential hazards that could influence successful closure of the mine.
- Evaluate the risks given the management controls/strategies described within the MCP and consideration of the risk likelihood and consequences (using the descriptors included within the Rio Tinto HSEC 5 x 5 risk determination matrix, refer to OBJOBJOBJOBJTable 71OBJ) to establish an overall risk class, which can range from Class I (Low) to Critical IV (Critical).
- Identify additional control measures (actions) for significant threats rated as either Class III (High) or Class IV (Critical) to ensure the residual risk rating is As Low As Reasonably Practicable (ALARP).
- Review and update risk, control effectiveness and action status.
- Communicate risk information.

Issues are assessed against set consequence criteria (environment, health and safety, cost of closure, community trust, and compliance). Risk is evaluated based on the maximum reasonable outcome consequence and the likelihood of that consequence occurring to derive an inherent risk rating, prior to the application of controls, and a residual risk rating, inclusive of current management and commitments. The ALARP principle is to be used when determining which risk treatments to apply.

Table 7-1: Risk class determination

Likelihood	Most serious consequence				
	Very low	Low	Moderate	High	Very high
Almost certain	Class II	Class III	Class IV	Class IV	Class IV
Likely	Class II	Class III	Class III	Class IV	Class IV
Possible	Class I	Class II	Class III	Class IV	Class IV
Unlikely	Class I	Class I	Class II	Class III	Class IV
Rare	Class I	Class I	Class II	Class III	Class III

The risk classification identifies the level of management action that must be taken to mitigate the threat (Table 7-1). A risk determination of Class III or Class IV reflects a material risk that requires active management and consideration of additional control measures (Table 7-2). All actions associated with risk management and mitigation are captured in Archer and reflected in the HD2 MCP as Appendix 4.

Table 7-2: Risk management response

Risk class - threats	Management response
Class I	Risks that are below the risk acceptance threshold and do not require active management.
Class II	Risks that lie on the risk acceptance threshold and require active monitoring.
Class III	Risks that exceed the risk acceptance threshold and require proactive management.
Class IV	Risks that significantly exceed the risk acceptance threshold and need urgent and immediate attention.

A control effectiveness rating is determined for each risk to evaluate whether the control will effectively mitigate the risk. If controls are deemed Marginal or Weak, then actions are assigned to improve the control effectiveness. Rio Tinto's definitions of control effectiveness are:

- **Good** – control is considered adequately designed and is operating effectively on almost all occasions.
- **Satisfactory** – control is considered adequately designed and is operating effectively on most occasions.
- **Marginal** – control is considered inadequately designed or is only operating to partial effectiveness on most occasions.
- **Weak** – there is no control designed or the control is operating ineffectively on all occasions.

7.2 Risk evaluation

The risks (threats and opportunities) were defined by considering the likelihood of different outcomes occurring for the Proposal given the nature of the local environment, established through collection of baseline data, and scope of the approved operations.

- The inherent risk presents the conditions that may result without implementation of controls during operations or closure.
- The residual risk was determined by considering the likelihood of the most credible consequences occurring after the nominated controls are implemented. When evaluating residual risk, Rio Tinto considers that a control cannot reduce the residual risk until it has been implemented, unless the control is a mandatory legal obligation, such as the management of inadvertent access to a pit void through the construction of abandonment bunds. A final, or treated risk, can be determined once the nominated control has been implemented, and the risk assessment will be updated accordingly.

Risk registers are reviewed and updated as conditions change. The closure risk register is also systematically reviewed and updated at least every three years in support of the update of the MCP.

7.3 Risk profile

The first Proposal closure risk assessment was undertaken in 2020 and refreshed in 2021, this updated risk assessment is presented in Appendix 4.

A summary of the current closure risk profile shows there are currently two Class II, eight Class III and one Class IV threats, a total of twelve risks associated with the closure of the Proposal. A summary of the

threat profile is presented in

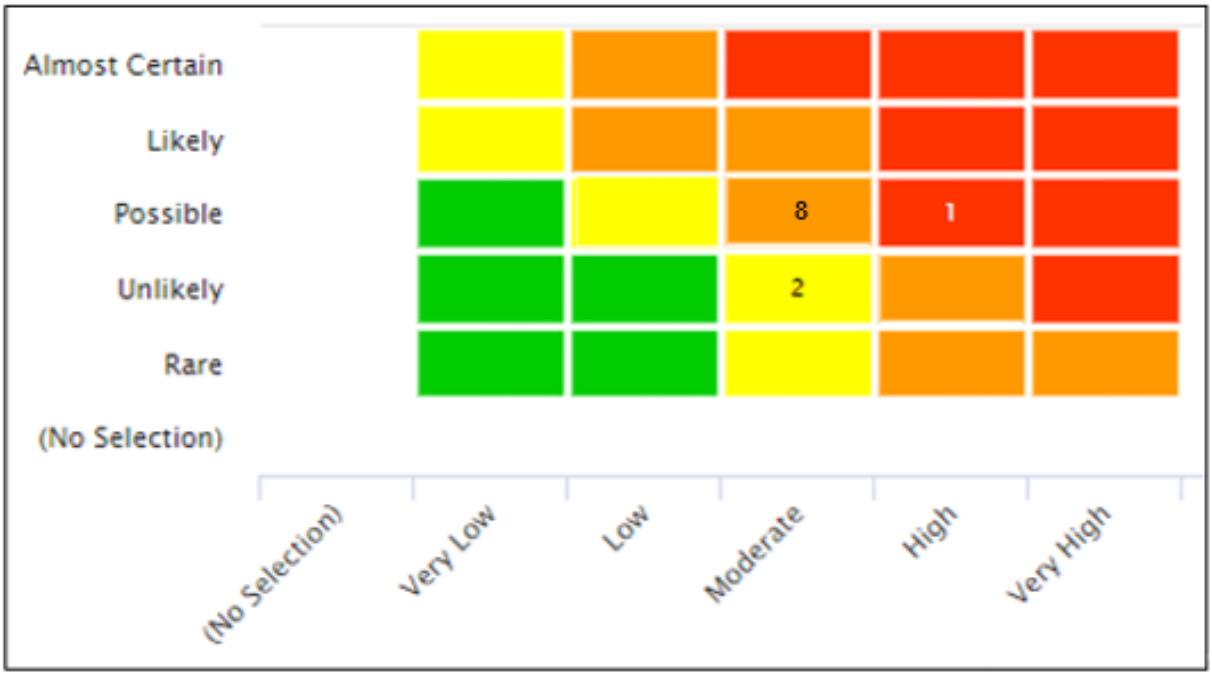


Figure 40 and Class IV and III risks are detailed below.

Actions are assigned to risks that exceed Rio Tinto's risk acceptance threshold and therefore require additional control measures to reduce the risk at closure to ALARP and an acceptable level. Actions are also assigned to address knowledge gaps where further information is required to reduce uncertainty. This would typically be the case in the early stages of operations where the detailed knowledge of an aspect may be low. These actions are captured in Table 6-1, Appendix 4 and Appendix 5.

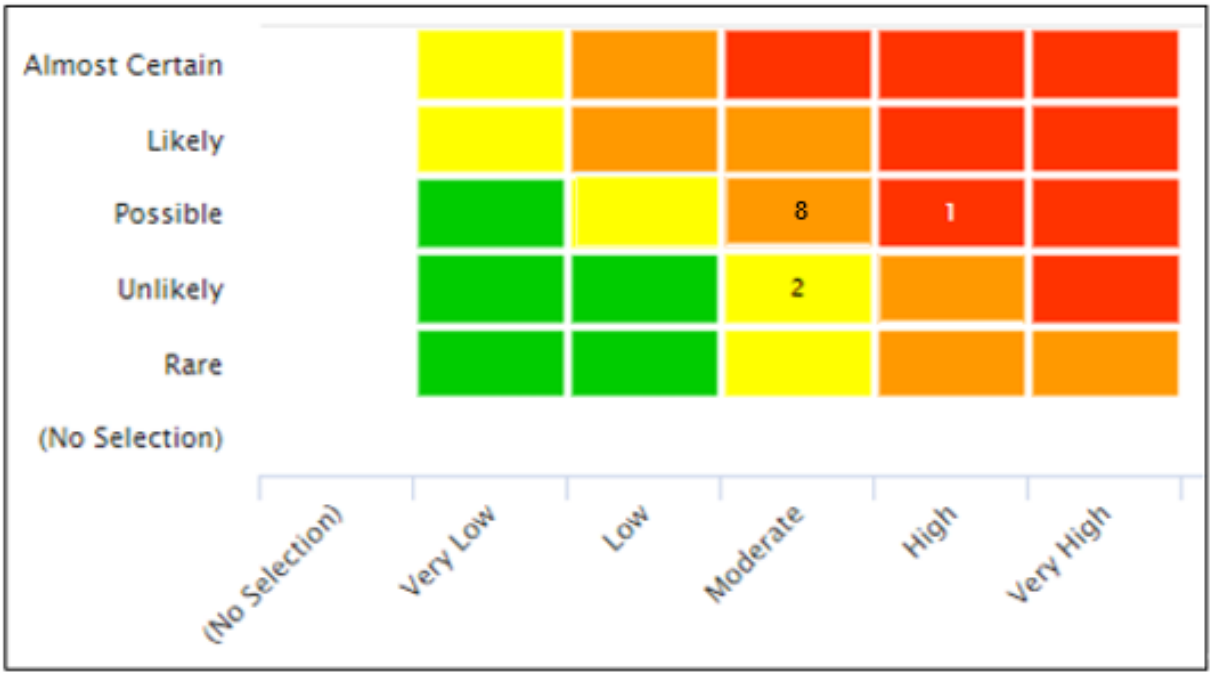


Figure 40: Proposal threat risk profile

7.3.1 Closure class IV risk

One Class IV risk was identified during the 2020 closure risk assessment:

- Risk 696068 - The safety risk for people entering the Proposal area after it has been rehabilitated and closed has not been effectively mitigated

The causes, impacts, existing controls, evaluation rationale and planned actions for each of these threats are detailed within Appendix 4.

7.3.2 Closure class III risks

Eight Class III risks were identified during the 2020 closure risk assessment:

- Risk 696234 - Implementation of the closure strategy does not achieve the required environmental outcomes.
- Risk 696240 - Implementation of the closure strategy does not achieve the required cultural heritage outcomes.
- Risk 696247 - Consultation fails to identify and/or address stakeholder concerns.
- Risk 696032 - Inadequate management of contaminating activities at the Proposal during operations increases closure costs.
- Risk 696217 - Inadequate management of surface water results in increased closure complexity and costs.
- Risk 696208 - Failure to reach agreement with the State on suitable completion criteria for the Proposal
- Risk 696223 - Rehabilitation outcomes at HD2 do not meet closure objectives.
- Risk 974578 - Waste rock landforms and / or landbridges at the Proposal are subject to excessive erosion.

The causes, impacts, existing controls, evaluation rationale and planned actions for each of these threats are detailed within Appendix 4.

8 Management of Key Issues

Appendix 7 of DMIRS *Mine Closure Plan Guidance - How to prepare in accordance with Part 1 of the Statutory Guidelines for Mine Closure Plans* (DMIRS 2020) lists a number of rehabilitation and closure issues that may be relevant for mine sites, including several that are identified as key issues at the Proposal. An evaluation of the relevance of each of these issues is presented in Table 8-1 and summarises data and information previously presented in Section 5 of this MCP.

Table 8-1: Relevance of potential closure and rehabilitation issues

Issue	Evaluation of issue
Key issues relevant to closure of the Proposal	
Dispersive, sodic and erosive materials	A proportion of waste material is anticipated to be of high erodibility. No dispersive or sodic waste materials have been identified.
Geotechnical stability	All final landforms will be located outside the PUPEZ. Specific design of two sections of the abandonment bund and pit crest of HD2 will be required if the temporary diversion of PMC is removed.
Inadvertent public access	Pit abandonment bunds will be constructed in accordance with the DoIR 1997 *Safety bund walls around abandoned open pit mines*. Alternative design of some sections of the pit abandonment bund may be required if temporary diversion of PMC is removed. Agreed access to the area for Traditional Owners is required post-closure.
Alteration of the hydrology and flow of surface waters	Permanent diversion of minor PMC flows to WWC is proposed. This diversion is planned to be retained after closure pending assessment of impacts to the pit crest stability of two sections of the HD2 pit. A floodway crossing of PMC is proposed north of the BHT pits. Landbridges associated with the BHT deposit remain at closure but are unlikely to affect the flow of surface water. They will be reshaped and rehabilitated.
Social and cultural heritage values	Significant social and cultural heritage values have been identified by the relevant Traditional Owners and closure strategies are required to ensure values are protected.
Hazardous materials	Hazardous materials (e.g. hydrocarbons, ammonium nitrate) will be removed prior to, or during, decommissioning activities.
Hazardous and unsafe facilities	All infrastructure will either be decommissioned and removed or legally transferred to a third-party or the State in accordance with State Agreement Act requirements.
Contaminated sites	Given the developmental phase of the HD2 mine, there are currently no known or suspected contaminated sites associated with the mining area. A preliminary sampling and investigation programme will be undertaken prior to closure to determine if any remediation measures are required. All activities will be conducted in accordance with DWER guidance, and any known or suspected site will be reported to DWER Contaminated Sites Branch.
Acid and metalliferous drainage	Geochemical waste characterisation across deposits HD2 and BHT deposits has been assessed as having a low risk of AMD generation. The mine plan will avoid the minor volumes of black Mount McRae Shale identified during resource definition drilling.
Rehabilitation materials availability	There is no topsoil or rehabilitation material deficit anticipated. A soil survey has not been conducted at HD2, and as such any chemical and physical limitations of topsoil and subsoil for use in rehabilitation have not yet been determined. The soil survey will be reported in the next iteration of the MCP and implications for soil management and use in rehabilitation will also be addressed. Regarding other rehabilitation materials, as the site is considered to have a low AMD, fibrous materials and erosive materials risk, cover and/or capping materials are not currently expected to be required for closure.

Issue	Evaluation of issue
Challenges associated with rehabilitation and revegetation	As mining has not commenced at the Proposal limited progressive rehabilitation of resource development disturbance has occurred to date. Once rehabilitation has commenced, and the associated monitoring data becomes available, any evident challenges will be presented in the MCP.
Visual amenity	A visual amenity assessment will be undertaken during closure studies, once the final landform is refined, and again post implementation.
Key issues not relevant to the closure of the Proposal and not considered further in this MCP	
Radioactive materials	No naturally occurring radioactive materials are expected to be encountered during mining.
Fibrous materials	Fibrous minerals are not expected to be encountered during mining.
Waste fines storage facilities	There is no proposed WFSF for the Proposal.
Mine pit lakes	All mine pits are above water table and, therefore, groundwater pit lakes are not expected to form.
Dust emissions	Closure dust management will be consistent with operational dust controls. Closure implementation is not expected to require additional management measures above those adopted during operations.
Flora and fauna diversity / threatened species	Management of disturbance in proximity of conservation significant species and mining exclusion zones will be consistent with operational controls. Closure implementation is not expected to require additional management measures above those adopted during operations.
Surface water / groundwater quality	No significant impacts on surface water or groundwater quality are anticipated, groundwater quality baseline has been collected and monitoring will continue. Surface water quality sampling is highlighted as a knowledge gap and will be addressed. PMC and WWC are located outside the development envelope, excepting a crossing of PMC.
Alteration of the direction of groundwater flow and alteration of the depth to water table of the local aquifer	As all mining is above water table, there is no alteration of the groundwater flow direction beyond the local scale associated with the production borefield.
Community issues	There are no townships, remote communities or pastoral stations which will be impacted by the closure of the Proposal.

9 Closure Planning Process

The closure planning process at Rio Tinto is an iterative process that commences during the mine development planning phase and is regularly updated and refined during the operational phase. MCPs are updated to account for changes resulting from:

- amendments to the mine plan.
- improvements of the site closure knowledge base (e.g., through daily activities, technical studies, research actions and progressive rehabilitation).
- new or amended regulation.
- changes to surrounding land uses; and
- evolving stakeholder expectations.

The review brings specialists together to discuss current performance, proposed mine changes and opportunities to improve closure outcomes. At the end of the review, improvement actions are assigned, and the MCP is updated.

A key output of closure planning is the development of a closure cost estimate. Closure provisions are subsequently integrated into business planning processes to ensure funds will be available to close the site effectively.

As part of the *Rio Tinto Closure Standard* (2021), closure studies are required at intervals as the site, or a discreet area of the site suitable for partial closure, approaches the end of mine life. Like development projects, closure studies are progressed through several evaluation stages: from OoM to Pre-Feasibility (PFS) and Feasibility (FS) level.

Progressive rehabilitation is also planned, undertaken and monitored to inform the closure planning process, as detailed in Section 11.3. The final MCP is prepared as an output of the Feasibility stage of closure study and is submitted to the relevant regulatory agencies to approve for implementation. In the final MCP, location specific management plans will be provided for each closure domain. These detailed plans cover the physical closure, dismantling and subsequent rehabilitation implementation requirements. The supporting technical reports that have been used to define the post-closure outcomes will be appended to the final MCP.

10 Land Use, Closure Outcomes and Completion Criteria

10.1 Pre-mining land use

The Proposal is located primarily on land the subject of the Nyiyaparli native title determination, with smaller portions located on land the subject of the Banjima and Ngarlawangga Native Title Determinations. These Native Title Determinations recognise each Traditional Owner group's non-exclusive right to continue to access, use and enjoy their country.

Since European settlement, land uses in the region have also included cattle grazing, exploration, mining, and conservation.

Part of the GNH currently traverses a portion of the closure boundary and is a main regional transport route as well as being used by tourists and locals. The current HD1 mine access road also traverses the Proposal closure boundary and is one of the main ways to access WWC and WWS, which are of environmental, social and cultural significance in the region.

Aside from mining activity and associated infrastructure, the area within the Proposal closure boundary is largely undeveloped. Pastoral activity in the region has historically been limited to cattle grazing. The Proposal conceptual footprint is generally on areas of rugged terrain of low pastoral land value. There are several other mines currently proposed and operating in the vicinity of the Proposal including:

- Rio Tinto Hope Downs 1;
- Hamersley Iron – Yandi Pty Limited (HI) Yandicoogina;
- Robe River Mining Co Pty Ltd West Angelas;
- Rio Tinto Hope Downs 4;
- BHP Mining Area C (MAC);
- BHP Yandicoogina;
- Process Minerals International (wholly owned subsidiary of Mineral Resources Limited) Phil's Creek Iron Ore Mine;
- BCI Minerals Limited Iron Valley Project;
- Proposed FMG Nyidinghu Project;
- BHP Southern Flank development; and
- Mineral Resources Wonmunna Mining Area.

10.2 Closure domains

Rio Tinto uses closure domains to group areas with common features for rehabilitation, and decommissioning requirements at closure. Detailed closure strategies for the rehabilitation and decommissioning of individual closure domains, beyond those of current standard management practices, will be documented in the final MCP to be prepared as the site approaches closure. The distribution of closure domains for the Proposal is illustrated in Figure 41.

HD2 domains include:

- pits - includes currently operating or planned pits:
    - above water table voids
- inert waste rock landforms remaining at closure:
    - inert external waste rock landforms
    - stockpiles

- landbridges.
- infrastructure areas, haul roads, ROM Pads.
- disturbed areas – all areas of disturbance that are not categorised by any of the above landform domain categories. This domain has been broken down into 'high disturbance', 'moderate disturbance' and 'low disturbance' sub-domains, based on the number of earthworks that will be required during final landscaping, to allow for more accurate closure cost estimation.
- rehabilitated areas – areas which have been progressively rehabilitated; and
- undisturbed areas that retain natural vegetation.

Proposed closure measures for each of the closure domains are included in Table 10-1 and presented in Figure 41. Designs and key criteria for all major landforms are included in Appendix 6.

Table 10-1: Proposal implementation strategies by closure domain

Domain class	Footprint	Domains	Closure measures to be undertaken where appropriate
Pits	**(ha)**		

Above water table (AWT) pits	965.89	HD2_West
		HD2_Center
		HD2_East
		BHT_West
		BHT_Center
		BHT_East
			• when and where possible undertake opportunistic backfill during operations to:
			  ○ minimise the volume of waste remaining in waste rock landforms; and/or
			  ○ manage highly erodible material.
			• no rehabilitation is proposed within the pit footprint (unless backfilled to near or above surface).
			• prior to final closure, appropriate evaluation and implementation of measures to restrict inadvertent public access.
			• construct abandonment bunds around pit perimeters, outside of the PUPEZ, as required; and
			• HD2_West pit may be partially backfilled with mine waste to facilitate the realignment (to the original location) of the GNH.

Waste Rock Landforms			•
Inert ex-pit waste rock landforms	939.24	HD2 DP_NW HD2 DP_NC HD2 LG BHT DP_ NEWD BHT NELG	• reshaping outer slopes to appropriate angles/profiles based on design criteria suitable for waste type (Appendix 6 and Appendix 7). • apply a maximum 200 mm[2] layer of topsoil (or subsoil where topsoil is unavailable); and • rip and seed using appropriate native species.
Topsoil and subsoil stockpiles	Included in infrastructure footprint area	HD2_TS_DES_01 HD2_TS_DES_02 HD2_TS_DES_03 HD2_TS_DES_04	• stockpiles are generally planned to be removed prior to, or during, closure activities. • rehabilitate underlying surface in accordance with standard procedures (as per infrastructure areas).

[2] To maximise the value of the available topsoil a maximum depth of 200 mm is assumed across rehabilitated areas based on expected availability and machine capability. However, the intent is to optimise usage to achieve the best possible rehabilitation outcomes.

Domain class	Footprint	Domains	Closure measures to be undertaken where appropriate
Pits	**(ha)**		
		HD2_TS_DES_05	
		HD2_TS_DES_06	
		HD2_TS_DES_07	
		HD2_TS_DES_08	
		HD2_TS_DES_09	
		HD2_SS_W_01	
		HD2_SS_E_01	
		BHT subsoil and topsoil stockpiles	
Landbridges			
BHT Landbridges	62.88	LB_Central 3	• assess whether landbridge needs to be partially or completely removed considering geotechnical stability and surface water considerations. • reshaping outer slopes to appropriate angles/profiles based on design criteria suitable for waste type (5.7 and Appendix 6). • apply a maximum 200 mm[3] layer of topsoil (or subsoil where topsoil is unavailable); and • rip and seed using appropriate native species.
		LB_East	
		LB_East 6	
		LB_Central	
		LB_West	
Other domains			
Haul roads	2932.14	Haul roads	• install cross bunds where appropriate (at approximately 50m to intervals if the gradient of the reshaped road corridor is greater than 10 degrees); and • rehabilitate final surfaces in accordance with standard procedures (as per inert waste rock landforms).
BHT ROM pad		ROM pad	• remove all structures and footings that are above surface or buried within 1m of the final land surface. • utilise material for pit backfill, capping or encapsulation if required; and • rehabilitate final surface in accordance with standard procedures (as per inert waste rock landforms).
Infrastructure areas		Areas where infrastructure is located, including, but not limited to:	• retain or remove infrastructure in accordance with State Agreement requirements and stakeholder engagement. • undertake contaminated sites assessment and remediation measures, where required.

[3] To maximise the value of the available topsoil a maximum depth of 200mm is assumed across rehabilitated areas based on expected availability and machine capability. However, the intent is to optimise usage to achieve the best possible rehabilitation outcomes.

Domain class	Footprint	Domains	Closure measures to be undertaken where appropriate
Pits	**(ha)**		
		• Vehicle workshops and fixed plant workshops • Hydrocarbon storage areas, • ANFO facilities, • Laydown areas, • Turkey's nests, • Transfer pads, • Roads • Offices. • Processing facilities • Run of mine (ROM) pads • Ore stockpile. • Conveyors, • Camps, • Fuel facilities • and any associated disturbances.	• where infrastructure requires removal, remove all structures and footings that are above surface or buried within 1 m of the final land surface. • drain pipelines and remove hazardous materials (from pipelines and elsewhere across the site) in accordance with Controlled Waste Regulations. • where linear infrastructure is removed, reinstate drainage lines where appropriate. • actively seek reuse and recycling opportunities for decommissioned infrastructure. • dispose of inert materials that are not retained, reused or recycled in an inert landfill area (may be a used pit area); and • rehabilitate final surface in accordance with standard procedures, which includes: o apply a maximum 200 mm[4] layer of topsoil (or subsoil where topsoil is unavailable). o deep rip the surface where required to address compaction; and o revegetate with an appropriate mix of species of local provenance.
Disturbed area – low		Various	• respread topsoil, sub-soil or alternative growth medium (if available) onto disturbed area; and • rip and seed. • The need for seeding may be reassessed closer to closure on the basis that these areas have a high probability of retaining some degree of a seed bank.
Disturbed area –moderate		Various	• recontour to remove windrows and other impediments to surface water flows. • respread topsoil onto disturbed area; and • rip and seed.
Disturbed area – high		Various	• undertake earthworks reshaping of high disturbance area. Includes cell creation and minor windrow or bund formation or removal as required. • respread topsoil onto disturbed area; and • rip and seed.
Rehabilitated areas		Various	• Will be assessed to ensure performance meets agreed completion criteria. If any areas do not meet completion criteria, they will be assessed for rehabilitation rework.

[4] To maximise the value of the available topsoil a maximum depth of 200mm is assumed across rehabilitated areas based on expected availability and machine capability. However, the intent is to optimise usage to achieve the best possible rehabilitation outcomes.

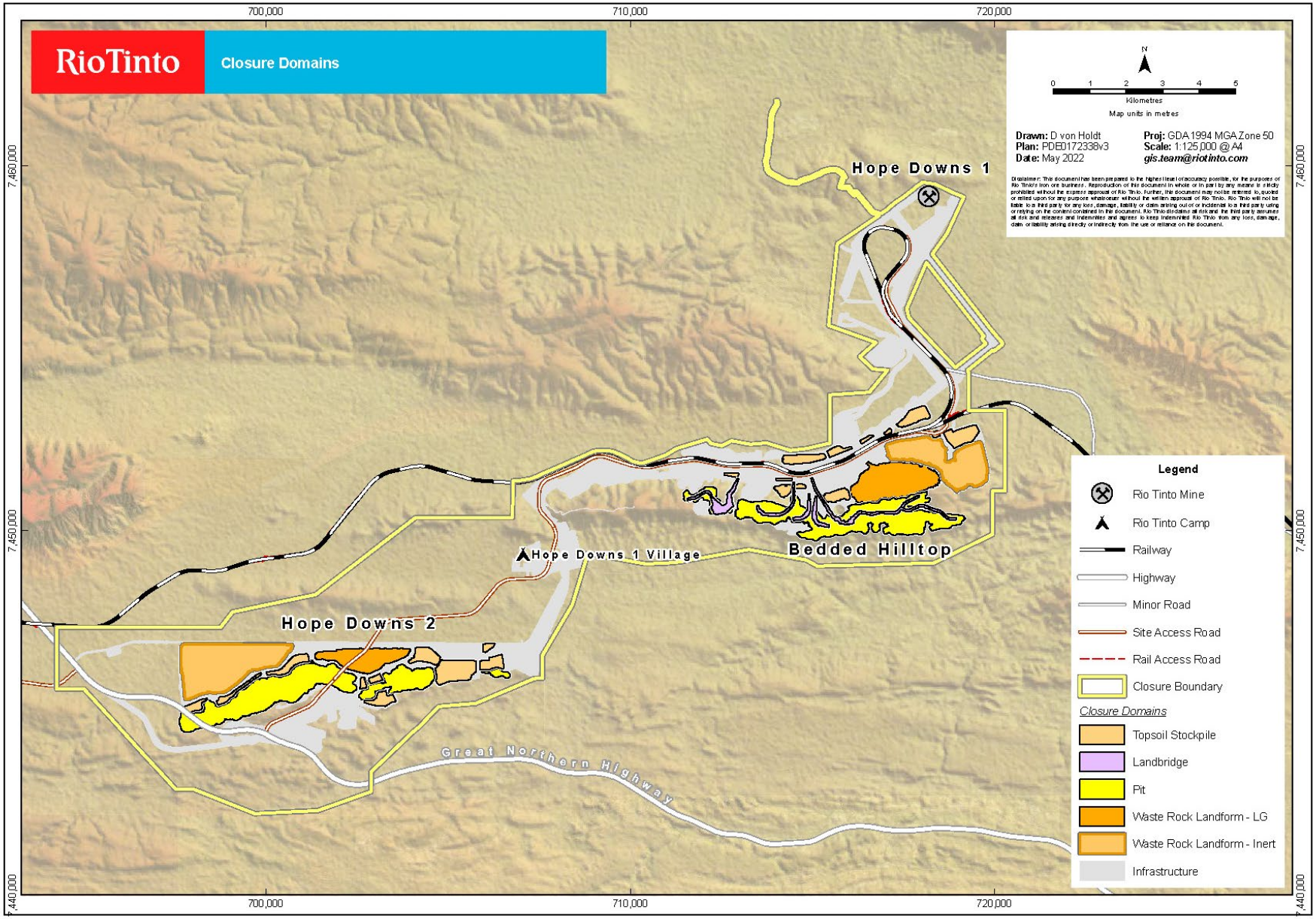


Figure 41: Closure domains

10.3 Proposed post-mining land use

The post-mining land use needs to be clearly articulated to allow for the development of specific closure outcomes, which are used in the development and formalisation of closure criteria. In accordance with the DMIRS Statutory Guidelines (DMIRS, 2020) the proposed post-mining land use should be:

- relevant to the wider regional environment.
- achievable in the context of post-mining land capability.
- acceptable to Rio Tinto stakeholders; and
- ecologically sustainable in the context of the local and regional environment.

Subject to the Native Title Determinations noted above, Traditional Owner groups continue to access and use the land the subject of the closure boundary for traditional purposes (Section 5.1), and this will be factored into post-mining land use.

Options for commercial post-mining land use are limited in the Pilbara region, with mining and pastoralism the only industries that have historically proven viable. Inland regions are sparsely populated, with the largest inland towns (such as Tom Price, Paraburdoo and Newman) established specifically to support the mining industry. Beneficial uses for the mining area (e.g., recreation or aquaculture) that might have potential in areas supported with a higher population base are unlikely to be viable.

As the current surrounding and underlying land use across the Proposal closure boundary is UCL and given the natural topography and landscape changes that will result from mining, including deep voids and constructed landforms, a pastoral post-mining land use is not considered a viable land use for the site, however closure outcomes need to consider that livestock from surrounding areas are likely to access the site inadvertently.

Rio Tinto proposes the following post-mining land use at the Proposal:

> *The site will be rehabilitated to create a safe, stable and non-polluting landscape, vegetated with native species of local provenance, that maintains environmental and cultural heritage values.*

10.4 ALUM Classification

The proposed post-mining land use for the Proposal have been developed using the Australian Land Use Management (ALUM) Classification system, which was developed by the Australian Federal Government to describe land capability and use from an agricultural perspective. Adopting an ALUM domain approach allows closure to be undertaken in such a manner that maximises the potential future land use opportunities. These post-mining land uses will not come into effect until post relinquishment.

Under the ALUM code system HD2 will have areas classified as per Table 10-2. The site will have large areas classified as ‘Class 1 - Conservation and Natural Environments’ (ALUM 1.3.4 – Rehabilitation), which is consistent with the surrounding area’s land use of UCL. Non disturbed areas will remain ALUM 1.3.3 Residual Native Cover. Areas assigned ALUM 1.3.4 (Rehabilitation), and ALUM 1.3.3 (Residual Native Cover) will remain consistent with the surrounding area’s land use of UCL, including supporting access for social and cultural activities by Traditional Owners, where possible.

A change to pastoral activity is not considered a viable post-closure land use for the mine area due to the landforms which will remain and the nature of the mining activity undertaken. The final landform will include large pit voids and waste rock landforms, which do not provide suitable range land for grazing. Abandonment bunds are proposed for construction around the pit voids and waste rock landforms to restrict inadvertent human access to these areas. Post-mining land uses, such as grazing activities, will not be suitable for some areas of the site, such as pit voids, which will be designated ‘Extractive Industry - not in use’ (ALUM 5.8.4).

The remaining landforms and disturbed areas, once rehabilitated, will be classified as Class 1 - Conservation and Natural Environments (ALUM 1.3.4). These areas will be rehabilitated to develop safe, stable, non-

polluting, self-sustaining, functioning ecosystems, but such rehabilitation will not attempt to fully restore the pre-mining environment.

As the Proposal is situated on UCL and given its proximity to WWS and Creek, the return to UCL with rehabilitated areas supporting native vegetation is the most appropriate post-mining land use. Table 10-2 and Figure 42 outlines proposed post mining land uses for the Proposal.

Table 10-2: Post-mining land uses of the Proposal

Class	Relevant domains	Anticipated outcomes
1.3.3 Residual native cover	UCL underlying areas not cleared by the operation	Residual native vegetation not cleared by the operation. Supports access for social and cultural activities by Traditional Owners, where possible.
1.3.4 Rehabilitation	Infrastructure Areas Roads, tracks and laydown areas Stockpiles (selected areas) Surface Water Management structures Waste rock landforms, landbridges and backfill	Safe, stable non-polluting landscapes vegetated with native vegetation of local provenance. Applicable to all crown land underlying low risk rehabilitation areas. Supports access for social and cultural activities by Traditional Owners, where possible.
5.8.4 Extractive industry not in use	Pit voids	Areas will be made safe and stable with access restricted to the public where required

The proposed post-mining land uses will continue to be refined as further investigations are completed and as additional consultation is held with stakeholders. Some examples of the alternative options for consideration post relinquishment include mining tourism and solar farming. Alternative land use options will continue to be investigated throughout the mine life, in consultation with local communities, Traditional Owner groups and other relevant stakeholders.

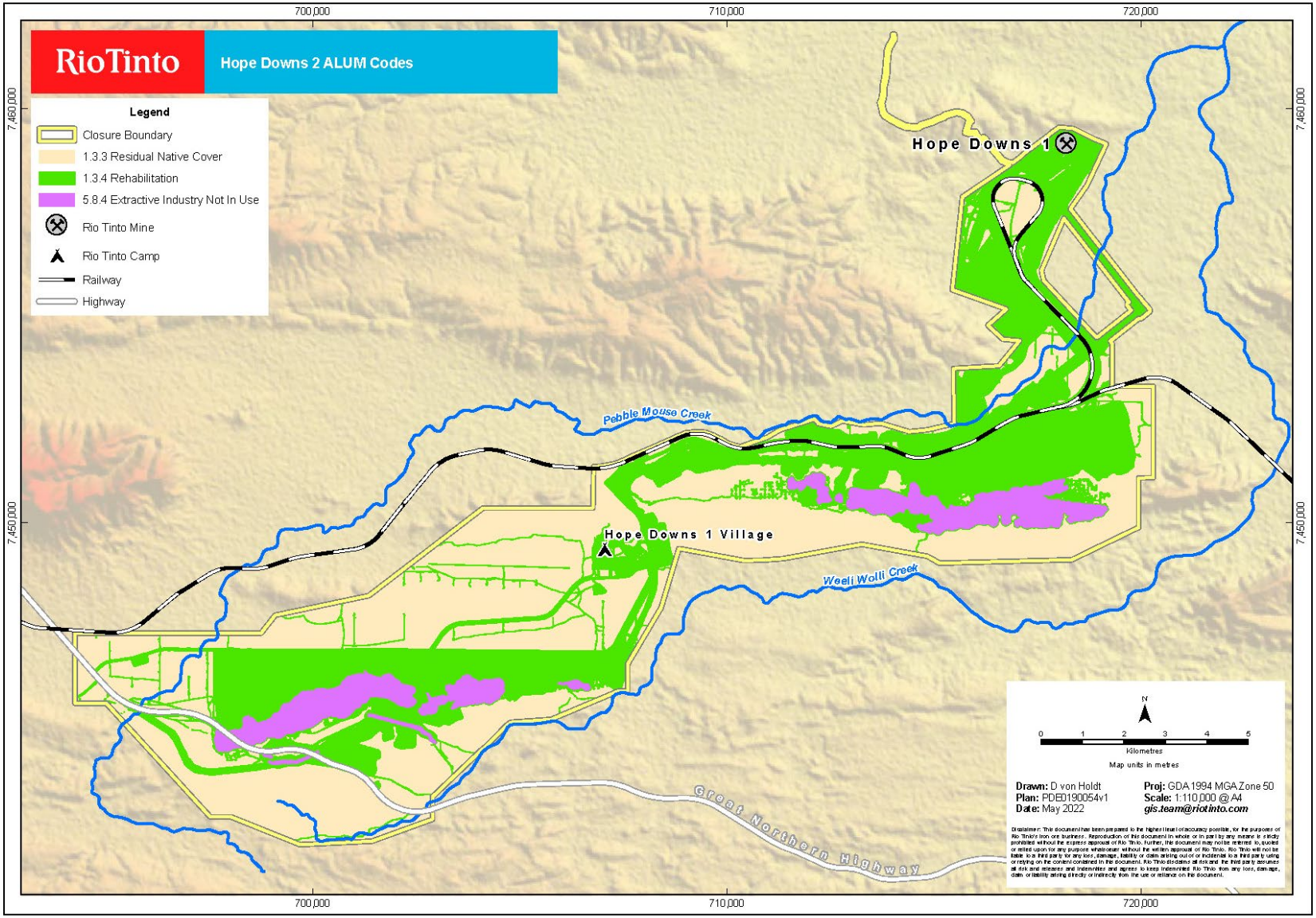


Figure 42 ALUM Codes

10.5 Closure outcomes

10.5.1 Rio Tinto vision for closure in the Pilbara

Closure outcomes have been developed with consideration of Rio Tinto's general vision for closure, which is to:

- Relinquish its mining leases to the Western Australian State Government.
- Preserve, protect and manage the social and cultural heritage values of the area in cooperation with Traditional Owners and other stakeholders.
- Develop and implement strategies for closure that consider the implications on local communities.
- Achieve completion criteria that have been developed with stakeholders and agreed with WA Government.
- Develop landforms that are safe, stable, and compatible with the surrounding environment and post-mining land use.
- Achieve environmental outcomes that are compatible with the surrounding environment.
- Implement a workforce strategy that addresses the impacts of closure on employees and contractors; and
- Achieve successful closure in a cost-effective manner.

Rio Tinto's overall goal for closure of the Proposal is to relinquish the site to the State Government. Through demonstrating that the agreed closure outcomes have been met. This will be achieved once the government and community agree that the condition of the site is compatible with an agreed post-mining land use.

Closure outcomes reflect the aspects of the MCP that government and community stakeholders agree are key to evaluating the site condition. They do not represent the full range of issues that need to be addressed upon closure; rather they represent the key outcomes against which the ability to relinquish will be assessed.

The MCP outcomes considered appropriate for the Proposal are presented in Table 10-3. Due to the early stage of the operation, these outcomes have yet to be agreed with key stakeholders and are likely to evolve in future versions of this plan as knowledge of closure issues progress and detailed closure discussions commence.

Table 10-3: Proposed Proposal closure outcomes

Number	Outcome
1	Cultural heritage values have been preserved where possible, in consultation with stakeholders.
2	Public health and safety hazards have been appropriately managed.
3	Infrastructure has been appropriately managed.
4	The final landform is stable, and its design considers hydrological and ecological factors.
5	Vegetation on rehabilitated land is self-sustaining native species and compatible with the post-mining land use.
6	Conservation significant flora and fauna habitat is not significantly impacted by closure activities.
7	Contamination risks have been appropriately managed and do not preclude the agreed post-mining land use(s).

Note that these outcomes do not represent the full range of issues that need to be addressed upon closure of the Proposal; rather they represent the key outcomes against which the ability to relinquish will be assessed.

Preliminary completion criteria and measurement tools have been drafted for each of these outcomes and are discussed further in Section 10.6.

10.6 Completion criteria

Completion criteria are defined as the indicators used to determine whether closure outcomes have been met. They are used to measure the success of closure implementation against outcomes, and to facilitate relinquishment of mining tenure.

Completion criteria (Table 10-4) have been developed in consideration of predicted closure outcomes. Measurement processes and the associated supporting data (evidence and / or metrics), that could be used to evaluate the success of closure are also described in Table 10-4.

The completion criteria are subject to ongoing review and update, informed by the outcome from studies, monitoring and ongoing stakeholder consultation. Given the number of years until scheduled closure, the completion criteria contained in this plan should be considered preliminary only. As the site approaches scheduled closure, the completion criteria will contain more measurable and time-bound parameters.

Table 10-4: Preliminary completion criteria

Outcome	Preliminary completion criteria	Verification process/method	Evidence
Cultural heritage values have been preserved where possible.	1) Safe access to sites of social and cultural significance is implemented as agreed with key stakeholders. 2) Key heritage sites have not been impacted by closure implementation where possible. 3) Closure strategies have been developed in consultation with Traditional Owner representatives. 4) The final landform has been subject to visual impact assessment.	• Designated access pathways have been identified and communicated. • Abandonment bund restriction areas are communicated. • Heritage survey confirms heritage sites of significance have not been impacted. • Stakeholder consultation. • Visual impact assessment. • Ethnographic survey and/or site inspection.	• Maps of designated access pathways. • Maps of abandonment bund locations. • Heritage survey report. • Consultation register. • Visual impact assessment report. • Survey report.
Public health and safety hazards have been appropriately managed.	1) Safety and health risks have been identified. 2) Measures to mitigate the identified public safety (and fauna where appropriate) and human health hazards have been agreed with key stakeholders and have been implemented. 3) Transfer of any residual liabilities is agreed with stakeholders.	• Risk assessment conducted and mitigation actions implemented. • Relevant stakeholders have been engaged on risk mitigation measures to be employed. • Independent audit(s)/review to confirm that hazard mitigation measures have been implemented. • Process for transfer of residual liabilities is documented.	• Risk assessment report. • Audit report to confirm effectiveness of controls. • Records of stakeholder engagement. • Liability transfer agreement/s.
Contamination risks have been appropriately managed.	1) Requirements under the *Contaminated Sites Act 2003 (*WA) have been met for the identification, recording, management, remediation and transfer of any contaminated sites as appropriate. 2) Restriction on use as defined on the Notice does not prevent the ability to conduct agreed post-mining land use(s).	• The site has been appropriately assessed for the presence of suspected or known contaminated sites. • Suspected or known contaminated sites have been appropriately reported under the *Contaminated Sites Act 2003*. • Appropriate management measures to address contamination have been implemented.	• Contaminated sites investigation report/s undertaken in accordance with the Department of Water and Environmental Regulation *Contaminated Sites Guidelines* and the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (NEPM). • Reports submitted to the Department of Water and Environmental Regulation. • Notice of Classifications.

Outcome	Preliminary completion criteria	Verification process/method	Evidence
The final landform is stable and considers hydrological factors.	1) No erosion features that compromise landform integrity are present and if present, erosion features are stable. 2) The final landform was designed and constructed with consideration given to its stability during intense rainfall and large flood events. 3) Final landforms are outside predicted potentially unstable pit edge zones.	• Rehabilitation monitoring program including quantitative evaluation of behaviour of rills and gullies (if required) over time. • Analysis of aerial imagery to provide qualitative analysis of landform stability. • Post-closure landform review to confirm that risks have been appropriately managed.	• Rehabilitation monitoring results. • Survey data assessment. • Post-closure landform evaluation report. • Analysis of aerial imagery.
Vegetation on rehabilitated land is self-sustaining and compatible with the post-mining land use.	1) Seed used in rehabilitation works is of local provenance[5]. 2) Native plants within rehabilitated areas are observed to flower and/or fruit. 3) Recruitment of native perennial plants is observed. 4) Species richness[6] of native perennial plants within rehabilitated areas is not less than reference sites. 5) Any weed species recorded within rehabilitation areas are present within the local area.	• Seed management plan • Rehabilitation monitoring / site inspections. • Analysis of historical monitoring data. • Analysis of weed species and richness within revegetation against baseline data.	• Rehabilitation closeout report (inclusive of seed list). • Rehabilitation monitoring reports.
Infrastructure has been appropriately managed.	1) Legal agreement to transfer residual liability completed (if required). 2) Where transfer of liability is not established, infrastructure has been decommissioned and removed.	• Appropriate agreements and transfer processes in place and communicated for any infrastructure remaining post-closure. • Decommissioning and demolition plan.	• Agreements in place with party assuming liability for infrastructure. • Visual inspection and close out report of decommissioning activities

[5] Note: Some seed used in rehabilitation predates accurate recording of collection area. Note 2: Local is defined as Pilbara IBRA

[6] Richness is defined as the number of different species in the defined area.

11 Closure Implementation

The closure measures identified below consider the methods used to manage key risks as discussed in the previous section.

11.1 Closure work program

The Closure Work Program, documented in Table 11-1 to Table 11-6, reflect the current level of site knowledge for each closure domain. As the site is not yet operational these Closure Work Programs are considered preliminary and will be developed over the LoM to provide detailed closure implementation requirements, final landform designs, closure strategies and progress of addressing knowledge gaps.

It is intended that the Closure Work Program for each domain will form the basis of a more detailed Decommissioning and Rehabilitation Plan which will be used for closure implementation.

The Closure Work Program for each domain presents key information relevant to each domain, including:

- domain features, status and closure date.
- post-mining land use ALUM classification.
- relevant closure design information.
- closure assumptions.
- knowledge gaps.
- preliminary closure outcomes relevant to each domain.
- closure monitoring and maintenance requirements; and
- closure strategy and key tasks for rehabilitation and closure phases.

Table 11-1: HD2 and BHT pit voids closure works program

Program Aspect	Program Summary
Domain features	Pit voids: (HD2 West, Centre, East) (BHT West, Centre, East)
Footprint (ha)	965.89
Status of domain features	Proposed
Estimated closure date	2040
Post-mining land use	5.8.4 Extractive industry not in use
Relevant preliminary closure outcomes	• Public health and safety hazards have been appropriately managed. • Cultural heritage values have been preserved where possible, in consultation with stakeholders.

Program Aspect	Program Summary

Specific closure assumptions	• Undertake opportunistic backfill during operations or post-closure to:
	  ○ minimise the volume of waste remaining in waste rock landforms; and/or
	  ○ manage highly erodible material.
	• Prior to final closure, appropriate evaluation and implementation of measures to restrict inadvertent public access.
	• Hd2_west pit may be partially backfilled with mine waste to facilitate the realignment (to the original location) of the GNH.
	• In-pit areas, including pit walls and floors, will not be rehabilitated, unless in-pit backfill is within 10 m of the natural ground level.
	• Abandonment bund will be constructed during operations, using competent NAF mineral waste.
	• All permanent ex-pit mining landforms will be located outside the PUPEZ.
	• Prior to final closure, appropriate evaluation and implementation of measures to restrict public access will be undertaken.

Landform design	• Indicative locations of abandonment bunds and WDs / LG stockpiles, based on the current mine plan, are presented in Figure 4.
Knowledge gaps	• Abandonment bund location / design requires consideration of opportunities to tie-in to natural topography or WDs; intersection with flood inundation zones under a 1:1000 AEP (as a minimum); and site access requirements for Traditional Owners. • Progressive operational backfilling opportunities to be. • PUPEZ associated with final pit voids, abandonment bund locations and surface water management implications. • Inventory of rehabilitation materials (low erodibility waste) to be utilised for capping and abandonment bunding where required.
Closure and rehabilitation materials required	• Competent NAF mineral waste for abandonment bund.
Closure monitoring and maintenance	• Access assessment. • Geotechnical monitoring. • Assessment of abandonment bund.
Closure Strategy – key tasks	
Progressive rehabilitation and closure activities	• Large, deep voids likely to remain at closure • Construction of abandonment bund as per DoIR 1997 guidelines
Decommissioning and closure	• Removal of rubbish and remaining infrastructure. • Final closure of abandonment bund and pit ramp. • Installation of signage, if required. • Monitoring / assessment as required.
Premature closure	• Access to pit made safe by construction of abandonment bund (where required) and blocking pit ramps. • Monitoring and maintenance program revised and implemented.

Table 11-2: HD2 and BHT waste landform closure works program

Program aspect	Program summary
Domain features	• Waste rock landforms: HD2DP_NW (Goanna), • Low-grade stockpiles: HD2 DP_NC (Tortoise) • BHT Landbridge/s
Footprint (ha)	965.89, 62.88
Status of domain features	Proposed
Estimated closure date	2040
Post-mining land use	1.3.4 Rehabilitation
Relevant preliminary closure outcomes	• The final landform is stable, and its design considers hydrological and ecological factors. • Vegetation on rehabilitated land is self-sustaining and compatible with the post-mining land use. • Cultural heritage values have been preserved where possible, in consultation with stakeholders.
Specific closure assumptions	• All waste landforms are NAF and have a low risk of metalliferous drainage. • Greater than 50% of mineral waste is predicted to be high erodibility. • LG stockpiles may be processed during the LoM, however, if any remain at closure they will be rehabilitated as per WRLs. • Waste rock landforms will be located outside the PUPEZ and 1:1,000 AEP flood inundation zone of PMC. • Waste landforms will be constructed in accordance with RTIO design criteria and rehabilitated in accordance with RTIO standards and procedures. • Progressive rehabilitation of waste landforms will occur during operations where possible. • Landbridge's will be modified or removed to reinstate natural surface water flow. • Landbridges not removed at closure will be rehabilitated as per Waste Rock Landform requirements.
Landform design	Conceptual closure landform design is presented in Section11.2.
Knowledge gaps	• Erodibility of HD2 mineral waste. • Soil inventory and topsoil recovery strategy and volumes.
Rehabilitation materials required	• Topsoil for use as growth medium.
Closure monitoring and maintenance	• Post-closure landform stability monitoring • Erosion maintenance • Revegetation monitoring
Closure strategy – key tasks	
Progressive rehabilitation and closure activities	• Opportunistic progressive pit backfilling during operations may be undertaken to reduce volume of ex-pit waste landforms • Implementation of progressive rehabilitation during operations as per RTIO standards and procedures
Decommissioning and closure	• Removal of rubbish and mining infrastructure. • Re-profile batter slopes to closure design criteria. • Construct toe bunds and safety berms to design criteria. • Spread topsoil on all slopes and flat surfaces, rip and seed.
Premature closure	• Closure outcomes and completion criteria revised.

	• Revised materials rehabilitation inventory. • Closure designs and provision revised and updated as required. • Implementation of revised rehabilitation and closure works as appropriate. • Monitoring and maintenance program revised and implemented.

Table 11-3: HD2 (HD1) and BHT processing infrastructure closure works program

Note – Proposal is utilising HD1 existing Crushers and associated infrastructure. The liability for closure of these pieces of infrastructure will be transferred to the MCP once the Proposal is approved.

Program aspect	Program summary
Domain features	Conveyor between BHT and HD1, Transfer pads, haulage roads and laydown areas
Footprint (ha)	Included in infrastructure footprint - 2932.14
Status of domain features	Proposed
Estimated closure date	2040
Post-mining land use	1.3.4 Rehabilitation
Relevant preliminary closure outcomes	• Public health and safety hazards have been appropriately managed. • Infrastructure has been appropriately managed. • Contamination risks have been appropriately managed and do not preclude the agreed post-mining land use(s). • Vegetation on rehabilitated land is self-sustaining and compatible with the post-mining land use. • Cultural heritage values have been preserved where possible, in consultation with stakeholders.
Specific closure assumptions	• All recoverable ore has been processed. • Unless transfer to an agreed third party, decommissioning and disposal of processing infrastructure will occur. • Chemicals and hazardous materials are appropriately removed and managed prior to decommissioning phase. • Processing infrastructure will be decommissioned, removed and disturbance rehabilitated. • Removal of below-ground infrastructure will occur to a depth of 1 m • Infrastructure will be salvaged, recycled or buried on-site as appropriate.
Landform design	• Conceptual landscape design will be included as information becomes available for revised versions of the MCP.
Knowledge gaps	• Third party transfer or sale of non-processing infrastructure. • Contaminated sites investigation at closure. • Soil inventory and topsoil recovery strategy and volumes.
Rehabilitation materials required	• Topsoil
Closure monitoring and maintenance	• Erosion monitoring • Revegetation monitoring
Closure strategy – key tasks	
Progressive rehabilitation and closure activities	• Implementation of progressive decommissioning and rehabilitation during operations as per Rio Tinto standards and procedures.
Decommissioning and closure	• Retain or remove infrastructure in accordance with State Agreement Act requirements and stakeholder engagement. • Drain pipelines and remove hazardous materials in accordance with Controlled Waste Regulations. • Where infrastructure is removed, reinstate drainage lines where appropriate.

	• Undertake contaminated sites assessment and remediation measures, if required. • Dispose of inert materials that are not retained, reused or recycled in an inert landfill area (may be a used pit area). • Spread topsoil, rip and seed
Premature closure	• Closure outcomes and completion criteria revised. • Revised materials rehabilitation inventory. • Closure designs and provision revised and updated as required. • Implementation of revised rehabilitation and closure works as appropriate. • Monitoring and maintenance program revised and implemented.

Table 11-4: HD2 and BHT non-processing infrastructure closure works program

Program aspect	Program summary
Domain features	Vehicle workshops and fixed plant workshops, hydrocarbon storage areas, ANFO facilities, laydown areas, turkey's nests, transfer pads, roads, offices. camps, fuel facilities and associated disturbances.
Footprint (ha)	Included in infrastructure footprint - 2932.14
Status of domain features	Proposed
Estimated closure date	Final closure 2040
Post-mining land use	1.3.4 Rehabilitation
Relevant preliminary closure outcomes	• Public health and safety hazards have been appropriately managed. • Infrastructure has been appropriately managed. • Contamination risks have been appropriately managed and do not preclude the agreed post-mining land use(s). • Vegetation on rehabilitated land is self-sustaining and compatible with the post-mining land use. • Cultural heritage values have been preserved where possible, in consultation with stakeholders.
Specific closure assumptions	• Unless transfer to an agreed third party, decommission and rehabilitation of infrastructure will occur.
Landform design	Conceptual final landform design for this domain is not currently available and will be prepared and provided in revised versions of this MCP.
Knowledge gaps	• Third party transfer or sale of non-processing infrastructure. • Contaminated sites investigation at closure. • Soil inventory and topsoil recovery strategy and volumes.
Rehabilitation materials required	• Topsoil
Closure monitoring and maintenance	• Erosion monitoring • Revegetation monitoring
Closure strategy – key tasks	
Progressive rehabilitation and closure activities	• Implementation of progressive rehabilitation during operations as per RTIO standards and procedures.
Decommissioning and closure	• Retain or remove infrastructure in accordance with State Agreement Act requirements and stakeholder engagement. • Drain pipelines and remove hazardous materials in accordance with Controlled Waste Regulations. • Where infrastructure is removed, reinstate drainage lines where appropriate.

	• Undertake contaminated sites assessment and remediation measures, if required. • Dispose of inert materials that are not retained, reused or recycled in an inert landfill area (may be a used pit area). • Spread topsoil, rip and seed
Premature closure	• Closure outcomes and completion criteria revised. • Revised materials rehabilitation inventory. • Closure designs and provision revised and updated as required. • Implementation of revised rehabilitation and closure works as appropriate. • Monitoring and maintenance program revised and implemented.

Table 11-5: Linear infrastructure closure works program

Note - Rail: utilised from the Hope Downs 1 operations. The liability for closure of this infrastructure will be transferred to the MCP once the Proposal is approved.

Program aspect	Program summary
Domain features	Powerlines, pipelines, communications cable (as required).
Footprint (ha)	Included in infrastructure footprint - 2932.14
Status of domain features	Proposed
Estimated closure date	2040
Post-mining land use	1.3.4 Rehabilitation
Relevant preliminary closure outcomes	• Public health and safety hazards have been appropriately managed. • Infrastructure has been appropriately managed. • Contamination risks have been appropriately managed and do not preclude the agreed post-mining land use(s). • Vegetation on rehabilitated land is self-sustaining and compatible with the post-mining land use. • Cultural heritage values have been preserved where possible, in consultation with stakeholders.
Specific closure assumptions	• Unless transfer to an agreed third party, decommissioning and rehabilitation of infrastructure will occur.
Landform design	Conceptual final landform design for this domain will be prepared and provided in revised versions of this MCP.
Knowledge gaps	• Contaminated sites investigation at closure. • Soil inventory and topsoil recovery strategy and volumes. Soil inventory and topsoil recovery strategy and volumes. • Management plan for the section of rail that intercepts the WAMA to be developed for closure.
Rehabilitation materials required	• Topsoil • Cover materials if / as required.
Closure monitoring and maintenance	• Erosion monitoring • Revegetation monitoring
Closure strategy – key tasks	
Progressive rehabilitation and closure activities	• Implementation of progressive rehabilitation during operations as per Rio Tinto standards and procedures.
Decommissioning and closure	• Retain or remove infrastructure in accordance with State Agreement requirements and stakeholder engagement. • Undertake contaminated sites assessment and remediation measures, if required.

	• Where infrastructure requires removal, remove all structures and footings that are above surface or within 1m of the final land surface. • Drain pipelines and remove hazardous materials in accordance with Controlled Waste Regulations. • Where infrastructure is removed, reinstate drainage lines where appropriate. • Actively seek reuse and recycling opportunities for decommissioned infrastructure. • Dispose of inert materials that are not retained, reused or recycled in an inert landfill area (may be a used pit area). • Spread topsoil, rip and seed.
Premature closure	• Closure outcomes and completion criteria revised. • Revised materials rehabilitation inventory. • Closure designs and provision revised and updated as required. • Implementation of revised rehabilitation and closure works as appropriate. • Monitoring and maintenance program revised and implemented

Table 11-6: Roads and other disturbance closure works program

Program aspect	Program summary
Domain features	• Topsoil stockpiles: HD2: TS1, TS2, TS3, TS4, TS5, TS6, TS7, TS8. • Topsoil stockpiles: BHT: TS1, TS2, TS3, TS4, TS5, TS6, TS7, TS8, TS9, TS10. • Subsoil stockpiles HD2: SS1. • Subsoil stockpiles BHT: SS1, SS2.
Footprint (ha)	• Included in infrastructure footprint - 2932.14
Status of domain features	• Haul roads, roads, tracks: proposed • Borrow pits and laydowns: proposed • PMC diversion drain and levee: proposed • Topsoil and subsoil stockpiles: stockpiling proposed
Estimated closure date	2040
Post-mining land use	1.3.4 Rehabilitation
Relevant preliminary closure outcomes	• Vegetation on rehabilitated land is self-sustaining and compatible with the post-mining land use. • Cultural heritage values have been preserved where possible, in consultation with stakeholders.
Specific closure assumptions	• Linear infrastructure will be rehabilitated unless ownership is transferred to a third party. • Disturbance will be rehabilitated to according to relevant Rio Tinto standards and procedures.
Landform design	Conceptual final landform design will be presented in revised versions of the MCP as available.
Knowledge gaps	• Resolution is required regarding retention of linear infrastructure. • Soil inventory and topsoil recovery strategy and volumes. Soil inventory and topsoil recovery strategy and volumes.
Rehabilitation materials required	• Topsoil
Closure monitoring and maintenance	• Erosion monitoring • Revegetation monitoring
Closure strategy – key tasks	

Progressive rehabilitation and closure activities	• Implementation of progressive rehabilitation during operations as per Rio Tinto standards and procedures.
Decommissioning and closure	• Retain or remove infrastructure in accordance with State Agreement requirements and stakeholder engagement. • Undertake contaminated sites assessment and remediation measures, if required. • Where infrastructure requires removal, remove all structures and footings that are above surface or within 1m of the final land surface. • Where linear infrastructure is removed, reinstate drainage lines where appropriate. • Actively seek reuse and recycling opportunities for decommissioned infrastructure. • Dispose of inert materials that are not retained, reused or recycled in an inert landfill area (may be a borrow pit, or mined pit area); and • Spread topsoil, rip and seed.
Premature closure	• Closure outcomes and completion criteria revised. • Revised materials rehabilitation inventory. • Closure designs and provision revised and updated as required. • Implementation of revised rehabilitation and closure works as appropriate. • Monitoring and maintenance program revised and implemented.

11.2 Closure landscape

The post-closure landform is the final expected landform at the completion of the closure measures outlined in Section 11.1. A conceptual image of landforms at the end of mining and post-closure for the Proposal is included in Figure 43 through to Figure 46. This landscape is likely to change as the Proposal commences construction and moves into the operational phase, and in response to regulator and stakeholder feedback on the proposed closure strategies within this MCP. Updates will be presented in each future iteration of this MCP in consultation with key stakeholders.

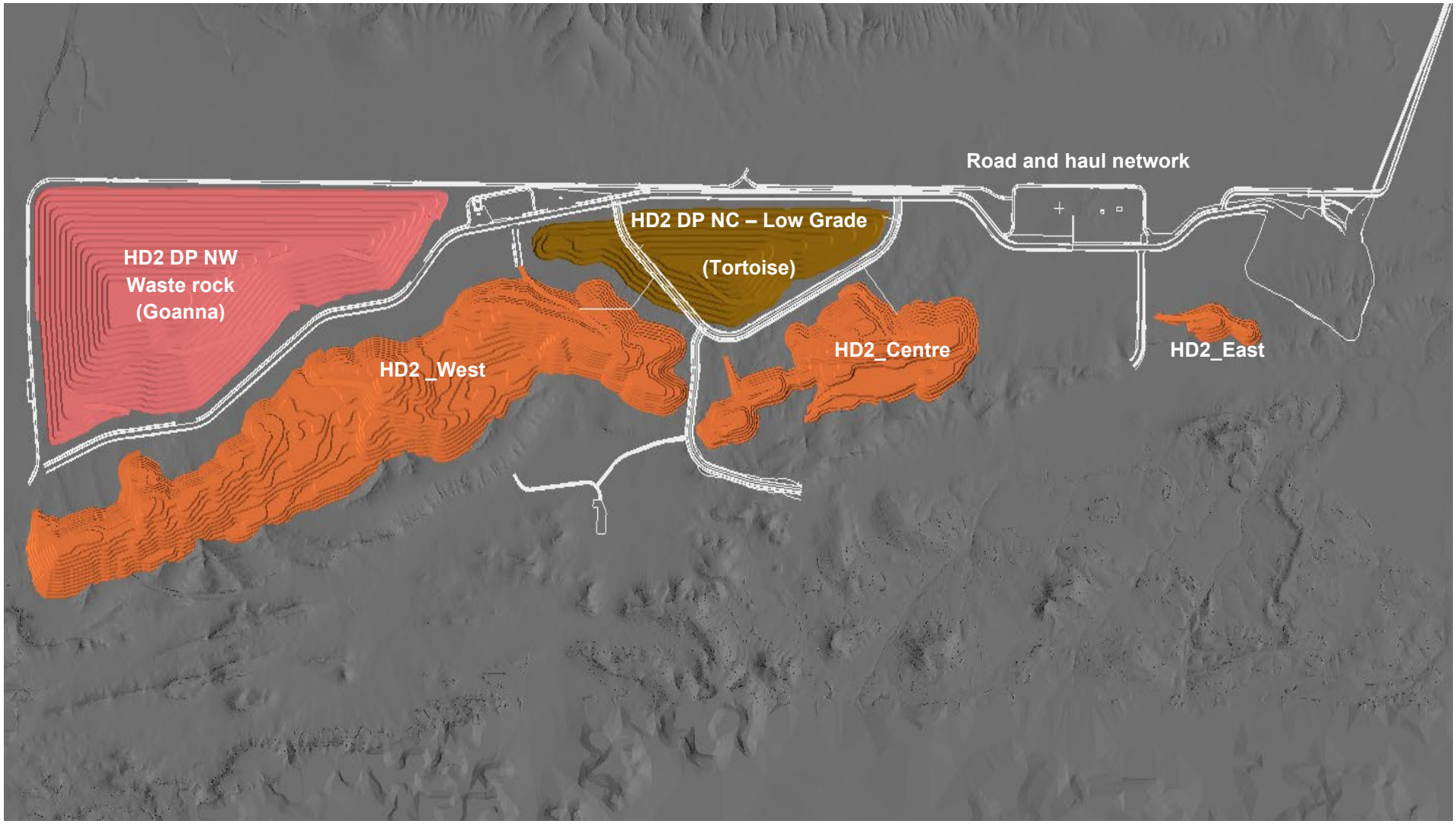


Figure 43: Conceptual layout of the HD2 deposit at completion of mining (mineral waste in pink, low grade material in brown, pits in orange)

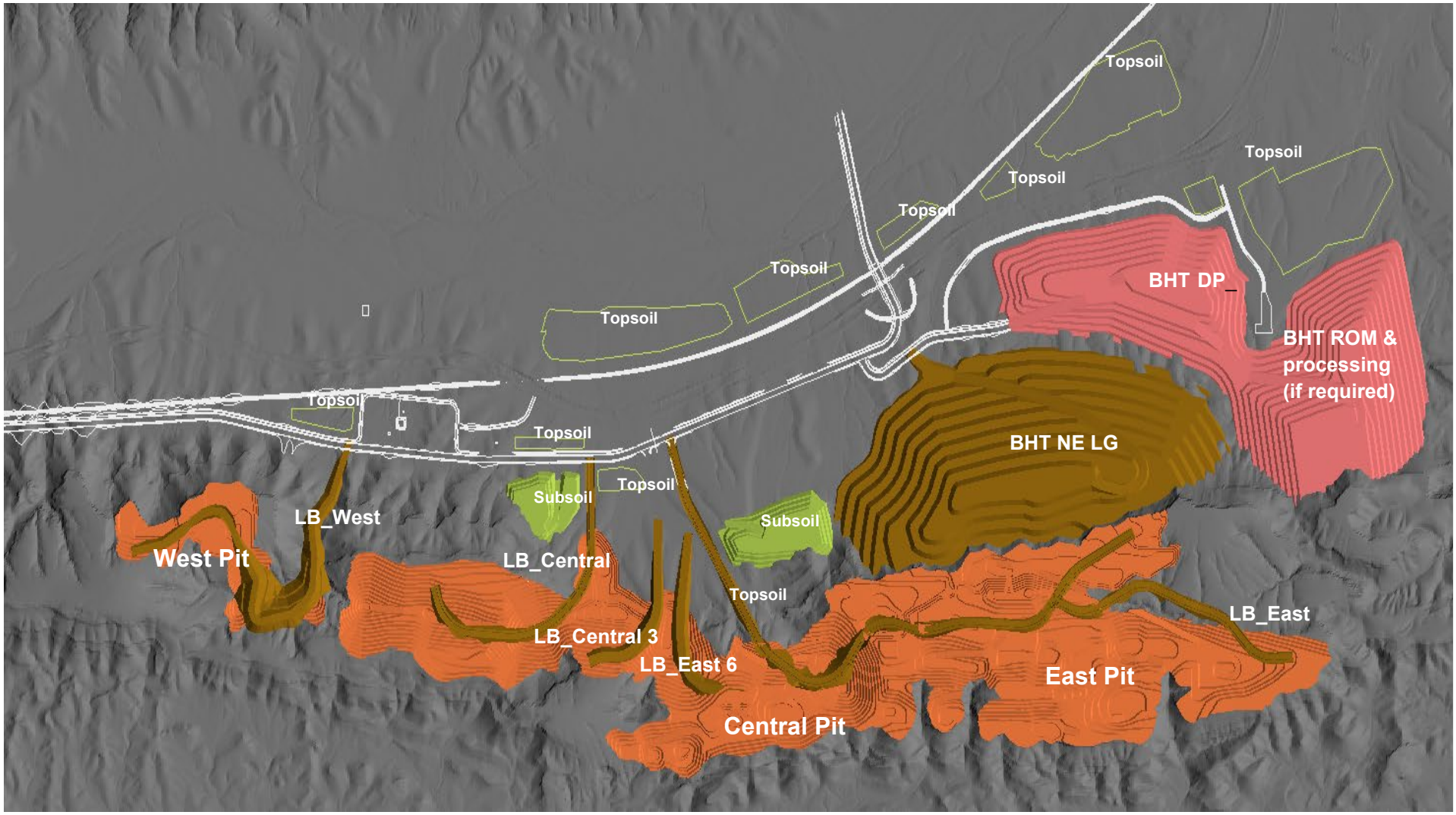


Figure 44: Conceptual layout of BHT deposit at completion of mining (mineral waste in pink, low grade material in brown, pits in orange)

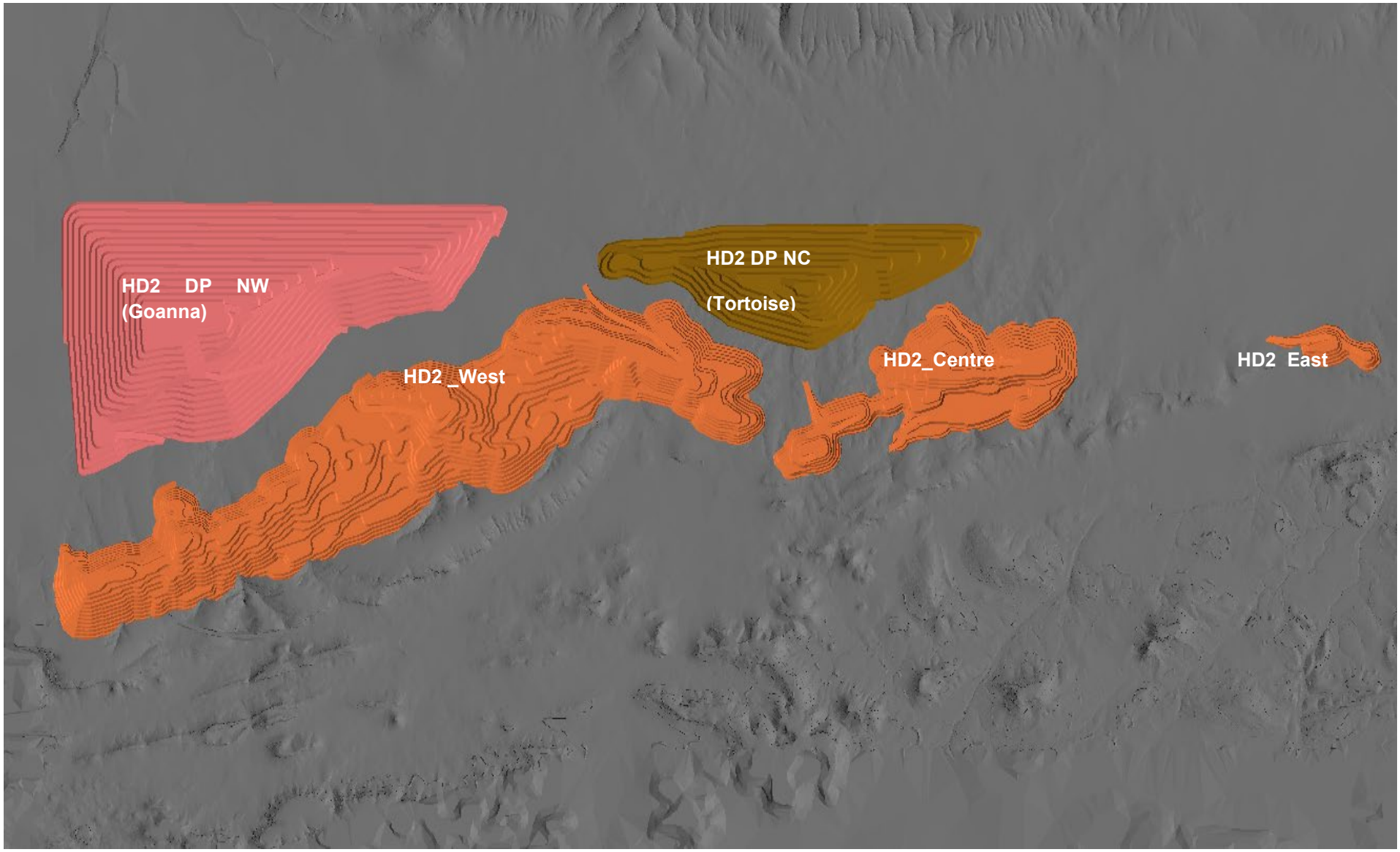


Figure 45: Conceptual layout of HD2 deposit at completion of rehabilitation activities (mineral waste in pink, low grade material in brown, pits in orange)

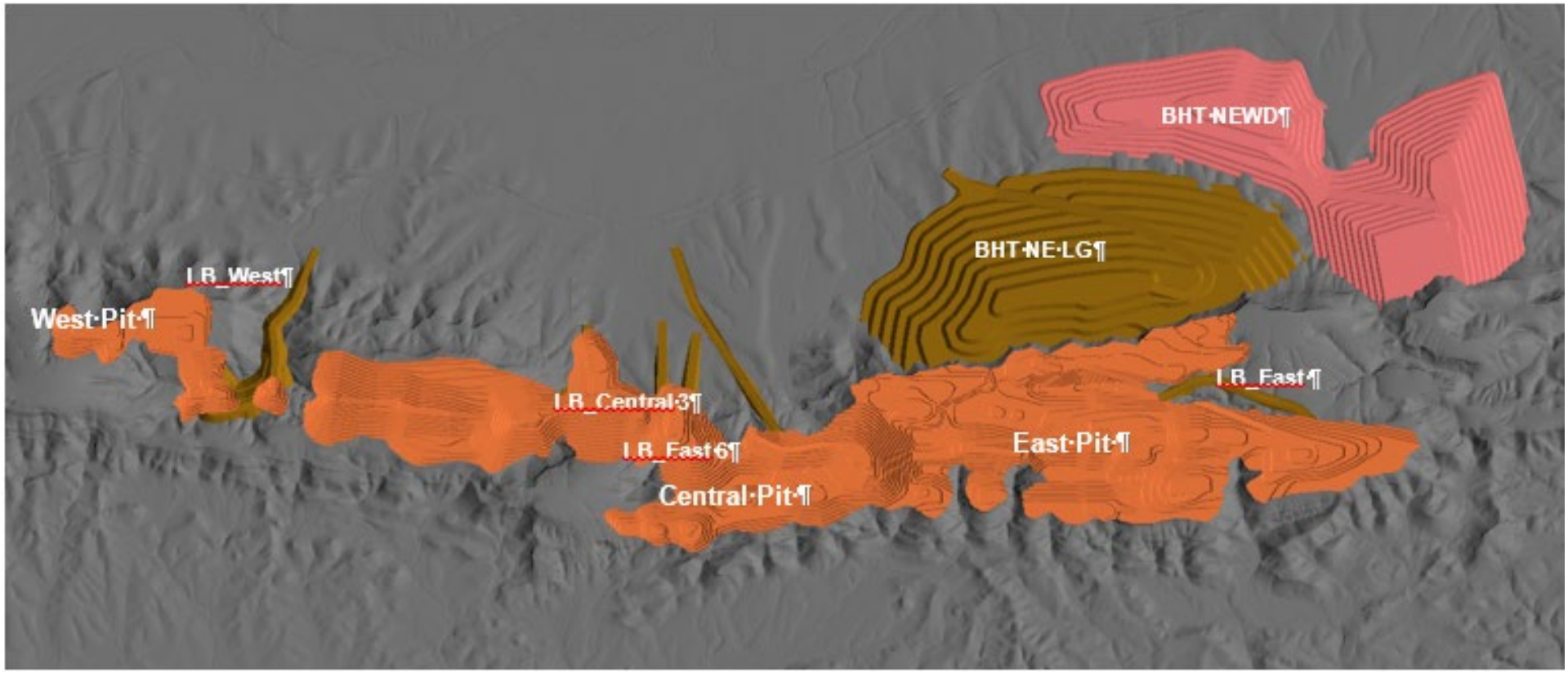


Figure 46: **Conceptual layout of BHT deposit at completion of rehabilitation activities (mineral waste in pink, low grade material in brown, pits in orange). Note – Only landbridges outside the pit areas will remain at closure.**

11.3 Progressive rehabilitation

As operations have not commenced for the Proposal, opportunities for progressive rehabilitation have not presented themselves to date. The mining sequence and short mine life will require that most waste rock landforms are in use until closure. However, tracks, borrow pits and other disturbance areas will be progressively rehabilitated in alignment with rehabilitation planning processes.

11.3.1 Rehabilitation planning

Rio Tinto has formal processes for identifying areas which are no longer required for operational activity and are therefore available for rehabilitation. However, mine plans are dynamic and subject to continuous revision, and rehabilitation may need to be re-disturbed for mining or operational use. Progressive rehabilitation opportunities are reassessed regularly as part of the planning process.

Rehabilitation is classified based on the extent of disturbance, or high, moderate, or low disturbance, Rehabilitation classifications are based on the closure domains and will be presented in progressive rehabilitation performance reporting in future iterations of the Proposal MCP. These classifications are broken down in the following subsections.

11.3.1.1 Low impact disturbance areas

Areas where vegetation has been cleared and there has been minimal disturbance to the soil profile are classified as low impact disturbance areas; examples include laydown areas, linear infrastructure (pipelines, tracks etc.), topsoil stockpile footprints and exploration disturbance. Rehabilitation of such areas involves spreading of topsoil where available and ripping of the area to relieve compaction. Seeding may occur if topsoil is not available.

11.3.1.2 Moderate impact disturbance areas

Areas requiring minor earthworks to either return the area to natural relief or create a compatible landform consistent with the surrounding natural relief and topography are classified as moderate impact disturbance areas. Examples of moderate impact areas include airstrips, buildings, infrastructure, mine roads and borrow pits. Typically, rehabilitation of such areas involves re-contouring, application of topsoil, ripping, and sometimes seeding.

11.3.1.3 High impact disturbance areas

High impact disturbance areas require extensive earthworks to either return them to natural relief or create a compatible landform consistent with the surrounding landforms and topography. Typically, such areas contain concrete footings that require cracking and covering with fill, voids that need to be filled with waste rock, and significant reshaping and contouring to create the required relief. Examples include accommodation camps, fuel farm facilities, haul roads, bridges, dams, power stations and processing plants. Constructed landforms, such as waste rock landforms and waste fines storage facilities, are also highly disturbed areas that require significant earthworks to achieve stable rehabilitation designs.

11.3.2 Rehabilitation implementation

Rehabilitation is conducted in accordance with the *Rio Tinto Iron Ore Rehabilitation Handbook* (2016) which is reviewed and updated periodically to reflect changes in industry standards, reflect new knowledge obtained through research and development, and to adopt learnings from ongoing rehabilitation projects. The Handbook addresses:

- soil resource management;
- rehabilitation techniques;
- local provenance species seeding practices; and
- Records, data management and on-going monitoring.

11.3.3 Seeding practices

Locally collected seed is required to assist in revegetation and the creation of a self-sustaining ecosystem as the viability of the seedbank within stockpiled topsoil deteriorates. In addition, the stockpiled topsoil may not contain the seeds of all the target species of its new location / habitat.

Seed mixes for rehabilitation are of local provenance, which for the Proposal is defined as 200km and within the same IBRA subregion. Specific seed mixes are selected to provide a range of species taking into consideration landscape position and slope. In areas where erosion risks are identified, seed mixes may be modified to include or increase the portion of species that provide rapid cover.

Rio Tinto purchases seeds from commercial seed suppliers, with emphasis on ensuring that these are appropriate local provenance species. Seeds are stored in purpose-built, climate-controlled storage facilities to maximise long term viability.

The inclusion of rare and threatened flora species in rehabilitation programmes is limited by the following factors:

- habitat preference - preference for drainage lines, gullies, calcretes or other habitat not suitable or similar to those likely to be present in the rehabilitation landscapes.
- abundance - very few populations or small populations from which to source seed.
- difficult taxonomy / unresolved taxonomy issues and thus status of species highly uncertain.
- growth form - e.g., short-lived annual species with preference for growth under woodland canopies.
- seed production - some species do not regularly produce seed.
- propagation methods - some species are not able to germinate from seed and cuttings are required which is not a suitable method for broad scale application in an arid environment.
- availability of seed at the time when rehabilitation occurs; and/or
- seed dormancy.

Given these issues, the focus of rehabilitation programs is to restore vegetation complexes that include the more common species present in the habitat type, and to achieve a diverse range of strata. Seed mixes may include species of conservation significance if they are available, but presence of these species in rehabilitation areas is more likely to result from natural recruitment from surrounding areas.

11.3.4 Local reference sites

Reference sites are used when assessing the progress of rehabilitation works carried out at Rio Tinto's Pilbara mine sites. Reference sites are usually representative of the 'natural' undisturbed landscape surrounding the mine site or rehabilitated area. Such sites should consist of the target vegetation community and terrain and provide an example of what the rehabilitated area may achieve over time. Reference site data also assists in planning further rehabilitation programmes i.e., seed lists, and in the development of completion criteria. Reference sites will be installed at HD2 in a variety of locations to represent key current and future landform types and across the range of site vegetation types and structures. The reference sites will be chosen strategically to achieve both good representation as well as to remain in areas least likely to be disturbed and will be presented in the next revision of the MCP. Appropriate rehabilitation monitoring reference sites will be established as the rehabilitation and monitoring programs develop for HD2.

11.4 Rehabilitation performance

As operations have not commenced at the Proposal opportunities for progressive rehabilitation have not presented themselves to date, however some progressive rehabilitation has been undertaken to date associated with exploration activities (Figure 47). Rio Tinto has extensive experience in rehabilitating similar landforms to those expected to be present in the post-mining landscape at the Proposal across the Pilbara, including at the nearby and analogous HD1 and HD4 operations. A summary of progressive rehabilitation performance at HD1 is provided below with additional information on rehabilitation activities at HD4.

Progressive rehabilitation has taken place at other Rio Tinto sites in the Pilbara and selected areas are detailed in Section 11.3, these areas have some contextual similarities to the Proposal and learnings will be transferred where applicable.

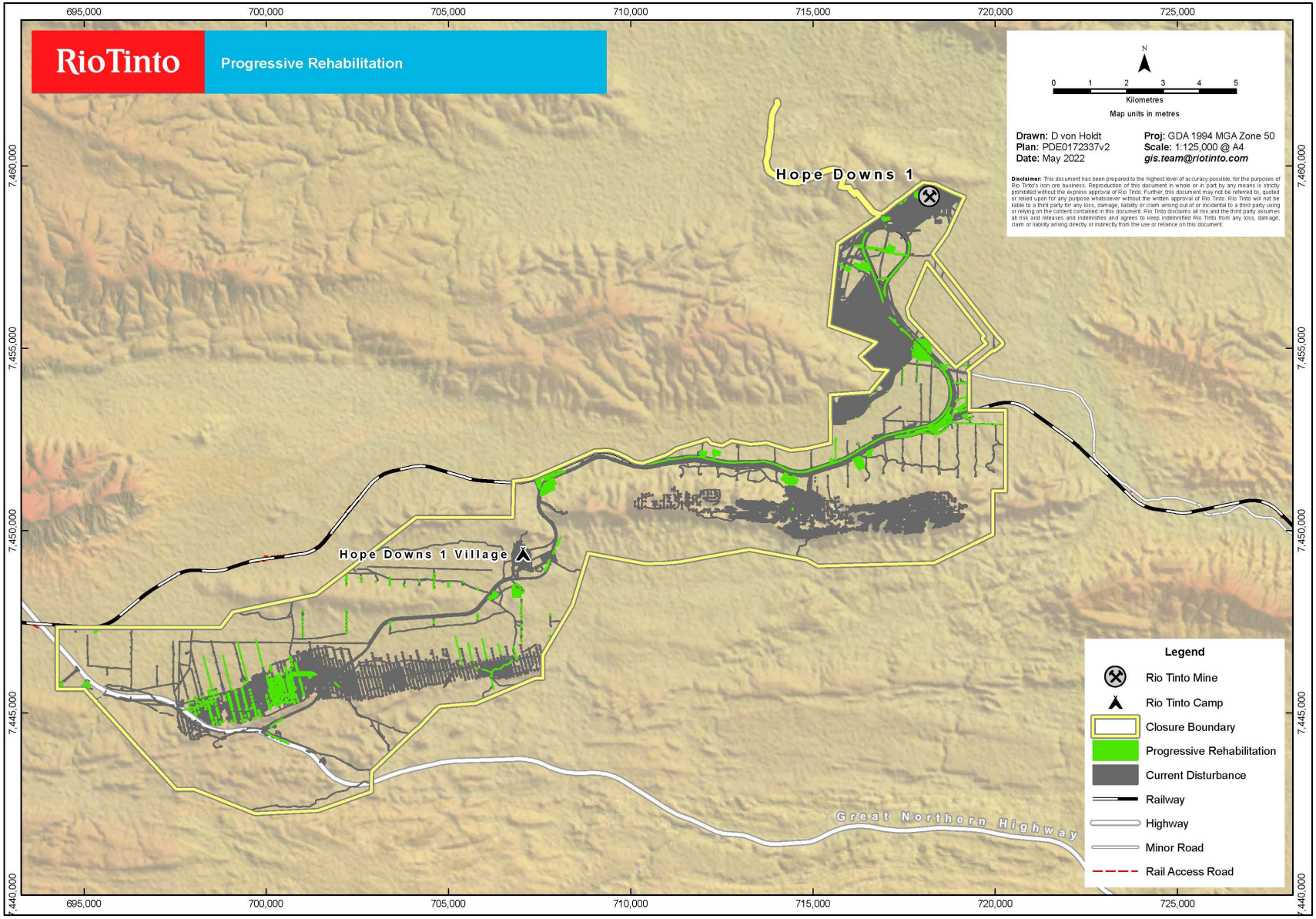


Figure 47: Progressive rehabilitation

11.4.1 HD1 Borrow pits

At the HD1 operation, an area of approximately 144 ha has been rehabilitated to date, these areas include borrow pits, old landfill and service pads.

Rehabilitation of borrow pits located around HD1 was undertaken in 2007. A monitoring program based on 51 monitoring points was established across the rehabilitated borrow pits in 2010.

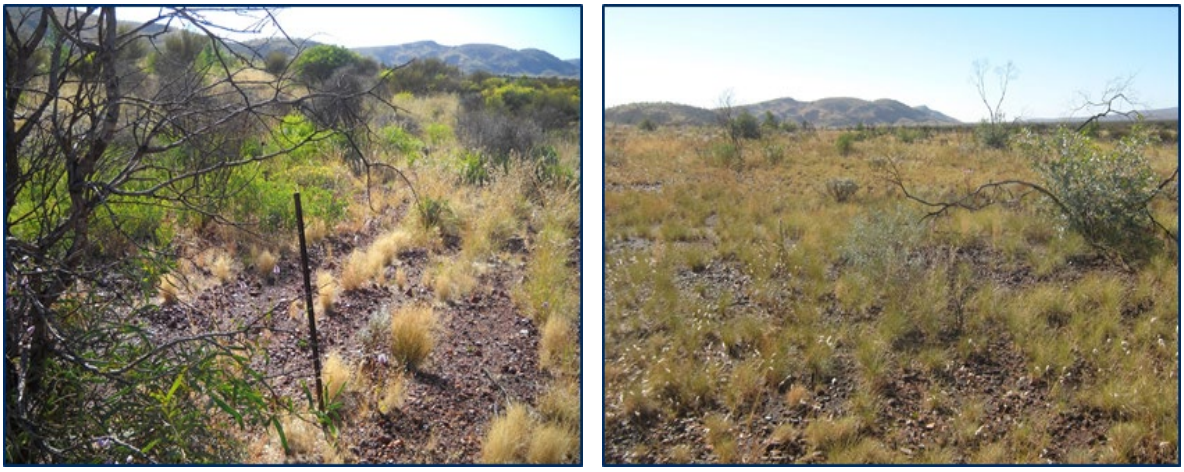


Figure 48: HD1 Borrow Pit rehabilitation outcomes (left) and control areas (right)

Results from annual rehabilitation monitoring indicate that all except two borrow pit sites are stable, erosion has been noted at the two exceptions. Vegetation at the sites appears to be in good condition. Plant species number and perennial plant density have increased, and the overall canopy cover has increased at most sites. Data analysis shows that many of the rehabilitated sites compare favourably with reference sites in terms of plant abundance and species composition. Sites rehabilitated by installation of topsoil only were found to have higher number of species in comparison to some reference sites. It is thought this could be the result of viable seeds in the topsoil seedbank and natural re-colonisation from neighbouring vegetation communities.

Based on monitoring data, it can be inferred that in general the vegetation of the rehabilitated borrow pit sites is well established with the number of species expected to increase over time through natural re-colonisation from surrounding areas (Figure 48).

11.4.2 Old landfill and service pads

Two sites at HD1 extend over the Old Landfill and Service Pad sites that were rehabilitated in 2013 and first monitored in 2014. Both sites appear stable, although some breaks in the bank at the Old Landfill have been noted. The Old Landfill site was rehabilitated using topsoil and the introduction of seeds at 4.95 kg/ha. The survey data show that the Old Landfill site is still in an early stage of establishment with a low plant cover. However, due to the wide range of seeds in the uppermost soil layer, seedlings from diverse species have been observed. It was also noted that cattle grazing was impacting native grasses (Figure 49).

Vegetation at the Service Pad site is relatively well established with a good species diversity and abundance despite being recently rehabilitated (Figure 50). This outcome has been attributed to the area having only been partially cleared, facilitating re-colonisation from adjacent vegetation.



Figure 49: HD1 Landfill rehabilitation outcomes (2014 and 2017)



Figure 50: HD1 service pad rehabilitation outcomes (2014 and 2017)

Weeds are absent at both sites, but there is a risk the presence of cattle may lead to the spread of invasive plant species to the Old Landfill.

Overall, species composition and extent of bare areas at both the Old Landfill and Service Pad sites were comparable with most reference sites. Species abundance and perennial cover are expected to increase over time as no major threats to the establishment of the native vegetation have been recorded.

11.4.3 Tom Price Marra Mamba East

Rehabilitation success across the Pilbara has been variable, with well-developed vegetative systems observed in some areas, and limited rehabilitation outcomes in others. Rehabilitation techniques have improved markedly over the last decade, and learnings from landform configuration improvements, usage of growth media and seeding have been incorporated into more recent rehabilitation projects.

Rehabilitation sites completed recently which are similar to conceptual dumps at the Proposal include Marra Mamba East (MME) waste rock landform at Tom Price and the Brockman 2 Pit 6 waste rock landform. Both rehabilitation areas contained non-polluting waste types of a similar character to the majority waste makeup of waste rock landforms in the Proposal and the outcomes of these projects can be applied to landforms at the Proposal.

The MME waste rock landform at Tom Price was rehabilitated in 2018 to a 5 m lift, 18 linear degree slope angle and 10 m berm configuration (Figure 51). The majority material types within the dump were highly erodible West Angelas Shale members interspersed with some blocky BIF material. Rock capping was also used on one batter slope of the rehabilitated landform to provide additional protection for a significant cultural site present close to the toe of the final landform. Topsoil was not applied to the rehabilitated slope due to low quantities available at Tom Price Operation, and in effect this project is a trial to determine how

successful vegetation growth would be in the absence of topsoil. Appropriately treated seed was applied at a rate of 8 kg/ha.



Figure 51: Tom Price MME re-profiled waste rock landform

Some of the lessons learnt from the design and tender process include material availability and quality, design changes to improve practicality and seeding techniques. These lessons are all being incorporated into the rehabilitation design process to provide better closure outcomes.

MME waste rock landform rehabilitation was less than two years old at the last monitoring point and had not yet established native perennial vegetation. Poor vegetation establishment at the MME waste rock landform is considered to be likely related to low rainfall in the region in the 12 months prior to the 2019 monitoring assessment. Erosion features are also present on the dump and require continued monitoring.

11.4.4 Brockman 2 Pit 6

Rehabilitation works on the Brockman 2 Pit 6 waste rock landform were completed in 2017, with a resultant landform consisting of four lifts of varying heights, and a total footprint of 9.7 ha (Figure 52). Earthworks were performed by pushing the existing angle of repose slopes out to 20 linear degrees; with 20 m, 15 m and 10 m lift heights and 10 m back sloping berms for the final design. An unmanned aerial vehicle (UAV) was used to survey the dump and ensure it was conforming to the design with a tolerance of +/-200 mm. Once the final surface was confirmed as conforming to the design, topsoil was spread on the surface to a depth of 100 to 200 mm (including berms along contour). Deep ripping and seeding were completed with a dozer mounted seeder and with a multi-tine ripper without wings. A seed mix of local native species was sown on the same pass as ripping.

Two rehabilitation transects were installed at Pit 6 waste rock landform in 2018: one on the upper lift and one on the second lift. The area received rainfall well below average in the year preceding rehabilitation activities, and no significant rainfall in the months following seeding. Species richness and density were comparable to or exceeded the reference sites, indicating successful early establishment of the rehabilitation. High species richness is characteristic of new rehabilitation areas, and often declines as the rehabilitation matures.

Some erosion was already present on the rehabilitation surface, and continued monitoring will determine whether these features stabilise or increase in severity over time. The annual weed *Rumex vesicarius* (Ruby Dock) was present at both transect sites however contributed little cover in 2018. This weed will continue to be managed via the operational weed management programme. It is likely to take some years before the rehabilitated sites approach the reference sites in terms of structure, composition and associated parameters, however early signs are indicating a self-supporting ecosystem



Figure 52: Brockman 2 Pit 6 revegetation 2017 (left) and 2019 (right)

Learnings from this project contribute to improvements in Rio Tinto's rehabilitation implementation processes to prevent similar issues occurring in future projects. These include the recommendation that an unmanned aerial vehicle fly over is completed prior to any rehabilitation design commencing, topsoil haulage scheduling and optimised resourcing to prevent re-handling of material, and machine requirements with regard to adequate ripping and contouring local reference sites.

11.5 Unexpected closure

Unexpected or premature closure of the Proposal may result in modifications of the proposed mine closure strategies detailed in this MCP and its subsequent revisions.

In the event of unexpected or premature closure, revision and update of the closure risk assessment would occur to determine key areas for closure works and any change in residual risk from premature closure. Outcomes of the review will be used to prioritise closure tasks. A revision and update of the MCP inclusive of decommissioning requirements will be completed to address changed circumstances and gain approval from relevant key stakeholders where strategies may require amendment.

These plans would require the following as a minimum:

- stakeholder engagement to communicate the amended closure strategy and address stakeholder concerns.
- review closure outcomes and completion criteria to determine any which may be difficult to achieve in given premature closure. Communicate these with relevant key stakeholders to determine a way to resolve issues.
- amended landform designs for all permanent landforms and mining voids where the proposed design could no longer be met.
- review of topsoil and other rehabilitation materials balances to determine any deficiencies in materials, and options to address this.
- undertake contaminated land assessment, and where required, remediation works, of all areas of the site used for storage or utilise hazardous materials.
- update the final void groundwater model where the proposed extent of mining did not occur to determine if the closure strategy requires amendment.
- finalise any rehabilitation or closure trials to determine if findings are adequate to implement.
- review and update monitoring and maintenance requirements.

- revision and update of the closure cost estimate to determine any financial constraints associated with altered designs or deficit of rehabilitation materials.
- address all safety obligations required under Sections 42 and 88 of the Mines Safety and Inspection Act 1994 (WA) relating to mine suspension or abandonment. One of those obligations is to notify the relevant DMIRS District Inspector before a mining operation is suspended or abandoned.

11.6 Decommissioning

A Decommissioning Plan will be developed based on the Closure Work Programs presented in Section 11.1 for implementation and stakeholder approval where required.

Once ore processing has been completed, decommissioning of equipment and facilities prior to removal of those items not identified to remain post-closure will be undertaken. Equipment and facilities that will not remain post-closure will either be dismantled for reuse or resale, or demolished for on-site disposal, with the approach selected being based on economic conditions at the time of closure. Contaminated land assessments will be undertaken following removal of infrastructure, or within the vicinity of infrastructure to be handed over to a third party. Where required, remediation activities will occur and the monitoring and maintenance requirements within the MCP updated.

Final landforms will be constructed, including any installation of covers, placement of topsoil, abandonment bunds and surface drainage structures. Where required, soil amendments will be made, and seed mixes spread.

Groundwater production and monitoring bores not required for the post-closure monitoring program, or being handed over to a third party, will be decommissioned to meet DWER requirements.

Monitoring activities will commence within the required timeframes following completion of rehabilitation activities. Revision and update of the closure cost estimate will occur, to determine any financial constraints associated with altered designs or deficient materials.

12 Closure Monitoring and Maintenance

The primary purpose of closure monitoring is to assess whether the agreed closure completion criteria have been met for the Proposal. A specific monitoring program will be finalised as the site approaches closure, and this current plan outlines the principles that will be employed rather than specific details.

12.1 Phases of monitoring

For the purposes of this plan, monitoring is assumed to be conducted in several phases including:

- baseline monitoring, which is conducted as operations expand into new mining areas. Results that are relevant to closure are summarised in the environment knowledge base.
- operational monitoring, which occurs throughout the life of the mine, in line with regulatory requirements and the Rio Tinto operational standards. Results that are relevant to closure are incorporated in the environment knowledge base when it is reviewed.
- pre-closure monitoring, which occurs as the site approaches closure to underpin assessment of post-closure performance.
- closure monitoring, which is conducted during the period of active site closure (approximately two years following the cessation of mining); and
- post-closure monitoring, which is conducted on a regular basis, for at least 10 years or until either:
    - there is a demonstration that closure criteria have been met and that the site is able to be relinquished; or
    - parameters being monitored reach a steady state.

This plan considers pre-closure, closure and post-closure monitoring, while baseline monitoring informs the closure knowledge base and development of closure strategies.

12.2 Preliminary monitoring program

The closure monitoring program will be finalised during the detailed closure planning stages as the site approaches closure. However, the program could be expected to include such components as indicated in Table 12-1. Specific and appropriate monitoring will be conducted to ensure data is obtained to allow assessment of performance against completion criteria (Section 10.6). The monitoring program will be sufficiently flexible to enable adjustments to be made if results indicate that more, or less monitoring is warranted at any phase. Specific parameters within each aspect are to be defined.

Table 12-1: Preliminary plan for closure monitoring

Aspect	Phase		
	Pre-closure	During closure implementation	Post-closure
Erosion monitoring	✓	✓	✓
Rehabilitation (vegetation) monitoring	✓	✓	✓
Groundwater level monitoring	✓	✓	✓
Groundwater quality monitoring	✓	✓	✓
Surface water quality monitoring	✓	✓	✓
Contaminated sites assessment	✓	✓	
Heritage survey	✓	✓	
Visual impact assessment	✓		✓
Geotechnical stability	✓	✓	

12.3 Rehabilitation monitoring

The purpose of the rehabilitation monitoring program is to evaluate successional development of the rehabilitation, and thereby provide useful feedback for the improvement of rehabilitation techniques, and to help assess progress towards long term rehabilitation goals. Monitoring also provides information which can be used to set realistic and achievable completion criteria. This objective can be achieved by examining changes in key parameters over time and comparing results from the rehabilitation with those from corresponding reference sites in undisturbed areas.

Reference sites, also known as control sites or analogues, are positioned within remnant native vegetation representative of the local area. Such sites should contain the vegetation community commensurate with those existing at the rehabilitated site prior to disturbance and be situated in a similar topographical position within the landscape, and as such serve as an indicator of what the rehabilitated area may achieve over time. However, suitable references sites may not be available for all rehabilitation sites as landforms undergoing rehabilitation are often highly modified, and in such cases references sites provide a guide only. Reference site data also assists in planning aspects of the rehabilitation program i.e., seed lists and the species of which they comprise.

Rehabilitation monitoring is completed in the cooler months (June to September) each year. The monitoring program design (i.e., monitoring technique and frequency) for each rehabilitated area considers the following factors:

- the level of complexity of the rehabilitation and therefore rehabilitation quality risk i.e., waste rock landforms are high risk; exploration rehabilitation is low risk.
- regulatory monitoring requirements.
- rehabilitation age.
- rehabilitation quality.
- rehabilitation area size.
- part of a rehabilitation trial area.
- natural disturbance i.e., fire, cyclonic rainfall.
- safe access for monitoring personnel; and
- efficient use of monitoring resources.

Several rehabilitation monitoring techniques are used which are usually matched to the level of rehabilitation quality risk. For example, the intensive quantitative method is used on high-risk waste rock landform areas. The techniques used are summarised below.

12.3.1 Vegetation, fauna habitat and erosion quantitative method

Vegetation monitoring involves permanent transects up to 100 m in length, comprised of 2 m x 2 m quadrats at intervals of 5 m. Within each quadrat, numbers of all native perennial plant species and weeds are counted, and their % cover estimated. Total native perennial plant cover is assessed by dividing the 2 m section along the transect baseline into eight, 25 cm sections and recording the number of these that have no cover of any native perennial plant species. A subjective assessment of total native perennial plant cover (%), for plants rooted within the quadrat, is also recorded for each quadrat. Notes are taken of the general condition of the rehabilitation, including new disturbance and fire damage. A photograph is taken from both the start and end point of each transect.

Fauna and habitat monitoring involve estimating litter cover, noting rocks and logs in each quadrat along the same transect, and then doing a whole of transect assessment of grazing extent, native animal scats, ant numbers present, and indicators of native animal activity.

Erosion monitoring involves identifying gullies (i.e., rills greater than 30 cm deep) along the same transect, but extended to 150 m, recording the location of each gully and measuring their total width and depth at the deepest point. If erosion is identified elsewhere in the rehabilitation area, then an erosion specific transect would be installed on a representative section of the gully and total width and depth at the deepest point recorded. A photograph is taken of each measured gully. This intensive quantitative method is used on high disturbance areas such as waste landforms.

12.3.2 Rehabilitation quality assessment

Rehabilitation Quality Assessments (RQAs) are used on low to moderate disturbance areas, historical rehabilitation with no monitoring history, or on areas too small for transects. They can also be used in combination with the above transect methods on large rehabilitation areas to manage monitoring resources efficiently. The purpose is to gain an overview of the rehabilitation quality including erosion, growth medium, vegetation cover, species richness, vegetation structure, plant density, weed presence and general condition. Each characteristic is compared between the rehabilitation and local undisturbed native vegetation and given a score according to the RQA field book guidelines. A representative photograph is taken of both the rehabilitation and reference areas.

12.3.3 Water monitoring

Water monitoring during closure will focus on confirming water quality downstream. Rio Tinto will seek to engage with other industry stakeholders to discuss the potential for data sharing with emphasis on a better understanding of the potential impacts to Ben's Oasis. A specific program of monitoring will be developed prior to decommissioning.

12.3.4 Heritage surveys

Heritage assessments are undertaken prior to closure to ascertain potential cultural heritage impacts of closure implementation and inform the development of alternative strategies if required. Assessments are also undertaken post-closure to confirm that implementation has been undertaken in an appropriate manner.

The SCHMP will also set out consultation processes in respect of broader social and cultural values, throughout the life of mine and prior to closure.

12.3.5 Visual impact

Visual impact assessment will be undertaken prior to closure to ascertain any potential visual impacts of the closure implementation and inform the development of alternative strategies if required.

12.3.6 Post-closure maintenance

Post-closure, maintenance will continue as required until it is determined that the closure outcomes have been met or it is otherwise agreed with Government to allow relinquishment of the site.

13 Financial Provisioning for Closure

Rio Tinto considers specifics of the closure cost estimate to be commercially sensitive information. This section outlines the general process used to develop the closure cost estimate.

13.1 Principles of Rio Tinto closure cost estimation

Closure cost estimates are determined based on methods outlined in the Rio Tinto Closure Standard and the Rio Tinto Accounting Policy. Closure costs are considered in two formats:

- Present Closure Obligation (PCO) which is indicative of costs associated with closure of the mine given its current footprint, this accounts for the progressive development of a site over time.
- Total Projected Closure (TPC) cost which predicts the cost (in current terms) associated with closure at the end of the life of the mine. The TPC includes areas that are not currently approved, but that feature within the life of mine plan and that are considered likely to be developed in the future.

The cost estimates consider the following components[7]:

- pre-closure studies.
- decommissioning (i.e., removal of infrastructure)[8];
- final landform construction.
- rehabilitation and biodiversity management.
- heritage management.
- workforce management (i.e., training costs and redundancy payments)[9];
- monitoring costs.
- costs associated with the development of the final closure plan.
- costs associated with undertaking a final shutdown of operations [12].
- allowance for failed rehabilitation or pollution that may necessitate rework of rehabilitation areas.
- assignment of indirect costs in accordance with Rio Tinto Accounting Policy; and
- a contingency factor.

13.2 Closure cost estimation methods

The closure cost estimation methodology is based on methods outlined in the Rio Tinto Closure Standard and Rio Tinto Accounting Policy, with the level of accuracy increasing as the site approaches closure[10]. The closure cost estimates are conducted based on the most recent information of mine plans and infrastructure. Closure costs estimate are generally undertaken by specialist external consultants. The PCO estimate for

[7] Costs associated with decontamination are assessed during closure plan development but are costed separately as they are classified as operating costs, not closure costs.

[8] The decommissioning cost estimate assumes that infrastructure will be demolished and buried on site. The site is sufficiently remote that deconstruction for the purposes of materials salvage and recycling is likely to be cost prohibitive. However, opportunities for salvage and recycling will be sought as the site approaches closure.

[9] Workforce management costs are only included in the TPC.

[10] The level of accuracy applied to Rio Tinto estimates is as follows:

- greater than 10 years from closure: ±30%.
- between 10 years and 5 years from closure: ±20%; and
- less than 5 years from closure: ±15%.

each site is revised on an annual basis to account for incremental mine development during the year. As part of Rio Tinto assurance processes these cost estimates are audited by external financial auditors annually to ensure adequate processes to generate the provisions are maintained. The TPC estimate is typically revised whenever a formal closure plan review is conducted (usually 3-yearly) to capture any changes to LoM design.

Note that for commercial reasons the actual estimate is not documented in this closure plan.

14 Management of Information and Data

The management of baseline, closure risks and issues data, as well as legal and other obligations and stakeholder consultation records is critical to the management of closure planning and implementation activities. The following data management systems support the management of this data to inform closure planning for the Proposal.

14.1 Information Management System (IMS)

Rio Tinto operates a comprehensive document management system, with electronic records of all key information and data. The document system, known as the Information Management System (IMS) is linked to other business units within the Rio Tinto group of companies, and processes are in place to ensure that the data contained within this system is appropriately backed up and protected. Each document stored within this system is given a unique document number which identifies the document and enables it to be accessed. This system will continue to operate following site closure, and all relevant data will be retained according to appropriate data retention requirements.

An audit will be conducted prior to closure to ascertain whether there is any additional information stored in hard copy form at the site. Such data will be scanned and entered into the IMS to ensure that it is appropriately retained post-closure.

14.2 Closure knowledge base

The closure knowledge database (CKB) is a knowledge management process designed to bring closure related research and monitoring outcomes together into one searchable location. It uses a single-entry form to capture where the report is stored, and how and where the research can be applied for all new ongoing and completed closure related studies. This information is then managed by the Closure team within a secure database. An extract from the CKB which summarises technical information relevant to the Proposal is attached as Appendix 3.

14.3 EnviroSys

EnviroSys is an environmental database that is used by Rio Tinto to manage environmental and hydrogeological data. The tool is used to store, monitor, and analyse those parameters and report trends on data collections.

Data collected currently includes:

- groundwater – biological, chemical, field, levels, production.
- marine water – biological, chemical, field.
- soil chemistry.
- surface water – biological, chemical, field, levels, production.
- tonnes and moisture.
- rehabilitation monitoring.
- water meters; and
- weather (rainfall, temperatures etc.).

EnviroSys is used to support the building of closure knowledge bases, as well as ensure compliance with operating licenses pertaining to data management. At closure this data would be appropriately stored to allow for review of post-closure completion criteria.

14.4 ARCHER

The Archer system is a centralised database of all operational and closure risks. This database is used by Rio Tinto to manage risks and address actions to progress closure related planning during the life of mining.

Archer currently stores risks, controls and actions and the system functionality also enables the user to rate the effectiveness of these risks and controls, as well as verify actions have been completed.

The Proposal closure risk register is currently stored in Archer, with closure planning actions aiming to address knowledge gaps highlighted in this closure plan. As indicated in Section 7, quarterly review of actions and controls is undertaken for the life of the asset.

14.5 Tenement management system (TMS)

TMS is a system used to store tenement, licencing, permitting and other land management data, as well as legal and other obligations. This database is maintained to inform the Legal Obligations Register of the MCP (Appendix 1) and will continue to be updated as changes to legal obligations associated with land management change.

14.6 Dynamics 365

Dynamics 365 is a system used to capture stakeholder feedback and consultation records. This system also enables the user to set actions to address responses to feedback and enquiries. All consultation minutes and reports will be stored in IMS and record of these stored in Dynamics 365. This system is used to collate feedback for planned consultations regarding the Proposal and to collate consultation records for inclusion in the Proposal MCP. These records can be reviewed in the Stakeholder Consultation Register (Appendix 2).

15 Reviewed Mine Closure Plans

This is the first MCP completed for the HD2 Proposal. Table 15-1 outlines Rio Tinto's response to EPA Services comments (DWERDT704549 and APP-0013051) received 27th June and 6th October 2023 on the preliminary draft HD2 MCP (versions April and August 2023), as a supporting document and appendix to the HD2 ERD to support a Part IV. Changes and updates as indicated are reflected in this MCP (October 2023).

Table 15-1: Summary of regulator feedback and Rio Tinto responses to the revised Mine Closure Plan

Rio Tinto response to EPA comments (DWERDT704549 and APP-0013051) received on the Hope Downs 2 Mine Closure Plan (versions April - August 2023). Updates reflected in the HD2 MCP (October 2023)	
EPA Services comments	**Rio Tinto response**

It is noted that the Hope Downs 2 proposal will require State Agreement approval and that DMIRS is an advisory body for the MCP (see comments above).
Actions
• Update the dates on the MCP document.
  ○ The MCP document is dated April 2023 although the corporate endorsement date is 13 July 2022.
  ○ Clarify why the MCP refers to a closure date of 2033 although Hope Downs 2 life of mine is expected to be 15 years from 2025.
  ○ Clarify why the MCP does not include infrastructure that is included in Hope Downs 1, however Hope Downs 2 will use Hope Downs 1 infrastructure and the life of mine extends past the Hope Downs 1 end of life of mine.
	The dates in the MCP will be updated to reflect the corporate endorsement, and the latest mine life dates (2025-2040).
	The closure boundary for the HD2 proposal includes infrastructure from HD1, including HD1S ROM and associated infrastructure. The closure boundary shows overlap of Baby Hope waste dumps at HD1 due to the HD2 Proposal use of the BH haul roads to transport ore to HD1 infrastructure as mentioned above. Once HD2 is approved, this HD1 infrastructure will be reassigned as HD2 infrastructure. The MCP text will be reviewed and amended to clarify this.
	The reference to West Angelas is included because it is a requirement of the DMIRS Guidelines for the Preparation of Mine Closure Plans to list the current underlying tenure of proposal extent. The re-alignment of the Great Northern Highway will not be constructed under the L47/52 tenure,

• Update details in the MCP Closure obligations to refer to Hope Downs 2 – currently refers to West Angelas not Hope Downs 2.	rather, in consultation with Main Roads WA, suitable tenure will be sought. The footnote in section 1.2 has been amended to reflect that L47/52 is considered part of the scope of the Rio Tinto West Angelas Closure Plan. Once the realignment route is finalised, this tenure may be removed from the scope in future updates to this MCP as new tenure will be acquired to address this. Tenement conditions associated with L47/52 are therefore included in Appendix 1 – HD2 Closure Obligations Register.
Section 5.7.7 Erodible mineral waste management and Table 5-4 The conceptual WRL designs proposed at this early stage comprise multiple lifts with relatively narrow (10 m) back sloping (11 degrees) berms. This creates the potential for those berms to fill up with sediment and create a failure point post-closure. The risk is mentioned at length in the Landloch paper titled "*Hydrological function of berms within a waste landform design: Mine Closure 2016* – AB Fourie and M Tibbett (eds) © 2016 Australian Centre for Geomechanics, Perth, ISBN 978-0-9924810-4-9. For 10 m wide berms with a 5% back slope in the Pilbara setting a time frame of 63 years is estimated from water erosion prediction project (WEPP) model before the capacity is reached and failure may likely occur. • **Actions** • Review the proposed conceptual WRL designs. • Provide a design life for those features to indicate at what point the berm capacity is likely to be exceeded and explain how that risk will be mitigated. • Consider in the risk assessment, the elimination of the risk created by the construction of the berms.	WRL slope designs have been determined from application of the RTIO Batter Selector Tool, a purpose built tool informed by years of sampling and testwork of key stratigraphies across the Pilbara, including Greater Hope Downs. Parameters generated from testwork provided inputs into the WEPP model, along with site specific climate sequences – in this case the HD1 and HD2 climate sequence. The Batter Selector Tool outputs slope parameters that would result in stable slopes by considering site specific rainfall and the waste types within an individual WRL. Additionally, landform evolution modelling was completed for HD2 to inform WRL design. This modelling utilised an average erosion rate for the batter geometry, which was calculated and converted to a cumulative erosion volume for a 300 year period. A period of 300 years was selected because the DMIRS mine closure guidance for considering closure criteria and performance indicators states that the "identified completion criteria and associated performance indicators must be able to demonstrate that rehabilitation is progressing as anticipated, particularly where mathematical modelling is utilised to predict long term (usually 300 years or longer) environmental performance (e.g. waste rock landforms)." (DMIRS 2020). In following these processes, the proposed conceptual WRL designs are considered appropriate.
Section 5.8.1 Soil inventory **Action** • It is more pragmatic to state that the topsoil stockpiles will be paddock dumped (to minimise further disturbances) instead of stating a 2m height limit (depending on trucks used). o The height of the topsoil stockpiles is a function of the height of the truck bins used to carry out the topsoil haulage and dumping post stripping (~2 m height with a Moxy and ~4 m height if using a Haulpack).	Comment noted: the 2m height limit is the nominal height as documented within the *Rio Tinto Iron Ore Soil Resource Management Work Practice* (Rio Tinto 2020b). As noted, in some cases stockpile heights may be higher than this depending on the machinery used.
Section 5.8.1 Soil inventory, Table 5-10 Predicted life of mine (LoM) balances for Hope Downs 2 (BHT and HD2) **Action** • Table 5-10 should include estimated soil losses that occur during the stripping/haulage and stockpiling of topsoil (~5%).	Comment noted: the soil volumes in Table 5-10 assume a soil recovery rate of 30% this estimate already factors in soil losses during stripping and recovery.
Section 5.8.2 Alternative growth media **Action**	Comment noted: Excess stemming material will be considered for use as alternative growth media if available.

• Include stemming material (if a surplus is created) is another potential source of suitable alternative growth media.	
Section 5.8.3 Rehabilitation materials inventory • The MCP recognises that waste material produced will have variable erodibility properties and that the less erodible, competent material will need to be segregated and stockpiled during operations for rehabilitation purposes (Table 5-11). **Actions** • Include the requirement to log, track, record and reconcile where the waste is dumped as the individual WRL's are constructed. • Close tracking and recording of this detail for individual truck dumps is crucial to allow for the best possible WRL closure design to be implemented and consider changes that will necessarily occur as the project progresses. • Include this information in section 11.5 (Unexpected Closure) also.	Noted: RTIO is currently investigating how existing mine systems may be used to track the movement of beneficial (competent) waste materials. Learnings from this work will be applied across RTIO managed operations, including HD2.
Section 5.13.3 Invasive flora and 5.13.4 implications for closure and knowledge gaps. The proposal is adjacent to, and is linked to, existing mining operations and includes area disturbed by exploration works (see figure 47 progressive rehabilitation, current disturbance). **Actions** • Consider and provide invasive flora in a broader and contemporaneous context to inform the weed risk assessment: o The flora surveys used to document weeds are pre-disturbance and most likely do not reflect the current situation. As an example, it is most likely that Kapok Bush (a very common weed of disturbed areas and roadsides in the Pilbara) is already present in the project area, yet not recorded in table 5-14. • Provide the reference to the weed species ranking used in the assessment: o It is noted that the DBCA weed species ranking includes priority weed species that may not be relevant to most mining operations in the Pilbara (for example, Cotton Palm is rated as high risk for its potential to invade Millstream Chichester National Park). o Use a weed priority listing that reflects the potential for certain weed species to invade disturbed and rehabilitated mining landscapes, rather than the potential for species like WoNS to invade areas that are essentially undisturbed with significant conservation values (also see comments above in flora and vegetation). o It is also noted that rehabilitation success on Pilbara mine sites is impacted by problematic weeds Kapok, Buffel Grass, Ruby Dock and Calotropis (where present).	Noted: Baseline surveys were undertaken in 2019/2020. At this time the survey area was adjacent to existing Baby Hope and Hope Downs 1 mining operations. Flora and vegetation surveys within the Proposal closure boundary have recorded a total of 17 introduced flora species (weeds) pre-disturbance (Table 5-14 of the MCP). To inform appropriate management of weed species, both the WoNS and DBCA Weed Species Ranking have been used. DBCA Weed Species Ranking considers the potential distribution, current distribution, ecological impact, invasiveness and feasibility of control to derive a final broad qualitative weed species ranking corresponding to specific management actions. RTIO is not aware of any Pilbara specific guidance for weed species. If such guidelines exist then, these will be considered. The ERD recognises the potential impact that weeds have to conservation values and includes mitigation and management measures in Table 6-21. Management of weeds is also addressed in the EMP. Weed management includes commitments to engage a consultant to develop a survey and control program to ensure a robust approach to identifying and managing introduced species within the Development Envelope that focuses on high-risk areas (e.g., environmental value, existing weed presence, status of weeds that are present, and potential for further transfer/dispersal e.g., waterways and high trafficable areas). To manage weeds in rehabilitation sites, weed species are identified during rehabilitation monitoring work and appropriate controls implemented as required. Monitoring of rehabilitation sites is conducted to assess impact of problem weeds and control measures are implemented as required. Monitoring of weeds in rehabilitation sites is described in Section 12.3.1 of the MCP.
Section 11.5 (Unexpected Closure). Management of project changes.	Noted: Please refer to comment above regarding Section 5.8.3 of the MCP.

Action
• See comments for Section 5.83 above:
  o Having a record and understanding of waste characteristics, precise location and date for individual truck dumps as WRLs are constructed is crucial.
  o This allows for the best possible WRL closure design to be implemented and take into account changes that will occur as the project progresses including unexpected closure type scenarios, or when pits, and corresponding WRL, do not progress as initial project expectations.	

MCP Appendix 4 HD2 Closure Risk register. Waste dumps and or land bridges at HD2 are subject to excessive erosion (974458) Rehabilitation outcomes at HD2 do not meet closure objectives. **Action** • Update the existing controls for waste rock management to include a requirement to track and record what type of waste rock (based on block model understanding followed by in-pit validation) is dumped in which location of the various WRLs. This will minimise the overall risks of excessive erosion occurring as well as help design the most optimal final closure slope based on 'as-dumped' data and inevitable project changes over time.	Noted: Please refer to comment above regarding Section 5.8.3 of the MCP.
Appendix 6 HD2 Landform Design Criteria BHT LB West, BHT LB Central 3, BHT LB East 6 and BHT LB East - The external portion will have an updated rehabilitation design completed prior to approval of the project, designs and landforms evolution modelling are underway and planned for completion in 2023. **Actions** • Present in more detail, the proposed rehabilitation designs that are contemplated for the portions of the land bridges that are proposed to stay in-situ and be rehabilitated. • Typically, land bridges are required for haulpacks to reach elevated areas and the rehabilitation of the ramps can result in impacts to surface water or result in slopes left at angle-of-repose (to avoid the former) that cannot be successfully rehabilitated.	Rehabilitation designs for the proposed remaining sections of landbridges are shown in Appendix 6 of the MCP. Further review and design of these landbridges is to be conducted and updated designs will be provided in the next major revision of the MCP. Significant work is undertaken during design to assess impact of hydrological impact of landbridges on surface water flow during operations and at closure. Where significant risks remain at closure, landbridges will be removed or altered to minimise impacts on surface water flows.

16 References

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17 Appendices

Appendix 1: Closure Obligations

HOPE DOWNS 2 CLOSURE OBLIGATIONS REGISTER

APPROVAL CONDITIONS

Mining Act 1978	
Tenement No. L47/00052	
Condition No.	**Closure conditions**
4	All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines and Petroleum (DMP). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DMP.
11	At the completion of operations, all buildings and structures being removed from site or demolished and buried to the satisfaction of the Executive Director, Environment Division, DMP.
15	On the completion of operations or progressively when possible, all waste dumps, tailings storage facilities, stockpiles or other mining related landforms must be rehabilitated to form safe, stable, non-polluting structures which are integrated with the surrounding landscape and support self sustaining, functional ecosystems comprising suitable, local provenance species or alternative agreed outcome to the satisfaction of the Executive Director, Environment Division, DMP.
20	Management of mine closure is to be undertaken in accordance with the Mine Closure Plan (Reg ID 75896) "West Angelas Closure Plan" dated 11 April 2018 signed by Santi Pal, and retained on Department of Mines, Industry Regulation and Safety File No. EARS-MPMCP-75896 as Doc ID 6012188.
24	A Mine Closure Plan is to be submitted in the Annual Environmental Reporting month specified in tenement conditions in the year specified below, unless otherwise directed by the Executive Director Resource and Environmental Compliance Division, Department of Mines, Industry Regulation and Safety. The Mine Closure Plan is to be prepared in accordance with the Department's "Guidelines for Preparing Mine Closure Plans" 2020.
Tenement No. M282SA (Mining lease issued pursuant to State Agreement)	
Condition No.	**Closure conditions**
n/a	No closure conditions

CLOSURE OBLIGATIONS REGISTER
COMMITMENTS

Formal Commitments	
Iron Ore (Hope Downs) Agreement Act 1992	
Clause No.	**Closure obligations**
7 (1)	The Company shall subject to the EP Act and the provisions of this Agreement submit to the Minister on or before 30 June 1998 to the fullest extent reasonably practicable its detailed proposals (including plans where practicable and specifications where reasonably required by the Minister) with respect to the production of iron ore from the area or areas approved pursuant to subclause (1) of Clause 6 and the transport and shipment of iron ore produced which proposals shall make provisions for the Company's workforce and associated population required to enable the Company to mine and recover iron ore from the mining lease and transport and ship the iron ore and shall include the location, area, lay out, design, quantities, materials and time programme for the commencement and completion of construction or the provision (as the case may be) of each of the following matters, namely : (m) an environmental management programme as to measures to be taken, in respect of the Company's activities under this Agreement, for rehabilitation and the protection and management of the environment.
16 (1) & (2)	(1)The Company shall in respect of the matters referred to in paragraph (m) of subclause (1) of Clause 7 and which are the subject of approved proposals, carry out a continuous programme of investigation research and monitoring to ascertain the effectiveness of the measures it is taking both generally and pursuant to such approved proposals for rehabilitation and the protection and management of the environment. (2) The Company shall during the currency of this Agreement submit to the Minister at yearly intervals commencing from the date when the Company's proposals are approved or determined (except those years in which a comprehensive report is required to be submitted) a brief report concerning investigations research and monitoring carried out pursuant to subclause (1) and the implementation by the Company of the elements of the approved proposals relating to rehabilitation and the protection and management of the environment in the year ending two calendar months before the due date for the brief report and, at three yearly intervals commencing from such date a comprehensive report on the result of such investigations research and monitoring and the implementation by the Company of the elements of the approved proposals relating to rehabilitation and the protection and management of the environment during the three year period ending two calendar months before the due date for the comprehensive report and the programme proposed to be undertaken by the Company during the following three year period in regard to investigations research and monitoring pursuant to subclause (1) and the implementation by the Company of the elements of the approved proposals relating to rehabilitation and the protection and management of the environment.

38 (1), (2) and (3)	(1) On the cessation or determination of this Agreement — (a) except as otherwise agreed by the Minister the rights of the Company to in or under this Agreement and the rights of the Company or of any assignee of the Company or any mortgagee to in or under the mining lease and any other lease licence easement grant or other title or right granted hereunder or pursuant hereto (but excluding townsite lots which have been granted to or acquired by the Company and \Iron Ore (Hope Downs) Agreement Act 1992 Schedule 1 Iron Ore (Hope Downs) Agreement which are no longer owned by it) shall thereupon cease and determine but without prejudice to the liability of either of the parties hereto in respect of any antecedent breach or default under this Agreement or in respect of any indemnity given under this Agreement; (b) the Company shall forthwith pay to the State all moneys which may then have become payable or accrued due; (c) save as aforesaid and as otherwise provided in this Agreement neither of the parties shall have any claim against the other of them with respect to any matter or thing in or arising out of this Agreement. (2) Subject to the provisions of subclause (3) upon the cessation or determination of this Agreement except as otherwise determined by the Minister all buildings erections and other improvements erected on any land then occupied by the Company under the mining lease or any other lease licence easement grant or other title made under or pursuant to this Agreement shall become and remain the absolute property of the State without the payment of any compensation or consideration to the Company or any other party and freed and discharged from all mortgages and other encumbrances and the Company shall do and execute all such deeds documents and other acts matters and things (including surrenders) as the State may reasonably require to give effect to the provisions of this subclause. (3) In the event of the Company immediately prior to the cessation or determination of this Agreement or subsequently thereto desiring to remove any of its fixed or movable plant and equipment or any part thereof from any part of the land occupied by it at the date of such cessation or determination it shall give to the State notice of such desire and thereby shall grant to the State the right or option exercisable within 3 months thereafter to purchase in situ such fixed or moveable plant and equipment at a fair valuation to be agreed between the parties or failing agreement determined by arbitration under this Agreement.
39	Nothing in this Agreement shall be construed to exempt the Company from compliance with any requirement in connection with the protection of the environment arising out of or incidental to its activities under this Agreement that may be made pursuant to the EP Act.

CLOSURE OBLIGATIONS REGISTER

RELEVANT LEGISLATION

Relevant Legislation	
Closure planning and implementation requires consideration of general legislative requirements beyond those that apply to a specific site. A list of potentially	
Australian Commonwealth Legislation	**Western Australian State Legislation**
Environmental Protection and Biodiversity Conservation Act 1999	*Environmental Protection Act 1986*
Native Title Act 1993	*Environmental Protection Regulations 1987*
Aboriginal and Torres Strait Islander Heritage Protection Act 1984	*Environmental Protection (Controlled Waste) Regulations 2004*
Workplace Relations Act 1996	*Environmental Protection (Unauthorised Discharges) Regulations 2004*
	Contaminated Sites Act 2003
	Contaminated Sites Regulations 2006
	Conservation and Land Management Act 1984
	Mining Act 1978
	Mining Regulations 1981
	Parks and Reserves Act 1895
	Rights in Water and Irrigation Act 1914
	Wildlife Conservation Act 1950
	Aboriginal Heritage Act 1972
	Aboriginal Affairs Planning Authority Act 1972
	Mines Safety and Inspection Act 1994
	Mines Safety and Inspection Regulations 1995
	Occupiers Liability Act 1985
	Criminal Code Compilation Act 1913

CLOSURE OBLIGATIONS REGISTER
GUIDELINES AND STANDARDS

Relevant Guidelines and Standards	
Closure planning and implementation requires consideration of relevant guidelines and standards, some of which may have regulatory consequence through being referenced in regulatory documents. A list of key guidelines and standards that are routinely considered is provided below, but is not exhaustive due to the breadth of the closure planning discipline. This closure plan has been prepared so as to be considered with relevant content of these guidelines and standards.	
Guideline or Standard	**Author**
Guidelines for the Preparation of Mine Closure Plans (2020)	Western Australian Department of Mines and Petroleum and
Leading Practice Sustainable Development Program for the Mining Industry - Mine Closure and Completion (2006)	Commonwealth Department of Industry Trade and Resources
Mine Rehabilitation Handbook (1998)	Minerals Council of Australia
Guideline for the Assessment of Environmental Factors: Rehabilitation of Terrestrial Ecosystems (2006)	Western Australian Environmental Protection Authority
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000)	Agriculture and Resource Management Council of Australia and New Zealand and the Australian and New Zealand Environment and Conservation Council
Mine Void Water Resource Issues in Western Australia (2003)	Western Australian Water and Rivers Commission
Contaminated Sites guideline series	Western Australian Department of Environmental Regulation
Environmental Notes on Mining: Acid Mine Drainage (2009)	Western Australian Department of Mines and Petroleum
Environmental Notes on Mining: Waste Rock Dumps (2009)	Western Australian Department of Mines and Petroleum
Safety Bund Walls Around Abandoned Open Pit Mines (1997)	Western Australian Department of Industry and Resources
Global Acid Rock Drainage Guide (2014)	International Network for Acid Prevention
Australian Standard 2601: The Demolition of Structures (2001)	Standards Australia
Australian Standard 4976: The Removal of Underground Petroleum Storage Tanks (2008)	Standards Australia
Demolition Work Code of Practice (2015)	Safe Work Australia

Appendix 2: Closure Consultation Register

Start date	Stakeholder	Consultation Type / Forum	Information provided by Proponent (summary for ERD and MCP)	Stakeholder Response/ Comments	Proponent Response (summary)	Key feedback for Closure Planning
22/05/2018	Weeli Wolli Creek Co-Management Board (now Weeli Wolli Creek Advisory Committee)	Meeting	Introduction to the Project, including scope and proposed timing.	NA	NA	Discussion of early Project design
5/09/2018	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli Heritage Sub-Committee meeting	Cultural heritage survey update provided for HD2 and BHT. Discussion of the deposits and planned heritage work.	NA	NA	Discussion of early Project design
6/09/2018	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli LIC meeting	Introduction to the Project, including the HD2 and BHT deposits and two potential ore transport options (haul and conveyor). Studies will continue to investigate the most cost-effective way of transporting ore from these deposits. Proposed first ore dates will depend on ongoing studies work.	KNAC expressed concerns that with Bedded Hilltop coming online, access to Weeli Wolli Creek (WWC) may become blocked. KNAC requested updates on access to WWC at future LIC meetings.	KNAC and the Nyiyaparli people will be kept informed about the progress of the Studies (i.e. new deposits) – particularly through the LIC forum.	Project design and closure planning will need to maintain access to Weeli Wolli Creek.
10/10/2018	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga LIC meeting	Introduction to the Project, including the portion potentially within the Ngarlawangga native title determination	NA	NA	NA
3/04/2019	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli Heritage Sub-Committee meeting	Cultural heritage survey update provided for HD2 and BHT. Discussion of the BDH16-03 very significant site and that additional geotechnical assessment will be required if blasting is to occur within 300m of the site. The cultural values of BDH16-03 were discussed in detail.	NA	NA	Protection of BDH16-03 to be considered in closure planning.
4/04/2019	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli LIC meeting	The Order of Magnitude study phase is complete and the Pre-feasibility stage will commence later in 2019. HD2 and BHT are within the Nyiyaparli native title determination and heritage survey work will continue to cover the proposed pits, waste dumps and infrastructure areas.	NA	NA	NA
23/09/2019	BNTAC/ Banjima Traditional Owners	USB	Copies of the biological reports undertaken in respect of the Project area, as well as an explanatory memo were provided to BNTAC	NA	NA	NA
23/09/2019	BNTAC/ Banjima Traditional Owners	Meeting with BNTAC staff	Overview of Project, including that HD2 and BHT are on Nyiyaparli country, but that ore will be processed at the existing plant on Banjima country. Overview of biological survey outcomes. Overview of proposed Assessment on Referral Information approval process and timeline for the Project.	The potential interaction of the Proposal with Weeli Wolli Creek is likely to be a concern. BNTAC requested that information about the Proposal be presented to the Weeli Wolli Creek Advisory Committee. BNTAC are looking at cumulative impacts of mining in the Pilbara.	The Proponent advised that above water table mining only is proposed so there should be no impact to Weeli Wolli Creek. It is proposed to build a crossing over Pebble Mouse Creek and modelling will be completed to ensure there are no downstream impacts to Weeli Wolli Creek. The Proponent confirmed it would present information about the Proposal to the Weeli Wolli Creek Advisory Committee. The Proponent will provide a copy of the referral to BNTAC at the time of submission to the EPA and will continue to consult with BNTAC.	NA
25/09/2019	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga LIC meeting	Overview of Project, noting that the only portion of the Project on Ngarlawangga country is the potential diversion of part of Great Northern Highway to develop the full extent of the HD2 deposits. An overview of the Project scope was provided including that it involves above water table mining only of the HD2 and BHT deposits, external waste dumps, water supply and associated infrastructure, transport of ore (via conveyors or haulage) to HD1 for processing , access tracks and roads, rail crossing, and the potential diversion of part of Great Northern Highway on to Ngarlawangga country. Discussion of the proposed Assessment on Referral Information approvals process and timeline for the Project	Ngarlawangga are concerned about the impact of the potential Great Northern Highway diversion on their country and would like more information about the proposed highway alignment footprint. Ngarlawangga are interested in a scoping session to define the consultation pathway.	The Proponent will provide a copy of the referral to NAC at the time of submission to the EPA and will continue to consult with NAC.	NA

Start date	Stakeholder	Consultation Type / Forum	Information provided by Proponent (summary for ERD and MCP)	Stakeholder Response/ Comments	Proponent Response (summary)	Key feedback for Closure Planning
26/09/2019	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli LIC meeting	Overview of Project, including that it involves above water table mining only of the HD2 and BHT deposits, external waste dumps, water supply and associated infrastructure, transport of ore (via conveyors or haulage) to HD1 for processing , access tracks and roads, Pebble Mouse creek crossing, rail crossing, and the potential diversion of part of Great Northern Highway onto Ngarlawangga country. Discussion of the proposed Assessment on Referral Information approval process and timeline for the Project and update on biological survey work and outcomes.	KNAC requested that the referral be provided to for it to review.	The Proponent will provide the referral and ERD to the group at the time of submission to the EPA and will continue to consult with KNAC.	NA
16/10/2019	KNAC/ Nyiyaparli Traditional Owners	Meeting	Overview of Project and timing, and proposed approvals process and consultation. Discussion included that the Project involves above water table mining only of the HD2 and BHT deposits, and as a result dewatering will not be required. Discussion of water courses within the Development Envelope, along with known environmental values, including the known MNES. The Proponent advised that additional biological reports are being prepared and will be provided to KNAC for review. The Proponent provided an update on the proposed approvals process and timing.	Nyiyaparli raised concerns about maintaining access to sites during construction, operation and closure (particularly Weeli Wolli Creek) and the importance of protecting water. Suggestions regarding sharing of information to support social surroundings. Nyiyaparli are keen to undertake additional fieldwork and surveys with the Proponent, especially to identify important plants and bush foods.	The Proponent will share biological information and undertake desktop assessment with on country verification in 2020. Access to Weeli Wolli Creek by Traditional Owners will be considered as part of mine planning. Updated maps showing water sources and rockshelters to be provided to KNAC to assist its desktop review of the Proposal. Common names of flora and fauna (and images) to be added to maps ahead of the next consultation. The Proponent indicated that it is keen to schedule additional surveys and fieldwork with Nyiyaparli people starting in February or March 2020.	Discussion of early Project design and environmental approvals process. Protection of watercourses and maintaining access to sites (particularly Weeli Wolli Creek) will need to be considered in mine design and closure planning.
12/11/2019	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga Board of Directors meeting	An overview of the Project was provided to the Ngarlawangga Board of Directors, noting that the only portion of the Project on Ngarlawangga country is the potential diversion of part of Great Northern Highway. An overview of the Project scope was provided including that it involves above water table mining only of the HD2 and BHT deposits, external waste dumps, water supply and associated infrastructure, transport of ore (via conveyors or haulage) to HD1 for processing , access tracks and roads, rail crossing, and the potential diversion of part of Great Northern Highway on to Ngarlawangga country. Discussion of the proposed Assessment on Referral Information approvals process and timeline for the Project. An overview of the biological survey outcomes to date was also provided.	The Ngarlawangga Board asked if the potential diversion of Great Northern Highway will be surveyed. NAC asked what impact the highway diversion will have on Ghost Bats,	The Proponent said heritage surveys will be conducted over the area of the potential diversion of the Great Northern Highway, and that it is not currently clear what impact the diversion may have on Ghost Bats, but that it would try to avoid disturbance to the bats where possible. The Proponent will provide biological reports to NAC for review, and is available to attend further meetings to discuss the Proposal. The Proponent will continue to consult with NAC in respect of the Proposal.	Discussion of early Project design and environmental approvals process. Protection of important plants and animals will need to be considered in mine design and closure planning.
19/11/2019	BNTAC/ Banjima Traditional Owners	Banjima LIC	An overview of Proposal and biological survey outcomes was presented to the LIC, including that it will involve above water table mining only at HD2 and BHT, permanent external waste dumps, water supply from a small borefield and the transport of ore to HD1 for processing. Infrastructure required by the Proposal will include a crossing over Pebble Mouse Creek, access tracks and roads, a rail crossing and the potential diversion of part of Great Northern Highway. Discussion of the proposed Assessment on Referral Information approvals process and timeline for the Project. An overview of the biological survey outcomes to date was also provided.	BNTAC noted that the Proponent presented information about the Proposal to BNTAC previously and this has been shared with the elders. Banjima LIC members noted that HD2 and BHT are on Nyiyaparli country but the ore will be processed on Banjima country.	The Proponent will provide biological reports to BNTAC for review, and is available to attend further meetings in respect of the Proposal and related issues.	Discussion of early Project design and environmental approvals process.
24/02/2020	Weeli Wolli Creek Advisory Committee	Weeli Wolli Creek Advisory Committee meeting	Overview of the Proposal and summary of environmental studies to date. NB Committee did not meet quorum.	The Committee noted that continued access to Weeli Wolli Creek will be an important consideration, and Traditional Owner consultation will be appreciated.	The Proponent will continue to engage with Traditional Owners in respect of the Project and maintaining access to Weeli Wolli Creek, including via LICs and other forums.	Discussion of early Project design. Maintaining access to Weeli Wolli Creek will need to be considered in mine design and closure planning.
16/04/2020	KNAC, BNTAC, NAC	Email	The Proponent provided an explanatory memo and copies of the updated biological reports.	NA	NA	NA
1/07/2020	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli Executive Committee meeting	Overview of the Project and summary of the approvals process.	NA	NA	NA

Start date	Stakeholder	Consultation Type / Forum	Information provided by Proponent (summary for ERD and MCP)	Stakeholder Response/ Comments	Proponent Response (summary)	Key feedback for Closure Planning
19/08/2020	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga LIC meeting	Overview of the Project scope including that it involves above water table mining only of the HD2 and BHT deposits, external waste dumps, water supply and associated infrastructure, transport of ore (via conveyors or haulage) to HD1 for processing , access tracks and roads, rail crossing, and the potential diversion of part of Great Northern Highway on to Ngarlawangga country. New crossings of Pebble Mouse Creek will be required to transport ore to HD1. Overview of biological surveys completed to date and outcomes and initial visual impact assessment work. Discussion of the Social Surroundings consultation sought with Ngarlawangga. Discussion of the approvals process.	Request for more information about Ghost Bats. Copies of additional biological reports to be provided to NAC.	The Proponent is happy to meet with NAC and provide additional information about Ghost Bats. Additional biological reports were provided to NAC in October.	NA
21/08/2020	KNAC/ Nyiyaparli Traditional Owners	Teleconference with KNAC staff	Overview of the Project and approvals process and timing. Discussion of the Social Surroundings consultation sought with Nyiyaparli.	NA	NA	NA
17/09/2020	BNTAC/ Banjima Traditional Owners	Meeting with BNTAC staff	Overview of the Project and approvals process and timing. Update on biological reports. Discussion of the Social Surroundings consultation sought with Banjima.	BNTAC noted that ore will be processed on Banjima country and that Banjima should be compensated for this impact. BNTAC asked for more information about water use at HD1 and that water will be a focus for Banjima in future consultation. BNTAC also asked if traffic will increase in frequency.	The Proponent and BNTAC have agreed an approach for further discussions about compensation. Information about water use at HD1 was provided to BNTAC. The Proponent advised that the process rate will be similar to now so traffic will be about the same frequency.	Discussion of early Project design and that water use and management will be important to consider in project design and closure planning.
23/09/2020	BNTAC/ Banjima Traditional Owners	Delivery of USB with information	Additional biological reports and explanatory memos provided	NA	NA	NA
25/09/2020	NAC/ Ngarlawangga Traditional Owners	Meeting with NAC staff and representatives to plan pre-fieldwork meeting	Discussion and planning of Social Surroundings consultation sought and proposed timing. Planning of pre-fieldwork meeting held on 9 October 2020.	This will be a collaborative approach to capture information for the Proponent to feed into the mine design and approval but also to make sure Ngarlawangga capture the information and knowledge for the group.	NA	NA
1/10/2020	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli LIC meeting	Overview of the Project and approvals process and timing. Information on the HD2 Project, closure strategy and objectives. Discussion of the proposed Social Surroundings consultation to feed into the approvals process. The Proponent is seeking Nyiyaparli feedback to include in the Project design and the approvals process, and would like to get feedback on the ore transport options (haul road or conveyor) and location of the proposed Pebble Mouse Creek crossing. Initial information about the closure planning process.	Protecting water and heritage sites and places is important - especially Weeli Wolli Creek and maintaining the flow of Pebble Mouse Creek. Free and safe access to Weeli Wolli Creek needs to be considered in planning. The proposed waste rock landform near Weeli Wolli Creek is too close. Impacts to water and cumulative impacts to water are a concern. Nyiyaparli requested the Proponent work with other mining companies in the area on a combined water management approach. Nyiyaparli want to be involved in environmental surveys and monitoring work. Nyiyaparli ladies and their plant knowledge should also be included in survey work (both environmental surveys and ethnobotanical surveys). Nyiyaparli want to be consulted about closure of the Project, and an opportunity to explain to Rio Tinto what they would like.	Feedback included in ongoing project revision work, and to inform ongoing consultation. The water rock landform south of the HD2 pit was removed in subsequent mine designs and access to Weeli Wolli Creek will be maintained as part of the Project design. Access to Weeli Wolli Creek will also be supported during construction of the Project. The Proponent is developing a framework to work with BHP on water management. Ethnobotanical work with Nyiyaparli ladies has commenced and will continue. Closure consultation is ongoing as the project design is refined and developed.	Discussion of early Project design and that the waste rock landform south of the HD2 pit is too close, and that water use and management will be important to consider in project design and closure planning, along with maintaining access to Weeli Wolli Creek. Additional closure consultation is required for the Proponent t better understand closure planning for the Project and provide input. An agreed closure consultation process will be part of the SCHMP.
2/10/2020	KNAC/ Nyiyaparli Traditional Owners	Social Surroundings pre-fieldwork workshop	Whole-day workshop with KNAC staff and representatives and Nyiyaparli Traditional Owners. Discussion of the approvals process and timing and what 'Social Surroundings' is. Discussion of the Project scope and timing, including surface and ground water and water supply options, proposed Pebble Mouse Creek crossings, and the proposed surface water diversion near the proposed HD2 pit. Discussion of initial closure planning and outcomes and heritage survey work to date. Discussion of key social and cultural values in the Project area. Discussion of the Social Surroundings consultation sought to inform the Project and support the approval. Scoping for the first in-field consultation planned for late October 2020.	Key issues raised by the Nyiyaparli Traditional Owners to be considered in the Project design and discussed further included impacts to waterways and water flows, water use and management, increased dust and noise, impacts to heritage sites, access to country, ground disturbance and other impacts to country, closure and rehabilitation (including opportunities to backfill), Nyiyaparli involvement in environmental and other monitoring and business development and employment opportunities. Meeting feedback also captured in the first Social Surroundings Short Report (provided in December 2020)	NA	Discussion of early Project design and that water use and management will be important to consider in project design and closure planning, along with access to important sites and places and opportunities to backfill to reduce pit voids at closure.
2/10/2020	KNAC/ Nyiyaparli Traditional Owners	USB	Additional biological reports and explanatory memos provided to KNAC	NA	NA	NA

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9/10/2020	NAC/ Ngarlawangga Traditional Owners	USB	Additional biological reports and explanatory memos provided to NAC	NA	NA	NA
9/10/2020	NAC/ Ngarlawangga Traditional Owners	Social Surroundings pre-fieldwork workshop	Whole-day workshop with NAC staff and representatives and Ngarlawangga Traditional Owners to discuss two Projects, including the HD2 Proposal. Discussion of the approvals process and timing and what 'Social Surroundings' is. Discussion of the Project scope and timing, including above water table mining of HD2 and BHT, ore transport infrastructure, proposed Pebble Mouse Creek crossings, water supply options and the potential realignment of part of Great Northern Highway. Discussion of visual impacts from Ngarlawangga country and the biological survey work completed to date. Discussion of the Social Surroundings consultation sought to inform the Project and the approval, and approvals timing.	Water is a main concern for Ngarlawangga, including impacts to waterways and waterholes and the animals that rely on waterholes. Ngarlawangga would like more information about the Pebble Mouse Creek crossings. Dust, access to country and support for Ngarlawangga to access country are also important.	Feedback from Ngarlawangga will be included in the mine design and approval. In field consultation will be undertaken to visit the Project area and better understand important values and potential impacts to help guide work to avoid, reduce or manage impacts. Pebble Mouse Creek crossings will be designed to allow water to flow through. Understanding what areas Ngarlawangga want to access will help us develop options.	Discussion of detailed project design and that surface water flows at Pebble Mouse Creek and access to important areas will be important to consider in project design and closure planning.
22/10/2020	BNTAC/ Banjima Traditional Owners	Banjima LIC meeting	Update on the Project and scope, including that it involves above water table mining at HD2 and BHT, infrastructure for processing and transporting ore (via conveyors or haulage) to HD1, external waste rock landforms and stockpiles, potential realignment of part of Great Northern Highway, water supply (groundwater abstraction and / or existing HD1 dewatering water that is discharged via the gabion). The Project will also include new Pebble Mouse Creek crossings for the haul road/conveyor, and potential new mine access road and realignment of Great Northern Highway, Discussion of approvals process and timing, Social Surroundings consultation and the consultation sought with Banjima.	What impacts will the Project have on Pebble Mouse Creek? What is the cost of water from Weeli Wolli Creek versus Baby Hope?	The Proponent will need to ensure maintenance of Pebble Mouse Creek flows and prevent the banking-up of water upstream of crossings. Water supply will be needed for the Project and several options are being investigated e.g., ground water at Baby Hope or using some of the water from dewatering at HD1 which would otherwise be discharged to Weeli Wolli Creek. The Proponent is keen to receive feedback on the options. In looking at water supply options, the Proponent will take into consideration the impact of using that option and then the costs. The Environmental Protection Authority requires a study on the social surroundings e.g., animals, natural landscape, environment with cultural significance, so we can understand the impacts on the cultural values and look at options to avoid and reduce impacts.	Discussion of detailed project design and that surface water flows at Pebble Mouse Creek and water supply options to reduce impacts to the environment will be important to consider in project design and closure planning.
22/10/2020	KNAC/ Nyiyaparli Traditional Owners	First Social Surroundings in-field consultation	1.5 day in-field consultation with KNAC staff and representatives and Nyiyaparli Traditional Owners to visit areas within the Project and to discuss the Project in more detail. Topics discussed included the importance of water, water use and management and water quality (diversions, discharge, drawdown, dust control), concerns about impacts of dust on country (particularly accumulation in water features/drainage), amenity, impacts to people and animals. Discussed that access to country needs to be easy and not restricted by permit systems, fences, gates etc. More consultation is required to discuss closure planning.	Request that the Proponent investigate moving the proposed waste rock landform south of the HD2 pit further away from Weeli Wolli Creek. Request for additional information and consultation about the size of the proposed pits and waste rock landforms, water use and management, expected dust levels and management, plant and animal studies in the Project area, closure planning, opportunities for Nyiyaparli involvement in on ground monitoring and management work and business development opportunities. Short report from trip received 15 December 2020.	Feedback and recommendations included in planning future in-field consultation. Waste rock landform south of the HD2 pit removed in subsequent mine design updates.	Discussion of detailed project design and key issues to be considered in project design and closure planning.
9/12/2020	NAC/ Ngarlawangga Traditional Owners	Social Surroundings pre-fieldwork workshop	1.5 day workshop with NAC staff and representatives and Ngarlawangga Traditional Owners to discuss what Social Surroundings is, and to scope the first Social Surroundings field trip planned for early 2021 which will be for 2 Projects, including the HD2 Proposal.	Joint planning of the first Social Surroundings field trip planned for early 2021. Key concerns include protecting access to country, protecting animals and animal habitats, protecting water flows and waterways, water use and management, impacts to heritage sites, dust and visual impacts to country, rehabilitation of country after mining.	Feedback included in jointly planning the first in-field consultation with Ngarlawangga which was held in April 2021.	Discussion of detailed project design and key issues to be considered in project design and closure planning.

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27/01/2021	BNTAC/ Banjima Traditional Owners	Meeting with BNTAC staff	Meeting with BNTAC staff to discuss the Project and Social Surroundings consultation sought. Discussion of the Project scope, including that it involves above water table mining at HD2 and BHT, infrastructure for processing and transporting ore (via conveyors or haulage) to HD1, external waste rock landforms and stockpiles, potential realignment of part of Great Northern Highway, water supply (groundwater abstraction and / or existing HD1 dewatering water that is discharged via the gabion). The Project will also include new Pebble Mouse Creek crossings for the haul road/conveyor, and potential new mine access road and realignment of Great Northern Highway. Discussion of biological survey work undertaken to date. Discussion of approvals process and timing, Social Surroundings consultation and the consultation sought with Banjima.	BNTAC has provided the biological survey reports to their consultant to review. BNTAC requested spatial data for the biological surveys.	Project and biological survey spatial data provided on 8/07/2021.	Discussion of detailed project design.
3/03/2021	BNTAC/ Banjima Traditional Owners	Email	Updated biological reports provided to BNTAC and its consultant.	NA	NA	NA
29/03/2021	BNTAC/ Banjima Traditional Owners	Email	Additional environmental reports provided to BNTAC and its consultant.	NA	NA	NA
29/06/2021	BNTAC/ Banjima Traditional Owners	Email	Additional environmental reports provided to BNTAC and its consultant.	NA	NA	NA
11/03/2021	BNTAC/ Banjima Traditional Owners	Banjima LIC/LoMP meeting	Update on the Project scope, including that it involves above water table mining at HD2 and BHT, infrastructure for processing and transporting ore (via conveyors or haulage) to HD1, external waste rock landforms and stockpiles, potential realignment of part of Great Northern Highway, water supply (groundwater abstraction and / or existing HD1 dewatering water that is discharged via the gabion). The Project will also include new Pebble Mouse Creek crossings for the haul road/conveyor, and potential new mine access road and realignment of Great Northern Highway. Discussion of biological survey work undertaken to date. Discussion of approvals process and timing, Social Surroundings consultation and the consultation sought with Banjima.	BNTAC requested more information on how deep and wide the pits will be. Will the Pebble Mouse Creek crossing disrupt the creek? What about dust and other impacts? Can the waste rock landform south of the HD2 pit and near Weeli Wolli Creek be removed? Can the Development Envelope be reduced? Visual impact assessment will be important. Concerns about lack of compensation to Banjima for impacts to country.	The Proponent advised that the Pebble Mouse Creek crossings will be designed to allow water to flow through. We will do more work to understand potential dust creation and how to reduce it. The waste rock landform south of the HD2 pit near Weeli Wolli Creek was removed in subsequent mine designs, and the Development Envelope has been reduced in a number of areas as project planning has refined the footprint. A process to support discussions about compensation to Banjima was agreed around mid 2021.	Discussion of detailed project design and key issues to be considered in project design and closure planning.
18/03/2021	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga LIC meeting	Update on the Project, that at this stage we have a conceptual footprint. The Proponent will consult with NAC and Ngarlawangga further in the next few months before the approvals process commences. The Proponent is seeking Ngarlawangga involvement in Social Surroundings consultation.	NA	NA	High level discussion of Project.
8/04/2021	NAC/ Ngarlawangga Traditional Owners	First Social Surroundings in-field consultation	3 day in-field consultation with NAC staff and representatives and Ngarlawangga Traditional Owners to visit areas within the Project's Development Envelope to discuss the Project in more detail. NB this was an combined trip for 2 projects with only a small amount of time spent discussing the HD2 Proposal. Topics discussed included the importance of water, and maintaining water flows, potential Pebble Mouse Creek crossings, concerns about dust creation, impact to country, impacts to people and animals. Discussed that greater access to country is desired. discussed biological survey work to date.	Key issues raised include impacts to water (including water abstraction, water flows and dust in waterways and waterholes), impacts to cultural heritage, Country, plants and animals and access, changes to the landscape and aesthetic values of Country. Concerns about current and increased traffic on Great Northern Highway, and impacts the potential new bridge may have on water flows and existing water pools along Pebble Mouse Creek. Request for ongoing consultation, including about the proposed Project footprint, cultural values mapping and Traditional Ecological Knowledge surveys, additional visual and sound modelling of the proposed Great Northern Highway realignment. Request for further consultation about closure planning and rehabilitation. Final Report finalised in July 2021.	Key issues raised include impacts to water (including water abstraction, water flows and dust in waterways and waterholes), impacts to cultural heritage, Country, plants and animals and access, changes to the landscape and aesthetic values of Country. Concerns about current and increased traffic on Great Northern Highway, and impacts the potential new bridge may have on water flows and existing water pools along Pebble Mouse Creek. Request for ongoing consultation, including about the proposed Project footprint, as well as closure planning and rehabilitation. Final Report finalised in July 2021.	Discussion of detailed project design and key issues to be considered in project design and closure planning.
23/04/2021	KNAC, BNTAC and NAC	KNAC, BNTAC and NAC	Draft Referrals and draft ESD provided to Traditional Owner groups for review and feedback.	See responses from each Traditional Owner group	See responses from each Traditional Owner group	See responses from each Traditional Owner group
5/07/2021	KNAC/ Nyiyaparli Traditional Owners	Email	Updated biological reports provided to KNAC.	NA	NA	NA

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7/07/2021	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli LIC meeting	Update on Project, discussion of Part IV process and timing, Social Surroundings and consultation to date and ongoing work/changes to project in response. Nyiyaparli feedback sought in relation to ore transport options and Project design.	NA	NA	Discussion of detailed project design.
8/07/2021	BNTAC/ Banjima Traditional Owners	Email	Spatial data files for updated biological surveys provided.	NA	NA	NA
21/07/2021	BNTAC/ Banjima Traditional Owners	Banjima LOMP meeting	Brief discussion that the Project requires Social Surroundings consultation, and that the draft Referral and ESD for the Project has been provided to BNTAC and its consultant for review and feedback. A dedicated Social Surroundings workshop is to be held for the Project to develop the consultation process and plan the consultation.	NA	NA	NA
22/07/2021	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli Social Surroundings workshop	2-day workshop. Update on the Project and changes to the mine design based on feedback to date. Discussion of Part IV process and timing, Social Surroundings consultation to date and planned future consultation. Discussion of approvals process, draft Referral and ESD	Discussion of key Social Surroundings issues including water, dust, restricted access to country, impacts to heritage sites, interfering with caring for country, increased opportunities to take part in on-ground work to monitor and manage country. Need to protect Weeli Wolli Creek, including reducing or removing the waste rock landform near it.	Feedback included in ongoing mine design work. Feedback also included in Short Report for this workshop and the August Social Surrounding in-field consultation which was provided in November 2021	Discussion of detailed project design and key issues to be considered in project design and closure planning.
23/07/2021	BNTAC/ Banjima Traditional Owners	Email	Peer review report prepared on behalf of BNTAC provided to the Proponent.	Feedback provided in respect of biological survey and other studies undertaken to date and additional work required to meet EPA guidance.	Project design is continuing to be refined and additional biological survey and other studies will be undertaken to address any gaps in initial survey coverage and the coverage required for the refined project design. Some changes were made to the draft Referral in response to this report.	NA
29/07/2021	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga Social Surroundings workshop	Workshop to discuss outcomes of Social Surroundings consultation to date (the first Social Surroundings in-field consultation), the approvals process and timing, and provide a Project update.	Social Surroundings consultation to continue. Ngarlawangga requested additional consultation in respect of compensation for impacts to country as well as ongoing consultation about visual and other impacts.	Social Surroundings consultation to continue. Ngarlawangga requested additional consultation in respect of compensation for impacts to country as well as ongoing consultation about visual and other impacts.	High level feedback on project design and additional information regarding visual impacts.
6/08/2021	KNAC/ Nyiyaparli Traditional Owners	KNAC	KNAC provided feedback to the Proponent on the draft Referral and ESD	Feedback provided on draft referral and ESD.	Feedback considered and incorporated into the draft referral and ESD where relevant.	Feedback in respect of referral and ESD.
9/08/2021	KNAC/ Nyiyaparli Traditional Owners	Second Social Surroundings in-field consultation	Second In-field consultation with Nyiyaparli Traditional Owners to visit key, discuss the Project and changes to date in response to Nyiyaparli feedback. Discussion of key feedback to date, key Social Surroundings values and potential impacts including water, water management and water quality (diversions, drawdown, dust control), concerns about dust creation and impacts of dust on country (particularly accumulation in water features/drainage), amenity, animals, people, access to country: including optional access roads to highly significant heritage sites and important plants and animals, including biological surveys to date.	Discussion of key Social Surroundings values including water, dust, access to country, Weeli Wolli Creek and caring for country. Key issues raised include water impacts and water management, mine design, including waste rock landforms and the importance of mine closure and rehabilitation on impacts to country and visual amenity.	Feedback included in ongoing mine design work. Feedback summarised in Short report received in November 2021.	Discussion of detailed project design and key Social Surroundings issues to be considered in project design and closure planning.
16/08/2021	BNTAC/ Banjima Traditional Owners	Meeting with BNTAC staff	Discussion of the information provided by the Proponent to date and the peer review report provided by BNTAC's consultant. Discussion that the Proponent will make some changes to the Referral in response to the feedback received and that it will provide a copy of the updated Referral at the time of submission to the EPA.	BNTAC will prepare a letter providing feedback on the Referral document in respect of three key issues: troglofaunal, inland waters and the link between the HD1 mine and the HD2 Proposal.	The Proponent updated the referral document based on feedback from a number of parties and also considered the feedback from BNTAC. The Proponent provided an updated copy of the referral at the time of lodging with the EPA.	Feedback in respect of the biological and other studies undertaken to date and feedback on the referral document will be considered as part of the approvals documents and process and in mine design, where relevant

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17/08/2021	NAC/ Ngarlawangga Traditional Owners	Email	NAC provided to Rio Tinto feedback on the draft Referral and ESD	Feedback provided on the draft documents. Request for ongoing consultation about the Project footprint, request to reduce the Development Envelope where possible -particularly to remove key heritage and drainage features including Weeli Wolli Creek. Additional information about access, noise, light and litter impacts from the potential diversion of Great Northern Highway. Ngarlawangga desire for greater involvement in environmental survey, monitoring and management work.	The Proponent updated the Referral document based on feedback from a number of parties and also considered the feedback from NAC. The Proponent provided an updated copy of the referral at the time of lodging with the EPA.	Feedback in respect of referral and ESD.
19/08/2021	BNTAC/ Banjima Traditional Owners	Letter from BNTAC	BNTAC provided the Proponent with a letter providing feedback on the draft referral.	Feedback provided in respect of the Inland Waters, Social Surroundings and Subterranean Fauna sections of the referral.	The Proponent updated the referral document based on feedback from a number of parties and also considered the feedback from BNTAC. The Proponent provided an updated copy of the referral at the time of lodging with the EPA.	Feedback in respect of the biological and other studies undertaken to date and feedback on the referral document will be considered as part of the approvals documents and process and in mine design, where relevant.
3/09/2021	KNAC, NAC, BNTAC	Email	Response to feedback from KNAC and NAC on draft Referral, provision of updated Referral to KNAC, NAC and BNTAC	NA	NA	NA
8/09/2021	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga LoMP meeting	Update on project and Social Surroundings consultation to date. Discussion of next steps in the social Surroundings consultation process and that the draft Referral and ESD were provided to NAC for review and feedback.	NAC and its consultants have reviewed the draft Referral and ESD and provided feedback to the Proponent. Ngarlawangga want to progress discussions about compensation Ngarlawangga want more information about water and potential impacts to the the flow of Pebble Mouse Creek.	NAC paused consultation for the project while compensation issues were progressed between the parties. A Social Investment package was developed and presented to the NAC Board in March 2022. This was well received and consultation was scheduled to recommence with a further Social Surroundings in-field consultation in May 2022 but this had to be postponed due to severe weather and flooding in the Pilbara.	Discussion of detailed project design and that flows to Pebble Mouse Creek will need to be considered in project design and closure planning.
4/10/2021	BNTAC/ Banjima Traditional Owners	Meeting with BNTAC staff	Brief update on the approval process and timing, Discussion of the Social Surroundings and consultation sought and proposed timing.	BNTAC requested that the Proponent provide copies of the heritage survey reports for the portion of the Project's Development Envelope in Banjima Country.	Copies of heritage reports were provided on 17/01/2022.	NA
22/11/2021	KNAC/ Nyiyaparli Traditional Owners	Third Nyiyaparli Social Surroundings in-field consultation	Third In-field consultation with Nyiyaparli Traditional Owners to visit key areas, discuss the Project and changes to date in response to Nyiyaparli feedback. Further discussion of key topics including water and water management, dust and impacts of dust on country (particularly accumulation in water features/drainage), amenity, animals, people and closure and rehabilitation.	Discussion of key Social Surroundings values including water, dust, access to country, and closure and rehabilitation. Key issues raised include water impacts and water management, mine design, including waste rock landforms and the importance of mine closure and rehabilitation on impacts to country and visual amenity.	Feedback included in ongoing mine design work. Feedback summarised in Short report received in November 2021.	Discussion of detailed project design and key Social Surroundings issues to be considered in Project design and closure planning.
26/11/2021	BNTAC/ Banjima Traditional Owners	Banjima LIC/LOMP meeting	Update on the project scope. Discussion of Part IV process and timing, Social Surroundings and consultation sought	Discussion of proposed first Social Surroundings field trip and scope of work.	Scope of work developed for first in-field Social Surroundings consultation.	NA
15/12/2021	BNTAC/ Banjima Traditional Owners	Banjima LIC/LOMP meeting	Confirmation of dates for first Social Surroundings in-field consultation, confirmation of scope of work for trip.	Scope of work agreed for Phase 1 of the Social Surroundings Assessment.	NA	NA
17/12/2021	KNAC, NAC and BNTAC	Email	The Proponent provided a copy of updated draft ESD and a summary of what feedback had been incorporated prior to lodgement	NA	NA	NA
17/01/2022	BNTAC/ Banjima Traditional Owners	First Social Surroundings in-field consultation	First in-field Social Surroundings consultation with Banjima Traditional Owners undertaken to identify and record social and cultural values and to identify key issues/concerns to be considered in project design and the approvals documents. Project overview provided and key locations visited. Key topics in respect of which feedback was sought included surface and ground water, dust, noise and vibration, access during and post mining, culturally significant plants and animals, any impacts from increased personnel and traffic, considerations related to mine closure and rehabilitation and visual impacts from the Project. Feedback on ore transport options and water supply options was also sought.	Draft Preliminary Advice provided by BNTAC to the Proponent on 28/03/2022. Key issues/values identified include water, plants, animals, hills/ranges and people. Key themes included protecting country, capacity building and sustainable businesses, and Banjima governance and processes. Protecting water and the flow of water, as well as access to Weeli Wolli Creek were noted as particularly important. Pending an updated Final Report, this information has been incorporated into the draft HD2 Proposal Social Surroundings chapter.	Information from the first in-field consultation and the draft Preliminary Advice will considered in ongoing mine design work as well as the Social Surroundings chapter.	Discussion of detailed project design and key issues to be considered in project design and closure planning, including protection of waterways and water flows and maintaining access to Weeli Wolli Creek.

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8/03/2022	KNAC/ Nyiyaparli Traditional Owners	Email	The proponent provided a copy of the Draft HD2 Proposal ERD and associated appendices. The proponent advised the ERD package will be provided in two tranches (ERD with exception of Fauna chapter and appendices) and remainder on 18 December 2022.	Social Surrounds studies and consultation - HD2 ERD review for Karlka Aboriginal Corporation Nyiyaparli People by Preston Consulting - 05 April 2023. Provided by KNAC to the proponent.	The proponent provided a response to feedback on the KNAC review of the HD2 Proposal ERD and SCHMP on 11 Aug 2023. Refer to table in letter for summary.	TO concern more than just cumulative impacts on surface water Impacts on the waterholes have an impact on sense of place Waste management includes landfills? The MCP largely ignores consultation with Nyiyaparli People So no post mining land use? Despite the ongoing use of the land by TO's?"
14/03/2022	KNAC/ Nyiyaparli Traditional Owners	Fourth Social Surroundings in-field consultation	Fourth in-field consultation to discuss the Project, changes to date in response to Nyiyaparli feedback, discussion of ore transport options, waterholes, closure and rehabilitation and ongoing work to refine the project and avoid, reduce and manage impacts to social surroundings through the SCHMP and ongoing consultation.	Feedback in respect of ore transport options, discussion of the HD2 waterhole and BHT Rockhole, further discussion and feedback in respect of closure and rehabilitation.	Feedback to be included in ongoing mine design work. Summary of feedback to be included in consolidated Social Surroundings report due in June 2022.	Discussion of detailed project design and key issues to be considered in project design and closure planning, including protection of waterways, visual amenity and access to and use of country post-mining.
10/04/2022	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli Ethnobotanical survey	In field consultation to identify and record ethnobotanical and land management information in the vicinity of the HD2 Proposal	Report pending (awaiting the conduct of a second ethnobotanical trip which was postponed from May 2022 to September 2022 due to flooding)	Ethno survey 3 completed 21 Oct 2022	Culturally important elements identified: Ash and Bark, Totem Plants and animals, Burials, Wild Honey, Plant Medicines, Larvae and Eggs, Culturally significant plants. See report for full details.
28/04/2022	KNAC/ Nyiyaparli Traditional Owners	Email	Provision of draft Social Surroundings chapter to KNAC and Nyiyaparli Traditional Owners for review and feedback	Social Surrounds studies and consultation - HD2 ERD review for Karlka Aboriginal Corporation Nyiyaparli People by Preston Consulting - 05 April 2023. Provided by KNAC to the proponent.	The proponent provided a response to feedback on the KNAC review of the HD2 Proposal ERD and SCHMP on 11 Aug 2023. Refer to table in letter for summary.	Weeli Wolli Creek (Wirlawarli) was identified as Nyiyaparli's most important landscape feature in the vicinity of the HD2 Proposal. Though any waterway (Pebble Mouse Creek, for example) and associated yinta (permanent or semi-permanent pool along the creeks and rivers) also hold special importance. There are important sites and places within or adjacent the Development Envelope, too; artefact scatters, cultural scarred trees, rockshelters with cultural assemblages or petroglyphs, and a large cultural site-complex HOPE4-07). These sites and cultural features of the andscape heighten the level of concern around possible impact. And these are elements of culture to be handed on to future generations
4/05/2022	KNAC/ Nyiyaparli Traditional Owners	Social Surroundings consolidation workshop	Three-day Social Surroundings workshop with Nyiyaparli Traditional Owners to discuss the Project, changes to date in response to Nyiyaparli feedback, discussion of residual impacts including to water, country and ongoing work to refine the project and avoid, reduce and manage impacts to Social Surroundings through the SCHMP and ongoing consultation. Discussion of the content and purpose of the Social Surroundings chapter and SCHMP, feedback from Nyiyaparli to inform the SS chapter and joint development of the SCHMP.	Feedback in respect of Project scope and key issues, including initial option to avoid impacts to HD2 waterholes and BHT Rockhole, Consolidated Social Surroundings report pending.	Feedback to be included in ongoing mine design work. Summary of feedback to be included in consolidated Social Surroundings report due in June 2022.	Discussion of detailed project design and key issues to be considered in project design and closure planning, including protection of waterways, visual amenity and access to and use of country post-mining.
17/05/2022	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli LOMP meeting	Proponent provided an update on HD2 Proposal Provided information about a dust management strategy (included in HD1 S study update), Dust Noise and Vibration monitoring is ongoing. Confirmed access to WWC will be maintained by new access road,	LoMP committee members requested a better timeline that will show how HD2 BHT and HD1 Closure fits together.	Proponent responded it's unlikely that Rio Tinto would go back into HD1 South and HD1 North due to backfill but would need business endorsement for this to be formalised.	NA

Start date	Stakeholder	Consultation Type / Forum	Information provided by Proponent (summary for ERD and MCP)	Stakeholder Response/ Comments	Proponent Response (summary)	Key feedback for Closure Planning
20/06/2022	BNTAC/ Banjima Traditional Owners	Banjima LIC meeting	Proponent provided a Study update. Proponent advised in response to feedback from previous engagements, the proposed pits and associated activities have been relocated away from Weeli Wolli Creek. Key approvals and timelines discussed, with conversation held regarding requirement for ongoing consultation at Study stage. Proponent presented ore transport options and access to Weeli Wolli Creek during construction. Discussions held regarding progressing social surroundings consultations. First consultation held in January 2021.	Draft minutes to be finalised. Commitment to continue working to progress Social Surroundings consultations.	NA	NA
20/06/2022	KNAC/ Nyiyaparli Traditional Owners	Mine Closure Workshop	Nyiyaparli closure workshop. Discussion of closure planning principles and relationship between HD1 and the HD2 Project.	See below	See below	See below
6/09/2022	KNAC/ Nyiyaparli Traditional Owners	Report: Mine Closure Workshop 20-24 June 2022 [DRAFT] Report prepared for Karlka Nyiyaparli Aboriginal Corporation by Preston Consulting Pty Ltd	Nyiyaparli closure workshop. Discussion of closure planning principles and relationship between HD1 and the HD2 Project.	<u>The report is still in draft</u> - Workshop details - Discussion related to closure of RTIO sites on Nyiyaparli country - Revised Principles for mine closure on Nyiyaparli country - List of Action Items Important considerations regarding this report: - - The report is based on consultation that was pertaining to the HD1 area and therefore some of the recommendations, requests, considerations etc will only be relevant to that area. - This was an early consultation on closure and further consultation will likely lead to additional concerns, ideas and opportunities being raised. - The forum was not a decision-making forum.	Further consultation is required	While this document is still in draft and requires further discussion prior to finalisation, it does provide valuable insight to the areas of alignment with RTIO current plans and processes and those areas where there may be variations or gaps. This information will help to focus attention of future consultations related to closure within the Hope Downs area.
27/06/2022	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga LOMP meeting	Proponent provided an update of HD1 Sustaining (HD2 Proposal) including proposed rock landforms and pits. Life of mine – 7-12 years. Construction – 2024-25. The Study is in Pre-Feasibility (PFS) to move into Feasibility (FS) soon	Ngarlawangga Aboriginal Corporation CEO –raised that officially Ngarlawangga hasn't received any road options - Options preferred to receive prior to field trip	NA	NA
28/06/2022	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga Social Surroundings workshop	Proponent provided and introduction and explanation of the ERD/SS chapter and what it involves. Proponent provided an overview of what an SCHMP is and th SS Champter and SCHMP Process Timeline.	NLW have requested to have 2 day works shops to enable more time to discuss and digest content – This has been agreed	NA	NA
30/06/2022	NAC/ Ngarlawangga Traditional Owners	Email	Template SCHMP provided	NA	NA	Note SCHMP is only being completed for NYI, not required for BAN or NLW.
26/07/2023	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga Closure Principles Workshop	Draft MCP	Feedback on MCP	Reponses to comments	Closure means we are going to get filled in and will go back to looking like Country it is. What we want vs reality of what we will get. We want an asset not a liability. We all have concerns of terminology of mine closure.
10/07/2023	BNTAC/ Banjima Traditional Owners	Email	Draft MCP, Letter to BNTAC_HD2 ERD Response to BNTAC Review	Feedback on MCP	Reponses to comments and changes to MCP	TBC
10/09/2023	KNAC/ Nyiyaparli Traditional Owners	Email	Draft MCP - sent as part of updated August 2023 ERD package	Feedback on MCP	Reponses to comments and changes to MCP	TBC
13/08/2023	EPA	Letter	Draft MCP	Feedback on MCP	Reponses to comments and changes to MCP	TBC
16/08/2023	EPA	Email	Responses to feedback on Part IV assessment, including comments on the MCP and comments specific to closure in the Environmental Review Document.	06.10.2023 EPAS Letter to RTIO - Comments on Hope Downs 2 draft ERD v3 October 2023	Reponses to comments and changes to MCP	TBC

Appendix 3: Closure Knowledge Database

Rio Tinto Hope Downs 2 closure knowledge database

The closure knowledge database is a summary of the technical reports that directly or indirectly contribute to the development of the closure plan. These documents do not form part of the report and are for indicative purposes only.

The knowledge and understanding of closure issues and management strategies evolve and improve over time, coincident with the development of the mining operation. As a result, some components of some reports and studies may be superseded by new research or studies. While the closure plan addresses the current state of understanding and strategy for closure, the closure knowledge database captures the historical development of closure knowledge, and demonstrates how experience and knowledge developed at other Rio Tinto sites has been considered during the development of the closure plan and across the life of the operation. Accordingly, some information presented in the closure knowledge database may be obsolete.

Technical reports supporting the closure of the operation will be presented as part of the last plan produced prior to the implementation of closure (also known as the Decommissioning Plan).

Geochemical characterisation

Review of Waste Rock Geochemistry a) General Overview of Acid Base Accounting — **2006**

This report contains a general overview of acid base accounting and a summary of the geochemical test work that has been previously completed for various sites and lithologies.

Internal reference: RTIO-PDE-0021130

There are large discrepancies in the total sulfur concentration measured using XRF and LECO machines. The XRF machine underestimates the sulfur concentration at values greater than 2%. Materials with total sulfur concentrations less than 0.1% can contain low capacity PAF material, however, it is considered only to be low additional acid and metalliferous risk if the boundary for inert material and potentially acid forming material is shifted from 0.02%S to 0.1%S. A paste pH result of less than 7 should be sent to the black shale dump and a paste pH result of greater than 7 can be sent to an inert material waste dump.

Mineralogical Analysis of Potentially Acid Forming Materials — **2008**

Quantitative mineralogy (QEM-Scan) for samples of rock collected from Tom Price, Channar, West Angelas, Brockman, Paraburdoo (4 East Extension), Western Turner Syncline and Hope Downs 1 North was undertaken. Comparisons were made between two methodologies use to characterise potentially acid forming materials; acid base accounting and mineralogical analysis.

Internal reference: RTIO-PDE-0053725

All samples contained elevated total sulfur concentrations and the lithologies were either shale, banded iron formation or dolomite. Pyrite was the dominant mineral contributing to acidity and the dominant sulfate secondary mineralisation consisted of alunite and jarosite.

Determination of ARD potential of Rio Tinto Iron Ore (WA) Waste Rock Samples — **2008**

This report investigates the use of mineralogy to predict acid and metalliferous drainage potential. Analysis of numerous rocks was undertaken using QEM-SCAN.

Internal reference: RTIO-PDE-0051613

Areas of waste rock which have underdone oxidation can be identified where sulfur-bearing minerals vary between samples in the form of pyrite, alunite and jarosite. The variability of gangue mineral phases suggest that some areas of composite waste rock pile may provide some neutralising potential while other areas will have no neutralising potential. Variable textural and mineralogical controls on sulfide mineral occurrence result in decreased accessibility of pyrite to oxidising fluids.

Contaminant Leaching from Non-Sulfidic Waste Material — **2011**

The available leach extract data and information pertaining to the distribution of metals and metalloids in non sulfur materials at neutral pH was reviewed. Based on this review conceptual models for controls on their leaching and mobility were developed.

Internal reference: RTIO-HSE-0145041

The review found that contaminant leaching from non-sulfidic materials was generally very limited. Usually the pH in leach tests was near-neutral (pH 6 to 8), and dissolved contaminant concentration were at or below detection limits. It is believed that a primary leachable contaminant source is the oxidation of sulfide minerals. Release from oxidising sulfides leads to release of soluble reaction products. Under neutral pH conditions, there is the potential for release of these contaminants when those products dissolve.

Environmental Status of Selenium (Se) in the Pilbara Region of Western Australia – Potential Risk from Iron Ore Mining — **2011**

This report includes information about Selenium geochemistry, distribution in the environment, occurrence in rocks in the Pilbara and potential risks to the environment.

Internal reference: RTIO-PDE-0103857

The Selenium (Se) content of shales containing significant pyrite should be recorded as part of the overall risk assessment for acid and metalliferous mine drainage. However, it should also be noted Se solubility is far less constrained by pH than in the case of metals and near neutral drainage may contain significant Se concentrations in solution. It would be most useful to study the Selenium budget of the wetlands in the Pilbara as, apart from the chance poisoning of livestock from the consumption of plants that have taken up high concentrations of Selenium, impacts are most likely to be felt in wetlands receiving mine site drainage.

Contaminant Leaching from Low-Sulphur Waste Minerals (Summary) **2011**

Internal reference:
RTIO-PDE-0090689

RTIO's Geochemical Database was reviewed and based upon this data, conceptual models for controls on the leaching and mobility of a range of metals and metalloids were developed. This summary also describes potential controls on the amount of dissolved element that may be released. This is a summary of a comprehensive report RTIO-PDE-0100104.

For most contaminants, dissolved concentrations at circum neutral pH (pH 6 to 8) were very low, typically at or below detection limit. Geochemical modelling indicates that water-rock interactions are controlled by equilibrium, for salt, carbonates and sulphates this equilibrium is often source term limited whilst hydroxyl-sulphates and hydroxides are solubility controlled. Results also indicate that sorption plays an important role in solute concentration; weak (but detectable) sorption occurred for selenium and zinc whilst the strongest sorption was evident for cobalt. The review suggested that storage waste facilities containing low-sulfur materials pose a low level of environmental risk however, there is a small risk of increased in mobility of some contaminants if acidic conditions arise. Acidic conditions can sometimes arise from the interactions between iron and aluminium hydroxyl-sulphates and hydroxides.

Geochemical Assessment of Tailings from Yandi, Paraburdoo, Tom Price, Brockman 4 and Mesa J **2014**

Internal reference:
RTIO-PDE-0123030

This report presents the results from geochemical testing and saline solution extraction of tailings samples from Yandi, Paraburdoo, Tom Price, Brockman 4 and Mesa J deposits.

Overall the tailings from these operations are unlikely to generate acid and are not expected to leach significant levels of metals under oxidising or saline conditions.

Oxidation and solute accumulation in dewatered pit wall rocks **2014**

Internal reference:
RTIO-PDE-0109045

Dewatering and removing the water table may result in de-saturation of sulphide-bearing lithologies. This study was undertaken to review how oxygen ingress and consequent sulphide oxidation of Mount McRae Shales could impact water quality when the groundwater table rebounds after mining.

Large Scale Column Construction Procedure and Initial Chemistry **2014**

Internal reference:
RTIO-PDE-0123894

Large scale column experiments have been constructed to examine the reactivity of hot and cold black shale material in an operational environment. The memo describes the construction of the columns and the first geochemistry data collected after small rainfall events at Rhodes Ridge.

Initial results suggest that effluent water retains the chemistry of the incident rainfall. Constituents to note in the initial chemistry include nitrate and ammonia detected in the hot black shale effluent. This study provides an important comparison between laboratory characterisation studies and field reactivity of waste rock. Data from the large scale column tests can be applied to reactivity of in pit waste/talus as well as waste rock dumps. It can be used as an intermediate to predict long term reactivity of waste rock.

Tom Price – Historical black shale exposures in SEP Pit compared to expected black shale exposures at BS4 and HD4 **2017**

Internal reference:
RTIO-PDE-0149285

The purpose of this study was to understand and compare potential surface water and groundwater quality risks from pits with areas of exposed Mount McRae Shale (MCS) at Tom Price, Brockman Syncline 4 and Hope Downs 4 operations.

The annual (approximate wet season) black MCS exposures in South East Prongs (SEP) pit at Tom Price have been modelled as part of this exercise. The maximum black MCS surface area within the SEP pit (from 2000-2010) is modelled to be 200,000 m2 (2010), representing approximately 9% of the SEP pit catchment area. It is noted that acid water was first observed in a SEP groundwater bore in 2001, when total black MCS surface areas were modelled to be 68,500 m2 (3% of total pit shell catchment area). Acidic water within groundwater was observed in 2001, approximately three years after dewatering of the SEP pit commenced in 1998 via a number of in-pit dewatering bores. It is possible that surface water may have been acidic earlier than 2001. The significant accumulation and pooling of water within the SEP pit during large successive rainfall events, particularly Cyclone Monty in 2004 (representing a 12 year ARI (average recurrence interval) at Tom Price), likely caused acidity within the in-pit groundwater bores. In subsequent years, the pH had an increasing trend in many of the bores, however groundwater remained acidic for at least four years following Cyclone Monty.

Geochemical Characterisation of mine waste from Tom Price, Hope Downs 1 and Hope Downs 4 **2018**

Internal reference:
RTIO-PDE-0159203

The purpose of this work was to investigate the leaching kinetics of six low-sulfur waste rock samples collected from Tom Price, Hope Downs 1 and Hope Downs 4. Static testing was conducted to provide a 'snapshot' of the geochemical characteristics of each waste rock sample. These tests were completed to screen all samples before commencing more detailed leach column tests. The geochemical test program was designed to assess the degree of risk from the presence of reactive sulfides, acid generation and leaching of soluble metals/metalloids and salts in accordance with relevant mine waste geochemistry and mine closure guidelines.

The results from the geochemical assessment indicate the samples have negligible to low-sulfur content, low but generally sufficient ANC and are generally classified as non-acid forming. The amount of potential acidity that could be generated from the samples is expected to be negligible to low, with all samples having low reactivity; there is a high factor of safety and low risk of any significant acid generation from these materials. Waste rock materials represented by these samples are likely to generate pH neutral surface runoff and seepage with low salinity and generally low concentrations of dissolved metals(loids) (excluding the Tom Price black MCS sample where elevated manganese was measured in the leachate).

Assessment of erosion potential of mineral wastes **2019**

Internal reference: 0

This report summaries the erosion studies undertaken on four mineral wastes from Hope Downs 1 Iron Ore Mine. It includes an assessment of the erodibility of four mineral waste samples (Detrital (Col or Di); Limonite (Li); NEW 1 - Moount Newman Member and NEW 2 - Mount Newman Member.

Bulk samples of four materials were characteristed by experimental methods to derive the key erodibility parameters to calibrate the WEPP model. The Detrital (Col or Di) assessed represents one of the more erosion resistant Detrital wastes assessed since methodical erodibility assessment began in 2012. Results for uniform slopes indicate that for the HD1 climate and moderate risk dumps; the Detrital (Col or Di) can be used on unifrom lifts of up to 15m high with gradients 14 to 20 degrees. Limonite (Li), NEW 1 and 2 materials can used on uniform lifts up to 20m high and gradients 14 to 20 degrees. For high risk dumps; Detrtial material can be used on uniform lifts up to 10m high with gradients of 14 to 20 degrees. Limonite and NEW 1 material can be used on unifrom lifts up to 15m high, with gradients of 14-20 degrees.

Hope Downs (Sustaining Deposits) – Geochemical Characterisation of Waste Rock Samples **2019**

Internal reference: RTIO-PDE-0170053

to provide guidance for waste rock management in particular with respect to managing and limiting acid generation and metalliferous drainage and involved static geochemical characterisation of 96 waste rock samples from 10 stratigraphies at the Hope Downs (Sustaining Deposits) project (Bedded Hilltop and Hope Downs 2 deposits).

Of the 96 samples tested, the 10 lignites had the greatest acid generation potential. The samples were all classed as PAF since they contained significant sulfide sulfur and low ANC. Leachate from the lignites is expected to be generally acidic with high solute concentrations – including high concentrations of major cations (i.e. Ca and Mg), anions (i.e. SO4) and a range of trace elements (e.g. Al, As, Cd, Co, Cr, Cu, Mn, Ni and Zn). The 20 WF samples were all classed as NAF, they contained the greatest ANC and negligible total sulfur. Leachate from the samples was invariably circum neutral to alkaline, with a low solute concentration. The remaining 66 samples were from a range of lithologies. The samples contained low to negligible total sulfur and low to modest ANC with most samples expected to be NAF. The acid generation potential of the samples classed as UC or PAF-LC will be low to negligible. Most samples are expected to generate leachate that is circum neutral and with a low solute concentration.

Physical characterisation

Net solute load response to the installation of infiltration limiting dry cover systems over acid forming waste piles **2014**

Internal reference: RTIO-PDE-0128431

This work was conducted to verify the central design concept of store-and-release covers over sulfidic above water table waste dumps that is, whether limiting net percolation volume through the cover results in a lesser sulfate and acidity load being realised generated and passing through the dump.

The results from this thesis project confirm that the central aim of store-and-release covers to reduce net percolation volume is a valid measure for reducing the net loading of sulfate and acidity. The mechanism through which decreasing net percolation (applied water volume) results in a lesser sulfate and acidity load was identified, however further work in a site context is needed to assess how this relationship between percolation volume and loading persists in the real-world environment.

Growth Media Characterisation **2018**

Internal reference: RTIO-HSE-0324326

This report provides an interpretation of material characterisation data for a total of 53 potential growth media samples made up of 34 samples for which data has been previously collected by Outback Ecology Services on behalf of Rio Tinto, 11 samples for which data has been previously collected by Landloch on behalf of Rio Tinto as part of previous erosion studies and 8 additional samples collected and analysed as part of this project. Based on this characterisation, each material was classified as either suitable or not suitable for use as a growth medium.

Properties tested for included pH1:5 (water), salinity (EC1:5, EC1:2), exchangeable cations (K+, Ca2+, Mg2+, Na+, Al3+), effective cation exchange capacity (ECEC), exchangeable sodium percentage (ESP), particle size distribution (fine fraction<2mm), coarse fraction (> 2mm), particle size distribution (all material), texture, emerson class, dispersion potential rating, rock particle density, rock water absorption and rock cover of rain-armoured surface. A classification scheme for key parameters was then developed to classify a material as suitable or unsuitable. Several materials have properties that were invariably suitable. In some cases, materials have some properties that are suitable and others unsuitable. In others, several of the properties are problematic. Suitable materials represent those that have base properties that are not likely to impede vegetation. Marginal materials are those that are likely to support vegetation but that have some properties that may limit establishment and growth. Unsuitable materials are those that have properties that are likely to significantly impact on vegetation growth either through being saline, prone to dispersion, and having pH values quite different to those typically observed. Of the 53 samples, 21 were recommended as suitable growth media, 25 were assessed as marginal growth media and 8 were not recommended as growth media. Samples which were recommended were sourced from Yandicoogina, Channar, Mesa J, Mesa K, Eastern Range, Paraburdoo and Parker Point. Marginal samples were sourced from Brockman 4, Brockman 2/Nammuldi, Mesa A, Mesa J, Channar, Eastern Range, Paraburdoo, Yandicoogina and Hope Downs 4. Samples which were not recommended were sourced from areas at Greater Paraburdoo (Paraburdoo and Eastern Range), West Angelas, Western Turner Syncline and Parker Point.

Groundwater

Hope Downs 2 Water Supply Abstraction **2019**

Internal reference:
RTIO-PDE-0171127

This memorandum provides supporting hydrogeological information for Hope Downs 2.

The HD2 orebody is located within both the Marra Mamba Formation and the overlaying detrtial deposits. The gorundwater table is located in both the Marra Mamba and Wittenoom Formations and is below the base of the detrital deposits. Gorundwater in Marra Mamba Formation is expected to be in hydraulic connection with Wittenoon Formation (forming a single aquifer). Groundwater flow is from southwest to northeast. Depth to groundwater below ground surface ranges between 50 and 100 m. It does become shallower along Weeli Wolli Creek and Pebble Mouse Creek. Abstraction is close to 509,804 kL to supply water for HD1 village. Groundlevels recorded has declined 2 m over 10 yearsperiod, indicating groundwater drawndown is minor and localised. Not aware of any Groundwater Dependent Ecosystems within Wittenoom Aquifer (where abstraction is proposed).

Surface water

Assessment of surface water impacts on sensitive receptors in Weeli Wolli Creek catchment **2019**

Internal reference:
RTIO-PDE-0171688

This report presents an assessment of the potential impacts on surface water quantity and quality at Weeli Wolli Spring and Ben's Oasis from mining infrastructure for the Hope Downs 2 proposal, which includes deposits at Bedded Hilltop and Hope Downs 2. A two dimensional hydraulic model was developed to characterise the surface water flow regime of Weeli Wolli Creek and Pebble Mouse Creek.

Results from the regional model indicated that mining operations truncated approx. 3.5% of the total catchment reporting to Weeli Wolli Spring. This results in a loss of 1% of the total run-off volume at the Spring and a reduction of the peak flow by 1.4% (based on 1:100 annual exceedance probability (AEP) 24 hour rainfall event). The catchment reporting to Ben's Oasis was truncated by 0.2% which resulted in a reduction to peak flow of 1.1%. Results from the localised model indicated that during frequent (1:5 AEP) and rare (1:100 AEP) rainfall events, flood depths are increased on the upstream side of the floodway and rail culverts due to the attenuation and backwater impacts of these structures. Sediment transported from the floodway is considered unlikley to impact water quality at Weeli Wolli Spring, due to high flood depths and low velocities on the upstream of the rail crossing.

Water interactions and pit lakes

Geochemical and hydrological processes controlling groundwater salinity of a large inland wetland of northwest Australia **2013**

Internal reference:
RTIO-HSE-0198428

Understanding mechanisms of hydrochemical evolution of groundwater under saline and brine wetlands in arid and semiarid regions is necessary to assess how groundwater extraction or injection in large-scale basins may affect the natural interface between saline–fresh aquifers in those systems. This paper investigated the evolution of groundwater of the Fortescue Marsh, a large inland wetland of northwest Australia.

The deep groundwater (>50m depth) of the Fortescue Marsh is highly saline (>100g/L), whilst shallow groundwater (~0–20m depth) and surface water are mainly fresh or brackish. Currently, the marsh is mainly recharged by occasional floodwater. Consequently, salt in the marsh is concentrated by evaporation of rainfall. It was found that groundwater associated with the marsh could be divided into two groups characterised by their stable isotope compositions; i) fresh and brackish groundwater (TDS b10 g L−1; δ18O −8.0 ± 0.9‰) and ii) saline and brine groundwater (TDS N10 g L−1, δ18O varies from +2.5 to −7.2‰). Fresh groundwater was evaporated by<20% compared to rainwater. Brackish water mainly reflects modern recharge whilst saline and brine groundwater reflects mixing between modern rainfall, brackish water and relatively old groundwater.

Testing hay as an in situ remediation option for acidic pit lakes in the Pilbara **2017**

Internal reference:
RTIO-PDE-0159196

A field experiment was conducted at the Tom Price mine in two small temporary pit lakes ('West' and 'East' Lakes). Water-damaged hay produced by Rio Tinto Iron Ore in the Pilbara was used to treat the West Lake, with the East Lake kept untreated. A laboratory-based microcosm experiment was conducted in order to determine if bio-physical processes that occur in microcosms (a classic method in mine water treatment experiments) represent field conditions. A laboratory-based microcosm pilot experiment containing acidic lake water was conducted for 60 days. Results from the pilot demonstrated that (relative to controls) microcosms containing hay become more neutral to pH >6. Review of the pilot experiment resulted in a range of improvements in the design and execution of the microcosm experiment in order to better mimic conditions in the field trial.

The West Lake controls exhibited a slight improvement in pH over the course of the experiment, whereas the East Lake controls did not. The likely contamination of the water and sediment by hay prior to the experiment (due to collection of in situ water after the field experiment commenced) indicates that the carbon that leached from the hay may have been sufficient to increase pH in the microcosms. The main observable effect of lake water source appeared to be that chemical composition of West Lake was such that the hay - while effective at reducing dissolved oxygen concentrations - was not as effective in driving oxidation reduction potential to levels that classically are considered necessary to support sulphate reducing bacteria. A seasonal algal bloom in East Lake indicated that pit lakes are subject to the same processes as natural lakes; the specific cause of the bloom is currently unclear but likely seasonal. The main risk associated with the use of organic matter to treat acidity in pit lakes is the potential for release of problematic quantities of gases such as methane, carbon dioxide or hydrogen sulphide. Due to a lack of within-lake replication the effect of hay on microbial assemblages could not be determined for the field trial. Further research is needed on gas flux and the microbes responsible associated with organic matter treatments in pit lakes to better understand potential risks associated with gas flux on closure.

Flora

Hope Downs 2, Bedded Hilltop and Wonmunna Detailed Flora and Vegetation Survey **2018**

Internal reference:
0

This study summaries the botanical aspects of the Hope Down 2 area.

A total of 379 flora taxa from 50 families and 151 genera were recorded. No threatened flora were recorded within the study area, ten State-listed Priority flora species were recorded; Eremophila sp. Hamersley Range (K. Walker KW 136) P1; Eremophila sp. West Angelas (S. van Leeuwen 4068) P1; Aristida lazaridis P2; Hibiscus sp. Gurinbiddy Range (M.E Trugen MET 15708) P2; Grevillea saxicola P3; Rhagodia sp. Hamersley (M. Trugen 17794) P3; Triodia sp. Mt Ella (M.E Trudgen 12739) P3; Acaia bromilowiana P4; Lepidium catapycnon P4; and Ptilotus mollis P4. Fourteen introduced species were recorded, none listed as Weeds of National Significance or Declared Pests. None of the plant communities were considered threatened ecological community or priority ecological comminunity.

Hope Downs 2 Proposal: Flora and Vegetation Survey May 2019 **2019**

Internal reference:
0

This report presents the finding of a detailed flora and vegetation survey of the Hope Downs 2 (HD2) development envelope, over three separate phases to support and inform the environmental assessment process.

A total of 23 vegetation units were recorded within the study area, none of the units represent a threatened ecological community. One vegetation unit recorded was associated with the Wannamunna land system and held some affinity with the Priority 1 priority ecological community 'West Angelas Cracking Clays', however unlikley to represent the community due to differences in species composition, habitat and scale. There were 411 confirmed vascular flora taxa from 52 families and 161 genera. No threatened flora species were recorded. Eleven state-listed priorty flora were recorded 1 (P1); 2 (P2); 4 (P3); and 4 (P4). Seventeen introduced (weed) species were recorded. None of the weed species are listed as Weed of National Significance or as a Declared Pest.

Fauna

Hope Downs 2 Proposal Fauna Survey - Contextual Analysis **2019**

Internal reference:
0

This letter details the results of statistical comparsion.

The letter concludes the contextual analysis indicates that the Ricky Hills, Stony Plains and Mulga Woodlands habitat types within a local context exhibited a significantly different herpetofauna or bird assemblage from other sampled habitats. Within Rocky Hills its most likley attributed to presence of rock-specialist reptile species or an absence of woodland bird species. The reason for differences in the herpetofauna assemblage of the Mulga Woodland habitat and the bird assemblage of the Stony Plain habitat are unknown and differences appear to be between species that are considered habitat generalists and would be expected to occur across multiple habitat types in the area.

Hope Downs 2 proposal: Fauna Survey March 2019 **2019**

Internal reference: 0

This report presents the finding of a terrestrial Level 2 vertebarte fauna and Short Range Endemic (SRE) assessment of the Hope Downs 2 (HD2) development envelope, over three seperate phases of fauna surveying.

This report concludes there are eight broad fauna habitats types within the survey area, and none are restricted at a local level. The Gorge/Gully and Breakaway habitat were considered important for fauna due to microhabitats they provide (caves and potential for semi-permanent water pools). There were 174 vertebrate fauna species recorded, the fauna species assemblage is considered by Astron typical of the Hamersley subregion. Seven fauna species of conservation sigificance were recorded; Nortehrn Quoll, Pilbara Leaf-nosed Bat, Ghost Bat, Orintal Plover, Lerista macropisthopus remota, Letter-winged Kite and Western Pebble-mound Mouse. Five habitats were considered conductive to relictual SRE; Breakaway, Mulga Woodland, Minor Drainage, Gorge/Gully and Rocky Hill.

Hope Downs 2 Proposal - Matters of National Environmental Sigificance Fauna Assessment **2019**

Internal reference: 0

This reports summaries the matters of national environmental significance (MNES) fauna values associated with Hope Downs 2 study area.

The report concluded eight broad habitat types have been recorded within the study area. The Gorge/Gully and Breakaway habitats were considered important habitat for MNES fauna species, due to microhabitats such as caves and semi-permanent water pools which are improtant for species forgaing and sheltering requirements. Four MNES fauna species; Northern Quoll (Endangered), Ghost Bat (Vulnerable), Pilbrara Leaf-nosed Bat (Vulnerable) and Oriental Plover (Migratory) have been recorded within the study area. The Northern Quoll records are significant due to being on the edge of this species' regional distribution.

Biodiversity improvement studies

Evaluation of mine waste materials as alternative rehabilitation growth medium **2010**

Internal reference: RTIO-HSE-0109961

This study reviewed the physical and chemical properties of soil, tailing and mineral waste from select Pilbara mining operations, to identify waste material and material combinations for use as a topsoil substitute or supplement.

The study showed plant-available nutrients held within the waste materials, although variable, was characteristically low and comparable to natural soils in the region. The majority of the waste materials had macro and micro nutrient concentrations within the range or above the levels measured in benchmark Pilbara topsoil and rehabilitated soils. The pH and phosphorus buffering index of most waste materials were also comparable to that of the benchmark topsoil materials. However, some of the waste types and tailings may need to be mixed with rocky material due to poor physical / erodibility characteristics.

Genetic diversity in Eucalyptus leucophloia across the Pilbara: Provenance zone implications **2011**

Internal reference: RTIO-HSE-0108843

This study was undertaken to define the provenance seed collection zones for a common species of the Pilbara, Eucalyptus leucophloia (Snappy Gum). This report details information on genetic analysis conducted on E. leucophloia. Collections of E. leucophloia were made from 20 populations across the Pilbara bioregion and genetic analysis was conducted using microsatellite markers.

Genetic diversity in E. leucophloia was high and was typical of that found in other eucalypt species with wide spread distributions. Across the species the level of population differentiation was low and the majority of the diversity was maintained within populations with only 6% of variation partitioned between populations. Genetic variation in E. leucophloia showed little structure across the Pilbara with no clustering of populations based on any geographical proximity or in association with obvious topographical, physiogeographical or geological features such as the Hamersley or Chichester Ranges. Populations towards the edges of the species distribution within the Pilbara showed greater levels of differentiation from populations within the species main range. The high levels of genetic diversity and low levels of differentiation within E. leucophloia implies that seed resources for rehabilitation can be selected from a wide range within the Pilbara.

Genetic diversity in Acacia ancistrocarpa across the Pilbara: Provenance zone implications **2011**

Internal reference: RTIO-HSE-0119260

This study was undertaken to define the provenance seed collection zones for Acacia ancistrocarpa (Fitzroy Wattle). This report details information on genetic analysis conducted on Acacia ancistrocarpa. Collections were made from 24 populations across the Pilbara bioregion and genetic analysis was conducted on 16 populations using microsatellite markers.

Genetic diversity in A. ancistrocarpa was high but lower than that in E. leucophloia, another widespread species in the Pilbara. Across the species Pilbara range the level of population differentiation was low and the majority of the diversity was maintained within populations with only 3% of variation partitioned between populations. Genetic variation in A. ancistrocarpa showed little structure across the Pilbara with no clustering of populations based on geographical proximity or in association with obvious topographical, physiogeographical or geological features. Populations towards the edges of the species distribution within the Pilbara showed greater levels of differentiation from populations within the species main range. The high levels of genetic diversity and low levels of differentiation within A. ancistrocarpa implies that seed resources for land rehabilitation and mine-site revegetation programs can be selected from a wide range within the Pilbara

Root hydraulic conductance and aquaporin abundance respond rapidly to partial root-zone drying events in a riparian Melaleuca species **2011**

Internal reference:
RTIO-HSE-0252171

This study examined partial root zone drying (PRD) responses of Melaleuca argentea.

The results demonstrate that PRD can induce rapid changes in root hydraulic conductance and aquaporin expression in roots, which may play a role in short-term water uptake adjustments, particularly in species adapted to heterogeneous water availability.

Baseline Terrestrial Fauna Assessment of Pilbara Rehabilitation Areas **2012**

Internal reference:
RTIO-HSE-0134168

In 2011 a fauna survey was conducted within established rehabilitation areas at Brockman 2 and Tom Price mine sites, with the aim of identifying whether fauna is recolonising rehabilitation sites in assemblages comparable to reference sites.

The study found that at least 85 species of native vertebrate fauna, as well as representatives from each of six major groups of invertebrate fauna, are using rehabilitation areas at Brockman 2 and Tom Price, with species compositions that were broadly similar to reference sites. Ant collections were typical of the Pilbara bioregion, with an absence of invasive ant species. The study found greater data correlation between monitoring sites at a particular mine site (Tom Price or Brockman 2) than between rehabilitation and reference sites, indicating the importance of selecting local reference sites. The study concluded that the best candidates for bio-indicators are ants and reptiles.

Hay Project – Native Seed Orchard **2012**

Internal reference:
RTIO-HSE-0141263

Commencing in 2011 (and still ongoing), a trial irrigated seed orchard was established at the Hamersley Agriculture Project (Marandoo). The purpose of the trial was to identify an alternate method of addressing seed deficits. If successful, the project may be implemented at other Rio Tinto operations, such as the Nammuldi agriculture project.

Genetic diversity in Aluta quadrata:Implication for management and provenance zone **2012**

Internal reference:
RTIO-HSE-0156732

This study was undertaken to define the provenance seed collection zones for Aluta quadrata. This report details information on genetic analysis conducted on Aluta quadrata. Collections were made from 8 populations across the Pilbara bioregion and genetic analysis was conducted using microsatellite markers.

Genetic diversity in A. quadrata was moderate and lower than in the other two more widespread Pilbara species, E. leucophloia and A. ancistrocarpa. The findings suggest that its populations may have fluctuated significantly in size over time with genetic drift and possibly inbreeding resulting in a reduction in genetic variability, particularly in rare alleles. Despite the narrow geographic range, the level of population differentiation in A.quadrata was relatively high with 25% of the genetic variation maintained between populations and 19% due to differences between the three different locations. This significant genetic structure indicates that A. quadrata consists of three conservation or management units, Western Ranges, Pirraburdoo and Howie's Hole.

Genetic diversity in Acacia atkinsiana across the Pilbara: Provenance zone implications **2012**

Internal reference:
RTIO-HSE-0187256

This study was undertaken to define the provenance seed collection zones for Acacia atkinsiana (Atkins wattle). This report details information on genetic analysis conducted on Aluta quadrata. Collections were made from 16 populations across the Pilbara bioregion and genetic analysis was conducted using microsatellite markers.

Genetic diversity in A. atkinsiana was low and lower than that observed in its congener Acacia ancistrocarpa, a widespread species across northern Australia. The level of population differentiation was high and 30% of the diversity was partitioned between populations across the range of A. atkinsiana. Genetic variation in A. atkinsiana showed some structure across the Pilbara with clustering of populations in the western part of the distribution and from the Hamersley Range, along with other populations that were divergent from these groups. The low levels of genetic diversity and high levels of differentiation within A. atkinsiana implies that seed for land rehabilitation and mine-site revegetation programs should be restricted to specific zones. For rehabilitation of sites within the Hamersley Range we recommend seed collections be restricted to that region. Similarly, for rehabilitation in the part of the distribution west of Pannawonica, seed collections should be restricted to that area.

Rehabilitation Quality Metric (RQM) Project **2012**

Internal reference: RTIO-HSE-0164020

Western Australia has no formal process to measure habitat quality and as such RTIO has needed to design its own customised metrics. Vegetation condition scoring has previously been developed by RTIO through a Biodiversity Net Positive Impact Assessment, but a more precise metric was needed. The Rehabilitation Quality Metric (RQM) project was developed to provide a repeatable method to assess rehabilitation quality against pre-determined reference sites, on a site by site basis, to predict rehabilitation ecosystem quality at the time of relinquishment.

The RQM methodology employs seventeen parameters to characterise the landscape, including vegetation, fauna habitat, fauna presence, erosion, and ecosystem function. Parameters are tailored to be an applicable measure for both rehabilitation and native vegetation (reference sites). Parameters are scored, based on measured or observed characteristics, with a value between 0 and 1, with 1 being functional (terrestrial ecosystem is functioning for the maintenance of biodiversity values at a local or property scale) and 0 being dysfunctional (terrestrial ecosystem is failing; indicators of ecosystem function have scored below acceptable levels). Both rehabilitation areas and reference sites are scored. Scores are subsequently determined for the entire mine lease, based on the condition of the land before mining (extrapolated from the reference sites, area weighted) and the likely post-mining conditions (extrapolated from the rehabilitation areas and expected closure domain distribution, area weighted, ie pits with no rehabilitation score 0). The difference between the pre-mining and post-mining scores represents the residual impact of mining.

Propagation of Pilbara spinifex (Triodia sp.) **2012**

Internal reference: RTIO-HSE-0169744

Triodia has often been observed to have very poor establishment from broadcast seed. This project investigated alternatives to growing Triodia (spinifex) from seed, focussing on ways to propagate seedlings from wild harvested material.

The project found the most successful propagating material was stolons. Greatest propagation success was achieved when Triodia were collected when semi to fully dormant (mid Winter-Spring). The 'Moist Root Induction Method' recommended by previous researchers was less successful than the standard propagation techniques employed in this project. Success varied notably between populations. Consequently, any future collections of propagating material should target multiple populations to maximise potential for success.

Pilbara Seed Science Project, Part 2 Final Report Jan 2012 **2013**

Internal reference: RTIO-HSE-0174944

Undertaken between 2009-2012, this seed research investigated germination, biology, dormancy classification and treatments for dormancy alleviation for a range of species from the Pilbara.

The *Acacia atkinsiana, Indigofera monophylla and Sida echinocarpa* seed lots have physical dormancy. Heat treatments and mechanical scarification improved germination on dormant seeds, however, heat treatments killed non-dormant seeds. The treatments used for *Goodenia stobbsiana* seeds failed to overcome dormancy, suggesting deep physiological dormancy. The *Hakea lorea/ chordophylla* seed lots were found to be non-dormant, with very high germination results in the controls. As such, they will not require any pre-treatments prior to direct seeding. The florets surrounding the *Triodia pungens* and *T. wiseana* seeds were found to restrict germination, however, many of the freshly extracted seeds out of the florets were found to be physiologically dormant. Treatments for dormancy include mechanical scarifier to rupture seed coat, hot water (noting potential damage to immature or non-dormant seeds) and increases to germination through wet / dry cycling and / or temperature cycling.

Morphological variation in the western rainbowfish (Melanotaenia australis) among habitats of the Pilbara region of northwest Australia. **2013**

Internal reference: RTIO-HSE-0252169

The aim of this honours thesis was to determine and quantify the extent of morphological variation present in M. australis and relate this to environmental variables, which will provide the first step to understanding how the species copes with environmental change.

This results of this thesis found that there was limited evidence that fish morphology correlated with environmental variables

Patterns of water use by the riparian tree Melaleuca argentea in semi-arid northwest Australia **2013**

Internal reference: RTIO-HSE-0249538

This thesis examines the water use physiology of the riparian tree Melaleuca argentea, and the ways in which this species may respond to anthropogenic disturbances to hydrologic processes.

M. argentea displays highly plastic root-level responses to heterogeneous water availability and to waterlogging, facilitating high rates of water use and growth in the riparian wetland habitats of the Pilbara. Mature M.argentea trees appear to tolerate groundwater drawdown of at least several metres, most likely by employing the same plastic root strategies to access deeper water. M.argentea can also withstand short periods of severe drought, by adopting a 'waiting' strategy of ceasing growth and shedding leaves to avoid moisture loss, a state from which they can then recover. M. argentea populations are unlikely to thrive under large and prolonged reductions in water availability.

Priority Species Seed Quality and Germination Final Report **2013**

Internal reference: RTIO-HSE-0207487

This study investigated the quality and germination biology of a range of priority and keystone (Triodia) plant species from the Pilbara.

Eremophila magnifica subsp. Magnifica has physical & physiological dormancy. Propagation methods other than seed may be more successful. Geijera salicifolia and Olearia mucronata has physiological dormancy. Temperature cycling may be required to stimulate germination. Indigofera ixiocarpa and Indigofera sp. Bungaroo Creek has physical dormancy or is non-dormant. Mechanical scarification may be required. Ptilotus subspinescens is non-dormant and will germinate easily without removal from the perianth sheath. However, seed is likely to lose viability with a few years. Sida echinocarpa and Sida sp. Barlee Range has physical dormancy. Seeds should be removed from the mericarp and then scarified in order to germinate. Triodia pungens has T. wiseana non-deeep or deep physiological dormancy. Germination of de-husked seeds can be improved by applying gibberellic acid or 1% smoke water and wet/dry cycling.

Early physiological flood-tolerance and extensive morphological changes are followed by slow post-flooding root recovery in the dryland tree Eucalyptus camaldulensis subsp. Refulgens **2014**

Internal reference: RTIO-HSE-0252170

This study investigated physiological and morphological response to flooding and recovery in Eucalyptus camaldulensis subsp. Refulgens, a riparian tree species from a dryland region prone to intense episodic flood events.

E. camaldulensis subsp. Refulgens underwent considerable morphological changes during flooding, including extensive adventitious root production, increased root porosity and stem hypertrophy. Physiologically, net photosynthesis and stomatal conductance were maintained for at least 2 weeks of flooding before declining gradually. Despite moderate flood-tolerance during flooding and presumably high environmental selection pressure, recovery of reduced root mass after flooding was poor.

Priority Species Project Progress Report 2013 **2014**

Internal reference: RTIO-HSE-0207486

The Priority Species Project, initiated in 2012, aims to improve knowledge of priority plant species and develop methods to successfully germinate and establish priority species, to enable priority plant species to be integrated into Rio Tinto rehabilitation programmes. This work is being undertaken in conjunction with the Department of Parks and Wildlife.

13 plant species were selected as being potentially suitable for establishment in rehabilitation: Eremophila magnifica subsp. magnifica, Indigofera sp. Bungaroo Creek, Indigofera sp. gilesii, Acacia bromilowiana, Sida sp. Barlee Range, Ptilotus subspinescens, Ptilotus mollis, Acacia subtiliformis, Isotropis parviflora, Grevillea sp. Turee, Hibiscus sp. Canga, Themeda sp. Hamersley Station, and Aluta quadrata. Indigofera sp. Bungaroo Creek and Ptilotus subspinescens were found to readily germinate in laboratory conditions, and a field trial was established at Brockman 4 late in 2013.

Regional Variation in Metal Concentrations of Pilbara Fish in Relation to Concentrations in Water and Sediments **2014**

Internal reference: RTIO-HSE-0216967

This study aimed to characterise and document natural, background metal concentrations in freshwater fishes from different locations across the Pilbara in order to understand how local geology may affect baseline metal levels in fish tissues and surface waters. Metal concentrations were analysed from water, sediment and muscle and liver tissues from fish collected from up to 13 sites as yet unimpacted by mining across the Pilbara during October (dry season) of 2012.

Levels of dissolved metals from water samples were generally low. However, some elevated concentrations of Boron, Copper and Zinc were recorded. Concentrations of heavy metals in sediments were variable across the Pilbara. Generally, sediment concentrations were well below the Interim Sediment Quality Guidelines (ISQG). However, metal concentrations in excess of ISQG TVs were recorded for Chromium and Copper at some sites. There was no relationship between metal concentrations in sediment and those in water. Metal concentrations in fish tissue (muscle and liver) varied between species with some significantly higher in some particular species. The study concluded that variation in metal concentrations in water, sediment and fish across pools in the Pilbara was likely to be mainly dictated by the local geological setting in which the pool occurs.

Progress Report 2014, Ecological responses of native fishes to dynamic water flows in northwest arid Australia **2014**

Internal reference: RTIO-HSE-0246021

This three year Australian Research Council linkage Project commenced in 2013 and aims to increase understanding of the effects of altered stream flows on the Pilbara freshwater aquatic environment. Project aims: 1. Quantifying fish biodiversity and population structure in relation to hydrological and environmental parameters to identify thresholds of ecological concern for water management; 2. Determine the fundamental physiological, morphological and behavioural adaptations of fishes to variations in water quality using experimental manipulations; and 3. Examine spatial scales of gene flow to determine if increased flows increase genetic connectivity relative to natural-flow sites.

To date work has focuses on characterisation of baseline physicochemical parameters across aquatic habitats within the Fortescue River catchment (Aim 1), analysis of variation in rainbow fish morphometrics and mechanosensory lateral line systems in response to geographic region and water management regime (Aim 2), and extraction of DNA samples from 17 populations across the Fortescue River catchment (Aim 3). The project will culminate in the development of a predictive model for stream restoration relevant to future closure scenarios for above and below-groundwater mines. Results from an honours thesis indicate that rainbow fish body shape varies according to geographic region but fish from a dewatered site (WW Ck) were more streamlined than other populations from the upper Fortescue catchment. This statement of results has been superseded by the results of the actual thesis report RTIO-HSE-0252169.

Progressive rehabilitation

Seeding success in rehabilitation — 2019

Internal reference: RTIO-HSE-0330943

This report aims to outline which species have been successful and unsuccessful in rehabilitation as part of previous seed mixes. This will allow future rehabilitation efforts to focus on key species and realise savings in seed costs by eliminating poor recruiting species. By costing these unsuccessful species in non-recruitment circumstances, it is aimed to demonstrate the importance of considering previous seed success in the future. Highlighting unsuccessful species will also allow focus to shift to these species in regards to trialling new methods of planting and pre-treating seed. It is also aimed to identify opportunity species that may have been underutilised in the past despite their success, due to a lack of collated knowledge on rehabilitation success. Natural recruiting species will also be analysed, to determine which species are dominant natural recruiters.

The top 10 and bottom 20 recruiting species were identified. The bottom 20 were recommended for further research to determine better germination and/or establishment processes. Ten species were also identified as promising but rarely used, so should be tested in upcoming rehabilitation where possible.

Landform design

Results of flume investigations of the stability of rock mulches — 1998

Internal reference: RTIO-HSE-0109221

This study assessed the potential for rock mulches to be stripped from the soil surface by overland flows.

Although 150-300mm diameter BIF was not removed by simulated overland flows, even for 100mm/hr simulated runoff on 55% gradients, considerable scour of the spoil between the rocks was observed, indicating potential for long-term development of rills or gullies if the level of rock cover was less than 100%. Large reductions in sediment concentrations were observed when finer rocks were mixed with BIF. The data indicate that it is crucial for any rock mulch to cover a wide range of particle diameters, including a component of finer rocks. The resulting mixed rock created a framework of large rocks that resist movement by flows, while the smaller rocks reduce erosion being anchored within the larger (framework) rock. For rock mulches with a mixture of rock diameters, 80% cover produced acceptable erosion rates. Sediment loads were slightly higher for 40% cover by rock of mixed diameters, and it was speculated that this may also achieve acceptable erosion rates with the addition of vegetation.

Final Landform Design Criteria for Use During Mine Planning — 2012

Internal reference: RTIO-PDE-0159989

Rio Tinto Iron Ore WA have historically designed closure landforms for waste materials with berms ~10 m, lifts ~20 m and ad hoc alterations to batter gradients where erosion rates have been perceived to be unacceptably high. This report integrates recent advances in characterisation and modelling of materials, climate and erosion processes to provide appropriate final landform batter characteristics for key Pilbara mineral wastes and soils.

Material properties of mineral wastes were assessed and classified for the range of mineral wastes found across Rio Tinto Pilbara sites. Climate sequences were used to model and test potential erosion rates for a range of batter configurations (shapes (linear, concave), heights, gradients, berm capacity) and validated against existing slopes for which material and climate data were available. This information was used to develop a searchable waste dump batter database for all major mineral wastes and soils, intended for use during mine planning design.

Contamination

Impact of Nitrogen from Explosives on Mine Site Water Quality — 2008

Internal reference: RTIO-PDE-0054638

The likely issues associated with the use of nitrogen based explosives on mineral waste and any leachate water are explored in this report. The amounts of explosives used on site are described, along with nitrogen chemistry and toxicity. Nitrogen concentrations for various mine sites and specific lithologies are presented which includes concentration in rock assays and liquid extracts.

It was concluded that the largest risk of nitrogen contamination is likely to arise from the discharge of surface waters that have been in contact with blasted materials and are discharged off site into creeks or waterways. This becomes a more significant issue if the water is also acidic. Algae (ie cyanobacteria) plumes have been identified in acidic water at Tom Price

Control Measures for Potentially Acid Forming Pit Wall Rocks — 2010

Internal reference: RTIO-PDE-0079541

Desktop study of potential strategies to manage exposed sulfidic materials and find viable options for management was conducted with a focus on the Hope Downs 1 and Tom Price sites.

Chemical treatments have the potential to be effective only in the short-term and only for minor water quality issues. Grouting of the pit walls is expected to have limited applicability, although grout curtains behind the wall may have success (untested). Cover technologies have the greatest potential to be effective over the long term, but would need to be resistant to puncture by underlying rocks, resistant to weathering and UV damage ie shotcrete, geomembranes. For long term performance the exposed surface need to be as stable and free of loose material as possible. Treatment effectiveness will also depend on the site conditions, eg chemical less effective at Tom Price.

Workshop Summary and Desktop Review: Dewatering and Sulfate Accumulation **2012**

Internal reference:
RTIO-PDE-0101903

This is a summary of a workshop held to determine the risks of dewatering sulphides within the pit wall. The outcomes from this workshop will be used to develop models to estimate the mass of sulfate produced as a consequence of dewatering activities.

There are many processes that contribute to poor pit water quality. Most of these processes are known and accounted for in existing models. However, the science of fluid flow in fractured rock is not well developed and this lack of knowledge restricts the outcomes of studies on pit water quality. There is a general lack of empirical data for estimating parameters used in models, creating a large degree of uncertainty in predictive models. Sensitivity analysis can be used to overcome some of these challenges.

Development of a conceptual model: Sulfate accumulation as a consequence of pit dewatering activities, memo **2012**

Internal reference:
RTIO-PDE-0101903

Mine dewatering and the consequent lowering of the water table may result in desaturation of sulfide bearing lithologies. The objective of this work was to develop a conceptual model of the associated processes: where sulphide bearing rock intersects the pit walls, and where the sulphide bearing rock is located behind the pit walls but not directly exposed on the pit wall face.

The conceptual model developed estimates the mass of sulfate produced as a consequence of dewatering activities, considering processes during operations and after operations cease, and using sensitivity analysis where parameter inputs are uncertain. The model output provides the basis for an assessment of potential impacts on water quality for general risk assessment applications. Further work was identified to improve parameterisation of the model, including the collection of additional empirical data for pit wall fracturing, saturation of pit wall fractures and sulfide oxidation rates in talus and on pit walls.

Ethnographic or archaeological values

Water and Indigenous People in the Pilbara: A Preliminary Study, CSIRO: Water for a Healthy Country **2011**

Internal reference:
RTIO-HSE-0218222

Water resources are vital to Indigenous identities, beliefs, environmental philosophies and livelihoods. This report provides a broad-scale scoping study of Indigenous relationships to water in the Pilbara and considers the potential impacts of Indigenous water values.

Indigenous belief systems perceive water as an elemental part of the broader cultural landscape, held and managed under customary systems of law. Water sources were derived during the Dreaming and are the most important features in the Pilbara cultural landscape. Interviews raised issues of long term drying, obstruction of water flow, over-extraction, inappropriate discharge from de-watering and access restrictions.

Appendix 4: Closure Risk Register

Risk Title	Potential Causes (trigger/Indicators)	Impacts/Consequences	Existing Controls	Evaluation Rationale	Inherent Risk Classification	Current Risk Management Class
The safety risk for people entering HD2 after it has been rehabilitated and closed has not been effectively mitigated (696068)	• Post-closure access / land-use requirements, e.g. for stock/pastoralism, people, heritage, environmental monitoring, adjacent mining activities. • Potential for general public to create their own access if appropriate access not provided. • Long term integrity of abandonment bunds. • Decommissioning of infrastructure not implemented effectively. • Some roads will be retained for post-closure access. • Realignment of the Hwy has the potential to complicate access and safety controls.	Health and Safety Community and Social Performance License to operate Legal and Regulatory Compliance	Abandonment bunds to prevent inadvertent access [782553] Above ground infrastructure made safe or removed [782555] Closure studies process (OoM, PFS, FS) 758192 Biannual Local Implementation Committee meetings with TO's 758281 Cultural Heritage Management Plan 703848 RTIO Closure Strategy 758188 Rio Tinto Closure Standard 758190	Single fatality to member of public Loss of access to significant cultural or environmental site causes upset or non compliance with commitments	IV	**IV**
Implementation of the closure strategy does not achieve the required cultural heritage outcomes	• Previously unidentified heritage sites or cultural heritage values, not considered in existing assessment, discussions, agreements or with no authority to disturb. • Changes to landforms at closure have potential to alter conditions at downstream sites, e.g. consider drainage, landform footprint, erosion implications. • Cessation of maintenance of / access to heritage site. • Cultural values not considered in rehabilitation strategies. • The presence of several heritage sites in close proximity to mining areas. • Plans for repatriation of salvaged artefacts not well understood. • Downstream regional area of high value to multiple Traditional Owner groups. • Changes to environmental conditions due to cessation of operational or artificial support / mitigation activities, e.g. dewatering, water supplementation. • Unplanned impact to known heritage site from machinery activity/material movement. • Impacts to PMC heritage values, or WWC downstream environments due to mining activities. • No closure consultation has occurred in regards to final closure landform or other aspects of Hope Downs 2 closure	Licence to Operate Communities and Social Performance Legal Total Cost of Closure	Cultural Heritage Management Plan [703848] Ground disturbance Approval Request system [758266] Heritage GIS database [519558]	Cessation of maintenance of / access to heritage site. Closure implementation results in unapproved impacts to cultural heritage values in the area (i.e. previously unidentified heritage sites or cultural heritage values, not considered in existing assessment, discussions, agreements or with no authority to disturb). Waterways are not returned to prior to mine life and so cultural use cannot return to what was expected (due to water levels, water quality, accessibility etc)	IV	**III**

Risk Title	Potential Causes (trigger/Indicators)	Impacts/Consequences	Existing Controls	Evaluation Rationale	Inherent Risk Classification	Current Risk Management Class
Inadequate management of contaminating activities at HD2 during operations increases closure costs (696032)	• Poor use or uncontrolled use of chemicals and hydrocarbons during operations. • Inadequate housekeeping practice and maintenance of work areas and equipment. • Contaminated sites have not been identified. • Inadequate clean-up of contamination. • Potential contamination source has not been addressed. • The full nature and extent of reportable contaminated sites have not been adequately determined. • Lag contamination events from historical waste disposal practices. • Changes in regulatory expectations and continually developing regulatory understanding of emerging contaminates of concern.	Total cost of closure Environment Lega and Regulatory Compliance	Licensing of Prescribed Premises [783245] RTIO Contaminated Sites Strategy [782520] RTIO Environment Design Standard for Permanent Infrastructure [782521] RTIO Environment Design Standards Temporary Infrastructure [782523] RTIO Landfarm Work Practice [782519] RTIO Landfill Work Practice [782518] RTIO Potentially Contaminated Sites Register [519506] RTIO Spill Response Procedure [779354]	Contamination is identified during closure implementation or post closure and remediation is required	III	III
Waste dumps and or landbridges at HD2 are subject to excessive erosion (974458)	• Material characterisation assumptions are incorrect. • Incorrect assumptions or understanding of technical aspects underpinning the closure strategy. • Climatic conditions or changes impact outcomes.	Environment Licence to Operate Total cost of closure	Physical materials characterisation completed for common waste types [519539] Closure review of landform designs through MDAS system [758263] Landform Design Guidelines [754554] RTIO Rehabilitation handbook [759546] RTIO SCARD management plan [519521] Temporary and permanent surface water structures designed to conform with relevant legal and engineering standards 519543	Waste dumps and / or Landforms require re-work to achieve closure outcomes Downstream environmental receptor impacted and needs remediation	III	III

Risk Title	Potential Causes (trigger/Indicators)	Impacts/Consequences	Existing Controls	Evaluation Rationale	Inherent Risk Classification	Current Risk Management Class
Failure to reach agreement with the State on suitable completion criteria for HD2 (696208).	• Current completion criteria still at conceptual stage. • Final completion criteria not agreed with key stakeholders. • Inadequate consultation with stakeholders to identify expectations. • Regulator standards change with time (required to achieve the "standard of the day"). • Insufficient or unreliable corporate knowledge to define final completion criteria. • Unrealistic expectations for closure outcomes (restoration compared to rehabilitation). • Research not being undertaken and/or outcomes not being analyzed/utilized. • Conceptual models and/or limited technical data to achieve proposed closure strategies.	Total cost of closure Licence to operate	Closure legal obligations register [757139] Mine Closure Plan is updated for approval every three years [757145] Progressive rehabilitation is trialed and completed during operations [758285] Quarterly regulator closure forum [758282] RTIO Stakeholder Engagement Strategy for Closure [754125] Stakeholder Engagement Register [757141] Business Conformance Audit (Closure) 754099 Post Closure Monitoring & Maintenance Plan 759549 Rehabilitation monitoring program 759547 MCP is updated for approval every three years 757145 Quarterly regulator closure forum 758282 RTIO Closure Strategy 758188 Rio Tinto Closure Standard 758190 Closure studies process (OoM, PFS, FS) 758192	Stakeholder engagement with regulators fails to reach agreement on closure strategy leading to increased closure costs and relationship impacts	III	III

Risk Title	Potential Causes (trigger/Indicators)	Impacts/Consequences	Existing Controls	Evaluation Rationale	Inherent Risk Classification	Current Risk Management Class
Implementation of the closure strategy does not achieve the required environmental outcomes.	• Scheduled, listed or declared rare and / or threatened species of flora or fauna present in/adjacent to site. • Downstream regional area of high value. • Regional groundwater impacts not well understood. • Environmental conditions post-closure differ significantly from pre-mining conditions. • Post-mining land use differs from pre-mining land use. • Failure to understand or consider cumulative impacts on off-site areas. • Changes to environmental conditions due to cessation of operational or artificial support / mitigation activities, e.g. dewatering, water supplementation.	Environment Compliance	Baseline flora and fauna surveys [759550] Biological GIS database [782559] Ground disturbance Approval Request system [758266] Rehabilitation trials to increase confidence in rehabilitation outcomes [759222] RTIO Rehabilitation handbook [759546] Seed management and procurement program [759225] Soil resource management work practice [759226] RTIO Closure Strategy 758188 Rio Tinto Closure Standard 758190 Closure studies process (OoM, PFS, FS) 758192 Research and Development program 764041 Rehabilitation monitoring program 759547 Post Closure Monitoring & Maintenance Plan 759549 Progressive Rehabilitation is trialled and completed during operations 758285 Environmental exclusions zones established to protect conservation significant fauna and habitat 832623	Regional impact results in loss of trust, delay to relinquishment and increased closure costs.	III	III

Risk Title	Potential Causes (trigger/Indicators)	Impacts/Consequences	Existing Controls	Evaluation Rationale	Inherent Risk Classification	Current Risk Management Class
Inadequate management of surface water results in increased closure complexity and costs	• Unplanned post-closure impacts occur as a result of migration of a contaminant (e.g. sediment) off-site. • Diversion or catchment of important surface water flows on-site, impacting on downstream areas off-site.	Environment Community and Social Performance Total cost of closure	Water management strategies during operations prioritise minimisation of closure management liability 786840 Water discharge monitoring and management plans 702366 Temporary and permanent surface water structures designed to conform with relevant legal and engineering standards 519543 Environmental and groundwater monitoring regime in place during operations 699589	Impact requires ongoing management or clean up	III	III

Risk Title	Potential Causes (trigger/Indicators)	Impacts/Consequences	Existing Controls	Evaluation Rationale	Inherent Risk Classification	Current Risk Management Class
Rehabilitation outcomes at HD2 do not meet closure objectives.	• Vegetation established, but does not re-seed in same abundance. • Weed competition. • Species selection / insufficient species diversity. • Animal interference i.e. feral animals eating new growth. • Changes to soil water conditions e.g. salinity, water logging. • Vegetation does not provide suitable habitat for local fauna. • Availability of soil/poor stockpile management/failure to collect soils during ground disturbing activities. • Low moisture retention i.e. hydrophobic soils development, very rocky materials. • Chemical properties of materials on waste dump / rehab surface e.g. salt circulation, alkalinity. • Completion criteria are currently indicative only and therefore final requirements/expectations are not yet understood or agreed.	Environment Total cost of closure Legal and Regulatory Compliance	Rehabilitation trials to increase confidence in rehabilitation outcomes [759222] RTIO Rehabilitation handbook [759546] Seed management and procurement program [759225] Soil resource management work practice [759226] Rehabilitation monitoring program 759547 Baseline flora and fauna surveys [759550] Biological GIS database [782559] Environmental Management Plan [759548] Ground disturbance Approval Request system [758266] (Issue/Site specific) Management Plan MSA's with contractors 759823 Skilled and resourced closure planning team within RTIO 759826 Rehabilitation trials to increase confidence in rehabilitation outcomes 759222 Post Closure Monitoring & Maintenance Plan 759549 Research and Development program 764041 Environmental exclusions zones established to protect conservation significant fauna and habitat 832623	Rehabilitation (~50% $50M AUD) rework is required causing increase of costs and delayed relinquishment	III	III
Consultation fails to identify and/or address stakeholder concerns [696247]	• Conflicting stakeholder expectations or areas of authority e.g. different regulators for environment, heritage, health, economic, tourism. • Conflicting legal obligations e.g. State Agreement and EPA. • Interactions between catchment land uses, including mining developments, at different points in time. • Traditional owners are not satisfied with the rehabilitation undertaken. Consultation fails to identify issues prior to them being playing out.	Community and Social Performance Licence to operate Legal and Regulatory Compliance Total cost of closure	Mine Closure Plan is updated for approval every three years [757145] RTIO Closure Strategy [758188] RTIO Stakeholder Engagement Strategy for Closure [754125] Stakeholder Engagement Register [757141]	Consultation is undertaken but fails to idenitfy stakeholder concerns.	III	III

Risk Title	Potential Causes (trigger/Indicators)	Impacts/Consequences	Existing Controls	Evaluation Rationale	Inherent Risk Classification	Current Risk Management Class
Pit wall stability at HD2 compromises closure outcomes (696059)	• Influence of erosion, subsidence, seismicity, wall slip. • Influence of groundwater recovery and surface water flows on stability. • Creek system neighbouring or within zone of instability, potential stream capture. • Geotechnical assessment incorrectly defines the zone of instability. • Built landforms (waste dumps/land bridges) within potentially unstable pit edge zone. • Run on from surface water catchments onto waste dumps and pits (currently not incorporated into design)	Community and Social Performance License to operate Environment Environment Total Cost of Closure	D3 Standard Management of Slope Geotechnical Hazards 758274 Buttressing design to improve pit wall stability at closure 786838 Geotechnical assessments for wall stability and zone of collapse as part of mine design reviews 519534 Closure review of landform designs through MDAS system 758263 Landform Design Guidelines 754554	Post closure pit wall failure impacts potential MNES habitat	III	II
Acid and / or metalliferous drainage generation creates a contaminated site (969040).	• Interaction of water and mineral waste could generate acid / alkaline levels that leach metals / salts from the mineral waste or local environment.	Environment Legal & Regulatory Compliance Licence to Operate Total cost of closure	Groundwater operating and monitoring plan [702372] Geochemical waste characterisation and column leach tests [702369] RTIO Mineral Waste Management Plan for undeveloped resource and studies [754152] RTIO SCARD management plan [519521]	AMD results in an environmental legacy and ongoing acid water management is required (i.e. acid water treatment plant). Note: No PAF expected to be encountered during operations.	II	II

Appendix 5: Closure Action Register

Ref	Task	Indicative timeframe
1	Develop SMART completion criteria for HD2 and BHT deposits; considering stakeholder consultation and access requirements, climatic, geotechnical, mineral waste, hydrogeological, hydrological, flora and fauna knowledge and assessments.	2030
2	Stakeholder engagement strategy and communications plan to be prepared for community, regulators, and internal audience.	Next Closure Plan
3	Undertake specific closure stakeholder engagement to determine social and cultural heritage values to be maintained at the closure of the HD2 and BHT deposits, include salvage and repatriation of sites.	Next Closure Plan
4	Undertake visual impact assessment of HD2 and BHT deposits final landform configuration and visibility from GNH and other key vantage points or points of cultural heritage importance.	Next Closure Plan
5	Develop seed mix(es) HD2 and BHT deposits in line with progressive rehabilitation targets and consultation with stakeholders.	Next Closure Plan
6	Develop consultation tools to assist in communicating closure strategy with stakeholders.	Next Closure Plan
7	Schedule consultation with stakeholders over the life of asset to consult on closure strategy options and opportunities.	Ongoing
8	Complete consultation with TOs on key heritage locations and access requirements post-closure to contribute to the final closure landform or landscape	Ongoing
9	Complete consultation on closure outcomes, completion criteria and measurement tools.	Ongoing
10	Complete consultation on the final closure landform or landscape and opportunities for TOs to get involved.	Ongoing
11	Investigate opportunity to allow safe access for viewing/observation of post-closure landform to deter unauthorised access to site.	Next Closure Plan
12	Potential social and economic impacts to be assessed including amenity, public health associated with closure activities, loss of employment and business opportunities.	Ongoing
13	Consult with stakeholders to address any potential socio-economic impacts post-closure.	Ongoing
14	Complete landform evolution modelling to confirm the optimal final Waste Rock Landform design, including physical waste characterisation.	Next Closure Plan
15	Flood modelling of the closure landform to consider climatic variation and the potential for extreme rainfall events.	Next Closure Plan
16	Develop post-closure monitoring and maintenance plan for HD2 and BHT deposits	2030
17	Evaluate planned post-closure pit wall stability for HD2 and BHT deposits pits to determine if mitigation is required to prevent wall collapse and PMC creek capture.	Ongoing
18	The zone of geotechnical instability or PUPEZ will be revised and updated for HD2 and BHT deposits in each iteration of the MCP to reflect any changes to the mine plan, understanding of the closure landscape and to address any updated flood modelling.	Ongoing
19	The location of the proposed pit abandonment bunds for the HD2 and BHT deposits will be revised and updated in each iteration of the MCP to reflect any changes to the mine plan, understanding of the closure landscape and to address any updated flood modelling.	Ongoing

20	Develop a rehabilitation materials inventory for HD2 and BHT deposits for low erodibility waste to be utilised for capping and abandonment bunding where required.	Ongoing
21	Undertake landform evolution modelling for HD2 and BHT landforms to further inform and verify final landform design and rehabilitation parameters.	Ongoing
22	Site specific geotechnical assessments will be completed for rehabilitation designs of final closure landforms for HD2 and BHT deposits to confirm closure landform safety and stability.	Ongoing
23	Complete consultation with the State on preferences with regards to final closure landform and public access to the post-closure landscape. This will be determined through ongoing consultation during the life of the operation.	Ongoing
24	Assess opportunities to allow safe access for viewing/observation of the post-closure landform near the highway to deter unauthorised access to site. If this is considered appropriate to key stakeholders, details will be included in further updates to this MCP.	2030
25	Assess the expected post-closure access to the site, and include the installation of additional control measures, where appropriate.	2030
26	Site specific physical waste characterisation will be progressively undertaken when each mineral waste unit becomes available during mining operations.	Ongoing
27	Include HD2 and BHT deposit materials in updates of the BST.	Ongoing
28	Undertake further testing of BHT (detrital) lignite materials when geological units become available during mining operations as per the SCARD management plan.	Ongoing
29		
30	Revise waste rock landform rehabilitation and overall closure landform designs based on physical waste characterisation, BST parameters, hydrological and ecological factors and stakeholder consultation as required.	Ongoing
31	Update the topsoil balance for estimated topsoil recovery annually once mining commences.	Ongoing
32	Complete subsoil characterisation work when vegetation clearing commences as required.	Ongoing
33	Undertake Preliminary Site Investigation 5 years prior to closure.	2030
34	Undertake Detailed Site Investigation 2 years prior to closure.	2032
35	Complete final options assessment for water source for HD2 Proposal and impacts for HD2 and BHT deposits.	Next Closure Plan
36	Update closure hydrogeological model with new conceptualisations for HD2 and BHT deposits water supply options.	Ongoing
37	Complete closure hydrogeological water quality model for HD2 and BHT deposits once water supply options are agreed with stakeholders.	Next Closure Plan
38	Update the conceptual hydrogeological model for HD2 and BHT deposits final closure landform 5 years from closure.	2029
39	Update surface water modelling for PMC creek diversion in line with changes to landform design and closure strategy for HD2 deposit (1:100AEP, 1:1000AEP and 1:10,000AEP).	Ongoing
40	Upgrade of drainage designs for permanent closure drainage structures (PMC) where required, in line with flood risk assessments (1:100AEP, 1:1000AEP and 1:10,000AEP).	2030
41	Undertake hydrological water quality sampling of PMC and WWC prior to commencing mining of the HD2 and BHT deposits.	2025
42	Undertake hydrological modelling (1:100AEP, 1:1000AEP and 1:10,000AEP) of updated landbridge closure strategy and designs.	Ongoing
43	Undertake hydrological modelling of abandonment bund alignment and final closure landform for HD2 and BHT deposits (1:100AEP, 1:1000AEP and 1:10,000AEP).	2030

44	Determine required engineering flood mitigation structures for HD2 and BHT deposit's closure landforms.	2030
45	Conservation significant areas will be considered in closure planning with reference to post-closure land use, access to the landscape and closure outcomes.	Ongoing
46	Seed mixes have not been developed for the HD2 Proposal, to facilitate progressive rehabilitation. Considering the short mine life for the HD2 Proposal, flora species recorded in baseline surveys will be used to inform rehabilitation seed mix(es). Seed mixes will be developed in consultation with stakeholders.	2025
47	The selection of reference / analogue sites and the development of revegetation completion criteria (species richness, percentage cover and percentage weed cover) have not yet been undertaken. Vegetation mapping completed for the HD2 Proposal will be used to inform the selection of reference / analogue sites and inform the development of revegetation completion criteria (species richness, percentage cover and percentage weed cover) and monitor against progressive rehabilitation	Next Closure Plan
48	Select reference / analogue sites for HD2 and BHT deposits to inform revegetation criteria and progressive rehabilitation.	Next Closure Plan
49	Implement progressive closure and rehabilitation of waste rock landforms and disturbed areas as soon as possible to reduce closure liabilities.	Ongoing
50	Revise seed mix(es) in line with progressive rehabilitation targets and consultation with stakeholders.	2030
51	Conduct closure research and rehabilitation trials to demonstrate methodologies.	Ongoing
52	Complete fauna habitat assessment of the final closure landform for HD2 and BHT deposits 5 years from closure.	2029
53	Undertake review of final closure landform and completion criteria to determine the functional habitats likely to be present post-closure.	2029
54	Incorporated social and cultural heritage values regarding Special Places for Nyiyaparli, as documented in the HD2 SCHMP (Rio Tinto 2023), into the MCP.	Next Closure Plan
55	The risk title regarding cultural heritage will be reworded and evaluated to ensure that closure outcomes consider social values.	Next Closure Plan

Appendix 6: Landform Design Criteria

HD2 DP_NW (Goanna)

Waste volume	174 Mm^3	
Erodibility ranking		
	Low	12 %
	Medium	31 %
	High	57 %
Classification	Inert ☒	Capping required at closure:
	PAF ☐	Y
	Fibrous minerals ☐	Mm^3
	WFSF ☐	-
Overall height (m)	150	
Topsoil required (Mm^3)	**0.6**	

	Construction Specifications	Rehabilitation Specifications
Slope angle (deg)	34	20°
Lift height (m)	10	7
Berm width (m)	23.6	11
Berm slope (deg)	°	°
Footprint (ha)	264	269

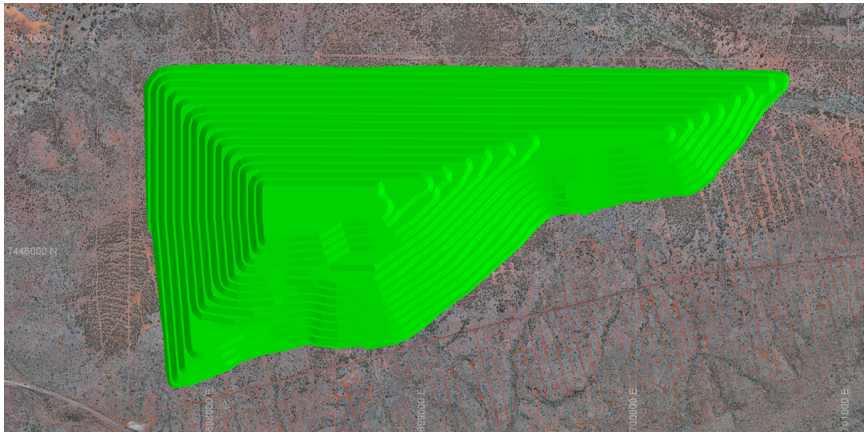
Comments:

Please note designs are conceptual and features such as ramps and design parameters are subject to change.
Capping requirements will be assessed as more information on material characteristics are gained through further study.

Construction Design



Rehabilitation Design



HD2 DP_NC (Tortoise)

Waste volume	34Mm^3	
Erodibility ranking		
	Low	56 %
	Medium	31 %
	High	28 %
Classification	Inert ☒	Capping required at closure:
	PAF ☐	Y
	Fibrous minerals ☐	Mm^3
	WFSF ☐	-
Overall height (m)	75	
Topsoil required (Mm^3)	**0.2**	

	Construction Specifications	**Rehabilitation Specifications**
Slope angle (deg)	34	20°
Lift height (m)	10	7
Berm width (m)	23.6	11
Berm slope (deg)	°	°
Footprint (ha)	75	77

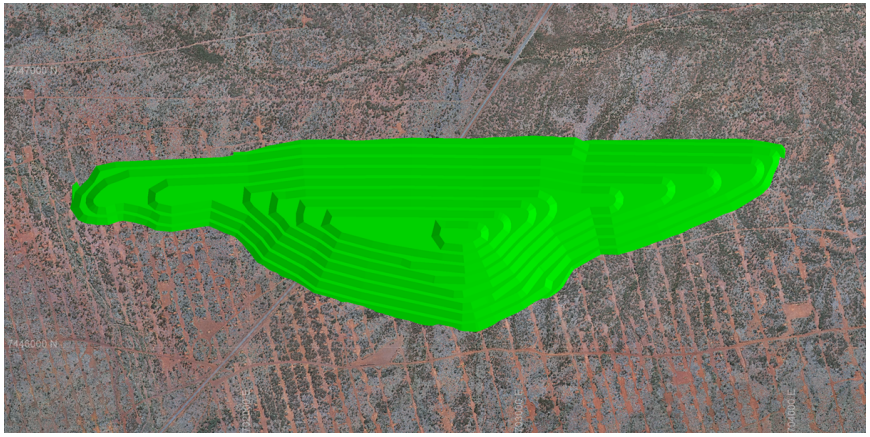
Comments:

Please note designs are conceptual and features such as ramps and design parameters are subject to change.
Capping requirements will be assessed as more information on material characteristics are gained through further study.

Construction Design



Rehabilitation Design



BHT DP_NELG

Waste volume	125Mm³	
Erodibility ranking		
	Low	94 %
	Medium	2 %
	High	4 %
Classification	Inert ☒	Capping required at closure:
	PAF ☐	N
	Fibrous minerals ☐	Mm³
	WFSF ☐	-
Overall height (m)	175	
Topsoil required (Mm³)	**0.5**	

	Construction Specifications	**Rehabilitation Specifications**
Slope angle (deg)	36°	20°
Lift height (m)	10	10
Berm width (m)	24	10
Berm slope (deg)	°	°
Footprint (ha)	207	207

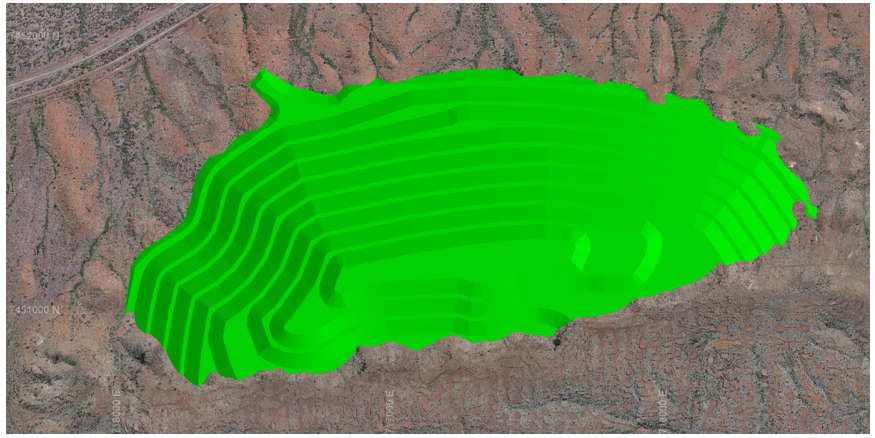
Comments:

Please note designs are conceptual and features such as ramps and design parameters are subject to change.

Construction Design



Rehabilitation Design



BHT DP_NEWD

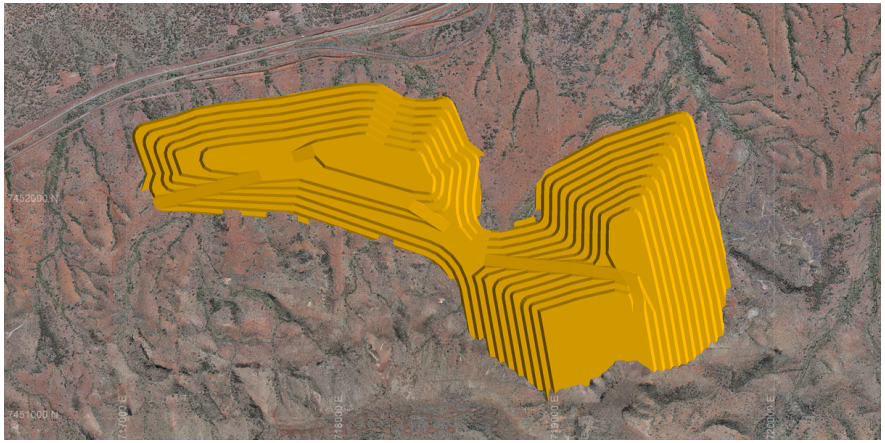
Waste volume	83 Mm^3	
Erodibility ranking		
	Low	82 %
	Medium	3 %
	High	15 %
Classification	Inert ☒	Capping required at closure:
	PAF ☐	N
	Fibrous minerals ☐	Mm^3
	WFSF ☐	-
Overall height (m)	120	
Topsoil required (Mm^3)	**0.5**	

	Construction Specifications	**Rehabilitation Specifications**
Slope angle (deg)	36°	20°
Lift height (m)	10	10
Berm width (m)	24	10
Berm slope (deg)	°	°
Footprint (ha)	204	206

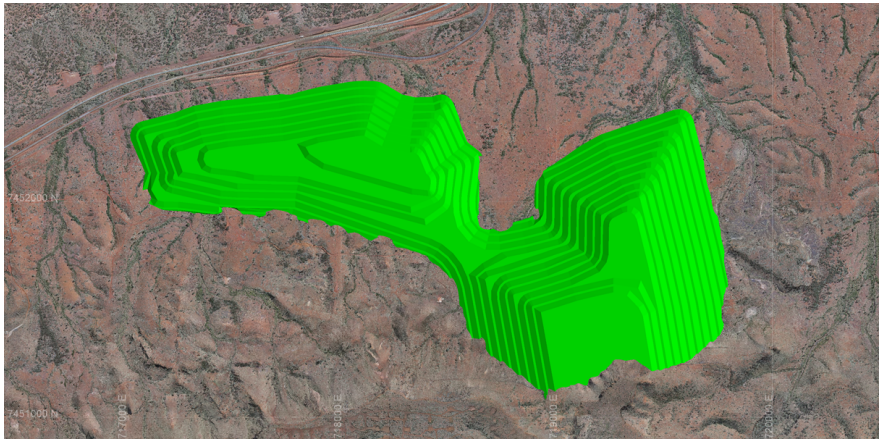
Comments:

Please note designs are conceptual and features such as ramps and design parameters are subject to change.

Construction Design



Rehabilitation Design



BHT LB_West

Waste volume	During operations - 6.0Mm^3, Rehabilitation - 0.188Mm^3	
Erodibility ranking		
	Low	82 %
	Medium	3 %
	High	15 %
Classification	Inert ☒	Capping required at closure:
	PAF ☐	N
	Fibrous minerals ☐	Mm^3
	WFSF ☐	-
Overall height (m)	Max 47m	
Topsoil required (Mm^3)	**N/A**	

	Construction Specifications	**Rehabilitation Specifications**
Slope angle (deg)	36°	20 °
Lift height (m)	15m	15m
Berm width (m)	24m	10m
Berm slope (deg)	3°	11°
Footprint (ha)	38.6ha	

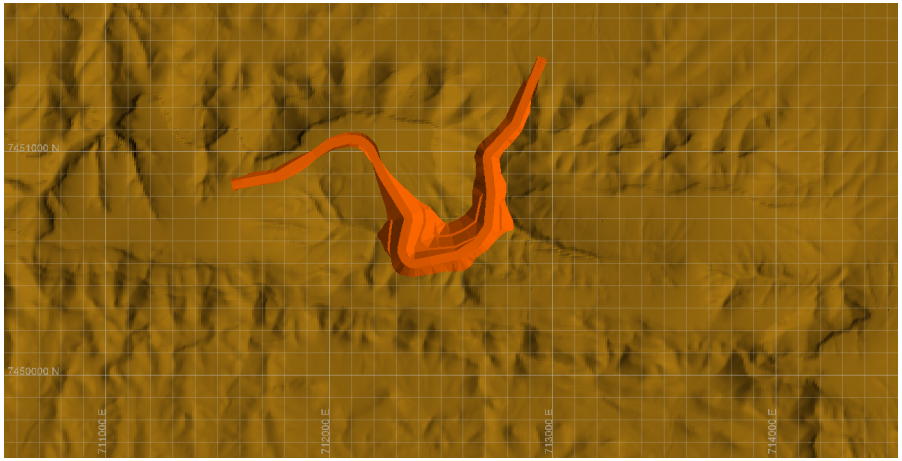
Comments:

Landbridge designs are conceptual and are likely to change with updates to pit designs and schedules.

The majority of this landbridge is in pit and does not require a rehabilitation design, portions of the landbridge not located within pit areas will be reclaimed into the adjacent pit areas or shaped to maintain surface water flows where possible.

The external portion will have an updated rehabilitation design completed prior to approval of the project, designs and landforms evolution modeling are underway and planned for completion in 2023.

Construction Design



Rehabilitation Design



BHT LB_CEN

Waste volume	During operations - 0.7Mm^3. Rehabilitation - Removed at closure.	
Erodibility ranking		
	Low	82 %
	Medium	3 %
	High	15 %
Classification	Inert ☒	Capping required at closure:
	PAF ☐	N
	Fibrous minerals ☐	Mm^3
	WFSF ☐	-
Overall height (m)	Max.31m	
Topsoil required (Mm^3)	N/A	

	Construction Specifications	**Rehabilitation Specifications**
Slope angle (deg)	36°	20 °
Lift height (m)	15m	20m
Berm width (m)	24m	10m
Berm slope (deg)	3°	11°
Footprint (ha)	12.5ha	

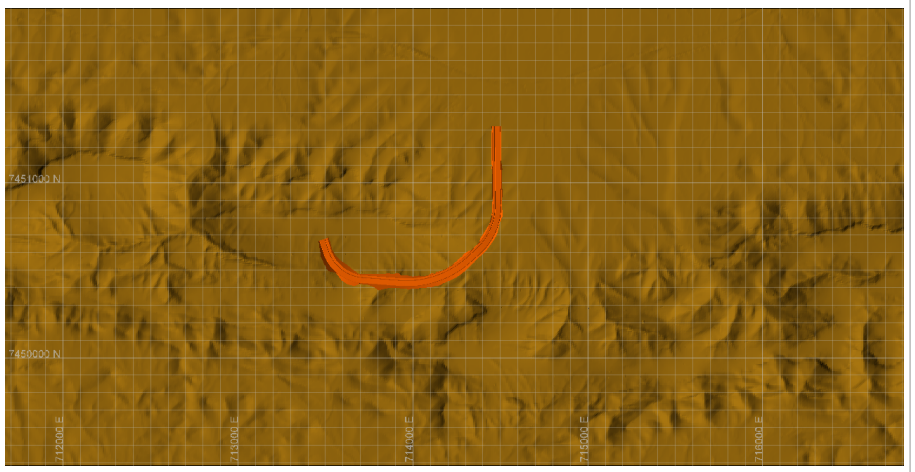
Comments:

Landbridge designs are conceptual and are likely to change with updates to pit designs and schedules.

The majority of this landbridge is in pit and does not require a rehabilitation design, portions of the landbridge not located within pit areas will be reclaimed into the adjacent pit areas or shaped to maintain surface water flows where possible.

The external portion is currently planned to be reclaimed at closure, however, updated designs and landforms evolution modeling are underway and planned for completion in 2023.

Construction Design



Rehabilitation Design

N/A

BHT LB_Central 3

Waste volume	During operations - 0.9Mm³ , Rehabilitation - 0.066Mm³	
Erodibility ranking		
	Low	82 %
	Medium	3 %
	High	15 %
Classification	Inert ☒	Capping required at closure:
	PAF ☐	-
	Fibrous minerals ☐	Mm³
	WFSF ☐	-
Overall height (m)	Max 38	
Topsoil required (Mm³)	N/A	

	Construction Specifications	**Rehabilitation Specifications**
Slope angle (deg)	36°	20 °
Lift height (m)	15m	20m
Berm width (m)	24m	10m
Berm slope (deg)	3°	11°
Footprint (ha)	8.2ha	

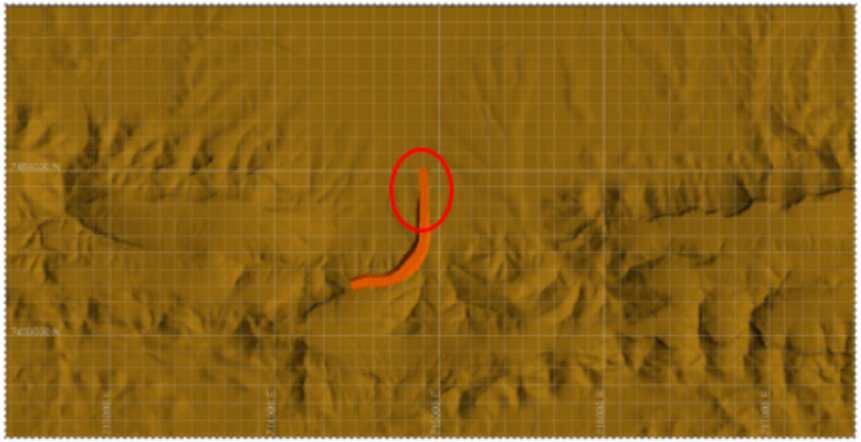
Comments:

Landbridge designs are conceptual and are likely to change with updates to pit designs and schedules.

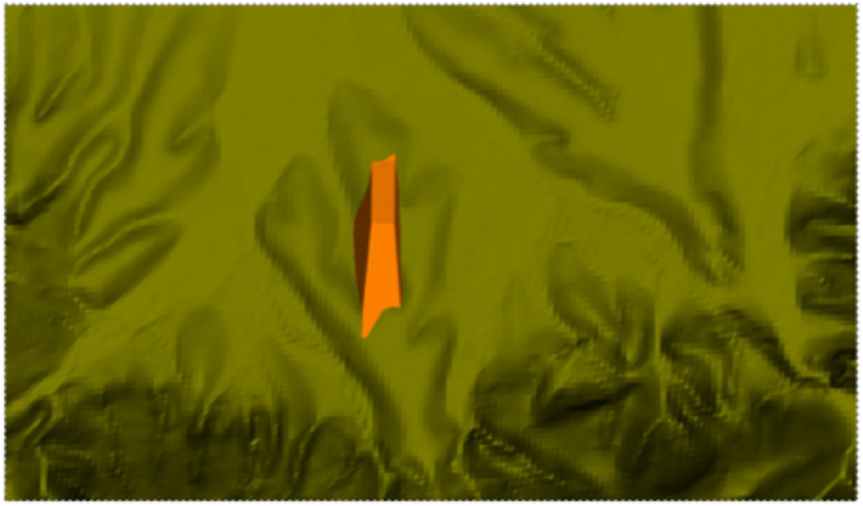
The majority of this landbridge is in pit and does not require a rehabilitation design, portions of the landbridge not located within pit areas will be reclaimed into the adjacent pit areas or shaped to maintain surface water flows where possible.

The external portion will have an updated rehabilitation design completed prior to approval of the project, designs and landforms evolution modeling are underway and planned for completion in 2023.

Construction Design



Rehabilitation Design



BHT LB_East 6

Waste volume	During operations - 0.8Mm^3 , Rehabilitation - 0.061Mm^3	
Erodibility ranking		
	Low	82 %
	Medium	3 %
	High	15 %
Classification	Inert ☒	Capping required at closure:
	PAF ☐	N
	Fibrous minerals ☐	Mm^3
	WFSF ☐	-
Overall height (m)	Max. 78m	
Topsoil required (Mm^3)	**N/A**	

	Construction Specifications	**Rehabilitation Specifications**
Slope angle (deg)	36°	20 °
Lift height (m)	15m	20m
Berm width (m)	24m	10m
Berm slope (deg)	3°	11°
Footprint (ha)	10.1ha	

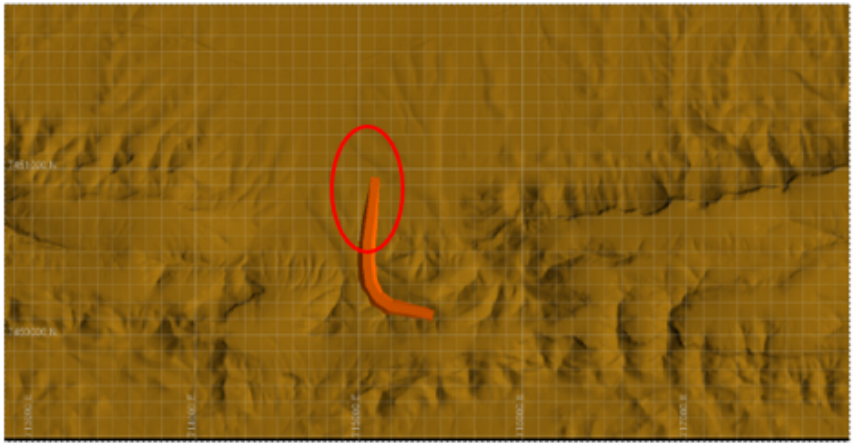
Comments:

Landbridge designs are conceptual and are likely to change with updates to pit designs and schedules.

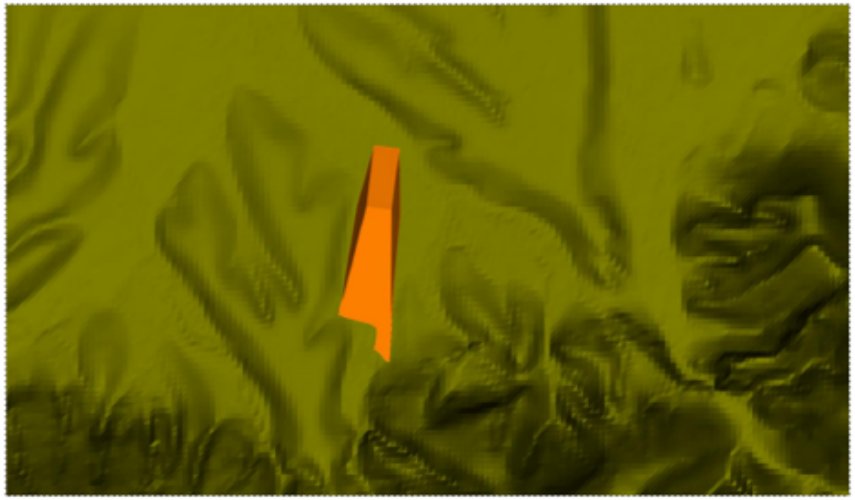
The majority of this landbridge is in pit and does not require a rehabilitation design, portions of the landbridge not located within pit areas will be reclaimed into the adjacent pit areas or shaped to maintain surface water flows where possible.

The external portion will have an updated rehabilitation design completed prior to approval of the project, designs and landforms evolution modeling are underway and planned for completion in 2023.

Construction Design



Rehabilitation Design



BHT LB_East

Waste volume	During operations -1.6Mm^3 , Rehabilitation - 0.20Mm^3 and 0.12Mm^3	
Erodibility ranking		
	Low	82 %
	Medium	3 %
	High	15 %
Classification	Inert ☒	Capping required at closure:
	PAF ☐	N
	Fibrous minerals ☐	Mm^3
	WFSF ☐	-
Overall height (m)	Max. 78m	
Topsoil required (Mm^3)	**N/A**	

	Construction Specifications	**Rehabilitation Specifications**
Slope angle (deg)	36°	20 °
Lift height (m)	15m	20m
Berm width (m)	24m	10m
Berm slope (deg)	3°	11°
Footprint (ha)	38.6ha	

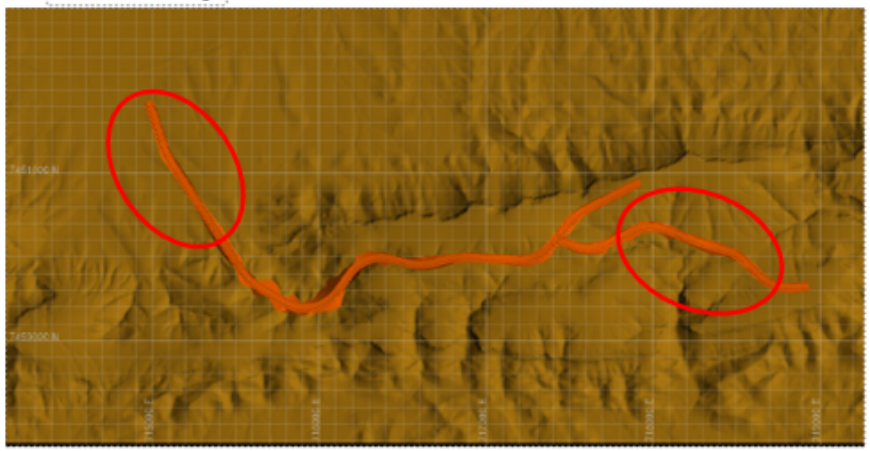
Comments:

Landbridge designs are conceptual and are likely to change with updates to pit designs and schedules.

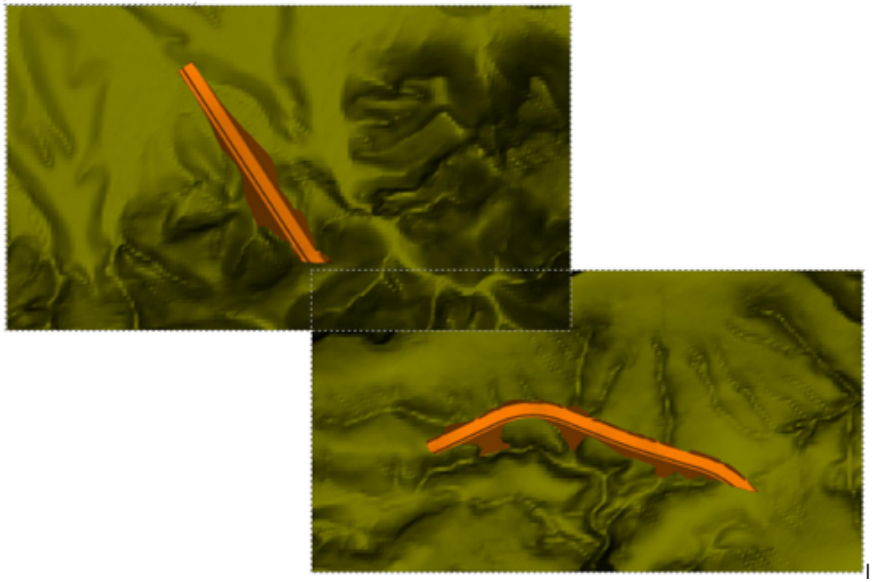
The majority of this landbridge is in pit and does not require a rehabilitation design, portions of the landbridge not located within pit areas will be reclaimed into the adjacent pit areas or shaped to maintain surface water flows where possible.

The external portion will have an updated rehabilitation design completed prior to approval of the project, designs and landforms evolution modeling are underway and planned for completion in 2023.

Construction Design



Rehabilitation Design



Appendix 7: Memorandum: Characterisation of erosion potential of mineral wastes for use in developing rehabilitated landform designs, Hope Downs 1 & 2

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152-158 St George's Terrace
PERTH WA 6000

20 May 2020

2079.20e (Rev 1)

Attn: Belinda Yaqub – Closure Specialist, Studies and Technology

Memorandum: Characterisation of erosion potential of mineral wastes for use in developing rehabilitated landform designs, Hope Downs 1 & 2

1. Introduction

1.1 Regulatory expectations

Across Australia, mining regulatory bodies provide guidance on the required state of rehabilitated landforms. In Western Australia the Department of Mines, Industry Regulation and Safety (DMIRS) define land rehabilitation as the, "return of disturbed land to a safe, stable, non-polluting/non-contaminating landform in an ecologically sustainable manner that is productive and/or self-sustaining consistent with the agreed post-mining land use"[1]. In their technical guidance note on waste rock dumps, DMIRS also state that the geometry of waste dump batter slopes should be designed such that they are not prone to significant erosion[2].

Fundamental to creating safe, stable, and non-polluting landforms is the development of land surfaces that do not erode at rates likely to be unstable in the long-term, that are sufficiently stable such that vegetation can establish, and that generate sediment levels consistent with background levels such that the impact on the surrounding landscape is low.

1.2 Rio Tinto's historical involvement in erodibility testing and erosion modelling

Rio Tinto Iron Ore (WA) has been involved in the development of erosion assessment methods for mining waste landforms for a long time, with the first application of material erodibility testing and erosion models to mining landforms occurring in 1998. Since that time, the use of models has improved and been refined to the point where final landform shapes can be informed through models calibrated using site-specific material erodibility and climate data.

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[1] Department of Mines, Industry Regulation and Safety (2020) *Mine Closure Plan Guidance - How to prepare in accordance with Part 1 of the Statutory Guidelines for Mine Closure Plans*, Version 3.0, Government of Western Australia, https://www.dmp.wa.gov.au/Documents/Environment/REC-EC-112D.pdf, accessed 22 July 2020.

[2] Department of Mines and Petroleum (2009) *Waste Rock Dumps, Environmental Notes on Mining*, Government of Western Australia, https://www.dmp.wa.gov.au/Documents/Environment/ENV-MEB-223.pdf, accessed 22 July 2020.

In the period of 1998 to 2006, this included field based studies at Tom Price, Paraburdoo, and Nammuldi, and laboratory-based studies for materials from Tom Price, Channar, and Marandoo. Rio Tinto Iron Ore (WA) undertook an extensive project in 2010-2012 along with several studies since that time to source erodibility data for a range of materials across all the Pilbara iron ore mine sites. These data have been used to establish a means by which a material's erosion characteristics can directly inform mine and rehabilitation planning. An outcome of these projects has been the creation of a database of erodibility parameters for a large number of mineral wastes. This erodibility parameter database has subsequently been used within erosion models[3] to define a collection of erosionally stable landform batter geometries (height, gradient, and profile shape) for the key mineral wastes and soils across Rio Tinto Iron Ore's Pilbara operations. Rio Tinto use these erosionally stable batter geometries to develop 3-D rehabilitation landform designs that will satisfy long-term erosional stability requirements.

Erodibility ranking

The materials for which erodibility data exists have been given a general erodibility ranking (high, medium, low) to assist in describing the different mineral waste types. The ranking system was developed by considering the particle size distribution (PSD) and rain armoured rock cover levels for a range of Rio Tinto's materials. The ranking system is broad in nature and is used to describe the relative erodibilities in different mineral waste types.

The erodibility ranking system was developed by considering the erosion potential of mineral wastes using the Revised Universal Soil Loss Equation (RUSLE). The RUSLE is an empirical equation that calculates erosion using 5 factors. Of these factors, 2 (K, erodibility and C, cover) are specifically related to the material (the remaining 3 describe the climate and slope conditions).

The K-factor describes the erodibility of the fine fraction (<2mm) excluding the coarse fraction. It is estimated from the equation given in Rosewell and Loch (2002)[4] using material characterisation data. The C-factor describes the rock cover levels of a surface that has been armoured under simulated rainfall. It was calculated using the RUSLE software (version 1.06) supplied by the US Department of Agriculture that allows for the C-factor to be determined based on rock cover.

The results of this testing (on 36 mineral waste samples from across the Pilbara sites) showed that the K-factor (fine fraction only) are consistent with highly and very highly erodible materials[4]. When factoring in the rock cover levels observed for each material in the differences in erodibility became apparent. The major driver of material erodibility was not the erodibility of the fine-fraction, but the amount of rock that was typically within a material. Using the erodibility rankings (high, medium, low) given in Rosewell and Loch (2002), materials that typically had rock cover levels >70% had low erodibility, materials with rock cover levels of 30-70% had medium erodibility, and materials with rock cover levels <30% had high erodibility.

[3] The Water Erosion Prediction Program (WEPP) is the main runoff/erosion model used.
[4] Rosewell, C.J. and Loch, R.J. (2002) *Estimation of the RUSLE soil erodibility factor*, in N. McKenzie, K. Coughlan, and H. Cresswell (eds), Soil Physical Measurement and Interpretation for Land Evaluation, CSIRO Publishing, Collingwood.

It is important to note that the actual erosion that occurs for a given material is dependent on not only the material erodibility, but also on the climate and how the materials are placed. A material that has low erosion risk can be used to produce an erosionally unstable batter if the batter gradients are too steep or the slope length too long. Therefore, the actual erosion potential of a material is not defined by this ranking, but by the results of the erosion modelling that considers all these factors (materials, climate, and batter geometry).

The erodibility database

To create the erodibility database from which erosionally stable batter geometries are defined using erosion modelling, available information on mineral waste types were initially collated from Rio Tinto's waste drilling records. This collated information was used to determine the range of key waste types for sites across the Pilbara. Erodibility parameters for these key waste types were then gathered using simulated rainfall and overland flow techniques.

Long-term erosion modelling

The erodibility parameters are used within erosion models to develop rehabilitated landform design batter geometries for a range of climates and mineral wastes. More detail on the process of testing, validation of the model outputs, and the character of the climate files used are discussed below. At this stage, it is important to note that the climate files used contain numerous rainfall events that represent a wide range of rainfall intensities, durations and frequencies. These range from frequent small events through to rare and large rainfall events. Therefore, the long-term erosion rates modelled are those derived from a wide range of rainfall events.

Establishing acceptable long-term erosion rates

The suitability of the batter geometries is determined by comparison of the modelled long-term average erosion rates with rates that have been found to be acceptable. Historically, this long-term acceptable erosion rate has been set based on a desire to limit the initiation of rill erosion. More recently, a review of acceptable erosion rates for the Pilbara region considered acceptability using six different concepts: rates of soil renewal, maintenance of soil quality, rates of natural erosion, rates that lead to gully development, water quality, and impacts on vegetation[5]. The results of this review confirmed that the rates of long-term erosion used to classify the acceptability of modelled batter geometries are consistent with those found to be acceptable using the wider range of concepts.

2. Identification and classification of key minerals wastes

The following section seeks to describe the different waste types extracted from Rio Tinto (WA) iron ore mines in the Pilbara, and explain the rationale behind the selection of the key mineral wastes for which detailed testing of erodibility was conducted.

[5] Howard, E.J. and Loch, R.J. (2019) *Acceptable erosion rates for mine waste landform rehabilitation modelling in the Pilbara, Western Australia*, in AB Fourie & M Tibbett (eds), Proceedings of the 13th International Conference on Mine Closure, Australian Centre for Geomechanics, Perth, pp. 1545-1560, https://doi.org/10.36487/ACG_rep/1915_121_Howard

2.1 Waste types

Rio Tinto Iron Ore (WA) initially defines mineral wastes based on deposit geology which is described in detail in *Geology and Mineralogy of the Hamersley Province Ores*[6]. Deposit geologies include the Banded Iron Formation from which come Brockman and Marra Mamba hosted deposits, and Channel Iron Deposits. Other deposits such as Detrital Iron Deposits can occur as overburden to the ore hosted in the more extensive Banded Iron Formation.

Mineral wastes within each deposit geology are subsequently classified by their waste 'geozone'. Geozones are well-defined sequences of rock strata that have consistent characteristics across broad regions of the Pilbara. A total of 18 waste geozones were identified for Brockman deposits, 18 for Marra Mamba deposits and 8 for Channel Iron Deposits. Each waste geozone can then be further classified into individual waste types. Table 1 lists the mineral waste types defined by Rio Tinto. They are found within different waste geozones. The abundance of the different wastes can vary between geozones.

Table 1: Mineral waste types found within various waste geozones.

Banded Iron Formation (BIF)	Pyrolusite*	Aluminous Shale
Magnetic BIF	Pyrite*	Pisolite
Quartz*	Dolerite (fresh)	Calcite
Siliceous Goethite	Manganese*	Clay
Cherty BIF	Dolomite	Water Reactive Clay
Ferruginous Chert	Dolerite	Soil
Secondary Silica*	Hematite*	Powdery BIF
Jasperlitic BIF	Shale	Cavity Fill
Goethitic BIF	Ferruginous Shale	Dolerite (weathered)
Silcrete	Goethitic Shale	Crocidolite*
Goethitic Chert	Carbonaceous Shale	Calcrete
Magnetite	Manganiferous Shale	Ochreous Hematite

* These minerals may be indicated as present in the waste material, but do not represent an actual waste rock type that is delineated within the geology/mining model.

2.2 Abundance of different waste types

The abundance of each waste type within the various waste geozones was assessed across Rio Tinto's Pilbara drill hole and geological database with specific focus on existing operations at the time of the study: Greater Paraburdoo, Western Turner Syncline, Brockman 2, Brockman 4, Mount Tom Price, Marandoo, Nammuldi, Silvergrass East, Hope Downs 1 (North and South), Mesa A, Mesa J, and Mesa K.

For Brockman and Marra Mamba deposits, the assessment utilised existing drilling records that generally list geozone, material type, and material hardness for each drilling sample length (typically a vertical interval of 1.5m or 2.0m depending on the age of the database). Wastes can be described as hard, medium, or soft, with hard wastes being more competent and slow

[6] Rio Tinto Iron Ore (2010) Geology and Mineralogy of the Hamersley Province Ores, Rio Tinto Iron Ore.

weathering, and likely to present as rocky waste once blasted and transported to a waste stockpile. Soft wastes tend to be more weathered and/or fine-grained or unconsolidated. In terms of erosion, they tend to represent more problematic materials than the hard wastes. Medium wastes are neither hard nor soft (or are a combination of the two), and for the sake of this assessment were considered more erodible than the harder wastes. For each of the sites listed above, the drilling records were first separated into the different waste geozones. Then, within each waste geozone, the abundance of different waste types was determined.

To assist in assessment of the large database of materials, these waste types were grouped into 'hard', 'medium', and 'soft' wastes[7]. In doing so, the abundance of different wastes within each waste geozones could be determined and the major wastes (typically those comprising more than ~90% of the waste) identified. Sections marked as ore were excluded from this assessment.

It is noted that geozones describe a mixture of waste types. Given that individual waste types are not generally segregated during mining, defining wastes more broadly by their geozones and assessing these (rather than individual waste types) provide a realistic basis from which to assess erosion potential. Defining the erodibility of individual waste types could be misleading and difficult to apply to create landform designs. For Channel Iron Deposits, geozones were not defined at the time of sample collection and testing. In these cases individual waste types were assessed. This is suitable because the different wastes can be managed as separate materials.

The assessment of wastes for the Brockman and Marra Mamba deposits and Channel Iron Deposits are described below.

2.3 Wastes within Brockman and Marra Mamba hosted deposits

Summary data for the wastes from the Brockman and Marra Mamba deposits were sourced from Landloch's report titled *Final Landform Design Criteria for Mine Planning*[8].

A summary of the mineral waste assessment for the Brockman hosted deposits[9] and Marra Mamba hosted deposits[10] are shown in Tables 2 and 3, respectively. Also listed in these tables are the major waste types for each waste geozone. This is based on the assessment of Rio Tinto's drill hole data.

There were several key findings of the assessment:

- The proportions of individual waste types contained within a particular geozone remains relatively consistent irrespective of the ore body in question. This means that a geozone can be used to describe a relatively consistent mixture of different material types.

[7] Hard waste types include Banded Iron Formation (BIF), Calcrete, Magnetic BIF, Siliceous BIF, Cherty BIF, Ferruginous Chert, Jasperlitic BIF, Goethitic BIF, Silcrete, Goethitic Chert, Magnesite, Fresh Dolerite, Medium wastes include Dolomite. Soft wastes include Shale, Ferruginous Shale, Goethitic Shale, Carbonaceous Shale, Manganiferous Shale, Aluminous Shale, Pisolite, Clay, Water Reactive Clay, Soil, Powdery BIF, Cavity Fill, Dolerite (weathered), and Ochreous Hematite.

[8] Landloch Pty Ltd (2012) Final landform design criteria for mine planning, Report prepared for Rio Tinto Iron Ore (WA)

[9] Deposits included SEC6, SEC7, 4EST, 4WES, 5W, 94E, CHE, 84E, 64E, 47E, 37E, 32E, 23E, 24E, 11W, B1, S17, and S10.

[10] The assessment used a range of Marra Mamba mine site, including Silvergrass, Hope Downs 1 North, Hope Downs 1 South, Marandoo, and Nammuldi.

- The Dales Gorge waste geozones (401, 411, 421, 431), Joffre waste geozones (201-261), Footwall zone geozone (501), and the Marra Mamba geozones (711-781) excluding West Angelas Shale (701) all contain similar proportions of hard wastes and similar dominant waste types. Therefore, these geozones can be considered to be similar from the perspective of erosion.
- The West Angelas Shale (701, 705) geozones are similar to each other but different to other Marra Mamba geozones. Therefore, these two geozones can be considered erosionally similar.
- The Whaleback Shale waste geozones (301,311) contain similar proportions of hard and soft wastes and the same dominant waste types. These can also be considered erosionally similar.
- Detritals are variable in their abundance of hard waste types, though they tend to be dominated by clay and shale wastes. Therefore, it can be expected that there is variability in the erosion potential of materials geologically classed as detritals.

Table 2: Proportion of hard and soft and medium wastes within the Brockman waste geozones.

Waste Geozone	Mean Proportion (%)of:		Major Waste Types	
	Hard Materials	Soft and Medium Materials	Hard	Soft/Medium
201 – Joffre 6	78	22	BIF wastes	Shales
211 – Joffre 5	83	17	BIF wastes	-
221 – Joffre 4	84	16	BIF wastes	-
231 – Joffre 3	80	20	BIF wastes	-
241 – Joffre 2	82	18	BIF wastes	-
251 – Joffre 1	77	23	BIF wastes	Shales
261 – Undifferentiated Joffre	78	22	BIF wastes	Shales
265 – Joffre Hydrated	34	66	BIF wastes	Shales
301 – Whaleback Shale 2	38	62	BIF wastes	Shales, Ferruginous Shale
311 – Whaleback Shale 1	49	51	BIF wastes	Shales, Ferruginous Shale
321 – Undifferentiated Whaleback Shale	48	52	BIF wastes	Shales
325 – Whaleback Shale Hydrated	25	75	BIF wastes	Shales, Ferruginous Shale
401 – Dales Gorge 3	83	17	BIF wastes	Shales
411 – Dales Gorge 2	75	25	BIF wastes	Shales
421 – Dales Gorge 1	83	17	BIF wastes	Shales
431 – Undifferentiated Dales Gorge	70	30	BIF wastes	Powdery BIF, Shales
435 – Dales Gorge Hydrated	31	69	BIF wastes	Shales
501 – Footwall Zone	62	38	BIF wastes	Shales
601 – Mount McRae Shale	5	95	BIF wastes	Shales, Carbonaceous Shale

Given these findings, and the fact that different waste types within a geozone are not generally segregated during mining, waste geozones were used as the basic waste unit to assess material erodibility and from which landform batter geometries were developed.

Table 3: Proportion of hard and soft and medium wastes within the Marra Mamba waste geozones.

Waste Geozone	Mean Proportion (%)of:		Major Waste	
	Hard Materials	Soft + Medium Materials	Hard	Soft/Medium
701 – West Angelas Shale	16	84	BIF wastes	Shales, Clay
705 – West Angelas Shale Hydrated	12	88	-	Shales, Clay
781 – Undifferentiated Marra Mamba	74	26	BIF wastes	-
711 – Undifferentiated Newman	83	17	BIF wastes	-
741 – Newman	45	55	BIF wastes	Shales
721 – Newman	75	25	BIF wastes	-
731 – Newman	75	25	BIF wastes	-
751 – Newman	83	17	BIF wastes	-
761 – MacLeod	64	36	BIF wastes	Shales
771 – Nammuldi	71	29	BIF wastes	Shales
785 – Marra Mamba Hydrated	15	85	BIF wastes	Shales, Clay
7 – Detritals	6	94	-	Clay, Shales
8 – Calcrete Detritals	9	91	-	Calcrete, Clay
9 – Lignite Detritals	4	96	-	Clay, Shales
11 – Colluvium Detritals	27	73	-	Clay, Shales
12 – Rounded Detritals	25	75	-	Clay, Shales
31 – Cemented Limonitic Detritals	15	85	-	Clay
81 – Siderite Detritals	5	95	-	Clay, Dolomite

2.4 Material selection

Based on the assessment of materials detailed above, the following key materials were identified:

- Dales Gorge Member, Footwall Zone, and Marra Mamba (considered collectively);
- Joffre Member;
- Whaleback Shale;
- West Angelas Shale;
- Weathered pisolite;
- Alluvials; and
- Detritals.

Hydrated zone materials were also considered separately because it was recognised by Rio Tinto geologists that:

- They are available at the start of mining for all deposits;
- They tend to include stable, coarse, blocky material with minor fine-grained components;
- They are likely to be more similar in appearance to materials from the natural landscape than some wastes and hence are preferred in this sense;
- Being weathered, they are relatively inert (low ARD risk);
- They are generally available in large volumes; and
- There may be more flexibility to stockpile them and use in final waste dumps.

3. Material testing

Erodibility studies have been carried out on 48 waste samples from Rio Tinto's Pilbara iron ore mining operations. The waste types tested include Alluvials, Calcrete, Clay Waste, Coarse Tails, Dales Gorge Member, Detritals, Footwall Zone, Hydrated Zone, Joffre Member, Limonite (a type of detrital), Mount McRae Shale, Mount Newman Member, Powdery BIF, Tertiary Pisolite Clay, Topsoil, Weathered Dolerite, Whaleback Shale, Weathered Pisolite, and West Angelas Shale. Of these 48 bulk samples, 6 were sourced specifically from Hope Downs 1:

- Hydrated Zone;
- Limonite;
- Mount Newman Member dominated by BIF (2 samples); and
- Detritals (3 samples).

These material types cover 75% of the waste from HD1 North, 79% of the waste at HD1 South, 85% of the waste at BH, 44% of the waste from HD2. An additional 8 samples of Dales Gorge and Joffre wastes, and 5 samples of West Angelas Shale are available from other Rio Tinto iron ore sites. Using these, 84% of the HD2 waste types have also been broadly characterised. These would be broadly applicable to both HD1 and HD2.

3.1 Material characterisation testing

Samples of the fine component (<2 mm) of these materials were sent to a commercial soil laboratory and analysed for soil $pH_{1:5}$, $EC_{1:5}$ as a measure of salinity, Exchangeable Sodium Percentage (ESP), and particle size distribution (coarse sand, fine sand, silt, and clay). These properties were used to define risks to vegetation growth inherent in the wastes (e.g. salinity and poor structure), and to consider risks associated with tunnel erosion. The data was also used to assist in parameterising the runoff and erosion model.

The coarse component (>16 mm) of the rocky wastes were further assessed for properties that indicate their likely durability, tendency to weather, and usefulness as an armour material. Properties assessed include rock particle size, rock particle density, and rock water absorption.

3.2 Material erodibility

Assessment of long-term erosion potential for each of the materials was assessed using the Water Erosion Prediction Program (WEPP) model. WEPP describes erodibility using a number of specific parameters: Interrill erodibility (K_i); Rill erodibility (K_R); Critical shear for rill initiation (τ_c); and Effective hydraulic conductivity (K_e).

These WEPP erodibility parameters were derived for each of the 48 samples from data collected using application of:

- Simulated rain to a soil or waste surface, and measurement of runoff and sediment in runoff to obtain estimates of K_i and K_e; and
- Surface water flows to obtain estimates of K_R and τ_c.

Rainfall simulation and overland flows

Rainfall and overland flow simulation have been widely used to define the erodibility of mine wastes in WA. The process is briefly described below.

For rainfall simulation, flat fan nozzles mounted on an oscillating manifold positioned ~2m above a test surface produce the simulated rain (Figure 1). The kinetic energy generated by the nozzles are ~29.5 J/m2/mm, consistent with the energy of natural rainfall at intensities >40 mm/h. The nozzles uniformly sweep back and forth across the test plots, achieving high spatial distribution (<10% coefficient of variation) of the generated rainfall. For each material triplicate plots are subjected to a rainfall event sufficiently intense (usually 80-100mm/hr) to ensure runoff occurs. This allows measurement of rainfall infiltration and interrill erodibility.

For overland flow simulations, rill erodibility parameters are derived by applying various rates of overland flow to flumes 0.4 m wide and 2.0 m long set at gradients ranging from 10-30% (Figure 2). Rill erodibility and critical shear were derived on the basis of relationships between flow shear stress and sediment detachment rates measured from these flumes.

A summary of the parameter values adopted for each broad waste type (combining like samples) is also listed below in Table 5. The adopted parameter values of Table 5 represent an average value for each parameter for all samples collected within the material type.

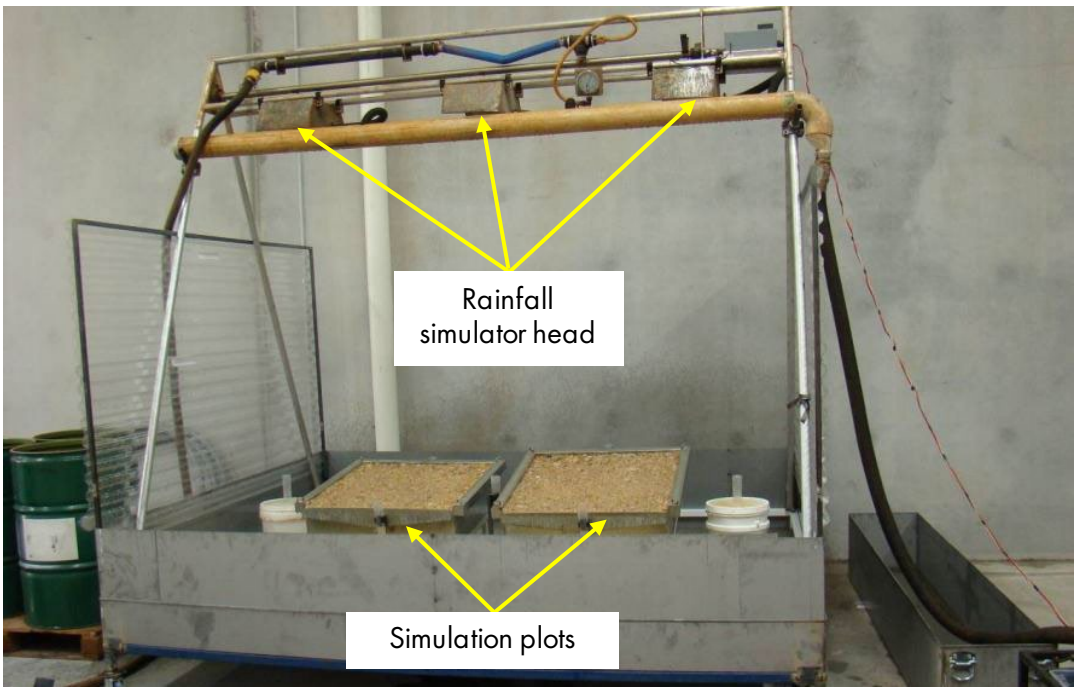

Figure 1: Typical laboratory-based rainfall simulator installation

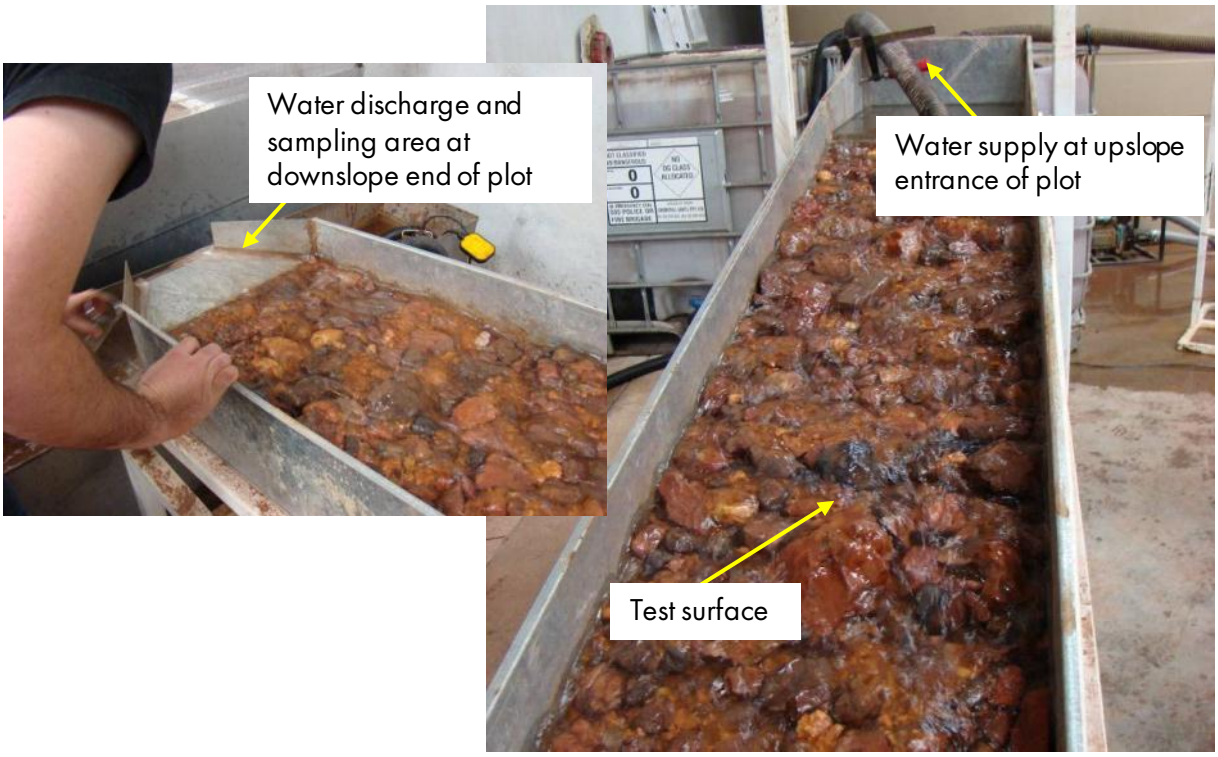

Figure 2: Example of flume plot setup used to apply overland flows.

Table 5: Parameter values adopted for each waste material.

Material	**K_e (mm/h)**	**K_i (kg.s/m^4)**	**K_R (s/m)**	**τ_c (Pa)**
Alluvials	20	246,568	0.0072	28
West Angelas Shale	28	609,814	0.0030	19
Calcrete	34	349,975	0.0016	46
Clay waste	10	285,844	0.0043	13
Detritals	26	236,317	0.0116	28
Dales Gorge	33	203,540	0.0033	28
Dolerite	20	335,337	0.0027	11
Footwall	33	203,540	0.0033	28
Hydrated Zone	103	63,860	0.0030	28
Joffre	33	203,540	0.0033	28
Limonite	25	448,929	0.0029	40
MacLeod Member	33	203,540	0.0033	28
McRae Shale	25	763,560	0.0010	20
Nammuldi Member	33	203,540	0.0033	28
Mt Newman Member	25	311,045	0.0034	44
Powdery BIF	12	531,064	0.0090	10
Tertiary Pisolite Clay	11	435,600	0.0016	37
Weathered pisolite	15	612,276	0.0097	6
Whaleback Shale	46	100,207	0.0042	26

The erodibility parameters that underpin the adopted batter geometries are:

- Material specific and collected in such a way[11] that they can be used for a range of locations and data geometries;
- A direct measure of erosion potential for a material (not a surrogate measure);
- Repeatable, with the methods having been first developed by the U.S. Department of Agriculture, and used hundreds of times by numerous groups to generate parameters.
- Accurate and precise, with assessments of measured erosion from many rehabilitation landforms being shown to be close to modelled values calculated using these erodibility parameters (see Validation of WEPP Modelling section below).

3.3 Erosion modelling

The WEPP model

The WEPP model was used for simulations of runoff and erosion. It was developed by the United States Department of Agriculture (USDA) to predict runoff, erosion, and deposition for hillslopes and watersheds. WEPP is a simulation model with a daily input time step, although sub-daily parameters are used to describe storm events used to calculate runoff and erosion (enabling more accurate estimation of runoff and erosion potential than achievable with daily time step models). Soil characteristics important to erosion processes are updated every day. When rainfall occurs, those soil characteristics are considered in determining the likelihood of any runoff. If runoff is predicted to occur, the model computes sediment detachment, transport, and deposition at points along the inputted slope profile. The erosion component of the WEPP model uses a steady-state sediment continuity equation as the basis for the erosion computations. Soil detachment in interrill areas is calculated as a function of the effective rainfall intensity and runoff rate. Soil detachment in rills is predicted to occur if the flow hydraulic shear stress is greater than the soil's critical flow hydraulic shear stress, and when the sediment load of the flow is below its capacity to transport sediment. Deposition in rills is computed when the sediment load is greater than the capacity of the flow to transport it.

Climate data

All WEPP simulations developed by Landloch use a 100-year stochastic climate sequence for Rio Tinto sites derived from observed data from the sites themselves and nearby Bureau of Meteorology weather stations. Nine associated climate sequences were created for 15 mine sites:

- Brockman 2, Brockman 4, and Nammuldi;
- Tom Price and Western Turner Syncline;
- West Angelas;
- Channar, Eastern Range, and Paraburdoo;
- Marandoo;
- Hope Downs 1;
- Hope Downs 4;
- Mesa J and Mesa A; and
- Yandicoogina.

[11] By defining erodibility on a shear stress-basis and not on the basis of a set slope length or gradient.

Each of the 9 sequences contain 36,525 daily climate data sets that describe rainfall total, storm duration and intensities, temperature, solar radiation, and wind. The 100-year sequences contain a wide range of rainfall events, including several extreme events. Each climate sequence was assessed against the Bureau of Meteorology's Design Rainfall Data System to consider the Annual Exceedance Probabilities (AEP) of the larger rainfall events. The findings were summarised in Table 6.

Table 6: AEP and ARI values of the three rarest rainfall events per climate sequence.

Climate Sequence	Rainfall Event Details					
	Rarest		2nd Rarest		3rd Rarest	
	Total & Duration	AEP & ARI	Total & Duration	AEP & ARI	Total & Duration	AEP & ARI
Annual Exceedance Probability (%)						
Brockman 2 & 4, and Nammuldi	268mm 5 hours	<0.05	175mm 5 hours	0.07	171mm 4 hours	0.1
Tom Price & Western Turner Syncline	256mm 4 hours	<0.05	145mm 3 hours	0.05	135mm 7 hours	0.7
West Angelas	145mm 5 hours	0.2	140mm 4 hours	0.2	147mm 11 hours	1
Channar, Eastern Range, & Paraburdoo	317mm 13 hours	0.1	176mm 6 hours	0.2	140mm 4 hours	0.2
Marandoo	289mm 9 hours	<0.05	223mm 6 hours	0.05	165mm 6 hours	0.2
Hope Downs 1/2	195mm 7 hours	0.3	194mm 7 hours	0.3	203mm 10 hours	0.5
Hope Downs 4	254mm 12 hours	0.3	211mm 10 hours	0.5	189mm 9 hours	1
Mesa J and Mesa A	301mm 7 hours	0.05	282mm 11 hours	0.2	181mm 7 hours	1
Yandi	219mm 4 hours	0.07	177mm 5 hours	0.5	143mm 4 hours	0.7
Average Recurrence Interval (Years)						
Brockman 2 & 4, and Nammuldi	268mm 5 hours	>2,000	175mm 5 hours	1,500	171mm 4 hours	1,000
Tom Price & Western Turner Syncline	256mm 4 hours	>2,000	145mm 3 hours	2,000	135mm 7 hours	150
West Angelas	145mm 5 hours	500	140mm 4 hours	500	147mm 11 hours	100
Channar, Eastern Range, & Paraburdoo	317mm 13 hours	1,000	176mm 6 hours	500	140mm 4 hours	500
Marandoo	289mm 9 hours	>2,000	223mm 6 hours	2,000	165mm 6 hours	500
Hope Downs 1/2	195mm 7 hours	333	194mm 7 hours	333	203mm 10 hours	200
Hope Downs 4	254mm 12 hours	333	211mm 10 hours	200	189mm 9 hours	100
Mesa J and Mesa A	301mm 7 hours	2,000	282mm 11 hours	500	181mm 7 hours	100
Yandi	219mm 4 hours	1,500	177mm 5 hours	200	143mm 4 hours	150

The rarest event within the climate sequences typically has an AEP <0.2%, equivalent to rainfall storms with an average recurrence interval (ARI) of more than 500 years. These storms are defined within the Australian Rainfall and Runoff Guideline (AR&R) as 'very rare' rainfall events. In several cases, the rarest event has an AEP of <0.05% (>2,000 year ARI). These are consistent with 'extreme' rainfall events as defined by AR&R. The rarest event within the Hope Downs' sequence is an AEP of <0.3% (333 year ARI).

It is also noted that there are several extreme to very rare rainfall events in each of the climate sequences. For example, for HD1, the second rarest rainfall event has an AEP of 0.3% (333 year ARI) and the third rarest event has an AEP of 0.5% (200 year ARI). Therefore, it can be concluded that these climate sequences represent climates consistent with long-term averages, including the occurrence of multiple very rare rainfall events. The resultant erosion modelling is therefore also consistent with long-term averages, including the erosion that would occur from very rare events.

Erosion of differing batter geometries

The different waste materials have different erodibilities. This translates into different erosion potentials (hence the generally classification of some wastes as being high erodibility and others being medium and low erodibility). The erosionally stable batter geometries developed for each material account for these differences in erosion potential by adopting different slope geometries. For example, a material that is highly erodible would require to be used on much shorter slope lengths (same as smaller vertical intervals). A less erodible material could be used on longer slope lengths.

The appropriate slope geometry is set by assessing the modelled long-term erosion rate against acceptable erosion rates for the Pilbara. Howard and Loch (2019)[12] produced a summary of acceptable erosion rates for the Pilbara region. It considered a number of approaches by which an acceptable erosion rate could be defined. They include linking erosion rates to:

- Rates of soil renewal (soil formation and deposition by dust);
- Maintenance of surface soil/growth media quality;
- Rates of naturally occurring erosion in the Pilbara;
- Rates that increase the potential for gully development;
- Water quality and off site impacts; and
- Impacts on vegetation.

Based on this assessment, it was found that – regardless of the approach – the acceptable rates of long-term erosion were similar. A value of 6t/ha/y for long term average slope erosion was found to be reasonable, consistent with the rates of soil renewal and naturally occurring erosion, and consistent with a surface with a low tendency for rill and gully erosion. Given that the batter geometries that are typically adopted by Rio Tinto are modelled to erode at rates less than 6t/ha/y, it is considered that the slopes being used are suitable, provided surface water control from the dump top and berms are also suitably managed.

[12] Howard, EJ & Loch, RJ 2019, 'Acceptable erosion rates for mine waste landform rehabilitation modelling in the Pilbara, Western Australia', in AB Fourie & M Tibbett (eds), Proceedings of the 13th International Conference on Mine Closure, Australian Centre for Geomechanics, Perth, pp. 1545-1560, https://doi.org/10.36487/ACG_rep/1915_121_Howard

Validation of WEPP modelling

WEPP model validation data is provided to demonstrate that it is able to adequately predict erosion in a mining context. The WEPP model has been extensively validated by Landloch for mine site batters (Figure 3). Erosion data for this validation were sourced from 27 locations on 12 waste landforms on mine sites in Western Australia. Several sites were located at Rio Tinto's Pilbara iron ore sites. The observed erosion data were collected using cross-slope transects 30-50 m wide, located on upper and lower sections of waste dump batters. Batter shapes include both linear and concave cross-sectional profiles. Gradients assessed are consistent with the slopes commonly used for mining landforms. Surfaces assessed include loamy soils, clay soils, and rocky sandy loam soils. The ages of the batters range from 3–8 years. Slope conditions range from minimally eroded to heavily eroded.

The measured cumulative erosion rates show good agreement with rates predicted by WEPP. Given that these data include predictions from both the upper and lower section of landform batters, WEPP is shown to be able to suitably predict changes in erosion rates with changing slope lengths and gradients. Model output can adequately represent both runoff accumulation down the slope, and flow concentration across the slope. The accuracy of the predictions shown in Figure 3 also indicates that the methods used to derive the essential model parameters are producing well calibrated model results. This gives confidence that accurate calibration of the WEPP model can be achieved provided suitable laboratory and field-based methodologies are used.

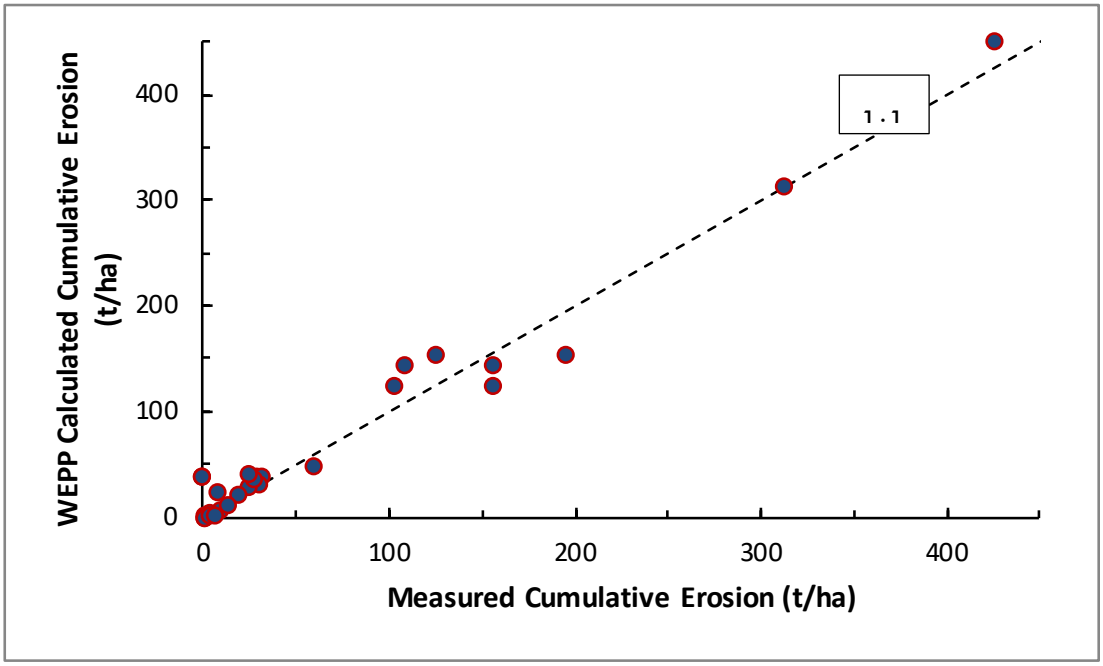

Figure 3: WEPP-predicted cumulative erosion and observed cumulative erosion rates for 27 batter slope locations from Western Australian mine sites.

Summary

Erosion modelling has used data collected from 48 samples of key wastes across Rio Tinto's Pilbara operations. These samples have been subjected to testing to measure their erodibility, with these erodibility parameters used to model long-term erosion using the WEPP model.

The climate sequences used in the modelling contain a wide range of rainfall events including several extreme and rare events. The model results have been compared against acceptable erosion rate values consistent with measured erosion for undisturbed land in the Pilbara, soil renewal rates, and rates at which the risk of rill and gully erosion is low. The model output has been validated at 27 locations on mine sites in Western Australia and shown to agree with observed erosion.

3.4 Landform evolution modelling

A range of erosion models exist that can be usefully deployed as part of landform design at different phases of mining operations. The models include process-based two-dimensional models such as WEPP, from which Rio Tinto's erosionally stable landform batter designs have been developed. The other type of model is a three-dimensional landform evolution model (LEM). The SIBERIA LEM is the most widely adopted model for use in mining, particularly in Australia. The key attributes of these different models are outlined in Table 7. The SIBERIA LEM is a model tailored to the consideration of the impacts of the 3-D shape on the long-term stability of a landform. SIBERIA modifies the 3-D shape of a landform in response to erosion and deposition. It is different to a surface water model in that it doesn't predict runoff or route flow over the surface. Rather it uses relationships between surface hydrology (contributing areas and discharge rates) and erosion to predict changes in 3-D landform shape.

Within the context of mining landforms, SIBERIA has been used to consider the:

- likelihood of the development of rill or gully erosion;
- breaching of surface layers required to encapsulate underlying problematic wastes;
- erosion risk at the interface of a waste landform and undisturbed ground;
- erosional impact of placement of different materials over the land surface.

SIBERIA is more complex to parametrise than process-based erosion models such as WEPP. SIBERIA requires parameterisation with time series data of runoff and erosion for a specific material and broad landform shape. It does not accept input of daily rainfall values. Because it is fitted to time series data for runoff and erosion, the SIBERIA LEM cannot easily be used to predict erosion for a single rainfall event. For example, it is not able to be used to predict land changes in response to an extreme event. The intent of SIBERIA is to long long-term changes in landform shape (over decades or hundreds of years).

Given that the final 3-D landform shape is not exactly known during the early phases of mining (i.e. feasibility or approvals stage) and that SIBERIA is tailored to modelling 3-D shapes, the use of SIBERIA is limited in these early stages. Process-based models such as WEPP provide sufficient information in order for the broad geometry of a rehabilitation landform to be defined. For example, details such as the erosionally stable slope length, height, and gradient, the profile shape (linear, concave etc.) the required capacity of cross-slope berms and crest bunding can all be derived from WEPP modelling. If the broad shape of the landform is set based on erosion model output, and if the model output indicates that the broad scale will be erosionally stable in the long-term, the resultant 3-D landform is likely stable, assuming it is coupled with an investigation of surface water flows to account for risks such as impeding flood flows (which SIBERIA is not equipped to do). SIBERIA modelling becomes increasingly useful closer to the point of rehabilitation when more detailed engineering designs are completed and address risks such as how the landform ultimately meshes with the surrounding landscape.

Table 7: Key attributes of the WEPP and SIBERIA erosion and landform evolution models.

Attribute	WEPP	SIBERIA
Time step	Daily	Annual
Slope profiles considered	Complex	Very complex
Consideration of vegetation	Poor	Fair
Erodibility parameter	Measurable	Derived from runoff & erosion data
Consideration of sediment transport	Good	Fair
Consideration of different surface erosion processes	Good	Fair
Consideration of tunnel (piping) erosion	Not possible	Not possible
Prediction of deposition	Good	Fair
Modelled timeframes(s)	Single events-years	Years-hundreds of years

4. Materials of Hope Downs 1/2

4.1 Material abundance

Three deposits exist at Hope Downs 1 (HD1): HD1 North, HD1 South, and Baby Hope (BH). Hope Downs 2 (HD2) consists of both HD2 and the associated Bedded Hilltop (BHT) areas. Tables 5 and 6 provide a summary of the percentage of each waste material type at HD1 and HD2 respectively. Proportions for HD1 are those provided by B. Yaqub (Rio Tinto) on 22 July 2020. Proportions for HD2 are those from the 2020 Mine Closure Plan.

Table 8: Waste material summary for HD1

Waste types	Waste Proportion (%) for:		
	HD1 North	HD1 South	BH
Marra Mamba (Newman, Nammuldi, MacLeod)	41	12	9
Detritals	52	31	61
Hydrated	1	42	15
Wittenoom	0	13	1
Other	5	1	14

Table 9: Waste material summary for HD2 including BHT

Waste types	Waste Proportion (%)
Marra Mamba (Newman, Nammuldi, MacLeod)	8
Detritals	36
Dales Gorge	22
West Angelas Shale	18
Footwall	7
Other	6

Newman Member materials and Detritals are dominant wastes at HD1 North and BH. Detritals and Hydrated Zone wastes are dominant at HD1 South. Dales Gorge and West Angelas Shale are present in appreciable proportions at HD2. Several materials specifically sourced from HD1 were recently tested, including a Detrital, a Limonite (a type of Detrital), and two examples of Newman Member materials. Previous testing for a Hydrated Zone waste and 2 other samples of Detrital also exist for HD1. Three examples of Dales Gorge are available from Tom Price and Western Turner Syncline, and 2 examples of West Angelas Shale and 1 Detrital are available from West Angelas and Marandoo. These materials will be used to discuss plant growth and erosion potential below. They are applicable for both HD1 and HD2.

4.2 Plant growth potential

A summary of these data for the HD1 and HD2 is given in Tables 10 and 11.

Table 10: Characteristics of the soil fraction (<2mm) of the specific Hope Downs 1 and other site wastes tested for erodibility.

Source Location	Geology	Particle Size Distribution (Fine Fraction)				Soil Texture	$pH_{1:5}$ (H_2O)	$EC_{1:5}$	ESP
		Coarse Sand	Fine Sand	Silt	Clay				
		%	%	%	%		-	dS/m	%
Hope Downs 1	Detrital (Col or Di)	61.4	7.4	7.6	23.6		6.1	0.07	5
	Limonite (Li)	56.2	18.9	9.9	14.9		7.6	0.07	2
	Newman Member	50.0	26.3	13.3	10.4		7.5	0.07	6
	Hydrated Zone	80		5	15	SL	-	-	-
	Detrital 1	59	24	0	16	SL	7.4	1.1	9
	Detrital 2	-	-	-	-	-	-	-	-
Tom Price/ Western Turner Syncline	Dales Gorge 1	24	2	38	34	CL	8.5	0.08	2
	Dales Gorge 2	45	22	24	25	CL	-	-	-
	Dales Gorge 3	18	23	20	35	ZL	-	-	-
West Angelas/ Marandoo	West Angelas Shale 1	28	33	8	32	CL	5.6	0.05	7
	West Angelas Shale 2	-	-	-	-	-	-	-	-

Notes: Coarse sand: 2.0-0.2mm; Fine sand: 0.2-0.02mm; Silt: 0.02-0.002mm; Clay <0.002mm. Texture: ZCL: Silty Clay Loam; SL: Sandy Loam; SCL: Sandy Clay Loam; CL: Clay Loam; ZL: Silty Loam. '-' indicates that no data are available for this parameters. Those samples with no baseline data shown here are included for completeness as they are present in the erodibility testing results.

Table 11: Characteristics of the coarse fraction (>2mm) of the specific Hope Downs 1 and other site wastes tested for erodibility.

Source Location	Geology	Full Particle Size Distribution				Coarse Fraction Content	Rock Partide Density	Rock Water Absorption
		Rock	Pebble	Gravel	Fines			
		%	%	%	%	%	g/cm³	%
Hope Downs 1	Detrital (Col or Di)	12	14	49	23	77	3.2	1.4
	Limonite (Li)	20	11	38	31	69	2.3	12.5
	Newman Member	19	17	44	20	80	3.2	2.3
	Hydrated Zone	60	22	17	1	99	4.6	3.5
	Detrital 1	7	6	42	45	55	2.9	5.3
	Detrital 2	29	15	35	19	81	-	-
Tom Price/ Western Turner Syncline	Dales Gorge 1	32	22	33	13	87	2.3	13.2
	Dales Gorge 2	0	19	38	43	57	-	-
	Dales Gorge 3	0	32	18	50	50	-	-
West Angelas/ Marandoo	West Angelas Shale 1	21	12	39	28	72	-	-
	West Angelas Shale 2	0	8	12	80	20	-	-
	Detrital	8	11	56	26	74	-	-

Notes: Rock: >45mm; Pebble: 15-45mm; Gravel: 2-15mm; Fines: <2mm.

The materials have the following properties:

- Commonly low salinity (though one sample had elevated salinity), with values unlikely to adversely affect plant germination or growth.
- Acidic to alkaline pH values.
- High coarse fraction content (50-99%, mean 73%) except for West Angelas Shale, which has ~20% coarse fraction.
- The rock fraction of the samples tested (Table 11) tends to be dense (high rock particle density) and the water absorption rates are low to moderate. The materials are likely to be reasonable for use as armouring, particularly materials that contain BIF.
- The fine fraction (< 2 mm diameter) of the samples tested tends to have a sandy loam to clay loam texture.
- Wastes generally have low (<6%) Exchangeable Sodium Percentage (ESP), though ESP values can be moderate (6-10%) on occasion. Low ESP indicates a clay fraction with a low tendency to disperse and a low risk of structural decline. One sample of Detrital has a slightly elevated ESP value (9%). However, this material would still have a low tendency for structural decline for the following reasons. In the case of the Detrital, 55% of the material is non-dispersive gravels, pebbles, and rock (Table 11). Of the remaining 45% of the material, 83% is non-dispersive sands and silts. Therefore, the potentially dispersive clays account for only 7% of the total volume of the Detrital material. One sample of West Angelas Shale also has elevated ESP values. Assessing it in the same way, 89% of the material is non-dispersive pebbles, gravels, sands, and silts, and only 11% of the material is potentially dispersive clay. The overall structure of these 2

moderate ESP materials is controlled by the significant proportion of non-dispersive coarse fragment. The majority of the voids between the non-dispersive coarse fragments are filled with non-dispersive sands. Therefore, if the clay were to disperse, it is not likely to mobilise through the void spaces within the material and will not likely result in tunnel erosion. That said, the dispersion of the clay may cause hardsetting surfaces that will impact runoff and erosion rates. This impact is incorporated in the erodibility testing and the erosionally stable batter geometries adopted for these materials.

4.3 Erodibility

Table 12 shows the site specific erodibility parameters for Hope Downs 1 (Western Turner Syncline data was used for Dales Gorge, and West Angelas was used for West Angelas Shale) compared to the average parameters adopted for erosion modelling and from which Rio Tinto has developed rehabilitation batter geometries.

Table 12: Site specific erodibility parameters and those generally adopted for erosion modelling.

Material	**Erosion Class**	**K_e (mm/h)**	**K_i (kg.s/m^4)**	**K_R (s/m)**	**τ_c (Pa)**
Detritals (Col or Di)					
Average Value (Detrital)	High	26	236,317	0.0116	28
HD1 COL/DI Sample	High	7	375,227	0.0022	40
Limonite (Li)					
Average Value (Detrital)	High	26	236,317	0.0116	28
HD1 LI Sample	High	25	448,929	0.0029	40
Detritals					
Average Value	High	26	236,317	0.0116	28
HD 1 DET Samples (average of 2)	High	27	272,445	0.0085	21
Newman Member 1					
Average Value	Low	33	203,540	0.0033	28
HD1 NEW Sample	Low	10	347,648	0.0014	41
Newman Member 2					
Average Value	Low	33	203,540	0.0033	28
HD1 NEW Sample	Low	40	274,442	0.0054	46
Hydrated Zone					
Average Value	Low	103	63,860	0.0030	28
HD1 HYD Sample	Low	200	50,000	0.0001	14
Dales Gorge					
Average Value	Low	33	203,540	0.0033	28
WTS DG Sample	Low	18	128,962	0.0010	45
West Angelas Shale					
Average Value	High	28	609,814	0.0030	19
West Angelas ANG Samples (average of 2)	High	18	594,097	0.0102	17

The impact of this variation in erodibility parameters was assessed by conducting additional modelling with the WEPP model. Predicted erosion for the Detritals using the average parameters indicates that a stable geometry would be a uniform gradient of 20 degrees and height of 7m. When compared to the 'Col or Di' form of detritals, the Col or Di materials are more erosion resistant, achieving stable heights of 15m at 20 degrees. For the Limonite material, the stable height is predicted to be 20m at 20 degrees. Therefore, these materials are more resistant to erosion than the average Detritals. The Detritals from HD1 are predicted to erode at rates similar to the rates predicted using the average parameter set, and stable heights for the HD1 Detritals are similar to those predicted using the average parameters.

Based on these results, it can be concluded that the HD1 detritals have similar erodibility or are more erosion resistant that the average Detrital from which landform batter geometries have been developed.

Historically, the Newman Member materials have been considered similar to the Dales Gorge material because of a similar composition. Testing of two samples of the Newman Member materials from HD1 has shown that both samples are as or more resistant to erosion than the average Dales Gorge parameters. As such, stable heights of 20m and gradients of 20 degrees are suitable for this material.

The Hydrated Zone waste from HD1 is much more erosion resistant than the average Hydrated parameters that have been used to generate stable batter geometries for this material. Therefore, stable heights of 20m and gradients of 20 degrees are suitable for this material.

For the Dales Gorge waste, there are no samples from HD1 or HD2. Adoption of the average Dales Gorge parameters from Western Turner Syncline predicts that 20m high batters at 20 degrees are stable. Additional modelling suggests that slope heights of 15m and gradients of 20 degrees would have erosion rates higher than adopted in previous modelling but within the rates of acceptable erosion reported for the Pilbara by Howard and Loch (2019)[13]. Therefore, the slope geometries adopted for Dales Gorge using the average parameter set appear reasonable.

For West Angelas Shale, there are no parameters specific to HD1. These materials are highly erodible, and when the West Angelas Shale from West Angelas were considered (the closest site to HD1), they were found to be more erodible than the average parameter set. This indicates that this material poses a risk in terms of erosion and will require specific management (i.e. burial) if slope heights greater than 5m are adopted at HD1 or HD2.

5. Closing

Erosion modelling has used data collected from 48 samples of key wastes across Rio Tinto's Pilbara operations. These samples have been subjected to testing to measure their erodibility, with these erodibility parameters used to model long-term erosion using the WEPP model. The climate sequences used in the modelling contain a wide range of rainfall events including several extreme and rare events.

[13] Howard, EJ & Loch, RJ 2019, 'Acceptable erosion rates for mine waste landform rehabilitation modelling in the Pilbara, Western Australia', in AB Fourie & M Tibbett (eds), Proceedings of the 13th International Conference on Mine Closure, Australian Centre for Geomechanics, Perth, pp. 1545-1560, https://doi.org/10.36487/ACG_rep/1915_121_Howard

The model results have been compared against acceptable erosion rate values consistent with measured erosion for undisturbed land in the Pilbara, soil renewal rates, and rates at which the risk of rill and gully erosion is low. The model output has been validated at 27 locations on mine sites in Western Australia and shown to agree with observed erosion.

An assessment of the samples specific to Hope Downs 1/2 (and for other sites with similar waste types) show that the batter geometries generated using the averaged adopted erodibility parameters will be suitable for use at Hope Downs 1/2, with the exception of West Angelas Shale. This waste was shown to be erodible, and will require specific management (i.e. burial) if batter heights greater than 5m are adopted at HD1 or HD2.

Regards





Mr EVAN HOWARD
PRINCIPAL CONSULTANT

Disclaimer

All care and diligence have been exercised in testing, interpreting data and the development of recommendations presented in this document. The monitoring and testing have been undertaken in a skilled, professional manner, according to accepted practices. Specific circumstances and research findings after the date of publication may influence the accuracy of the data and recommendations within this document.

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Appendix 8: Suitability of Topsoil for Plant Growth HD2 & BHT



SUITABILITY OF TOPSOIL FOR PLANT GROWTH

HOPE DOWNS 2 AND BEDDED HILLTOP

Rio Tinto Iron Ore

May 2022

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EXECUTIVE SUMMARY

Landloch Pty Ltd (Landloch) was engaged by Rio Tinto Iron Ore (RTIO) to undertake characterisation testing of a range of soils from Hope Downs 2 and Bedded Hilltop. Thirty-eight (38) soil samples were selected by RTIO and tested for a range of parameters. The purpose of the characterisation was to determine the plant growth potential of the soils, with pH, salinity, structural stability, water regime, and fertility all being considered.

Fifty-two percent of the Hope Downs 2 soils have pH values that are lower than would be expected from the available broad scale data; 48% of the soils have suitable pH values. All but 2 of the 15 Bedded Hilltop soils have suitable pH. The low values for some soils are not commonly leading to increased available aluminium concentrations, nor are they leading to a reduction in nutrient availability to levels likely to limit plant growth. However, there could be some negative impact on soil biological activity. It is concluded that the low pH of some soils is not likely to have a significant impact on vegetation growth, and that field or pot trials aimed at establishing this for the low pH soils may be useful. If it is established that vegetation is adversely impacted by the low pH, amendments such as lime could be considered to increase pH values.

The salinity values of all soils are <1dS/m. The soluble chloride values for all soils are also low. Salinity is not likely to limit plant growth.

More of the Bedded Hilltop soils are structurally stable than for Hope Downs 2s. Eleven of the 15 Bedded Hilltop soils (73%) are classed as stable. Eleven of the 23 Hope Downs 2 soils (48%) are classed as stable. In total, 22 of the 38 soils (58%) are structurally stable. The soils that are classed as unstable are spatially well distributed across the Hope Downs 2 and Bedded Hilltop areas. Soils that are classed as structurally unstable are more prone to:

- Reduced permeability;
- Reduced water holding capacity;
- Increased runoff potential;
- Increased erosion potential;
- Reduced root penetrability; and
- Increased tunnel erosion potential.

Given that the *in situ* soils have low salinity and that the observed instability in the sampled soils was often also driven by low salinity, it can be concluded that *in situ* soils may also be structurally unstable and that the sampled soils are therefore similar to the *in situ* soils. The risk posed by structural instability could be addressed through mixing of these soils into rockier, structurally stable wastes as part of rehabilitation. Alternatively, placement of these soils on low gradient areas (<10%) would reduce the risk posed by increased erosion potential. Addition of gypsum could be considered for soils with elevated ESP and low ESI. This includes all structurally unstable soils except for one soil sample (HD2_05). An application rate of 0.2t/ha incorporated into a layer that is 0.1m thick is recommended.

The Hope Downs 2 soils have higher median total N values than the Bedded Hilltop soils. This could be due to reduced vegetation in the shallower soils from Bedded Hilltop. Soil from Both Hope Downs 2 and Bedded Hilltop have median C:N ratios of 20, indicating that decomposition rates of organic matter will be slightly reduced for many of the soils, and vegetation growth may be improved by addition of some nitrogen. Addition of N as a means of improving vegetation growth should be considered. Options include mixing of low total N soils with higher total N soils, .addition of N-based fertilisers, and inclusion of N-fixing vegetation into the rehabilitation seed mixes.

Total P, available P, available S, trace Cu, trace Mn, and trace Zn values for all soils are within suitable levels. The available K is slightly low for 87% of the Bedded Hilltop soils, but low for only 26% of the Hope Downs 2 soils. Despite being low, these values may not translate into adverse conditions for plant growth. The impact of the addition of potassium could be considered along with the impact of the addition of N within pot or field vegetation trials.

The median plant available water (PAW) value (unadjusted for rock) for both the Hope Downs 2 and Bedded Hilltop soils is 90mm/m. This is classed as suitable. When adjusted for rock, the median PAW for the Hope Downs 2 and Bedded Hilltop soils was 42mm/m and 32mm/m, respectively. Given that rainfall events are often larger than this PAW, the underlying waste materials are likely to function as a water storage zone that plants will need to access. The properties of the material below the soil applied are also important when considering plant growth potential.

Saturated hydraulic conductivity (K_{sat}) values are often higher for the Bedded Hilltop soils (median 74mm/hr) than for the Hope Downs 2 soils (12mm/hr). The higher values for Bedded Hilltop are associated with the higher rock content for these soils. The K_{sat} of the soils from both locations is considered suitable.

The results have been summarised in the table below

Property	Hope Downs 2	Bedded Hilltop
pH_w, pH_{Ca}	Suitable (pH_w 6-8), though a significant amount of low pH soils exists that may reduce nutrient availability and biological activity.	Suitable (pH_w 6-8).
Salinity, chloride	Suitable ($EC_{1:5}$<1dS/m)	Suitable ($EC_{1:5}$<1dS/m)
Structural stability	Often unstable (52% of soils)	Infrequently unstable (27% of soils)
Fertility	Often low total N (<500mg/kg) Often low available K (<80mg/kg)	Often low total N (<500mg/kg) Sometimes low available K (<80mg/kg)
Plant available water	Suitable (median 90mm/m)	Suitable (median 90mm/m)
Saturated hydraulic conductivity	Suitable (median >10mm/hr)	Suitable (median >10mm/hr)

1 INTRODUCTION

Landloch Pty Ltd (Landloch) was engaged by Rio Tinto Iron Ore (RTIO) to undertake characterisation testing of a range of soils from Hope Downs 2 and Bedded Hilltop. The purpose of the characterisation was to determine the plant growth potential of the soils, with soil pH, salinity, structural stability, water regime, and fertility all considered.

1.1 Scope of work

The following scope of work was undertaken:

- Receive 38 topsoil samples and undertake plant growth potential testing.
- Report the findings of the soil characterisation, including:
  - Methods used for testing,
  - Tabulation and interpretation of the results,
  - Definition of risks associated with the use of these soils, and
  - Management recommendations for their use as soils for rehabilitation.

2 BACKGROUND DETAIL

Hope Downs 2 and Bedded Hilltop are adjacent to each other and both are located ~80km west-north-west of Newman and ~300km south-south-east of Port Hedland, in the Pilbara region of Western Australia (Figure 1).

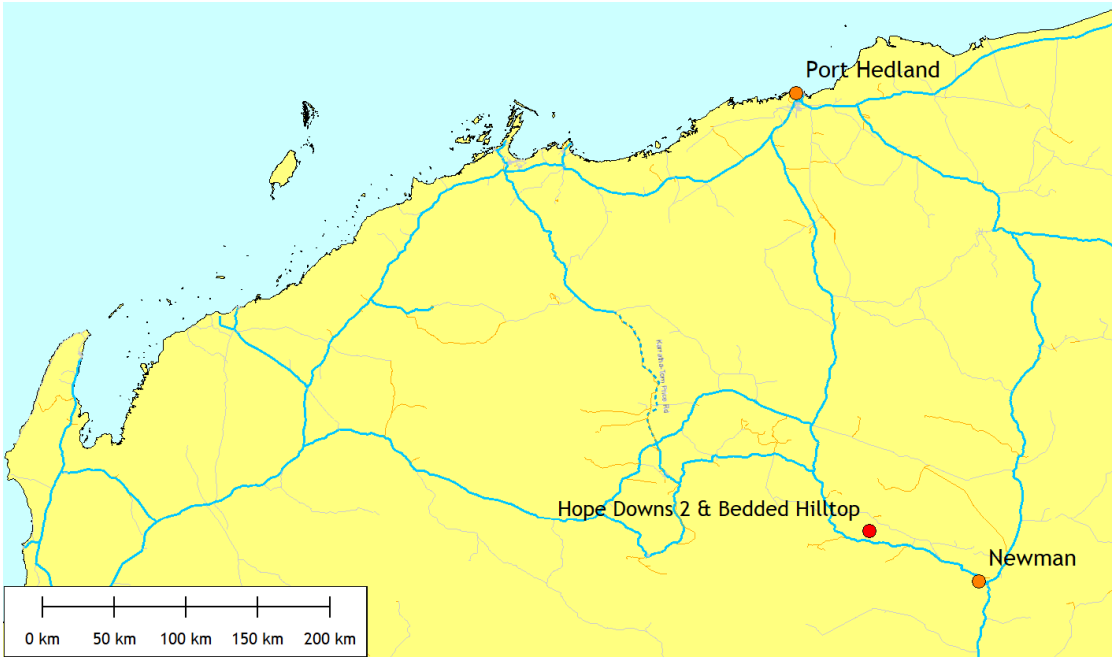

Figure 1: Location of Hope Downs 2 and Bedded Hilltop.

2.1 Climate

Hope Downs 2 and Bedded Hilltop are located in a hot, semi-arid to desert climate. Mean annual rainfall is 277mm[1] and mean annual pan evaporation is 3,350mm[2]. This suggests that surface soil profiles for Hope Downs are very often dry, and that vegetation is adapted to commonly dry soil conditions.

The largest daily rainfall event between 1920 and 2021 was 214mm, which occurred in December 1999. A storm with a daily total of ~150mm has a return period of 50 years. A storm with a daily total of ~100mm has a return period of 10 years. A storm with a daily total of ~40 mm has a return period of 1 year. An assessment of sub-daily rainfall data for the nearest pluviograph station[3] shows an average of 31 storm events per year with events having a mean average rainfall intensity of 4.3 mm/h. The largest average storm intensity was 52.3 mm/hr, and 90% of all storms have an average storm intensity of <9 mm/hr. When peak storm intensities are considered, the mean peak storm intensity was 15 mm/hr. The largest peak storm intensity was 156 mm/hr, and 90% of all storms have a peak storm intensity of <41 mm/hr.

2.2 Soils and landscape

2.2.1 Bedded Hilltop

The Bedded Hilltop mining area is located primarily within the Newman land system which is characterised by rugged plateaux and strike ridges with vertical escarpments, steep scree slopes, and more gently inclined lower slopes. The Newman land system supports hard spinifex grasslands. Soils within the Newman land system are predominantly classified as stony soils, with smaller proportions of red shallow loams and red shallow sands. Stony soils tend to be shallow with physical rooting depths no more than 0.5m. They have circum-neutral pH_w, low salinity, loam to clay loam textures, and very high coarse fragment abundance. The red shallow loams have similar properties except for low coarse fragment abundance. The red shallow sands are similar except for low coarse fragment abundance and a loamy sand to clayey sand texture.

2.2.2 Hope Downs 2

Hope Downs 2 is located within the Newman, Platform, and Boolgeeda land systems. The relative position of these three land systems is shown in Figure 2 (van Vreeswyk *et al.* 2004). Newman has been described in the previous section. Platform is characterised by dissected slopes and raised plains supporting shrubby hard spinifex. Boolgeeda is characterised by stony lower slopes and plains below systems supporting hard and soft spinifex or mulga shrublands.

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[1] Based on patched point rainfall data for Newman between 1920 and 2021 (Bureau of Meteorology station 7176).
[2] Based on gridded pan evaporation data sourced from the Bureau of Meteorology, http://www.bom.gov.au/jsp/ncc/climate_averages/evaporation/index.jsp
[3] Based on data from Capricorn Roadhouse between July 1984 and Nov 2006 (Bureau of Meteorology station 7191).

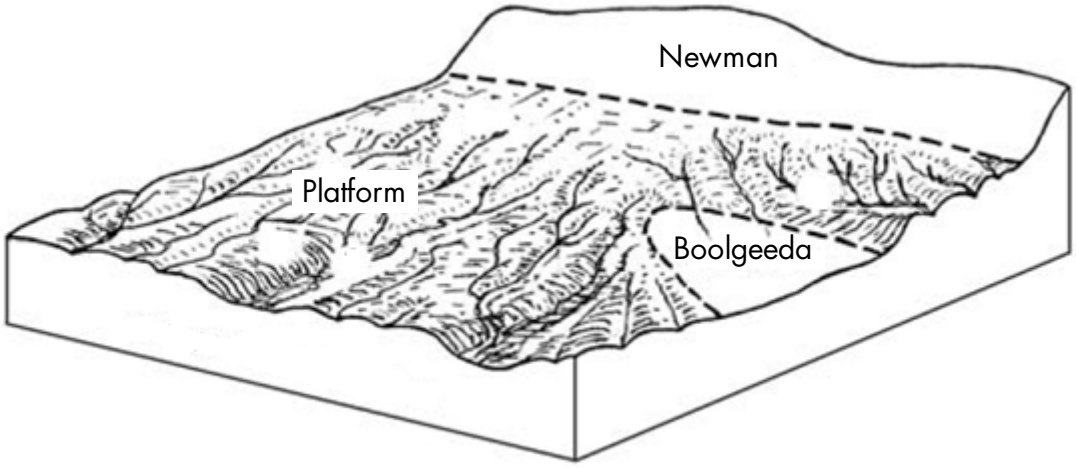

Figure 2: Diagram of the relative position of the Newman, Platform, and Boolgeeda land systems (Source: van Vreeswyk *et al.* 2004).

Soils of the Newman system have been previously described, and their stony and shallow character is a function of their position within the landscape. Soils within the Platform system are predominantly stony soils (similar to those of the Newman system) and red loamy earths. The red loamy earths are similar to the stony soils except they tend to be deeper and have low coarse fragment abundance. Soils within the Boolgeeda system are commonly red shallow loams or red/brown non-cracking clays. Red shallow loams tend to be shallow with physical rooting depths no more than 0.5m. They have circum-neutral pH_w, low salinity, sandy loam to clay loam textures, and low to moderate coarse fragment abundance. The red/brown cracking clays also have a shallow rooting depth due to increased clay content and chemical limitations in soils deeper than ~0.3m. They have neutral to alkaline pH_w, low salinity, and low coarse fragment abundance. Surface soils have a sandy clay texture, with subsoils becoming light to medium clays. Sodicity increases with depth in the non-cracking clays and becomes high in soils deeper than ~0.3m.

2.2.3 Summary of soils

The soils present at Hope Downs 2 and Bedded Hilltop can be summarised as follows:

- Circum-neutral to alkaline pH_w.
- Low salinity.
- Loam to clay loam textures, with loamy sand and clay textured soils also present but less common.
- Variable coarse fragment abundance, with stony soils having >90% coarse fragments and the loam and clay textured soils within the Boolgeeda land system having <10% coarse fragments.
- Clay subsoils within the Boolgeeda land system may be sodic and prone to dispersion. This is a potential issue for Hope Downs 2 only as the Boolgeeda system is not present at Bedded Hilltop.

3 CHARACTERISATION METHODOLOGY

3.1 Selection of topsoil samples

Thirty-eight (38) soil samples were selected by RTIO. Coordinates and a description of the samples are given in Table 1. Their locations are shown in Figure 3.

Table 1: Sample coordinates and descriptions (GDA94, Zone 50).

Sample ID	Easting (m)	Northing (m)	Description
BHT_01	714,466	7,450,557	Lower elevation, rock, minimal fine material
BHT_02	715,270	7,450,683	In lower elevation, rocky, minimal fine material
BHT_03	710,814	7,450,689	Higher elevation, very rocky
BHT_04	711,254	7,450,890	Higher elevation, very rocky
BHT_05	712,104	7,450,886	Higher elevation, very rocky
BHT_06	712,865	7,450,351	Higher elevation, very rocky, close to gully
BHT_07	714,007	7,450,511	Still high elevation
BHT_08	714,263	7,451,086	Fine material with rocks
BHT_09	714,961	7,450,481	Very rocky area, on side of hill
BHT_10	714,958	7,449,848	Very dry area, rocky material in higher elevation
BHT_11	716,447	7,450,084	Higher elevation, very rocky
BHT_12	716,471	7,450,589	Finer material with rocks
BHT_13	717,914	7,450,148	Dirt like with roots
BHT_14	718,158	7,450,995	Higher elevation, very rocky
BHT_15	718,719	7,450,694	Higher elevation, very rocky, closer to a gully
HD2_01	697,594	7,444,602	Hill side, recent bushfire, rocky material, little soil
HD2_02	698,176	7,444,546	Hill side, recent bushfire, rocky material, little soil
HD2_03	697,905	7,445,198	Finer material with rocks, on lower elevation
HD2_04	699,435	7,444,870	Finer material with rocks, on lower elevation
HD2_05	699,319	7,445,924	Finer soil, on lower elevation
HD2_06	700,553	7,446,345	Finer material with rocks, on lower elevation
HD2_07	700,857	7,445,958	Finer material with rocks, on lower elevation
HD2_08	701,507	7,445,840	Finer material with rocks, on lower elevation
HD2_09	701,037	7,446,470	Finer material with rocks, on lower elevation
HD2_10	701,256	7,446,423	Finer material with rocks, on lower elevation
HD2_11	702,941	7,446,495	Finer material with rocks, on lower elevation
HD2_12	703,310	7,445,661	Finer material with rocks, on lower elevation
HD2_13	703,307	7,446,073	Finer material with rocks, on lower elevation
HD2_14	704,869	7,446,424	Finer material with rocks, on lower elevation
HD2_15	704,110	7,445,763	Finer material with rocks, on lower elevation
HD2_16	704,470	7,446,372	Finer material with rocks, on lower elevation
HD2_17	704,788	7,445,938	Finer material with rocks, on lower elevation
HD2_18	705,706	7,446,381	Finer material with rocks, on lower elevation
HD2_19	705,806	7,445,994	Finer material with rocks, on lower elevation
HD2_20	706,556	7,446,290	Finer material with rocks, on lower elevation
HD2_21	706,885	7,446,013	Finer material with rocks, on lower elevation
HD2_22	707,162	7,446,343	Finer material with rocks, on lower elevation
HD2_23	707,537	7,446,491	Finer material with rocks, on lower elevation

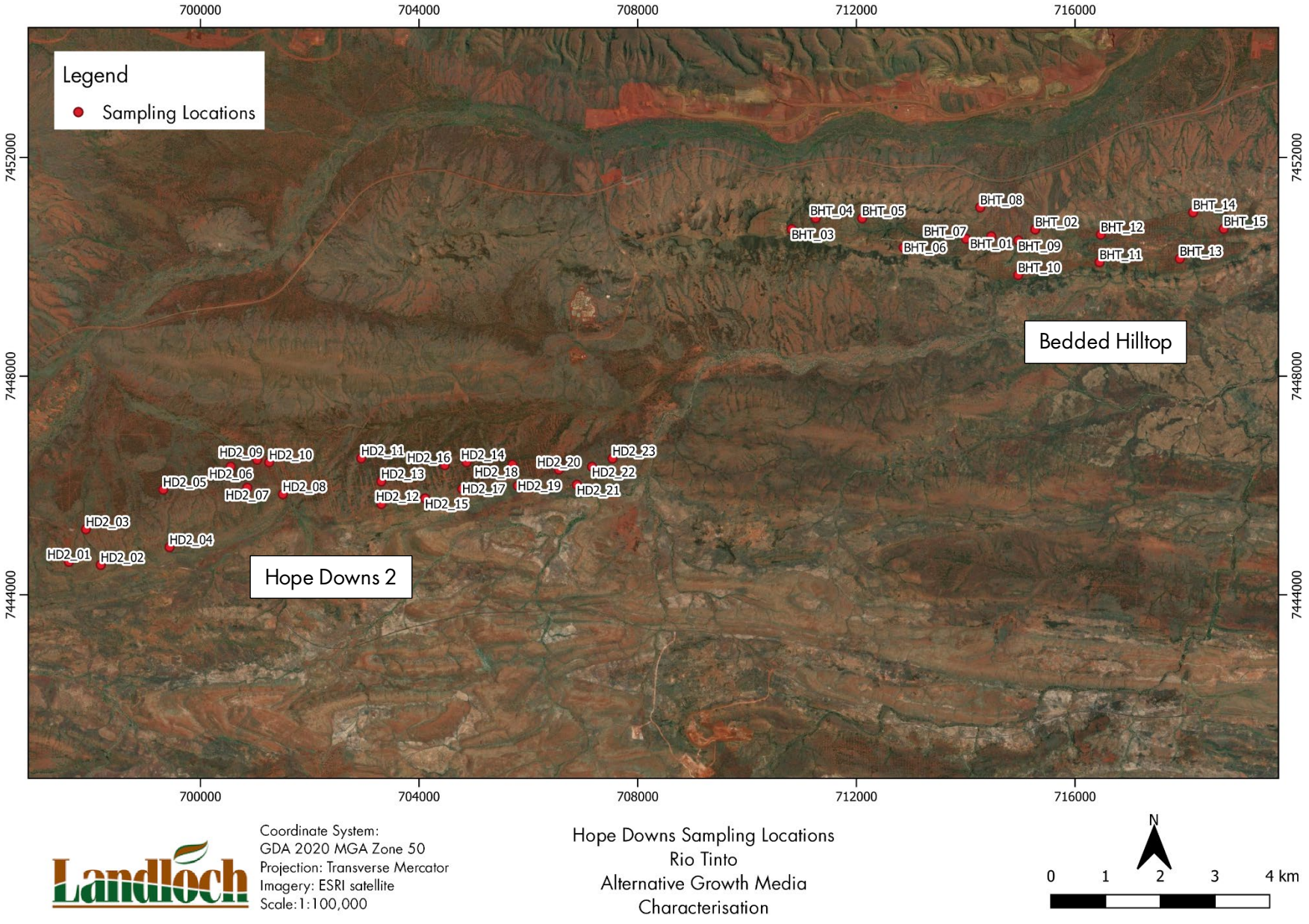

Figure 3: Sampling locations of topsoil samples from Hope Downs 2 and Bedded Hilltop.

3.2 Soil characteristics assessed

Each soil sample was sieved through a 2mm sieve and the coarse fraction percent was recorded[4]. Unless otherwise stated, sub-samples of the fine fraction[4] were sent to an ASPAC and NATA[5] accredited laboratory and tested for the following properties:

- Soil pH_w, measured in a 1:5 solid:water solution;
- Soil pH_{Ca}, calculated based on pH_w;
- Electrical Conductivity ($EC_{1:5}$), measured in a 1:5 solid:water solution;
- Total soluble chloride (Cl);
- Exchangeable cations (Ca^{2+}, Mg^{2+}, Na^{+}, K^{+} and Al^{3+});
- Effective Cation Exchange Capacity (ECEC), calculated as the sum of exchangeable cations;
- Exchangeable Sodium Percentage (ESP), calculated as the ratio of exchangeable sodium to ECEC and expressed as a percentage;
- Exchangeable Magnesium Percentage (EMP), calculated as the ratio of exchangeable magnesium to ECEC and expressed as a percentage;
- Ca:Mg ratio, calculated as the ratio between exchangeable Ca and exchangeable Mg, using the units of meq/100g;
- Electrochemical Stability Index (ESI), calculated as the ratio of $EC_{1:5}$ (dS/m) to ESP (%);
- Emerson Dispersion Index[6];
- Total N, ammonium (NH_4^+), nitrate (NO_3^-);
- Organic C;
- Total P;
- Plant available P (Colwell), K (Colwell), and S (KCl);
- Trace elements (Cu, Zn, Mn) (DTPA extractable);
- Plant Available Water (PAW), calculated as the difference in volumetric moisture contents measured at soil suctions of 33kPa and 1,500kPa[6];
- Saturated hydraulic conductivity (K_{sat})[6]; and
- Particle size distribution (PSD) (coarse sand, fine sand, silt, clay)[7].

3.3 Interpretation of results

3.3.1 Soil pH_w and pH_{Ca}

The pH_w of the soils was assessed using a 1:5 soil:water solution. The pH_{Ca} was estimated as the pH_w value minus 0.8 using the conversion equation given in Moore (2001). The impact of the pH on plant growth was assessed by comparing the measured pH_w values with the pH_w values of *in situ* soils that currently support vegetation. Sampled soils that have similar pH_w to that of the *in situ* soils can be considered suitable for plant growth – at least with respect to soil pH.

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[4] The coarse fraction includes particles with diameters >2mm. The fine fraction includes all particles with diameters <2mm.
[5] Australian Soil and Plant Analysis Council; National Association of Testing Authorities
[6] Performed in a laboratory not accredited with NATA or ASPAC.
[7] Coarse sand: 2.0-0.2mm; fine sand: 0.2-0.02mm; silt: 0.02-0.002mm; clay: <0.002mm

The range of pH_w for *in situ* soils was sourced from the soils information that accompanies the soil landscape mapping supplied by Western Australia's Department of Primary Industries and Regional Development[8]. This soils information represents a modelled mean value for a particular soil-landscape zone and actual pH_w values can vary significantly. It does, however, offer a reasonable estimate of the pH_w of soils for the Hope Downs 2 and Bedded Hilltop areas. Using this data source, soil pH_w values range from 7.0 to 7.5. This pH_w range lies within the pH rating of 'slightly alkaline' (Hazelton and Murphy 2016) (7.0-8.0). Nutrient availability for slightly alkaline soils is generally very similar to soils that are slightly acidic (6.0-7.0).

For this study, soils with pH_w values ranging from 6.0-8.0 (slightly acid to slightly alkaline) are classified as having pH that would not adversely affect vegetation growth. For pH_{Ca}, the range used to define suitable soil was 5.2-7.2. pH values outside of this range may have an impact on plant growth. The severity of the impact would need to be quantified through further studies. Vegetation may still grow in soils with pH_w values that fall outside this range, though it may not grow optimally.

3.3.2 Soil salinity ($EC_{1:5}$) and total soluble chloride

3.3.2.1 Soil salinity

Salinity was assessed by measuring the electrical conductivity of a 1:5 soil:water solution. Most salinity suitability ranking systems assume agricultural vegetation, and direct application of these systems to plant species used in rangeland rehabilitation is not appropriate. Western Australia's Department of Primary Industries and Regional Development provides a summary of published salinity tolerance values for a range of common species used in revegetation of disturbed rangelands in Western Australia. These data were reported by Tanji and Kielen (2003). Salt tolerant species (e.g. *Atriplex*, *Tecticornia*) are likely to exhibit some adverse impacts on vegetation growth at $EC_{1:5}$ values of >1.2dS/m[9]. van Vreeswyk *et al.* (2004) used $EC_{1:5}$ values of greater than 0.8dS/m and 1.2dS/m to define highly saline topsoils and subsoils, respectively.

The range of $EC_{1:5}$ for *in situ* soils was also determined using the soils information that accompanies the soil landscape mapping supplied by Western Australia's Department of Primary Industries and Regional Development. $EC_{1:5}$ values were found to be <0.1dS/m at Hope Downs 2 and Bedded Hilltop, suggesting that salt tolerant species are not likely to be commonly endemic.

For this study, an $EC_{1:5}$ value >1dS/m was used to indicate soils sufficiently saline to adversely impact vegetation establishment and growth. $EC_{1:5}$ values of 1-2dS/m may limit the establishment and growth of more salt sensitive species, but vegetation growth is still likely to occur. $EC_{1:5}$ values <1dS/m are not likely to significantly impact vegetation establishment and growth.

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[8] Accessed via the Natural Resources Information (WA) system managed by the Government of Western Australia, http://maps.agric.wa.gov.au/nrm-info/

[9] Tolerance values were given as EC values measured using the saturation extract method (EC_e). Conversion between $EC_{1:5}$ and EC_e is not exact and is dependent on texture. Hazelton and Murphy (2016) suggest that for sandy loam soils, EC_e should be divided by 14 to estimate $EC_{1:5}$.

3.3.2.2 Total chloride

Chloride is measured along with $EC_{1:5}$ as an indicator of the dominance of Cl salts. Chloride, as opposed to sulphate salts, tends to be more toxic to plants at the same level of salinity. The proportion of the $EC_{1:5}$ that is supplied by chloride salts (EC_{Cl}) can be estimated by dividing the chloride concentration expressed in mg/kg by 66,400 (DNR 1997). Both $EC_{1:5}$ and EC_{Cl} are expressed as dS/m.

3.3.3 Structural stability

A soil's structural stability was assessed by considering the interrelated properties of exchangeable cations, salinity, and particle size distribution. The Emerson test was also conducted, though its value was used as only a guide when considering structural instability. Preference was given to the chemical and physical indicators when assessing issues of soil structure.

From a chemical perspective, the proportion of exchangeable sodium (Na) held on the soil's exchange complex in relation to other exchangeable cations is important. This is referred to as the Exchangeable Sodium Percentage (ESP). McKenzie *et al.* (2004) considers the measurement of ESP as suitable for assessing the potential for clay dispersion and tunnel erosion risk when a soil's Effective Cation Exchange Capacity (ECEC) is ≥3meq/100g and where exchangeable Na ≥0.3meq/100g. Further, the risk of clay dispersion is greatest in soils with loam or clay textures (clay fraction ≥10%); sand dominated soils are not prone to structural instability via clay dispersion. Where these conditions are met, ESP ≥6% are considered to indicate a soil at increased risk of structural instability.

Additionally, the dispersion potential for a soil is influenced by interactions between clay content, ESP, and $EC_{1:5}$. The Electrochemical Stability Index (ESI) is a means of considering the relationship between ESP and $EC_{1:5}$ for loam and clay textured soils. A tentative critical ESI value is 0.05 (McKenzie 1998), with ESI <0.05 (and clay content ≥10%) indicating a soil that is prone to structural instability.

Magnesic soils can also be prone to structural instability. This is assessed using a combination of the Exchangeable Magnesium Percentage (EMP), Ca:Mg ratio, and ESP. Fenton and Conyers (2002) indicated that Mg by itself has little effect on spontaneous clay dispersion. However, it can enhance the effect of exchangeable Na in causing clay dispersion. Where EMP ≥30%, dispersion may occur when the Ca:Mg ratio is <1, ESP ≥4%, and/or ESP + (EMP ÷ 10) is ≥6% (assuming clay content is also >10%).

From a physical perspective, soils with a high combined fine sand, silt, and clay fraction (particles ≤0.2mm) are prone to structural instability, even if their clay fractions are not chemically dispersive. This is because these smaller particles can mobilise within the voids of the coarser sand matrix. For this reason, soils with a combined fine sand, silt, and clay fraction ≥70% are considered to be at increased risk of structural instability (Vacher *et al.* 2004).

Finally, a soil can have a fine fraction that is prone to structural instability for any of the reasons described above, but if the proportion of unstable fines is small, the soil as a whole may remain stable and not be prone to structural instability. Typically, a binary mixture with >30-40% fine particles and <60-70% coarse particles could be considered

a fine material that contains a coarse fraction; a binary mixture with <30-40% fine particles and >60-70% coarse particles could be considered a coarse material that contains a fine fraction. Based on this, a fines cut-off of ≥40% seems reasonable, with soils that contain ≥40% fines being at risk of structural instability if it meets one or more of other criteria described above.

To capture interactions between physical and chemical properties and their effect on structural stability, the soils were assessed against four criteria. If any of these criteria are met, the soil was classified as being prone to structural instability.

ESP-based criteria: • Clay content ≥10% of fines, and • Fines ≥40%, and • ECEC ≥3meq/100g, and • Exchangeable Na ≥0.3meq/100g, and • ESP ≥6%.	EMP-based criteria: • Clay content ≥10% of fines, and • Fines ≥40%, and • ECEC ≥3meq/100g, and • EMP ≥30%, Ca:Mg <1, & ESP ≥4%, or • EMP ≥30%, Ca:Mg <1, & (ESP + (EMP ÷ 10) ≥6%
ESI-based criteria: • Clay content ≥10% of fines, • Fines ≥40%, and • ESI <0.05.	PSD-based criteria: • Fines ≥40%, and • Fine sand + silt + clay ≥70% of fine fraction.

The Emerson class was used as a general guide of aggregate stability and the possible impacts of dispersive clay fractions. It can be used only as a general guide because of the large number of factors that determine whether clay dispersion occurs, such as sodicity, salinity, clay type, history of working of the soil and the speed of aggregate wetting (Hazelton and Murphy 2016). Soils with an Emerson class of 1, 2, or 3 can be considered to have an unstable structure due to the presence of a dispersive clay fraction. Class 4 soils may be structurally unstable, and classes 5 and 6 are likely to have a stable clay fraction provided salinity values are not high.

3.3.4 Fertility

The impact of the fertility of the soils on rehabilitation success was assessed by comparing their fertility values with those of *in situ* soils that currently support vegetation. Soils that have similar or heightened fertility to that of the *in situ* soils can be considered unlikely to limit plant growth.

Fertility values for Hope Downs 2 and Bedded Hilltop were sourced from values in the Soil and Landscape Grid of Australia (SLGA)[10]. These values are predicted based on spatial modelling and represent the best estimate of soil attributes using the currently available soil information. Information is available for total N, total P, and organic C. Values for plant available P, K, and S, and trace elements were based on available published tolerance values and Landloch's experience with soils across the Pilbara.

[10] https://www.clw.csiro.au/aclep/soilandlandscapegrid/index.html

Total N is used to indicate the amount of nitrogen in a soil. Values from the SLGA indicated that total N values <500mg/kg are common for surface soils in the region of Hope Downs 2 and Bedded Hilltop. Mineralised forms of N (NH_4^+ and NO_3^-) indicate the amount of N held in forms that are more readily available to plants. These numbers tend to be highly variable and dependent on factors such as the time of sampling, the amount of rainfall prior to sampling, and sample handling protocols. The mineralised forms of N were not used to consider the suitability of the N store, but were used to consider the proportion of N that may be readily available to plants.

Organic C is used with total N to consider the relative rate of decomposition of organic matter where present. C:N ratios <25 indicate sufficiently high organic matter to allow for unimpeded decomposition of organic matter. C:N ratios >25 indicate that C levels are high relative to the available N, and that decomposition will slow unless N is added. For these soils, addition of N may be beneficial, but its availability for plant growth may be limited as the N is utilised for the decomposition of organic material. It is possible for the addition of N to lead to a decrease in plant growth in the short term as a result. Therefore, if fertiliser addition is considered, it must first be trialled to quantify the impacts of these interactions.

Total P is used to indicate the amount of phosphorus in a soil. Information from the SLGA indicated that total P values can be <200mg/kg, but commonly range from 200-500mg/kg. Plant available P values tend to be much lower than the total P value, with values <2mg/kg indicating a soil with very low available P. Suitable available P values tend to be >8-10mg/kg.

Suitable available K, S, and trace element values were based on measured values for soils on other iron ore mine sites in the Pilbara. Adopted values are:

- Plant available K (Colwell), >80mg/kg;
- Plant available S (KCl), >2mg/kg;
- Plant available Cu (DTPA), >0.2mg/kg;
- Plant available Mn (DTPA), >4mg/kg; and
- Plant available Zn (DTPA), >0.5mg/kg.

3.3.5 Water regime

3.3.5.1 Plant available water

For sandy loam to clay loam soils without rock, PAW of 90-150mm of water per metre depth of soil are common (Hazelton and Murphy 2016). Values less than this indicate a soil for which water holding capacity may be limited, likely through poor soil structure. In this report, these PAW values without adjustment for the presence of rock are used to consider limitations in water holding capacity of the fine fraction,

The PAW adjusted for rock is also reported as a means of demonstrating a more realistic PAW value for the actual soils being examined. This allows for the PAW to be compared against the typical size of storm events that occur at Hope Downs 2 and Bedded Hilltop.

In all cases, the values reported are based on volumetric moisture contents, and assume a bulk density of 1.5g/cm^3.

3.3.5.2 Saturated hydraulic conductivity

For sandy loam to clay loam soils, saturated hydraulic conductivity values can range from 10-60mm/hr, assuming weak pedality (Hazelton and Murphy 2016). Values lower than this would indicate a soil that could be considered less permeable than is commonly measured for similar textured soils. The presence of an appreciable coarse fraction will likely act to increase this rate. Properties such as structural instability may act to reduce this rate.

4 DATA INTERPRETATION

Results of the characterisation of soils from Hope Downs 2 and Bedded Hilltop are provided in Appendix A. The data are summarised in this section. An interpretation of values is also given, based on the scheme outlined in Section 3.

4.1 Soil pH_w

The pH_w for the Hope Downs 2 and Bedded Hilltop soils are given in Figure 4.

The pH_w of the Hope Downs 2 soils range from 4.6-8.0 and average 6.0. Of the 23 Hope Downs 2 soils supplied, 12 had a low pH_w (4.6-5.9, average 5.5). The remaining 11 soils had pH_w values within the range that is likely to not limit plant growth. The pH_w of the Bedded Hilltop soils range from 5.6-8.2 and average 6.5. Of the 15 Bedded Hilltop soils supplied, one soil had a low pH_w (5.6) and one had a high pH_w (8.2). The remaining 10 soils had pH_w values within the suitable range.

A large proportion of the Hope Downs 2 soils (12 samples, 52%) have pH_w values that are classed as slightly-strongly acidic. These low pH soils are spatially well distributed across the Hope Downs 2 area. Of those 12 soils, 7 were within 0.5 pH units of the suitable range, and 11 were within 1.0 pH unit of the suitable range. Soils with low pH_w (<5.5) are associated with increased solubility of aluminium, decreased availability of several nutrients including nitrogen, phosphorus, potassium, and sulphur, and decreased soil biological activity. The measured exchangeable aluminium values do show some trend towards greater mobility at lower pH values. However, similar exchangeable aluminium values are observed for soils with higher pH_w. A comparison of the nutrient data for those Hope Downs 2 soils with acidic pH against those with alkaline pH show a relative decrease in total nitrogen and available potassium, but the actual values for the acidic pH soils are commonly still within levels that are not likely to limit plant growth.

In summary, 52% of the Hope Downs 2 soils have pH values that are lower than would be expected from the available broad scale data; 48% of the soils have suitable pH values. All but 2 of the Bedded Hilltop soils have suitable pH. Although low pH_w is present, the low values for those soils are not commonly leading to available aluminium concentrations significantly greater than that measured in soils with higher pH_w. Nor are they leading to a reduction in nutrient availability to levels likely to limit plant growth. However, there could be some negative impact on soil biological activity. It is concluded that the low pH is not likely to have a significant impact on vegetation growth, and that field or pot trials aimed at establishing this for the low pH soils may be useful. If it is established that vegetation is adversely impacted by the low pH, amendments such as lime could be considered to increase pH values.

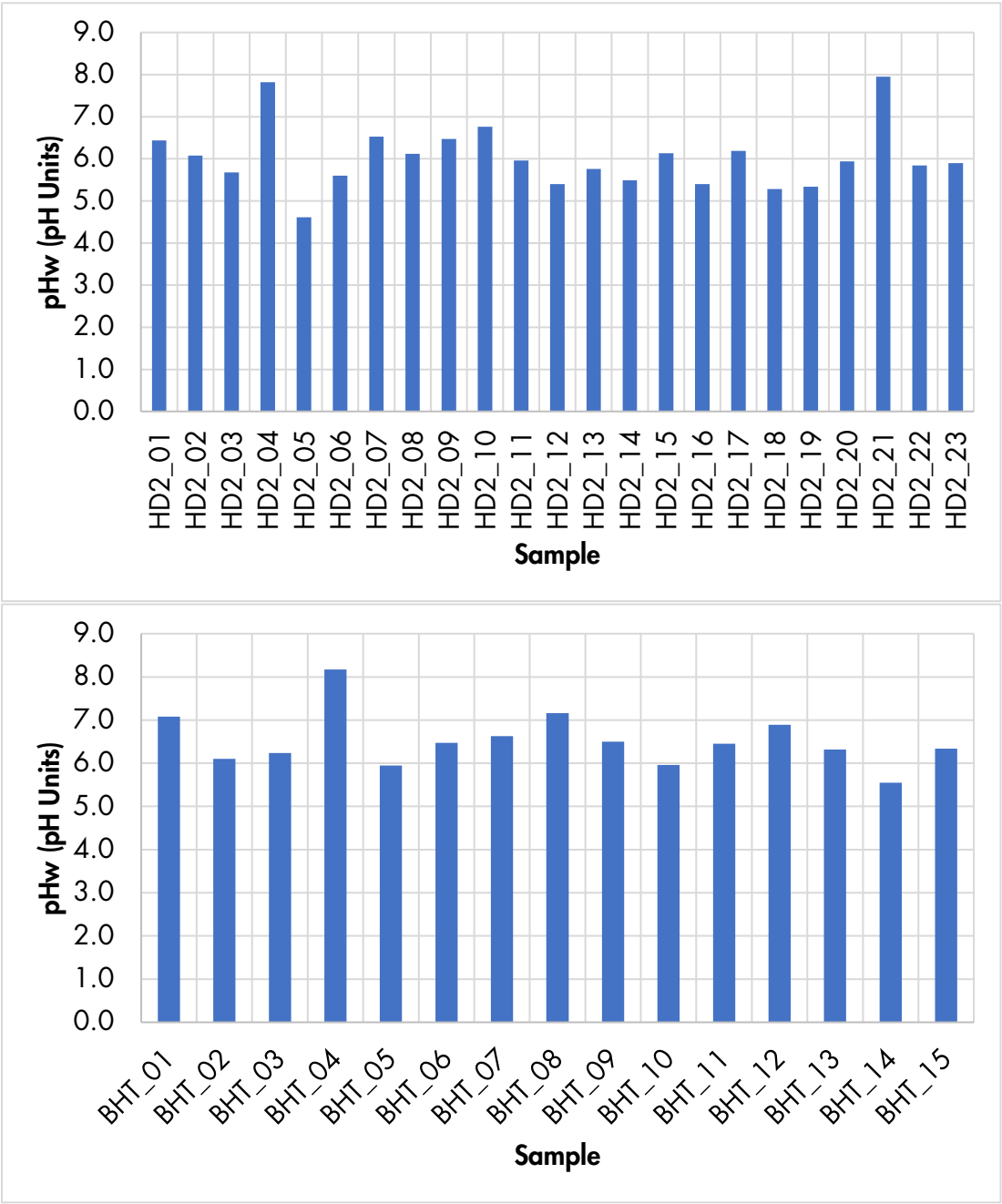

Figure 4: pH_w values for the Hope Downs 2 soils (top) and Bedded Hilltop soils (bottom)

4.2 Salinity ($EC_{1:5}$) and chloride

The salinity ($EC_{1:5}$) values of all soils are <1dS/m. The highest value recorded is 0.41dS/m (HD2_05). Therefore, salinity is not likely to adversely impact vegetation establishment and growth in these soils.

The soluble chloride values for all soils are also low. The proportion of $EC_{1:5}$ that is supplied by chloride salts (EC_{Cl}) was estimated to be <1%. This suggests that the small amount of salts that are present are likely to be sulphate based salts that originate from the soil's parent material.

4.3 Structural stability

Results of the assessment of structural stability are given in Table 2.

The Bedded Hilltop soils are more structurally stable than the Hope Downs 2 soils. Eleven of the 15 Bedded Hilltop soils (73%) are classed as stable. Of the 4 that are classed as unstable, all are classed as unstable due to their low salinity, while one is also unstable due to its high combined fine sand, silt, and clay fraction. Eleven of the 23 Hope Downs 2 soils (48%) are classed as stable. Of the 12 that are classed as unstable, 11 are classed as unstable due to their low salinity. Four are also classed as unstable because of their elevated ESP and 10 because of their high combined fine sand, silt, and clay fraction. Several soils are classed as unstable due to more than one criteria.

In total, 22 of the 38 soils (58%) are structurally stable. The soils that are classed as unstable are spatially well distributed across the Hope Downs 2 and Bedded Hilltop areas. Soils that are classed as structurally unstable are more prone to:

- Reduced permeability;
- Reduced water holding capacity;
- Increased runoff potential;
- Increased erosion potential;
- Reduced root penetrability; and
- Increased tunnel erosion potential.

Given that the *in situ* soils have low salinity (section 3.3.3) and that the observed instability in the soils was often also driven by low salinity, it can be concluded that *in situ* soils may also be structurally unstable and that the soils are therefore similar to the *in situ* soils.

The risk posed by structural instability could be addressed through mixing of these soils into rockier, structurally stable wastes as part of rehabilitation. This would increase the coarse fraction content that will assist with the maintenance of structure. Alternatively, placement of these soils on low gradient areas (<10%) would reduce the risk posed by increased erosion potential.

Addition of gypsum could be considered for soils with elevated ESP and low ESI. This includes all structurally unstable soils except for HD2_05. An application rate of 0.2t/ha incorporated into a layer that is 0.1m thick is recommended. Amendment of the instability of HD2_05 is best addressed through its incorporation into another structurally stable material.

Table 2: Assessment of the risk of structural stability.

Sample ID	ESP	EMP	ESI	PSD	Structurally Stable?
BHT_01					Yes
BHT_02					Yes
BHT_03					Yes
BHT_04					Yes
BHT_05					Yes
BHT_06					Yes
BHT_07					Yes
BHT_08					Yes
BHT_09					Yes
BHT_10			✓		No
BHT_11					Yes
BHT_12			✓		No
BHT_13			✓	✓	No
BHT_14					Yes
BHT_15			✓		No
HD2_01					Yes
HD2_02					Yes
HD2_03					Yes
HD2_04			✓		No
HD2_05				✓	No
HD2_06			✓	✓	No
HD2_07					Yes
HD2_08					Yes
HD2_09			✓	✓	No
HD2_10			✓	✓	No
HD2_11	✓		✓	✓	No
HD2_12	✓		✓	✓	No
HD2_13			✓	✓	No
HD2_14			✓	✓	No
HD2_15					Yes
HD2_16	✓		✓	✓	No
HD2_17			✓	✓	No
HD2_18	✓		✓		No
HD2_19					Yes
HD2_20					Yes
HD2_21					Yes
HD2_22					Yes
HD2_23					Yes

4.4 Fertility

The Hope Downs 2 soils have total N values ranging from 114-1252mg/kg with a median value of 426mg/kg. The Bedded Hilltop soils have total N values ranging from 197-1004mg/kg with a median value of 284mg/kg. The lower nitrogen levels in the Bedded Hilltop soils could be due to reduced vegetation in these shallower soils. The range in total nitrogen values is given in Figure 5.

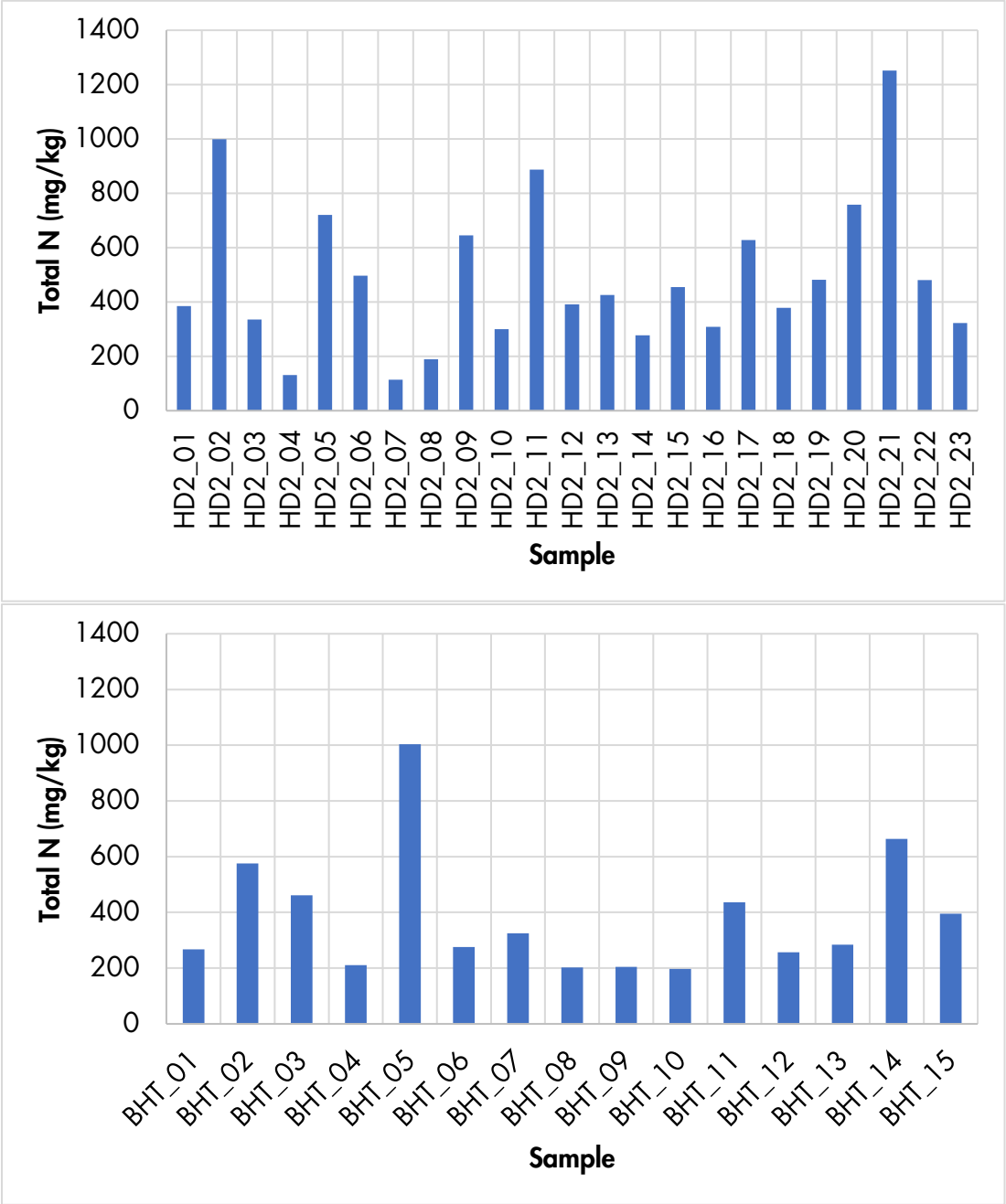

Figure 5: Total nitrogen values for the Hope Downs 2 soils (top) and Bedded Hilltop soils (bottom)

Both the Hope Downs 2 and Bedded Hilltop soils generally have relatively low ammonium-N and nitrate-N, indicating that a small proportion of the nitrogen is in readily-available forms and that a large proportion is contained within organic matter present in the soils.

Organic C values range from 0.4-1.5% (median 0.7%) for the Hope Downs 2 soils, and 0.4-1.7% (median 0.8%) for the Bedded Hilltop soils. The C:N ratios range from 4-79 (median 20) for Hope Downs 2 soils, and 8-61 (median 20) for the Bedded Hilltop soils.

Median values of 20 indicate that decomposition rates of organic matter will be slightly reduced for many of the soils, and vegetation growth may be improved by addition of some nitrogen. Addition of N as a means of improving vegetation growth should be considered and could be done through any or all of these options:

- Mixing of soils with higher total N levels to those with lower total N values prior to spreading during rehabilitation.
- Addition of N-based fertiliser. The rates, types, and modes of application would need to be determined through pot or field based trials.
- Inclusion of N-fixing vegetation into the seed mixes used as part of rehabilitation.

Total P, available P, available S, trace Cu, trace Mn, and trace Zn values for all soils are within suitable levels. The available K is slightly low for 87% of the Bedded Hilltop soils, but low for only 26% of the Hope Downs 2 soils. Despite being low, these values may not translate into adverse conditions for plant growth. The impact of the addition of potassium could be considered along with the impact of the addition of N within pot or field vegetation trials.

4.5 Water regime

4.5.1 Plant available water

Plant available water content (without adjustment for the coarse fraction) for the Hope Downs 2 soils ranged from 60-180mm water per metre of soil (median 90mm/m). The PAW for the Bedded Hilltop ranged from 75-120mm/m (median 90mm/m). These values are consistent with common PAW values for sandy loam soils, though it is within the lower bounds of the range. This could be due to the loss (partial to complete) in structure caused by disturbance of the soil. This disturbance is akin to the disturbance that would occur during stripping and rehandling of the soils as part of rehabilitation. Given that the structure of soils used in rehabilitation would improve through time, the measured values are likely to increase through time. Therefore, the PAW of the soils is considered suitable.

When the PAW values are adjusted to include the rock fraction, the PAW for the Hope Downs 2 soils range from 16-148mm/m (median 42mm/m), and the PAW for the Bedded Hilltop soils range from 16-60mm/m (median 32mm/m). The adjusted PAW is strongly correlated to the coarse fragment content (Figure 6).

Soils with a higher abundance of coarse fragments hold less water. Storms with a return period of 1 year (40mm, see section 2.1) are likely to wet these soils through to a depth of ~1m. Rarer storm events are likely to wet to depths greater than 1m. Given that soils are often placed in thin layers during rehabilitation (much thinner than 1m), the underlying waste materials are likely to function as a water storage zone that plants will be able to access. This highlights that the properties of the underlying material (below the soil applied) are also important when considering plant growth potential.

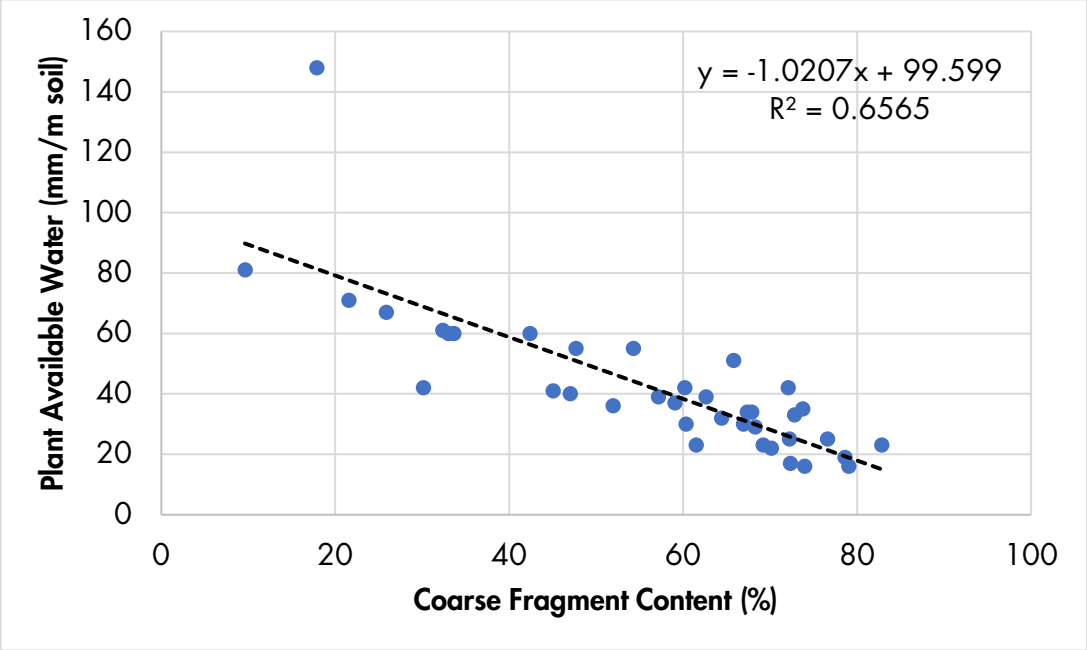

Figure 6: Plant available water compared to coarse fragment content.

4.5.2 Saturated hydraulic conductivity

Saturated hydraulic conductivity (K_{sat}) values are often higher for the Bedded Hilltop soils than for the Hope Downs 2 soils. K_{sat} values for the Hope Downs 2 soils range from 4-29mm/hr and have a median value of 12mm/hr. K_{sat} values for the Bedded Hilltop soils range from 7-1564mm/hr and have a median value of 74mm/hr. Figure 7 shows the measured values compared to the coarse fragment content. In general, those soils with larger coarse fragment contents, (particularly >70%), have higher saturated hydraulic conductivity.

Excluding the K_{sat} values for the soils with larger coarse fractions (>70%), the mean K_{sat} value for all soils is 13mm/h. This is consistent with common values, though it is within the lower bounds of the range. Similar to PAW, this could be due to the loss in structure caused by disturbance of the soil, and it will likely increase through time after they are used as part of rehabilitation. Therefore, the K_{sat} of the soils is considered suitable.

It is instructive to compare the K_{sat} values to the typical rainfall intensity values. Steady infiltration rates are approximately twice the measured K_{sat} values, and a K_{sat} value of 13mm/h would likely translate to a steady infiltration rate of ~20-30mm/hr. This infiltration rate is larger than the average rainfall intensities for storms in the Hope Downs area (90% of all storms have an average intensity of <9mm/hr), but lower than the peak

intensity values that can occur in a few events. It can be concluded from this that the majority of rainfall events that occur will readily infiltrate into these soils, but that there will be some events that will cause runoff and possibly erosion. The amount of erosion will depend on a range of factors including the duration of runoff, the intensity of the rainfall, and the erodibility of the soil.

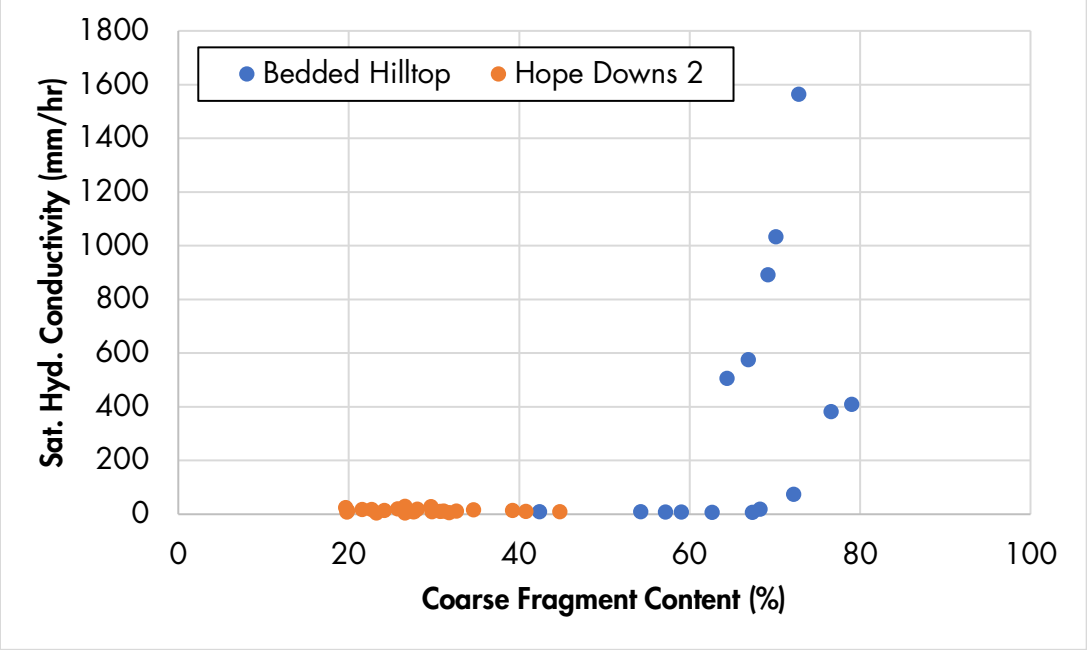

Figure 7: Saturated hydraulic conductivity compared to coarse fragment content.

5 SUMMARY

A summary of the suitability of the soils is given in Table 3. Soils from Hope Downs 2 and Bedded Hilltop are considered separately. The summary uses the mean or median values for the samples provided.

The topsoil samples could be considered to have similar properties to soils in the region of Hope Downs 2 and Bedded Hilltop, with the following caveats.

The pH of the soils at Hope Downs 2 is often lower than likely present (based on the available broadscale data) and the impact of the low pH could be considered using field/pot trials. Lime could be used to address the low pH if the trials show it to be necessary.

The structural instability of the soils may be similar to that present in the *in situ* soils and may be mitigated by mixing these soils with structurally stable materials as part of rehabilitation activities. The ability to RTIO to achieve this mixing is yet to be determined. The availability of stable materials and machinery to do the mixing would need to be ascertained.

The Bedded Hilltop often has low nitrogen levels and can also sometimes have low available potassium. The Hope Downs 2 soil can also have low nitrogen and often has low available potassium. The impact of these low nutrient levels should be investigated further. Field or pot trials could be used to consider the impact on plant growth to

changes in the levels of these nutrients via fertiliser. As part of any field/pot trials of fertiliser, the type, rate and mode of delivery of the nutrient should also be considered as they can have a significant bearing on the efficacy of the fertiliser. Nitrogen levels could also be altered through mixing low N and high N soils together as part of rehabilitation. To achieve this, RTIO would need to demonstrate the ability to achieve this mixing as part of any rehabilitation action. Alternatively, N levels could be altered through inclusion of N-fixing vegetation into the seed mix. The availability of N-fixing rehabilitation species and the degree to which these plant can cause an increase in available N would need to be investigated.

Table 3: Summary of suitability.

Property	Hope Downs 2	Bedded Hilltop
pH_w, pH_{Ca}	Suitable (pH_w 6-8), though there are a significant amount of low pH soils that may reduce nutrient availability and biological activity. This reduction did not reduce fertility to unsuitable levels. Field/pot trials to confirm this is recommended. Lime could be used to increase pH if shown by trials to be needed	Suitable (pH_w 6-8). Only 1 of 15 soils had slightly low pH and 1 of 15 soils had slightly high pH.
Salinity, chloride	Suitable ($EC_{1:5}$<1dS/m)	Suitable ($EC_{1:5}$<1dS/m)
Structural stability	Often unstable (52% of soils)	Infrequently unstable (27% of soils)
Fertility	Often low total N (<500mg/kg) Often low available K (<80mg/kg)	Often low total N (<500mg/kg) Sometimes low available K (<80mg/kg)
Plant available water	Suitable (median 90mm/m)	Suitable (median 90mm/m)
Saturated hydraulic conductivity	Suitable (median >10mm/hr)	Suitable (median >10mm/hr)

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APPENDIX A: TABULATED RESULTS

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Analyses	Unit	HD2_01	HD2_02	HD2_03	HD2_04	HD2_05	HD2_06
pH_w	pH units	6.44	6.08	5.68	7.82	4.61	5.60
pH_{Ca}	pH units	5.64	5.28	4.88	7.02	3.81	4.80
$EC_{1:5}$	dS/m	0.03	0.04	0.01	0.03	0.41	0.06
Chloride	mg/kg	18.7	28.7	21.9	22.1	65.6	20.2
Ca^{2+}	meq/100g	2.6	4.7	1.8	1.8	3.1	3.6
Mg^{2+}	meq/100g	1.0	1.3	0.8	1.0	0.7	0.8
K^+	meq/100g	0.3	0.5	0.2	0.1	0.4	0.4
Na^+	meq/100g	0.3	0.2	0.1	0.2	0.2	0.3
Al^{3+}	meq/100g	0.1	0.0	0.1	0.0	0.2	0.2
ECEC	meq/100g	4.2	6.6	3.0	3.0	4.5	5.3
ESP	%	6.0	2.7	4.8	5.0	4.0	5.5
EMP	%	23	20	26	32	15	16
Ca:Mg	-	2.7	3.6	2.2	1.8	4.5	4.3
ESI	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Emerson Class	-	3	3	5	3	5	5
Total N	mg/kg	385	999	335	131	720	497
Ammonium, NH_4	mg/kg	3.15	3.95	6.23	<2.0	10.4	4.04
Nitrate, NO_3	mg/kg	2.93	7.04	2.17	1.5	232	15.1
Organic C	%	0.9	0.4	0.5	0.7	0.7	0.6
Total P	mg/kg	489	474	468	225	601	483
Av. P	mg/kg	14.9	8.5	20.8	23.0	20.0	17.1
Av. K	mg/kg	159	188	91.1	80.7	209	144
Av. S	mg/kg	7.4	9.3	11	7.2	23	16
Trace Cu	mg/kg	0.9	1.0	0.8	1.0	2.2	2.9
Trace Mn	mg/kg	26	48	37	12	59	46
Trace Zn	mg/kg	0.6	0.8	0.6	1.0	1.3	1.2
Coarse fraction*	%	74	74	79	48	26	32
Coarse sand*^	%	39.2	29.8	19.8	44.8	26.6	29.7
Fine Sand*^	%	44.6	52.5	62.1	33.8	37.0	37.7
Silt*^	%	3.0	4.8	4.8	8.3	11.6	9.8
Clay*^	%	13.1	12.9	13.3	13.1	24.9	22.8
PAW	mm/m	60	135	90	105	90	90
PAW (adjusted)#	mm/m	16	35	19	55	67	61
K_{sat}#	mm/hr	14	9	8	10	29	28

Analyses	Unit	HD2_07	HD2_08	HD2_09	HD2_10	HD2_11	HD2_12
pH_w	pH units	6.53	6.12	6.47	6.76	5.96	5.40
pH_{Ca}	pH units	5.73	5.32	5.67	5.96	5.16	4.60
$EC_{1:5}$	dS/m	0.02	0.02	0.02	0.01	0.09	0.02
Chloride	mg/kg	19.1	12.6	18.8	14.6	29.8	20.6
Ca^{2+}	meq/100g	2.1	2.4	5.2	6.3	4.0	2.5
Mg^{2+}	meq/100g	1.3	0.9	1.7	2.7	1.1	1.3
K^+	meq/100g	0.1	0.1	1.2	0.6	0.4	0.1
Na^+	meq/100g	0.4	0.4	0.3	0.4	0.4	0.4
Al^{3+}	meq/100g	0.2	0.1	0.1	0.0	0.1	0.1
ECEC	meq/100g	4.1	3.9	8.4	10.0	6.0	4.3
ESP	%	10	9.5	3.1	3.6	7.1	8.5
EMP	%	31	24	20	27	18	30
Ca:Mg	-	1.7	2.6	3.2	2.3	3.7	1.9
ESI	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Emerson Class	-	3	3	3	3	3	3
Total N	mg/kg	114	189	645	300	887	391
Ammonium, NH_4	mg/kg	3.95	3.15	2.07	3.24	<2.0	2.16
Nitrate, NO_3	mg/kg	3.63	5.22	3.06	1.42	31.3	2.71
Organic C	%	0.9	0.6	1.0	0.6	0.9	0.5
Total P	mg/kg	394	326	568	373	482	351
Av. P	mg/kg	19.7	27.4	32.5	42.2	12.1	20.4
Av. K	mg/kg	90.6	68.2	431	228	140	67.2
Av. S	mg/kg	8.4	6.7	6.5	6.9	14	10
Trace Cu	mg/kg	0.8	1.0	2.9	3.5	3.5	1.9
Trace Mn	mg/kg	26	43	35	18	23	28
Trace Zn	mg/kg	0.5	0.6	4.0	3.9	2.2	0.7
Coarse fraction*	%	72	61	18	10	34	52
Coarse sand*^	%	32.6	40.8	23.3	26.6	22.7	19.9
Fine Sand*^	%	46.5	43.2	36.2	47.0	39.1	48.8
Silt*^	%	4.7	4.7	14.1	11.6	8.5	6.8
Clay*^	%	16.2	11.3	26.4	14.7	29.6	24.5
PAW	mm/m	60	60	180	90	90	75
PAW (adjusted)#	mm/m	17	23	148	81	60	36
K_{sat}#	mm/hr	12	11	4	4	18	12

Analyses	Unit	HD2_13	HD2_14	HD2_15	HD2_16	HD2_17	HD2_18
pH_w	pH units	5.76	5.49	6.13	5.40	6.19	5.28
pH_{Ca}	pH units	4.96	4.69	5.33	4.60	5.39	4.48
$EC_{1:5}$	dS/m	0.02	0.03	0.02	0.03	0.03	0.02
Chloride	mg/kg	16.6	20.3	17.6	16.7	14.5	14.3
Ca^{2+}	meq/100g	2.6	2.4	3.0	2.8	4.3	2.6
Mg^{2+}	meq/100g	0.9	1.2	1.1	0.9	1.3	0.7
K^{+}	meq/100g	0.3	0.2	0.1	0.2	0.5	0.3
Na^{+}	meq/100g	0.2	0.1	0.3	0.3	0.2	0.3
Al^{3+}	meq/100g	0.1	0.1	0.0	0.3	0.2	0.2
ECEC	meq/100g	4.1	4.0	4.5	4.4	6.4	4.1
ESP	%	4.4	3.3	6.6	7.3	3.3	8.0
EMP	%	23	31	24	20	20	16
Ca:Mg	-	2.8	1.9	2.7	3.1	3.4	4.0
ESI	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Emerson Class	-	3	5	3	5	3	3
Total N	mg/kg	426	277	455	309	628	379
Ammonium, NH_4	mg/kg	<2.0	2.25	5.45	2.79	2.34	2.34
Nitrate, NO_3	mg/kg	7.35	7.58	4.33	4.63	2.94	3.73
Organic C	%	0.8	0.7	0.9	0.7	1.1	0.9
Total P	mg/kg	348	426	432	382	292	442
Av. P	mg/kg	22.6	13.2	26.7	26.2	10.1	16.4
Av. K	mg/kg	97.0	70.0	67.5	70.3	200	126
Av. S	mg/kg	7.8	8.8	9.0	13	8.5	9.7
Trace Cu	mg/kg	2.7	2.1	1.4	3.1	3.7	2.6
Trace Mn	mg/kg	14	27	41	23	39	37
Trace Zn	mg/kg	0.9	1.2	0.6	1.8	4.1	1.3
Coarse fraction*	%	30	33	60	45	47	22
Coarse sand*^	%	19.7	27.7	31.8	25.8	28.1	31.2
Fine Sand*^	%	44.2	37.5	45.2	41.3	42.6	39.7
Silt*^	%	8.5	6.5	6.5	8.6	4.9	8.0
Clay*^	%	27.6	28.3	16.5	24.4	24.4	21.2
PAW	mm/m	60	90	105	75	75	90
PAW (adjusted)#	mm/m	42	60	42	41	40	71
K_{sat}#	mm/hr	24	10	6	19	19	11

Analyses	Unit	HD2_19	HD2_20	HD2_21	HD2_22	HD2_23
pH_w	pH units	5.34	5.94	7.95	5.84	5.90
pH_{Ca}	pH units	4.54	5.14	7.15	5.04	5.10
$EC_{1:5}$	dS/m	0.08	0.04	0.11	0.04	0.01
Chloride	mg/kg	38.7	19.3	23.9	22.1	17.0
Ca^{2+}	meq/100g	3.9	4.0	7.4	3.8	2.2
Mg^{2+}	meq/100g	1.4	1.0	1.3	1.2	1.1
K^{+}	meq/100g	0.1	0.3	0.7	0.3	0.2
Na^{+}	meq/100g	0.2	0.3	0.2	0.1	0.1
Al^{3+}	meq/100g	0.1	0.0	0.0	0.0	0.1
ECEC	meq/100g	5.8	5.6	9.7	5.2	3.8
ESP	%	4.1	4.8	2.1	1.0	2.6
EMP	%	25	18	14	22	29
Ca:Mg	-	2.7	3.9	5.6	3.3	2.1
ESI	-	<0.05	<0.05	0.05	<0.05	<0.05
Emerson Class	-	5	3	3	3	5
Total N	mg/kg	482	758	1252	481	323
Ammonium, NH_4	mg/kg	10.2	4.61	<2.0	3.06	<2.0
Nitrate, NO_3	mg/kg	12.1	10.3	4.12	11.8	1.06
Organic C	%	1.0	1.5	1.4	1.0	0.5
Total P	mg/kg	279	374	603	442	283
Av. P	mg/kg	35.6	8.7	21.4	12.8	20.7
Av. K	mg/kg	75.4	105	302	99.7	90.5
Av. S	mg/kg	18	9.5	8.7	8.6	8.8
Trace Cu	mg/kg	2.2	1.2	1.7	1.2	0.8
Trace Mn	mg/kg	20	34	18	49	31
Trace Zn	mg/kg	0.9	0.8	0.8	0.8	0.6
Coarse fraction*	%	60	68	66	72	83
Coarse sand*^	%	24.2	34.6	30.7	27.5	21.6
Fine Sand*^	%	47.8	45.8	43.3	49.3	57.9
Silt*^	%	6.4	4.8	6.8	4.9	5.0
Clay*^	%	21.6	14.7	19.1	18.3	15.5
PAW	mm/m	75	105	150	150	135
PAW (adjusted)#	mm/m	30	34	51	42	23
K_{sat}#	mm/hr	14	16	11	9	18

Analyses	Unit	BHT_01	BHT_02	BHT_03	BHT_04	BHT_05	BHT_06
pH_w	pH units	7.08	6.10	6.24	8.17	5.95	6.47
pH_{Ca}	pH units	6.28	5.30	5.44	7.37	5.15	5.67
$EC_{1:5}$	dS/m	0.02	0.02	0.02	0.04	0.01	0.02
Chloride	mg/kg	21.1	21.4	23.0	21.8	16.3	18.7
Ca^{2+}	meq/100g	2.7	2.8	2.4	3.4	3.0	1.7
Mg^{2+}	meq/100g	0.8	1.0	1.0	0.8	1.1	0.7
K^{+}	meq/100g	0.1	0.2	0.1	0.2	0.2	0.1
Na^{+}	meq/100g	0.4	0.3	0.1	0.1	0.2	0.2
Al^{3+}	meq/100g	0.0	0.1	0.1	0.0	0.1	0.1
ECEC	meq/100g	4.1	4.3	3.6	4.5	4.6	2.7
ESP	%	8.9	5.9	3.4	1.8	5.1	5.6
EMP	%	21	24	26	17	24	24
Ca:Mg	-	3.2	2.7	2.5	4.5	2.7	2.6
ESI	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Emerson Class	-	3	3	3	5	3	5
Total N	mg/kg	267	576	461	210	1004	275
Ammonium, NH_4	mg/kg	<2.0	4.83	7.62	<2.0	7.71	2.43
Nitrate, NO_3	mg/kg	1.97	5.08	3.57	2.05	1.62	2.58
Organic C	%	0.5	1.1	0.8	0.5	1.4	0.7
Total P	mg/kg	561	492	558	349	559	495
Av. P	mg/kg	24.6	14.1	19.1	16.9	13.3	24.6
Av. K	mg/kg	70.6	75.0	74.3	76.5	72.9	66.8
Av. S	mg/kg	4.6	3.7	7.0	9.4	7.7	20
Trace Cu	mg/kg	1.1	0.7	0.7	0.7	0.9	0.6
Trace Mn	mg/kg	15	34	34	11	36	23
Trace Zn	mg/kg	0.9	0.7	0.6	0.6	0.7	0.6
Coarse fraction*	%	70	72	69	73	77	67
Coarse sand*^	%	42.3	30.4	41.8	32.0	28.1	51.1
Fine Sand*^	%	44.6	49.4	43.5	49.8	53.6	34.0
Silt*^	%	3.1	5.0	3.1	1.5	5.0	4.9
Clay*^	%	10.0	15.2	11.6	16.7	13.3	10.0
PAW	mm/m	75	90	75	120	105	90
PAW (adjusted)#	mm/m	22	25	23	33	25	30
K_{sat}#	mm/hr	1033	74	892	1564	382	576

Analyses	Unit	BHT_07	BHT_08	BHT_09	BHT_10	BHT_11	BHT_12
pH_w	pH units	6.63	7.16	6.50	5.96	6.45	6.89
pH_{Ca}	pH units	5.83	6.36	5.70	5.16	5.65	6.09
$EC_{1:5}$	dS/m	0.03	0.04	0.04	0.02	0.01	0.03
Chloride	mg/kg	16.6	20.2	30.4	35.4	16.9	16.8
Ca^{2+}	meq/100g	2.6	3.9	2.1	1.2	2.5	3.2
Mg^{2+}	meq/100g	0.9	1.3	1.1	1.0	1.1	0.9
K^{+}	meq/100g	0.1	0.1	0.1	0.1	0.2	0.1
Na^{+}	meq/100g	0.2	0.2	0.2	0.1	0.2	0.1
Al^{3+}	meq/100g	0.1	0.1	0.2	0.1	0.1	0.0
ECEC	meq/100g	3.9	5.7	3.7	2.4	4.1	4.3
ESP	%	5.8	3.4	6.0	4.5	4.4	2.5
EMP	%	22	23	29	41	27	20
Ca:Mg	-	3.0	3.0	2.0	1.2	2.3	3.6
ESI	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Emerson Class	-	3	3	5	5	3	3
Total N	mg/kg	325	202	204	197	436	257
Ammonium, NH_4	mg/kg	3.33	2.43	6.84	7.88	3.33	2.25
Nitrate, NO_3	mg/kg	2.43	7.13	5.31	2.89	1.46	6.25
Organic C	%	0.7	0.4	0.4	0.5	0.7	0.8
Total P	mg/kg	524	332	407	654	424	482
Av. P	mg/kg	25.9	21.1	21.0	30.2	22.7	20.6
Av. K	mg/kg	66.2	71.1	65.7	63.3	76.9	66.3
Av. S	mg/kg	21	12	7.9	41	8.1	9.3
Trace Cu	mg/kg	0.8	0.8	0.6	0.4	0.6	0.8
Trace Mn	mg/kg	15	19	23	8.5	24	24
Trace Zn	mg/kg	0.5	0.5	0.7	0.5	0.6	0.5
Coarse fraction*	%	64	63	67	54	79	59
Coarse sand*^	%	40.3	34.9	27.8	38.4	33.1	39.3
Fine Sand*^	%	33.3	42.8	52.6	34.7	53.7	42.5
Silt*^	%	6.5	5.0	3.1	6.6	3.2	6.7
Clay*^	%	19.9	17.2	16.5	20.3	10.0	11.6
PAW	mm/m	90	105	105	120	75	90
PAW (adjusted)#	mm/m	32	39	34	55	16	37
K_{sat}#	mm/hr	506	7	7	9	409	8

Analyses	Unit	BHT_13	BHT_14	BHT_15
pH_w	pH units	6.32	5.55	6.34
pH_{Ca}	pH units	5.52	4.75	5.54
$EC_{1:5}$	dS/m	0.02	0.33	0.02
Chloride	mg/kg	17.2	126	21.4
Ca^{2+}	meq/100g	3.9	4.6	2.0
Mg^{2+}	meq/100g	1.5	1.7	1.1
K^+	meq/100g	0.3	0.2	0.1
Na^+	meq/100g	0.3	0.7	0.3
Al^{3+}	meq/100g	0.1	0.1	0.1
ECEC	meq/100g	6.0	7.3	3.7
ESP	%	4.5	9.9	7.8
EMP	%	24	23	30
Ca:Mg	-	2.7	2.8	1.9
ESI	-	<0.05	<0.05	<0.05
Emerson Class	-	3	5	3
Total N	mg/kg	284	664	395
Ammonium, NH_4	mg/kg	<2.0	13.2	8.31
Nitrate, NO_3	mg/kg	4.53	203	4.32
Organic C	%	1.7	0.5	0.6
Total P	mg/kg	329	488	414
Av. P	mg/kg	15.0	19.7	17.3
Av. K	mg/kg	105	90.1	70.2
Av. S	mg/kg	7.3	15	7.8
Trace Cu	mg/kg	1.3	0.9	0.8
Trace Mn	mg/kg	22	49	31
Trace Zn	mg/kg	0.5	0.5	0.5
Coarse fraction*	%	42	68	57
Coarse sand*^	%	23.6	30.8	40.3
Fine Sand*^	%	48.3	48.7	41.4
Silt*^	%	6.9	5.0	3.2
Clay*^	%	21.2	15.4	15.1
PAW	mm/m	105	90	90
PAW (adjusted)#	mm/m	60	29	39
K_{sat}#	mm/hr	10	19	8

Table notes:

* Coarse fraction: >2mm; coarse sand: 2.0-0.2mm; fine sand: 0.2-0.02mm; silt: 0.02-0.002mm; clay: <0.002mm.

^ Expressed as a percentage of the fine fraction only. The sum of coarse sand, fine sand, silt, and clay will equal 100%, with allowance to be made for rounding error.

Data were adjusted to account for the coarse fraction, assuming that only the fine fraction (<2mm diameter) is able to store moisture. Water retention values measured for the fine fraction were multiplied by the fine fraction percent to estimate the water retention of the fine and coarse fraction combined. Values given are volumetric water contents, assuming a bulk density of 1.5g/cm^3.

APPENDIX B: LABORATORY DATA SHEETS

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ANALYSIS REPORT SOIL

PROJECT NO: EW211809		**Date of Issue:**	**20/01/2022**
Customer:	LANDLOCH PTY. LTD. (W.A.)	Report No:	1
Address:	PO BOX 5175 SOUTH LAKE WA 6164	Date Received:	31/12/2021
		Matrix:	Soil
Attention:	Anna Reed	Location:	2079.21eRTIO HD1
Phone:	08 9494 2835	Sampler ID:	Client Supplied
Fax:	08 9417 3744	Date of Sampling:	23/12/2021
Email:	reed@landloch.com.au	Sample Condition:	Acceptable

Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

Signed:

Stephanie Cameron
Laboratory Operations Manager

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PROFICIENT LAB
Visit www.aspac-australasia.com to view our certification details.

East West is certified by the Australian-Asian Soil & Plant Analysis Council to perform various soil and plant tissue analysis. The tests reported herein have been performed in accordance with our terms of accreditation.

This report must not be reproduced except in full and EWEA takes no responsibility of the end use of the results within this report.

This analysis relates to the sample submitted and it is the client's responsibility to make certain the sample is representative of the matrix to be tested.

Samples will be discarded one month after the date of this report. Please advise if you wish to have your sample/s returned.



ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

					BHT_01	BHT_02	BHT_03	BHT_04
			CLIENT SAMPLE ID					
			DEPTH					
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-1**	**211809-2**	**211809-3**	**211809-4**
Moisture Content (Oven Dry)	Oven-Dry	PMS-17	%	na	1.20	1.13	1.24	1.47
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	7.08	6.10	6.24	8.17
Chloride Soluble	DA	DAP-06	mg/kg	2	21.1	21.4	23.0	21.8
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.02	0.02	0.02	0.04
Total N (LECO)	LECO	R&L 7A5	mg/kg	50	267	576	461	210
Extractable Nitrate-N	DA	DAP-03	mg/kg	0.5	1.97	5.08	3.57	2.05
Ammonium - N (Ex)	ExKCl/UV-Vis	PMS-22	mg/kg	2	<2.0	4.83	7.62	<2.0
Phosphorus (Total)	HNO3/HCLO4 ICP	ICP-03	mg/kg	40	561	492	558	349
Organic Carbon (LECO)	LECO	R&L 6B3	%	0.05	0.48	1.13	0.84	0.46
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	1	24.6	14.1	19.1	16.9
Potassium (Available)	Bicarb/ICP	R&L 18A1	mg/kg	10	70.6	75.0	74.3	76.5
Sulphate-Sulphur	KCl40/ICP	R&L 10D1	mg/kg	3	4.63	3.69	6.97	9.42
Extractable Copper	DTPA/ICP	R&L 12A1	mg/kg	0.2	1.12	0.72	0.70	0.66
Extractable Zinc	DTPA/ICP	R&L 12A1	mg/kg	0.2	0.89	0.65	0.55	0.59
Extractable Manganese	DTPA/ICP	R&L 12A1	mg/kg	0.5	14.9	33.8	34.4	10.8
Extractable Iron	DTPA/ICP	R&L 12A1	mg/kg	0.5	8.80	16.6	12.7	6.02
Extractable Boron	Hot CaCl2/ICP	R&L 12C2	mg/kg	0.2	0.37	0.28	0.36	1.36
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	54.9	84.9	44.1	75.4
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	540	555	477	1551
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	101	125	114	101
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	82.8	59.3	28.8	33.3
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	1	<1.00	4.95	6.45	<1.00
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.14	0.22	0.11	0.19
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	2.70	2.78	2.39	7.76
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	0.84	1.04	0.95	0.84
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.36	0.26	0.13	0.14

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

				CLIENT SAMPLE ID	BHT_01	BHT_02	BHT_03	BHT_04
				DEPTH				
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-1**	**211809-2**	**211809-3**	**211809-4**
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.01	0.06	0.07	0.01
ECEC	Calculation	PMS-15A1	cmol/kg	na	4.05	4.35	3.64	8.95
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	3.21	2.66	2.51	9.21
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.17	0.21	0.12	0.23
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	3.47	5.01	3.10	2.16
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	66.6	63.8	65.4	86.7
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	20.8	24.0	26.1	9.41
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	8.88	5.93	3.44	1.62
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	0.27	1.27	1.97	0.12
Exchangeable Potassium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Calcium	ICP-OES	R&L 15A2	mg/kg	20	NA	NA	NA	NA
Exchangeable Magnesium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Sodium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Potassium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Calcium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Magnesium	PMS-15A2	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Sodium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
ECEC	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Ca/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
K/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Potassium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Calcium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Magnesium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Sodium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Aluminium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Potassium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	94.4

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

					BHT_01	BHT_02	BHT_03	BHT_04
			CLIENT SAMPLE ID					
			DEPTH					
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-1**	**211809-2**	**211809-3**	**211809-4**
Exchangeable Calcium	ICP-OES	R&L 15C1	mg/kg	20	NA	NA	NA	689
Exchangeable Magnesium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	91.0
Exchangeable Sodium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	19.0
Exchangeable Potassium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	0.24
Exchangeable Calcium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	3.45
Exchangeable Magnesium	PMS-15C1	PMS-15C1	cmol/kg	na	NA	NA	NA	0.76
Exchangeable Sodium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	0.08
ECEC	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	4.54
Ca/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	4.54
K/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	0.32
Exchangeable Potassium %	Calculation	PMS-15C1	%	na	NA	NA	NA	5.33
Exchangeable Calcium %	Calculation	PMS-15C1	%	na	NA	NA	NA	75.9
Exchangeable Magnesium %	Calculation	PMS-15C1	%	na	NA	NA	NA	16.7
Exchangeable Sodium %	Calculation	PMS-15C1	%	na	NA	NA	NA	1.82
Exchangeable Aluminium %	Calculation	PMS-15C1	%	na	NA	NA	NA	0.24
Gravel >2.0mm	Sieve	ASTMD422-63	%	na	48.9	31.8	45.7	58.8
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	21.6	20.7	22.7	13.2
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	22.8	33.7	23.6	20.5
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	1.6	3.4	1.7	0.6
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	5.1	10.4	6.3	6.9

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

				CLIENT SAMPLE ID	BHT_05	BHT_06	BHT_07	BHT_08
				DEPTH				
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-5**	**211809-6**	**211809-7**	**211809-8**
Moisture Content (Oven Dry)	Oven-Dry	PMS-17	%	na	1.14	1.08	1.34	1.07
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	5.95	6.47	6.63	7.16
Chloride Soluble	DA	DAP-06	mg/kg	2	16.3	18.7	16.6	20.2
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.01	0.02	0.03	0.04
Total N (LECO)	LECO	R&L 7A5	mg/kg	50	1004	275	325	202
Extractable Nitrate-N	DA	DAP-03	mg/kg	0.5	1.62	2.58	2.43	7.12
Ammonium - N (Ex)	ExKCl/UV-Vis	PMS-22	mg/kg	2	7.71	2.43	3.33	2.43
Phosphorus (Total)	HNO3/HCLO4 ICP	ICP-03	mg/kg	40	559	495	524	332
Organic Carbon (LECO)	LECO	R&L 6B3	%	0.05	1.35	0.65	0.70	0.42
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	1	13.3	24.6	25.9	21.1
Potassium (Available)	Bicarb/ICP	R&L 18A1	mg/kg	10	72.9	66.8	66.2	71.1
Sulphate-Sulphur	KCl40/ICP	R&L 10D1	mg/kg	3	7.71	19.7	21.4	11.8
Extractable Copper	DTPA/ICP	R&L 12A1	mg/kg	0.2	0.86	0.63	0.78	0.82
Extractable Zinc	DTPA/ICP	R&L 12A1	mg/kg	0.2	0.69	0.60	0.47	0.51
Extractable Manganese	DTPA/ICP	R&L 12A1	mg/kg	0.5	36.3	22.7	15.3	19.1
Extractable Iron	DTPA/ICP	R&L 12A1	mg/kg	0.5	20.5	10.3	9.92	6.48
Extractable Boron	Hot CaCl2/ICP	R&L 12C2	mg/kg	0.2	0.28	0.32	0.40	0.68
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	80.8	36.3	41.6	57.4
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	596	342	517	783
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	131	79.1	104	158
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	53.8	34.8	51.2	43.6
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	1	4.50	7.05	7.80	7.80
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.21	0.09	0.11	0.15
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	2.98	1.71	2.59	3.92
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	1.09	0.66	0.87	1.32
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.23	0.15	0.22	0.19

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

				CLIENT SAMPLE ID	BHT_05	BHT_06	BHT_07	BHT_08
				DEPTH				
Test Parameter	Method Description	Method Reference	Units	LOR	211809-5	211809-6	211809-7	211809-8
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.05	0.08	0.09	0.09
ECEC	Calculation	PMS-15A1	cmol/kg	na	4.56	2.69	3.87	5.66
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	2.73	2.59	2.98	2.97
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.19	0.14	0.12	0.11
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	4.54	3.46	2.76	2.60
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	65.3	63.5	66.8	69.2
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	23.9	24.5	22.4	23.3
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	5.13	5.62	5.76	3.35
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	1.10	2.91	2.24	1.53
Exchangeable Potassium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Calcium	ICP-OES	R&L 15A2	mg/kg	20	NA	NA	NA	NA
Exchangeable Magnesium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Sodium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Potassium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Calcium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Magnesium	PMS-15A2	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Sodium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
ECEC	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Ca/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
K/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Potassium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Calcium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Magnesium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Sodium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Aluminium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Potassium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	NA

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

				CLIENT SAMPLE ID	BHT_05	BHT_06	BHT_07	BHT_08
				DEPTH				
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-5**	**211809-6**	**211809-7**	**211809-8**
Exchangeable Calcium	ICP-OES	R&L 15C1	mg/kg	20	NA	NA	NA	NA
Exchangeable Magnesium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	NA
Exchangeable Sodium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	NA
Exchangeable Potassium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Calcium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Magnesium	PMS-15C1	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Sodium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	NA
ECEC	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
Ca/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
K/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Potassium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Calcium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Magnesium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Sodium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Aluminium %	Calculation	PMS-15C1	%	na	1.10	1.73	1.91	1.91
Gravel >2.0mm	Sieve	ASTMD422-63	%	na	43.8	34.8	27.2	30.4
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	15.8	33.3	29.3	24.3
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	30.1	22.2	24.2	29.8
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	2.8	3.2	4.7	3.5
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	7.5	6.5	14.5	12.0

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

					BHT_09	BHT_10	BHT_11	BHT_12
			CLIENT SAMPLE ID					
			DEPTH					
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-9**	**211809-10**	**211809-11**	**211809-12**
Moisture Content (Oven Dry)	Oven-Dry	PMS-17	%	na	0.70	1.51	0.97	0.82
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	6.50	5.96	6.45	6.89
Chloride Soluble	DA	DAP-06	mg/kg	2	30.4	35.4	16.9	16.8
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.04	0.02	0.01	0.03
Total N (LECO)	LECO	R&L 7A5	mg/kg	50	204	197	436	257
Extractable Nitrate-N	DA	DAP-03	mg/kg	0.5	5.31	2.89	1.46	6.25
Ammonium - N (Ex)	ExKCl/UV-Vis	PMS-22	mg/kg	2	6.84	7.88	3.33	2.25
Phosphorus (Total)	HNO3/HCLO4 ICP	ICP-03	mg/kg	40	407	654	424	482
Organic Carbon (LECO)	LECO	R&L 6B3	%	0.05	0.41	0.53	0.72	0.77
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	1	21.0	30.2	22.7	20.6
Potassium (Available)	Bicarb/ICP	R&L 18A1	mg/kg	10	65.7	63.3	76.9	66.3
Sulphate-Sulphur	KCl40/ICP	R&L 10D1	mg/kg	3	7.85	40.8	8.06	9.30
Extractable Copper	DTPA/ICP	R&L 12A1	mg/kg	0.2	0.60	0.38	0.64	0.76
Extractable Zinc	DTPA/ICP	R&L 12A1	mg/kg	0.2	0.73	0.45	0.57	0.53
Extractable Manganese	DTPA/ICP	R&L 12A1	mg/kg	0.5	23.3	8.52	23.9	23.6
Extractable Iron	DTPA/ICP	R&L 12A1	mg/kg	0.5	8.06	7.66	9.90	9.06
Extractable Boron	Hot CaCl2/ICP	R&L 12C2	mg/kg	0.2	0.40	0.54	0.34	0.42
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	37.8	33.7	83.1	38.1
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	424	232	504	639
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	126	117	131	106
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	50.4	24.7	41.4	24.9
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	1	16.9	6.00	5.55	4.35
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.10	0.09	0.21	0.10
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	2.12	1.16	2.52	3.20
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	1.05	0.98	1.09	0.88
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.22	0.11	0.18	0.11

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

				CLIENT SAMPLE ID	BHT_09	BHT_10	BHT_11	BHT_12
				DEPTH				
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-9**	**211809-10**	**211809-11**	**211809-12**
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.19	0.07	0.06	0.05
ECEC	Calculation	PMS-15A1	cmol/kg	na	3.67	2.40	4.07	4.33
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	2.02	1.19	2.31	3.62
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.09	0.09	0.20	0.11
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	2.64	3.61	5.24	2.25
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	57.7	48.4	62.0	73.7
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	28.6	40.7	26.8	20.4
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	5.96	4.48	4.43	2.50
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	5.11	2.78	1.52	1.12
Exchangeable Potassium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Calcium	ICP-OES	R&L 15A2	mg/kg	20	NA	NA	NA	NA
Exchangeable Magnesium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Sodium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Potassium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Calcium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Magnesium	PMS-15A2	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Sodium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
ECEC	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Ca/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
K/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Potassium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Calcium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Magnesium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Sodium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Aluminium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Potassium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	NA

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

					BHT_09	BHT_10	BHT_11	BHT_12
			CLIENT SAMPLE ID					
			DEPTH					
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-9**	**211809-10**	**211809-11**	**211809-12**
Exchangeable Calcium	ICP-OES	R&L 15C1	mg/kg	20	NA	NA	NA	NA
Exchangeable Magnesium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	NA
Exchangeable Sodium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	NA
Exchangeable Potassium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Calcium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Magnesium	PMS-15C1	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Sodium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	NA
ECEC	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
Ca/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
K/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Potassium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Calcium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Magnesium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Sodium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Aluminium %	Calculation	PMS-15C1	%	na	4.14	1.47	1.36	1.06
Gravel >2.0mm	Sieve	ASTMD422-63	%	na	38.8	24.1	53.8	25.1
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	17.0	29.1	15.3	29.4
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	32.2	26.3	24.8	31.8
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	1.9	5.0	1.5	5.0
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	10.1	15.4	4.6	8.7

ANALYSIS REPORT

PROJECT NO: EW211809 **Location: 2079.21eRTIO HD1**

					BHT_13	BHT_14	BHT_15	HD2_01
			CLIENT SAMPLE ID					
			DEPTH					
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-13**	**211809-14**	**211809-15**	**211809-16**
Moisture Content (Oven Dry)	Oven-Dry	PMS-17	%	na	1.38	1.15	1.28	1.00
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	6.32	5.55	6.34	6.44
Chloride Soluble	DA	DAP-06	mg/kg	2	17.2	126	21.4	18.7
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.02	0.33	0.02	0.03
Total N (LECO)	LECO	R&L 7A5	mg/kg	50	284	664	395	385
Extractable Nitrate-N	DA	DAP-03	mg/kg	0.5	4.53	203	4.32	2.93
Ammonium - N (Ex)	ExKCl/UV-Vis	PMS-22	mg/kg	2	<2.0	13.2	8.31	3.15
Phosphorus (Total)	HNO3/HCLO4 ICP	ICP-03	mg/kg	40	329	488	414	489
Organic Carbon (LECO)	LECO	R&L 6B3	%	0.05	1.73	0.51	0.64	0.89
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	1	15.0	19.7	17.3	14.9
Potassium (Available)	Bicarb/ICP	R&L 18A1	mg/kg	10	105	90.1	70.2	159
Sulphate-Sulphur	KCl40/ICP	R&L 10D1	mg/kg	3	7.28	15.1	7.81	7.41
Extractable Copper	DTPA/ICP	R&L 12A1	mg/kg	0.2	1.30	0.88	0.84	0.90
Extractable Zinc	DTPA/ICP	R&L 12A1	mg/kg	0.2	0.47	0.53	0.53	0.60
Extractable Manganese	DTPA/ICP	R&L 12A1	mg/kg	0.5	21.5	48.8	30.6	25.6
Extractable Iron	DTPA/ICP	R&L 12A1	mg/kg	0.5	13.2	12.6	10.1	11.7
Extractable Boron	Hot CaCl2/ICP	R&L 12C2	mg/kg	0.2	0.48	0.54	0.34	0.38
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	118	89.0	50.6	117
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	782	928	407	516
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	174	200	131	116
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	62.5	167	65.5	57.8
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	1	6.45	6.90	11.4	7.95
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.30	0.23	0.13	0.30
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	3.91	4.64	2.04	2.58
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	1.45	1.67	1.09	0.97
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.27	0.73	0.28	0.25

ANALYSIS REPORT

PROJECT NO: EW211809 **Location: 2079.21eRTIO HD1**

				CLIENT SAMPLE ID	BHT_13	BHT_14	BHT_15	HD2_01
				DEPTH				
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-13**	**211809-14**	**211809-15**	**211809-16**
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.07	0.08	0.13	0.09
ECEC	Calculation	PMS-15A1	cmol/kg	na	6.01	7.34	3.67	4.19
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	2.70	2.78	1.86	2.67
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.21	0.14	0.12	0.31
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	5.04	3.11	3.54	7.17
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	65.1	63.2	55.5	61.6
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	24.1	22.7	29.8	23.1
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	4.52	9.90	7.76	6.00
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	1.19	1.04	3.45	2.11
Exchangeable Potassium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Calcium	ICP-OES	R&L 15A2	mg/kg	20	NA	NA	NA	NA
Exchangeable Magnesium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Sodium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Potassium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Calcium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Magnesium	PMS-15A2	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Sodium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
ECEC	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Ca/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
K/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Potassium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Calcium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Magnesium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Sodium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Aluminium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Potassium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	NA

ANALYSIS REPORT

PROJECT NO: EW211809 **Location: 2079.21eRTIO HD1**

					BHT_13	BHT_14	BHT_15	HD2_01
			CLIENT SAMPLE ID					
			DEPTH					
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-13**	**211809-14**	**211809-15**	**211809-16**
Exchangeable Calcium	ICP-OES	R&L 15C1	mg/kg	20	NA	NA	NA	NA
Exchangeable Magnesium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	NA
Exchangeable Sodium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	NA
Exchangeable Potassium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Calcium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Magnesium	PMS-15C1	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Sodium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	NA
ECEC	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
Ca/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
K/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Potassium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Calcium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Magnesium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Sodium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Aluminium %	Calculation	PMS-15C1	%	na	1.58	1.69	2.79	1.95
Gravel >2.0mm	Sieve	ASTMD422-63	%	na	26.3	32.5	40.5	30.7
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	17.4	20.8	24.0	27.2
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	35.6	32.9	24.7	30.9
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	5.1	3.4	1.9	2.1
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	15.6	10.4	9.0	9.1

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

				CLIENT SAMPLE ID	HD2_02	HD2_03	HD2_04	HD2_05
				DEPTH				
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-17**	**211809-18**	**211809-19**	**211809-20**
Moisture Content (Oven Dry)	Oven-Dry	PMS-17	%	na	1.29	0.81	1.00	1.22
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	6.08	5.68	7.82	4.61
Chloride Soluble	DA	DAP-06	mg/kg	2	28.7	21.9	22.1	65.6
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.04	0.01	0.03	0.41
Total N (LECO)	LECO	R&L 7A5	mg/kg	50	999	335	131	720
Extractable Nitrate-N	DA	DAP-03	mg/kg	0.5	7.04	2.17	1.50	232
Ammonium - N (Ex)	ExKCl/UV-Vis	PMS-22	mg/kg	2	3.95	6.23	<2.0	10.4
Phosphorus (Total)	HNO3/HCLO4 ICP	ICP-03	mg/kg	40	474	468	225	601
Organic Carbon (LECO)	LECO	R&L 6B3	%	0.05	0.42	0.46	0.73	0.72
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	1	8.51	20.8	23.0	20.0
Potassium (Available)	Bicarb/ICP	R&L 18A1	mg/kg	10	188	91.1	80.7	209
Sulphate-Sulphur	KCl40/ICP	R&L 10D1	mg/kg	3	9.30	10.9	7.19	23.2
Extractable Copper	DTPA/ICP	R&L 12A1	mg/kg	0.2	1.00	0.78	1.00	2.20
Extractable Zinc	DTPA/ICP	R&L 12A1	mg/kg	0.2	0.81	0.59	0.95	1.29
Extractable Manganese	DTPA/ICP	R&L 12A1	mg/kg	0.5	47.7	37.2	12.3	59.4
Extractable Iron	DTPA/ICP	R&L 12A1	mg/kg	0.5	24.4	11.1	8.58	12.6
Extractable Boron	Hot CaCl2/ICP	R&L 12C2	mg/kg	0.2	0.50	0.32	0.38	0.72
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	177	96.3	36.3	183
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	935	351	730	877
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	156	95.3	123	98.2
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	41.6	33.3	52.4	53.7
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	1	3.15	9.45	<1.00	17.7
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.45	0.25	0.09	0.47
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	4.68	1.76	3.65	4.39
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	1.30	0.79	1.03	0.82
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.18	0.14	0.23	0.23

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

				CLIENT SAMPLE ID	HD2_02	HD2_03	HD2_04	HD2_05
				DEPTH				
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-17**	**211809-18**	**211809-19**	**211809-20**
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.04	0.11	0.01	0.20
ECEC	Calculation	PMS-15A1	cmol/kg	na	6.64	3.05	5.01	6.10
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	3.60	2.21	3.56	5.36
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.35	0.31	0.09	0.57
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	6.83	8.11	1.86	7.69
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	70.4	57.6	72.9	71.9
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	19.6	26.1	20.5	13.4
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	2.72	4.75	4.55	3.83
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	0.53	3.45	0.22	3.22
Exchangeable Potassium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	163
Exchangeable Calcium	ICP-OES	R&L 15A2	mg/kg	20	NA	NA	NA	611
Exchangeable Magnesium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	80.9
Exchangeable Sodium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	42.1
Exchangeable Potassium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	0.42
Exchangeable Calcium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	3.06
Exchangeable Magnesium	PMS-15A2	PMS-15A2	cmol/kg	na	NA	NA	NA	0.67
Exchangeable Sodium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	0.18
ECEC	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	4.53
Ca/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	4.53
K/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	0.62
Exchangeable Potassium %	Calculation	PMS-15A2	%	na	NA	NA	NA	9.23
Exchangeable Calcium %	Calculation	PMS-15A2	%	na	NA	NA	NA	67.5
Exchangeable Magnesium %	Calculation	PMS-15A2	%	na	NA	NA	NA	14.9
Exchangeable Sodium %	Calculation	PMS-15A2	%	na	NA	NA	NA	4.04
Exchangeable Aluminium %	Calculation	PMS-15A2	%	na	NA	NA	NA	4.34
Exchangeable Potassium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	43.1	NA

ANALYSIS REPORT

PROJECT NO: EW211809 **Location: 2079.21eRTIO HD1**

					HD2_02	HD2_03	HD2_04	HD2_05
			CLIENT SAMPLE ID					
			DEPTH					
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-17**	**211809-18**	**211809-19**	**211809-20**
Exchangeable Calcium	ICP-OES	R&L 15C1	mg/kg	20	NA	NA	355	NA
Exchangeable Magnesium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	117	NA
Exchangeable Sodium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	34.6	NA
Exchangeable Potassium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	0.11	NA
Exchangeable Calcium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	1.78	NA
Exchangeable Magnesium	PMS-15C1	PMS-15C1	cmol/kg	na	NA	NA	0.98	NA
Exchangeable Sodium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	0.15	NA
ECEC	Calculation	PMS-15C1	cmol/kg	na	NA	NA	3.02	NA
Ca/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA	1.82	NA
K/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA	0.11	NA
Exchangeable Potassium %	Calculation	PMS-15C1	%	na	NA	NA	3.66	NA
Exchangeable Calcium %	Calculation	PMS-15C1	%	na	NA	NA	58.7	NA
Exchangeable Magnesium %	Calculation	PMS-15C1	%	na	NA	NA	32.3	NA
Exchangeable Sodium %	Calculation	PMS-15C1	%	na	NA	NA	4.98	NA
Exchangeable Aluminium %	Calculation	PMS-15C1	%	na	0.77	2.31	0.37	6.51
Gravel >2.0mm	Sieve	ASTMD422-63	%	na	33.2	52.0	29.3	9.0
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	19.9	9.5	31.7	24.2
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	35.1	29.8	23.9	33.6
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	3.2	2.3	5.9	10.5
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	8.6	6.4	9.3	22.6

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

			CLIENT SAMPLE ID		HD2_06	HD2_07	HD2_08	HD2_09
			DEPTH					
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-21**	**211809-22**	**211809-23**	**211809-24**
Moisture Content (Oven Dry)	Oven-Dry	PMS-17	%	na	1.10	1.09	0.85	1.44
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	5.60	6.53	6.12	6.47
Chloride Soluble	DA	DAP-06	mg/kg	2	20.2	19.1	12.6	18.8
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.06	0.02	0.02	0.02
Total N (LECO)	LECO	R&L 7A5	mg/kg	50	497	114	189	645
Extractable Nitrate-N	DA	DAP-03	mg/kg	0.5	15.1	3.63	5.22	3.06
Ammonium - N (Ex)	ExKCl/UV-Vis	PMS-22	mg/kg	2	4.04	3.95	3.15	2.07
Phosphorus (Total)	HNO3/HCLO4 ICP	ICP-03	mg/kg	40	483	394	326	568
Organic Carbon (LECO)	LECO	R&L 6B3	%	0.05	0.61	0.90	0.58	1.02
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	1	17.1	19.7	27.4	32.5
Potassium (Available)	Bicarb/ICP	R&L 18A1	mg/kg	10	144	90.6	68.2	431
Sulphate-Sulphur	KCl40/ICP	R&L 10D1	mg/kg	3	15.6	8.41	6.71	6.46
Extractable Copper	DTPA/ICP	R&L 12A1	mg/kg	0.2	2.94	0.82	1.00	2.92
Extractable Zinc	DTPA/ICP	R&L 12A1	mg/kg	0.2	1.21	0.53	0.59	3.99
Extractable Manganese	DTPA/ICP	R&L 12A1	mg/kg	0.5	45.8	26.3	42.8	34.8
Extractable Iron	DTPA/ICP	R&L 12A1	mg/kg	0.5	12.5	7.68	11.6	12.0
Extractable Boron	Hot CaCl2/ICP	R&L 12C2	mg/kg	0.2	0.50	0.46	0.28	0.46
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	156	50.7	50.3	460
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	726	418	473	1047
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	101	152	111	198
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	66.8	93.8	85.8	60.6
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	1	14.4	16.5	12.8	7.20
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.40	0.13	0.13	1.18
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	3.63	2.09	2.37	5.24
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	0.84	1.27	0.93	1.65
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.29	0.41	0.37	0.26

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

				CLIENT SAMPLE ID	HD2_06	HD2_07	HD2_08	HD2_09
				DEPTH				
Test Parameter	Method Description	Method Reference	Units	LOR	211809-21	211809-22	211809-23	211809-24
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.16	0.18	0.14	0.08
ECEC	Calculation	PMS-15A1	cmol/kg	na	5.32	4.08	3.93	8.41
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	4.31	1.65	2.56	3.17
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.48	0.10	0.14	0.71
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	7.52	3.19	3.28	14.0
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	68.2	51.3	60.1	62.3
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	15.8	31.1	23.5	19.6
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	5.46	10.0	9.48	3.13
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	3.01	4.50	3.61	0.95
Exchangeable Potassium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Calcium	ICP-OES	R&L 15A2	mg/kg	20	NA	NA	NA	NA
Exchangeable Magnesium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Sodium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Potassium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Calcium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Magnesium	PMS-15A2	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Sodium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
ECEC	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Ca/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
K/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Potassium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Calcium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Magnesium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Sodium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Aluminium %	Calculation	PMS-15A2	%	na	3.53	4.05	3.14	1.77
Exchangeable Potassium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	NA

ANALYSIS REPORT

PROJECT NO: EW211809 **Location: 2079.21eRTIO HD1**

					HD2_06	HD2_07	HD2_08	HD2_09
			CLIENT SAMPLE ID					
			DEPTH					
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-21**	**211809-22**	**211809-23**	**211809-24**
Exchangeable Calcium	ICP-OES	R&L 15C1	mg/kg	20	NA	NA	NA	NA
Exchangeable Magnesium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	NA
Exchangeable Sodium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	NA
Exchangeable Potassium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Calcium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Magnesium	PMS-15C1	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Sodium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	NA
ECEC	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
Ca/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
K/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Potassium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Calcium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Magnesium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Sodium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Aluminium %	Calculation	PMS-15C1	%	na	5.29	6.07	4.71	2.65
Gravel >2.0mm	Sieve	ASTMD422-63	%	na	22.0	42.0	29.8	7.2
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	23.1	18.9	28.6	21.6
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	29.4	26.9	30.3	33.6
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	7.6	2.7	3.3	13.1
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	17.8	9.4	7.9	24.5

ANALYSIS REPORT

PROJECT NO: EW211809 **Location: 2079.21eRTIO HD1**

				CLIENT SAMPLE ID	HD2_10	HD2_11	HD2_12	HD2_13
				DEPTH				
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-25**	**211809-26**	**211809-27**	**211809-28**
Moisture Content (Oven Dry)	Oven-Dry	PMS-17	%	na	1.40	0.90	0.94	1.02
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	6.76	5.96	5.40	5.76
Chloride Soluble	DA	DAP-06	mg/kg	2	14.6	29.8	20.6	16.6
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.01	0.09	0.02	0.02
Total N (LECO)	LECO	R&L 7A5	mg/kg	50	300	887	391	426
Extractable Nitrate-N	DA	DAP-03	mg/kg	0.5	1.42	31.3	2.71	7.35
Ammonium - N (Ex)	ExKCl/UV-Vis	PMS-22	mg/kg	2	3.24	<2.0	2.16	<2.0
Phosphorus (Total)	HNO3/HCLO4 ICP	ICP-03	mg/kg	40	373	482	351	348
Organic Carbon (LECO)	LECO	R&L 6B3	%	0.05	0.64	0.92	0.54	0.79
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	1	42.2	12.1	20.4	22.6
Potassium (Available)	Bicarb/ICP	R&L 18A1	mg/kg	10	228	140	67.2	97.0
Sulphate-Sulphur	KCl40/ICP	R&L 10D1	mg/kg	3	6.94	13.6	10.3	7.84
Extractable Copper	DTPA/ICP	R&L 12A1	mg/kg	0.2	3.46	3.49	1.90	2.70
Extractable Zinc	DTPA/ICP	R&L 12A1	mg/kg	0.2	3.91	2.17	0.65	0.89
Extractable Manganese	DTPA/ICP	R&L 12A1	mg/kg	0.5	18.2	22.8	28.1	13.7
Extractable Iron	DTPA/ICP	R&L 12A1	mg/kg	0.5	9.24	8.80	13.7	9.10
Extractable Boron	Hot CaCl2/ICP	R&L 12C2	mg/kg	0.2	0.30	0.70	0.34	0.46
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	253	144	42.2	102
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	1253	809	495	521
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	322	130	156	110
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	82.8	97.5	84.6	41.1
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	1	2.25	5.85	7.20	8.40
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.65	0.37	0.11	0.26
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	6.27	4.05	2.48	2.61
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	2.68	1.08	1.30	0.92
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.36	0.42	0.37	0.18

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

				CLIENT SAMPLE ID	HD2_10	HD2_11	HD2_12	HD2_13
				DEPTH				
Test Parameter	Method Description	Method Reference	Units	LOR	211809-25	211809-26	211809-27	211809-28
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.03	0.07	0.08	0.09
ECEC	Calculation	PMS-15A1	cmol/kg	na	9.98	5.99	4.33	4.06
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	2.33	3.73	1.90	2.84
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.24	0.34	0.08	0.29
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	6.50	6.17	2.50	6.45
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	62.8	67.6	57.1	64.2
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	26.9	18.1	30.0	22.6
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	3.61	7.08	8.49	4.41
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	0.25	1.09	1.85	2.30
Exchangeable Potassium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Calcium	ICP-OES	R&L 15A2	mg/kg	20	NA	NA	NA	NA
Exchangeable Magnesium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Sodium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Potassium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Calcium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Magnesium	PMS-15A2	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Sodium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
ECEC	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Ca/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
K/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Potassium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Calcium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Magnesium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Sodium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Aluminium %	Calculation	PMS-15A2	%	na	0.55	1.44	1.77	2.06
Exchangeable Potassium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	NA

ANALYSIS REPORT

PROJECT NO: EW211809 **Location: 2079.21eRTIO HD1**

				CLIENT SAMPLE ID	HD2_10	HD2_11	HD2_12	HD2_13
				DEPTH				
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-25**	**211809-26**	**211809-27**	**211809-28**
Exchangeable Calcium	ICP-OES	R&L 15C1	mg/kg	20	NA	NA	NA	NA
Exchangeable Magnesium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	NA
Exchangeable Sodium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	NA
Exchangeable Potassium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Calcium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Magnesium	PMS-15C1	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Sodium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	NA
ECEC	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
Ca/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
K/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Potassium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Calcium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Magnesium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Sodium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Aluminium %	Calculation	PMS-15C1	%	na	0.83	2.15	2.65	3.09
Gravel >2.0mm	Sieve	ASTMD422-63	%	na	13.3	11.0	24.6	16.5
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	23.1	20.2	15.0	16.4
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	40.8	34.8	36.8	36.9
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	10.1	7.6	5.1	7.1
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	12.8	26.3	18.5	23.0

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

				CLIENT SAMPLE ID	HD2_14	HD2_15	HD2_16	HD2_17
				DEPTH				
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-29**	**211809-30**	**211809-31**	**211809-32**
Moisture Content (Oven Dry)	Oven-Dry	PMS-17	%	na	1.30	1.08	1.11	1.35
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	5.49	6.13	5.40	6.19
Chloride Soluble	DA	DAP-06	mg/kg	2	20.3	17.6	16.7	14.5
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.03	0.02	0.03	0.03
Total N (LECO)	LECO	R&L 7A5	mg/kg	50	277	455	309	628
Extractable Nitrate-N	DA	DAP-03	mg/kg	0.5	7.58	4.33	4.63	2.94
Ammonium - N (Ex)	ExKCl/UV-Vis	PMS-22	mg/kg	2	2.25	5.45	2.79	2.34
Phosphorus (Total)	HNO3/HCLO4 ICP	ICP-03	mg/kg	40	426	432	382	292
Organic Carbon (LECO)	LECO	R&L 6B3	%	0.05	0.68	0.94	0.68	1.07
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	1	13.2	26.7	26.2	10.1
Potassium (Available)	Bicarb/ICP	R&L 18A1	mg/kg	10	70.0	67.5	70.3	200
Sulphate-Sulphur	KCl40/ICP	R&L 10D1	mg/kg	3	8.83	9.00	13.1	8.50
Extractable Copper	DTPA/ICP	R&L 12A1	mg/kg	0.2	2.14	1.42	3.08	3.70
Extractable Zinc	DTPA/ICP	R&L 12A1	mg/kg	0.2	1.19	0.57	1.83	4.14
Extractable Manganese	DTPA/ICP	R&L 12A1	mg/kg	0.5	26.9	41.3	23.2	38.9
Extractable Iron	DTPA/ICP	R&L 12A1	mg/kg	0.5	10.7	11.3	8.28	12.6
Extractable Boron	Hot CaCl2/ICP	R&L 12C2	mg/kg	0.2	0.30	0.42	0.37	0.54
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	76.3	58.3	62.5	202
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	474	593	554	851
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	146	131	107	152
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	30.3	69.3	74.7	48.3
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	1	4.80	2.35	26.1	14.5
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.20	0.15	0.16	0.52
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	2.37	2.97	2.77	4.26
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	1.22	1.09	0.89	1.27
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.13	0.30	0.32	0.21

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

				CLIENT SAMPLE ID	HD2_14	HD2_15	HD2_16	HD2_17
				DEPTH				
Test Parameter	Method Description	Method Reference	Units	LOR	211809-29	211809-30	211809-31	211809-32
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.05	0.03	0.29	0.16
ECEC	Calculation	PMS-15A1	cmol/kg	na	3.97	4.53	4.44	6.41
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	1.95	2.72	3.11	3.36
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.16	0.14	0.18	0.41
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	4.93	3.30	3.61	8.08
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	59.7	65.4	62.4	66.4
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	30.7	24.1	20.1	19.8
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	3.32	6.65	7.32	3.28
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	1.34	0.58	6.54	2.51
Exchangeable Potassium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Calcium	ICP-OES	R&L 15A2	mg/kg	20	NA	NA	NA	NA
Exchangeable Magnesium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Sodium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Potassium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Calcium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Magnesium	PMS-15A2	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Sodium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
ECEC	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Ca/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
K/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Potassium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Calcium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Magnesium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Sodium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Aluminium %	Calculation	PMS-15A2	%	na	1.18	0.58	6.41	3.56
Exchangeable Potassium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	NA

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

					HD2_14	HD2_15	HD2_16	HD2_17
			CLIENT SAMPLE ID					
			DEPTH					
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-29**	**211809-30**	**211809-31**	**211809-32**
Exchangeable Calcium	ICP-OES	R&L 15C1	mg/kg	20	NA	NA	NA	NA
Exchangeable Magnesium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	NA
Exchangeable Sodium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	NA
Exchangeable Potassium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Calcium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Magnesium	PMS-15C1	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Sodium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	NA
ECEC	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
Ca/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
K/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	NA
Exchangeable Potassium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Calcium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Magnesium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Sodium %	Calculation	PMS-15C1	%	na	NA	NA	NA	NA
Exchangeable Aluminium %	Calculation	PMS-15C1	%	na	1.76	0.86	9.60	5.33
Gravel >2.0mm	Sieve	ASTMD422-63	%	na	15.5	37.1	20.0	23.0
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	23.4	20.0	20.6	21.6
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	31.7	28.4	33.0	32.8
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	5.5	4.1	6.9	3.8
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	23.9	10.4	19.5	18.8

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

				CLIENT SAMPLE ID	HD2_18	HD2_19	HD2_20	HD2_21
				DEPTH				
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-33**	**211809-34**	**211809-35**	**211809-36**
Moisture Content (Oven Dry)	Oven-Dry	PMS-17	%	na	1.01	1.20	1.09	1.53
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	5.28	5.34	5.94	7.95
Chloride Soluble	DA	DAP-06	mg/kg	2	14.3	38.7	19.3	23.9
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.02	0.08	0.04	0.11
Total N (LECO)	LECO	R&L 7A5	mg/kg	50	379	482	758	1252
Extractable Nitrate-N	DA	DAP-03	mg/kg	0.5	3.73	12.1	10.3	4.12
Ammonium - N (Ex)	ExKCl/UV-Vis	PMS-22	mg/kg	2	2.34	10.2	4.61	<2.0
Phosphorus (Total)	HNO3/HCLO4 ICP	ICP-03	mg/kg	40	442	279	374	603
Organic Carbon (LECO)	LECO	R&L 6B3	%	0.05	0.93	1.02	1.51	1.43
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	1	16.4	35.6	8.72	21.4
Potassium (Available)	Bicarb/ICP	R&L 18A1	mg/kg	10	126	75.4	105	302
Sulphate-Sulphur	KCl40/ICP	R&L 10D1	mg/kg	3	9.72	18.2	9.53	8.70
Extractable Copper	DTPA/ICP	R&L 12A1	mg/kg	0.2	2.60	2.18	1.18	1.66
Extractable Zinc	DTPA/ICP	R&L 12A1	mg/kg	0.2	1.29	0.89	0.81	0.83
Extractable Manganese	DTPA/ICP	R&L 12A1	mg/kg	0.5	36.5	19.5	34.1	18.4
Extractable Iron	DTPA/ICP	R&L 12A1	mg/kg	0.5	10.6	17.2	14.7	8.28
Extractable Boron	Hot CaCl2/ICP	R&L 12C2	mg/kg	0.2	0.56	0.64	0.36	0.94
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	135	55.3	113	305
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	527	785	805	3026
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	78.9	173	124	208
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	76.0	55.3	61.7	82.9
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	1	13.6	7.20	2.70	<1.00
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.35	0.14	0.29	0.78
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	2.64	3.93	4.03	15.1
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	0.66	1.44	1.03	1.73
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.33	0.24	0.27	0.36

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

				CLIENT SAMPLE ID	HD2_18	HD2_19	HD2_20	HD2_21
				DEPTH				
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-33**	**211809-34**	**211809-35**	**211809-36**
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.15	0.08	0.03	0.01
ECEC	Calculation	PMS-15A1	cmol/kg	na	4.12	5.83	5.65	18.0
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	4.01	2.72	3.90	8.73
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.53	0.10	0.28	0.45
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	8.40	2.43	5.13	4.34
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	64.0	67.3	71.3	84.0
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	16.0	24.7	18.3	9.62
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	8.02	4.12	4.75	2.00
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	3.67	1.37	0.53	0.06
Exchangeable Potassium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Calcium	ICP-OES	R&L 15A2	mg/kg	20	NA	NA	NA	NA
Exchangeable Magnesium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Sodium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA	NA	NA
Exchangeable Potassium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Calcium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Magnesium	PMS-15A2	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Sodium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA	NA	NA
ECEC	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Ca/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
K/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA	NA	NA
Exchangeable Potassium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Calcium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Magnesium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Sodium %	Calculation	PMS-15A2	%	na	NA	NA	NA	NA
Exchangeable Aluminium %	Calculation	PMS-15A2	%	na	3.34	1.77	0.66	0.25
Exchangeable Potassium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	292

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

					HD2_18	HD2_19	HD2_20	HD2_21
			CLIENT SAMPLE ID					
			DEPTH					
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-33**	**211809-34**	**211809-35**	**211809-36**
Exchangeable Calcium	ICP-OES	R&L 15C1	mg/kg	20	NA	NA	NA	1475
Exchangeable Magnesium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	158
Exchangeable Sodium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA	NA	46.4
Exchangeable Potassium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	0.75
Exchangeable Calcium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	7.38
Exchangeable Magnesium	PMS-15C1	PMS-15C1	cmol/kg	na	NA	NA	NA	1.32
Exchangeable Sodium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA	NA	0.20
ECEC	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	9.65
Ca/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	5.60
K/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA	NA	0.57
Exchangeable Potassium %	Calculation	PMS-15C1	%	na	NA	NA	NA	7.76
Exchangeable Calcium %	Calculation	PMS-15C1	%	na	NA	NA	NA	76.4
Exchangeable Magnesium %	Calculation	PMS-15C1	%	na	NA	NA	NA	13.6
Exchangeable Sodium %	Calculation	PMS-15C1	%	na	NA	NA	NA	2.09
Exchangeable Aluminium %	Calculation	PMS-15C1	%	na	5.00	2.65	0.99	0.12
Gravel >2.0mm	Sieve	ASTMD422-63	%	na	13.9	23.9	33.9	26.8
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	26.8	18.4	22.9	22.5
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	34.1	36.4	30.3	31.7
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	6.9	4.9	3.2	5.0
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	18.2	16.4	9.7	14.0

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

				CLIENT SAMPLE ID	HD2_22	HD2_23		
				DEPTH				
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-37**	**211809-38**		
Moisture Content (Oven Dry)	Oven-Dry	PMS-17	%	na	0.87	1.08		
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	5.84	5.90		
Chloride Soluble	DA	DAP-06	mg/kg	2	22.1	17.0		
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.04	0.01		
Total N (LECO)	LECO	R&L 7A5	mg/kg	50	481	323		
Extractable Nitrate-N	DA	DAP-03	mg/kg	0.5	11.8	1.06		
Ammonium - N (Ex)	ExKCl/UV-Vis	PMS-22	mg/kg	2	3.06	<2.0		
Phosphorus (Total)	HNO3/HCLO4 ICP	ICP-03	mg/kg	40	442	283		
Organic Carbon (LECO)	LECO	R&L 6B3	%	0.05	0.95	0.54		
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	1	12.8	20.7		
Potassium (Available)	Bicarb/ICP	R&L 18A1	mg/kg	10	99.7	90.5		
Sulphate-Sulphur	KCl40/ICP	R&L 10D1	mg/kg	3	8.62	8.83		
Extractable Copper	DTPA/ICP	R&L 12A1	mg/kg	0.2	1.22	0.76		
Extractable Zinc	DTPA/ICP	R&L 12A1	mg/kg	0.2	0.75	0.55		
Extractable Manganese	DTPA/ICP	R&L 12A1	mg/kg	0.5	48.6	30.9		
Extractable Iron	DTPA/ICP	R&L 12A1	mg/kg	0.5	15.8	8.20		
Extractable Boron	Hot CaCl2/ICP	R&L 12C2	mg/kg	0.2	0.36	0.22		
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	97.7	94.3		
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	755	449		
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	138	131		
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	11.5	22.2		
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	1	1.65	9.15		
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.25	0.24		
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	3.78	2.25		
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	1.15	1.09		
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.05	0.10		

ANALYSIS REPORT

PROJECT NO: EW211809 Location: 2079.21eRTIO HD1

				CLIENT SAMPLE ID	HD2_22	HD2_23		
				DEPTH				
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-37**	**211809-38**		
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.02	0.10		
ECEC	Calculation	PMS-15A1	cmol/kg	na	5.24	3.78		
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	3.28	2.06		
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.22	0.22		
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	4.78	6.40		
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	72.0	59.4		
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	21.9	28.9		
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	0.95	2.56		
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	0.35	2.69		
Exchangeable Potassium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA		
Exchangeable Calcium	ICP-OES	R&L 15A2	mg/kg	20	NA	NA		
Exchangeable Magnesium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA		
Exchangeable Sodium	ICP-OES	R&L 15A2	mg/kg	10	NA	NA		
Exchangeable Potassium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA		
Exchangeable Calcium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA		
Exchangeable Magnesium	PMS-15A2	PMS-15A2	cmol/kg	na	NA	NA		
Exchangeable Sodium	R&L 15A2	R&L 15A2	cmol/kg	na	NA	NA		
ECEC	Calculation	PMS-15A2	cmol/kg	na	NA	NA		
Ca/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA		
K/Mg Ratio	Calculation	PMS-15A2	cmol/kg	na	NA	NA		
Exchangeable Potassium %	Calculation	PMS-15A2	%	na	NA	NA		
Exchangeable Calcium %	Calculation	PMS-15A2	%	na	NA	NA		
Exchangeable Magnesium %	Calculation	PMS-15A2	%	na	NA	NA		
Exchangeable Sodium %	Calculation	PMS-15A2	%	na	NA	NA		
Exchangeable Aluminium %	Calculation	PMS-15A2	%	na	0.40	2.25		
Exchangeable Potassium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA		

ANALYSIS REPORT

PROJECT NO: EW211809 **Location: 2079.21eRTIO HD1**

				CLIENT SAMPLE ID	HD2_22	HD2_23		
				DEPTH				
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**211809-37**	**211809-38**		
Exchangeable Calcium	ICP-OES	R&L 15C1	mg/kg	20	NA	NA		
Exchangeable Magnesium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA		
Exchangeable Sodium	ICP-OES	R&L 15C1	mg/kg	10	NA	NA		
Exchangeable Potassium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA		
Exchangeable Calcium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA		
Exchangeable Magnesium	PMS-15C1	PMS-15C1	cmol/kg	na	NA	NA		
Exchangeable Sodium	R&L 15C1	R&L 15C1	cmol/kg	na	NA	NA		
ECEC	Calculation	PMS-15C1	cmol/kg	na	NA	NA		
Ca/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA		
K/Mg Ratio	Calculation	PMS-15C1	cmol/kg	na	NA	NA		
Exchangeable Potassium %	Calculation	PMS-15C1	%	na	NA	NA		
Exchangeable Calcium %	Calculation	PMS-15C1	%	na	NA	NA		
Exchangeable Magnesium %	Calculation	PMS-15C1	%	na	NA	NA		
Exchangeable Sodium %	Calculation	PMS-15C1	%	na	NA	NA		
Exchangeable Aluminium %	Calculation	PMS-15C1	%	na	0.19	1.05		
Gravel >2.0mm	Sieve	ASTMD422-63	%	na	34.3	52.3		
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	18.1	10.3		
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	32.4	27.6		
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	3.2	2.4		
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	12.0	7.4		

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Soils are air dried at 40°C and ground <2mm.

NB: LOR is the Lowest Obtainable Reading.

DOCUMENT END

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Date Received: 29/12/2021
Date Completed: 8/2/2022

FINAL REPORT

Project:

2079.21e RTIO HD1

All results in this report relate only to the items tested. Results are expressed on an "as received basis".

Client Name: Landloch Pty Ltd

Contact: Anna Reed

Sample Type: soil

Number of samples: 38

Agricultural Chemistry Pty Ltd

Soil Analysis Report
Batch Number: 22/01

Date Received: 29/12/2021
Date Completed: 8/2/2022

Client: Landloch Pty Ltd

Lab No	Sample ID	Depth	K-Sat	Vol Drained	Time	1/3 bar	15 bar
		cm	cm/hr	mls	min	%	%
1	BHT_01		103.3	1800	9	13	8
2	BHT_02		7.4	860	60	14	8
3	BHT_03		89.2	1900	11	14	9
4	BHT_04		156.4	1600	10	18	10
5	BHT_05		38.2	1480	20	16	9
6	BHT_06		57.6	1450	13	15	9
7	BHT_07		50.6	1470	15	18	12
8	BHT_08		0.65	150	120	16	9
9	BHT_09		0.65	150	120	14	7
10	BHT_10		0.90	210	120	21	13
11	BHT_11		40.9	1900	24	14	9
12	BHT_12		0.75	175	120	12	6
13	BHT_13		0.95	220	120	16	9
14	BHT_14		1.85	430	120	14	8
15	BHT_15		0.77	180	120	15	9
16	HD2_01		1.38	320	120	13	9
17	HD2_02		0.90	210	120	19	10
18	HD2_03		0.84	196	120	15	9
19	HD2_04		0.95	220	120	17	10
20	HD2_05		2.9	675	120	17	11
21	HD2_06		2.8	650	120	17	11
22	HD2_07		1.18	275	120	14	10
23	HD2_08		1.08	250	120	12	8
24	HD2_09		0.41	95	120	24	12
25	HD2_10		0.44	102	120	16	10
26	HD2_11		1.79	415	120	18	12
27	HD2_12		1.23	285	120	16	11
28	HD2_13		2.43	565	120	15	11
29	HD2_14		0.95	220	120	17	11
30	HD2_15		0.56	130	120	17	10
31	HD2_16		1.94	450	120	16	11
32	HD2_17		1.91	445	120	17	12
33	HD2_18		1.12	260	120	16	10
34	HD2_19		1.42	330	120	16	11
35	HD2_20		1.59	370	120	17	10
36	HD2_21		1.05	245	120	23	13
37	HD2_22		0.89	206	120	20	10
38	HD2_23		1.76	410	120	18	9

METHOD DESCRIPTIONS

Soil

Methods used to Analyse Samples

Analyte	ALHS*	Uncertainty %	LOQ	Unit	Name	Method Description
pH	4A1	1.1	0.1	pH	pH	1:5 water extr, pH meter
EC	3A1	5.4	0.01	dS/m	Electrical conductivity	1:5 water extr, EC meter
Cl	5A2	10.0	10.0	mg/kg	Chloride	1:5 water extr, (AA) colorimetric
NO3-N	7C2	6.7	1.0	mg/kg	Nitrate-nitrogen	1:5 water extr, (AA) colorimetric
NH4-N	7C2	7.8	0.6	mg/kg	Ammonium-nitrogen	1M KCl extr, (AA) colorimetric
Bicarb.P	9B2	16.8	1.0	mg/kg	Bicarb.ext.phosphorus	0.5M NaHCO3 @ pH 8.5, (AA) colorimetric
TN	7A2	12.9	0.01	%	Total Kjeldahl Nitrogen	Sulphuric acid digest, (AA) colorimetric
OC	8B1	9.7	0.02	%	Organic Carbon	Walkley & Black, (H2SO4/K2Cr2O7), titr.
Ca (Neut)	15A1	10.3	0.10	meq/100g	Exchangeable calcium	1M NH4Cl @ pH 7.0 shake, AAS
Mg (Neut)	15A1	6.6	0.10	meq/100g	Exchangeable magnesium	1M NH4Cl @ pH 7.0 shake, AAS
Na (Neut)	15A1	7.3	0.03	meq/100g	Exchangeable sodium	1M NH4Cl @ pH 7.0 shake, AAS
K (Neut)	15A1	3.9	0.02	meq/100g	Exchangeable potassium	1M NH4Cl @ pH 7.0 shake, AAS
ECEC	15J1	5.0	1	meq/100g	Effective cation ex.capacity	Sum of exchangeable cations
ESP	15N1	5.0	3	%	Exchangeable Na%	(Exchangeable Na/sum of exch.cations)%
Sand	no ref	22.1	1.0	%	Particle size, sand	Hydrometer, gravimetric
Silt	no ref	16.6	1.0	%	Particle size, silt	Hydrometer, gravimetric
Clay	no ref	12.7	1.0	%	Particle size, clay	Hydrometer, gravimetric

*** Australian Laboratory Handbook of Soil and Water Chemical Methods (1992)**

For Manager
Analytical Services: _____

Agricultural Chemistry Pty Ltd

METHOD DESCRIPTIONS

Soil

Methods used to Analyse Samples

Analyte	ALHS*	Uncertainty %	LOQ	Unit	Name	Method Description
Ca (Alc)	15C1	7.2	0.18	meq/100g	Exchangeable calcium	1M NH4Cl (alcoholic) @ pH 8.5 leach, AAS
Mg (Alc)	15C1	4.7	0.31	meq/100g	Exchangeable magnesium	1M NH4Cl (alcoholic) @ pH 8.5 leach, AAS
Na (Alc)	15C1	9.6	0.09	meq/100g	Exchangeable sodium	1M NH4Cl (alcoholic) @ pH 8.5 leach, AAS
K (Alc)	15C1	4.8	0.02	meq/100g	Exchangeable potassium	1M NH4Cl (alcoholic) @ pH 8.5 leach, AAS
CEC	15I3	5.7	1.0	meq/100g	Cation Exchange Capacity	KNO3 + Ca(NO3)2 extr, (AA) colorimetric
DTPA-Cu	12A1	17.1	0.26	mg/kg	DTPA ext. copper	DTPA extraction, AAS
DTPA-Zn	12A1	16.4	0.10	mg/kg	DTPA ext. zinc	DTPA extraction, AAS
DTPA-Mn	12A1	9.0	0.32	mg/kg	DTPA ext. manganese	DTPA extraction, AAS
DTPA-Fe	12A1	13.0	0.23	mg/kg	DTPA ext. iron	DTPA extraction, AAS
ADMC	2A1	11.9	0.4	%	Air Dried Moisture Content	Gravimetric oven dry @ 105C
R1	NA	20.2	NA		Dispersion Ratio	Ratio [Aqueous dispersible (Silt + Clay):Total (Silt + Clay)]
SO4-S	10B3	11.5	0.6	mg/kg	Sulfate sulfur	Ca(H2PO4)2 @ pH 4.0 extractable sulfate-sulfur, ICPOES
Al	15G1	NA	NA	meq/100g	Exchangeable Aluminium	Exch. Hydrogen and Aluminium by 1M KCl
H+	15G1	NA	NA	meq/100g	Exchangeable Acidity	Exch. Hydrogen and Aluminium by 1M KCl
15 Bar		NA	NA		15 Bar Analysis	Pressure Plate/Gravimetric oven dry @ 105C
1/3 Bar		NA	NA		1/3 Bar Analysis	Pressure Plate/Gravimetric oven dry @ 105C
Permeability	AS 4419			cm/hr	Permeability	

*** Australian Laboratory Handbook of Soil and Water Chemical Methods (1992)**

For Manager
Analytical Services: _____

Agricultural Chemistry Pty Ltd

QUALITY CONTROL DATA

Reference: 22/01

Soil

*** Australian Laboratory Handbook of Soil and Water Chemical Methods (1992)**

Test Method	Units		Actual Value	Acceptance Criteria [Range]
pH	pH	MB		7.5 - 8.1
EC	dS/m	MB		.120 - .145
Cl	mg/kg	MB		30 - 40
NO3-N	mg/kg	MB		1.5 - 4.1
NH4-N	mg/kg			
Bicarb.P	mg/kg	MB		58 - 75
Total N	%	114-08		.414 - .600
Total P	%	114-08		.189 - .230
Organic Carbon	%	MB		2.3 - 2.8
Ca (Exch. cations)pH7	meq/100g	KAL		17.2 - 20.9
Mg (Exch. cations)pH7	meq/100g	KAL		9.9 - 11.5
Na (Exch. cations)pH7	meq/100g	KAL		1.01 - 1.33
K (Exch. cations)pH7	meq/100g	KAL		.455 - .721
Exch. Acidity	meq/100g			
CEC	meq/100g	S12		58 - 73
Coarse sand	%	RD		29 -33
Fine Sand	%	RD		27 - 33
Silt	%	RD		11 - 16
Clay	%	RD		21 - 30
R1		RD		.40 - .57

Test Method	Units	Test Soil	Actual Value	Acceptance Criteria [Range]
DTPA-Cu	mg/kg	kal		1.55 - 2.10
DTPA-Zn	mg/kg	kal		.15 - .35
DTPA-Mn	mg/kg	kal		31.5 - 61.2
DTPA-Fe	mg/kg	kal		29.1 - 46.3
Suflate-sulfur	mg/kg	PM		60 - 75
15 Bar	%	G	28, 28, 30, 30	23 - 32
0.33 Bar	%	G	45, 47, 48, 50	38 - 52
1 Bar	%	G		36 - 45
3 Bar	%	G		30 - 38
0.1 Bar	%	G		53 - 65
Saturation	%	G		64 - 78
Ca (Exch. cations)pH8.5	meq/100g	S12		27.7 - 37.4
Mg (Exch. cations)pH8.5	meq/100g	S12		22.88 - 26.5
Na (Exch. cations)pH8.5	meq/100g	S12		2.0 - 2.28
K (Exch. cations)pH8.5	meq/100g	S12		1.64 - 2.09

EMERSON DISPERSION TEST

CLIENT: RTIO Hope Downs 1
PROJECT: Hope Downs 2 Topsoil Suitability
PROJECT CODE: 2079.21e
MATERIAL: Growth media
DATE: 16/12/2021

SAMPLE ID	Description	SLAKING @ 2 HOURS Y/N	DISPERSION @ 2HOURS Y/N	DISPERSON @ 20 HOURS Y/N	REMOULD DISPERSION @ 2 HOURS Y/N	SHAKE TEST D/F	EMERSON CLASS -
BHT_01	Lower elevation, rock, minimal fine material	No aggregates	No aggregates	No aggregates	Y - SLIGHT	D	3
BHT_02	In lower elevation, rocky, minimal fine material	N	N	N	Y	D	3
BHT_03	Higher elevation, very rocky	No aggregates	No aggregates	No aggregates	Y - SLIGHT	D	3
BHT_04	Higher elevation, very rocky	No aggregates	No aggregates	No aggregates	N	D	5
BHT_05	Higher elevation, very rocky	No aggregates	No aggregates	No aggregates	Y	D	3
BHT_06	Higher elevation, very rocky, close to gully	No aggregates	No aggregates	No aggregates	N	D	5
BHT_07	Still high elevation, closer to	Y	N	N	Y - SLIGHT	D	3
BHT_08	Finer material with rocks	No aggregates	No aggregates	No aggregates	Y	D	3
BHT_09	Very rocky area, on side of hill	No aggregates	No aggregates	No aggregates	N	D	5
BHT_10	Very dry area, rocky material in higher elevation	No aggregates	No aggregates	No aggregates	N	D	5
BHT_11	Higher elevation, very rocky	No aggregates	No aggregates	No aggregates	Y	D	3
BHT_12	Finer material with rocks	Y	N	N	Y	D	3
BHT_13	Dirt like with roots	Y	N	N	Y	D	3
BHT_14	Higher elevation, very rocky	No aggregates	No aggregates	No aggregates	N	D	5
BHT_15	Higher elevation, very rocky, closer to a gully	No aggregates	No aggregates	No aggregates	Y	D	3

SAMPLE ID	Description	SLAKING @ 2 HOURS	DISPERSION @ 2HOURS	DISPERSON @ 20 HOURS	REMOULD DISPERSION @ 2 HOURS	SHAKE TEST	EMERSON CLASS
		Y/N	Y/N	Y/N	Y/N	D/F	-
HD2_01	On side of hill, recent bushfire through area, rocky material, little soil	No aggregates	No aggregates	No aggregates	Y	D	3
HD2_02	On side of hill, recent bushfire through area, rocky material, little soil	No aggregates	No aggregates	No aggregates	Y	D	3
HD2_03	Finer material with rocks, on lower elevation	No aggregates	No aggregates	No aggregates	N	D	5
HD2_04	Finer material with rocks, on lower elevation	No aggregates	No aggregates	No aggregates	Y	D	3
HD2_05	Finer soil, on lower elevation	Y	N	N	N	D	5
HD2_06	Finer material with rocks, on lower elevation	Y	N	N	N	D	5
HD2_07	Finer material with rocks, on lower elevation	No aggregates	No aggregates	No aggregates	Y - SLIGHT	D	3
HD2_08	Finer material with rocks, on lower elevation	No aggregates	No aggregates	No aggregates	Y - SLIGHT	D	3
HD2_09	Finer material with rocks, on lower elevation	Y	N	N	Y	D	3
HD2_10	Finer material with rocks, on lower elevation	Y	N	N	Y	D	3
HD2_11	Finer material with rocks, on lower elevation	N	N	N	Y - SLIGHT	D	3
HD2_12	Finer material with rocks, on lower elevation	Y	N	N	Y	D	3
HD2_13	Finer material with rocks, on lower elevation	Y	N	N	Y	D	3
HD2_14	Finer material with rocks, on lower elevation	Y	N	N	N	D	5
HD2_15	Finer material with rocks, on lower elevation	No aggregates	No aggregates	No aggregates	Y - SLIGHT	D	3
HD2_16	Finer material with rocks, on lower elevation	Y	N	N	N	D	5
HD2_17	Finer material with rocks, on lower elevation	Y	N	N	Y	D	3
HD2_18	Finer material with rocks, on lower elevation	Y	N	N	Y	D	3
HD2_19	Finer material with rocks, on lower elevation	N	N	N	N	D	5
HD2_20	Finer material with rocks, on lower elevation	No aggregates	No aggregates	No aggregates	Y	D	3
HD2_21	Finer material with rocks, on lower elevation	No aggregates	No aggregates	No aggregates	Y	D	3
HD2_22	Finer material with rocks, on lower elevation	No aggregates	No aggregates	No aggregates	Y	D	3
HD2_23	Finer material with rocks, on lower elevation	No aggregates	No aggregates	No aggregates	N	D	5

BASE PROPERTIES DATA

CLIENT NAME: RTIO Hope Downs 2
PROJECT NAME: Hope Downs 2 Topsoil Suitability
PROJECT CODE: 2079.21e
DATE: 16/12/2021

Sample ID	Description	Coarse Fragments >2mm
BHT_01	Lower elevation, rock, minimal fine material	70
BHT_02	In lower elevation, rocky, minimal fine material	72
BHT_03	Higher elevation, very rocky	69
BHT_04	Higher elevation, very rocky	73
BHT_05	Higher elevation, very rocky	77
BHT_06	Higher elevation, very rocky, close to gully	67
BHT_07	Still high elevation, closer to	64
BHT_08	Finer material with rocks	63
BHT_09	Very rocky area, on side of hill	67
BHT_10	Very dry area, rocky material in higher elevation	54
BHT_11	Higher elevation, very rocky	79
BHT_12	Finer material with rocks	59
BHT_13	Dirt like with roots	42
BHT_14	Higher elevation, very rocky	68
BHT_15	Higher elevation, very rocky, closer to a gully	57
HD2_01	On side of hill, recent bushfire through area, rocky material, little soil	74
HD2_02	On side of hill, recent bushfire through area, rocky material, little soil	74
HD2_03	Finer material with rocks, on lower elevation	79
HD2_04	Finer material with rocks, on lower elevation	48
HD2_05	Finer soil, on lower elevation	26
HD2_06	Finer material with rocks, on lower elevation	32
HD2_07	Finer material with rocks, on lower elevation	72
HD2_08	Finer material with rocks, on lower elevation	61
HD2_09	Finer material with rocks, on lower elevation	18
HD2_10	Finer material with rocks, on lower elevation	10
HD2_11	Finer material with rocks, on lower elevation	34
HD2_12	Finer material with rocks, on lower elevation	52
HD2_13	Finer material with rocks, on lower elevation	30
HD2_14	Finer material with rocks, on lower elevation	33
HD2_15	Finer material with rocks, on lower elevation	60
HD2_16	Finer material with rocks, on lower elevation	45
HD2_17	Finer material with rocks, on lower elevation	47
HD2_18	Finer material with rocks, on lower elevation	22
HD2_19	Finer material with rocks, on lower elevation	60
HD2_20	Finer material with rocks, on lower elevation	68
HD2_21	Finer material with rocks, on lower elevation	66
HD2_22	Finer material with rocks, on lower elevation	72
HD2_23	Finer material with rocks, on lower elevation	83

Appendix 9: Proposal AMD Risk Assessment

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Technical memo

From	Steven Lee, Sarah Fyfe
Department	Mineral Waste - Water Resource Evaluation
To	Michelle Doak, Kylie McKay, Belinda Yaqub, Chantelle Dodge
Copies	Shane Trott
Reference	RTIO-PDE-0178960
Date	November 2020

Hope Downs 2 and Bedded Hilltop AMD risk assessment

Context

A review of the acid and metalliferous drainage (AMD) risk associated with the Hope Downs 2 and Bedded Hilltop iron ore deposits has been completed to support the Hope Downs 2 Mine Closure Plan. This review considers drillhole and mine planning data, supplemented by geochemical test data, to assess the AMD risks relating to waste rock remaining upon closure.

The overall AMD risk for the Hope Downs 2 and Bedded Hilltop deposits is low.

Background Information

The risk assessment process followed is outlined in *Geochemical Risk Assessment Process for Rio Tinto's Pilbara Iron Ore Mines* (Green and Borden, 2011). A risk-based process is used to identify those rock types which require specific management to mitigate the impacts associated with AMD.

It is recognised that AMD includes *acidic drainage* (elevated concentrations of metals at low-pH), *neutral metalliferous drainage* (elevated concentrations of metals at near-neutral to alkaline pH) and *saline drainage* (generally low concentrations of metals, but moderate concentrations of sulfate, magnesium and calcium, at neutral to alkaline pH) (INAP, 2009; DIIS, 2016). With the presence of potentially acid forming (PAF) rock types associated with sulfide or some sulfate minerals, it is understood that neutral metalliferous drainage requires, at a minimum, low-pH conditions on a microscopic scale as a mechanism to initially solubilise contaminants. If the PAF rock also has sufficient acid neutralising capacity (ANC), the acid generated is *neutralised*. However, as a result of this reaction, concentrations of some contaminants (e.g., As, Cd, Mn, Ni, Sb, Se and Zn) do not precipitate at near-neutral pH, and remain in solution, resulting in poor-quality drainage (DIIS, 2016). An analysis of total sulfur in mineral waste will help infer the likelihood for the rock type to generate acidity which may lead to poor quality drainage characterised by either low-pH or near-neutral pH.

Rio Tinto has undertaken an extensive program of geochemical testing over several years to understand the potential for AMD to occur as a result of exposing various waste rock types common to Pilbara mining operations. The geochemical characterisation process considers sulfur content and elemental abundance as an indicator of acidic and neutral metalliferous drainage potential, and is supported by static (acid base accounting) and, if appropriate, kinetic testing of target materials. It is understood that poor quality drainage may also result from low-sulfur waste rock containing compounds that do not require acidic conditions to maintain elevated concentrations of parameters of concern. For instance, the dissolution of readily soluble salts may mobilise minor and trace elements into pore water that may then be transported into the surrounding environment via surficial or internal drainage. This risk is assessed by considering elemental data collected during routine and extra analysis of drillhole samples, and the results derived from a phased and risk-based approach involving the selection of fit-for-purpose leach extract tests (e.g., Green et al. (2019)). General methodologies used by laboratories to undertake geochemical test work are attached in Appendix A.

The results of geochemical test work and interpretation are applied to the geological and mining models to ensure materials posing potential geochemical risks are identified prior to mining and managed appropriately. This work is in accordance with internal standards and processes.

The most significant geochemical risk posed by mining iron ore deposits in the Pilbara is associated with the sulfide mineral pyrite, which can form sulfuric acid when exposed to oxygen and water. The unoxidised (black) Mount McRae Shale and Lignite a part of the detrital sequence, are most commonly associated with pyrite and AMD, are known to occur in the Hope Downs 2 and Bedded Hilltop deposits. Other sulfate minerals, such as alunite and jarosite, may also pose a geochemical risk, albeit the risk is usually lower due to self-limiting chemical processes.

Acid Base Accounting and Geochemical Characterisation

Acid Base Accounting and Geochemical Characterisation has been undertaken on 96 reverse-circulation (RC) drillhole samples collected from the Hope Downs 2 (43 samples) and Bedded Hilltop (53 samples) deposits (SRK, 2019). The purpose of these tests was to determine:

- The net acid generating potential;
- The acid neutralising capacity (ANC); and
- The presence and quantities of leachable contaminants.

The test work results are available in a report detailing the geochemical characterisation of samples from Hope Downs 2 and Bedded Hilltop (SRK, 2019). A summary of the sample information, sulfur assay values, acid neutralising capacity and the final classification are available in and the collar locations for the drillholes selected are shown in Appendix B. In summary of the 96 Samples analysed, the lignite material tested had the greatest potential for acid generation and metal release, all were classed as Potentially Acid forming (PAF). The total sulfur content of the lignite material ranged from 1.27% to as high as 33.3%, with the sulfur either present as pyrite or marcasite. Leachate from the lignite was generally acidic with high solute concentrations.

Two samples, one from the Dales Gorge Member and one from the Footwall Zone were classed as PAF in a low capacity (<5kg H_2SO_4/t) to generate acidity. The 20 Wittenoom Formation samples were all classed as Non-acid forming (NAF) and had considerable ANC. The remaining 64 samples were classified as Non-acid forming or Uncertain (NAF). These samples are expected to generate circum neutral leachates with low solute concentrations.

RioTinto

Table 1 - Summary of ABA and NAG data

Strat	Statistic	No. of Samples	Paste pH	Paste EC	NAG pH	NAG pH 4.5	NAG pH 7	ANC	Total S	MPA	NAPP	AMIRA Classification			
			pH units	µS/cm	kg H_2SO_4/t				%	kg H_2SO_4/t		NAF	UC (NAF)	PAF-LC	PAF
DET	Min.	14	5.7	69	6.2	<0.1	<0.1	<0.5	<0.01	0.3	-32	13	1		
	Median		7.5	191	7.3	<0.1	<0.1	2.65	0.02	0.6	-				
	Max.		8.6	735	9.2	<0.1	0.4	32.9	0.03	0.9	0.4				
DET LIG	Min.	10	1.9	1,930	1.8	19.4	42.3	<0.5	1.27	39	38				10
	Median		3.8	3,925	2.2	150	221	<0.5	6.63	203	-				
	Max.		5.6	21,100	2.6	626	699	6.9	33	1019	1013				
DG	Min.	15	4.6	40	3.9	<0.1	<0.1	<0.5	<0.01	0.3	-0.2	2	12	1	
	Median		6.4	72	6.2	<0.1	0.7	<0.5	0.02	0.6	-				
	Max.		8.8	461	7	0.8	2.4	0.9	0.07	2.1	4.1				
FWZ	Min.	9	3.9	43	4.1	<0.1	<0.1	<0.5	<0.01	0.3	-0.2	3	5	1	
	Median		6	140	6.2	<0.1	0.4	<0.5	0.02	0.6	-				
	Max.		6.8	1,540	6.8	0.8	4.7	0.5	0.15	4.6	0.7				
MCS	Min.	7	4.5	115	5.6	<0.1	<0.1	<0.5	0.02	0.6	-0.5	3	4		
	Median		6.7	214	6.1	<0.1	0.5	0.7	0.02	0.6	-				
	Max.		7.1	575	7.2	<0.1	2	1	0.04	1.2	0.1				
MTS	Min.	2	6.2	96	6.4	<0.1	<0.1	<0.5	<0.01	0.3	-0.5	1			
	Median		6.4	133	6.6	<0.1	0.25	0.65	0.015	0.5	-				
	Max.		6.6	169	7	<0.1	0.4	0.8	0.02	0.6	0.1				
WF	Min.	20	3.8	40	5.6	<0.1	<0.1	<0.5	<0.01	0.3	-968	20			
	Median		7.6	294	8.1	<0.1	<0.1	6.15	<0.01	0.3	-				
	Max.		9.8	1,310	10.2	<0.1	1.5	968	0.14	4.3	-0.2				
NEW	Min.	9	5.4	19	6.6	<0.1	<0.1	<0.5	<0.01	0.3	-8.7	9			
	Median		7.5	78	7.2	<0.1	<0.1	<0.5	<0.01	0.3	-				
	Max.		8.9	276	8.5	<0.1	0.7	9	<0.01	0.3	-0.2				
MAC	Min.	7	4	26	4.6	<0.1	<0.1	<0.5	<0.01	0.3	-0.2	4	3		
	Median		7.2	102	6.6	<0.1	0.5	<0.5	<0.01	0.3	-				
	Max.		8.4	911	7.4	<0.1	2.1	0.7	0.1	3.1	2.6				

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Table 1 - continued

Strat	Statistic	No. of Samples	Paste pH	Paste EC	NAG pH	NAG pH 4.5	NAG pH 7	ANC	Total S	MPA	NAPP	AMIRA Classification			
			pH units	µS/cm	kg H_2SO_4/t				%	kg H_2SO_4/t		NAF	UC (NAF)	PAF-LC	PAF
NAM	Min.	3	6	30	6	<0.1	0.5	<0.5	<0.01	0.3	-0.2	2	1		
	Median		6.7	117	6.4	<0.1	0.6	<0.5	<0.01	0.3	-				
	Max.		7.6	239	6.6	<0.1	2	<0.5	0.03	0.9	0.4				
All Samples	Min.	96	1.9	19	1.8	<0.1	<0.1	<0.5	<0.01	0.3	-968	57	27	2	10
	Median		7	167	6.7	<0.1	0.3	<0.5	0.02	0.6	-				
	Max.		9.8	21,100	10.2	626	699	968	33	1,019	1013				

Note: EC – Electrical Conductivity; NAG – Net Acid Generation; ANC – Acid Neutralising Capacity; S – Sulfur; MPA – Maximum Potential Acidity; NAPP – Net Acid Producing Potential; NAF – Non Acid Forming; UC – Uncertain; PAF – Potentially Acid Forming; LC – Low Capacity.

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Total Sulfur Analysis of Drillhole Samples

An analysis of sulfur values in drillhole data for the three deposits (to the July of 2020) was undertaken to identify those rock types requiring further investigation related to acid-forming potential (and any related metalliferous drainage). An outcome of this analysis includes determining the likelihood that a rock type will pose an acid drainage risk. For the purpose of this assessment, the rock types comprise like-material separated into their sub-divided stratigraphy and further differentiated on dominant material type (ore, waste or hydrated – "Tag"). It should be noted that the following factors may also influence the interpretations in this report:

- Negative assay results represent concentrations below the detection limit. The assay value for the element was taken to the absolute value (i.e. the detection limit). This approach is conservative, as the true values for these assays sit somewhere between zero and the detection limit value;
- Assay values of "-99" or "zero" (0) indicate that the element was not assayed and were deleted and not considered in this assessment;
- The logging code for pyrite (PYT) can be used where it is readily identifiable. However, logging codes either do not exist or are not readily used for the sulfate minerals gypsum or alunite as these minerals are less identifiable. In lieu of direct logging information for these two minerals, concentrations of potassium and calcium within elevated-sulfur samples can be used to infer the presence of these sulfate minerals, though is it also possible that the two elements may be present in various other minerals in the sample. Sulfate may also be present in other minerals other than pyrite, alunite or gypsum.
- Total sulfur was measured using the XRF method rather than using combustion infrared detection techniques. The XRF method may underestimate the total sulfur concentrations when the sulfur values are high.
- The drillhole data for the ore body is extensive with less data collected for waste rock types. Information on all waste material that has or will be mined in the future may be missing due to the focus on characterising the ore body rather than the waste material;
- Some intervals had incomplete stratigraphy, strand or tag information. These samples were grouped into an UNKNOWN rock type category;

The following analyses have been conducted on the dataset divided spatially using a filter in the acquire database on the "PROJECTCODE" field. Drillhole samples represent lithologies associated with the Bedded Hilltop and Hope Downs 2 deposits and that not all rock types drilled and listed in the tables are expected to be mined.

A total of 655 intervals from Bedded Hilltop and Hope Downs 2 deposits had pyrite visually identified in the logging. For Bedded Hilltop, pyrite was visually identified in 644 intervals with the majority of the samples associated with Lignite, Mount McRae Shale and Wittenoom Formation, representing 86% of all the intervals with pyrite logged. A smaller number of intervals from the Mount Sylvia Member, Dolerite, Limonite, Dales Gorge Member, Whaleback Shale and detritals had pyrite visually identified. Only 11 intervals from the Hope Downs 2 deposit had pyrite visually identified, associated with the Marra Mamba hydrated, West Angela Member and detritals. These intervals are associated with oxidised stratigraphies and/or low sulfur samples, so it is unlikely that pyrite or sulfides are present.

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Sulfur Assay Analysis of Bedded Hilltop samples

A summary of the total sulfur analysis performed using the drillhole sample assays extracted from the acQuire database up until the end of July 2020 is given in Table 2. The average sulfur value for those samples with elevated-sulfur is considered for the analysis. Drillhole samples represent rock types associated with the Bedded Hilltop deposit, and that not all rock types drilled and listed in the table are expected to be mined and were further filtered by the proposed pit shell as seen by the in-pit sulfur analysis (Table 3).

The highest sulfur value associated with the Bedded Hilltop deposit is 27.4% associated with lignite. Along with other high sulfur lignite sample they are located below the water table, black in colour, with lignite (LIG), pyrite (PTY) and PYR (which is pyrolusite; however, it is more likely that this was meant to be logged as PYT) logged.

Approximately 2.7% of the 62,252 samples have sulfur values greater than 0.3%, with approximately 6.9% of waste samples with sulfur values greater than 0.3%. Those rock types where more than 3% of samples have sulfur values greater than 0.3% include: Lignite, Limonite Waste, Dolerite, Whaleback Shale Waste, Mount McRae Shale, Mount Sylvia Formation and Wittenoom Formation. When the proposed pit shells are used to filter the drillhole intervals, of the 21,786 samples located within the pit shell there are only 15 samples with sulfur greater than 0.3%, indicating that the majority of elevated sulfur samples sit outside of the proposed pit shell.

Based on the outcome of the analysis it is unlikely that any stratigraphic units will require management during operations and should be confirmed by reviewing the mining models for PAF quantities.

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Table 2 – Total Sulfur analysis for the Bedded Hilltop deposit

Strand-tag Group	Total Samples Assayed for S	Number of Samples with S>0.1%	Percentage of total samples with S>0.1%	Number of samples with S>0.3%	Percentage of total samples with S>0.3%	Average S for samples with S>0.1%	Average S for samples with S>0.3%
Clay	857	12	1.40%	1	0.12%	0.18	0.42
Calcrete	227	1	0.44%	0	0.00%	0.13	-
Lignite	**868**	**866**	**99.77%**	**839**	**96.66%**	4.66	4.8
Detrital Waste	**1292**	**44**	**3.41%**	15	1.16%	0.69	1.75
Detrital Ore	**1020**	**44**	**4.31%**	8	0.78%	0.26	0.83
Canga Waste	**57**	**4**	**7.02%**	0	0.00%	0.15	-
Canga Ore	**627**	**23**	**3.67%**	2	0.32%	0.17	0.48
Limonite Waste	**758**	**88**	**11.61%**	**30**	**3.96%**	0.76	1.92
Limonite Ore	**1522**	**119**	**7.82%**	33	2.17%	0.32	0.79
Pisolite Waste	642	4	0.62%	1	0.16%	0.19	0.37
Pisolite Ore	1606	41	2.55%	8	0.50%	0.23	0.45
Red Ochre Detrtial Waste	27	0	0.00%	0	0.00%	-	-
Red Ochre Detrtial Ore	75	1	1.33%	0	0.00%	0.1	-
Dolerite	**47**	**38**	**80.85%**	**22**	**46.81%**	0.48	0.68
Whaleback Shale Waste	**362**	**50**	**13.81%**	**19**	**5.25%**	0.37	0.73
Whaleback Shale Ore	43	0	0.00%	0	0.00%	-	-
Whaleback Shale Hydrated	**121**	**8**	**6.61%**	0	0.00%	0.15	-
Dales Gorge Waste	**5270**	**121**	**2.30%**	5	0.09%	0.15	0.6
Dales Gorge Ore	14439	192	1.33%	6	0.04%	0.15	0.82
Dales Gorge Hydrated	**7249**	**381**	**5.26%**	15	0.21%	0.16	0.68
Footwall Zone Waste	4926	151	3.07%	13	0.26%	0.19	0.86
Footwall Zone Ore	**4483**	**229**	**5.11%**	1	0.02%	0.13	0.4
Mt McRae Shale	**5054**	**622**	**12.31%**	**464**	**9.18%**	1.84	2.41
Mount Sylvia Formation	**417**	**68**	**16.31%**	**38**	**9.11%**	0.66	1.04
Wittenoom Formation	**516**	**69**	**13.37%**	**48**	**9.30%**	1.2	1.63
UNKNOWN	**9747**	**499**	**5.12%**	90	0.92%		

Total number of samples assayed for S	**62252**	**62252**
Total number of samples with S>0.1%/0.3%	**3675**	**1658**
Percentage of total with S>0.1%/0.3%	**5.90%**	**2.66%**
Total number of waste samples assayed for S**	**21320**	**21320**
Total number of waste samples with S>0.1%/0.3%	**2138**	**1473**
Percentage of total waste samples with S>0.1%/0.3%	**10.03%**	**6.91%**

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Table 3 – Total in-pit sulfur analysis for the Bedded Hilltop deposit

Strand-tag Group	Total Samples Assayed for S	Number of Samples with	Percentage of total samples	Number of samples with	Percentage of total samples
CLAY	22	0	0.00%	0	0.00%
DET WASTE	174	5	2.87%	0	0.00%
DET ORE	**387**	**18**	**4.65%**	2	0.52%
CA WASTE	15	0	0.00%	0	0.00%
CA ORE	**287**	**14**	**4.88%**	0	0.00%
LI WASTE	**59**	**10**	**16.95%**	0	0.00%
LI ORE	**73**	**18**	**24.66%**	0	0.00%
PI WASTE	**19**	**2**	**10.53%**	0	0.00%
PI ORE	378	6	1.59%	0	0.00%
ROD WASTE	4	0	0.00%	0	0.00%
WS WASTE	**166**	**24**	**14.46%**	**7**	**4.22%**
WS ORE	30	0	0.00%	0	0.00%
WS HYD	**67**	**6**	**8.96%**	0	0.00%
DG WASTE	**1441**	**54**	**3.75%**	0	0.00%
DG ORE	8546	131	1.53%	1	0.01%
DG HYD	**4889**	**186**	**3.80%**	3	0.06%
FWZ WASTE	345	5	1.45%	0	0.00%
FWZ ORE	**971**	**53**	**5.46%**	0	0.00%
MCS	107	0	0.00%	0	0.00%
UNKNOWN	**3806**	**196**	**5.15%**	2	0.05%
Total number of samples assayed		21786		21786	
Total number of samples with S>0.1%/0.3%		728		15	
Percentage of total with S>0.1%/0.3%		**3.34%**		0.07%	
Total number of waste samples		2186		2186	
Total number of waste samples with S>0.1%/0.3%		100		7	
Percentage of total waste samples with S>0.1%/0.3%		**4.57%**		0.32%	

Sulfur Assay Analysis of Hope Downs 2

A summary of the total sulfur analysis performed using the drillhole sample assays extracted from the acQuire database up until the end of July 2020 is given in Table 4. The average sulfur value for those samples with elevated-sulfur is considered for the analysis. Drillhole samples represent rock types associated with the Hope Downs 2 deposit, and that not all rock types drilled and listed in the table are expected to be mined and were further filtered by the proposed pit shell as seen by the in-pit sulfur analysis (Table 5). The highest sulfur value associated with the Hope Downs 2 deposit is 4.13% and is associated with hydrated MacLeod Member located within 14 m of the surface and has coincidently high potassium. It is likely that this sample is alunite, an aluminium hydroxysulfate

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mineral.

Approximately 0.5% of the 89,006 samples have sulfur values greater than 0.3%, with approximately 0.6% of waste samples with sulfur values greater than 0.3%. Only the Fortescue Group stratigraphic unit has 3.9% of samples with sulfur values greater than 0.3%. When the proposed pit shells are used to filter the drillhole intervals, of the 29,978 samples located within the pit shell there are only 231 samples with sulfur greater than 0.3%, spread across all the rock types. NAM WASTE and NAM ORE have greater than 3% of samples with S >0.3%, however all are in proximity of the surface and are above water table so unlikely to be sulfide minerals.

Based on the outcome of the analysis it is unlikely that any stratigraphic units will require management during operations and should be confirmed by reviewing the mining models for PAF quantities.

Table 4 - Total Sulfur analysis for the Hope Downs 2 deposit

Strand-Tag group	Total Samples assayed for S	Number of Samples with S>0.1	Percentage of Samples with S>0.1%	Number of samples with S>0.3	Percentage of Samples with S>0.3%	Average S for samples with S>0.1%	Average S for samples with S>0.3%
CLAY	7382	209	2.83%	41	0.56%	0.25	0.58
CALCRETE	57	4	7.02%	1	1.75%	0.24	0.51
DET WASTE	9159	321	3.50%	75	0.82%	0.26	0.56
DET ORE	783	19	2.43%	0	0.00%	0.14	-
CA WASTE	27	10	37.04%	0	0.00%	0.16	-
CA ORE	61	2	3.28%	0	0.00%	0.12	-
LI WASTE	184	13	7.07%	3	1.63%	0.2	0.38
LI ORE	205	6	2.93%	1	0.49%	0.15	0.36
PI WASTE	145	2	1.38%	0	0.00%	0.13	-
ROD WASTE	7408	542	7.32%	71	0.96%	0.2	0.49
ROD ORE	8812	442	5.02%	43	0.49%	0.18	0.5
WF	2176	5	0.23%	1	0.05%	0.23	0.46
ANG WASTE	13311	796	5.98%	65	0.49%	0.2	0.83
ANG ORE	3182	332	10.43%	4	0.13%	0.14	0.62
ANG HYD	864	16	1.85%	2	0.23%	0.18	0.36
NEW WASTE	8265	23	0.28%	3	0.04%	0.22	0.42
NEW ORE	9685	82	0.85%	2	0.02%	0.13	0.55
MAC WASTE	3373	275	8.15%	23	0.68%	0.22	1.16
MAC ORE	2202	568	25.79%	19	0.86%	0.16	0.63
NAM WASTE	1729	52	3.01%	12	0.69%	0.32	0.89
NAM ORE	540	129	23.89%	12	2.22%	0.22	0.87
MM HYD	6251	402	6.43%	44	0.70%	0.22	0.86
FOR	332	39	11.75%	13	3.92%	0.62	1.52
(blank)	2873	74	2.58%	2	0.07%		
Total number of samples assayed for S		89006		89006			
Total number of samples with S>0.1%/0.3%		4363		437			
Percentage of total with S>0.1%/0.3%		4.90%		0.49%			
Total number of waste samples assayed for S		53548		53548			
Total number of waste samples with S>0.1%/0.3%		2291		308			
Percentage of total waste samples with S>0.1%/0.3%		4.28%		0.58%			

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Table 5 - Total in-pit sulfur analysis for the Hope Downs 2 deposit

Strand-Tag group	Total Samples assayed for S	Number of S>0.1	Percentage of Samples with S>0.1%	Number of samples with S>0.3	Percentage of Samples with S>0.3%
CLAY	905	33	3.65%	21	2.32%
DET WASTE	4608	173	3.75%	40	0.87%
CA WASTE	491	10	2.04%	0	0.00%
CA ORE	23	2	8.70%	0	0.00%
LI WASTE	52	1	1.92%	0	0.00%
LI ORE	111	2	1.80%	0	0.00%
PI WASTE	75	0	0.00%	0	0.00%
ROD WASTE	1005	169	16.82%	13	1.29%
ROD ORE	2151	247	11.48%	31	1.44%
WF	36	0	0.00%	0	0.00%
ANG WASTE	3686	660	17.91%	64	1.74%
ANG ORE	1971	298	15.12%	4	0.20%
ANG HYD	706	16	2.27%	2	0.28%
NEW WASTE	661	11	1.66%	2	0.30%
NEW ORE	6810	69	1.01%	2	0.03%
MAC WASTE	285	9	3.16%	2	0.70%
MAC ORE	690	141	20.43%	8	1.16%
NAM WASTE	87	7	8.05%	6	6.90%
NAM ORE	179	58	32.40%	11	6.15%
MM HYD	4174	182	4.36%	24	0.57%
FOR WASTE	15	1	6.67%	0	0.00%
UNKNOWN	1257	29	2.31%	1	0.08%

Total number of samples assayed	**29978**	**29978**
Total number of samples with S>0.1%/0.3%	**2118**	**231**
Percentage of total samples with S>0.1%/0.3%	**7.07%**	**0.77%**
Total number of waste samples	**11906**	**11906**
Total number of waste samples with S>0.1%/0.3%	**1074**	**148**
Percentage of total waste samples with S>0.1%/0.3%	**9.02%**	**1.24%**

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PAF Risk flagging in the mining models
Based on the review of the mining models hdipr_hd1bht_20200817_007 and hdipr_hd2_20200902_028 no PAF material is flagged as occurring within the mine plan and is consistent with the findings of the sulfur assay analysis.

Analysis of Geochemical Enrichment in the Bedded Hilltop and Hope Downs 2 deposits
The multi-element analysis of all drillhole assay data (derived from the full chemical suite) for Bedded Hilltop and the corresponding GAI values are given in Appendix C.

The extent of enrichment of a drillhole sample can be reported as the Global Abundance Index (GAI), which relates the actual concentration with average crustal abundance on an adjusted log 2 scale (Bowen, 1979). The GAI is typically expressed in integer increments where a GAI of zero indicates the element is present at a concentration similar to, or less than, the average crustal abundance, and a GAI of 6 indicates approximately a 100-fold enrichment above the average crustal abundance. The main purpose of the GAI is to provide an indication of elemental enrichment that may be of environmental importance. Generally, a GAI of 3 or greater signifies enrichment that warrants further examination, while a GAI of 1 or 2 indicates the element may be elevated. The same factors as for analysing drillholes may also influence the interpretations within this section. Most rock types are either enriched or elevated in Fe, as correlated with the iron mineralisation associated with the ore body. Arsenic (As) is enriched in most rock types while tin (Sn) is generally elevated.

In general, whilst concentrations of some trace elements of potential environmental concern (e.g. As, Pb) were enriched or elevated in some of the sampled ore and waste materials, these elements will not necessarily mobilise into groundwater. Arsenic in particular is commonly enriched in ore and waste for many Hamersley Group deposits. Iron oxy-hydroxides such as hematite and magnetite have high sorption capacities for As (e.g., Zhang et. Al., 2004), and consequently, these materials have been used around the world for treating water enriched in arsenic.

In summary, the following elements have been identified as being enriched in the Bedded Hilltop deposit and should be considered in any monitoring related to potential AMD impacts: **Fe, As, Mn, Sn, S and Zn.**

AMD Risk Assessment and Conclusion
A review of the acid and metalliferous drainage (AMD) risk associated with the Hope Downs 2 and Bedded Hilltop iron ore deposits has been completed to support the Hope Downs 2 Mine Closure Plan. This review considers drillhole and mine planning data, supplemented by geochemical test data, to assess the AMD risks relating to waste rock remaining upon closure. Furthermore, information in this assessment can be used to support the development of a source-path-receptor model or AMD-related ecological risk assessment to describe the mechanisms by which acid and metals/metalloids may mobilise from specific mining areas (including specific pit voids and waste dumps) and interact with environmental receptors.

Mining of the assessed designs for Hope Downs 2 and Bedded Hilltop deposits pose a low AMD risk.

The AMD Hazard Scorecard, as described in Geochemical Risk Assessment Process for Rio Tinto's

Pilbara Iron Ore Mines (Green and Borden, 2011) has also been completed and presented in Appendix D.

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Appendix A – Summary of Geochemical Test Work Methodologies

RTIO-PDE-0174239 - Methodologies used for geochemical test work:
http://iodms/iodms/drl/objectId/090188a380bd490e

(memo attached)

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From	Kate Glasson
Department	Water Resource Evaluation & Services - Mineral Waste Management
To	Steven Lee and Lisa Terrusi
Date	20/02/2020
Number of pages	5
Reference	RTIO-PDE-0174239

Methodology Memo

Context

This memorandum aims to provide an outline for all methodologies used for geochemical test work coordinated by the Mineral Waste Management team. Test work programmes undertaken for various rock types are designed to characterise and assess the geochemical risks related to acid and metalliferous drainage (AMD) including acidic, neutral and saline drainage.

1.0 Acid base accounting (ABA)

The acid-base account involves static laboratory procedures which evaluate the acid generation and neutralising potential of minerals. The list below contains the recommended basic screening tests used to categorise the relative acid forming potential of a sample.

1.1 Total sulfur

Total sulfur is commonly determined using LECO analysis. The analysis does not distinguish between acid and non-forming acid forming sulfur species. Analysis using X-ray Fluorescence (XRF) typically underestimates sulfur concentrations compared to that determined using LECO (Eaglan & White, 1998). For samples with high sulfur content it is important that LECO tests are undertaken rather than using XRF.

1.2 Sulfate sulfur

The sample is dissolved in dilute hydrochloric acid (HCl) and the solution is bulked to volume. An aliquot of this solution is then analysed by ICP-AES to determine the (soluble) sulfate sulfur content. In some cases, routine sulfate sulfur calculated does not account for sulfate associated with alunite (or jarosite). Therefore, sulfur attributed to sulfate vs sulfide can be determined using the chromium reducible (CRS) method which is not subjected to interference from organic matter (SRK,2010; Linklater et al., 2012)

1.3 Chromium reducible sulfur (CRS) method

A direct measure of the sulphide sulfur can be made using the CRS method. By conversion of reducible sulfur species to H_2S the amount of sulfur generated is quantified. The analysis yields an estimate of pyrite and other disulphides, elemental sulfur and acid volatile sulfides (SRK, 2010).

1.4 Total carbon
The sample is combusted in oxygen at a high temperature. Carbon present in the sample is evolved as carbon dioxide and swept to a measurement cell for quantification by infrared detection (LECO).

1.5 Total inorganic carbon (TIC) and total organic carbon (TOC)
Inorganic carbon is removed by reaction with dilute hydrochloric acid. After drying, the remaining sample is combusted in oxygen. Any organic carbon in the sample present as organic matter or graphite is evolved as carbon dioxide and swept to a cell for quantification by infrared detection (LECO).

1.6 Leach test
Simple leach extraction involves dissolution of elements from the solid matrix using de-ionised water. The water and solids are mixed at a ratio of 1:2 (solids: water) and agitated for a period of 12 hours. The leachates are filtered (e.g., using 0.45 µm or 0.2 µm filters) prior to analysis. Analytical techniques are selected depending on the elements under investigation and include ICP-AES and ICP-MS.

1.7 Modified leach tests
A variety of leach tests are available to ensure the selected test method closely simulates the site-specific ambient environment and conditions. These tests are outlined in *Rio Tinto's framework for evaluating risks from low sulfur waste rock* report (Green et al., 2019) and include mild acid leach, alkaline leach, saline leach, high temperature leaching, multi-step leach and low contact ratio leach

1.8 Paste pH (1:2)
Paste pH measurements are performed on a 1:2 solid:water extract.

1.9 Paste EC (2:1)
Electrical conductivity (EC) measurements are performed on a 1:2 solid:water extract.

1.10 Acid neutralising capacity (ANC)
Determined by adding HCl to the sample, heating it, and then back-titrating the mixture with NaOH in order to determine the amount of HCl that remains on completion of the reaction. The amount of acid consumed in the initial reaction is calculated and expressed as the ANC. Details of the procedure are outlined in the AMIRA International *ARD Test Handbook* (AMIRA , 2002).

1.11 Net acid generation (NAG) testing via single addition NAG
The single addition NAG test is explained briefly below. However, there are other methods via kinetic and sequential NAG and more information can be found in the AMIRA Handbook (AMIRA , 2002).
The single addition NAG test involves addition of hydrogen peroxide to prepared samples. The NAG pH is the pH of the final solution. The resultant acidity is then titrated (using NaOH) to pH 4.5 to pH 7. Details of the procedure are outlined in the AMIRA International *ARD Test Handbook* (AMIRA, 2002)

2.0 Detailed Static and kinetic tests
In order to better understand, provide definition and resolve issues identified in the initial screening of samples, follow up testing can be conducted. Detailed geochemical test commonly used are as follows and are outlined in AMIRA (2002).

2.1 Sequential NAG test
For samples with high sulfide content it is possible for oxidation to be incomplete in the single addition NAG test. To overcome this limitation, a multi-stage sequential NAG test is often carried out.

2.2 Kinetic NAG test
The kinetic NAG test is similar to the single addition NAG test except that the temperature, pH and EC liquor are recorded. Variability in these parameters are an indication of the kinetics of sulfide oxidation and acid generation during the test (AMIRA , 2002).

2.3 Acid buffering characteristic curves (ABCC) test
This test involves the constant monitoring of pH whilst conducting a slow titration (AMIRA, 2002). Data collected from this test provides insight into the portion of ANC within a sample readily available for acid neutralisation.

2.4 Mineralogy
Mineralogy of a sample can be determined using various techniques including optical mineralogy, scanning electron microscopy (SEM, QEM SEM), micro-probe, x-ray diffraction (XRD) and bulk elemental/oxide determinations (such as ICP or XRF) (Price, 2009)

2.5 Fizz rating
The fizz test is used to evaluate if carbonates are present by adding a few drops of concentrated HCl to a sample and observing if there is a slight, moderate or strong fizz (AMIRA, 2002).

2.5 Leach column test
Leach column tests are used to compliment the other geochemical investigations described above. Generally, columns are loaded with crushed waste rock or tailings and subjected to wetting and drying cycles to encourage oxidation and flushing of oxidation products (AMIRA , 2002). Water flushed through the column is tested and analysed for a variety of parameters. More details on the free draining leach column or saturated columns which are typically used can be found in AMIRA (2002) and Green et al., (2019). Another widely used long term prediction test, humidity cells, subjects samples to cycles of dry and moist air and leaching (Price, 2009).

3.0 Intrinsic oxidation rate (IOR)
The IOR is the rate of oxidation of material at a point in a system under the particular conditions which pertain to that point. When dealing with sulfidic materials, IOR is key to understanding timescales over which pollutants will be generated (ANSTO, 2006).

4.0 Calculated data

4.1 Maximum potential acidity (MPA)
Calculated by multiplying the total sulfur content (wt%) by 30.6. Approach assumes that all sulfur is present as pyrite (AMIRA , 2002).

4.2 Acid potential (AP)
Calculated by multiplying the sulfide-sulfur content (wt%) by 30.6 (AMIRA , 2002).

4.3 Sulfide-sulfur
Total sulfur minus sulfate sulfur.

4.4 Carbonate neutralising potential (CarbNP)
Calculated by multiplying inorganic carbon content (wt%) by 81.6.

4.5 Net acid producing potential (NAPP)
NAPP is the difference between AP and ANC of the sample:
NAPP= AP-ANC
*If AP is not available, then MPA can be used.

4.6 Net potential ratio (NPR)
NPR is the ratio of MPA and ANC:
NPR = ANC/MPA
This ratio is commonly used as a way of assessing the risk of acid generation from waste rock materials. It is an alternative way of looking at the acid base account and provides an indication of the relative margin of safety (for prevention of acid material) within a material (AMIRA , 2002). Various ANC/MPA values are reported in literature and typically range from 1 to 3, a ratio of 2 or more signifies a high probability that the material will remain circum-neutral in pH (AMIRA , 2002).
*If AP is not available, then MPA can be used.

5.0 Analysis

The ABA analysis should provide information on the sample such that the sample can be classified as NAF, PAF or UC. For more detailed information on sample classification refer to AMIRA (2002).

5.1 Non-acid forming (NAF)

Samples classified as NAF are unlikely to be acid generating and either there is a low acid potential or there is sufficient neutralising potential within the material to counteract any acidity produced.

5.2 Potentially acid forming (PAF)

A sample that has been classified as PAF has a positive NAPP and a final NAGpH<4.5. There is a high chance that a sample classified as PAF will be acid producing.

5.3 Uncertain (UC)

A sample is classified as uncertain if the NAPP result is positive and NAGpH>4.5, or when the NAPP is negative and NAGpH <4.5. Samples with a high organic content are also classified as uncertain.

References

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EGi. (2014). *Geochemical assessment of tailings from Yandi, Paraburdoo, Tom Price, Brockman 4 and Mesa J.* Perth: Environmental Geochemistry International.

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Appendix B – Geochemical Sample Locations

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Bedded Hilltop Geochemical Characterisation Locations

Date: 11/11/2020

710,000 712,500 715,000 717,500 720,000

7,452,500 7,450,000 7,447,500

Legend

- ABA_Samples
- BHT Proposed Pits/Dumps

N

0 0.5 1 2 Km

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Hope Downs 2
Geochemical
Characterisation Locations

Date: 11/11/2020

700,000 702,500 705,000 707,500

7,447,500 7,445,000 7,442,500

Legend

- ABA Samples
- HD2 Proposed Pits/Dumps

N

0 0.5 1 2 Km

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Appendix C – Global Abundance Indices for Bedded Hilltop and Hope Downs 2

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Bedded Hilltop GAI

	Crustal abundance	UNKNOWN				CLAY				CALCRETE				LIGNITE				DET WASTE				DET ORE				CA WASTE				CA ORE				LI WASTE			
	mg/kg	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min
FE_XRF_pct	41000	2	4	3		2	2	3		1	1	2		1	1	3		2	3	3		3	3	3	1	2	2	3	1	3	3	3	2	2	2	3	
AI2O3_pct_BEST	309885.8414																																				
P_XRF_pct	1000			1				1								1																				1	
TIO2_XRF_pct	9343.471903			1				1												1																1	
CAO_XRF_pct	57367.26547			1				1				1								1																	
MN_COMBINED_D	950			6				5				3				4			2	3				2				5			3				5	
MGO_XRF_pct	37539.70763			1				1				2																									
S_XRF_pct	260	1	1	9				3				1		6	6	9		2		9				6				2				3		1		9	
MNO_XRF_pct	1226.665453							2				2		1	1	4																				4	
K2O_XRF_pct	50593.35038																																				
NA2O_XRF_pct	62007																																				
ARS_XRF_ppm	1.5	4	5	10	1	4	4	8	1	3	3	6	1	6	4	10	1	4	4	9	1	4	4	8	1	4	4	6	1	4	4	6	1	6	5	9	1
BA_XRF_ppm	500			3				2				1																1								2	
CL_XRF_ppm	130			4				2								1				2				1								1				4	
CO_XRF_ppm	20			5				5				5		1		7			4	5				2				4			1				5	
CR_XRF_ppm	100			4				3								1				2																1	
CU_XRF_ppm	50			2				1				1				2				1																	
NA_PPM_COMBINED_D	23000																																				
NI_XRF_ppm	80			5				3				3				5			2	4				2				3				1				3	
PB_XRF_ppm	14			4				3				2				3			1	2				1				2								4	
SN_XRF_ppm	2.2	2	2	4		2	1	3		1		4		1		5		1	3	4		2	1	4				2		2	2	4		1		4	
SR_XRF_ppm	370																																				
V_XRF_ppm	160			1																																2	
ZN_XRF_ppm	75			8				3				4		3	1	8			2	6				3				2				2		1		7	
ZR_XRF_ppm	190			1				1												1																1	

	Crustal abundance	LI ORE				PI WASTE				PI ORE				ROD WASTE				ROD ORE				DOLERITE				WS WASTE				WS ORE				WS HYD			
	mg/kg	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min
FE_XRF_pct	41000	3	3	3	2	2	2	3	1	3	3	3	2	3	3	3	2	3	3	3	2			2		2	3	3		3	4	3	2	3	3	3	
AI2O3_pct_BEST	309885.8414																																				
P_XRF_pct	1000			1								1								1																	
TIO2_XRF_pct	9343.471903			1																								1									
CAO_XRF_pct	57367.26547																																				
MN_COMBINED_D	950			6				3				2								1				2				5				1				2	
MGO_XRF_pct	37539.70763																						1	1													
S_XRF_pct	260			6				3				4								1		3	2	5		1	1	5				1				2	
MNO_XRF_pct	1226.665453			2																																	
K2O_XRF_pct	50593.35038																																				
NA2O_XRF_pct	62007																																				
ARS_XRF_ppm	1.5	5	4	9	1	4	4	7	1	4	4	7	1	4	4	5	3	5	5	7	3	3	3	4	1	5	5	9	1	5	4	7	2	4	4	5	1
BA_XRF_ppm	500			3																								1									
CL_XRF_ppm	130			4				2				2																3								2	
CO_XRF_ppm	20	1		3				2				1										1	1	2				4								3	
CR_XRF_ppm	100																					2	2	3				1									
CU_XRF_ppm	50			1								2																1								2	
NA_PPM_COMBINED_D	23000																																				
NI_XRF_ppm	80			2								1										1	1	2				1								2	
PB_XRF_ppm	14			2				2				2				1				1				2		1	1	3								2	
SN_XRF_ppm	2.2	1		4		2	1	3		2	2	4		2	2	4		2	2	3		2		3		1	1	4		2	3	3		1		3	
SR_XRF_ppm	370																																				
V_XRF_ppm	160																																				
ZN_XRF_ppm	75	2	1	4				2				2												1				2				2		1			
ZR_XRF_ppm	190			1				1																				1									

	Crustal abundance	DG WASTE				DG ORE				DG HYD				FWZ WASTE				FWZ ORE				MCS				MTS				WF			
	mg/kg	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min
FE_XRF_pct	41000	2	3	3		3	4	3		3	3	3		2	2	3		3	4	3	1	1	3	3		1	3	3		1	1	3	
AI2O3_pct_BEST	309885.8414																																
P_XRF_pct	1000			1				1				1				1				2				1									
TIO2_XRF_pct	9343.471903											1				1				1				1									
CAO_XRF_pct	57367.26547																															1	
MN_COMBINED_D	950			3				4				4				6				5				6				5		2		6	
MGO_XRF_pct	37539.70763																															1	
S_XRF_pct	260		1	4				6				5				5			1	3		2		8		1		6		2		7	
MNO_XRF_pct	1226.665453							1												3				3				1		2		6	
K2O_XRF_pct	50593.35038																																
NA2O_XRF_pct	62007																																
ARS_XRF_ppm	1.5	3	4	8	1	4	4	9	1	4	3	9	1	5	4	10	1	5	5	9	1	6	7	10	1	5	6	9	1	4	4	7	1
BA_XRF_ppm	500			1				1				3				3				2				3								1	
CL_XRF_ppm	130			4				3				3				5				2				3				2				1	
CO_XRF_ppm	20			2				3				4				4				3				5				2				4	
CR_XRF_ppm	100							2																2				3				3	
CU_XRF_ppm	50							1				1				3				3				4				2				1	
NA_PPM_COMBINED_D	23000																																
NI_XRF_ppm	80							1				2				1				2				2								2	
PB_XRF_ppm	14		1	3				3				5				4				2		1	2	4		1	1	3		1	1	4	
SN_XRF_ppm	2.2	1	1	4		2	3	4		1		4		1		4		1	2	4		2	3	4		2	3	4		2	2	4	
SR_XRF_ppm	370																																
V_XRF_ppm	160																							1									
ZN_XRF_ppm	75			5				3				3				4				4		1	1	5			1	3				3	
ZR_XRF_ppm	190			1				1				1				1				1				1									

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Hope Downs 2 GAI

	Crustal abundance	CLAY				CALCRETE				DET WASTE				DET ORE				CA WASTE				CA ORE				LI WASTE				LI ORE			
	mg/kg	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min
FE_XRF_pct	41000	2	2	3		1	1	3		2	2	3		3	3	3	1	2	2	3	2	3	3	3		2	2	3		3	3	3	2
AI2O3_pct_BEST	309885.8414																																
P_XRF_pct	1000																																
TIO2_XRF_pct	9343.471903			3				1				2				1								1				1					
CAO_XRF_pct	57367.26547			1				1																									
MN_XRF_pct	950			6		1		5				7				5				3				4		1		6			2		
MGO_XRF_pct	37539.70763			1				1																									
S_XRF_pct	260			5				3				5				2				2				1				3			3		
MNO_XRF_pct	1226.665453																																
K2O_XRF_pct	50593.35038																																
NA2O_XRF_pct	62007																																
ARS_XRF_ppm	1.5	3	3	6	1	3	3	4	1	3	3	6	1	3	3	5	1	2	3	3	1	3	2	4	1	3	4	5	1	3	3	4	1
BA_XRF_ppm	500			1								2																					
CL_XRF_ppm	130			3				5				5				2				1				1				1			2		
CO_XRF_ppm	20			5				3				3				3				2				3				1			2		
CR_XRF_ppm	100	1	1	3				1				3				1								2				2					
CU_XRF_ppm	50			2				1				2												1				1					
NA_XRF_ppm	23000																																
NI_XRF_ppm	80			3				1				2				1																	
PB_XRF_ppm	14	1	1	3				2				5				2								2				1					
SN_XRF_ppm	2.2	1		4		1		3		1		4				4				2				3				3			3		
SR_XRF_ppm	370																																
V_XRF_ppm	160			2				1				2				1								1									
ZN_XRF_ppm	75	1		4		2	1	5				4				3		2	2	4		1	1	3		1		3		1		4	
ZR_XRF_ppm	190			2								1																					

	Crustal abundance	PI WASTE				ROD WASTE				ROD ORE				WF				ANG WASTE				ANG ORE				ANG HYD				NEW WASTE			
	mg/kg	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min
FE_XRF_pct	41000	2	2	3	1	2	2	3		3	4	3		1	1	3		2	2	3		3	4	3	2	3	3	3	1	2	4	3	
AI2O3_pct_BEST	309885.8414																																
P_XRF_pct	1000																																
TIO2_XRF_pct	9343.471903			1				2				1				1				1												1	
CAO_XRF_pct	57367.26547															2				1													
MN_XRF_pct	950			1		1		7			5	7		4	2	8		3	1	8		1		7		1		6				4	
MGO_XRF_pct	37539.70763							1								2				1													
S_XRF_pct	260			1				5				5				3				6				4				3				3	
MNO_XRF_pct	1226.665453																																
K2O_XRF_pct	50593.35038																																
NA2O_XRF_pct	62007																																
ARS_XRF_ppm	1.5	4	3	5	1	4	4	6	1	3	4	6	1	4	4	6	1	4	4	7	1	3	4	6	1	3	3	5	1	1	3	4	1
BA_XRF_ppm	500							3				1				1				2				1				2				2	
CL_XRF_ppm	130			1				2				2				2				4				2				3				2	
CO_XRF_ppm	20			3				3				4				5				6				2				2				2	
CR_XRF_ppm	100			2				2				3				2				2				1				1				2	
CU_XRF_ppm	50			1				2				2				2				2				1				1				1	
NA_XRF_ppm	23000																																
NI_XRF_ppm	80			1				2				2				3				4				1									
PB_XRF_ppm	14	1	1	2				3			1	2				2				3				2				2			1	2	
SN_XRF_ppm	2.2	2	2	4		1		4		1	2	4		1		4		1		4		1	2	4		1		3		1	2	4	
SR_XRF_ppm	370																			1													
V_XRF_ppm	160			1				1				1				1				1												1	
ZN_XRF_ppm	75			3				5			3	4		1		7				7				4				3			1	3	
ZR_XRF_ppm	190																																

	Crustal abundance	NEW ORE				MAC WASTE				MAC ORE				NAM WASTE				NAM ORE				MM HYD				FOR			
	mg/kg	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min
FE_XRF_pct	41000	3	5	3	1	2	2	3		3	3	3	2	2	2	3		3	3	3	2	3	3	3		1	1	3	
AI2O3_pct_BEST	309885.8414																												
P_XRF_pct	1000		1									1												1					
TIO2_XRF_pct	9343.471903							1																1					
CAO_XRF_pct	57367.26547																											1	
MN_XRF_pct	950			6				5				1				3				1				7				3	
MGO_XRF_pct	37539.70763																												
S_XRF_pct	260			4				6				4				5		1		5				5		1		6	
MNO_XRF_pct	1226.665453																												
K2O_XRF_pct	50593.35038																												
NA2O_XRF_pct	62007																												
ARS_XRF_ppm	1.5	2	4	4	1	2	2	4	1	2	2	4	1	2	2	4	1	2	2	5	1	2	2	4	1	1	1	4	1
BA_XRF_ppm	500			2				1																1					
CL_XRF_ppm	130			2				4				3				2				1				5				2	
CO_XRF_ppm	20			4				3				3				4				3				2		1		5	
CR_XRF_ppm	100							2				1				2				2				2				2	
CU_XRF_ppm	50			3				2				3				3				2				3				3	
NA_XRF_ppm	23000																												
NI_XRF_ppm	80			1				1				1				2								1				3	
PB_XRF_ppm	14		1	2				2				2				2				2				2				2	
SN_XRF_ppm	2.2	1	3	4		1		4		1		4		1		4		1		4		1		4		1		3	
SR_XRF_ppm	370																												
V_XRF_ppm	160							1								1								1				1	
ZN_XRF_ppm	75			4				4				5				5		1		4				4		3	2	6	
ZR_XRF_ppm	190																												

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Appendix D – AMD Hazard Scorecards

Project Name	Bedded Hilltop
Assessment Date	1/11/2020
Compiled by	Steven Lee
Final ARD Hazard Assessment	**LOW**

Version Date: 13/02/12
Version Number: 2

RTIO ARD Hazard Score

1. Preliminary Assessment (Order of Magnitude/Exploration)

A. Preliminary Geology Hazard

	Select Relevant Option Below	Score	Option Details
Ore Deposit Type	D) Enriched Dales Gorge Member mined below the water table (un-oxidised Mt McRae shale likely present)	19	Moderate/High
Host & Country Rock Neutralising Potential	Minor (5-25%)	7	
Brownfield's / Greenfields	Greenfield		
Known ARD Issues on Site	No	0	
	Geology Hazard Score		**29**

Complete following sections

B. Incipient ARD Risk

	Select Relevant Option Below	Score
Operation Age	< 5 years	5

**By default, all new projects should receive a <5 years value*

C. Scale of Disturbance

	Select Relevant Option Below	Score
Total Waste Stored	50 - 250 million tonnes	5
Footprint	100 - 250 hectares	3

D. Transport Pathways

	Select Relevant Option Below	Score
Project / Exploration?	Yes	
Precipitation / Areal Potential Evapo-transpiration Ratio	1/10 to 1/3 ratio_mining below the water table in an aquitard or an isolated local aquifer	3

**All new projects should respond Yes to Project / Exploration*

E. Sensitivity of Receiving Environment

	Select Relevant Option Below	Score
Distance to Perennial/Ephemeral Water Bodies	500 - 2000 metres	1
Alkalinity	>35 mg/L	1
Distance to closest protected / permanently inhabited area	>10000 metres	0

Preliminary Hazard Assessment

Preliminary Hazard Score	47
Preliminary Risk Assessment	**MODERATE**

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2. Detailed Assessment (Pre Feasibility/ Feasibility/Mining)

This assessment should be completed by an ARD expert

Pit	Bedded Hilltop

F. Geochemical Hazard (Interrogate the drill hole database)

	Select Relevant Option Below	Score	Option Details
Waste sulfur risk	Total number of waste samples with S>0.1% is between 3% and 10%, less than 0.5% of samples have S>0.3%	2	4.57%/0.32% (AWT pit)
Ore grade sulfur risk	Total number of ore grade samples with S>0.1% is less than 3%	0	
Spatial distribution of sulfur	Sulfur scattered throughout the pit and through numerous lithologies	3	only 15 inpit intervals with S>0.3%
Chemical enrichment	Enrichments of contaminants that are unlikely to mobilise into groundwater	1	

G. Mine Planning Hazard

	Select Relevant Option Below	Score	Option Details
PAF material management	No special waste management needed	0	NO PAF Material mined
Bulk NPR (Mass of neutralising material x mean ANC) / (Percent of lithology greater than 0.1% x tonnes of lithology x mean sulfur concentration for all data greater than 0.1 x 30.6 + repeat for each PAF lithologies)	>3	0	No PAF Material Mined
PAF rock mass disturbed or exposed (waste tonnes with S>0.1%)/(total tonnes of waste)*100	< 3% of the total disturbed mass	0	NO PAF Material mined
Pit backfilling	Pit will not be backfilled	5	Conservative assumption

H. Water Management Hazard

	Select Relevant Option Below	Score	Option Details
Dewatering volume	No releases of water	0	No dewatering of orebody required
Surface water	Isolated pit	0	
Water treatment during Operation	No water treatment or special management for ARD needed	0	No PAF
Final void management	No PAF rock exposures likely on final pit shell	0	No PAF (AWT Deposit)

Combined Hazard Assessment

Preliminary Assessment Score	47
Detailed Assessment Score	11
Combined Hazard Score	23
Risk Ranking	LOW

This risk ranking score card is relevant for Pilbara based iron ore operations and the ranking system can be used to assess the relative risk of each operation. The ranking system is likely to overestimate the risk if compared to porphry copper or some coal deposits.

For RTIO internal distribution only. The manager of Technical Projects and Development will need to review and approve this prior to external release. This risk assessment should be read in conjunction with the detailed ARD Risk Assessment

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Project Name	Hope Downs 2
Assessment Date	1/11/2020
Compiled by	Steven Lee
Final ARD Hazard Assessment	**LOW**

Version Date: 13/02/12
Version Number: 2

RTIO ARD Hazard Score

1. Preliminary Assessment (Order of Magnitude/Exploration)

A. Preliminary Geology Hazard

	Select Relevant Option Below	Score	Option Details
Ore Deposit Type	C) Enriched Marra Mamba Formation and Joffre Member, and/or channel and detrital ore bodies mined below the water table (un-oxidised lignite and black shales other than Mt McRae may be present). Enriched Dales Gorge Member mined above the water table only	14	Moderate / moderate
Host & Country Rock Neutralising Potential	Minor (5-25%)	7	
Brownfield's / Greenfields	Greenfield		
Known ARD Issues on Site	No	0	
		Geology Hazard Score	**23**

Complete following sections

B. Incipient ARD Risk

	Select Relevant Option Below	Score
Operation Age	< 5 years	5

**By default, all new projects should receive a <5 years value*

C. Scale of Disturbance

	Select Relevant Option Below	Score
Total Waste Stored	50 - 250 million tonnes	5
Footprint	100 - 250 hectares	3

D. Transport Pathways

	Select Relevant Option Below	Score
Project / Exploration?	Yes	
Precipitation / Areal Potential Evapo-transpiration Ratio	1/10 to 1/3 ratio_mining below the water table in an aquitard or an isolated local aquifer	3

**All new projects should respond Yes to Project / Exploration*

E. Sensitivity of Receiving Environment

	Select Relevant Option Below	Score
Distance to Perennial/Ephemeral Water Bodies	500 - 2000 metres	1
Alkalinity	>35 mg/L	1
Distance to closest protected / permanently inhabited area	>10000 metres	0

Preliminary Hazard Assessment

Preliminary Hazard Score	41
Preliminary Risk Assessment	**MODERATE**

RioTinto

2. Detailed Assessment (Pre Feasibility/ Feasibility/Mining)

This assessment should be completed by an ARD expert

Pit	Hope Downs 2

F. Geochemical Hazard (Interrogate the drill hole database)

	Select Relevant Option Below	Score	Option Details
Waste sulfur risk	Total number of waste samples with S>0.1% is between 3% and 10%	7	9%/1.24% (AWT pit designs)
Ore grade sulfur risk	Total number of ore grade samples with S>0.1% is between 3% and 10% but less than 0.5% of the samples have S>0.3%	2	
Spatial distribution of sulfur	Sulfur scattered throughout the pit and through numerous lithologies	3	Limited S intervals >0.3%
Chemical enrichment	Enrichments of contaminants that are unlikely to mobilise into groundwater	1	

G. Mine Planning Hazard

	Select Relevant Option Below	Score	Option Details
PAF material management	No special waste management needed	0	No PAF Exposed
Bulk NPR (Mass of neutralising material x mean ANC) / (Percent of lithology greater than 0.1% x tonnes of lithology x mean sulfur concentration for all data greater than 0.1 x 30.6 + repeat for each PAF lithologies)	>3	0	No PAF exposed
PAF rock mass disturbed or exposed (waste tonnes with S>0.1%)/(total tonnes of waste)*100	< 3% of the total disturbed mass	0	No PAF exposed
Pit backfilling	Pit will not be backfilled	5	Worst case

H. Water Management Hazard

	Select Relevant Option Below	Score	Option Details
Dewatering volume	No releases of water	0	No dewatering of orebody required
Surface water	Isolated pit	0	
Water treatment during Operation	No water treatment or special management for ARD needed	0	No PAF
Final void management	No PAF rock exposures likely on final pit shell	0	No PAF (AWT Deposit)

Combined Hazard Assessment

Preliminary Assessment Score	41
Detailed Assessment Score	18
Combined Hazard Score	28
Risk Ranking	**LOW**

This risk ranking score card is relevant for Pilbara based iron ore operations and the ranking system can be used to assess the relative risk of each operation. The ranking system is likely to overestimate the risk if compared to porphry copper or some coal deposits.

For RTIO internal distribution only. The manager of Technical Projects and Development will need to review and approve this prior to external release. This risk assessment should be read in conjunction with the detailed ARD Risk Assessment

Appendix 10: Geochemical Characterisation of Waste Rock Samples

Hope Downs (Sustaining Deposits) – Geochemical Characterisation of Waste Rock Samples

Report Prepared for

Rio Tinto Iron Ore



Report Prepared by

SRK Consulting (Australasia) Pty Ltd

RTS158

July 2019

Hope Downs (Sustaining Deposits) – Geochemical Characterisation of Waste Rock Samples

Rio Tinto Iron Ore

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July 2019

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Executive Summary

This work forms part of ongoing geochemical characterisation of samples from various Rio Tinto Iron Ore (RTIO) mining operations. The overall purpose of the geochemical characterisation program is to provide guidance for waste rock management in particular with respect to managing and limiting acid generation and metalliferous drainage.

The current program involved static geochemical characterisation of 96 waste rock samples from 10 stratigraphies at the Hope Downs (Sustaining Deposits) project (Bedded Hilltop and Hope Downs 2 deposits).

Of the 96 samples tested, the 10 lignites had the greatest acid generation potential and were all classed as potentially acid forming (PAF). The total sulfur content of the samples ranged between 1.27% and 33.3% (mostly as pyrite or marcasite) and the acid neutralising capacity (ANC) was low (<0.5 kgH_2SO_4/t to 7 kgH_2SO_4/t). Leachate from the lignites was generally acidic with high solute concentrations – including high concentrations of major cations (i.e. Ca and Mg), anions (i.e. SO_4) and a range of trace elements (e.g. Al, As, Cd, Co, Cr, Cu, Mn, Ni and Zn).

Two additional samples from the Dales Gorge and Footwall Zone lithologies were also classified as PAF, with a low capacity (<5 kgH_2SO_4/t) to generate acidity. These samples contained some sulfur (up to 0.15%) and negligible ANC (<0.5 kgH_2SO_4/t).

The 20 Wittenoom Formation (WF) samples were all classed as non acid forming (NAF); they contained significant ANC (up to 968 kgH_2SO_4/t) and negligible total sulfur (typically <0.01%). Leachate from the samples was invariably circum neutral to alkaline, with a low solute concentration.

The remaining 64 samples were from a range of lithologies, contained low to negligible total sulfur (up to 0.1%) and low to modest ANC (up to 33 kgH_2SO_4/t) – most samples (37 out of 64) were classified as NAF. The classification of 27 samples was uncertain (UC) and while most are not expected to be acid generating, eight contain a small store of readily soluble acidic weathering products. Most samples are expected to generate leachate that is circum neutral and with a low solute concentration.

SRK makes the following recommendations:

- A subset of the lignite samples should be submitted for kinetic column leach tests and measurement of the oxygen consumption rate. Special focus should be given to the behaviour of nitrogen in the leach tests (to follow up on an observation from previous studies that nitrogen release may be coincident with oxidation of carbonaceous materials).
- Supplemental leach testwork should be carried out on a subset of detrital and WF samples.

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Appendix A: Sample Logs

Appendix B: Laboratory Methods and Calculations

Appendix C: Mineralogical Assessment

Appendix D: ABA and NAG Test Data

Appendix E: Acid Buffering Characteristic Curve Data

Appendix F: Multi-element Chemical Assay and GAI Data

Appendix G: Leach Test Data

Disclaimer

The opinions expressed in this Report have been based on the information supplied to SRK Consulting (Australasia) Pty Ltd (SRK) by Rio Tinto Iron Ore (RTIO) and the ALS laboratory in Brisbane and the Genalysis/ Intertek laboratory in Perth. The opinions in this Report are provided in response to a specific request from RTIO to do so. SRK has exercised all due care in reviewing the supplied information. While SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this Report apply to the site conditions and features as they existed at the time of SRK's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

1 Introduction

This work forms part of ongoing geochemical characterisation of samples from various Rio Tinto Iron Ore (RTIO) mining operations. The overall purpose of the geochemical characterisation program is to provide guidance for waste rock management in particular with respect to managing and limiting acid generation and metalliferous drainage.

The current program involved characterisation of waste rock samples from the Hope Downs (Sustaining Deposits) project (Bedded Hilltop and Hope Downs 2 deposits).

2 Work Program

RTIO staff selected and collected 96 reverse circulation (RC) drill chip samples from 10 lithological units at the project site. The samples were selected to represent waste rock. A complete list of the samples is provided in Appendix A, and a summary is shown in Table 2-1 (in stratigraphical order, from youngest to oldest).

Table 2-1: Sample details

Stratigraphy	Strat Code	Bedded Hilltop (HD1)	HD2	Total	Comments
Detritals	DET	15	9	14	10 of the Bedded Hilltop samples are lignites (LIG)
Dales Gorge Member	DG	15	-	15	
Footwall Zone	FWZ	9	-	9	
Mount McRae Shale	MCS	7	-	7	
Mount Sylvia Formation	MTS	2	-	2	
Wittenoom Formation	WF	5	15	20	
Newman Member	NEW	-	9	9	
MacLeod Member	MAC	-	7	7	
Nammuldi Member	NAM	-	3	3	
Total		**53**	**43**	**96**	

The samples were submitted to the ALS laboratories (ALS) in Brisbane for preparation and analytical testwork. An initial phase of screening test work (Phase 1) comprised the following tests on all samples:

- Paste pH and electrical conductivity (EC) (at a 2:1 liquid to solid (L:S) ratio)
- Total sulfur
- Acid neutralisation capacity (ANC)
- Single addition net acid generation (NAG) tests
- Multi-element chemical analysis.

Based on the Phase 1 test results, a subset of samples was selected for Phase 2 testing, comprising:

- Sulfur speciation (chromium reducible sulfur and sulfate-sulfur)
- Carbon speciation (total inorganic carbon (TIC) and total organic carbon (TOC))
- Acid buffering characteristic curves (ABCC)
- Mineralogical assessment (quantitative X-ray diffraction (XRD))
- Static de-ionised (DI) water leach tests (2:1 L:S, 12 hour tumble).

Most testing was undertaken by ALS. The XRD analysis was completed at the Intertek/ Genalysis laboratory in Perth.

The Phase 1 and Phase 2 static test methods are summarised in Appendix B and are consistent with the *ARD Test Handbook* (AMIRA, 2002).

3 Results and Discussion

3.1 Mineralogy

The mineralogical assessment used powder XRD to identify the primary mineral phases. The procedure included the addition of an internal standard (e.g. corundum) to allow quantification of the phases identified. A total of 16 samples were assessed, and the results are shown in Appendix C and summarised in Table 3-1.

The sulfide minerals pyrite and marcasite were identified in eight samples at concentrations ranging between <1% and 38%. The samples were from the DET stratigraphy (four lignite samples), together with one sample each from the DG, FWZ, WF and NEW stratigraphies. The highest concentrations were present in lignite sample IDL538. A low concentration of sphalerite was also identified in one of the WF samples.

Other sulfur minerals present in the lignite samples included sulfates and hydroxysulfates. These minerals were present at concentrations between <1% and 7% (sulfates) and <1% and 4% (hydroxysulfates).

Carbonate minerals were identified in nine of the samples at concentrations between <1% and 82%. Most of the samples were from the WF lithology (four samples), lignites (two samples) and one sample each from the NEW, MAC and NAM lithologies. Dolomite was the most common carbonate identified and was present at high concentrations in two samples: 82% (IEZ052, WF) and 49% (ICL231, WF). A high concentration (25%) of rhodochrosite was also identified in one sample (HST214, WF). Low concentrations of aragonite (IDL538, lignite), calcite (ICY663, MAC) and siderite (ICV737, lignite and IEZ199, WF) were also recorded, typically around 1% or less.

Other minerals identified in the samples were silicates and aluminosilicates (at concentrations up to 86%) and oxides and oxyhydroxides (at concentrations up to 75%).

The amorphous content of the samples ranged between 10% and 71%. The sample with most amorphous material was IDL399 (71%, lignite), followed by IEX186 (67%, lignite).

Table 3-1: Results of the mineralogical assessment

Mineral	Approx Formula	Mineral Group	Mineral Abundance (wt%) for Sample ID and Stratigraphy															
			IEX071	IDL399	IEX186	ICV737	IDL538	IET896	IEW143	HWL551	IEZ052	IEZ199	ICL231	HST214	HST257	ICV072	ICY563	ICI423
			DET	DET-Lig				DG	FWZ	MCS	WF					NEW	MAC	NAM
Pyrite	FeS_2	Sulfides		3	13	1	38	1						4		1		
Marcasite	FeS_2				1		11	1	<1					1				
Sphalerite	(Zn,Fe)S														<1			
Melanterite	$FeSO_4(H_2O)_7$	Sulfates					1											
Gypsum	$CaSO_4.2H_2O$			<1														
Bassanite	$CaSO_4.0.5H_2O$			1	2													
Pickeringite	$MgAl_2(SO_4)_4.22(H_2O)$						7											
Rozenite	$FeSO_4.4(H_2O)$						4											
Jarosite	$KFe_3(SO_4)_2(OH)_6$	Hydroxy-sulfates			1	2	4											
Alunite	$KAl_3(SO_4)_2(OH)_6$						<1											
Aragonite	$CaCO_3$	Carbonates					1											
Calcite	$CaCO_3$																<1	
Dolomite	$CaMg(CO_3)_2$										82	<1	49	<1			4	1
Rhodocrosite	$MnCO_3$													25		2		
Siderite	$FeCO_3$					1						<1						
Quartz	SiO_2	Silicates and alumino-silicates	8	<1	1	47	1	<1	5	37	4	1	5	2	27	1	1	1
Chlorite	$(Fe,Al,Mg)_6(Si,Al)_4O_{10}(OH)_8$												3					
Illite/Muscovite	$(K,Ca,Na)(Al,Mg,Fe)_2(Si,Al)_4O_{10}(OH)_2$			1		14				5		1		1	15			
Kaolin	$Al_2Si_2O_5(OH)_4$		20	19	14	25		20	6	4		29	3	8	21		9	16
Serpentine	$Mg_3Si_2O_5(OH)_4$			1														
Na, Ca Plagioclase	$(Na,Ca)(Al,Si)_2Si_2O_8$			2														
Magnetite	Fe_3O_4	Oxides and oxy-hydroxides	<1	<1		<1	<1		1	<1		<1		1		<1	<1	<1
Gibbsite	$Al(OH)_3$			1	<1													
Goethite	FeO(OH)		16				1	52	56	18	2	12	7	24	10	62	59	61
Hematite	Fe_2O_3		25	1	1			1	1	17	1	15	<1	7	1	12	4	10
Anatase	TiO_2		1	1	<1							<1						
Rutile	TiO_2		1	<1		1				<1		1		<1	1			
Lithiophorite	$(Al,Li)MnO_2(OH)_2$														<1			
Amorphous Content		-	30	71	67	10	31	25	31	19	11	41	33	28	24	22	23	11

Notes: Amorphous content calculated by difference (100% - sum of absolute estimates).

3.2 Paste pH and electrical conductivity

Paste pH and EC results are tabulated in Appendix D. The paste tests give an indication of availability of readily soluble oxidation products and salts. An acidic pH (pH <5) may indicate the presence of acidic reaction products generated by sulfide oxidation. An alkaline pH (pH >7) suggests the presence of reactive neutralising minerals, or, if categorised as potentially acid generating, that the sample has, as yet, not oxidised sufficiently to become acidic.

Paste EC provides an indication of the state of oxidation/ weathering, where higher EC values usually suggest a more advanced state of oxidation/ weathering. Where the sample originates from a naturally saline environment, an elevated paste EC may simply indicate the presence of residual salts in the sample. Plots of the paste pH and EC as a function of total sulfur content are shown in Figure 3-1 and Figure 3-2 respectively. The samples are differentiated by stratigraphic unit.

Figure 3-1 shows the paste pH of the samples ranges between 1.9 and 9.8. The paste pH of most samples (77 out of 96) is greater than 5, with 13 samples giving paste pH values that were alkaline (pH >8). Acidic paste pH values (pH less than 5) were recorded for 19 of the samples (9 of the 10 lignite samples, five FWZ, two MAC, two DG and one WF sample).

Figure 3-2 shows that the paste EC of most samples (83 out of 96) was low, less than 1,000 µS/cm. Three of the samples (two WF and one FWZ) gave rise to marginally higher paste EC, up to 1,540 µS/cm. The highest values were measured for lignite samples (between 1,930 µS/cm and 21,100 µS/cm).

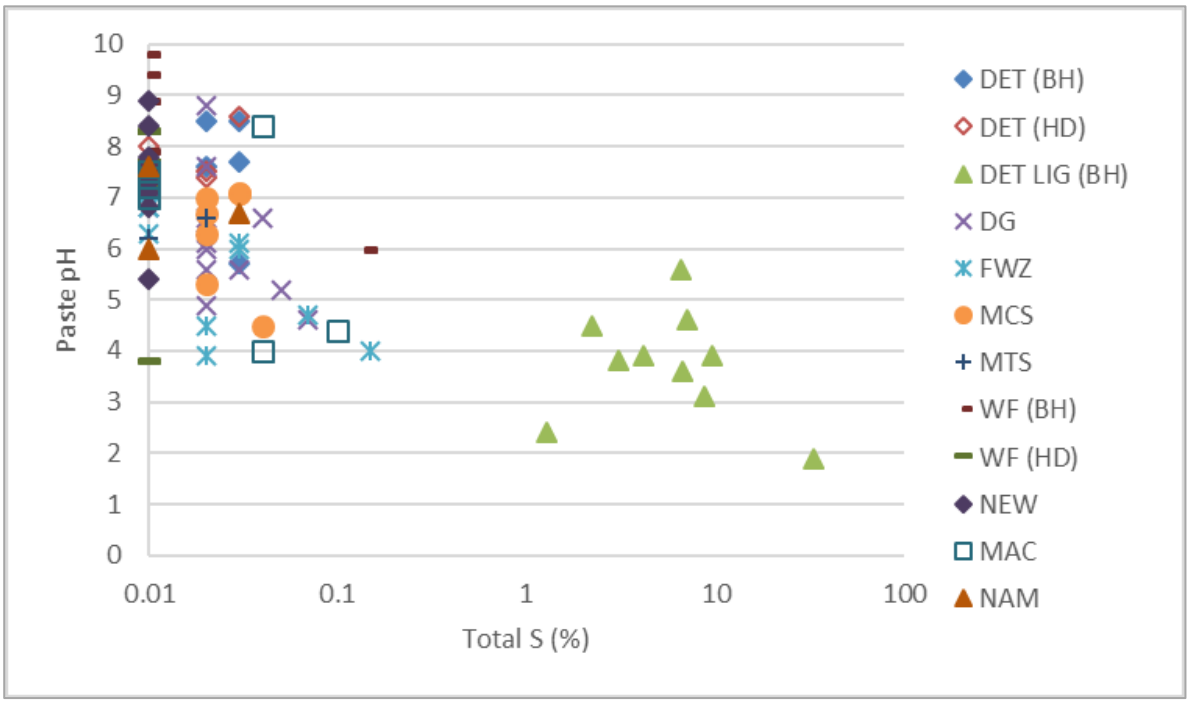


Figure 3-1: Paste pH plotted as a function of total sulfur content

Notes: BH – Bedded Hilltop; HD – Hope Downs 2.

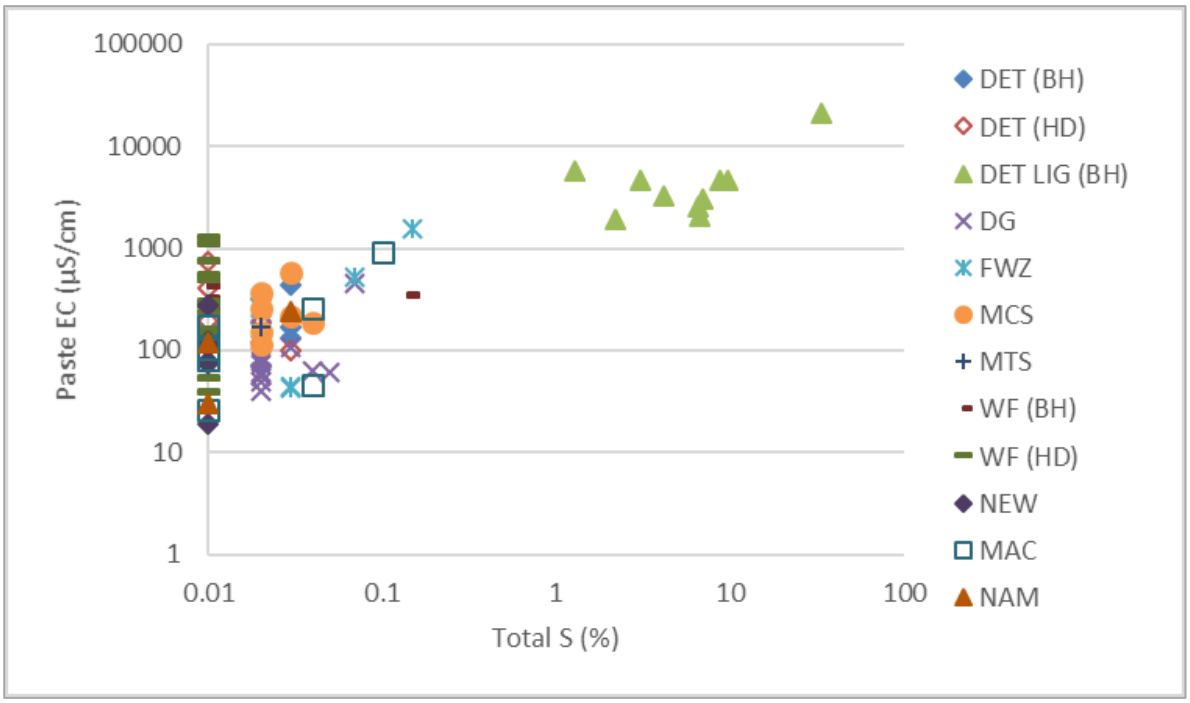


Figure 3-2: Paste EC plotted as a function of total sulfur content

Notes:
Log scale on the x and y axis; BH – Bedded Hilltop; HD – Hope Downs 2.

3.3 Acid base accounting

A summary of the results from acid base accounting (ABA) testwork is presented in Table 3-2. A complete set of results is given in Appendix D.

3.3.1 Acid generation potential

The maximum potential acidity (MPA) is calculated based on the total sulfur content assuming all the sulfur will transform to sulfuric acid. The acid potential (AP) is calculated using estimates of oxidisable sulfide sulfur (usually calculated as the difference between the total sulfur content and the acid soluble sulfur content).

The total sulfur content of the samples ranged from <0.01% to 33.3%. The sulfur content of most samples was low – with sulfur present below the limit of detection (0.01%) in 45 samples and between 0.01% and 0.15% in a further 41 samples (a total of 86 samples). The highest sulfur contents, between 1.27% and 33.3% were present in the 10 lignite samples.

The results of sulfur speciation testwork carried out on a subset of 19 samples is shown in Table 3-3. The table shows that sulfide sulfur generally dominates in the 10 lignite samples and the WF sample. In all other samples (DG, FWZ and MAC), sulfate sulfur dominates.

Comparison of the measured total sulfur with that calculated from the sum of the CRS (chromium reducible sulfur) and SO_4-S showed good agreement for all samples from the DG, FWZ and MAC lithologies. While there was also good agreement for two of the lignite samples, in most cases the calculated values either overestimated (two samples) or underestimated (six samples) the total sulfur content. Possible explanations may be sample variability, or the presence of hydroxysulfate minerals. Hydroxysulfates such as jarosite may not be fully soluble under the conditions of the HCl (hydrochloric acid) digest analytical procedure for sulfate sulfur – which would result in a portion of the sulfate sulfur remaining undetected. The lack of agreement was particularly significant for IDL538. For this sample,

inaccurate measurement of the sulfide sulfur content by the CRS test may have contributed; the reliability in the CRS measurement decreases at sulfide sulfur contents greater than 10%.

Table 3-3 includes results of sulfur speciation by mineralogical assessment, where available. There is generally good agreement in the sulfur values determined by LECO analyser and by XRD for the lignite samples and the MAC sample.

There was poor agreement in the LECO and XRD total sulfur values for five samples – HST214 (WF), HST257 (WF), IET896 (DG), IEW143 (FWZ) and ICV072 (NEW). For all five samples, the mineralogical assessment overestimates the sulfide mineral content (significantly in the case of HST214). As the mineralogical results conflict with the results of total sulfur (both LECO and XRF) and sulfur speciation testwork, they are considered unreliable.

Table 3-2: Summary of ABA and NAG data

Strat	Statistic	No. of samples	Paste pH	Paste EC	NAGpH	NAG pH 4.5	NAG pH 7	ANC	Total S	MPA	NAPP	AMIRA Classification			
			pH units	µS/cm	pH units	kgH_2SO_4/t			%	kgH_2SO_4/t		NAF[1]	UC (NAF)	PAF-LC	PAF
DET	Min.	14	5.7	69	6.2	<0.1	<0.1	<0.5	<0.01	0.3	-32	4(9)	1		
	Median		7.5	191	7.3	<0.1	<0.1	2.65	0.02	0.6	-				
	Max.		8.6	735	9.2	<0.1	0.4	32.9	0.03	0.9	0.4				
DET LIG	Min.	10	1.9	1,930	1.8	19.4	42.3	<0.5	1.27	39	38				10
	Median		3.8	3,925	2.2	150	221	<0.5	6.63	203	-				
	Max.		5.6	21,100	2.6	626	699	6.9	33	1019	1013				
DG	Min.	15	4.6	40	3.9	<0.1	<0.1	<0.5	<0.01	0.3	-0.3	(2)	12	1	
	Median		6.4	72	6.2	<0.1	0.7	<0.5	0.02	0.6	-				
	Max.		8.8	461	7	0.8	2.4	0.9	0.07	2.1	1.6				
FWZ	Min.	9	3.9	43	4.1	<0.1	<0.1	<0.5	<0.01	0.3	-0.2	(3)	5	1	
	Median		6	140	6.2	<0.1	0.4	<0.5	0.02	0.6	-				
	Max.		6.8	1,540	6.8	0.8	4.7	0.5	0.15	4.6	4.1				
MCS	Min.	7	4.5	115	5.6	<0.1	<0.1	<0.5	0.02	0.6	-0.2	(3)	4		
	Median		6.7	214	6.1	<0.1	0.5	0.7	0.02	0.6	-				
	Max.		7.1	575	7.2	<0.1	2	1	0.04	1.2	0.7				
MTS	Min.	2	6.2	96	6.4	<0.1	<0.1	<0.5	<0.01	0.3	-0.5	(1)	1		
	Median		6.4	133	6.6	<0.1	0.25	0.65	0.015	0.5	-				
	Max.		6.6	169	7	<0.1	0.4	0.8	0.02	0.6	0.1				
WF	Min.	20	3.8	40	5.6	<0.1	<0.1	<0.5	<0.01	0.3	-968	12(8)			
	Median		7.6	294	8.1	<0.1	<0.1	6.15	<0.01	0.3	-				
	Max.		9.8	1,310	10.2	<0.1	1.5	968	0.14	4.3	-0.2				
NEW	Min.	9	5.4	19	6.6	<0.1	<0.1	<0.5	<0.01	0.3	-8.7	1(8)			
	Median		7.5	78	7.2	<0.1	<0.1	<0.5	<0.01	0.3	-				
	Max.		8.9	276	8.5	<0.1	0.7	9	<0.01	0.3	-0.2				
MAC	Min.	7	4	26	4.6	<0.1	<0.1	<0.5	<0.01	0.3	-0.2	(4)	3		
	Median		7.2	102	6.6	<0.1	0.5	<0.5	<0.01	0.3	-				
	Max.		8.4	911	7.4	<0.1	2.1	0.7	0.1	3.1	2.6				

Strat	Statistic	No. of samples	Paste pH	Paste EC	NAGpH	NAG pH 4.5	NAG pH 7	ANC	Total S	MPA	NAPP	AMIRA Classification			
			pH units	µS/cm	pH units	kgH_2SO_4/t			%	kgH_2SO_4/t		NAF[1]	UC (NAF)	PAF-LC	PAF
NAM	Min.	3	6	30	6	<0.1	0.5	<0.5	<0.01	0.3	-0.2	(2)	1		
	Median		6.7	117	6.4	<0.1	0.6	<0.5	<0.01	0.3	-				
	Max.		7.6	239	6.6	<0.1	2	<0.5	0.03	0.9	0.4				
All Samples	Min.	96	1.9	19	1.8	<0.1	<0.1	<0.5	<0.01	0.3	-968	17(40)	27	2	10
	Median		7	167	6.7	<0.1	0.3	<0.5	0.02	0.6	-				
	Max.		9.8	21,100	10.2	626	699	968	33	1,019	1013				

Notes:
[1] Number of samples classified as NAF-Barren shown in parenthesis;
EC – Electrical Conductivity; NAG – Net Acid Generation; ANC – Acid Neutralising Capacity; S – Sulfur; MPA – Maximum Potential Acidity; NAPP – Net Acid Producing Potential; NAF – Non Acid Forming; Bar – Barren; UC – Uncertain; PAF – Potentially Acid Forming; LC – Low Capacity.

Table 3-3: Results of sulfur speciation tests

Sample ID	Lithology	Total S	Sulfide S	Sulfate S	Sulfide S	Sulfate S	Comment
		LECO	CRS	HCl Digest	XRD	XRD	
		%	%	%	%	%	
ICV737	DET LIG	1.3	0.65	0.62	0.53	0.26	Pyrite (1%) and jarosite (2%)
IDL399	DET LIG	2.2	3.2	0.42	1.6	0.41	Pyrite (3%), gypsum (<1%) and bassanite (1%)
IDL538	DET LIG	33	22	2.15	26	2.4	Pyrite (38%), marcasite (11%) and sulfates and hydroxysulfates
IEX186	DET LIG	7.0	7.1	0.95	7.4	0.6	Pyrite (13%), marcasite (1%), bassanite (2%) and jarosite (1%)
ICV974	DET LIG	3.0	1.3	1.24	-	-	-
ICW891	DET LIG	6.7	4.2	0.51	-	-	-
ICW899	DET LIG	8.7	5	1	-	-	-
IDL765	DET LIG	9.6	6.3	0.39	-	-	-
IER771	DET LIG	6.6	4.8	0.58	-	-	-
IEX193	DET LIG	4.2	2.0	0.83	-	-	-
IET896	DG	0.07	<0.005	0.03	1.1	ND	Pyrite (1%) and marcasite (1%)
HSS954	DG	0.05	0.015	0.005	-	-	-
HSS955	DG	0.02	0.007	0.01	-	-	-
IEW143	FWZ	0.15	<0.005	0.11	0.53	ND	Marcasite (<1%)
IER142	FWZ	0.02	<0.005	0.02	-	-	-
IEZ446	FWZ	0.07	0.006	0.05	-	-	-
ICV792	WF	0.14	0.15	0.03	-	-	-
HST214	WF	<0.01	-	-	2.7	ND	Pyrite (4%) and marcasite (1%)
HST257	WF	<0.01	-	-	0.33	ND	Sphalerite (<1%)
ICV072	NEW	<0.01	-	-	0.53	ND	Pyrite (1%)
ICY563	MAC	0.1	<0.005	0.08	ND	ND	No sulfur minerals detected
ICH905	MAC	0.04	<0.005	0.03	-	-	-

Notes:
S – Sulfur; CRS – chromium reducible sulfur; HCl – Hydrochloric acid; " – " not tested; ND – Not detected.

3.3.2 Acid neutralising capacity

The ANC ranged between <0.5 kgH_2SO_4/t and 968 kgH_2SO_4/t. For most samples the ANC was low – below the limit of detection (0.5 kgH_2SO_4/t) for 57 samples and between 0.5 kgH_2SO_4/t and 32.9 kgH_2SO_4/t for a further 34 samples (a total of 91 samples). The highest ANC (292–968 kgH_2SO_4/t) was measured in five samples – all from the WF lithology.

Carbonate neutralising potential

The total inorganic carbon (TIC) content may be used to infer the carbonate mineral content and estimate the carbonate neutralisation potential (CarbNP). Carbon speciation testing was carried out on 25 samples (see Appendix D). The CarbNP values ranged from 2 kgH_2SO_4/t to 873 kgH_2SO_4/t. A plot of the calculated CarbNP as a function of the measured ANC is shown in Figure 3-3. The black dotted line on the plot is a line of equivalence (where the CarbNP equals the ANC).

There was good agreement between the CarbNP and ANC for the WF and NEW samples – with most samples plotting close to the line of equivalence. Lignite and DET samples, on the other hand, show poor agreement.

The CarbNP exceeded the ANC for all lignite samples. Very high CarbNP values were calculated for most of the samples, which contained low to negligible measurable ANC. The carbonate in these samples is most likely in the form of iron bearing carbonate minerals that do not contribute effectively to the ANC under oxidising conditions. This includes minerals such as siderite ($FeCO_3$) which was identified in samples tested (Table 3-1). While dissolution of siderite consumes acidity, ferrous iron released has the potential to oxidise to ferric iron and precipitate as $Fe(OH)_3$, generating acidity. Combined, the reactions may not result in net consumption of acidity.

There was considerable scatter in the results for the DET samples, with samples plotting both above and below the line of equivalence. The two samples plotting below the line contain modest ANC (greater than 10 kgH_2SO_4/t) and low CarbNP (up to 3 kgH_2SO_4/t), suggesting most of the ANC measured in the test is associated with neutralisation by silicate minerals.

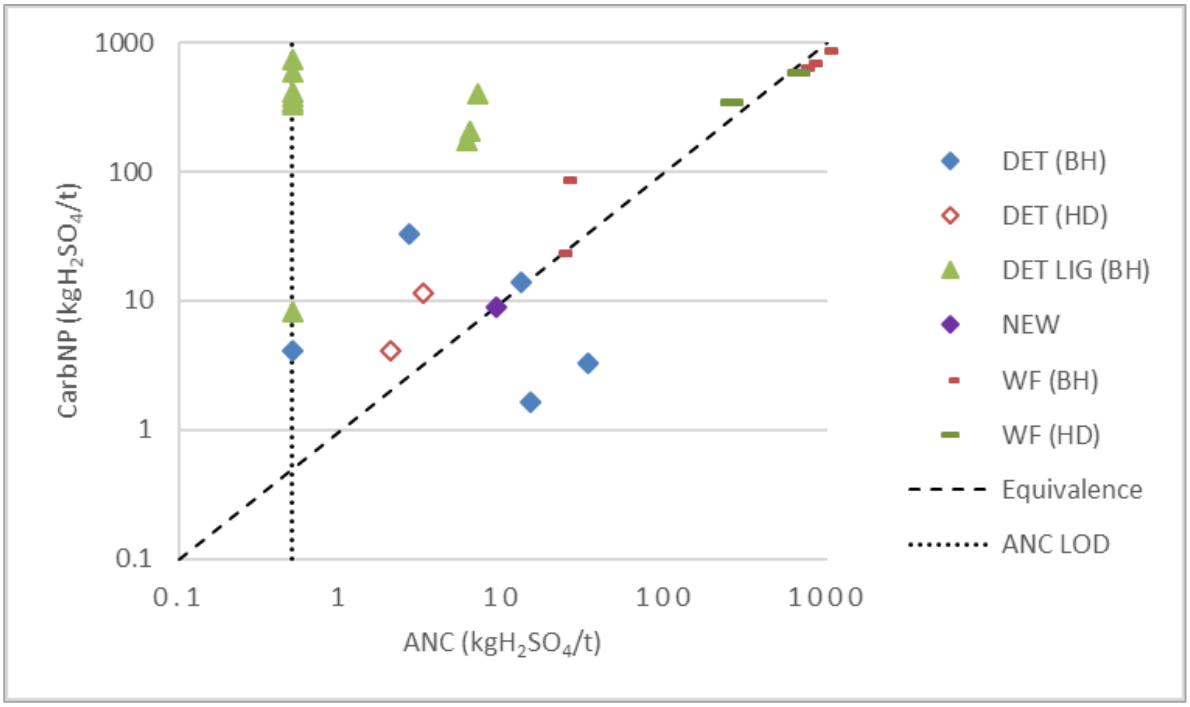


Figure 3-3: CarbNP plotted as a function of ANC

Acid buffering characteristic curves

To assess the availability of neutralising capacity, nine samples (from the DET, WF and NEW stratigraphies), exhibiting a range of ANC values, were submitted for ABCC testing. The results are illustrated in Figure 3-4 (samples with ANC greater than 200 kgH_2SO_4/t) and Figure 3-5 (samples with ANC less than 50 kgH_2SO_4/t) – a full set of results is provided in Appendix E.

Typically, buffering within certain pH ranges can be attributed to neutralisation by specific minerals. For example, buffering at around pH 7 and above is indicative of neutralisation by carbonate minerals such as calcite, while dolomite buffers the pH between pH 6 and 7. Buffering by aluminium and iron hydroxide minerals may occur below pH 4.5.

Figure 3-4 and Figure 3-5 both show strong evidence of buffering by carbonate minerals in most of the samples tested – consistent with the results of the mineralogical assessment, where calcite and dolomite were identified in the samples.

Samples from the WF lithology (Figure 3-4) contained the highest ANC and generally gave rise to well-defined plateaus.

Whilst IEX071 (DET) contained modest ANC (33 kgH_2SO_4/t), the plot shows no evidence of buffering capacity. For this sample, measured ANC may reflect the presence of silicates that were reactive under the conditions of the ANC test.

HST214 contained 25% rhodochrosite. The plot shows that the sample buffered acidity between pH 4 and 5 and Table 3-4 shows that it contained significant available ANC (175 kgH_2SO_4/t to pH 4.5).

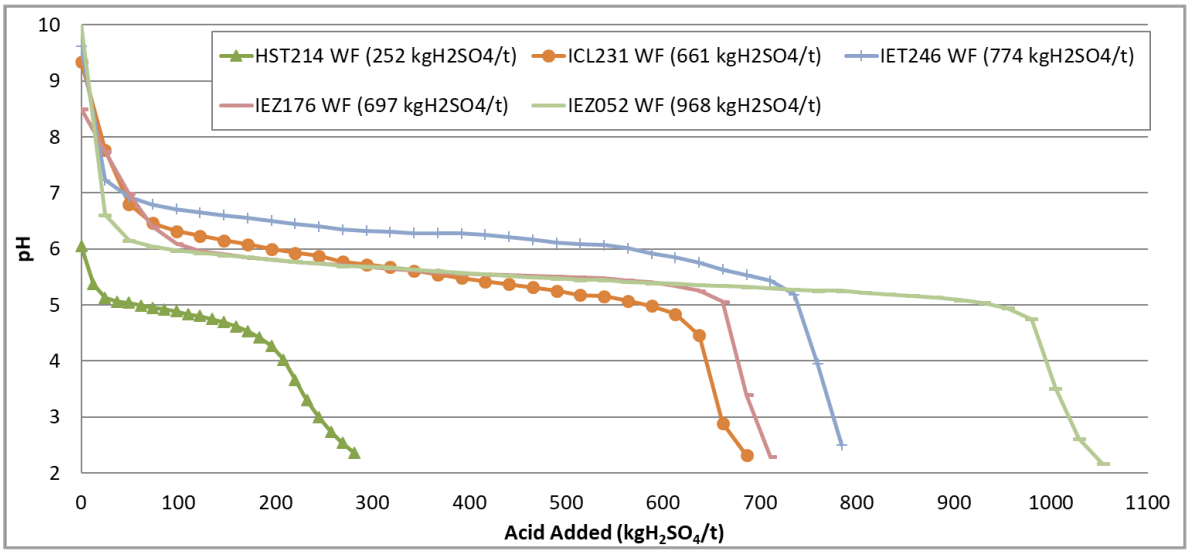


Figure 3-4: Acid buffering characteristic curves – samples with ANC >200 kgH_2SO_4/t

Note: Static ANC values are shown in brackets after the sample ID and stratigraphy.

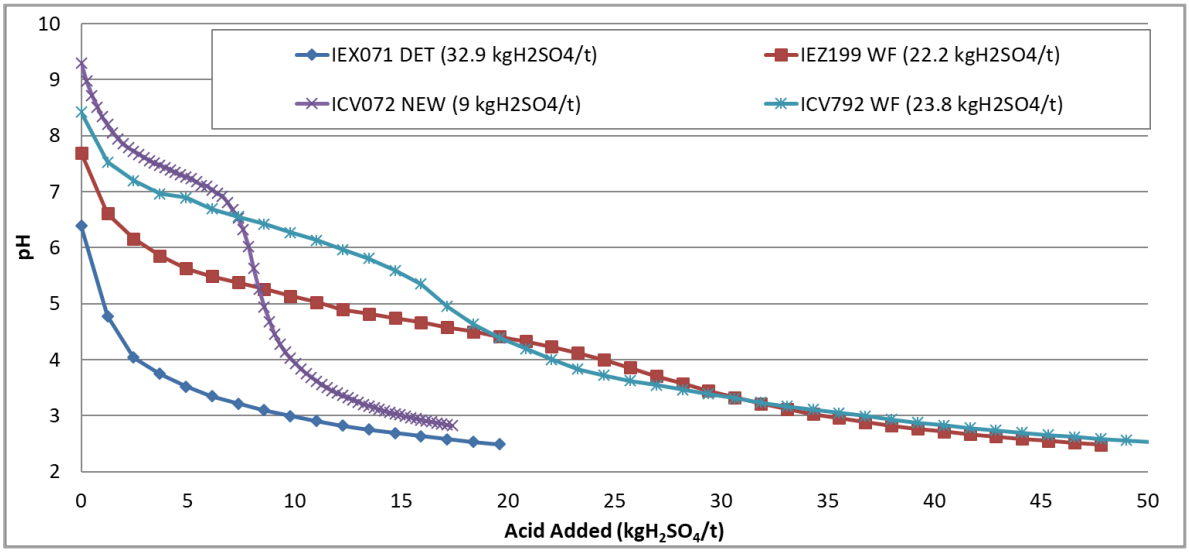


Figure 3-5: Acid buffering characteristic curves – samples with ANC < 50 kgH_2SO_4/t

Note: Static ANC values are shown in brackets after the sample ID and stratigraphy.

The measured ANC and the available ANC (ABCC measured to pH 6 and 4.5) are summarised in Table 3-4. The table also includes the carbonate-based neutralisation potential (CarbNP) calculated from the TIC results.

The ANC consumed to pH 6 ranged between 0.4% and 87% of the total ANC in the samples. For most samples, 69% or more of the ANC was consumed to pH 4.5. These results suggest that most samples contain a high proportion of readily available ANC to buffer pH above 4.5.

However, IEX071 (DET) is an exception; only 5% was consumed. As already mentioned, in this sample, it is possible that alumino-silicates significantly contributed towards the measured ANC.

Table 3-4: Summary of ANC results

Sample ID	Strat	ANC	ANC to pH 6		ANC to pH 4.5		CarbNP
		kgH_2SO_4/t	kgH_2SO_4/t	Consumed (%)	kgH_2SO_4/t	Consumed (%)	kgH_2SO_4/t
IEX071	DET	33	0.3	1	1.7	5	3
IEZ199	WF	22	3.1	14	18	83	24
HST214	WF	252	1.0	0.4	175	69	349
ICV792	WF	23.8	12	50	19	80	87
ICL231	WF	661	196	30	634	96	597
IET246	WF	774	566	73	748	97	702
IEZ176	WF	697	116	17	670	96	647
IEZ052	WF	968	89	9	985	102	873
ICV072	NEW	9	7.8	87	9.0	100	9

3.3.3 Net acid producing potential

The net acid producing potential (NAPP) of the samples is a balance of MPA and ANC (i.e. NAPP = MPA – ANC). A negative NAPP indicates an overall excess of neutralising capacity, while a positive NAPP indicates an excess of acidity.

The calculated NAPP values ranged from -968 kgH_2SO_4/t to 1,013 kgH_2SO_4/t, with most samples (57) giving negative NAPP values. Of the 39 samples that gave rise to positive NAPP values, most were low (NAPP of 29 samples was between 0.02 kgH_2SO_4/t and 4.1 kgH_2SO_4/t).

High NAPP values (between 38 kgH_2SO_4/t and 1013 kgH_2SO_4/t) were calculated for the 10 lignite samples. These samples contained between 1.27% and 33.3% sulfur and low ANC (up to 6.9 kgH_2SO_4/t).

Net acid generation and sample classification is discussed further in following sections.

3.4 Net acid generation tests

During the NAG test, the samples are contacted with the strong oxidant, hydrogen peroxide, to oxidise sulfide minerals contained in the sample. Concurrently, neutralising minerals present in the sample consumes the acidity generated until either the ANC or sulfide is depleted. Should the ANC be depleted first, excess acidity is generated and the sample pH decreases. Following a predetermined contact time, the solution pH (NAG pH) is recorded and the acidity of the sample is quantified by titration with a base (sodium hydroxide). The acidity generated at pH 4.5 and below is generally attributed to free sulfuric acid and ferric iron resulting from the oxidation of sulfide minerals after consumption of any neutralising mineral phases. The acidity generated between pH 4.5 and pH 7 includes a contribution from metals such as copper that are soluble at pH 4.5 but insoluble at pH 7.

Single addition NAG tests were conducted on all samples to assess the net amount of acid generated by the samples. In general, the results supported the findings of the ABA testwork, with good agreement between the NAG and the NAPP.

While most samples did not generate acidity (NAG pH values were above pH 6, and NAG acidities were generally close to or below detection limits), the 10 lignite samples generated significant acidity and gave rise to strongly acidic pH values.

3.4.1 Sample classification

The NAPP and NAG pH values are commonly used to classify the acid generating potential of samples as shown in Figure 3-6 and Appendix D. The classification scheme is summarised in Table 3-5.

Table 3-5: Summary of classification scheme

Class	Sub-class	Description
NAF	NAF	Samples with a negative NAPP value and a NAG pH ≥4.5
	NAF-Barren	As above, and also a low ANC (≤ 5 kg H_2SO_4/t); such samples have little value with respect to mitigating the effects of acid production in other mine waste materials
PAF	PAF	Samples with a positive NAPP value and a NAG pH <4.5
	PAF-LC	PAF materials associated with low NAG acidities ($NAG_{pH4.5}$ <5 kg H_2SO_4/t)
Uncertain	UC(PAF)	Samples with negative NAPP but giving NAG pH values <4.5
	UC(NAF)	Samples with positive NAPP but giving NAG pH values ≥4.5. Possibly in these samples some of the sulfur present is in non-pyritic forms

Notes: NAF – Non Acid Forming; PAF – Potentially Acid Forming; LC – Low Capacity (to produce acid); UC – Uncertain acid potential.

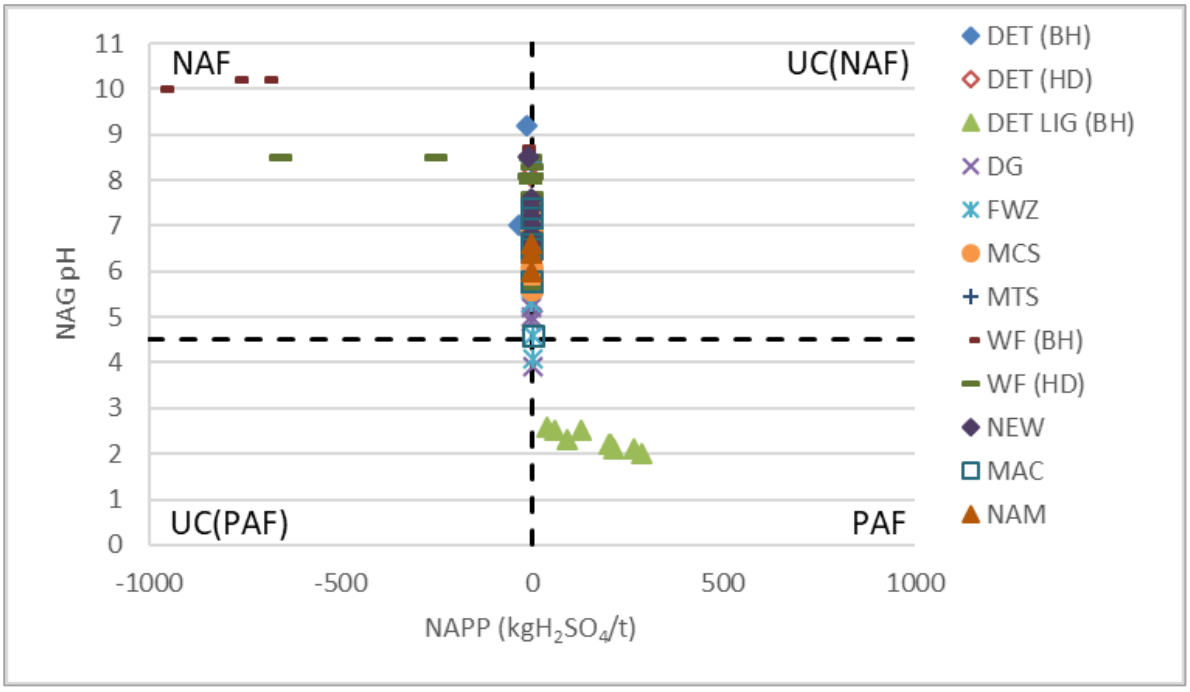


Figure 3-6: Geochemical classification plot

Notes: BH – Bedded Hilltop; HD – Hope Downs 2.

Most of the samples (57 out of 96) were classed as NAF, of which 40 were classed within the 'barren' subclass (where barren indicates material with no value in terms of ANC that could mitigate the effects of acid generation in other mine materials).

Figure 3-6 shows that all 10 of the lignite samples plotted within the PAF quadrant. Two other samples (one DG and one FWZ) were also classed as PAF, but with a low capacity to generate acidity (i.e. less than 5 kgH_2SO_4/t).

The classification of 27 samples was uncertain. These samples generally contained low sulfur (0.1% or less) and negligible ANC (<0.5 kgH_2SO_4/t). While most samples are not expected to be acid generating, eight samples gave rise to paste pH values that were less than 5, suggesting that they contain a store of readily soluble acidic weathering products. These samples were from the DG, FWZ, MAC and MCS lithologies.

For each stratigraphic group, Table 3-2 summarises the distribution of samples between the classes.

3.5 Multi-element chemical assays

The results of multi-element chemical analyses, including the calculated global abundance indicator (GAI) values are provided in Appendix F. The results show that the most abundant elements are Fe and Si as would be expected since iron and silicate minerals were found to be the dominant minerals in most samples.

GAIs provide an indication of how the measured elemental abundances compare to average crustal abundances. Elements with a GAI greater than 3 are considered to be enriched.

A summary of the number of samples that were enriched for each stratigraphy is shown in Table 3-6. Elements enriched in one or more samples were Ag, As, B, Bi, Cd, Hg, Mn, Re, S, Sb, Se, Te, Tl and Zn.

The greatest range of elemental enrichment occurs in DET LIG samples (12 elements) followed by the WF samples (9 elements). Samples from the Newman stratigraphy showed the least enrichment (only one sample that was enriched with Se).

Table 3-6: Summary of number of samples that were enriched (GAI values ≥3)

Rock type	No. of samples	Ag	As	B	Bi	Cd	Hg	Mn
Detritals	14		13		4		1	
Lignite	10		10	9	3	8	9	
Dales Gorge	15		2		1			
FWZ	9		6					
MCS	7	1	7		6			
MTS	2		2		1	1		
WF	20		13	4	8	3		7
Newman	9							
MacLeod	7							
Nammuldi	3							

Rock Type	No. of samples	Re	S	Sb	Se	Te	Tl	Zn
Detritals	14			11	11	14		
Lignite	10	8	10	3	10	10	2	1
Dales Gorge	15			1	2	4		
FWZ	9			1	3	3		
MCS	7			6	6	7		
MTS	2			1	1	2		
WF	20			11	5	14		2
Newman	9				1			
MacLeod	7				2	3		
Nammuldi	3				1	1		

Note: Cells have been left blank where no samples were enriched.

3.6 Element leachability

Static DI water leach tests were carried out on 25 samples to assess the leachability of contaminants from the materials. The leach tests involved pulverised samples and a 12-hour contact time (during which the sample was tumbled). The leachates were filtered using a 0.2 µm filter.

The results from the individual leach tests are shown in Appendix G. Table 3-7 lists the average dissolved concentrations observed in each stratigraphic unit in the leach tests for selected elements.

Since the physical and chemical conditions of the laboratory leach test will not be the same as those expected in the field – for example, the liquid to solid ratios and contact duration, the laboratory results cannot be used directly to represent leachate quality expected to seep from a stockpile of the material. Depending on field conditions, seepage water quality might be better or worse than indicated by these leach tests.

The pH of the leachate from the samples ranges from 1.9 to 7.8. For most samples, the leachate was in the near-neutral range (between pH 6 and 8). Two of the lignite samples (IDL538 and ICV737) gave rise to acidic leachates (pH <2.5).

The highest leach EC values were measured for the four lignite samples tested (EC was between 2,610 µs/cm and 24,900 µs/cm). The leach EC ranged between 78 µs/cm and 1,860 µs/cm for all other samples.

Higher levels of dissolved elements suggest the presence of readily soluble salts, such as carbonates, sulfates and chlorides, in the sample. The salts may represent pre-existing weathering products present in the samples, or may have formed following evaporation of sample pore water. Drilling fluids may also contribute to the salt content of samples. Some elements may be sourced from mineral surfaces, e.g. desorbed from ion exchange sites.

The major cations (Ca, Mg, Na and K) and anions (SO_4, Cl and F) were generally present at readily detectable concentrations in the leachate from all samples. The highest concentrations of SO_4, Ca and Mg were present in the leachate from the lignite samples. Concentrations of Na and K were similar for all samples. High concentrations of Ca and SO_4 are likely associated with dissolution of sulfur minerals such as gypsum (which was identified in the mineralogical assessment).

The total N concentration in the leachate from the samples was low – being close to, or below, the limit of detection (0.1 mg/L) for most samples. Readily detectable concentrations were present in the leachate from the lignites, as well as samples ICY563 (MAC) and IEX071 (DET). In most cases, organic N was the dominant species present.

The majority of trace elements (i.e. Ag, Be, Bi, Ce, Cr, Cs, Ga, Hf, Hg, La, Nb, Sb, Sn, Ta, Te, Th, Ti, Tl, U, V, W, Y and Zr) leached at concentrations that were low – close to the limit of detection or below it.

Of the trace elements that were readily detectable in most leachates (i.e. Al, As, B, Ba, Cd, Co, Cu, Fe, Li, Mn, Mo, Ni, Pb, Rb, Se, Sr and Zn), concentrations were highest in the acidic leachate from the lignite samples (IDL538, followed by ICV737).

Table 3-7: Static leach data summary – average dissolved concentrations

Parameter	Units	Stratigraphy										Min.	Average	Max.
		DET	DET LIG	DG	FWZ	MAC	MCS	MTS	NAM	NEW	WF			
		n=3	n=4	n=2	n=2	n=2	n=3	n=2	n=1	n=1	n=5	n=25		
pH	-	6.7	2.4	6.4	5.6	6.2	6.5	6.6	6.5	7.8	6.4	1.9	3.2	7.8
Ca	mg/L	5.7	8.8	8.5	17	7	6.3	11	19	67	236	<1	57	464
Mg	mg/L	5	24	26	33	8.5	6	8.5	21	61	167	<1	48	394
Na	mg/L	17	68	66	69	27	22	35	21	135	34	5	44	216
K	mg/L	3	8	9	13	4	1	6	2	10	6.2	<1	6	23
SO_4	mg/L	25	10,765	88	218	89	93	30	83	9	116	5	1,797	28,600
Cl	mg/L	13	45	26	187	140	105	22	28	9	91	3	71	366
F	mg/L	0.87	0.25	0.20	0.50	0.30	1.93	0.75	0.90	0.80	0.64	<0.1	0.71	3.60
Al	mg/L	0.10	172	0.03	0.41	0.12	0.08	0.03	0.02	0.013	0.03	<0.01	28	596
As	mg/L	0.001	8.2	0.0006	0.0005	0.0007	0.002	0.0006	0.0003	0.003	0.001	<0.0002	1.31	26
B	mg/L	0.26	1.8	0.27	0.46	0.38	0.41	0.19	0.30	0.16	0.41	0.06	0.57	3.1
Cd	mg/L	0.0002	0.46	0.0003	0.0005	0.0003	0.0005	0.0006	0.0003	0.00005	0.0006	<0.0001	0.07	1.08
Co	mg/L	0.0005	10	0.004	0.005	0.0004	0.005	0.007	0.0002	0.0001	0.003	<0.0001	1.63	33
Cr	mg/L	0.0007	0.35	<0.0002	<0.0002	0.0003	0.0003	<0.0002	<0.0002	<0.0002	0.0007	<0.0002	0.06	0.87
Cu	mg/L	0.0011	2.8	0.001	0.001	0.009	0.004	0.0009	0.0005	0.001	0.002	<0.001	0.45	11
Fe	mg/L	0.50	3,880	0.13	0.07	0.87	0.03	0.008	0.03	0.10	1.10	<0.002	621	12,200
Mn	mg/L	0.01	20	0.30	0.91	0.10	0.10	0.17	0.009	0.004	0.19	0.001	3.31	54
Mo	mg/L	0.001	0.01	<0.0001	0.0001	0.0007	0.0002	0.0006	<0.0001	0.003	0.0007	<0.0001	0.002	0.03
Ni	mg/L	0.002	26	0.02	0.02	0.002	0.01	0.01	0.001	0.002	0.04	<0.001	4.19	85
Pb	mg/L	0.0001	0.08	0.0001	0.0003	0.001	0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	0.01	0.26
Se	mg/L	0.006	0.08	0.003	0.0005	0.0006	0.003	0.001	0.001	0.001	0.001	0.0003	0.01	0.15
U	mg/L	0.0001	0.21	<0.0001	0.0004	<0.0001	0.0003	<0.00005	<0.0001	0.0001	0.0003	<0.0001	0.03	0.54
Zn	mg/L	0.07	205	0.22	0.60	0.34	0.33	0.06	0.08	0.006	0.39	0.006	33	703

Parameter	Units	Stratigraphy										Min.	Average	Max.
		DET	DET LIG	DG	FWZ	MAC	MCS	MTS	NAM	NEW	WF			
		n=3	n=4	n=2	n=2	n=2	n=3	n=2	n=1	n=1	n=5	n=25		
NO_2+NO_3	mg/L	0.06	0.53	0.02	<0.01	0.14	0.02	0.01	<0.01	<0.01	0.03	<0.01	0.11	1.28
TKN	mg/L	0.13	0.83	<0.1	<0.1	0.15	0.1	<0.1	<0.1	0.1	<0.1	<0.1	0.22	2.1
Total N	mg/L	0.17	1.4	<0.1	<0.1	0.3	0.1	<0.1	<0.1	0.1	<0.1	<0.1	0.33	3.4

Notes:
NO_2 + NO_3 as N, TKN – total Kjeldahl nitrogen; Average values calculated assuming results below the limit of detection are equal to it; n – number of samples.

4 Conclusions

The outcomes of the testwork program are summarised below:

- Total sulfur ranged from <0.01% to 33.3%, but was low (less than 0.15%) for 86 of the 96 samples. The 10 lignite samples contained between 1.27% and 33.3%, with a large proportion present as sulfide sulfur (likely pyrite and marcasite).
- The ANC ranged between <0.5 kgH_2SO_4/t and 968 kgH_2SO_4/t and for most samples it was low. The highest ANC (292 kgH_2SO_4/t to 968 kgH_2SO_4/t) was measured in five WF samples – a large proportion was present in the form of dolomite.
- Sample classification indicated that 57 samples were NAF, 27 were UC and 12 were PAF. Of the UC samples, eight generated acidic paste pH values (<5 – they contained a small store of readily soluble acidic weathering products and negligible ANC).
- Leachate pH values were near neutral (between 6 and 8) for most samples but ranged down to acidic values in some tests. The major cations and anions were generally present at readily detectable concentrations in the leachate from all samples.
- While most trace elements leached at concentrations that were low (close to the limit of detection or below it), Al, As, B, Ba, Cd, Co, Cu, Fe, Li, Mn, Mo, Ni, Pb, Rb, Se, Sr and Zn were readily detectable in most leachates.

The main conclusions of the testwork program are as follows:

- Of the 96 samples tested, the 10 lignites had the greatest acid generation potential. The samples were all classed as PAF since they contained significant sulfide sulfur and low ANC. Leachate from the lignites is expected to be generally acidic with high solute concentrations – including high concentrations of major cations (i.e. Ca and Mg), anions (i.e. SO_4) and a range of trace elements (e.g. Al, As, Cd, Co, Cr, Cu, Mn, Ni and Zn).
- The 20 WF samples were all classed as NAF, they contained the greatest ANC and negligible total sulfur. Leachate from the samples was invariably circum neutral to alkaline, with a low solute concentration.
- The remaining 66 samples were from a range of lithologies. The samples contained low to negligible total sulfur and low to modest ANC with most samples expected to be NAF. The acid generation potential of the samples classed as UC or PAF-LC will be low to negligible. Most samples are expected to generate leachate that is circum neutral and with a low solute concentration.

5 Recommendations

A review of the RTIO geochemical database indicates that eight lignite samples (five from Hope Downs) have been submitted for kinetic column tests in the past. A further 10 lignite samples have been tested as part of this project and provide an opportunity for RTIO to carry out further geochemical testwork to provide greater insight to lignite behaviour.

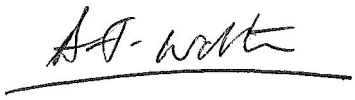
It is recommended that a subset of the samples be submitted for kinetic column leach tests and measurement of the oxygen consumption rate. The results of kinetic tests will provide an understanding of solute release from the samples and can also be used to calculate the sulfide oxidation rate based on sulfate release rates from the column. Measurement of the oxygen consumption rate will provide an indication of the oxygen consumed due to sulfide oxidation as well as organic carbon present in the samples. The results of the testwork may be used to assess oxygen consumption mechanisms and provide insight into lignite weathering processes.

It is also recommended that a laboratory program be developed to further investigate the leaching characteristics of lignite samples. This was one of the recommendations of a recent review carried out by SRK into N leachability (RTS154 – SRK, 2018). The review concluded that carbonaceous material was the most likely source of N in leachate and that further investigation should be carried out to assess the potential mechanisms for N release.

In addition, it is recommended that supplemental leach testwork be carried out on other DET (strands other than lignites) and WF samples. This could include:

- Low contact ratio leach testing – to assess the influence of contact ratio on leachability
- Mild acid leach testing – to assess the leaching potential of waste material that may come into contact with acidity generated by other materials at the site, for example, as a result of use as a possible management option to mitigate AMD risk from PAF materials.

Compiled by



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Peer Reviewed by



Claire Linklater

Principal Consultant

6 References

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Appendices

Appendix A: Sample Logs

Sample Log

Number	Location	Lithology	Project	Hole ID	Site ID	Sample ID	Depth (m)	
							From	To
1	Bedded Hilltop	Detritals	HD1	RC18BHT0134	246209	HWL255	28	30
2	Bedded Hilltop	Detritals	HD1	RC18BHT0174	255149	IEZ059	8	10
3	Bedded Hilltop	Detritals	HD1	RC18BHT0272	242966	IEX071	64	66
4	Bedded Hilltop	Detritals	HD1	RC18BHT0273	242968	IEX144	24	26
5	Bedded Hilltop	Detritals	HD1	RC18BHT0368	241355	IDS997	26	28
6	Bedded Hilltop	Detrital Lignite	HD1	RC18BHT0164	242428	IDL399	98	100
7	Bedded Hilltop	Detrital Lignite	HD1	RC18BHT0165	242430	IDL538	84	86
8	Bedded Hilltop	Detrital Lignite	HD1	RC18BHT0169	243512	IDL765	84	86
9	Bedded Hilltop	Detrital Lignite	HD1	RC18BHT0211	244053	IER771	90	92
10	Bedded Hilltop	Detrital Lignite	HD1	RC18BHT0273	242968	IEX186	102	104
11	Bedded Hilltop	Detrital Lignite	HD1	RC18BHT0273	242968	IEX193	114	116
12	Bedded Hilltop	Detrital Lignite	HD1	RC18BHT0274	242970	ICW891	102	104
13	Bedded Hilltop	Detrital Lignite	HD1	RC18BHT0274	242970	ICW899	118	120
14	Bedded Hilltop	Detrital Lignite	HD1	RC18BHT0275	242972	ICV737	88	90
15	Bedded Hilltop	Detrital Lignite	HD1	RC18BHT0277	243508	ICV974	104	106
16	Bedded Hilltop	Dales Gorge	HD1	RC18BHT0049	254302	HWK433	56	58
17	Bedded Hilltop	Dales Gorge	HD1	RC18BHT0081	254568	HSS954	48	50
18	Bedded Hilltop	Dales Gorge	HD1	RC18BHT0081	254568	HSS955	50	52
19	Bedded Hilltop	Dales Gorge	HD1	RC18BHT0084	253758	IDQ084	78	80
20	Bedded Hilltop	Dales Gorge	HD1	RC18BHT0184	244576	IER035	50	52
21	Bedded Hilltop	Dales Gorge	HD1	RC18BHT0184	244576	IER036	52	54
22	Bedded Hilltop	Dales Gorge	HD1	RC18BHT0187	244572	IER123	8	10
23	Bedded Hilltop	Dales Gorge	HD1	RC18BHT0232	236481	IET896	28	30
24	Bedded Hilltop	Dales Gorge	HD1	RC18BHT0241	240258	IEW193	26	28
25	Bedded Hilltop	Dales Gorge	HD1	RC18BHT0241	240258	IEW194	28	30
26	Bedded Hilltop	Dales Gorge	HD1	RC18BHT0312	218663	IEW862	4	6
27	Bedded Hilltop	Dales Gorge	HD1	RC18BHT0313	219203	IEW882	10	12
28	Bedded Hilltop	Dales Gorge	HD1	RC18BHT0336	224067	IEX556	8	10
29	Bedded Hilltop	Dales Gorge	HD1	RC18BHT0336	224067	IEX557	10	12
30	Bedded Hilltop	Dales Gorge	HD1	RC18BHT0379	241335	IGV835	8	10
31	Bedded Hilltop	Footwall Zone	HD1	RC18BHT0060	251064	HWK820	52	54
32	Bedded Hilltop	Footwall Zone	HD1	RC18BHT0165	242430	IDL631	256	258
33	Bedded Hilltop	Footwall Zone	HD1	RC18BHT0185	244578	IER083	80	82
34	Bedded Hilltop	Footwall Zone	HD1	RC18BHT0188	245112	IER142	14	16
35	Bedded Hilltop	Footwall Zone	HD1	RC18BHT0240	239716	IEW143	6	8
36	Bedded Hilltop	Footwall Zone	HD1	RC18BHT0262	242420	IEZ446	40	42
37	Bedded Hilltop	Footwall Zone	HD1	RC18BHT0274	242970	ICW973	252	254
38	Bedded Hilltop	Footwall Zone	HD1	RC18BHT0334	224063	IEX525	16	18
39	Bedded Hilltop	Footwall Zone	HD1	RC18BHT0377	240523	IGV812	20	22
40	Bedded Hilltop	Mount McRae Shale	HD1	RC18BHT0061	250525	HWK845	40	42
41	Bedded Hilltop	Mount McRae Shale	HD1	RC18BHT0076	255911	HSS744	76	78
42	Bedded Hilltop	Mount McRae Shale	HD1	RC18BHT0105	251592	IDP446	68	70
43	Bedded Hilltop	Mount McRae Shale	HD1	RC18BHT0135	246204	HWL294	38	40
44	Bedded Hilltop	Mount McRae Shale	HD1	RC18BHT0143	245934	HWL551	36	38
45	Bedded Hilltop	Mount McRae Shale	HD1	RC18BHT0190	243490	IER194	26	28
46	Bedded Hilltop	Mount McRae Shale	HD1	RC18BHT0264	240805	IEZ598	32	34
47	Bedded Hilltop	Mount Sylvia Formation	HD1	RC18BHT0142	245662	HWL528	46	48
48	Bedded Hilltop	Mount Sylvia Formation	HD1	RC18BHT0282	247824	IDS102	26	28
49	Bedded Hilltop	Wittenoom Formation	HD1	RC18BHT0173	249737	IEZ052	46	48
50	Bedded Hilltop	Wittenoom Formation	HD1	RC18BHT0221	271343	IET246	64	66
51	Bedded Hilltop	Wittenoom Formation	HD1	RC18BHT0252	265956	IEZ176	36	38
52	Bedded Hilltop	Wittenoom Formation	HD1	RC18BHT0253	265948	IEZ199	34	36
53	Bedded Hilltop	Wittenoom Formation	HD1	RC18BHT0275	242972	ICV792	190	192
54	Hope Downs 2	Detritals	HD2	RC18HD20040	14029	ICX396	10	12
55	Hope Downs 2	Detritals	HD2	RC18HD20060	14344	ICI037	6	8
56	Hope Downs 2	Detritals	HD2	RC18HD20109	27288	ICY932	106	108
57	Hope Downs 2	Detritals	HD2	RC18HD20116	27290	IDR366	102	104
58	Hope Downs 2	Detritals	HD2	RC18HD20176	26652	HST198	116	118
59	Hope Downs 2	Detritals	HD2	RC18HD20241	34321	ICW055	46	48
60	Hope Downs 2	Detritals	HD2	RC18HD20264	34968	IEU297	22	24

Number	Location	Lithology	Project	Hole ID	Site ID	Sample ID	Depth (m)	
							From	To
61	Hope Downs 2	Detritals	HD2	RC18HD20273	23776	ICW617	18	20
62	Hope Downs 2	Detritals	HD2	RC18HD20319	25373	IET519	146	148
63	Hope Downs 2	Wittenoom Formation	HD2	RC18HD20019	13390	ICY501	38	40
64	Hope Downs 2	Wittenoom Formation	HD2	RC18HD20036	14025	ICX217	14	16
65	Hope Downs 2	Wittenoom Formation	HD2	RC18HD20099	26646	HST001	26	28
66	Hope Downs 2	Wittenoom Formation	HD2	RC18HD20108	27287	ICY868	78	80
67	Hope Downs 2	Wittenoom Formation	HD2	RC18HD20108	27287	ICY871	82	84
68	Hope Downs 2	Wittenoom Formation	HD2	RC18HD20135	29535	ICL231	36	38
69	Hope Downs 2	Wittenoom Formation	HD2	RC18HD20164	27928	IDR802	94	96
70	Hope Downs 2	Wittenoom Formation	HD2	RC18HD20176	26652	HST214	146	148
71	Hope Downs 2	Wittenoom Formation	HD2	RC18HD20177	26653	HST257	72	74
72	Hope Downs 2	Wittenoom Formation	HD2	RC18HD20228	31764	ICV188	50	52
73	Hope Downs 2	Wittenoom Formation	HD2	RC18HD20233	32087	ICV374	66	68
74	Hope Downs 2	Wittenoom Formation	HD2	RC18HD20242	34322	ICW087	38	40
75	Hope Downs 2	Wittenoom Formation	HD2	RC18HD20278	8900	IEU427	16	18
76	Hope Downs 2	Wittenoom Formation	HD2	RC18HD20298	14189	IEV694	68	70
77	Hope Downs 2	Wittenoom Formation	HD2	RC18HD20319	25373	IET547	196	198
78	Hope Downs 2	Newman Member	HD2	RC18HD20059	14343	ICI031	46	48
79	Hope Downs 2	Newman Member	HD2	RC18HD20091	13709	ICP834	72	74
80	Hope Downs 2	Newman Member	HD2	RC18HD20104	26965	ICY761	32	34
81	Hope Downs 2	Newman Member	HD2	RC18HD20140	29843	ICL327	40	42
82	Hope Downs 2	Newman Member	HD2	RC18HD20144	29847	ICL518	96	98
83	Hope Downs 2	Newman Member	HD2	RC18HD20189	31122	ICL787	34	36
84	Hope Downs 2	Newman Member	HD2	RC18HD20200	31760	ICV072	4	6
85	Hope Downs 2	Newman Member	HD2	RC18HD20227	31763	ICV158	58	60
86	Hope Downs 2	Newman Member	HD2	RC18HD20277	8899	IEU414	56	58
87	Hope Downs 2	MacLeod Member	HD2	RC18HD20021	14657	ICY563	30	32
88	Hope Downs 2	MacLeod Member	HD2	RC18HD20053	14337	ICH905	34	36
89	Hope Downs 2	MacLeod Member	HD2	RC18HD20138	29841	ICL281	12	14
90	Hope Downs 2	MacLeod Member	HD2	RC18HD20188	31121	ICL766	36	38
91	Hope Downs 2	MacLeod Member	HD2	RC18HD20199	31759	ICV067	30	32
92	Hope Downs 2	MacLeod Member	HD2	RC18HD20203	33038	IDV159	6	8
93	Hope Downs 2	MacLeod Member	HD2	RC18HD20269	27921	ICW468	16	18
94	Hope Downs 2	Nammuldi member	HD2	RC18HD20073	19603	ICI423	12	14
95	Hope Downs 2	Nammuldi member	HD2	RC18HD20122	27924	IDR622	14	16
96	Hope Downs 2	Nammuldi member	HD2	RC18HD20263	33035	IEU280	60	62

Appendix B: Laboratory Methods and Calculations

The tests carried out as part of the geochemical characterisation programme and calculations used to assist in evaluating the acid base accounting parameters of the samples are shown in Table B-1 and B-2 respectively.

Table B-1: Parameters measured and description of method

Parameter	Description
Paste pH (1:2)	pH measurements are performed on a 1:2 solid/water extract.
Paste EC (1:2)	Electrical conductivity measurements are performed on a 1:2 solid/water extract.
Acid neutralising capacity (ANC)	Determined by adding hydrochloric acid (HCl) to the sample, heating it, and then back-titrating the mixture with sodium hydroxide (NaOH) in order to determine the amount of HCl that remains on completion of the reaction. The amount of acid consumed in the initial reaction is calculated and expressed as the ANC. Details of the procedure are outlined in the AMIRA International ARD Test Handbook (AMIRA, 2002).
Total carbon/sulfur	The sample is combusted in oxygen in a Leco furnace at 1350°C. Carbon/sulfur present in the sample is evolved as carbon dioxide/sulfur dioxide and swept to a measurement cell for quantification by infrared detection.
Total organic carbon	Inorganic carbon (carbonates, bicarbonates) is removed by reaction with dilute HCl. After drying, the remaining sample is combusted in oxygen in a Leco furnace at 1350°C. Any organic carbon in the sample present as organic matter or graphite is evolved as carbon dioxide and swept to a cell for quantification by infrared detection. See table B-2 for calculation of total inorganic carbon (TIC).
Acid extractable sulfur (SO_4-S)	Determined by adding HCl to the sample. Soluble sulfates dissolved in the HCl and are detected/quantified by ICP.
Chromium reducible sulfur (CRS)	Dried pulped sample is mixed with acid and chromium metal in a rapid distillation unit to produce hydrogen sulfide which is collected and titrated with iodine to measure CRS.
Single addition net acid generation (NAG) test	The NAG test involves addition of hydrogen peroxide (H_2O_2) to prepared samples (to oxidise any reactive sulfides). The NAG pH is the pH of the final solution. The resultant acidity is then titrated (using NaOH) to pH 4.5 and then to pH 7. Details of the procedure are outlined in the AMIRA International ARD Test Handbook (AMIRA, 2002).
Multi element chemical assay	Involves the near total dissolution of most elements using a variety of digestion techniques (e.g. aqua regia, four acid digest and lithium borate fusion). Analytical techniques are selected depending on the elements under investigation and include XRF, ICP-AES, ICP-MS, AAS, ISE and TGA.
Acid buffering characterisation curve	Involves a slow titration of the sample with HCl, whilst monitoring the pH. Details of the procedure are outlined in the AMIRA International ARD Test Handbook (AMIRA, 2002).
Leach test	Simple leach extraction involves dissolution of elements from the solid matrix using de-ionised water. The water and solids are mixed at a ratio of 2:1 (water:solids) and agitated for a period of 12 hours. Analytical techniques are selected depending on the elements under investigation and include ICP-AES and ICP-MS.
Mineralogical Assessment	Quantitative XRD carried out on a powdered sample containing an internal standard.

Table B-2: Calculated data

Parameter	Description
Maximum potential acidity (MPA)	Calculated by multiplying the total sulfur content (wt%) by 30.6. Approach assumes that all sulfur is present as pyrite.
Sulfide-sulfur	Difference between Total sulfur and sulfate sulfur
Net acid producing potential (NAPP)	NAPP is the difference between the MPA of the sample and the ANC: NAPP = MPA – ANC
Total inorganic carbon	Total inorganic carbon content was calculated as the difference between the total carbon content and total organic carbon content of the sample.
Carbonate-based neutralisation potential (CarbNP)	Calculated by multiplying the total inorganic carbon content (wt%) by 81.63.

Appendix C: Mineralogical Assessment

Phase	Amorphous Content	Alunite	Anatase	Aragonite	Bassanite	Calcite	Chlorite	Dolomite	Gibbsite	Goethite	Gypsum	Hematite	Illite/ Muscovite	Jarosite	Kaolin	Lithiophorite
Sample ID	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%
IEX071	30		1							16		25			20	
IDL339	71		1		1				1		<1	1	1		19	
IDL538	31	<1		1						1				4		
IEX186	67		<1		2				<1			1		1	14	
ICV737	10												14	2	25	
IEL199	41		<1					<1		12		15	1		29	
HST214	28							<1		24		7	1		8	
ICV072	22									62		12				
IET896	25									52		1			20	
IEW143	31									56		1			6	
IEZ052	11							82		2		1				
ICL231	33						3	49		7		<1			3	
ICY563	23					<1		4		59		4			9	
HWL551	19									18		17	5		4	
HST257	24									10		1	15		21	<1
ICI423	11							1		61		10			16	
IDL339 DUP	71		1		<1				1		<1	1	1		18	

Phase	Magnetite	Marcasite	Melanterite	Opaline Silica	Pickeringite	Pyrite	Quartz	Quartz (high)	Rhodocrosite	Rozenite	Rutile	Serpentine	Siderite	n Calcium Plag	Sphalerite	Total
Sample ID	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%
IEX071	<1						8				1					101
IDL339	<1					3	<1				<1	1		2		101
IDL538	<1	11	1	1	7	38	1			4						100
IEX186		1				13	1									100
ICV737	<1					1	47				1		1			101
IEL199	<1						1				1		<1			100
HST214	1	1				4	1	1	25		<1					101
ICV072	<1					1	1		2							100
IET896		1				1	<1									100
IEW143	1	<1					5									100
IEZ052							4									100
ICL231							5									100
ICY563	<1						1									100
HWL551	<1						37				<1					100
HST257	ND						27				1				<1	99
ICI423	<1						1									100
IDL339 DUP	<1					4	<1				1	1		2		101

Mineral Phase	Approximate Formula
Alunite	KAl3(SO4)2(OH)6
Anatase	TiO2
Aragonite	CaCO3
Bassanite	CaSO4.0.5H2O
Calcite	CaCO3
Chlorite	(Fe,Al,Mg)6(Si,Al)4O10(OH)8
Dolomite	CaMg(CO3)2
Gibbsite	Al(OH)3
Goethite	FeO(OH)
Gypsum	CaSO4.2H2O
Hematite	Fe2O3
Illite/Muscovite	(K,Ca,Na)(Al,Mg,Fe)2(Si,Al)4O10(OH)2
Jarosite	KFe3(SO4)2(OH)6
Kaolin	Al2Si2O5(OH)4
Lithiophorite	(Al,Li)MnO2(OH)2

Mineral Phase	Approximate Formula
Magnetite	Fe3O4
Marcasite	FeS2
Melanterite	FeSO4(H2O)7
Opaline Silica	SiO2
Pickeringite	MgAl2(SO4)4.22(H2O)
Pyrite	FeS2
Quartz	SiO2
Quartz (high)	SiO2
Rhodocrosite	MnCO3
Rozenite	FeSO4.4(H2O)
Rutile	TiO2
Serpentine	Mg3Si2O5(OH)4
Siderite	FeCO3
Sodium Calciur	(Na,Ca)(Al,Si)2Si2O8
Sphalerite	(Zn,Fe)S

Uncertainty in the analysis should reflect errors (absolute) of no greater than: +/- 10% for phases 50-95%, +/- 5% for phases 10-50% and +/- 2% for phases 3-10%. Phases of < 3% are approaching detection limit and normally no refinements are made on these.

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QUANTITATIVE X-RAY DIFFRACTION ANALYSIS

REPORT PREPARED FOR	SRK CONSULTING (AUSTRALASIA) PTY LTD ALEX WATSON
CLIENT CODE	735.02
JOB CODE	1902747
No. of SAMPLES	16
CLIENT O/N	RTS158
SAMPLE SUBMISSION No.	RTS158
PROJECT	N/A
STATE	PULP
DATE RECEIVED	7/03/2019
DATE COMPLETED	12/04/2019
DATE WRITTEN	12/04/2019
WRITTEN BY	Dr Cat Kealley Dr Sharon Ness
ANALYSING LABORATORY	Perth

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SAMPLE DETAILS

DISCLAIMER

This report relates specifically to the sample(s) that were drawn and/or provided by the client or their nominated third party. The reported results(s) provide no warranty or verification on the sample(s) representing any specific goods and/or shipment and only relate to the sample(s) as received and tested. This report is prepared solely for the use of the client named in this report. Intertek accepts no responsibility for any loss, damage or laibility suffered by a third party as a result of any reliance upon or use of this report.

The results provided are not intended for commercial settlement purposes.

SIGNIFICANT FIGURES

The method detection limit is approximately 1 wt% for most phases.

Uncertainty in the analysis should reflect errors (absolute) of no greater than: +/- 10% for phases 50-95%, +/- 5% for phases 10-50% and +/- 2% for phases 3-10%. Phases of < 3% are approaching detection limit and normally no refinements are made on these.

Please note that results are rounded off to integer values

LEGEND

ND	Not Detected
EMPTY CELL	Phase not included in refinement

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JOB INFORMATION

PREPARATION

XRD16 (dry 50C, mill < 60um, micronised)

ANALYTICAL METHOD

XRDQUANT01 - Quantitative analysis, crystalline and amorphous content

SAMPLING

Sample(s) coned and quartered, then grab(s) taken

AMORPHOUS CONTENT DETERMINATION

Internal standard single scan

ADDITIONS

Internal standard CaF2 (fluorite)
IEX071
IEL199
HST214
IET896
IEW143
IEZ052
ICL231
ICY563
HWL551
HST257

Internal standard TiO2 (rutile)
IDL538
IEX186
ICV072
ICI423

Internal standard ZnO (zincite)
IDL339
ICV737
IDL339 DUPLICATE

SAMPLE PRESENTATION

Sample(s) packed and presented as unoriented powder mount(s) of the total sample

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JOB INFORMATION

INSTRUMENTATION AND PARAMETERS

INSTRUMENT:

PANalytical Cubix^3 XRD
Copper radiation (operating at 45 kV and 40 mA)
Graphite monochromator (diffracted beam)

PARAMETERS:

Parameter	Setting
Start angle (deg 2θ)	4
End angle (deg 2θ)	65
Step size (deg 2θ)	0.02
Time/active length (secs)	150
Active length (deg 2θ)	4.01

SOFTWARE:

Qualitative analysis:
Bruker Diffrac.EVA 4.2 Search/Match
ICDD PDF-2 (2015) database

Quantitative analysis:
SIROQUANT Version 4
ICSD (2018) database

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RESULTS

The quantitative analysis of the crystalline and amorphous content of each sample is given in the file, **735.02_1902747 XRD RESULTS.xlsx**, attached to the report email.

Calculation of the phase abundances has been based on the Brindley contrast corrections using a particle diameter of 4 µm.

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NOTES

NONE

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QUALITY CONTROL

NIST STANDARD REFERENCE MATERIAL (SRM) 656

This standard is used for quality control on the instrument and software.

The standard reference material is a powder which consists of sub-micrometer, equi-axial, non-aggregated grains that do not display the effects of absorption contrast, extinction or preferred orientation.

An aliquot of this SRM, spiked with 10% Al2O3 (SRM 676a) for the amorphous content determination, was prepared as un-oriented powder mount of the total sample and the pattern analysed with SIROQUANT™.

Sample ID **α 656 (High α Phase Powder)**

		1902747	method std dev	SRM certified	SRM uncert
Phase	**Formula**	**wt%**	**wt%**	**wt%**	**wt%**
Amorphous content		9.4	0.5	9.5	0.61
Si3N4, alpha	Si3N4	87.5	0.5	87.5	0.59
Si3N4, beta	Si3N4	3.1	0.1	3.0	0.05

Each interval defined by the certified value and its uncertainty is a 95% confidence interval for the true value of the mean in the absence of systematic error.

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METHOD DESCRIPTION

Quantification is determined from the chosen software package: this uses the full-profile Rietveld method of refining the profile of the calculated XRD pattern against the profile of the measured XRD pattern. The total calculated pattern is the sum of the calculated patterns of the individual phases.

Results are given as weight % of the total crystalline phases and amorphous content.

The amorphous content quantifies the amorphous material and unknown minerals or known minerals for which there is not a suitable crystal structure.

Corrections are incorporated into the process that allows for a more accurate description of the mineral's contribution to the measured pattern and to allow for variation due to atomic substitution, layer disordering, preferred orientation, and other factors that affect the acquisition of the XRD scan.

The limitations of qualitative XRD analysis are as follows:

There is a limit of detection of approximately 1 wt% on the crystalline phases.
The detection of a phase may be dependent on its crystallinity.
Where there exist multiple phases, overlap of diffracted reflections can occur, thus rendering some ambiguity into the interpretation.
Overlapping reflections of a major phase can mask the presence of minor or trace phases.

Some phases cannot be unambiguously identified as they are present in minor or trace amounts.

The limitations of quantitative XRD analysis by a full-profile Rietveld method are as follows:

The limitations for qualitative XRD analysis apply.
The method as described is standardless: it relies solely on the published crystallographic data available for each phase. Some data may not exactly describe the phases present.

Particle size is important with respect to the absorption of the X-rays by the sample. Micronising reduces the particle size to that more suitable for quantitative analysis.

The accuracy of the analysis is dependent on sampling and sample preparation in addition to the calculated profiles being exactly representative of the chemistry of the component phases and their crystallinity. Some preferred orientation effects and reflection overlaps may occur which cannot be adequately resolved.

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AMORPHOUS CONTENT

INTERNAL STANDARD METHOD

Single scan (SIROQUANT™ and TOPAS)

The amorphous content is determined from the addition of a known spike of a well-crystalline internal standard to each sample.

When amorphous material is present, the weight percentage of the spike found is larger than actually weighed out. The amount of amorphous material that causes the difference in the spike weight percentages is then calculated and all weight percentages are normalised to include the amorphous content.

Double scan (SIROQUANT only)

SIROQUANT™ also allows the choice of using the spiked pattern completely, or combining the run with a previous unspiked pattern result. This choice is given because the weight percentages from an unspiked pattern are more accurate since the intensities are not diluted by the spike addition. The percentages from the unspiked sample are normalised to the amorphous content calculated from the spiked sample pattern.

EXTERNAL STANDARD METHOD (SIROQUANT™ and TOPAS)

The amorphous content is determined from the external standard method[1].

The normalisation constant is determined from the external standard which allows the calculated weight fractions to be placed on an absolute scale.

Reference:

1. O'Connor, B.H., and Raven, M.D., "Application of the Rietveld refinement procedure in assaying powdered mixtures", Powder Diffraction 3(1), (1988), 2-6.

Modelling

A pattern representing a poorly crystalline form of silica is used in the SIROQUANT program.[2]

Reference:

2. Ward, C.R. and French, D., "Determination of glass content and estimation of glass composition in fly ash using quantitative X-ray diffractometry." Fuel 85 (2006), 2268-2277.

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Appendix D: ABA and NAG Test Data

ABA and NAG Data

Sample ID	Location	Lithology	Paste pH	Paste EC	NAGpH	NAG pH 4.5	NAG pH 7	ANC	Total C	TIC	TOC	Total S	MPA	NAPP	Class
			pH Units	µS/cm	pH Units	kgH_2SO_4/t			%	%	%	%	kgH_2SO_4/t		AMIRA
HWL255	Bedded Hilltop	Detritals	5.7	168	6.2	<0.1	0.4	<0.5	0.14	0.05	0.09	0.03	0.9	0.4	UC(NAF)
IEZ059	Bedded Hilltop	Detritals	8.5	441	9.2	<0.1	<0.1	13	0.26	0.17	0.09	0.03	0.9	-12	NAF
IEX071	Bedded Hilltop	Detritals	7.7	133	7	<0.1	<0.1	33	0.3	0.04	0.26	0.03	0.9	-32	NAF
IEX144	Bedded Hilltop	Detritals	8.5	321	8.4	<0.1	<0.1	2.6	0.5	0.4	0.1	0.02	0.6	-2.0	NAF-Barren
IDS997	Bedded Hilltop	Detritals	7.6	69	7	<0.1	<0.1	15	0.09	0.02	0.07	0.02	0.6	-14	NAF
IDL399	Bedded Hilltop	Detrital Lignite	4.5	1930	2.5	67	138	6.2	32.2	2.5	29.7	2.2	67	61	PAF
IDL538	Bedded Hilltop	Detrital Lignite	1.9	21100	1.8	626	699	5.9	10.1	2.12	7.98	33	1019	1013	PAF
IDL765	Bedded Hilltop	Detrital Lignite	3.9	4670	2	200	285	6.9	38.5	4.9	33.6	9.6	294	287	PAF
IER771	Bedded Hilltop	Detrital Lignite	5.6	2590	2.2	148	212	<0.5	41	4.3	36.7	6.6	201	201	PAF
IEX186	Bedded Hilltop	Detrital Lignite	4.6	3040	2.1	165	250	<0.5	42.5	5.1	37.4	7.0	215	215	PAF
IEX193	Bedded Hilltop	Detrital Lignite	3.9	3290	2.5	64	128	<0.5	25.2	4	21.2	4.2	127	127	PAF
ICW891	Bedded Hilltop	Detrital Lignite	3.6	2070	2.2	152	230	<0.5	48.9	7.3	41.6	6.7	205	204	PAF
ICW899	Bedded Hilltop	Detrital Lignite	3.1	4560	2.1	185	264	<0.5	39.6	9	30.6	8.7	267	267	PAF
ICV737	Bedded Hilltop	Detrital Lignite	2.4	5780	2.6	19	42.3	<0.5	0.51	0.1	0.41	1.3	39	38	PAF
ICV974	Bedded Hilltop	Detrital Lignite	3.8	4570	2.3	85	139	<0.5	43.1	4.7	38.4	3.0	93	93	PAF
HWK433	Bedded Hilltop	Dales Gorge	5.6	107	4.9	<0.1	2.4	<0.5	0.11	-	-	0.03	0.9	0.4	UC(NAF)
HSS954	Bedded Hilltop	Dales Gorge	5.2	62	3.9	0.8	2.4	<0.5	0.22	-	-	0.05	1.5	1.0	PAF-LC
HSS955	Bedded Hilltop	Dales Gorge	4.9	61	5.3	<0.1	0.5	<0.5	0.1	-	-	0.02	0.6	0.1	UC(NAF)
IDQ084	Bedded Hilltop	Dales Gorge	5.6	49	5.2	<0.1	0.7	<0.5	0.07	-	-	0.02	0.6	0.1	UC(NAF)
IER035	Bedded Hilltop	Dales Gorge	6.4	79	6.5	<0.1	0.3	<0.5	0.09	-	-	0.02	0.6	0.1	UC(NAF)
IER036	Bedded Hilltop	Dales Gorge	6	56	6.2	<0.1	0.3	<0.5	0.06	-	-	0.02	0.6	0.1	UC(NAF)
IER123	Bedded Hilltop	Dales Gorge	8.8	161	7	<0.1	<0.1	0.9	0.11	-	-	0.02	0.6	-0.3	NAF-Barren
IET896	Bedded Hilltop	Dales Gorge	4.6	461	5.3	<0.1	1	<0.5	0.25	-	-	0.07	2.1	1.6	UC(NAF)
IEW193	Bedded Hilltop	Dales Gorge	6.6	271	6.5	<0.1	0.6	<0.5	0.05	-	-	0.02	0.6	0.1	UC(NAF)
IEW194	Bedded Hilltop	Dales Gorge	6.8	148	6.3	<0.1	0.6	<0.5	0.05	-	-	<0.01	0.3	-0.2	NAF-Barren
IEW862	Bedded Hilltop	Dales Gorge	6.5	40	5.8	<0.1	0.8	<0.5	0.05	-	-	0.02	0.6	0.1	UC(NAF)
IEW882	Bedded Hilltop	Dales Gorge	7.6	86	6.4	<0.1	1	<0.5	0.06	-	-	0.02	0.6	0.1	UC(NAF)
IEX556	Bedded Hilltop	Dales Gorge	6.8	56	6.2	<0.1	0.7	<0.5	0.06	-	-	0.02	0.6	0.1	UC(NAF)
IEX557	Bedded Hilltop	Dales Gorge	6.1	72	6.2	<0.1	0.4	<0.5	0.06	-	-	0.02	0.6	0.1	UC(NAF)
IGV835	Bedded Hilltop	Dales Gorge	6.6	63	5	<0.1	1.2	<0.5	0.16	-	-	0.04	1.2	0.7	UC(NAF)
HWK820	Bedded Hilltop	Footwall Zone	4.5	149	5.6	<0.1	4.7	<0.5	0.05	-	-	0.02	0.6	0.1	UC(NAF)
IDL631	Bedded Hilltop	Footwall Zone	6.3	117	6.8	<0.1	0.3	<0.5	0.03	-	-	<0.01	0.3	-0.2	NAF-Barren
IER083	Bedded Hilltop	Footwall Zone	6.8	96	6.7	<0.1	<0.1	<0.5	0.06	-	-	<0.01	0.3	-0.2	NAF-Barren
IER142	Bedded Hilltop	Footwall Zone	3.9	254	5.3	<0.1	1.9	<0.5	0.06	-	-	0.02	0.6	0.1	UC(NAF)
IEW143	Bedded Hilltop	Footwall Zone	4	1540	4.1	0.8	3.8	<0.5	0.08	-	-	0.15	4.6	4.1	PAF-LC
IEZ446	Bedded Hilltop	Footwall Zone	4.7	521	4.6	<0.1	1.8	<0.5	0.15	-	-	0.07	2.1	1.6	UC(NAF)
ICW973	Bedded Hilltop	Footwall Zone	6.8	140	6.8	<0.1	<0.1	0.5	0.06	-	-	<0.01	0.3	-0.2	NAF-Barren
IEX525	Bedded Hilltop	Footwall Zone	6	43	6.2	<0.1	0.3	<0.5	0.15	-	-	0.03	0.9	0.4	UC(NAF)
IGV812	Bedded Hilltop	Footwall Zone	6.1	45	6.2	<0.1	0.4	<0.5	0.12	-	-	0.03	0.9	0.4	UC(NAF)
HWK845	Bedded Hilltop	Mount McRae Shale	5.3	257	6.1	<0.1	0.5	<0.5	0.04	-	-	0.02	0.6	0.1	UC(NAF)
HSS744	Bedded Hilltop	Mount McRae Shale	6.7	115	5.9	<0.1	1.6	0.7	0.06	-	-	0.02	0.6	-0.1	NAF-Barren
IDP446	Bedded Hilltop	Mount McRae Shale	4.5	190	5.6	<0.1	2	<0.5	0.13	-	-	0.04	1.2	0.7	UC(NAF)
HWL294	Bedded Hilltop	Mount McRae Shale	7	150	7.2	<0.1	<0.1	0.8	0.08	-	-	0.02	0.6	-0.2	NAF-Barren
HWL551	Bedded Hilltop	Mount McRae Shale	7.1	214	7.1	<0.1	<0.1	0.9	0.11	-	-	0.03	0.9	0.0	UC(NAF)
IER194	Bedded Hilltop	Mount McRae Shale	6.3	370	5.6	<0.1	1.8	<0.5	0.08	-	-	0.02	0.6	0.1	UC(NAF)
IEZ598	Bedded Hilltop	Mount McRae Shale	7.1	575	6.9	<0.1	0.2	1	0.08	-	-	0.03	0.9	-0.1	NAF-Barren
HWL528	Bedded Hilltop	Mount Sylvia Formation	6.2	96	7	<0.1	<0.1	0.8	0.14	-	-	<0.01	0.3	-0.5	NAF-Barren
IDS102	Bedded Hilltop	Mount Sylvia Formation	6.6	169	6.4	<0.1	0.4	<0.5	0.07	-	-	0.02	0.6	0.1	UC(NAF)
IEZ052	Bedded Hilltop	Wittenoom Formation	9.4	120	10	<0.1	<0.1	968	10.8	10.7	0.1	<0.01	0.3	-968	NAF
IET246	Bedded Hilltop	Wittenoom Formation	9.8	325	10.2	<0.1	<0.1	774	8.94	8.6	0.34	<0.01	0.3	-774	NAF
IEZ176	Bedded Hilltop	Wittenoom Formation	8.9	259	10.2	<0.1	<0.1	697	8.02	7.93	0.09	<0.01	0.3	-697	NAF
IEZ199	Bedded Hilltop	Wittenoom Formation	7.9	445	8.7	<0.1	<0.1	22.2	0.46	0.29	0.17	<0.01	0.3	-22	NAF
ICV792	Bedded Hilltop	Wittenoom Formation	6	358	8.6	<0.1	<0.1	23.8	1.13	1.06	0.07	0.14	4.3	-20	NAF
ICX396	Hope Downs 2	Detritals	7.5	119	6.7	<0.1	<0.1	2	0.13	-	-	0.02	0.6	-1.4	NAF-Barren
ICI037	Hope Downs 2	Detritals	8.6	100	7.5	<0.1	<0.1	1.7	0.08	-	-	0.03	0.9	-0.8	NAF-Barren
ICY932	Hope Downs 2	Detritals	7.4	187	7.5	<0.1	<0.1	3.2	0.25	0.14	0.11	0.02	0.6	-2.6	NAF-Barren
IDR366	Hope Downs 2	Detritals	7.5	194	6.8	<0.1	<0.1	2	0.11	0.05	0.06	<0.01	0.3	-1.7	NAF-Barren
HST198	Hope Downs 2	Detritals	7.5	271	7.4	<0.1	<0.1	3.1	0.06	-	-	<0.01	0.3	-2.8	NAF-Barren
ICW055	Hope Downs 2	Detritals	7.7	272	7.4	<0.1	<0.1	1.9	0.05	-	-	<0.01	0.3	-1.6	NAF-Barren
IEU297	Hope Downs 2	Detritals	8	735	8.1	<0.1	<0.1	5.8	0.04	-	-	<0.01	0.3	-5.5	NAF
ICW617	Hope Downs 2	Detritals	7.3	410	6.8	<0.1	0.4	2.7	0.05	-	-	<0.01	0.3	-2.4	NAF-Barren
IET519	Hope Downs 2	Detritals	7.5	138	7.2	<0.1	<0.1	<0.5	0.1	-	-	<0.01	0.3	-0.2	NAF-Barren
ICY501	Hope Downs 2	Wittenoom Formation	7.6	129	7.5	<0.1	<0.1	<0.5	0.04	-	-	<0.01	0.3	-0.2	NAF-Barren
ICX217	Hope Downs 2	Wittenoom Formation	3.8	283	5.6	<0.1	1.5	<0.5	0.13	-	-	<0.01	0.3	-0.2	NAF-Barren
HST001	Hope Downs 2	Wittenoom Formation	7.3	513	6.8	<0.1	0.4	1.8	0.1	-	-	<0.01	0.3	-1.5	NAF-Barren
ICY868	Hope Downs 2	Wittenoom Formation	7.4	166	7.7	<0.1	<0.1	2.2	0.08	-	-	<0.01	0.3	-1.9	NAF-Barren
ICY871	Hope Downs 2	Wittenoom Formation	7.6	145	8.1	<0.1	<0.1	7	0.09	-	-	<0.01	0.3	-6.7	NAF
ICL231	Hope Downs 2	Wittenoom Formation	8.3	1150	8.5	<0.1	<0.1	661	7.36	7.31	0.05	<0.01	0.3	-661	NAF
IDR802	Hope Downs 2	Wittenoom Formation	7.7	558	8	<0.1	<0.1	6.2	0.1	-	-	<0.01	0.3	-5.9	NAF
HST214	Hope Downs 2	Wittenoom Formation	7.4	241	8.5	<0.1	<0.1	252	4.33	4.28	0.05	<0.01	0.3	-252	NAF
HST257	Hope Downs 2	Wittenoom Formation	7.7	305	8.3	<0.1	<0.1	2.6	0.02	-	-	<0.01	0.3	-2.3	NAF-Barren
ICV188	Hope Downs 2	Wittenoom Formation	7.7	40	8.5	<0.1	<0.1	5.8	0.1	-	-	<0.01	0.3	-5.5	NAF
ICV374	Hope Downs 2	Wittenoom Formation	7.7	55	8.1	<0.1	<0.1	2.3	0.07	-	-	<0.01	0.3	-2.0	NAF-Barren
ICW087	Hope Downs 2	Wittenoom Formation	8.3	1310	8	<0.1	<0.1	6.1	0.07	-	-	<0.01	0.3	-5.8	NAF
IEU427	Hope Downs 2	Wittenoom Formation	7.5	772	7.6	<0.1	<0.1	<0.5	0.05	-	-	<0.01	0.3	-0.2	NAF-Barren
IEV694	Hope Downs 2	Wittenoom Formation	7.6	102	8.1	<0.1	<0.1	<0.5	0.08	-	-	<0.01	0.3	-0.2	NAF-Barren

Sample ID	Location	Lithology	Paste pH	Paste EC	NAGpH	NAG pH 4.5	NAG pH 7	ANC	Total C	TIC	TOC	Total S	MPA	NAPP	Class
			pH Units	µS/cm	pH Units	kgH_2SO_4/t			%	%	%	%	kgH_2SO_4/t		AMIRA
IET547	Hope Downs 2	Wittenoom Formation	7.2	516	8.1	<0.1	<0.1	7.8	0.12	-	-	<0.01	0.3	-7.5	NAF
ICI031	Hope Downs 2	Newman Member	6.8	78	7	<0.1	<0.1	<0.5	0.1	-	-	<0.01	0.3	-0.2	NAF-Barren
ICP834	Hope Downs 2	Newman Member	7.1	74	7.6	<0.1	<0.1	<0.5	0.1	-	-	<0.01	0.3	-0.2	NAF-Barren
ICY761	Hope Downs 2	Newman Member	7.3	114	6.8	<0.1	<0.1	<0.5	0.03	-	-	<0.01	0.3	-0.2	NAF-Barren
ICL327	Hope Downs 2	Newman Member	8.4	108	7.4	<0.1	<0.1	<0.5	0.06	-	-	<0.01	0.3	-0.2	NAF-Barren
ICL518	Hope Downs 2	Newman Member	7.8	276	7.2	<0.1	<0.1	<0.5	0.03	-	-	<0.01	0.3	-0.2	NAF-Barren
ICL787	Hope Downs 2	Newman Member	7.5	76	6.6	<0.1	0.7	<0.5	0.04	-	-	<0.01	0.3	-0.2	NAF-Barren
ICV072	Hope Downs 2	Newman Member	8.9	125	8.5	<0.1	<0.1	9	0.22	0.11	0.11	<0.01	0.3	-9	NAF
ICV158	Hope Downs 2	Newman Member	7.6	19	6.6	<0.1	0.6	<0.5	0.04	-	-	<0.01	0.3	-0.2	NAF-Barren
IEU414	Hope Downs 2	Newman Member	5.4	76	7.2	<0.1	<0.1	<0.5	0.05	-	-	<0.01	0.3	-0.2	NAF-Barren
ICY563	Hope Downs 2	MacLeod Member	4.4	911	4.6	<0.1	2.1	<0.5	0.05	-	-	0.1	3.1	2.6	UC(NAF)
ICH905	Hope Downs 2	MacLeod Member	4	258	5.8	<0.1	0.8	<0.5	0.08	-	-	0.04	1.2	0.7	UC(NAF)
ICL281	Hope Downs 2	MacLeod Member	7	174	6.5	<0.1	0.5	<0.5	0.06	-	-	<0.01	0.3	-0.2	NAF-Barren
ICL766	Hope Downs 2	MacLeod Member	7.5	80	7.4	<0.1	<0.1	<0.5	0.02	-	-	<0.01	0.3	-0.2	NAF-Barren
ICV067	Hope Downs 2	MacLeod Member	7.4	26	6.6	<0.1	0.6	<0.5	0.03	-	-	<0.01	0.3	-0.2	NAF-Barren
IDV159	Hope Downs 2	MacLeod Member	8.4	46	7.2	<0.1	<0.1	0.5	0.13	-	-	0.04	1.2	0.7	UC(NAF)
ICW468	Hope Downs 2	MacLeod Member	7.2	102	7.2	<0.1	<0.1	<0.5	0.07	-	-	<0.01	0.3	-0.2	NAF-Barren
ICI423	Hope Downs 2	Nammuldi member	6.7	239	6.4	<0.1	0.6	<0.5	0.04	-	-	0.03	0.9	0.4	UC(NAF)
IDR622	Hope Downs 2	Nammuldi member	6	117	6	<0.1	2	<0.5	0.08	-	-	<0.01	0.3	-0.2	NAF-Barren
IEU280	Hope Downs 2	Nammuldi member	7.6	30	6.6	<0.1	0.5	<0.5	0.03	-	-	<0.01	0.3	-0.2	NAF-Barren

Notes: EC – Electrical Conductivity; NAG – Net Acid Generation; ANC – Acid Neutralising Capacity; S – Sulfur; MPA – Maximum Potential Acidity; NAPP – Net Acid Producing Potential; NAF – Non Acid Forming; UC – Uncertain; PAF – Potentially Acid Forming; LC – Low Capacity.

Appendix E: Acid Buffering Characteristic Curve Data

IEX071 **DET**

ANC 32.9 kgH_2SO_4/t

Addition	mLs added (total)	kgH_2SO_4/t	pH
0	0	0	6.39
1	0.5	1.225	4.78
2	1	2.45	4.04
3	1.5	3.675	3.74
4	2	4.9	3.52
5	2.5	6.125	3.35
6	3	7.35	3.21
7	3.5	8.575	3.10
8	4	9.8	3.00
9	4.5	11.025	2.90
10	5	12.25	2.82
11	5.5	13.475	2.75
12	6	14.7	2.69
13	6.5	15.925	2.63
14	7	17.15	2.58
15	7.5	18.375	2.53
16	8	19.6	2.49

ICV072 **NEW**

ANC 9 kgH_2SO_4/t

Addition	mLs added (total)	kgH_2SO_4/t	pH
0	0	0	9.29
1	0.1	0.245	8.97
2	0.2	0.49	8.72
3	0.3	0.735	8.51
4	0.4	0.98	8.34
5	0.5	1.225	8.20
6	0.6	1.47	8.06
7	0.7	1.715	7.94
8	0.8	1.96	7.85
9	0.9	2.205	7.78
10	1	2.45	7.72
11	1.1	2.695	7.67
12	1.2	2.94	7.61
13	1.3	3.185	7.55
14	1.4	3.43	7.51
15	1.5	3.675	7.47
16	1.6	3.92	7.43
17	1.7	4.165	7.39
18	1.8	4.41	7.34
19	1.9	4.655	7.30
20	2	4.9	7.27
21	2.1	5.145	7.23
22	2.2	5.39	7.18
23	2.3	5.635	7.11
24	2.4	5.88	7.10
25	2.5	6.125	7.03
26	2.6	6.37	6.97
27	2.7	6.615	6.92
28	2.8	6.86	6.80
29	2.9	7.105	6.68
30	3	7.35	6.53
31	3.1	7.595	6.32
32	3.2	7.84	6.01
33	3.3	8.085	5.63
34	3.4	8.33	5.26
35	3.5	8.575	4.94
36	3.6	8.82	4.68
37	3.7	9.065	4.46
38	3.8	9.31	4.28
39	3.9	9.555	4.14

ICV072 - Continued

ANC 9 kgH_2SO_4/t

Addition	mLs added (total)	kgH_2SO_4/t	pH
40	4	9.8	4.02
41	4.1	10.045	3.92
42	4.2	10.29	3.83
43	4.3	10.535	3.75
44	4.4	10.78	3.68
45	4.5	11.025	3.62
46	4.6	11.27	3.56
47	4.7	11.515	3.50
48	4.8	11.76	3.45
49	4.9	12.005	3.40
50	5	12.25	3.36
51	5.1	12.495	3.32
52	5.2	12.74	3.28
53	5.3	12.985	3.24
54	5.4	13.23	3.20
55	5.5	13.475	3.17
56	5.6	13.72	3.14
57	5.7	13.965	3.11
58	5.8	14.21	3.09
59	5.9	14.455	3.06
60	6	14.7	3.03
61	6.1	14.945	3.01
62	6.2	15.19	2.99
63	6.3	15.435	2.96
64	6.4	15.68	2.95
65	6.5	15.925	2.93
66	6.6	16.17	2.91
67	6.7	16.415	2.89
68	6.8	16.66	2.87
69	6.9	16.905	2.85
70	7	17.15	2.84
71	7.1	17.395	2.82

IEZ199 **WF**

ANC 22.2 kgH_2SO_4/t

Addition	mLs added (total)	kgH_2SO_4/t	pH
0	0	0	7.69
1	0.5	1.225	6.61
2	1	2.45	6.16
3	1.5	3.675	5.86
4	2	4.9	5.62
5	2.5	6.125	5.49
6	3	7.35	5.38
7	3.5	8.575	5.26
8	4	9.8	5.14
9	4.5	11.025	5.02
10	5	12.25	4.89
11	5.5	13.475	4.82
12	6	14.7	4.74
13	6.5	15.925	4.66
14	7	17.15	4.58
15	7.5	18.375	4.50
16	8	19.6	4.41
17	8.5	20.825	4.33
18	9	22.05	4.23
19	9.5	23.275	4.12
20	10	24.5	4.00
21	10.5	25.725	3.85
22	11	26.95	3.71
23	11.5	28.175	3.57
24	12	29.4	3.44
25	12.5	30.625	3.32
26	13	31.85	3.22
27	13.5	33.075	3.12
28	14	34.3	3.03
29	14.5	35.525	2.96
30	15	36.75	2.89
31	15.5	37.975	2.82
32	16	39.2	2.77
33	16.5	40.425	2.72
34	17	41.65	2.67
35	17.5	42.875	2.63
36	18	44.1	2.59
37	18.5	45.325	2.55
38	19	46.55	2.52
39	19.5	47.775	2.49

HST214 **WF**

ANC 252 kgH_2SO_4/t

Addition	mLs added (total)	kgH_2SO_4/t	pH
0	0	0	6.05
1	1	12.25	5.37
2	2	24.5	5.13
3	3	36.75	5.06
4	4	49	5.04
5	5	61.25	4.99
6	6	73.5	4.95
7	7	85.75	4.92
8	8	98	4.89
9	9	110.25	4.83
10	10	122.5	4.80
11	11	134.75	4.75
12	12	147	4.69
13	13	159.25	4.62
14	14	171.5	4.53
15	15	183.75	4.42
16	16	196	4.27
17	17	208.25	4.02
18	18	220.5	3.66
19	19	232.75	3.29
20	20	245	2.99
21	21	257.25	2.74
22	22	269.5	2.53
23	23	281.75	2.35

ICV792 **WF**

ANC 23.8 kgH_2SO_4/t

Addition	mLs added (total)	kgH_2SO_4/t	pH
0	0	0	8.42
1	0.5	1.225	7.53
2	1	2.45	7.20
3	1.5	3.675	6.96
4	2	4.9	6.89
5	2.5	6.125	6.69
6	3	7.35	6.56
7	3.5	8.575	6.42
8	4	9.8	6.27
9	4.5	11.025	6.14
10	5	12.25	5.96
11	5.5	13.475	5.81
12	6	14.7	5.59
13	6.5	15.925	5.35
14	7	17.15	4.95
15	7.5	18.375	4.63
16	8	19.6	4.39
17	8.5	20.825	4.19
18	9	22.05	4.00
19	9.5	23.275	3.83
20	10	24.5	3.72
21	10.5	25.725	3.62
22	11	26.95	3.54
23	11.5	28.175	3.46
24	12	29.4	3.38
25	12.5	30.625	3.31
26	13	31.85	3.24
27	13.5	33.075	3.17
28	14	34.3	3.11
29	14.5	35.525	3.05
30	15	36.75	2.99
31	15.5	37.975	2.93
32	16	39.2	2.88
33	16.5	40.425	2.83
34	17	41.65	2.78
35	17.5	42.875	2.74
36	18	44.1	2.69
37	18.5	45.325	2.65
38	19	46.55	2.62
39	19.5	47.775	2.59
40	20	49	2.56
41	20.5	50.225	2.53
42	21	51.45	2.50

ICL231 **WF**

ANC 661 kgH_2SO_4/t

Addition	mLs added (total)	kgH_2SO_4/t	pH
0	0	0	9.34
1	2	24.5	7.77
2	4	49	6.80
3	6	73.5	6.46
4	8	98	6.32
5	10	122.5	6.24
6	12	147	6.15
7	14	171.5	6.08
8	16	196	6.00
9	18	220.5	5.93
10	20	245	5.88
11	22	269.5	5.77
12	24	294	5.72
13	26	318.5	5.67
14	28	343	5.61
15	30	367.5	5.55
16	32	392	5.48
17	34	416.5	5.42
18	36	441	5.37
19	38	465.5	5.32
20	40	490	5.25
21	42	514.5	5.18
22	44	539	5.16
23	46	563.5	5.08
24	48	588	4.98
25	50	612.5	4.84
26	52	637	4.46
27	54	661.5	2.89
28	56	686	2.32

IET246 **WF**

ANC 774 kgH_2SO_4/t

Addition	mLs added (total)	kgH_2SO_4/t	pH
0	0	0	9.61
1	2	24.5	7.23
2	4	49	6.93
3	6	73.5	6.80
4	8	98	6.71
5	10	122.5	6.65
6	12	147	6.60
7	14	171.5	6.55
8	16	196	6.50
9	18	220.5	6.45
10	20	245	6.40
11	22	269.5	6.35
12	24	294	6.32
13	26	318.5	6.30
14	28	343	6.29
15	30	367.5	6.28
16	32	392	6.27
17	34	416.5	6.25
18	36	441	6.22
19	38	465.5	6.17
20	40	490	6.11
21	42	514.5	6.09
22	44	539	6.07
23	46	563.5	6.01
24	48	588	5.92
25	50	612.5	5.84
26	52	637	5.76
27	54	661.5	5.63
28	56	686	5.54
29	58	710.5	5.43
30	60	735	5.18
31	62	759.5	3.94
32	64	784	2.50

IEZ176 **WF**

ANC 697 kgH_2SO_4/t

Addition	mLs added (total)	kgH_2SO_4/t	pH
0	0	0	8.50
1	2	24.5	7.74
2	4	49	6.99
3	6	73.5	6.40
4	8	98	6.10
5	10	122.5	5.96
6	12	147	5.90
7	14	171.5	5.85
8	16	196	5.81
9	18	220.5	5.77
10	20	245	5.74
11	22	269.5	5.71
12	24	294	5.68
13	26	318.5	5.65
14	28	343	5.62
15	30	367.5	5.58
16	32	392	5.56
17	34	416.5	5.54
18	36	441	5.53
19	38	465.5	5.52
20	40	490	5.51
21	42	514.5	5.50
22	44	539	5.48
23	46	563.5	5.44
24	48	588	5.41
25	50	612.5	5.34
26	52	637	5.25
27	54	661.5	5.06
28	56	686	3.40
29	58	710.5	2.29

IEZ052 **WF**

ANC 968 kgH_2SO_4/t

Addition	mLs added (total)	kgH_2SO_4/t	pH
0	0	0	10.01
1	2	24.5	6.61
2	4	49	6.15
3	6	73.5	6.04
4	8	98	5.97
5	10	122.5	5.93
6	12	147	5.89
7	14	171.5	5.85
8	16	196	5.81
9	18	220.5	5.77
10	20	245	5.74
11	22	269.5	5.70
12	24	294	5.68
13	26	318.5	5.66
14	28	343	5.63
15	30	367.5	5.60
16	32	392	5.57
17	34	416.5	5.55
18	36	441	5.52
19	38	465.5	5.50
20	40	490	5.48
21	42	514.5	5.44
22	44	539	5.45
23	46	563.5	5.42
24	48	588	5.39
25	50	612.5	5.38
26	52	637	5.36
27	54	661.5	5.34
28	56	686	5.32
29	58	710.5	5.30
30	60	735	5.28
31	62	759.5	5.25
32	64	784	5.25
33	66	808.5	5.22
34	68	833	5.19
35	70	857.5	5.16
36	72	882	5.13
37	74	906.5	5.09
38	76	931	5.04
39	78	955.5	4.94
40	80	980	4.75
41	82	1004.5	3.51
42	84	1029	2.61

Appendix F: Multi-element Chemical Assay and GAI Data

Global Abundance Indicators

The global abundance index (GAI) values provide a direct comparison of the measured abundances of the elements with the average abundance of elements in the Earth's crust (Bowen, 1979). The GAI indicates which elements are 'enriched' in the sample with respect to the global average and is calculated using the following formula (Förstner, 1993):

$$\text{GAI} = Int\left(\log_2\left(\frac{\text{MeasuredConcentration}}{1.5\times\text{AverageAbundance}}\right)\right)$$

Zero or positive GAI values indicate enrichment of the element in the sample when compared to average-crustal abundances. As a general rule, a GAI of 3 or higher signifies enrichment that warrants further evaluation.

The table below relates GAI values to *n* (the ratio of the measured abundance in the sample to the reference material abundance).

GAI	***n* range**
0	$1 < n < 3$
1	$3 \leq n < 6$
2	$6 \leq n < 12$
3	$12 \leq n < 24$

Multi-Element Chemical Assay Data

Sample ID	Location	Lithology	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe
			ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%
HWL255	Bedded Hilltop	Detritals	0.109	2.74	152.5	10	19	1.03	0.782	0.02	0.045	13.65	5.43	101	3.1	16.9	27.4
IEZ059	Bedded Hilltop	Detritals	0.063	7.66	32.8	30	151	1.15	0.459	0.52	0.09	33.9	11.5	158.5	3.71	38	18.7
IEX071	Bedded Hilltop	Detritals	0.087	8.63	204	70	28	1.48	0.425	0.05	1.29	31.1	11.7	47.4	0.78	31.3	27.4
IEX144	Bedded Hilltop	Detritals	0.02	4.51	28.2	60	120	1.03	0.223	0.77	0.041	58.7	5.97	89.8	1.09	7.85	44.7
IDS997	Bedded Hilltop	Detritals	0.051	5.46	237	30	68	2.07	0.673	0.07	0.256	22.5	20	109.5	4.1	15.7	42.8
ICX396	Hope Downs 2	Detritals	0.206	4.98	41.1	30	162	0.83	0.573	0.09	0.115	42.1	9.08	206	1.24	46.1	41.4
ICI037	Hope Downs 2	Detritals	0.016	5.73	37.2	30	161	0.43	0.532	0.1	0.043	8.05	7.33	120.5	0.26	17.4	31.7
ICY932	Hope Downs 2	Detritals	0.042	9.27	88.6	30	8	2.04	0.75	0.05	0.108	19.35	14.45	195	0.11	115	30
IDR366	Hope Downs 2	Detritals	0.077	6.64	57.1	20	16	0.92	0.482	0.03	0.239	67.9	34	244	0.06	75.8	40.7
HST198	Hope Downs 2	Detritals	0.047	7.86	89.3	50	10	1.42	0.72	0.06	0.135	61.1	13.6	210	0.28	98.2	32.9
ICW055	Hope Downs 2	Detritals	0.007	3.74	15.75	20	33	2.97	0.169	0.04	0.968	14.35	75.1	61.9	0.07	46.2	46
IEU297	Hope Downs 2	Detritals	0.009	8.64	36.2	40	73	1.19	0.502	0.27	0.051	17.3	19.95	195	0.15	50.2	29.3
ICW617	Hope Downs 2	Detritals	0.304	10.6	23	50	59	0.98	0.5	0.1	0.147	22.1	13.25	358	3.11	115	16.15
IET519	Hope Downs 2	Detritals	0.091	5.53	55	20	7	1.39	0.419	0.04	0.062	34.5	6.78	179	0.2	52.7	36.1
IDL399	Bedded Hilltop	Lignite	**0.515**	**0.95**	**25**	400	**14.8**	**2.89**	**1.945**	**1.05**	**0.999**	**14.45**	**2.59**	**52.7**	**0.328**	**68.5**	**4.47**
IDL538	Bedded Hilltop	Lignite	**0.099**	**0.38**	**1810**	200	**11.4**	**0.69**	**0.261**	**0.12**	**5.12**	**17.65**	**29.1**	**11.6**	**1.825**	**31.7**	**30.2**
IDL765	Bedded Hilltop	Lignite	**0.058**	**0.58**	**28**	200	**10.6**	**2.84**	**0.428**	**0.65**	**1.645**	**60.4**	**14.35**	**20.6**	**0.82**	**14.65**	**8.87**
IER771	Bedded Hilltop	Lignite	**0.058**	**0.72**	**147.5**	200	**27.6**	**5.87**	**0.387**	**0.68**	**2.04**	**128.5**	**21.8**	**20.3**	**0.861**	**28.7**	**5.03**
IEX186	Bedded Hilltop	Lignite	**0.052**	**0.76**	**23**	<200	**44.4**	**6.64**	**0.33**	**1.07**	**6.58**	**182**	**16.8**	**28.6**	**0.406**	**29.2**	**5.46**
IEX193	Bedded Hilltop	Lignite	**0.052**	**4.53**	**45.9**	200	**52.3**	**5.44**	**0.474**	**0.63**	**2.34**	**152**	**4.54**	**26.8**	**0.277**	**27.4**	**10.8**
ICW891	Bedded Hilltop	Lignite	**0.045**	**0.66**	**31.8**	<200	**6.3**	**2.01**	**0.336**	**0.65**	**1.27**	**46.7**	**11.55**	**14.05**	**0.357**	**17.6**	**5.1**
ICW899	Bedded Hilltop	Lignite	**0.182**	**0.66**	**68.3**	200	**12.9**	**2**	**0.73**	**0.69**	**2.05**	**206**	**125**	**34.7**	**0.175**	**33.9**	**7.63**
ICV737	Bedded Hilltop	Lignite	0.253	6.99	66.9	40	88	2.92	0.843	0.02	2.12	31.7	72.1	70.8	7.4	32.4	2.49
ICV974	Bedded Hilltop	Lignite	**0.028**	**0.87**	**25.6**	<200	**20.7**	**6.53**	**0.242**	**0.93**	**2.7**	**181**	**23.6**	**11.5**	**0.188**	**19.05**	**1.95**
HWK433	Bedded Hilltop	Dales Gorge	0.018	0.5	4.85	<10	3	1.15	0.029	0.01	0.035	8.14	2.21	14	0.07	5.49	35.4
HSS954	Bedded Hilltop	Dales Gorge	0.014	0.3	9.44	10	2	0.83	0.028	0.01	0.026	7.33	1.99	10.9	0.03	3.51	38.6
HSS955	Bedded Hilltop	Dales Gorge	0.017	1.18	17.15	20	4	1.28	0.486	0.01	0.046	14.75	3.77	18	0.03	11.5	35.2
IDQ084	Bedded Hilltop	Dales Gorge	0.044	0.26	9.1	10	1	1.31	0.014	0.01	0.019	6.03	1.36	17.7	0.02	5.29	34.2
IER035	Bedded Hilltop	Dales Gorge	0.003	0.46	10.4	10	11	0.92	0.017	0.01	0.024	5.97	2.95	15.7	0.04	9.21	37.8
IER036	Bedded Hilltop	Dales Gorge	0.003	0.19	5.92	10	5	0.9	0.008	0.01	0.024	4.49	3.05	16.2	0.03	5.52	36.9
IER123	Bedded Hilltop	Dales Gorge	0.003	2.28	5.13	10	120	0.93	0.081	0.08	0.015	15.45	4.57	23.7	0.08	13.75	27.2
IET896	Bedded Hilltop	Dales Gorge	0.016	6.94	18.75	30	62	0.65	3.17	0.01	0.014	65	1.855	63.8	0.04	9.78	34.8
IEW193	Bedded Hilltop	Dales Gorge	0.004	0.48	3.54	10	18	1.43	0.008	0.01	0.036	19.4	1.285	15.3	0.04	7.13	34.9
IEW194	Bedded Hilltop	Dales Gorge	<0.002	0.36	3.18	10	13	1.4	0.007	0.01	0.028	15.6	1.135	16.5	0.03	5.66	36.5
IEW862	Bedded Hilltop	Dales Gorge	0.015	0.2	3.14	<10	5	1.5	0.009	0.01	0.03	2.72	1.705	45.5	0.04	5.69	34
IEW882	Bedded Hilltop	Dales Gorge	0.009	0.27	4.76	10	33	1.98	0.011	0.01	0.03	3.5	1.75	49.4	0.03	7.09	36.4
IEX556	Bedded Hilltop	Dales Gorge	<0.002	0.48	5.95	10	32	1.17	0.006	0.01	0.026	14.25	1.345	13	0.05	4.9	39.2
IEX557	Bedded Hilltop	Dales Gorge	0.007	0.43	5.29	10	47	1.23	0.007	0.01	0.028	5.61	1.395	23.4	0.06	5.6	38.3
IGV835	Bedded Hilltop	Dales Gorge	0.008	2.2	32.8	10	10	1.6	0.098	0.01	0.044	16.15	2.26	31.2	0.06	22.8	30.5
HWK820	Bedded Hilltop	FWZ	0.015	0.51	16.3	10	44	1.18	0.028	0.01	0.022	12	1.865	22.4	0.13	4.92	43.2
IDL631	Bedded Hilltop	FWZ	0.014	0.69	13.4	<10	3	1.41	0.023	0.02	0.084	9.2	2.74	13	0.04	9.46	46.1
IER083	Bedded Hilltop	FWZ	0.014	0.35	10.65	10	23	2.59	0.005	0.01	0.179	17.75	11.4	33.2	0.06	30.5	37.1
IER142	Bedded Hilltop	FWZ	0.018	0.78	57.5	10	4	1.31	0.052	0.01	0.036	9.79	6.75	18.4	0.03	13.6	37.4
IEW143	Bedded Hilltop	FWZ	0.005	3.3	119	20	195	7.91	0.316	0.02	0.263	47.9	18.05	55.8	0.07	43.6	40.7
IEZ446	Bedded Hilltop	FWZ	0.013	3.46	57.7	30	14	2.62	0.177	0.02	0.116	33.6	11.9	20.6	0.07	29	41.5
ICW973	Bedded Hilltop	FWZ	0.011	2.23	78	10	15	2.04	0.141	0.03	0.119	22.2	19.4	35.9	0.23	18.7	36.8
IEX525	Bedded Hilltop	FWZ	0.02	1.35	37.3	<10	19	1.04	0.053	0.01	0.053	24.9	5.55	20.5	0.05	17.6	39.3
IGV812	Bedded Hilltop	FWZ	0.054	1.03	412	10	51	1.47	0.057	0.01	0.123	6.12	3.44	21.7	0.04	33	38.2
HWK845	Bedded Hilltop	MCS	0.147	8.09	106.5	50	153	5.79	0.71	0.01	0.054	31.6	9.57	92.8	3.03	24.7	18.9
HSS744	Bedded Hilltop	MCS	0.073	8.73	57.4	70	271	2.42	0.731	0.02	0.148	135.5	2.03	88.2	6.76	22.6	2.42
IDP446	Bedded Hilltop	MCS	1.585	10.5	392	50	153	1.29	0.798	0.02	0.032	102	8.92	109	3.26	52	5.48
HWL294	Bedded Hilltop	MCS	0.196	4.05	113.5	20	111	4.53	0.347	0.01	0.598	28	9.8	27.1	2.74	93.6	15.1
HWL551	Bedded Hilltop	MCS	0.113	2.74	855	20	56	1.82	0.816	0.02	0.238	25.2	5.7	67.8	1.77	79.3	25.7
IER194	Bedded Hilltop	MCS	0.102	9.75	61.1	70	223	2.76	0.911	0.02	0.153	129	5.91	89.8	5.22	7.38	4.52
IEZ598	Bedded Hilltop	MCS	0.088	7.41	619	60	248	2.39	0.733	0.03	0.3	56.2	23.7	86.6	6.29	76.1	14.9
HWL528	Bedded Hilltop	MTS	0.171	3.6	41.1	10	23	1.41	0.528	0.02	1.865	58.4	34.2	81	0.36	36.9	3.47
IDS102	Bedded Hilltop	MTS	0.732	5.9	61.5	10	23	1.04	0.637	0.01	0.012	63.6	1.82	102.5	0.19	178	4.79
IEZ052	Bedded Hilltop	WF	0.007	0.13	5.79	<200	29	0.39	0.014	18.65	0.023	5.35	1.435	4.1	0.02	147.5	1.79
IET246	Bedded Hilltop	WF	0.03	1.84	8.2	<200	66	0.37	0.147	14.8	0.085	17.1	3.97	30.4	1.24	12.7	1.5
IEZ176	Bedded Hilltop	WF	0.046	0.42	8.24	<200	30	0.35	0.028	14.2	0.053	7.72	3.15	31.3	0.82	12.2	3.43
IEZ199	Bedded Hilltop	WF	0.054	11.35	106	60	196	0.83	1.79	0.41	0.018	38.2	10.85	555	10.45	53.2	19.4
ICV792	Bedded Hilltop	WF	0.035	5.8	12.6	10	13	0.42	0.019	0.38	0.121	3.24	65	937	0.42	87.5	10.1
ICY501	Hope Downs 2	WF	0.076	4.92	34.3	20	84	2.29	0.467	0.04	0.045	53.6	17.25	62.5	1.68	38.3	17.75
ICX217	Hope Downs 2	WF	0.01	8.54	43.7	60	52	1.25	0.85	0.04	0.086	28.9	38.1	63.3	2.39	49.6	27.7
HST001	Hope Downs 2	WF	0.029	8	35.6	40	20	0.46	0.703	0.07	0.027	3.28	7.67	202	3.97	132	31.6
ICY868	Hope Downs 2	WF	0.039	8.99	50.5	20	293	2.16	0.55	0.07	0.493	389	125	35.9	0.07	85.2	29.6
ICY871	Hope Downs 2	WF	0.105	8.6	49.3	20	520	4.61	0.603	0.18	0.628	224	61.5	59.5	0.39	56.2	26.3
ICL231	Hope Downs 2	WF	0.023	3.52	4.11	<200	64	1.13	0.145	11.3	1.475	35.8	91	50.5	1.3	35.7	5.58
IDR802	Hope Downs 2	WF	0.058	9.1	37.1	30	350	4.51	0.714	0.14	1.005	94.7	68.4	83.3	1.75	59.9	23.9
HST214	Hope Downs 2	WF	0.053	3.94	28.7	20	124	2.93	0.294	0.48	2.97	111.5	68.7	54	0.49	27.9	23
HST257	Hope Downs 2	WF	0.117	7.55	21.7	40	700	6	0.611	0.13	1.65	103	69.8	86.1	2.77	57.6	9.7
ICV188	Hope Downs 2	WF	0.043	0.62	6.39	10	9	0.96	0.046	0.07	0.497	8.5	20.4	27.5	0.1	22.1	28.8
ICV374	Hope Downs 2	WF	0.037	4.37	35.7	20	100	5.5	0.414	0.08	0.129	102	20.7	24.2	0.68	36.4	29.8
ICW087	Hope Downs 2	WF	0.016	6.17	36.6	50	78	1.79	0.584	0.2	0.428	21.8	58	44.1	1.19	44.5	24.1
IEU427	Hope Downs 2	WF	0.011	5.96	62.2	30	77	0.95	0.558	0.02	0.065	24.1	28.3	93.8	1.09	43.4	40.8
IEV694	Hope Downs 2	WF	0.016	0.53	3.74	10	3	0.67	0.051	0.02	0.178	4.7	5.63	12.3	0.04	5.03	27.6
IET547	Hope Downs 2	WF	0.107	7.64	33.9	30	197	2.86	0.641	0.18	0.228	100.5	33.5	49.9	2.95	49	17.65
ICI031	Hope Downs 2	Newman	0.004	0.2	1.57	10	4	0.56	0.011	0.01	0.019	9.44	1.4	12.3	0.02	4.52	37.3
ICP834	Hope Downs 2	Newman	0.006	0.33	1.71	10	3	0.25	0.018	0.01	0.076	3.2	2.42	9.8	0.04	2.72	36.6
ICY761	Hope Downs 2	Newman	0.024	0.94	1.37	10	47	0.13	0.039	0.01	0.038	1.57	2.56	51.1	0.12	22.5	11.2
ICL327	Hope Downs 2	Newman	0.016	0.31	1.24	10	3	0.27	0.013	0.02	0.09	2.52	5.56	26.7	0.05	22	32.8
ICL518	Hope Downs 2	Newman	0.006	0.23	2.24	10	28	0.61	0.009	0.01	0.046	6.36	8.96	96.2	0.06	3.65	28.2
ICL787	Hope Downs 2	Newman	0.022	0.19	1.31	10	4	0.32	0.016	0.01	0.147	1.81	4.09	34.8	0.04	18.75	32.2
ICV072	Hope Downs 2	Newman	0.021	1.95	17.65	20	89	1	0.073	0.35	0.041	15.15	17.4	34.4	0.11	31.2	48.5
ICV158	Hope Downs 2	Newman	0.013	0.17	1.01	10	2	0.3	0.011	0.01	0.158	2.4	2.97	24.4	0.05	10.45	29.1
IEU414	Hope Downs 2	Newman	0.015	0.19	1.9	10	1	0.27	0.012	<0.01	0.006	4.02	1.04	14.9	0.01	2.27	33.5
ICY563	Hope Downs 2	MacLeod	0.003	3.67	12.7	10	8	1.54	0.283	<0.01	0.017	4.86	1.65	49.8	0.05	25.1	48.6
ICH905	Hope Downs 2	MacLeod	0.01	0.49	5.01	10	5	0.8	0.055	<0.01	0.012	2.86	0.958	11.2	0.03	8.21	30.5
ICL281	Hope Downs 2	MacLeod	0.006	0.35	2.12	10	21	0.53	0.019	0.01	0.088	1.52	9.7	32.9	0.03	16	34.3
ICL766	Hope Downs 2	MacLeod	0.009	0.78	1.54	10	11	0.6	0.015	0.01	0.146	7.79	11	24	0.08	19.15	36.4
ICV067	Hope Downs 2	MacLeod	0.156	0.68	1.28	10	70	0.55	0.036	0.01	0.115	5.24	1.985	30.3	0.18	8.82	17.3
IDV159	Hope Downs 2	MacLeod	0.017	2.29	11.1	30	89	0.95	0.136	0.07	0.04	2.97	3.87	53.5	0.28	27	37.3
ICW468	Hope Downs 2	MacLeod	0.028	1.07	6.24	10	7	0.8	0.065	0.01	0.031	5.69	10.6	53.8	0.27	52.2	34.4
ICI423	Hope Downs 2	Nammuldi	0.099	6.03	3.91	10	24	1.31	0.164	0.01	0.028	3.92	3.05	80.5	0.2	152	42.6
IDR622	Hope Downs 2	Nammuldi	0.009	0.64	1.61	10	4	0.3	0.109	<0.01	0.013	2.88	2.03	33.3	0.05	3.89	30.2
IEU280	Hope Downs 2	Nammuldi	0.018	0.17	1.76	10	8	0.27	0.025	0.01	0.14	20.9	1.89	50	0.13	7.21	19.85

Note: Samples digested by 4 acid digest (normal font) and aqua regia digest (**BOLD** font)

Sample ID	Location	Lithology	Ga	Ge	Hf	Hg	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P
			ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm
HWL255	Bedded Hilltop	Detritals	14.95	0.16	2.15	0.026	0.102	0.22	7.93	4.7	0.07	127	5.32	0.008	4.01	19.25	280
IEZ059	Bedded Hilltop	Detritals	17.7	0.13	3.41	0.011	0.116	0.42	17.25	15.7	0.17	832	2.28	0.079	10.85	55.2	360
IEX071	Bedded Hilltop	Detritals	15.75	2.12	3.22	1.265	0.046	0.02	15.65	55.5	0.06	181	5.24	0.024	17.2	59.6	110
IEX144	Bedded Hilltop	Detritals	12.55	1.12	1.935	0.018	0.063	0.04	28.4	5.4	0.62	114	2.68	0.044	7.36	28.2	240
IDS997	Bedded Hilltop	Detritals	16.85	0.88	2.61	0.078	0.111	0.14	8.04	27.7	0.09	566	6.56	0.019	5.89	50.9	200
ICX396	Hope Downs 2	Detritals	21.4	0.37	3.66	0.011	0.128	0.12	11.25	7	0.07	2030	2.55	0.026	9.38	34.2	360
ICI037	Hope Downs 2	Detritals	13.85	0.33	3.09	0.011	0.053	0.09	3.23	5.7	0.08	869	1.89	0.04	6.02	19.45	270
ICY932	Hope Downs 2	Detritals	23.2	1.75	3.51	0.028	0.168	0.02	5.44	7.4	0.09	253	3.69	0.017	8.16	88.6	230
IDR366	Hope Downs 2	Detritals	16.6	1.22	2.48	0.011	0.153	0.01	12.8	3.3	0.03	721	3.18	0.014	6.14	40.8	230
HST198	Hope Downs 2	Detritals	23	0.75	3.1	0.01	0.159	0.06	20	7.7	0.06	990	4.37	0.019	6.94	67.8	310
ICW055	Hope Downs 2	Detritals	7.36	3.42	1.56	0.024	0.042	0.01	8.57	9.3	0.06	986	1.36	0.009	4.12	107.5	630
IEU297	Hope Downs 2	Detritals	18.05	0.47	2.58	0.008	0.141	0.02	6.78	31.8	0.52	1160	1.58	0.04	6.92	73.9	70
ICW617	Hope Downs 2	Detritals	32	0.43	4.1	0.005	0.278	0.27	14.25	18.3	0.15	369	1.93	0.06	12.6	78.7	320
IET519	Hope Downs 2	Detritals	13.75	0.73	2.05	0.025	0.104	0.04	15.45	4.4	0.05	507	2.43	0.013	4.57	42.9	490
IDL399	Bedded Hilltop	Lignite	**11.15**	**1.535**	**0.955**	**8.87**	**0.121**	**0.01**	**4.11**	**1.4**	**0.41**	**157**	**3.39**	**0.027**	**2.01**	**9.29**	**70**
IDL538	Bedded Hilltop	Lignite	**1.885**	**2.78**	**0.207**	**3.17**	**0.021**	**0.01**	**5.97**	**3.4**	**0.03**	**17**	**2.13**	**0.011**	**0.338**	**105.5**	**10**
IDL765	Bedded Hilltop	Lignite	**4.02**	**1.47**	**0.3**	**4.36**	**0.03**	**0.01**	**31.3**	**2.3**	**0.19**	**224**	**0.74**	**0.021**	**0.722**	**18.5**	**20**
IER771	Bedded Hilltop	Lignite	**4.11**	**1.405**	**0.259**	**3.01**	**0.041**	**0.02**	**57.8**	**2.9**	**0.22**	**599**	**0.86**	**0.021**	**0.72**	**43.8**	**10**
IEX186	Bedded Hilltop	Lignite	**4.29**	**0.892**	**0.229**	**1.265**	**0.029**	**0.01**	**65.3**	**1.5**	**0.33**	**303**	**0.66**	**0.028**	**0.597**	**36.7**	**10**
IEX193	Bedded Hilltop	Lignite	**9.47**	**2.05**	**0.533**	**2.33**	**0.044**	**0.01**	**65.1**	**0.8**	**0.2**	**117**	**1.96**	**0.025**	**1.105**	**9.8**	**1100**
ICW891	Bedded Hilltop	Lignite	**3.65**	**2.02**	**0.214**	**2.17**	**0.03**	**0.01**	**20**	**0.7**	**0.25**	**455**	**0.6**	**0.019**	**0.593**	**15.75**	**10**
ICW899	Bedded Hilltop	Lignite	**6.39**	**4.96**	**0.543**	**3.58**	**0.061**	**0.01**	**19.85**	**0.5**	**0.23**	**217**	**1.61**	**0.021**	**1.39**	**133**	**30**
ICV737	Bedded Hilltop	Lignite	17.3	<0.05	3.49	0.079	0.131	1.47	22.1	69	0.27	272	1.83	0.021	8.32	231	80
ICV974	Bedded Hilltop	Lignite	**3.14**	**1.07**	**0.209**	**1.9**	**0.027**	**0.01**	**75.2**	**2.2**	**0.41**	**210**	**0.63**	**0.031**	**0.582**	**42.4**	**20**
HWK433	Bedded Hilltop	Dales Gorge	0.98	0.08	0.189	0.01	0.011	0.01	1.595	0.7	0.02	241	0.29	0.004	0.795	5.04	790
HSS954	Bedded Hilltop	Dales Gorge	0.55	0.1	0.149	0.02	0.009	<0.01	2.85	0.5	0.01	116	0.38	0.003	0.443	3.1	730
HSS955	Bedded Hilltop	Dales Gorge	1.75	0.08	0.375	0.009	0.03	<0.01	6.21	1.2	0.02	248	0.74	0.006	1.085	9.58	1060
IDQ084	Bedded Hilltop	Dales Gorge	0.55	0.08	0.077	0.009	0.009	<0.01	1.97	0.3	0.01	98	0.6	0.002	0.437	3.29	950
IER035	Bedded Hilltop	Dales Gorge	0.49	0.09	0.137	0.005	0.01	<0.01	6.79	1	0.02	129	0.37	0.005	0.356	5.23	660
IER036	Bedded Hilltop	Dales Gorge	0.36	0.09	0.091	0.007	0.008	<0.01	4.85	0.8	0.02	124	0.39	0.005	0.3	5.14	680
IER123	Bedded Hilltop	Dales Gorge	2.65	0.1	0.654	0.008	0.022	0.03	4.86	1.8	0.05	81	0.67	0.029	1.79	8.84	620
IET896	Bedded Hilltop	Dales Gorge	11.55	4.33	3.26	0.023	0.193	0.01	35.4	4.2	0.02	53	2.58	0.026	5.3	36.9	600
IEW193	Bedded Hilltop	Dales Gorge	0.5	0.1	0.145	0.005	0.009	0.01	22.7	1.7	0.02	154	0.38	0.014	0.365	5.81	530
IEW194	Bedded Hilltop	Dales Gorge	0.41	0.11	0.104	0.006	0.008	<0.01	20.9	1.4	0.02	124	0.39	0.01	0.337	5.4	540
IEW862	Bedded Hilltop	Dales Gorge	0.46	0.09	0.14	0.009	0.011	<0.01	4.11	1.3	0.02	125	0.62	0.005	0.362	6.94	470
IEW882	Bedded Hilltop	Dales Gorge	0.54	0.09	0.173	0.007	0.01	0.01	1.085	0.9	0.01	187	0.84	0.015	0.455	9.07	510
IEX556	Bedded Hilltop	Dales Gorge	0.47	0.12	0.119	0.007	0.008	<0.01	22.9	1.4	0.02	175	0.86	0.009	0.345	5.48	600
IEX557	Bedded Hilltop	Dales Gorge	0.41	0.09	0.102	0.006	0.009	<0.01	6.51	1.2	0.02	175	0.79	0.009	0.361	4.88	790
IGV835	Bedded Hilltop	Dales Gorge	3.9	0.09	0.868	0.007	0.022	<0.01	6.65	0.7	0.01	206	1.93	0.005	2.39	13.15	1480
HWK820	Bedded Hilltop	FWZ	1.02	0.12	0.196	0.01	0.011	0.03	6.33	0.7	0.02	154	0.56	0.03	0.804	4.83	690
IDL631	Bedded Hilltop	FWZ	1.06	0.12	0.292	0.005	0.014	<0.01	5.34	2.6	0.02	163	0.94	0.004	0.817	13.25	1180
IER083	Bedded Hilltop	FWZ	0.35	0.12	0.104	0.069	0.009	0.01	46.9	2.2	0.02	246	0.77	0.008	0.362	19.2	640
IER142	Bedded Hilltop	FWZ	1.53	0.14	0.27	0.008	0.017	0.01	3.35	0.9	0.01	166	1.34	0.006	0.912	19.5	1130
IEW143	Bedded Hilltop	FWZ	8.25	1.1	1.535	0.015	0.076	0.04	17.85	2.4	0.3	3290	4.45	0.075	2.43	68.2	1610
IEZ446	Bedded Hilltop	FWZ	5.28	1.36	0.948	0.012	0.041	0.01	12.6	1.1	0.07	1230	2.3	0.018	2.89	25.3	2030
ICW973	Bedded Hilltop	FWZ	4.49	0.95	0.746	0.02	0.036	0.09	9.86	4.8	0.05	770	2.71	0.006	1.815	41	1120
IEX525	Bedded Hilltop	FWZ	2.06	0.14	0.546	0.01	0.022	<0.01	3.91	0.6	0.01	361	3.6	0.01	1.375	14.05	910
IGV812	Bedded Hilltop	FWZ	1.44	0.21	0.275	0.016	0.018	0.01	4.03	1	0.01	211	2.18	0.006	0.853	35.2	1090
HWK845	Bedded Hilltop	MCS	18.8	0.24	3.54	0.021	0.105	1.9	21.3	17.9	0.45	219	0.54	0.03	7.45	64.2	540
HSS744	Bedded Hilltop	MCS	19.75	0.12	3.77	0.005	0.117	2.71	67.3	25.9	0.63	24.9	4.68	0.026	10.7	28.4	260
IDP446	Bedded Hilltop	MCS	14.9	0.12	2.82	0.026	0.198	1.67	69.5	27.8	0.36	34.1	16.4	0.021	7.07	68.1	160
HWL294	Bedded Hilltop	MCS	10.7	0.09	2.93	0.103	0.062	1.2	17.9	30.4	0.22	384	3.76	0.017	4.43	28.6	230
HWL551	Bedded Hilltop	MCS	10.25	0.13	1.77	0.027	0.144	0.71	10.25	8.8	0.15	163	12.75	0.022	3.11	21.9	200
IER194	Bedded Hilltop	MCS	17.15	0.11	3.6	0.005	0.091	2.17	73.4	19.4	0.49	66.6	9.86	0.034	8.05	86	430
IEZ598	Bedded Hilltop	MCS	18.5	0.1	4.07	0.045	0.091	2.09	31.3	19.8	0.54	2220	5.48	0.049	8.08	90	410
HWL528	Bedded Hilltop	MTS	8.35	0.1	1.405	0.163	0.063	0.13	23.3	23.4	0.03	316	2.72	0.006	4.37	62.5	90
IDS102	Bedded Hilltop	MTS	10.45	0.06	1.625	0.133	0.091	0.06	11.2	6.2	0.02	103	5.92	0.007	4.98	31.9	90
IEZ052	Bedded Hilltop	WF	0.35	<0.05	0.055	0.013	<0.005	0.01	3.07	1.7	11.85	3300	0.33	0.01	0.128	8.27	80
IET246	Bedded Hilltop	WF	4.24	<0.05	0.797	0.031	0.016	1.42	8.91	6.4	9.01	3920	0.71	0.033	2.36	22.1	130
IEZ176	Bedded Hilltop	WF	1.05	<0.05	0.176	0.137	<0.005	0.03	4.99	2.5	7.28	407	0.31	0.03	0.588	8.33	30
IEZ199	Bedded Hilltop	WF	49	0.92	7.08	0.019	0.218	0.39	19.7	15.8	0.43	668	7.18	0.06	13.95	51.8	220
ICV792	Bedded Hilltop	WF	10.2	<0.05	0.782	0.016	0.042	0.07	1.19	29	7.13	2310	0.28	0.023	0.728	318	40
ICY501	Hope Downs 2	WF	10.95	0.13	2.21	0.024	0.062	0.47	34.7	10	0.21	2460	0.93	0.021	3.69	63.7	250
ICX217	Hope Downs 2	WF	20	0.72	4.64	0.01	0.086	0.65	10.45	12.2	0.27	5430	2.29	0.044	7.52	73.8	240
HST001	Hope Downs 2	WF	19.6	2.57	3.49	0.005	0.185	0.23	3.05	11.6	0.11	33	1.22	0.056	7.12	33.5	120
ICY868	Hope Downs 2	WF	18.5	1.39	3.04	0.073	0.073	0.02	59.9	207	0.39	>50000	3.5	0.024	1.94	442	800
ICY871	Hope Downs 2	WF	19.9	1.41	3.63	0.099	0.082	0.12	73.2	127	0.33	>50000	3.42	0.028	2.59	217	1220
ICL231	Hope Downs 2	WF	6.67	0.08	1.09	0.019	0.05	0.14	17.45	34.6	8.88	4380	0.27	0.025	2.47	158.5	110
IDR802	Hope Downs 2	WF	21.1	1.03	3.82	0.09	0.086	1.25	95.8	100.5	0.52	48900	0.87	0.037	4.28	214	920
HST214	Hope Downs 2	WF	10.75	1.61	1.48	0.562	0.038	0.13	74.7	18.3	0.54	>50000	0.63	0.011	2.85	94.8	780
HST257	Hope Downs 2	WF	18.8	0.29	3.02	0.148	0.063	2.12	142.5	50.8	0.59	40800	0.41	0.029	3.85	205	700
ICV188	Hope Downs 2	WF	1.65	0.1	0.215	0.02	0.008	0.03	5.2	3.2	0.08	3480	0.69	0.003	0.45	29.1	300
ICV374	Hope Downs 2	WF	11.75	0.86	2.17	0.019	0.062	0.32	53.6	10.3	0.25	25200	1.62	0.012	2.82	76.5	930
ICW087	Hope Downs 2	WF	13.6	0.36	2.9	0.015	0.053	0.38	10.4	13.6	0.24	4400	0.7	0.072	4.4	131	370
IEU427	Hope Downs 2	WF	13.35	1.47	2.55	0.009	0.08	0.56	9.18	3.8	0.17	2750	2.16	0.044	5.17	68.5	360
IEV694	Hope Downs 2	WF	1.14	0.09	0.186	0.013	<0.005	0.02	4.38	2.4	0.06	1010	0.27	0.002	0.424	14.2	200
IET547	Hope Downs 2	WF	20.2	0.68	3.75	0.075	0.076	1.2	60.2	40.2	0.44	46700	0.55	0.035	4.43	135.5	790
ICI031	Hope Downs 2	Newman	0.86	0.12	0.049	0.005	<0.005	0.01	1.605	1.3	0.02	176	0.17	0.003	0.147	5.07	620
ICP834	Hope Downs 2	Newman	0.88	0.11	0.141	0.007	<0.005	0.01	5.54	2.6	0.03	406	0.17	0.004	0.315	10.55	320
ICY761	Hope Downs 2	Newman	1.98	<0.05	0.266	0.023	0.012	0.01	0.908	6.3	0.02	74	0.37	0.005	0.587	8.45	100
ICL327	Hope Downs 2	Newman	0.77	0.31	0.125	0.009	0.005	0.01	1.375	2.3	0.04	133	0.31	0.007	0.369	11.6	270
ICL518	Hope Downs 2	Newman	0.48	0.18	0.062	0.006	<0.005	0.01	5.53	5.6	0.03	674	0.67	0.009	0.22	23.2	310
ICL787	Hope Downs 2	Newman	0.51	0.1	0.065	0.009	0.005	0.01	1.175	2.8	0.02	179	0.61	0.006	0.181	13.25	250
ICV072	Hope Downs 2	Newman	2.73	4.67	0.76	0.014	0.021	0.04	3.87	0.9	0.1	52	0.36	0.041	1.055	16.2	540
ICV158	Hope Downs 2	Newman	0.41	0.2	0.056	0.006	<0.005	0.01	0.737	3	0.03	194	0.19	0.003	0.171	7.99	240
IEU414	Hope Downs 2	Newman	0.41	0.09	0.058	0.005	<0.005	0.01	0.949	0.7	0.01	285	0.24	0.001	0.179	3.26	320
ICY563	Hope Downs 2	MacLeod	7.74	3.66	1.61	0.005	0.045	0.01	1.26	0.9	0.01	129	0.87	0.019	3.82	22.6	210
ICH905	Hope Downs 2	MacLeod	1.14	0.12	0.215	0.005	0.007	0.01	0.65	1	0.01	71	0.27	0.003	0.557	7.49	230
ICL281	Hope Downs 2	MacLeod	0.97	0.12	0.13	0.005	<0.005	0.01	1.41	1.5	0.04	180	0.45	0.007	0.335	14.75	240
ICL766	Hope Downs 2	MacLeod	0.44	0.14	0.047	0.01	<0.005	0.01	6.41	6.8	0.03	233	0.4	0.005	0.207	16.75	390
ICV067	Hope Downs 2	MacLeod	2.46	0.05	0.417	0.005	0.009	0.02	3.05	7.2	0.01	43	0.28	0.004	1.085	9.31	300
IDV159	Hope Downs 2	MacLeod	5.25	2.54	1.16	0.015	0.077	0.08	1.455	3.1	0.03	46	0.91	0.037	2.28	13.5	200
ICW468	Hope Downs 2	MacLeod	2.61	0.22	0.462	0.005	0.028	0.03	1.23	3.7	0.02	81	0.67	0.005	1.165	26.6	390
ICI423	Hope Downs 2	Nammuldi	8.58	2.32	1.3	0.009	0.095	0.03	2.58	5.6	0.02	21	0.67	0.01	3.28	27.8	1050
IDR622	Hope Downs 2	Nammuldi	1.74	0.1	0.374	0.005	0.006	0.01	0.835	1.7	0.02	86	0.3	0.001	0.8	5.84	360
IEU280	Hope Downs 2	Nammuldi	1.09	0.06	0.126	0.018	0.006	0.02	12.5	8.4	0.01	112	0.71	0.004	0.395	5.05	70

Note: Samples digested by 4 acid digest (normal font) and aqua regia digest (**BOLD** font)

Sample ID	Location	Lithology	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U
			ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm
HWL255	Bedded Hilltop	Detritals	31.8	21.7	<0.002	0.02	6.45	10.65	1.6	1.61	2.72	0.3	0.56	9.43	0.142	0.166	1.92
IEZ059	Bedded Hilltop	Detritals	24.9	40.6	<0.002	0.02	2.9	20.6	1	2.8	23.9	0.87	0.19	12.65	0.482	0.311	1.76
IEX071	Bedded Hilltop	Detritals	42.3	2.72	<0.002	0.03	3.65	9.7	1.1	4.03	7	1.36	0.07	7.98	0.581	0.736	3.31
IEX144	Bedded Hilltop	Detritals	19.7	5.37	<0.002	0.02	2.1	11.4	0.6	1.92	18.85	0.68	0.12	7.68	0.292	0.239	2.96
IDS997	Bedded Hilltop	Detritals	47.1	19	<0.002	0.02	6.05	12.75	1.2	2.58	5.32	0.45	0.44	12.7	0.217	0.45	2.85
ICX396	Hope Downs 2	Detritals	20.7	10.7	<0.002	0.03	4.66	20.2	2.3	2.75	17.7	0.67	0.53	13.75	0.418	0.249	2.09
ICI037	Hope Downs 2	Detritals	8.84	4.82	<0.002	0.04	4.43	10	3.9	1.94	24.5	0.44	0.61	9.42	0.264	0.041	0.96
ICY932	Hope Downs 2	Detritals	28.5	1.06	<0.002	0.03	4.63	26.8	0.7	3.38	3.06	0.66	0.45	7.37	0.422	0.013	3.95
IDR366	Hope Downs 2	Detritals	17.15	0.41	<0.002	0.01	3.11	21.2	0.6	2.53	3.17	0.45	0.62	5.88	0.38	0.014	2.04
HST198	Hope Downs 2	Detritals	39.5	2.95	<0.002	0.01	4.91	24.1	0.6	3.08	3.29	0.58	0.48	5.73	0.361	0.03	3.43
ICW055	Hope Downs 2	Detritals	8.91	0.44	<0.002	0.02	1.36	10.05	0.2	0.88	2.83	0.33	0.13	4.04	0.213	0.616	1.3
IEU297	Hope Downs 2	Detritals	14.1	1.22	<0.002	0.02	2.81	22.6	0.5	2.78	22.8	0.5	0.57	6.78	0.47	0.09	1.24
ICW617	Hope Downs 2	Detritals	31.5	33.1	<0.002	0.02	1.99	38.5	1.1	4.4	20.2	0.88	0.43	9.63	0.781	0.429	1.51
IET519	Hope Downs 2	Detritals	20.8	2.3	<0.002	0.01	2.8	19.55	0.4	1.77	2.33	0.35	0.23	5.57	0.301	0.032	1.86
IDL399	Bedded Hilltop	Lignite	**62.1**	**1.045**	**0.004**	**3.93**	**5.27**	**5.95**	**21.9**	**3.02**	**14.25**	**0.056**	**1.04**	**13.05**	**0.059**	**0.166**	**4.75**
IDL538	Bedded Hilltop	Lignite	**27.6**	**2.03**	**0.033**	**>10**	**0.555**	**0.992**	**6.7**	**0.54**	**3.87**	**<0.005**	**0.1**	**1.775**	**0.013**	**1.385**	**1.37**
IDL765	Bedded Hilltop	Lignite	**20.7**	**1.365**	**0.004**	**9.23**	**0.781**	**1.89**	**7.3**	**0.92**	**8.38**	**0.009**	**0.07**	**3.7**	**0.031**	**0.192**	**3.39**
IER771	Bedded Hilltop	Lignite	**32**	**1.56**	**0.01**	**5.67**	**0.85**	**2.65**	**4.9**	**0.86**	**14.9**	**0.006**	**0.06**	**3.8**	**0.031**	**0.512**	**3.68**
IEX186	Bedded Hilltop	Lignite	**30.9**	**1.07**	**0.01**	**6.81**	**1.14**	**3.59**	**3.4**	**0.63**	**14.75**	**0.006**	**0.08**	**4.14**	**0.025**	**0.784**	**4.01**
IEX193	Bedded Hilltop	Lignite	**65.8**	**0.952**	**0.008**	**3.67**	**1.145**	**3.67**	**10.9**	**0.99**	**50.3**	**0.023**	**0.12**	**5.43**	**0.035**	**0.17**	**7.33**
ICW891	Bedded Hilltop	Lignite	**12.95**	**0.528**	**0.005**	**6.42**	**0.654**	**1.46**	**4.1**	**0.6**	**9.07**	**0.016**	**0.07**	**2.74**	**0.018**	**0.217**	**1.97**
ICW899	Bedded Hilltop	Lignite	**38.7**	**0.741**	**0.03**	**8.74**	**2.81**	**2.92**	**16.8**	**1.05**	**8.67**	**0.032**	**0.36**	**6.09**	**0.038**	**15.4**	**2.69**
ICV737	Bedded Hilltop	Lignite	19.15	121	0.032	1.48	7.56	11.8	2.1	2.55	4.56	0.65	0.51	9.92	0.247	13.3	4.27
ICV974	Bedded Hilltop	Lignite	**27.4**	**1.035**	**0.007**	**3.27**	**0.72**	**1.915**	**3.5**	**0.56**	**14.85**	**0.01**	**0.06**	**2.59**	**0.02**	**0.853**	**3.74**
HWK433	Bedded Hilltop	Dales Gorge	2.58	1.05	<0.002	0.04	0.55	1.29	<0.2	0.16	0.6	0.04	0.04	0.695	0.018	0.131	0.44
HSS954	Bedded Hilltop	Dales Gorge	2.37	0.12	<0.002	0.06	0.48	0.67	0.2	0.11	0.56	0.02	<0.04	0.484	0.007	0.042	0.47
HSS955	Bedded Hilltop	Dales Gorge	6.57	0.21	<0.002	0.03	1.27	1.8	0.2	0.49	3.47	0.08	0.14	1.5	0.029	0.037	1.17
IDQ084	Bedded Hilltop	Dales Gorge	1.42	0.12	<0.002	0.03	0.31	0.58	<0.2	0.11	0.41	0.02	<0.04	0.275	0.009	0.02	0.47
IER035	Bedded Hilltop	Dales Gorge	0.96	0.27	<0.002	0.01	0.18	1.18	0.2	0.11	2.04	0.02	<0.04	0.227	0.018	0.016	0.26
IER036	Bedded Hilltop	Dales Gorge	0.92	0.19	<0.002	0.01	0.15	0.81	<0.2	0.08	2.34	0.01	<0.04	0.162	0.014	0.013	0.16
IER123	Bedded Hilltop	Dales Gorge	3.6	1.5	<0.002	0.02	0.47	3.17	0.4	0.4	6.89	0.13	0.06	1.975	0.089	0.026	0.62
IET896	Bedded Hilltop	Dales Gorge	54.3	0.41	<0.002	0.08	4.74	9.64	1.5	3.15	8.44	0.43	0.39	8.79	0.163	0.012	1.66
IEW193	Bedded Hilltop	Dales Gorge	0.66	0.4	<0.002	0.02	0.2	1.12	<0.2	0.08	5.01	0.02	<0.04	0.227	0.019	0.018	0.32
IEW194	Bedded Hilltop	Dales Gorge	0.62	0.27	<0.002	0.01	0.16	1.09	<0.2	0.09	3.74	0.02	<0.04	0.169	0.019	0.014	0.29
IEW862	Bedded Hilltop	Dales Gorge	1.17	0.31	<0.002	0.02	0.44	1.34	0.4	0.1	0.85	0.02	<0.04	0.277	0.018	0.006	0.16
IEW882	Bedded Hilltop	Dales Gorge	1.27	0.32	<0.002	0.03	0.47	1.58	1.3	0.11	2.16	0.02	<0.04	0.532	0.019	0.018	0.19
IEX556	Bedded Hilltop	Dales Gorge	1.21	0.35	<0.002	0.02	0.23	1.31	0.3	0.08	2.96	0.01	<0.04	0.237	0.015	0.011	0.17
IEX557	Bedded Hilltop	Dales Gorge	1.1	0.34	<0.002	0.02	0.2	1.21	0.2	0.09	1.26	0.01	<0.04	0.183	0.017	0.012	0.2
IGV835	Bedded Hilltop	Dales Gorge	3.87	0.28	<0.002	0.05	0.55	5.2	0.2	0.54	8.16	0.19	0.09	2.63	0.124	0.1	3.46
HWK820	Bedded Hilltop	FWZ	4.31	1.11	<0.002	0.01	0.48	1.95	0.4	0.18	4.69	0.04	0.04	0.66	0.023	0.04	0.39
IDL631	Bedded Hilltop	FWZ	0.99	0.19	<0.002	0.01	0.27	1.47	<0.2	0.18	0.84	0.05	<0.04	0.636	0.045	0.013	0.8
IER083	Bedded Hilltop	FWZ	2.21	0.49	<0.002	0.01	0.18	1.04	0.3	0.08	2.95	0.01	<0.04	0.177	0.016	0.158	1.4
IER142	Bedded Hilltop	FWZ	3.17	0.4	<0.002	0.03	0.79	1.72	0.3	0.22	2.68	0.06	<0.04	1.11	0.026	0.017	0.9
IEW143	Bedded Hilltop	FWZ	29.9	1.46	<0.002	0.21	2.98	9.02	2.6	0.8	24.4	0.19	0.28	6.16	0.101	0.311	4.26
IEZ446	Bedded Hilltop	FWZ	10.5	0.48	<0.002	0.09	2.09	6.32	0.4	0.7	11.5	0.22	0.19	3.94	0.09	0.092	4.79
ICW973	Bedded Hilltop	FWZ	6.98	3.34	<0.002	0.01	1.93	4.16	0.2	0.53	1.4	0.14	0.08	3.28	0.059	0.065	1.48
IEX525	Bedded Hilltop	FWZ	2.79	0.27	<0.002	0.04	0.7	3.01	0.6	0.28	0.82	0.1	0.04	1.54	0.077	0.025	0.64
IGV812	Bedded Hilltop	FWZ	6.44	0.36	<0.002	0.04	1.58	2.06	0.8	0.21	0.56	0.06	0.04	1.08	0.023	0.046	2.13
HWK845	Bedded Hilltop	MCS	41.6	94.6	<0.002	0.03	6.26	17.1	0.3	2.83	8.27	0.67	0.3	15.9	0.256	0.416	3.55
HSS744	Bedded Hilltop	MCS	60.3	145	<0.002	0.01	7.05	19.4	1.6	2.96	10.5	0.95	0.4	17.05	0.331	0.617	3.18
IDP446	Bedded Hilltop	MCS	102.5	71.5	<0.002	0.04	7.14	17.4	2.4	2.39	6.09	0.65	0.3	14.05	0.223	0.518	4.09
HWL294	Bedded Hilltop	MCS	23.4	56.2	<0.002	0.02	1.45	6.89	1.6	1.56	3.48	0.38	0.2	10.95	0.08	0.688	3.17
HWL551	Bedded Hilltop	MCS	32.7	29.8	<0.002	0.04	5.4	7.76	11.1	1.63	4.17	0.25	1.14	6.66	0.1	0.29	2.1
IER194	Bedded Hilltop	MCS	93	97.4	<0.002	0.02	4.35	15.8	0.6	2.61	10.3	0.68	0.38	14.7	0.253	0.576	2.57
IEZ598	Bedded Hilltop	MCS	46.6	111	<0.002	0.04	6.69	16.4	1.1	2.75	9.76	0.66	0.41	15.35	0.244	0.499	4.46
HWL528	Bedded Hilltop	MTS	20.9	9.71	<0.002	0.01	2.33	9.05	0.4	1.29	4.06	0.38	0.2	6.06	0.158	1.67	2.3
IDS102	Bedded Hilltop	MTS	29.3	4.16	<0.002	0.02	3.12	11.5	4.1	1.57	2.51	0.43	0.27	7.1	0.182	0.027	1.52
IEZ052	Bedded Hilltop	WF	1.02	0.34	<0.002	<0.01	0.4	0.31	0.3	0.24	16.1	0.01	<0.04	0.189	0.007	0.184	0.13
IET246	Bedded Hilltop	WF	4.71	36.8	<0.002	0.02	1.06	4.18	0.4	0.63	18.85	0.2	<0.04	3	0.099	0.162	0.86
IEZ176	Bedded Hilltop	WF	1.84	3.03	<0.002	0.02	0.32	1.48	0.3	0.16	40.3	0.04	<0.04	0.601	0.028	0.028	0.41
IEZ199	Bedded Hilltop	WF	38	44.9	<0.002	0.02	27.1	26.6	1.1	5.02	13.8	1.18	0.72	35.8	0.518	0.182	3.31
ICV792	Bedded Hilltop	WF	1.42	1.86	0.002	0.17	0.62	40.8	0.5	0.23	1.58	0.05	<0.04	0.176	0.194	0.184	0.28
ICY501	Hope Downs 2	WF	15.1	20.9	<0.002	0.01	3.96	11.85	0.2	1.47	5.02	0.31	0.23	7.74	0.163	0.142	1.72
ICX217	Hope Downs 2	WF	14.6	41.1	<0.002	0.03	6.34	14.55	1.3	2.82	10.2	0.64	0.3	12.65	0.295	0.177	2.96
HST001	Hope Downs 2	WF	15.2	13.15	<0.002	0.04	6.27	15.25	1.3	3.16	9.73	0.53	0.38	7.81	0.381	0.084	1.23
ICY868	Hope Downs 2	WF	21.2	0.76	<0.002	0.02	4.67	21.1	0.4	1.66	24.2	0.17	0.18	10.1	0.095	0.807	4.19
ICY871	Hope Downs 2	WF	20.8	4.51	<0.002	0.01	5.45	15.8	0.5	2.04	83.6	0.23	0.23	12.2	0.128	1.235	6.48
ICL231	Hope Downs 2	WF	7.72	7.91	<0.002	0.02	0.82	9.17	0.4	1	21.8	0.19	0.06	2.65	0.16	0.211	0.64
IDR802	Hope Downs 2	WF	21.7	40.3	<0.002	0.01	4.2	21.5	0.5	2.64	77.8	0.36	0.23	12.85	0.23	0.726	3.37
HST214	Hope Downs 2	WF	19.95	5.11	<0.002	<0.01	1.98	10.3	0.7	1.01	22.7	0.25	0.12	5.46	0.144	0.425	2.11
HST257	Hope Downs 2	WF	20.5	69.6	<0.002	0.01	3.9	17.05	0.5	2.23	88.3	0.35	0.16	11.5	0.201	1.48	2.84
ICV188	Hope Downs 2	WF	2.93	1.49	<0.002	0.01	0.66	2.16	0.2	0.18	1.23	0.03	<0.04	0.889	0.02	0.093	0.76
ICV374	Hope Downs 2	WF	14.55	14.25	<0.002	0.01	2.01	10.4	0.3	1.2	20.9	0.25	0.1	6.12	0.14	0.219	2.45
ICW087	Hope Downs 2	WF	11.6	16.8	<0.002	0.04	3.43	14.9	0.5	1.58	14.5	0.37	0.1	8.96	0.195	0.478	2.08
IEU427	Hope Downs 2	WF	19.55	23.5	<0.002	0.03	4.87	13.5	0.6	1.78	8.76	0.43	0.22	8.97	0.236	0.158	1.51
IEV694	Hope Downs 2	WF	2.01	0.77	<0.002	0.01	0.49	1.12	<0.2	0.15	0.6	0.03	<0.04	0.55	0.021	0.019	0.71
IET547	Hope Downs 2	WF	20.4	46.4	<0.002	0.01	4.77	17.65	0.5	2.22	68.5	0.41	0.26	11.85	0.211	0.486	2.47
ICI031	Hope Downs 2	Newman	0.75	0.32	<0.002	0.01	0.16	0.5	<0.2	0.04	3.15	0.01	<0.04	0.132	0.006	0.009	0.16
ICP834	Hope Downs 2	Newman	0.85	0.62	<0.002	<0.01	0.21	0.68	<0.2	0.12	0.58	0.03	<0.04	0.384	0.015	0.008	0.25
ICY761	Hope Downs 2	Newman	1.68	0.82	<0.002	0.01	0.18	2.02	0.3	0.34	2.15	0.04	<0.04	0.476	0.042	0.01	0.07
ICL327	Hope Downs 2	Newman	1.15	0.63	<0.002	0.01	0.16	1.01	<0.2	0.13	1.52	0.03	<0.04	0.344	0.027	0.013	0.09
ICL518	Hope Downs 2	Newman	0.63	0.73	<0.002	0.01	0.18	0.44	<0.2	0.09	1.04	0.01	<0.04	0.161	0.013	0.071	0.17
ICL787	Hope Downs 2	Newman	1.1	0.55	<0.002	0.01	0.17	0.83	0.2	0.13	0.72	0.01	<0.04	0.197	0.008	0.036	0.21
ICV072	Hope Downs 2	Newman	6.07	2.11	<0.002	0.03	1.25	8.01	1	0.45	21.8	0.07	<0.04	1.895	0.054	0.037	0.52
ICV158	Hope Downs 2	Newman	0.54	0.67	<0.002	<0.01	0.12	1.05	<0.2	0.07	0.34	0.01	<0.04	0.159	0.008	0.031	0.17
IEU414	Hope Downs 2	Newman	0.49	0.26	<0.002	0.01	0.19	0.37	<0.2	0.07	0.2	0.01	<0.04	0.152	0.008	0.007	0.09
ICY563	Hope Downs 2	MacLeod	5.62	0.25	<0.002	0.17	2.11	8.22	0.6	1.23	0.29	0.3	0.2	4.31	0.166	0.008	0.64
ICH905	Hope Downs 2	MacLeod	2.82	0.45	<0.002	0.07	0.92	1.56	0.2	0.17	0.14	0.04	0.06	0.55	0.027	<0.004	0.19
ICL281	Hope Downs 2	MacLeod	1.5	0.36	<0.002	0.01	0.3	1.87	0.3	0.16	2.2	0.03	<0.04	0.321	0.019	0.019	0.09
ICL766	Hope Downs 2	MacLeod	1.16	0.65	<0.002	0.01	0.18	1.29	<0.2	0.1	1.51	0.02	<0.04	0.197	0.009	0.121	0.12
ICV067	Hope Downs 2	MacLeod	1.6	2.46	<0.002	0.01	0.45	1.52	<0.2	0.48	3.2	0.08	<0.04	0.525	0.055	0.065	0.1
IDV159	Hope Downs 2	MacLeod	3.91	3.52	<0.002	0.07	1.69	6.58	2.6	1.18	14.35	0.16	0.1	2.87	0.116	0.04	0.49
ICW468	Hope Downs 2	MacLeod	5.41	2.06	<0.002	0.02	0.62	6.02	0.3	0.5	1.25	0.08	<0.04	0.731	0.087	0.035	0.18
ICI423	Hope Downs 2	Nammuldi	8.63	1.65	<0.002	0.05	1.27	32.4	1.2	1.82	2.25	0.23	0.23	1.785	0.232	0.039	0.38
IDR622	Hope Downs 2	Nammuldi	2.26	0.6	<0.002	0.01	0.2	1.44	<0.2	0.24	0.4	0.07	0.04	1.045	0.034	0.029	0.33
IEU280	Hope Downs 2	Nammuldi	3.11	1.88	<0.002	0.02	0.45	0.9	<0.2	0.17	2.75	0.03	<0.04	0.469	0.02	0.103	0.05

Note: Samples digested by 4 acid digest (normal font) and aqua regia digest (**BOLD** font)

Sample ID	Location	Lithology	V	W	Y	Zn	Zr	NO_2+NO_3 as N	TKN	Total N
			ppm	ppm	ppm	ppm	ppm	mg/kg	mg/kg	mg/kg
HWL255	Bedded Hilltop	Detritals	94.6	2.38	7.12	26.5	76.9	<0.1	30	30
IEZ059	Bedded Hilltop	Detritals	137.5	2.11	17.05	69.2	138	<0.1	60	60
IEX071	Bedded Hilltop	Detritals	62.6	5.34	22.4	135	141	0.2	<20	<20
IEX144	Bedded Hilltop	Detritals	65.3	2.18	18.6	5.7	78.8	<0.1	<20	<20
IDS997	Bedded Hilltop	Detritals	95.9	2.54	8.05	59.8	105	<0.1	<20	<20
ICX396	Hope Downs 2	Detritals	196	2.05	11.6	58.7	128	0.2	30	30
ICI037	Hope Downs 2	Detritals	107.5	1.595	5.44	20.1	107	<0.1	100	100
ICY932	Hope Downs 2	Detritals	186.5	2.01	14.2	370	122.5	0.2	<20	<20
IDR366	Hope Downs 2	Detritals	178	1.535	18.55	270	85.2	0.2	<20	<20
HST198	Hope Downs 2	Detritals	186	1.74	23.6	235	113	<0.1	<20	<20
ICW055	Hope Downs 2	Detritals	77.6	0.657	22.9	826	59.3	0.1	<20	<20
IEU297	Hope Downs 2	Detritals	155.5	1.545	11.35	184.5	90.9	0.1	20	20
ICW617	Hope Downs 2	Detritals	328	1.77	13.2	216	145	0.7	70	70
IET519	Hope Downs 2	Detritals	120	1.455	20.1	77.1	65.6	0.5	<20	<20
IDL399	Bedded Hilltop	Lignite	**69.6**	**0.584**	**9.76**	**23.2**	**30.1**	<0.1	3760	3760
IDL538	Bedded Hilltop	Lignite	**12.5**	**1.13**	**10.4**	**266**	**8.98**	<0.1	840	840
IDL765	Bedded Hilltop	Lignite	**29.9**	**0.55**	**22.1**	**155.5**	**10.75**	0.1	120	120
IER771	Bedded Hilltop	Lignite	**35.6**	**0.612**	**53.3**	**187**	**8.39**	<0.1	2940	2940
IEX186	Bedded Hilltop	Lignite	**37.2**	**0.557**	**56.4**	**545**	**7.81**	<0.1	4670	4670
IEX193	Bedded Hilltop	Lignite	**85.1**	**1.41**	**57**	**152.5**	**19.2**	<0.1	1720	1720
ICW891	Bedded Hilltop	Lignite	**20.4**	**0.583**	**16.85**	**100.5**	**6.88**	0.1	180	180
ICW899	Bedded Hilltop	Lignite	**42.1**	**0.878**	**55.7**	**664**	**17.7**	<0.1	1460	1460
ICV737	Bedded Hilltop	Lignite	59.7	3.16	16.05	1350	151.5	<0.5	160	160
ICV974	Bedded Hilltop	Lignite	**25.6**	**0.631**	**68.3**	**287**	**6.57**	<0.1	3060	3060
HWK433	Bedded Hilltop	Dales Gorge	9.6	0.733	4.65	21.1	11.9	0.8	<20	<20
HSS954	Bedded Hilltop	Dales Gorge	4.3	0.753	4.34	11.9	7.7	<0.1	<20	<20
HSS955	Bedded Hilltop	Dales Gorge	10.8	1.37	8.54	38	17.4	<0.1	<20	<20
IDQ084	Bedded Hilltop	Dales Gorge	5.8	1.015	5.82	19.1	5.7	<0.1	<20	<20
IER035	Bedded Hilltop	Dales Gorge	7.4	0.819	3.82	13.3	8.2	<0.1	<20	<20
IER036	Bedded Hilltop	Dales Gorge	6.1	1.15	3.71	12.3	5.6	<0.1	<20	<20
IER123	Bedded Hilltop	Dales Gorge	19	0.861	4.96	21.3	29.6	<0.1	<20	<20
IET896	Bedded Hilltop	Dales Gorge	75.3	5.24	4.76	16	142	<0.1	20	20
IEW193	Bedded Hilltop	Dales Gorge	8.3	0.617	5.49	18.5	9.2	<0.1	<20	<20
IEW194	Bedded Hilltop	Dales Gorge	7.4	0.528	4.68	17.4	6.8	<0.1	<20	<20
IEW862	Bedded Hilltop	Dales Gorge	7.5	3.32	6.7	23.9	8.1	0.5	<20	<20
IEW882	Bedded Hilltop	Dales Gorge	7.9	1.035	5.81	33.3	9.4	0.1	<20	<20
IEX556	Bedded Hilltop	Dales Gorge	9.2	1.22	5.67	17.1	8.2	<0.1	<20	<20
IEX557	Bedded Hilltop	Dales Gorge	7.1	0.803	5.24	15.6	6.5	<0.1	<20	<20
IGV835	Bedded Hilltop	Dales Gorge	31.1	0.852	8.18	78.5	39.2	<0.1	<20	<20
HWK820	Bedded Hilltop	FWZ	9.9	0.603	4.9	13.1	11.2	<0.1	<20	<20
IDL631	Bedded Hilltop	FWZ	10.9	0.523	10.65	58.1	14.2	<0.1	<20	<20
IER083	Bedded Hilltop	FWZ	7.1	1.37	8.51	36.2	6.2	<0.1	<20	<20
IER142	Bedded Hilltop	FWZ	9.5	1.36	6.97	120.5	12.7	<0.1	<20	<20
IEW143	Bedded Hilltop	FWZ	53.5	2.39	15.65	199.5	65	<0.1	<20	<20
IEZ446	Bedded Hilltop	FWZ	36.6	1.365	16.6	94.2	40.3	<0.1	<20	<20
ICW973	Bedded Hilltop	FWZ	25.8	1.375	22.7	166.5	33	<0.1	<20	<20
IEX525	Bedded Hilltop	FWZ	16.1	1.22	12	76	24.5	<0.1	<20	<20
IGV812	Bedded Hilltop	FWZ	14.3	1.39	8.15	112	12.2	<0.1	<20	<20
HWK845	Bedded Hilltop	MCS	111	4.72	36.8	340	145.5	0.4	610	610
HSS744	Bedded Hilltop	MCS	197.5	6.59	47.9	62.3	151	0.2	920	920
IDP446	Bedded Hilltop	MCS	150	4.16	16.45	15.5	115	<0.1	520	520
HWL294	Bedded Hilltop	MCS	23	1.7	25.1	73.4	119	<0.1	260	260
HWL551	Bedded Hilltop	MCS	98.4	2.03	11.95	102	66.3	<0.1	160	160
IER194	Bedded Hilltop	MCS	84.6	5.12	28.9	365	126	<0.1	880	880
IEZ598	Bedded Hilltop	MCS	99.6	5.38	22.4	319	150	<0.1	960	960
HWL528	Bedded Hilltop	MTS	80.9	3.1	20.6	64.5	47	<0.1	20	20
IDS102	Bedded Hilltop	MTS	98.2	1.845	8.83	8.1	55.6	<0.1	<20	<20
IEZ052	Bedded Hilltop	WF	2.2	0.255	5.57	8.9	2.4	<0.1	<20	<20
IET246	Bedded Hilltop	WF	28	0.782	12.6	21	26.9	0.4	50	50
IEZ176	Bedded Hilltop	WF	11.8	0.29	9.7	4.1	6.8	<0.1	<20	<20
IEZ199	Bedded Hilltop	WF	504	3.94	13.15	12.4	235	0.2	20	20
ICV792	Bedded Hilltop	WF	207	0.208	4.74	158	27	0.3	20	20
ICY501	Hope Downs 2	WF	66.8	1.69	84.4	65	78.1	0.3	30	30
ICX217	Hope Downs 2	WF	120.5	2.38	14.3	65.9	160	<0.1	60	60
HST001	Hope Downs 2	WF	204	1.545	5.32	243	125.5	2.2	30	30
ICY868	Hope Downs 2	WF	108.5	1	88.4	328	106	0.2	50	50
ICY871	Hope Downs 2	WF	118	1.27	91.3	256	127.5	0.3	80	80
ICL231	Hope Downs 2	WF	40.7	0.621	54.1	1635	36.4	0.2	40	40
IDR802	Hope Downs 2	WF	113	2.03	122	340	130.5	0.2	110	110
HST214	Hope Downs 2	WF	49.4	1.505	107.5	162	50.7	0.2	140	140
HST257	Hope Downs 2	WF	104.5	2.01	250	651	103	0.2	110	110
ICV188	Hope Downs 2	WF	15.8	1.035	12.9	300	7.2	0.2	<20	<20
ICV374	Hope Downs 2	WF	63	2	54.1	91.9	74.9	0.2	40	40
ICW087	Hope Downs 2	WF	74.2	3.33	31.2	959	101.5	<0.1	<20	<20
IEU427	Hope Downs 2	WF	92.7	1.895	15.6	74.5	90.6	<0.1	30	30
IEV694	Hope Downs 2	WF	7.1	0.642	5.75	256	6.8	0.1	<20	<20
IET547	Hope Downs 2	WF	87.2	2	92.1	79.2	135	0.8	80	80
ICI031	Hope Downs 2	Newman	2.7	0.398	3.62	14.8	2	<0.1	<20	<20
ICP834	Hope Downs 2	Newman	4.5	0.519	3.17	118.5	4.9	0.1	<20	<20
ICY761	Hope Downs 2	Newman	9.1	1.64	1.84	68.5	9.2	0.5	<20	<20
ICL327	Hope Downs 2	Newman	4.1	1.99	3.69	114.5	4.4	0.1	<20	<20
ICL518	Hope Downs 2	Newman	3.6	1.025	5.95	159.5	2.3	0.4	<20	<20
ICL787	Hope Downs 2	Newman	5.4	2.83	3.18	155	2.3	0.6	<20	<20
ICV072	Hope Downs 2	Newman	22.7	0.951	5.67	20.2	27.8	0.2	<20	<20
ICV158	Hope Downs 2	Newman	2.3	0.753	2.73	132.5	2	<0.1	<20	<20
IEU414	Hope Downs 2	Newman	2.5	1.66	1.36	6.2	2.1	<0.1	<20	<20
ICY563	Hope Downs 2	MacLeod	55.7	1.01	7.81	36.6	59	0.7	<20	<20
ICH905	Hope Downs 2	MacLeod	8.7	0.46	3.28	14.4	7.9	<0.1	<20	<20
ICL281	Hope Downs 2	MacLeod	7	1.05	3.71	46.9	5.1	<0.1	<20	<20
ICL766	Hope Downs 2	MacLeod	3.9	2.12	4.92	156.5	2.8	0.2	<20	<20
ICV067	Hope Downs 2	MacLeod	10	1.185	2.18	80	14.5	0.1	<20	<20
IDV159	Hope Downs 2	MacLeod	43.5	0.65	4.89	41.7	41.5	0.2	20	20
ICW468	Hope Downs 2	MacLeod	23.8	2.13	3.38	151	16.1	0.1	<20	<20
ICI423	Hope Downs 2	Nammuldi	50.2	0.566	5.32	110.5	52.1	<0.1	<20	<20
IDR622	Hope Downs 2	Nammuldi	8.3	2.42	2.58	8.5	13.5	<0.1	<20	<20
IEU280	Hope Downs 2	Nammuldi	13.7	2.64	6.29	70.7	5.4	<0.5	<20	<20

Note: Samples digested by 4 acid digest (normal font) and aqua regia digest (**BOLD** font); NO_2 - Nitrite; NO_3 - Nitrate, TKN - Total Kjeldahl Nitrogen.

GAI Data

Sample ID	Location	Lithology	Ag	As	B	Bi	Cd	Hg	Mn	Re	S	Sb	Se	Te	Tl	Zn
HWL255	Bedded Hilltop	Detritals	0	6	0	3	0	0	0	1	0	4	4	6	0	0
IEZ059	Bedded Hilltop	Detritals	0	3	1	2	0	0	0	1	0	3	3	4	0	0
IEX071	Bedded Hilltop	Detritals	0	6	2	2	2	4	0	1	0	3	3	3	0	0
IEX144	Bedded Hilltop	Detritals	0	3	2	1	0	0	0	1	0	2	3	4	0	0
IDS997	Bedded Hilltop	Detritals	0	6	1	3	0	0	0	1	0	4	4	5	0	0
ICX396	Hope Downs 2	Detritals	0	4	1	2	0	0	0	1	0	3	4	6	0	0
ICI037	Hope Downs 2	Detritals	0	4	1	2	0	0	0	1	0	3	5	6	0	0
ICY932	Hope Downs 2	Detritals	0	5	1	3	0	0	0	1	0	3	3	5	0	1
IDR366	Hope Downs 2	Detritals	0	4	0	2	0	0	0	1	0	3	3	6	0	1
HST198	Hope Downs 2	Detritals	0	5	1	3	0	0	0	1	0	4	3	6	0	1
ICW055	Hope Downs 2	Detritals	0	2	0	1	2	0	0	1	0	2	1	4	0	2
IEU297	Hope Downs 2	Detritals	0	4	1	2	0	0	0	1	0	3	2	6	0	0
ICW617	Hope Downs 2	Detritals	1	3	1	2	0	0	0	1	0	2	3	5	0	0
IET519	Hope Downs 2	Detritals	0	4	0	2	0	0	0	1	0	3	2	4	0	0
IDL399	Bedded Hilltop	Lignite	2	3	4	4	2	6	0	2	6	4	8	7	0	0
IDL538	Bedded Hilltop	Lignite	0	9	3	1	4	5	0	5	8	0	6	3	0	1
IDL765	Bedded Hilltop	Lignite	0	3	3	2	3	5	0	2	7	1	6	3	0	0
IER771	Bedded Hilltop	Lignite	0	6	3	2	3	5	0	4	7	1	6	3	0	0
IEX186	Bedded Hilltop	Lignite	0	3	<3	2	5	4	0	4	7	1	5	3	0	2
IEX193	Bedded Hilltop	Lignite	0	4	3	2	3	4	0	3	6	1	7	4	0	0
ICW891	Bedded Hilltop	Lignite	0	3	<3	2	2	4	0	3	7	1	5	3	0	0
ICW899	Bedded Hilltop	Lignite	0	4	3	3	3	5	0	5	7	3	7	5	4	2
ICV737	Bedded Hilltop	Lignite	1	4	1	3	3	0	0	5	5	4	4	6	3	3
ICV974	Bedded Hilltop	Lignite	0	3	<3	1	4	4	0	3	6	1	5	3	0	1
HWK433	Bedded Hilltop	Dales Gorge	0	1	0	0	0	0	0	1	0	0	1	2	0	0
HSS954	Bedded Hilltop	Dales Gorge	0	2	0	0	0	0	0	1	0	0	1	2	0	0
HSS955	Bedded Hilltop	Dales Gorge	0	2	0	2	0	0	0	1	0	2	1	4	0	0
IDQ084	Bedded Hilltop	Dales Gorge	0	2	0	0	0	0	0	1	0	0	1	2	0	0
IER035	Bedded Hilltop	Dales Gorge	0	2	0	0	0	0	0	1	0	0	1	2	0	0
IER036	Bedded Hilltop	Dales Gorge	0	1	0	0	0	0	0	1	0	0	1	2	0	0
IER123	Bedded Hilltop	Dales Gorge	0	1	0	0	0	0	0	1	0	0	2	3	0	0
IET896	Bedded Hilltop	Dales Gorge	0	3	1	5	0	0	0	1	1	3	4	5	0	0
IEW193	Bedded Hilltop	Dales Gorge	0	0	0	0	0	0	0	1	0	0	1	2	0	0
IEW194	Bedded Hilltop	Dales Gorge	0	0	0	0	0	0	0	1	0	0	1	2	0	0
IEW862	Bedded Hilltop	Dales Gorge	0	0	0	0	0	0	0	1	0	0	2	2	0	0
IEW882	Bedded Hilltop	Dales Gorge	0	1	0	0	0	0	0	1	0	0	4	2	0	0
IEX556	Bedded Hilltop	Dales Gorge	0	1	0	0	0	0	0	1	0	0	2	2	0	0
IEX557	Bedded Hilltop	Dales Gorge	0	1	0	0	0	0	0	1	0	0	1	2	0	0
IGV835	Bedded Hilltop	Dales Gorge	0	3	0	0	0	0	0	1	0	0	1	3	0	0
HWK820	Bedded Hilltop	FWZ	0	2	0	0	0	0	0	1	0	0	2	2	0	0
IDL631	Bedded Hilltop	FWZ	0	2	0	0	0	0	0	1	0	0	1	2	0	0
IER083	Bedded Hilltop	FWZ	0	2	0	0	0	0	0	1	0	0	2	2	0	0
IER142	Bedded Hilltop	FWZ	0	4	0	0	0	0	0	1	0	1	2	2	0	0
IEW143	Bedded Hilltop	FWZ	0	5	0	2	0	0	1	1	2	3	5	5	0	0
IEZ446	Bedded Hilltop	FWZ	0	4	1	1	0	0	0	1	1	2	2	4	0	0
ICW973	Bedded Hilltop	FWZ	0	5	0	0	0	0	0	1	0	2	1	3	0	0
IEX525	Bedded Hilltop	FWZ	0	4	0	0	0	0	0	1	0	1	3	2	0	0
IGV812	Bedded Hilltop	FWZ	0	7	0	0	0	0	0	1	0	2	3	2	0	0
HWK845	Bedded Hilltop	MCS	0	5	1	3	0	0	0	1	0	4	2	5	0	1
HSS744	Bedded Hilltop	MCS	0	4	2	3	0	0	0	1	0	4	4	5	0	0
IDP446	Bedded Hilltop	MCS	3	7	1	3	0	0	0	1	0	4	5	5	0	0
HWL294	Bedded Hilltop	MCS	0	5	0	2	1	0	0	1	0	2	4	4	0	0
HWL551	Bedded Hilltop	MCS	0	8	0	3	0	0	0	1	0	4	7	7	0	0
IER194	Bedded Hilltop	MCS	0	4	2	3	0	0	0	1	0	3	3	5	0	1
IEZ598	Bedded Hilltop	MCS	0	8	2	3	0	0	0	1	0	4	3	5	0	1
HWL528	Bedded Hilltop	MTS	0	4	0	2	3	1	0	1	0	2	2	4	0	0
IDS102	Bedded Hilltop	MTS	2	4	0	3	0	0	0	1	0	3	5	5	0	0
IEZ052	Bedded Hilltop	WF	0	1	<3	0	0	0	1	1	0	0	2	2	0	0
IET246	Bedded Hilltop	WF	0	1	<3	1	0	0	1	1	0	1	2	2	0	0
IEZ176	Bedded Hilltop	WF	0	1	<3	0	0	0	0	1	0	0	2	2	0	0
IEZ199	Bedded Hilltop	WF	0	5	2	4	0	0	0	1	0	6	3	6	0	0
ICV792	Bedded Hilltop	WF	0	2	0	0	0	0	0	1	2	1	2	2	0	0
ICY501	Hope Downs 2	WF	0	3	0	2	0	0	0	1	0	3	1	4	0	0
ICX217	Hope Downs 2	WF	0	4	2	3	0	0	1	1	0	4	4	5	0	0
HST001	Hope Downs 2	WF	0	3	1	3	0	0	0	1	0	4	4	5	0	1
ICY868	Hope Downs 2	WF	0	4	0	2	1	0	5	1	0	3	2	4	0	1
ICY871	Hope Downs 2	WF	0	4	0	3	1	0	5	1	0	4	2	4	0	1
ICL231	Hope Downs 2	WF	0	0	<3	1	3	0	1	1	0	1	2	3	0	3
IDR802	Hope Downs 2	WF	0	4	1	3	2	0	5	1	0	3	2	4	0	1
HST214	Hope Downs 2	WF	0	3	0	2	4	2	5	1	0	2	3	4	0	0
HST257	Hope Downs 2	WF	0	3	1	3	3	0	4	1	0	3	2	4	0	2
ICV188	Hope Downs 2	WF	0	1	0	0	1	0	1	1	0	1	1	2	0	1
ICV374	Hope Downs 2	WF	0	3	0	2	0	0	4	1	0	2	2	3	0	0
ICW087	Hope Downs 2	WF	0	4	1	3	1	0	1	1	0	3	2	3	0	3
IEU427	Hope Downs 2	WF	0	4	1	2	0	0	0	1	0	4	3	4	0	0
IEV694	Hope Downs 2	WF	0	0	0	0	0	0	0	1	0	0	1	2	0	1
IET547	Hope Downs 2	WF	0	3	1	3	0	0	5	1	0	3	2	5	0	0
ICI031	Hope Downs 2	Newman	0	0	0	0	0	0	0	1	0	0	1	2	0	0
ICP834	Hope Downs 2	Newman	0	0	0	0	0	0	0	1	0	0	1	2	0	0
ICY761	Hope Downs 2	Newman	0	0	0	0	0	0	0	1	0	0	2	2	0	0
ICL327	Hope Downs 2	Newman	0	0	0	0	0	0	0	1	0	0	1	2	0	0
ICL518	Hope Downs 2	Newman	0	0	0	0	0	0	0	1	0	0	1	2	0	0
ICL787	Hope Downs 2	Newman	0	0	0	0	0	0	0	1	0	0	1	2	0	0
ICV072	Hope Downs 2	Newman	0	2	0	0	0	0	0	1	0	2	3	2	0	0
ICV158	Hope Downs 2	Newman	0	0	0	0	0	0	0	1	0	0	1	2	0	0
IEU414	Hope Downs 2	Newman	0	0	0	0	0	0	0	1	0	0	1	2	0	0
ICY563	Hope Downs 2	MacLeod	0	2	0	1	0	0	0	1	2	2	3	4	0	0
ICH905	Hope Downs 2	MacLeod	0	1	0	0	0	0	0	1	0	1	1	3	0	0
ICL281	Hope Downs 2	MacLeod	0	0	0	0	0	0	0	1	0	0	2	2	0	0
ICL766	Hope Downs 2	MacLeod	0	0	0	0	0	0	0	1	0	0	1	2	0	0
ICV067	Hope Downs 2	MacLeod	0	0	0	0	0	0	0	1	0	0	1	2	0	0
IDV159	Hope Downs 2	MacLeod	0	2	1	0	0	0	0	1	0	2	5	3	0	0
ICW468	Hope Downs 2	MacLeod	0	1	0	0	0	0	0	1	0	1	2	2	0	0
ICI423	Hope Downs 2	Nammuldi	0	0	0	1	0	0	0	1	0	2	4	4	0	0
IDR622	Hope Downs 2	Nammuldi	0	0	0	0	0	0	0	1	0	0	1	2	0	0
IEU280	Hope Downs 2	Nammuldi	0	0	0	0	0	0	0	1	0	0	1	2	0	0

Note: Elements that are enriched (GAI ≥3) are shown in shaded cells

Appendix G: Leach Test Data

Static Deionised Water Leach Data

Sample ID	Location	Lithology	pH	EC	Tot Alk	Acidity	SO_4	Cl	F	SiO_2	Ag	Al	As	Ba	Be	Bi	Ca
				µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
HWL255	Bedded Hilltop	Detritals	6.29	148	3	3	30	15	0.4	20.6	<0.0001	0.034	0.0004	0.705	<0.0001	<0.00005	3
IEX071	Bedded Hilltop	Detritals	7.48	194	47	2	34	14	1.7	11.7	0.0001	0.069	0.0028	1.08	<0.0001	<0.00005	6
ICI037	Hope Downs 2	Detritals	7.53	154	40	1	10	9	0.5	15.5	<0.0001	0.186	0.0011	0.838	<0.0001	<0.00005	8
IDL538	Bedded Hilltop	Lignite	1.88	24900	<1	22900	28600	<20	<0.1	13.1	<0.0001	596	25.9	0.23	0.302	0.0001	399
ICV737	Bedded Hilltop	Lignite	2.33	8430	<1	7680	9640	<20	<0.1	7.25	0.0007	89.2	6.8	0.0668	0.053	<0.00005	48
IEX186	Bedded Hilltop	Lignite	4.55	4050	<1	64	3200	74	0.5	6.88	0.0001	1.97	0.056	0.258	0.0055	<0.00005	464
IDL399	Bedded Hilltop	Lignite	5.7	2610	7	8	1620	66	0.3	9.25	<0.0001	0.387	0.0188	0.0336	<0.0001	<0.00005	245
IET896	Bedded Hilltop	Dales Gorge	6.22	490	3	4	167	38	0.1	43.9	<0.0001	<0.005	0.001	0.702	<0.0001	<0.00005	8
IGV835	Bedded Hilltop	Dales Gorge	6.62	85	4	2	8	13	0.3	16	<0.0001	0.061	0.0002	0.171	<0.0001	<0.00005	<1
IEW143	Bedded Hilltop	FWZ	5.36	1860	<1	14	425	366	0.8	35.6	<0.0001	0.787	0.0004	0.522	0.0029	<0.00005	24
IGV812	Bedded Hilltop	FWZ	6.56	78	5	2	11	8	0.2	13.5	<0.0001	0.034	0.0006	0.801	<0.0001	<0.00005	2
ICY563	Hope Downs 2	MacLeod	5.9	1170	2	5	173	277	0.1	30.6	<0.0001	0.017	0.0007	0.877	<0.0001	<0.00005	10
IDV159	Hope Downs 2	MacLeod	7.67	93	33	1	5	3	0.5	29.4	<0.0001	0.224	0.0007	0.694	<0.0001	<0.00005	7
IDP446	Bedded Hilltop	MCS	6.11	404	3	3	86	55	0.3	6.26	<0.0001	0.075	0.0022	1.19	0.0001	<0.00005	10
IEZ598	Bedded Hilltop	MCS	6.79	1140	9	2	137	229	3.6	5.96	<0.0001	0.029	0.0021	0.825	<0.0001	<0.00005	24
HWL551	Bedded Hilltop	MCS	6.87	297	14	2	56	30	1.9	9.01	<0.0001	0.145	0.0012	0.825	<0.0001	<0.00005	7
IDS102	Bedded Hilltop	MTS	6.48	244	6	2	45	27	1	10.4	<0.0001	0.022	0.0006	0.984	<0.0001	<0.00005	7
HWL528	Bedded Hilltop	MTS	6.63	132	8	2	14	16	0.5	9.22	<0.0001	0.037	0.0006	0.655	<0.0001	<0.00005	5
ICI423	Hope Downs 2	Nammuldi	6.51	301	4	2	83	28	0.9	18.2	<0.0001	0.019	0.0003	0.89	<0.0001	<0.00005	8
ICV072	Hope Downs 2	Newman	7.81	184	61	<1	9	9	0.8	31.9	<0.0001	0.013	0.0029	0.405	<0.0001	<0.00005	6
ICX217	Hope Downs 2	WF	5.7	313	2	15	38	55	0.2	37.5	<0.0001	0.118	<0.0002	1.5	<0.0001	<0.00005	2
HST257	Hope Downs 2	WF	7.04	426	22	2	80	54	0.6	12.1	<0.0001	0.013	0.0008	1.2	<0.0001	<0.00005	20
HST214	Hope Downs 2	WF	7.36	375	81	1	38	26	0.9	6.22	<0.0001	<0.005	0.0016	1.02	<0.0001	<0.00005	19
ICW087	Hope Downs 2	WF	7.37	1580	36	2	385	282	1.1	9.78	0.0001	0.015	0.0005	0.638	<0.0001	<0.00005	67
IEZ199	Bedded Hilltop	WF	7.43	559	154	<1	39	40	0.4	16.6	<0.0001	<0.005	0.0017	1.13	0.0002	<0.00005	24

Sample ID	Location	Lithology	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga	Hf	Hg	K	La	Li	Mg	Mn
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
HWL255	Bedded Hilltop	Detritals	0.0002	<0.001	0.0007	<0.0002	<0.001	<0.0005	0.012	<0.001	<0.01	<0.0001	2	<0.001	0.0032	4	0.0325
IEX071	Bedded Hilltop	Detritals	0.00018	<0.001	0.0008	0.0016	<0.001	0.002	1.2	<0.001	<0.01	<0.0001	4	<0.001	0.0041	7	0.0035
ICI037	Hope Downs 2	Detritals	0.00031	<0.001	0.0001	0.0003	<0.001	0.0008	0.29	<0.001	<0.01	<0.0001	3	<0.001	0.0017	4	0.0056
IDL538	Bedded Hilltop	Lignite	0.734	6.5	6.88	0.874	0.026	0.084	12200	0.53	<0.05	<0.0001	3	2.12	0.639	122	9.44
ICV737	Bedded Hilltop	Lignite	1.08	0.116	33.4	0.514	0.002	11.1	3310	0.045	<0.01	<0.0005	1	0.03	0.0782	31	53.8
IEX186	Bedded Hilltop	Lignite	0.0395	0.058	0.356	0.0011	<0.001	0.0058	8.1	0.001	<0.01	<0.0001	12	0.03	0.006	394	13.8
IDL399	Bedded Hilltop	Lignite	0.00103	<0.001	0.0025	0.0012	<0.001	0.0132	0.092	<0.001	<0.01	<0.0001	9	<0.001	0.0065	262	1.43
IET896	Bedded Hilltop	Dales Gorge	0.0005	<0.001	0.0072	<0.0002	<0.001	0.0023	0.01	<0.001	<0.01	<0.0001	7	<0.001	0.0033	22	0.589
IGV835	Bedded Hilltop	Dales Gorge	<0.00005	<0.001	<0.0001	<0.0002	<0.001	<0.0005	0.25	<0.001	<0.01	<0.0001	<1	<0.001	0.0012	<1	0.0023
IEW143	Bedded Hilltop	FWZ	0.00073	0.004	0.0108	<0.0002	<0.001	0.0016	0.029	<0.001	<0.01	<0.0001	23	<0.001	0.0211	69	1.8
IGV812	Bedded Hilltop	FWZ	0.00025	<0.001	<0.0001	<0.0002	<0.001	<0.0005	0.102	<0.001	<0.01	<0.0001	<1	<0.001	0.0007	2	0.0104
ICY563	Hope Downs 2	MacLeod	0.00053	<0.001	0.0007	<0.0002	<0.001	0.017	0.01	<0.001	<0.01	<0.0001	16	<0.001	0.0012	49	0.205
IDV159	Hope Downs 2	MacLeod	0.00009	<0.001	0.0001	0.0004	<0.001	0.0007	1.72	<0.001	<0.01	<0.0001	2	<0.001	0.0022	2	0.0014
IDP446	Bedded Hilltop	MCS	0.0006	0.002	0.0138	0.0006	<0.001	0.0099	0.031	<0.001	<0.01	<0.0001	12	<0.001	0.0096	14	0.273
IEZ598	Bedded Hilltop	MCS	0.00059	<0.001	0.0001	<0.0002	<0.001	<0.0005	0.007	<0.001	<0.01	<0.0001	14	<0.001	0.0016	51	0.004
HWL551	Bedded Hilltop	MCS	0.00033	<0.001	0.0006	<0.0002	<0.001	0.0008	0.059	<0.001	<0.01	<0.0001	6	<0.001	0.0035	7	0.0153
IDS102	Bedded Hilltop	MTS	0.00033	<0.001	<0.0001	<0.0002	<0.001	0.0006	0.005	<0.001	<0.01	<0.0001	2	<0.001	0.0007	10	0.0182
HWL528	Bedded Hilltop	MTS	0.00085	<0.001	0.013	<0.0002	<0.001	0.0011	0.01	<0.001	<0.01	<0.0001	1	<0.001	0.0091	5	0.331
ICI423	Hope Downs 2	Nammuldi	0.00028	<0.001	0.0002	<0.0002	<0.001	<0.0005	0.025	<0.001	<0.01	<0.0001	1	<0.001	0.0019	10	0.0094
ICV072	Hope Downs 2	Newman	0.00005	<0.001	0.0001	<0.0002	<0.001	0.001	0.104	<0.001	<0.01	<0.0001	1	<0.001	<0.0005	3	0.0041
ICX217	Hope Downs 2	WF	0.00079	<0.001	0.0058	<0.0002	<0.001	0.002	5.46	<0.001	<0.01	<0.0001	8	<0.001	0.0048	3	0.199
HST257	Hope Downs 2	WF	0.0005	<0.001	0.0003	0.0016	<0.001	0.0042	0.002	<0.001	<0.01	<0.0001	4	<0.001	0.0008	14	0.0019
HST214	Hope Downs 2	WF	0.00045	<0.001	0.0007	0.0012	<0.001	0.0026	0.035	<0.001	<0.01	<0.0001	2	<0.001	0.0023	21	0.353
ICW087	Hope Downs 2	WF	0.00056	<0.001	<0.0001	0.0003	<0.001	<0.0005	<0.002	<0.001	<0.01	<0.0001	10	<0.001	0.0035	61	0.0011
IEZ199	Bedded Hilltop	WF	0.00046	<0.001	0.006	0.0004	<0.001	0.0017	0.025	<0.001	<0.01	<0.0001	6	<0.001	0.0011	24	0.389

Notes: Tot Alk - Total Alkalinity; Acidity as CaCO3; TKN - Total Kjeldahl Nitrogen.

Sample ID	Location	Lithology	Mo	Na	Nb	Ni	P	Pb	Rb	Sb	Se	Sn	Sr	Ta	Te	Th	Ti
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
HWL255	Bedded Hilltop	Detritals	<0.0001	14	<0.001	0.0024	<0.01	<0.0001	0.002	<0.0002	0.0028	<0.0002	0.019	<0.001	<0.0002	<0.001	<0.001
IEX071	Bedded Hilltop	Detritals	0.0007	23	<0.001	0.0024	0.02	0.0001	0.002	0.0004	0.0135	<0.0002	0.024	<0.001	<0.0002	<0.001	<0.001
ICI037	Hope Downs 2	Detritals	0.0018	15	<0.001	0.0006	<0.01	0.0001	0.002	0.0008	0.0004	<0.0002	0.057	<0.001	<0.0002	<0.001	0.004
IDL538	Bedded Hilltop	Lignite	0.0021	17	<0.005	19.1	8.57	0.255	0.08	0.0006	0.063	0.007	0.523	0.006	0.0005	0.276	4.38
ICV737	Bedded Hilltop	Lignite	0.0344	5	<0.001	85	3.1	0.0512	0.007	0.0189	0.146	<0.0002	0.129	<0.001	0.0039	0.256	0.024
IEX186	Bedded Hilltop	Lignite	<0.0001	45	<0.001	0.266	0.02	0.0036	0.03	0.001	0.0081	<0.0002	0.669	<0.001	<0.0002	<0.001	0.001
IDL399	Bedded Hilltop	Lignite	0.0012	60	<0.001	0.0022	0.03	0.0012	0.013	0.004	0.114	<0.0002	0.245	<0.001	0.001	<0.001	<0.001
IET896	Bedded Hilltop	Dales Gorge	<0.0001	39	<0.001	0.0302	0.04	0.0001	0.007	<0.0002	0.0054	<0.0002	0.047	<0.001	<0.0002	<0.001	<0.001
IGV835	Bedded Hilltop	Dales Gorge	<0.0001	8	<0.001	<0.0005	<0.01	<0.0001	<0.001	<0.0002	0.0005	<0.0002	0.012	<0.001	<0.0002	<0.001	0.001
IEW143	Bedded Hilltop	FWZ	<0.0001	216	<0.001	0.0355	0.02	0.0005	0.021	<0.0002	0.0005	<0.0002	0.475	<0.001	<0.0002	<0.001	<0.001
IGV812	Bedded Hilltop	FWZ	<0.0001	8	<0.001	0.0006	0.02	<0.0001	<0.001	<0.0002	0.0005	<0.0002	0.013	<0.001	<0.0002	<0.001	<0.001
ICY563	Hope Downs 2	MacLeod	<0.0001	118	<0.001	0.0038	0.01	0.0028	0.02	<0.0002	0.0006	<0.0002	0.1	<0.001	<0.0002	<0.001	<0.001
IDV159	Hope Downs 2	MacLeod	0.0013	13	<0.001	0.0007	<0.01	0.0001	0.002	0.0004	0.0006	<0.0002	0.075	<0.001	<0.0002	<0.001	0.006
IDP446	Bedded Hilltop	MCS	<0.0001	30	<0.001	0.0395	0.02	0.0002	0.006	<0.0002	0.0057	<0.0002	0.039	<0.001	<0.0002	<0.001	<0.001
IEZ598	Bedded Hilltop	MCS	0.0004	107	<0.001	0.0005	<0.01	<0.0001	0.012	0.0003	0.0021	<0.0002	0.195	<0.001	<0.0002	<0.001	<0.001
HWL551	Bedded Hilltop	MCS	0.0002	33	<0.001	0.0012	<0.01	0.0001	0.004	<0.0002	0.0017	<0.0002	0.043	<0.001	<0.0002	<0.001	0.002
IDS102	Bedded Hilltop	MTS	0.0008	20	<0.001	0.0006	<0.01	<0.0001	0.002	0.0002	0.002	<0.0002	0.034	<0.001	<0.0002	<0.001	0.003
HWL528	Bedded Hilltop	MTS	0.0003	10	<0.001	0.026	<0.01	<0.0001	0.001	0.0005	0.0003	<0.0002	0.019	<0.001	<0.0002	<0.001	<0.001
ICI423	Hope Downs 2	Nammuldi	<0.0001	30	<0.001	0.001	<0.01	<0.0001	0.001	<0.0002	0.0012	<0.0002	0.066	<0.001	<0.0002	<0.001	<0.001
ICV072	Hope Downs 2	Newman	0.0027	26	<0.001	0.0016	0.04	<0.0001	0.001	0.0006	0.001	<0.0002	0.051	<0.001	<0.0002	<0.001	<0.001
ICX217	Hope Downs 2	WF	<0.0001	39	<0.001	0.0067	<0.01	0.0003	0.008	<0.0002	0.0006	<0.0002	0.038	<0.001	<0.0002	<0.001	<0.001
HST257	Hope Downs 2	WF	<0.0001	30	<0.001	0.0006	<0.01	0.0002	0.002	<0.0002	0.0016	<0.0002	0.07	<0.001	<0.0002	<0.001	<0.001
HST214	Hope Downs 2	WF	0.0002	21	<0.001	0.0141	<0.01	0.0002	0.002	<0.0002	0.0008	<0.0002	0.011	<0.001	<0.0002	<0.001	<0.001
ICW087	Hope Downs 2	WF	0.0025	135	<0.001	0.0008	<0.01	<0.0001	0.011	0.0005	0.0011	<0.0002	0.401	<0.001	<0.0002	<0.001	<0.001
IEZ199	Bedded Hilltop	WF	0.0008	44	<0.001	0.155	<0.01	0.0002	0.01	0.0021	0.0008	<0.0002	0.108	<0.001	<0.0002	<0.001	<0.001

Sample ID	Location	Lithology	Tl	U	V	W	Y	Zn	Zr	B	TKN	TN	NH_3 as N	NO_2 as N	NO_3 as N	NO_2+NO_3 as N
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
HWL255	Bedded Hilltop	Detritals	<0.00002	<0.00005	<0.0002	<0.001	<0.001	0.08	<0.005	0.263	<0.1	<0.1	0.06	<0.01	<0.01	<0.01
IEX071	Bedded Hilltop	Detritals	<0.00002	0.00006	0.0006	<0.001	<0.001	0.049	<0.005	0.329	0.2	0.3	<0.01	0.09	0.04	0.13
ICI037	Hope Downs 2	Detritals	<0.00002	<0.00005	0.0005	<0.001	<0.001	0.086	<0.005	0.187	<0.1	<0.1	0.04	<0.01	0.04	0.04
IDL538	Bedded Hilltop	Lignite	0.0266	0.316	4.15	<0.005	3.46	111	0.106	0.984	2.1	3.4	<5	0.81	0.47	1.28
ICV737	Bedded Hilltop	Lignite	0.0064	0.538	1.47	<0.001	0.218	703	0.108	0.778	0.4	1.2	<2.5	<1	<1	0.76
IEX186	Bedded Hilltop	Lignite	0.00124	0.00013	0.0024	<0.001	0.019	6.36	<0.005	2.21	0.2	0.2	<0.01	<0.01	0.01	0.01
IDL399	Bedded Hilltop	Lignite	<0.00002	<0.00005	0.0068	<0.001	<0.001	1.12	<0.005	3.06	0.6	0.7	0.18	<0.01	0.06	0.06
IET896	Bedded Hilltop	Dales Gorge	<0.00002	<0.00005	<0.0002	<0.001	<0.001	0.402	<0.005	0.487	<0.1	<0.1	0.05	<0.01	0.01	0.01
IGV835	Bedded Hilltop	Dales Gorge	<0.00002	<0.00005	<0.0002	<0.001	<0.001	0.031	<0.005	0.055	<0.1	<0.1	0.06	<0.01	0.02	0.02
IEW143	Bedded Hilltop	FWZ	0.00013	0.00068	<0.0002	<0.001	0.002	1.11	<0.005	0.797	<0.1	<0.1	0.06	<0.01	<0.01	<0.01
IGV812	Bedded Hilltop	FWZ	<0.00002	<0.00005	<0.0002	<0.001	<0.001	0.08	<0.005	0.114	0.1	0.1	0.04	<0.01	<0.01	<0.01
ICY563	Hope Downs 2	MacLeod	<0.00002	<0.00005	<0.0002	<0.001	<0.001	0.644	<0.005	0.436	0.2	0.5	0.1	<0.01	0.26	0.26
IDV159	Hope Downs 2	MacLeod	<0.00002	<0.00005	0.0006	<0.001	<0.001	0.028	<0.005	0.316	<0.1	<0.1	0.03	<0.01	<0.01	<0.01
IDP446	Bedded Hilltop	MCS	<0.00002	0.00072	<0.0002	<0.001	0.002	0.702	<0.005	0.473	0.1	0.1	0.07	<0.01	0.02	0.02
IEZ598	Bedded Hilltop	MCS	<0.00002	<0.00005	<0.0002	<0.001	<0.001	0.161	<0.005	0.471	<0.1	<0.1	0.04	<0.01	<0.01	<0.01
HWL551	Bedded Hilltop	MCS	<0.00002	<0.00005	0.0002	<0.001	<0.001	0.118	<0.005	0.298	<0.1	<0.1	0.08	0.01	0.01	0.02
IDS102	Bedded Hilltop	MTS	<0.00002	<0.00005	<0.0002	<0.001	<0.001	0.059	<0.005	0.184	<0.1	<0.1	0.02	<0.01	<0.01	<0.01
HWL528	Bedded Hilltop	MTS	<0.00002	<0.00005	0.0003	<0.001	<0.001	0.066	<0.005	0.196	<0.1	<0.1	0.05	<0.01	0.01	0.01
ICI423	Hope Downs 2	Nammuldi	<0.00002	<0.00005	<0.0002	<0.001	<0.001	0.075	<0.005	0.297	<0.1	<0.1	0.04	<0.01	<0.01	<0.01
ICV072	Hope Downs 2	Newman	<0.00002	0.00013	0.0008	0.001	<0.001	0.006	<0.005	0.156	0.1	0.1	0.01	<0.01	<0.01	<0.01
ICX217	Hope Downs 2	WF	<0.00002	0.00041	<0.0002	<0.001	<0.001	1.39	<0.005	0.745	<0.1	<0.1	0.06	<0.01	0.02	0.02
HST257	Hope Downs 2	WF	<0.00002	<0.00005	<0.0002	<0.001	<0.001	0.091	<0.005	0.285	<0.1	<0.1	<0.01	<0.01	<0.01	<0.01
HST214	Hope Downs 2	WF	0.00002	<0.00005	<0.0002	<0.001	<0.001	0.196	<0.005	0.267	<0.1	<0.1	0.02	0.02	0.01	0.03
ICW087	Hope Downs 2	WF	<0.00002	0.00007	<0.0002	<0.001	<0.001	0.097	<0.005	0.374	<0.1	<0.1	0.05	<0.01	<0.01	<0.01
IEZ199	Bedded Hilltop	WF	0.00014	0.00081	0.0002	<0.001	<0.001	0.199	<0.005	0.375	<0.1	<0.1	0.07	0.03	0.04	0.07

Notes: Tot Alk - Total Alkalinity; Acidity as CaCO3; TKN - Total Kjeldahl Nitrogen.

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Name/Title	Company
Steven Lee	Rio Tinto Iron Ore

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Appendix 11: SCARD Management Plan

Iron Ore (WA)

Spontaneous Combustion and ARD (SCARD) Management Plan

for Operations

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1 Purpose

The Spontaneous Combustion and Acid Rock Drainage (SCARD) Management Plan for operations outline the activities and groups accountable for the management of the environmental, safety, health, reputational and business risks associated with:

- Black shale
- Sulfidic material within detritals
- Sulfidic material within Banded Iron Formation (BIF)
- Elevated-sulfur material within shale, waste and ore.

Due to differing risks, the management of sulfides within black shale has been delineated from that associated with sulfides within detritals and BIF, and material containing sulfates.

This plan enables the development and implementation of appropriate risk reduction measures to lower risk. It sets and implements the appropriate monitoring plans that quantify the actual impacts and compares them with that predicted, to determine if risk reduction methods have been effective.

2 Definitions

2.1 Abbreviations

ABA	Acid Base Accounting
AMD	Acid and Metalliferous Drainage
ANC	Acid Neutralising Potential
ARD	Acid Rock Drainage
BIF	Banded Iron Formation
BS	Black Shale
DG	Dales Gorge Member
FWZ	Footwall Zone
MCS	Mount McRae Shale
NAF	Non-Acid Forming
PAF	Potentially Acid Forming (including black shale and sulfides in BIF and detritals)
SWP	Safe Work Practice
WS	Whaleback Shale Member

2.2 Hazards Definitions

The risks associated with black shale, BIF and detritals are triggered by the presence of sulfides, in particular pyrite (FeS_2) within these material types. Pyrite will remain stable if constantly water-saturated with no exposure to oxygen or ferric iron. Alunite ($KAl_3(SO_4)_2(OH)_6$) and jarosite ($KFe_3(SO_4)_2(OH)_6$) have been identified in AWT waste and ore. When excavated during mining, pyrite can oxidise and sulfate minerals dissolve and generate the following risks to the operation:

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ARD (also known as Acid and Metalliferous Drainage (AMD))

The process of pyrite oxidation results in the release of dissolved acidity, sulfate, iron and other metal ions into drainage waters. The acidic conditions can often induce weathering of clay minerals in the host material and also release dissolved metals such as aluminium, manganese, zinc and/or copper into the drainage. The Acid Neutralising Capacity (ANC) of many of the other waste materials in the Hamersley Group is low and insufficient to neutralise the acidity released from most pyritic waste rocks.

Alunite weathers to an aluminium oxyhydroxide phase (e.g. gibbsite or boehmite, etc.) via dissolution; it can produce acid and buffer the pH in the region of 4.0 to 4.5. The rate of acid release is low and the acidity can be neutralised by any minerals that have the capacity to consume acid.

Risk Areas: Contamination of surface and/or ground water and soil, and potential disturbance to surrounding ecosystems from ARD generated within waste rock dumps and pits or voids. Potential health risks from direct handling or accidental consumption of ARD products.

Premature Blast Detonation

Spontaneous combustion is a major safety concern to RTIO (WA) due to the risk of reaction with explosives in loaded blast holes potentially leading to premature detonation. Ammonium nitrate (NH_4NO_3) based explosives, commonly known as ANFO, are typically used however due to the risk of spontaneous combustion, explosives based on inhibited emulsion blended with ANFO are used if spontaneous combustion may occur.

Risk areas: Potential safety risk from the premature and unexpected detonation of explosives.

Spontaneous Combustion within Dumps

In waste dumps where self-heating occurs, heat may be transferred from hot to cold regions of the dump through the evaporation of moisture (water vapour) in hot areas and subsequent condensation in colder areas. This heat transfer is in addition to the transport of heat by natural convection. Water vapour transport is an important heat transfer mechanism within waste dumps and therefore it is not recommended that water is added to a hot spot. The added water may shift the heat from one region to another. This may be the reason that self-heating is observed in black shale after increases in humidity and rain. If the rate of energy generated by oxidation is greater than the rate at which energy can be dissipated to the environment via conduction, convection and evaporation then the dump will self-heat.

Risk areas: Gas venting from waste dumps, geotechnical instability and increased rates of ARD generation due to the elevated temperatures and oxygen exposures.

Gas Exposures

The major gases produced from the spontaneous combustion of the black shale (and possibly lignite in detritals) are likely to be sulfur dioxide (SO_2), carbon dioxide (CO_2), hydrogen sulfide (H_2S), carbon monoxide (CO) and methane (CH_4). In the open air, the rate of reaction is slow and the heat of reaction is quickly dissipated to the environment. Within waste dumps, the heat cannot dissipate as readily and there can be localised hot spots that promote SO_2 generation. The SO_2 generated can then vent from the waste, potentially causing problems with the establishment of vegetation.

Risk areas: Human exposure to toxic gases and safety risks.

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Dust Exposure

Black shale can be fine and powdery with elevated concentrations of alumina and silica.

Risk areas: Human exposure to dust and safety risks.

2.3 Waste Definition

Waste containing sulfur can have the potential to generate ARD and some materials can also spontaneous combust. The potential for wastes to generate ARD or spontaneously combust is defined at Rio Tinto Iron Ore (WA) operations as:

ARD/AMD potential: The propensity for a material to generate ARD/AMD is determined using a series of tests referred to as Acid Base Accounting (ABA). Without site-specific ABA data, a total sulfur concentration of 0.1% is used as the approximate boundary between non-acid forming and potentially acid forming material. Marra Mamba Iron Formation BIF and detritals are the only material that can use a 0.3% sulfur cut-off value and this is due to the presence of some acid neutralising materials.

Spontaneous Combustion potential: The spontaneous combustion mechanisms of pyritic black shale are poorly understood. However, it is likely to be associated with the following properties of the shale: high surface area, high porosity, small particle size distribution, moisture content, carbon content and sulfur content. All black shale and lignite material is deemed by RTIO (WA) to pose a spontaneous combustion risk (although significant tonnages of lignite are yet to be mined so spontaneously combust has not been observed).

Depending on the potential for ARD generation and/or spontaneous combustion (risk), waste should be classified into one of three categories and it should be dumped in accordance with the specifications for that category (Appendix 1).

Inert waste: Material is currently classified as inert by RTIO (WA) if it does not contain sulfur or carbonaceous material (i.e., S < 0.3% for BIF and detritals located below the water table (BWT); S < 0.1% for elevated-sulfur material located above the water table (AWT); and not including any black shale or lignites). Black shale within the Whaleback Shale Member may be classified as inert waste when it represents a small fraction of a mine block and the average sulfur content of the block is < 0.1%.

Cold black shale/sulfidic BIF/sulfidic siderite: This material is not likely to spontaneously combust within the dump and is managed only to control the ARD risk. Typical material within this category includes:

- Cold black shale (MCS): Represents black shale with low sulfur concentrations. Due to possible variability within the unit, this material requires special management. Whilst the sulfur content is low (i.e., < 0.1%), there is still the potential for metalliferous drainage as a result of oxidation of the organic carbon material within the black shale.
- Dales Gorge Member (DG) black shale: Represents black shale with sulfur concentrations up to 2% and containing some acid neutralising capacity (e.g.,15 kgH_2SO_4/t). Samples are mostly non-acid forming but may be potentially acid forming with low capacity.
- Sulfides within BIF and detritals (siderite): The sulfur concentration in these materials is generally in the range of 0.1% to 0.3% but can reach 15%. The risk of spontaneous combustion in the dump is considered low due to the lack of organic carbon associated with this material.
- Whaleback Shale Member (WS) black shale: If the average sulfur content is > 0.1% or black shale accounts for the majority of the block material, then this material should be placed in a cold black shale dump as there is very low potential for acid generation.

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Hot black shale/Lignite: This material may spontaneously combust in the dump and is managed to control combustion within the dump. Typical material within this category is:

- Hot black shale (MCS): Black shale which generally has significantly higher sulfur concentrations and high organic carbon concentrations typically > 2%.
- Sulfides in lignite: The risk of spontaneous combustion of sulfidic lignite material is currently unknown. Until proven otherwise, sulfidic lignites should be managed to minimise the risk of spontaneous combustion.

Elevated sulfur: The sulfate minerals alunite and jarosite can be found AWT, predominantly in the Dales Gorge Member, Whaleback Shale Member and oxidised MCS. These are found particularly in close proximity to those units containing sulfide minerals, and/or a source of potassium such as dolerite dykes. When alunite or jarosite occur in significant quantities (termed elevated-sulfur material) it will need to be specially managed due to its propensity to release acid and associated metals. Without site specific test work for sulfates, a total sulfur concentration of 0.1% is used as the approximate boundary between non-acid and potentially acid forming material due to the low solubility of these minerals and presence of some acid neutralising materials.

3 Assessing if a Site needs to implement this Management Plan

The RTIO (WA) Mineral Waste Management Plan describes the ARD, spontaneous combustion and mineral waste characterisation work that must be undertaken during Resource Evaluation, Studies and Mine Operations. A detailed ARD Risk Assessment should be undertaken for any new deposits or significant expansions of current operations to identify whether excavated sulfides will represent a risk to health, safety and environment (including the impacts on-site, off-site and to the receiving environment). If risks are deemed to be minimal then a management plan will not be required. If a risk assessment has already been undertaken at a site then for any additional significant resource drilling or expansions of the operation the risk assessment should be updated. For any mine site that exposes or could potentially expose sulfidic or elevated-sulfur material, then this SCARD Management Plan will need to be implemented.

The accountability for the identification and subsequent management of spontaneous combustion and ARD risks associated with black shale and sulfidic BIF and detritals are listed in Section 4 and Section 5. It provides an overview of management at RTIO (WA) operations from initial characterisation and modelling, through project development, mine planning, production and closure. The RTIO (WA) SCARD management strategy is broadly based upon the following principles:

1) Identification of PAF material distribution and character;
2) Minimising the exposure and mining of PAF material to the extent possible;
3) Identification and special handling of PAF material that must be mined;
4) Encapsulation of PAF material inside inert waste rock dumps to limit water contact and allow the dumps to be revegetated, or placement of PAF material below the water table in backfilled open pits to limit oxygen contact; and
5) Monitoring impacts and taking corrective actions (when necessary).

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4 Requirements, Accountabilities and References for Black Shale

Black shale management during mining operations is conducted in accordance with Figure 1 and Figure 2. The mining protocols are designed to:

1) Minimise the risk of unplanned detonations in charged blast holes;
2) Ensure that hot and cold black shale truck loads are transported and placed in designated black shale dumps according to design requirements;
3) Ensure that the location and geometry of all black shale repositories is recorded;
4) Minimise environmental impacts of AMD products; and
5) Refine geological block models and block-out procedures.

Requirements	
4.1	**Mine Planning and Closure**
4.1.1	Mine plans must include estimates for hot and cold BS production and compare to inert waste production to ensure that sufficient material will be available for dump construction.
4.1.2	Ensure that BS dumps are sited to minimise long term environmental impacts and financial liabilities. Obtain signoff from Environment, Hydrogeology and Hydrology.
4.1.3	Ensure that final pit and dump designs are consistent with Appendix 1, Appendix 3, Appendix 4 and the RTIO Landform Design Guidelines. Waste dump designs must be coupled with a rehabilitation design showing how the dump is proposed to be rehabilitated upon closure. The rehabilitation design should be provided to the Rehabilitation team for review. Obtain signoff from Environment, Hydrogeology and Hydrology.
4.1.4	During the mine planning process identify areas that are available for rehabilitation and inform the rehabilitation and closure team.
4.2	**Mine Technical Services - Planning**
4.2.1	Ensure that Medium Term plans predict hot and cold BS production from each pit and delivery to each dump. Ensure that sufficient inert waste will be produced for encapsulation in accordance with the specifications in Appendix 1 and that sequencing will allow dump construction to occur as required.
4.2.2	Major changes to waste dump designs must be reflected in changes to the associated rehabilitation design. Receive sign-off from Environment, Rehabilitation Team, Hydrogeology and Hydrology before major modifications to BS dump designs are implemented.
4.2.3	Plan and design works for final waste rock dump surfaces and inactive open pits in a manner consistent with Appendix 4, Appendix 7 and the RTIO Landform Design Guidelines. Waste dump designs must be coupled with a rehabilitation design showing how the dump is proposed to be rehabilitated for closure. The design should be provided to the Rehabilitation Team for review. Obtain sign-off from Environment, Hydrogeology and Hydrology.
4.2.4	During the mine planning process identify areas that are available for rehabilitation and inform the rehabilitation and closure team.
4.2.5	When planning open pits that will intersect BS, the possibility of dewatering discharge/groundwater becoming acidic must be considered so that appropriate mitigation infrastructure can be installed.
4.2.6	Black shale exposed on the waste rock dumps must be minimised during the wet season (November to April).

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Requirements

4.3 Mine Geology

Blasting

4.3.1 Identify BS in blast hole cones and demarcate using agreed methods.

4.3.2 Alert key personnel in Mine Technical Services Planning and Pit Operations of the location of BS blast holes via e-mail.

Dumping

4.3.3 Based on visual inspection, total S values and stratigraphy, designate holes as cold BS, hot BS or inert waste. Create Block-outs that show contacts between waste types within blast patterns.

4.3.4 Perform periodic reconciliations between the Block-outs and the geological block model.

4.3.5 Collect (as required) representative samples of hot and cold black shale for full ABA and NAG analysis.

4.3.6 Regularly review the boundary between cold BS and hot BS to ensure it is still valid and has not changed as mining progresses deeper. Advise the relevant teams of the results and undertake change management if necessary.

4.4 Survey

4.4.1 Maintain as-built dump designs that include a 3D plan showing approximate locations and volumes of BS.

4.4.2 Ensure that monthly face pick-up surveys are conducted on all active BS waste dumps.

4.5 Operational Planning

4.5.1 Create a “Waste Dump Progression Plan” at least every three months to implement the detailed dump designs in the field.

4.5.2 Create “PLOD” sheets to aid dig operators in waste assignment and check that CAES is working.

4.5.3 Monitor and adjust to reconcile rehabilitation plans with original designs as appropriate.

4.5.4 Perform field inspections to ensure that BS is transported to the proper dump locations and placed as required. Register non-conformances in SAP.

4.5.5 Ensure reports contain hot and cold BS volumes delivered to every dump.

4.5.6 In consultation with Mine Geology perform regular reconciliations between Block-outs, survey and ORDW data for hot and cold BS volumes.

4.5.7 Black shale exposures on the waste rock dumps must be minimised during the wet season.

4.6 Drill, Blast and Development

4.6.1 Ensure all safety procedures related to BS management are followed during the charging and firing of blast holes i.e., temperature logging, timing.

4.6.2 Maintain site specific Drill and Blast SWPs and ensure it is consistent with this management plan and other SWPs and guidance notes.

4.6.3 Submit samples for isothermal reactivity testing for compatibility with ANFO explosives.

4.7 Load and Haul

4.7.1 Ensure that BS is properly identified and placed in the correct dump location consistent with PLOD sheets, CAES mining assignments and the Waste Dump Progression Plan from Operations Planning.

4.7.2 Perform field inspections to ensure that BS is transported to the proper dump locations and placed as required. Register non-conformances in SAP.

4.7.3 Ensure that “Exclusions” in CAES are reviewed and corrected in the field as required.

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Requirements	
4.7.4	The time between blasting and hauling of BS should be minimised and generally should occur within three weeks or less during the wet season (November to April) and within 12 weeks during the dry season (May to October). This will limit the amount of time the material has to oxidise in an uncontrolled manner.
4.7.5	Whenever possible the outer inert waste rock "skin" of a BS lift should be constructed first. This will ensure that BS lifts are not extended beyond the design footprint of the BS dump, will limit convective oxygen transport through the uncompacted sides of the dump lift, and will help contain contaminated contact water on the dump.
4.7.6	Hot BS lifts should be covered as rapidly as possible with the overlying inert waste rock layer, particularly during the wet season. Ideally, hot BS should be covered within two weeks of placement in the waste rock dump. If rapid covering is not possible the paddock-dumped hot BS piles should at least be dozed into a planar surface as soon as possible. This will help minimise infiltration and oxygen transport into the material.
4.7.7	The locations, volumes and sulfur concentrations (if available) of all BS repositories should be recorded so that a three dimensional plan of BS distribution within each dump is maintained by the survey group.

4.8 Hydrogeology/Technical Services

4.8.1	Maintain and implement a site specific "Acid Water Management Plan" and SWPs to deal with poor quality water that has contacted BS exposures or waste dumps. This should include information regarding bunding requirements, water quality monitoring (including the action response and relevant corrective actions including treatment) and disposal or use.
4.8.2	Ensure that water management and storage practices do not cause offsite surface water impacts or groundwater quality degradation in down gradient aquifers.
4.8.3	Provide technical overview and support during planning for above-ground and in-pit BS waste disposal.
4.8.4	Ensure that routine sampling, visual inspection, and analysis is performed for in-pit locations, including: • groundwater monitoring wells (surrounding BS dumps and pits; • dewatering water; and • surface water bodies (including temporary or permanent pit lakes within inactive open pits that contain BS exposures). This should be consistent with the master monitoring schedule for the site.

4.9 WRE Mineral Waste Management Team

4.9.1	Provide site support for the management of mineral waste, as necessary. Facilitate the transfer of knowledge between RTIO sites and studies.
4.9.2	Undertake or update AMD Risk Assessments for significant changes to the pit shell or geochemical risks. Advise the site leadership and environment group for significant changes to risk.
4.9.3	Ensure the SCARD management plan is updated at least every 2 years. More frequent updates may be required for significant changes to risk or the knowledge base.
4.9.4	For pits that intersect the water table, ensure the following information is available which would contribute to a conceptual understanding: • Catchment size; • Depth to pre-mining water table; • Current and ultimate pit depth; • Available water storage within the entire ultimate pit and above the pre-mining water table in the pit; • Predicted runoff volume for a 100 year storm event; • Distance to closest down-gradient permanent surface water body; and • Down-gradient water use. Determine the geochemical risk of the pit. Update this report for any significant changes.

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Requirements

4.9.5 Geochemical, hydrogeology and hydrology modelling to determine contaminant release from the pit should be undertaken if the report (in Item 4.9.4) finds a significant geochemical risk (i.e., a significant amount of PAF material exposed on the pit wall, a significant amount of dewatering occurring over many years, a likely saline and flow through water body, etc.).

4.9.6 For PAF material waste dumps, compile a 'Conceptual Model' report for each site. This report should contain the following information for each waste dump on the site:

- Footprint;
- Up-gradient catchment area;
- Likely material types in the waste dump i.e., oxidised MCS, DG1 BIF;
- Quantify the PAF tonnes and the total tonnes of material within each waste dump;
- Dumping methodology;
- Underlying and down-gradient geology;
- Distance to the closest regionally significant aquifer;
- Distance to closest down-gradient permanent surface water body;
- Down-gradient water use; and
- Closure/rehabilitation plans for the dump (or reference to the appropriate document).

4.9.7 Geochemical modelling to determine long-term contaminant release from the waste dump should be undertaken if the 'Conceptual Model' finds a significant geochemical risk (i.e., a significant amount of PAF material within the waste dump or significant receptors nearby).

4.10 Environment

4.10.1 Perform field inspections to ensure BS management, dump construction, rehabilitation and store and release cover performance is consistent with the requirements of the SCARD Management Plan.

4.10.2 Undertake relevant ecological assessment (appropriate for the scale of the SCARD generation and predicted level of pollution/ecological impacts), develop and implementation appropriate risk reduction measures and monitoring programmes.

4.10.3 Ensure that routine sampling, visual inspection, and analysis is performed for out of pit locations that could potentially be impacted by AMD. This may include

- groundwater monitoring wells surrounding BS dumps and pits (if they can be accessed outside the pit)
- surface water bodies (including abandoned pit lakes, permanent or seasonal natural water bodies, dewatering discharge to creeks).

This should be consistent with the master monitoring schedule for the site.

4.10.4 Record the environment risks related to BS in a site risk register and annually review/verify/validate these risks; verify that the ministerial conditions, legal and other requirements and obligations are met.

4.11 Rehabilitation and Closure

4.11.1 In consultation with relevant stakeholders identify monitoring requirements (e.g. lysimeters) for BS waste dumps following rehabilitation.

4.11.2 Coordinate the review and approval of the BS waste dump design by relevant stakeholders, including the Mineral Waste Management Team to ensure compliance with this document.

4.11.3 Assess the risks that need to be managed as part of the rehabilitation process for BS dump designs, focussing on the SCARD risks and ensure that all key stakeholders are consulted.

4.12 Health and Safety

4.12.1 Monitor the occupational gas and dust exposures surrounding BS. Ensure data is captured in a user friendly database. Ensure problems are brought to the attention of the site Mineral Waste Management Team.

4.12.2 Train occupational exposure groups on the correct use of respiratory equipment and monitors. Competency should be assessed and recorded in SAP.

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Requirements

4.12.3 Ensure the site specific guidance notes on acceptable gas levels, monitoring and demarcation are periodically refined and updated so it is consistent with current best practice.

4.12.4 Record health and safety risks associated with BS in a site risk register and annually review these risks.

4.13 Site Mineral Waste Management Team

4.13.1 A site based Mineral Waste Management Team should be formed and meet on a regular basis (e.g., monthly). It should include representatives of every department that has accountabilities related to SCARD management.

4.13.2 The primary function of the Site Mineral Waste Management Team is to ensure on-going improvement and implementation of the SCARD Management Plan.

4.13.3 Agenda items and meeting minutes should be produced for every meeting.

4.13.4 An overview of issues relating to BS must be included in any introductory training provided to new employees and contractors. The level of training should be commensurate to the level of risk BS poses to the site.

4.13.5 Develop emergency and contingency plans related to spontaneous combustion, ARD and BS management on an as need basis.

4.13.6 Coordinate a technical review of BS management by an external expert every four years. Track progress against outstanding actions at each meeting.

4.13.7 Coordinate all research related to BS characterisation, BS management, spontaneous combustion and ARD.

4.13.8 Ensure that SCARD related SWPs and guidance notes represent current practise and are up to date.

4.13.9 Changes to the SCARD management plan need to be provided to the Water Resource Evaluation Mineral Waste team to be included in future updates.

4.14 Management

4.14.1 Ensure progress is made against outstanding spontaneous combustion and AMD audit actions.

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Figure 1: Black shale (BS) management overview.

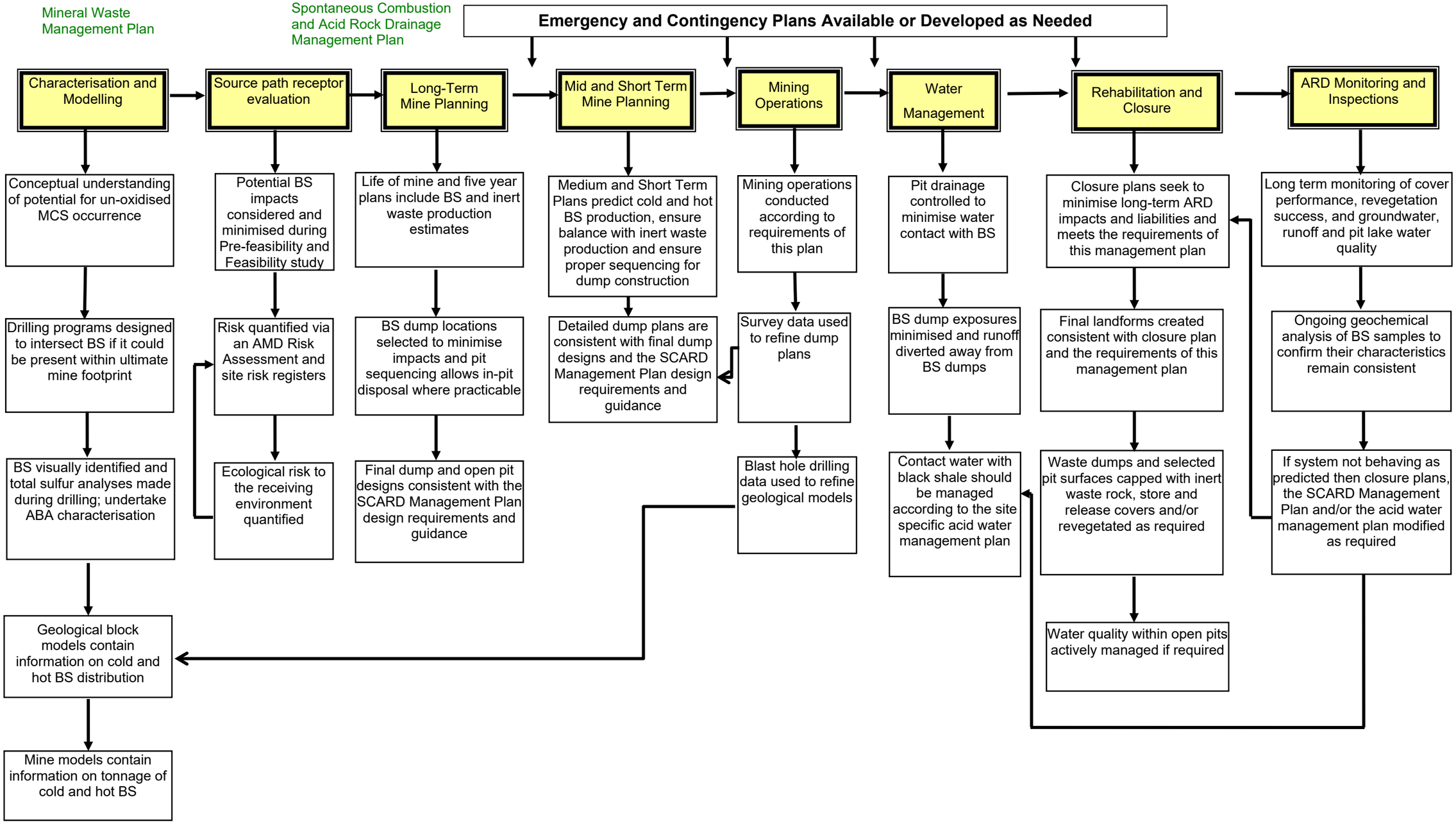

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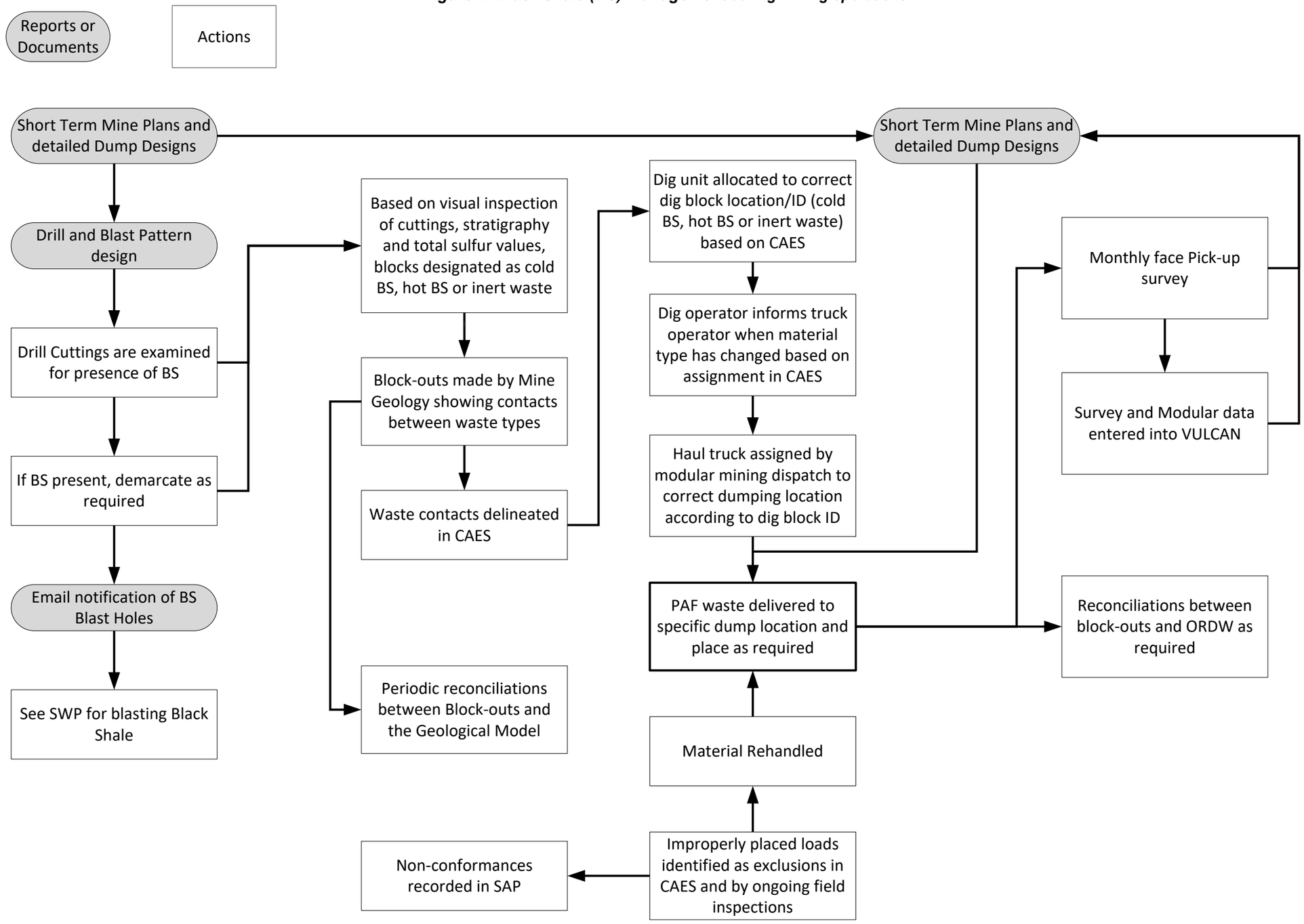
Figure 2: Black shale (BS) management during mining operations.



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5 Requirements, Accountabilities and References for Sulfides within BIF and Detritals

Management of sulfidic BIF and detritals during mining operations is conducted in accordance with Figure 3 and Figure 4. The mining protocols are designed to:

1) Minimise the risk of unplanned detonations in charged blast holes;
2) Ensure that sulfidic BIF and detrital truck loads are transported and placed in PAF dumps according to design requirements;
3) Ensure that the location and geometry of all PAF repositories is recorded;
4) Minimise environmental impacts of ARD products; and
5) Refine geological block models and block-out procedures.

Requirements	
5.1	**Mine Planning and Closure**
5.1.1	Mine Plans must include estimates for production of PAF, neutralising and inert waste material.
5.1.2	Ensure that PAF dumps are sited to minimise long-term environmental impacts and financial liabilities. Obtain signoff from Environment, Hydrogeology and Hydrology.
5.1.3	Ensure that final pit and dump designs are consistent with Appendix 4, Appendix 5, Appendix 6, Appendix 7 and the RTIO Landform Design Guidelines. Waste dump designs must be coupled with a rehabilitation design showing how the dump is proposed to be rehabilitated upon closure. The rehabilitation design should be provided to the Rehabilitation Team for review. Obtain signoff from Environment and Hydrogeology and Hydrology.
5.1.4	During the mine planning process identify areas that are available for rehabilitation and inform the rehabilitation specialist.
5.2	**Mine Technical Services - Planning**
5.2.1	Ensure that Medium term plans predict PAF material and net neutralising material production from each pit and delivery to each dump. Ensure that sufficient inert and net neutralising waste will be produced for encapsulation in accordance to the specifications in Appendix 1 and that sequencing will allow dump construction to occur as required. The tonnes of material with neutralising potential should be quantified and used with PAF dump designs in accordance with Appendix 2.
5.2.2	Major changes to waste dump designs must be reflected in changes to the associated rehabilitation design. Receive sign-off from Environment, Rehabilitation Team, Hydrogeology and Hydrology before major modifications to BS dump designs are implemented.
5.2.3	When planning open pits that will intersect sulfidic material, the possibility of dewatering discharge/groundwater becoming acidic must be considered so that appropriate mitigation infrastructure can be installed.
5.2.4	Lignite exposed on the waste rock dumps must be minimised during the wet season (November to April).
5.3	**Geology**
5.3.1	Identify lignite in blast hole cones and demarcate using agreed method.
5.3.2	Alert key personnel in Mine Technical Services and Pit Operations of the location of lignite blast holes via e-mail.
5.3.3	If the geological block model indicates that sulfur grades may be > 0.3%, then samples from drill hole cuttings should be collected for total sulfur concentration analysis.

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Requirements

5.3.4 Review total S results and demarcate holes that contain > 0.3% S (for drill and blast identification).

5.3.5 Based on visual inspections, total S values and stratigraphy, designate holes as PAF, net neutralising or inert waste. Create Block-outs that show contacts between waste, net neutralising material and the PAF material within blast pattern.

Material blocked out for the PAF dump include:

- BIF: S > 0.3%
- Detrital Siderite: S > 0.3%
- Detrital Lignite: All (to manage neutral mine drainage risks in additional to PAF risks)

5.3.6 Perform periodic reconciliations between the Block-outs and the geological block model.

5.3.7 Collect (as required) representative samples of sulfidic material associated with BIF and detritals for full ABA and NAG analysis. Ensure results are communicated to the relevant teams.

5.4 Survey

5.4.1 Maintain as-built dump designs in Vulcan that include a 3D plan showing approximate locations and volumes of sulfidic material.

5.4.2 Ensure that monthly face pick-up surveys are conducted on all active sulfidic material waste dumps.

5.5 Operational Planning

5.5.1 Create a “Waste Dump Progression Plan” at least every three months to implement the detailed dump designs in the field.

5.5.2 Create “PLOD” sheets to aid dig operators in waste assignment and check modular mining system is working.

5.5.3 Monitor and adjust to reconcile rehabilitation plans with original designs as appropriate.

5.5.4 Ensure that operational reports contain sulfidic material volumes delivered to every dump. Confirm that sulfidic material has been transported to the correct dump and register non-conformances in SAP.

5.5.5 In consultation with Mine Geology perform six-monthly reconciliations between Block-outs, survey and operational data for sulfidic material volumes.

5.5.6 Sulfidic material exposures on the waste rock dumps must be minimised during the wet season. Lignites should be covered rapidly during the wet season to reduce the spontaneous combustion risk (i.e. 1 month)

5.5.7 The location, volume and sulfur concentration (if available) of all PAF (sulfidic material) repositories should be recorded so that a three dimensional plan of the distribution within each dump is maintained.

5.6 Drill and Blast

5.6.1 Ensure all safety procedures related to pyritic material and in particular lignite are followed during the charging and firing of blast holes.

5.6.2 Annually submit samples for isothermal reactivity testing for compatibility with ANFO explosives.

5.7 Load and Haul

5.7.1 Ensure that sulfidic material is properly identified and placed in the correct dump location consistent with PLOD sheets, CAES mining assignments and the Waste Dump Progression Plan from Operations Planning.

5.7.2 Ensure that “Exclusions” in CAES Mining are reviewed and corrected in the field as required.

5.7.3 The outer inert waste rock “skin” of a sulfidic material lift should be constructed first. This will ensure that sulfidic material lifts are not extended beyond the design footprint of the sulfidic material dump, will limit convective oxygen transport through the uncompacted sides of the dump lift, and will help contain contaminated contact water on the dump.

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Requirements	
5.7.4	Lignite material should be covered rapidly (i.e. 1 month) with net neutralising material during the wet season to reduce the risk of spontaneous combustion.

5.8 Hydrogeology/Technical Services

5.8.1 Maintain and implement the site specific "Acid Water Management Plan" and SWPs to deal with poor quality water that has contacted sulfidic material exposures or waste dumps. This should include information regarding bunding requirements, water quality monitoring (including the action response and relevant corrective actions including treatment) and disposal or use.

5.8.2 Ensure that water management and storage practices do not cause offsite surface water impacts or groundwater quality degradation in down gradient aquifers.

5.8.3 Provide technical overview and support during planning for above-ground and in-pit sulfidic material waste disposal.

5.8.4 Ensure that routine sampling, visual inspection, and analysis is performed for in-pit locations, including:

- groundwater monitoring wells (surrounding BS dumps and pits;
- dewatering water; and
- surface water bodies (including temporary or permanent pit lakes within inactive open pits that contain BS exposures).

This should be consistent with the master monitoring schedule for the site.

5.9 WRE Mineral Waste Management Team

5.9.1 Provide site support for the management of mineral waste, as necessary. Facilitate the transfer of knowledge between RTIO sites and studies.

5.9.2 Undertake or update AMD Risk Assessments for significant changes to the pit shell or geochemical risks. Advice the site leadership and environment group for significant changes to risk.

5.9.3 Ensure the SCARD management plan is updated at least every 2 years. More frequent updates may be required for significant changes to risk or the knowledge base.

5.9.4 For pits that intersect the water table, ensure the following information is available which would contribute to a conceptual understanding:

- Catchment size;
- Depth to pre-mining water table;
- Current and ultimate pit depth;
- Available water storage within the entire ultimate pit and above the pre-mining water table in the pit;
- Predicted runoff volume for a 100 year storm event;
- Distance to closest down-gradient permanent surface water body; and
- Down-gradient water use.

Determine the geochemical risk of the pit. Update this report for any significant changes.

5.9.5 Geochemical, hydrogeology and hydrology modelling to determine contaminant release from the pit should be undertaken if the report (in Item 5.9.4) finds a significant geochemical risk (i.e. a significant amount of PAF material exposed on the pit wall, a significant amount of dewatering occurring over many years, a likely saline and flow through water body etc).

5.9.6 For PAF material waste dumps, compile a 'Conceptual Model' report for each site. This report should contain the following information for each waste dump on the site:

- Footprint;
- Up-gradient catchment area;
- Likely material types in the waste dump i.e., LIG, SID, CAL.
- Quantify the PAF tonnes and the total tonnes of material within each waste dump;
- Dumping methodology;
- Underlying and down-gradient geology;
- Distance to the closest regionally significant aquifer;
- Distance to closest down-gradient permanent surface water body;

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Requirements

- Down-gradient water use; and
- Closure/rehabilitation plans for the dump (or reference to the appropriate document).

5.9.7 Geochemical modelling to determine long term contaminant release from the waste dump should be undertaken if the 'Conceptual Model' finds a significant geochemical risk (i.e. a significant amount of PAF material within the waste dump or significant receptors nearby).

5.10 Environment

5.10.1 Perform field inspections to ensure sulfidic material management, dump construction, rehabilitation and store and release cover performance is consistent with the requirements of the SCARD Management Plan.

5.10.2 Undertake relevant ecological assessment (appropriate for the scale of the SCARD generation and predicted level of pollution/ecological impacts), develop and implementation appropriate risk reduction measures and monitoring programmes.

5.10.3 Ensure that routine sampling, visual inspection, and analysis is performed for out of pit locations that could potentially be impacted by AMD. This may include

- groundwater monitoring wells surrounding BS dumps and pits (if they can be accessed outside the pit)
- surface water bodies (including abandoned pit lakes, permanent or seasonal natural water bodies, dewatering discharge to creeks).

This should be consistent with the master monitoring schedule for the site.

5.10.4 Record sulfidic material environment risks in a site risk register and annually review/verify/validate these risks; verify that the ministerial conditions, legal and other requirements and obligations are met.

5.11 Rehabilitation and Closure

5.11.1 Ensure that the rehabilitation process is completed as outlined within the Progressive rehabilitation – process and responsibilities and Rehabilitation design and approval process documents.

5.11.2 In consultation with relevant stakeholders identify monitoring requirements (e.g. lysimeters) for waste dumps following rehabilitation.

5.11.3 Coordinate the review and approval of the design by relevant stakeholders including the mineral waste team to ensure compliance with this document.

5.11.4 Assess the risks that need to be managed as part of the rehabilitation process for BS dump designs, focussing on the SCARD risks and ensure that all key stakeholders are consulted.

5.12 Health and Safety

5.12.1 Monitor the occupational gas and dust exposures surrounding sulfidic material (and gas generation if appropriate for lignite material). Ensure problems are brought to the attention of the site Mineral Waste Management Team.

5.12.2 If spontaneous combustion is likely to occur, train occupational exposure groups on the correct use of respiratory equipment and monitors. Competency should be assessed and recorded in SAP.

5.12.3 Ensure health and safety guidance notes relating to spontaneous combustion gas generation and dust are developed, periodically refined and updated so it is consistent with the current best practice.

5.12.4 Record sulfidic material health and safety risks in a site risk register and annually review these risks.

5.13 Site Mineral Waste Management Team

5.13.1 A site based Mineral Waste Management Team should be formed and meet on a regular basis. It must include representatives of every Department that has responsibilities related to ARD management.

5.13.2 The primary function of the Mineral Waste Management Team is to ensure on-going improvement and implementation of the SCARD Management Plan.

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Requirements
5.13.3 Agenda items and meeting minutes should be produced for every meeting.
5.13.4 An overview of PAF issues must be included in any introductory training provided to new employees and contractors. Further training of those groups involved in the mining of PAF should be commensurate to the level of risk PAF material poses to the operation.
5.13.5 Develop site specific emergency and contingency plans related to spontaneous combustion, ARD and sulfidic material management on an as needs basis.
5.13.6 Coordinate a technical review of ARD management by an external expert every four years. Track progress against outstanding actions at each meeting.
5.13.7 Coordinate all research related to sulfidic material characterisation, management, spontaneous combustion and ARD.
5.13.8 Ensure that related SWPs and guidance notes represent current practise and are up to date.
5.13.9 Changes to the SCARD management plan need to be provided to the Water Resource Evaluation Mineral Waste Team to be included in future updates.
5.14 Management
5.14.1 Ensure progress is made against outstanding spontaneous combustion and AMD audit actions.

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Figure 3: Sulfidic material in BIF and detritals management during mining operations

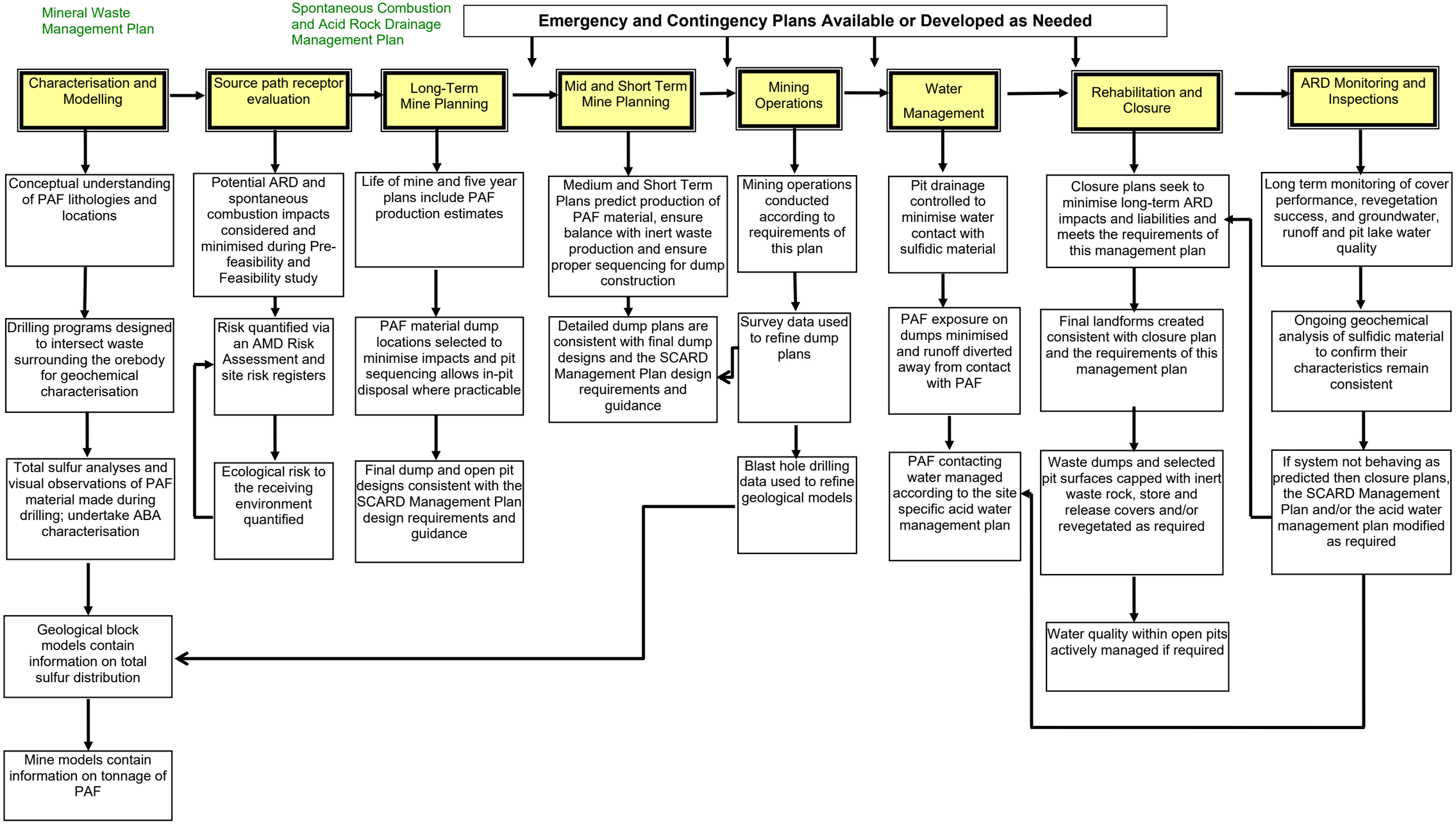

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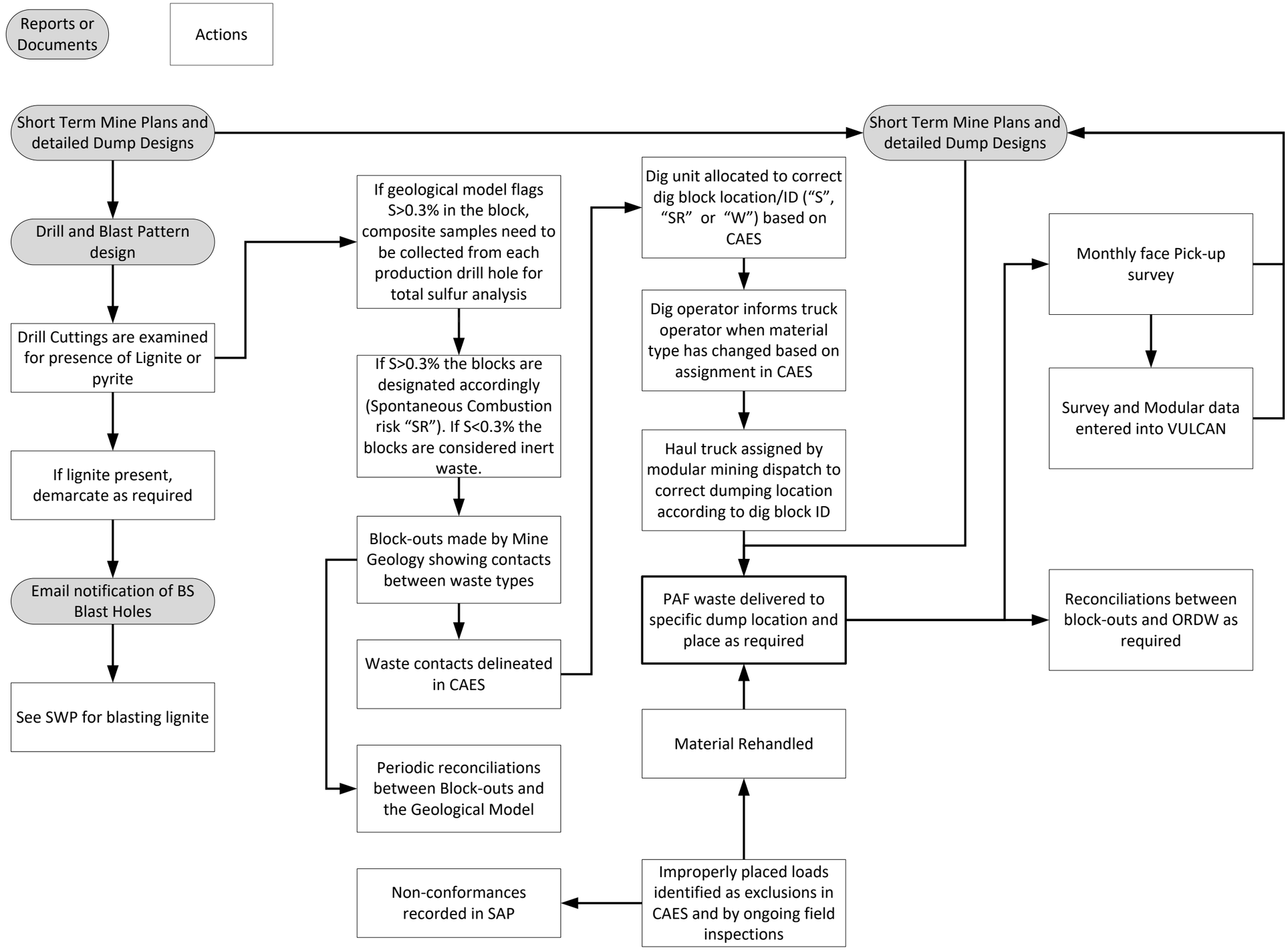
Figure 4: Sulfidic material in BIF and detritals management during mining operations



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6 Requirements, Accountabilities and References for Elevated Sulfur Material (including alunite)

It is expected that elevated sulfur presents an ARD risk but not a spontaneous combustion risk. This is based on the fact that the sulfur bearing mineral is sulfates rather than sulfides (AEISG, 2017).

Requirements	
6.1	**Mine Geology**
6.1.1	Identify from the geological model waste and low grade blocks estimated to contain elevated sulfur. Use these to create block-outs to show the contacts between elevated sulfur material and waste and low grade types within the blast patterns.
6.1.2	Collect (at least every five years) representative samples of elevated sulfur material for full ABA and NAG analysis. Ensure results are communicated to the relevant teams.
6.2	**Mine Technical Services - Planning**
6.2.1	Design elevated sulfur waste dump and low grade stockpiles such that the elevated sulfur material is not located within one metre of the outer surface at closure.
6.3	**Survey**
6.3.1	Monitor the construction of the dump such that elevated sulfur will not be located on the outer surface.
6.4	**Operational Planning**
6.4.1	Ensure material flagged as elevated sulfur is scheduled in CAES such that material is sent to the correct dump/stockpile.
6.5	**Load and Haul**
6.5.1	Ensure that elevated sulfur material is delivered to the correct location as assigned by mine geology.
6.5.2	Ensure that elevated sulfur material is dumped (where possible) from a tip head to ensure blending with inert material. If this is not achievable then paddock dumping will be satisfactory.
6.6	**Hydrogeology**
6.6.1	Ensure background water quality is established from water bores surrounding dumps and stockpiles where elevated sulfur material is stored. Undertake analysis of monitoring bores as required during dump construction and at closure.

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Appendices

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Appendix 1 Dump Specifications for Black Shale and Elevated Sulfur Material

Management of sulfates or sulfides within black shale, BIF or detritals needs to be considered during all phases of waste rock dump design, from initial selection of dump locations during the long-term planning process (five year and longer time horizon) to the detailed dump designs generated during short term planning (time horizon less than a year). The Waste Dump Design Checklist is to be filled in for all new waste dump designs to help ensure environmental issues are adequately considered.

A1.1 Selection of Dump Locations

When designing new PAF material dumps, the dump location and footprint should be selected to minimise potential long term environmental impacts and financial liabilities. Selection and design criteria that must be considered include:

- Under no circumstances should PAF material be used for works such as windrows, construction fill, ramps, fantails, roads or any other use that would disperse the material over a broad area in an uncontrolled manner.
- The PAF dump location should not receive runoff from surrounding areas. In particular waste dumps must not be sited in established drainages with significant upstream catchments.
- In pit disposal should be considered a priority instead of the construction of above ground waste rock dumps. However, hydrogeology investigations are required to evaluate water recovery levels and timeframes, and connection of the void to receptors.
- Placement of PAF material within pits that already contain PAF wall exposures is preferable to placement in pits that do not have these exposed on the pit walls.
- PAF dumps should not be placed over or adjacent to significant regional aquifers such as saturated valley fill alluvial deposits or fractured bedrock aquifers such as the Wittenoom Formation.
- PAF dumps should not be placed over ore grade or near ore grade CID or BIF-derived deposits. These not only have potential economic value, but may act as significant local aquifers.
- PAF dumps should not be placed over, adjacent to, or where there is a connection to significant seeps or springs.
- Avoid siting new PAF dumps in catchment basins that do not already contain PAF material.
- The number of sites containing PAF material and the footprint of these dumps should be kept to a minimum.
- PAF dumps should be located near sources of clean waste rock for encapsulation.
- Background groundwater quality surrounding the dump location must be measured before any material is dumped. This will require the installation of groundwater monitoring bores. These bores will be used to provide a temporal record of groundwater quality in the vicinity of the dump.

A1.2 In-Pit Disposal Requirements

In pit disposal of PAF material is generally more secure than disposal in above ground waste rock dumps. Where practicable, in pit disposal should be considered the preferred disposal alternative because it:

- Reduces the risk of erosion exposing PAF material in the long term;
- Inhibits convective oxygen transport because the waste is surrounded by relatively impermeable rock walls;

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- Reduces the footprint of the waste disposal facilities;
- Reduces the volume of inert or net neutralising waste needed to encapsulate the PAF material; and
- May help to prevent the formation of acidic or hyper-saline pit lakes if the pit can be filled to above the post-mining water table.

Note that in some pits it may be possible to place PAF material both above and below the water table with a minimum 10 metre thick inert waste layer placed against the predicted mean post-mining water table. If PAF material is placed BWT, hydrogeology investigations are required to determine the water recovery level, rate of recovery and if there are any connections to receptors.

A4.2.1 In Pit Disposal Below the Water Table

If PAF material is placed below the post-mining water table, it will become permanently flooded which will control subsequent oxidation and acid release. In the long term, placement below the water table is the most secure and low risk disposal option. It is particularly beneficial for hot black shale because it removes the long-term risk of spontaneous combustion. If a pit can be backfilled so that the fill elevation is above the pre-mining water table level, it is possible that the water table will eventually rebound to or near the pre-mining elevation. If the pit is only partially backfilled to below the pre-mining water table, it is likely that a shallow intermittent, seasonal or permanent pit lake will form on top of the fill material.

Elevated sulfur material (i.e., containing sulfate minerals such as alunite or jarosite) should not be placed below the post-mining water table as the release of acid is controlled by the dissolution of the minerals and is not a kinetic controlled reaction as is the case for sulfidic PAF materials.

For sulfidic PAF material placed below the post-mining water table the following minimum design criteria apply:

- For pits backfilled above the predicted post-mining water table, the top of the PAF material backfill must be at least 5 metres below the mean predicted post-mining water table (Figure 19).

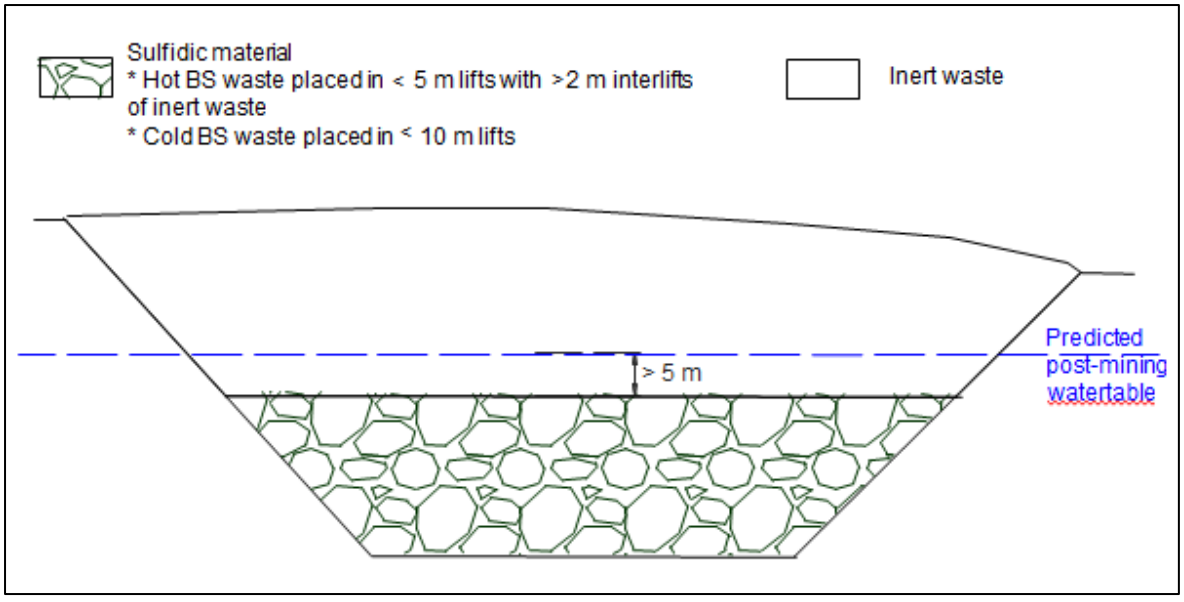

Figure 5: Example of PAF material placed BWT and with the pit completely backfilled.

- For pits that are only partially backfilled to below the pre-mining water table, the top of the PAF material backfill must be at least 5 metres below the estimated mean pre-mining water table and at least 5 metres below the predicted post-backfilling water table (Figure 20). In this situation it can generally be assumed that the mean post-mining water table will be at the top of the backfill. Thus, the PAF waste will be covered by at least 5 metres of inert waste.

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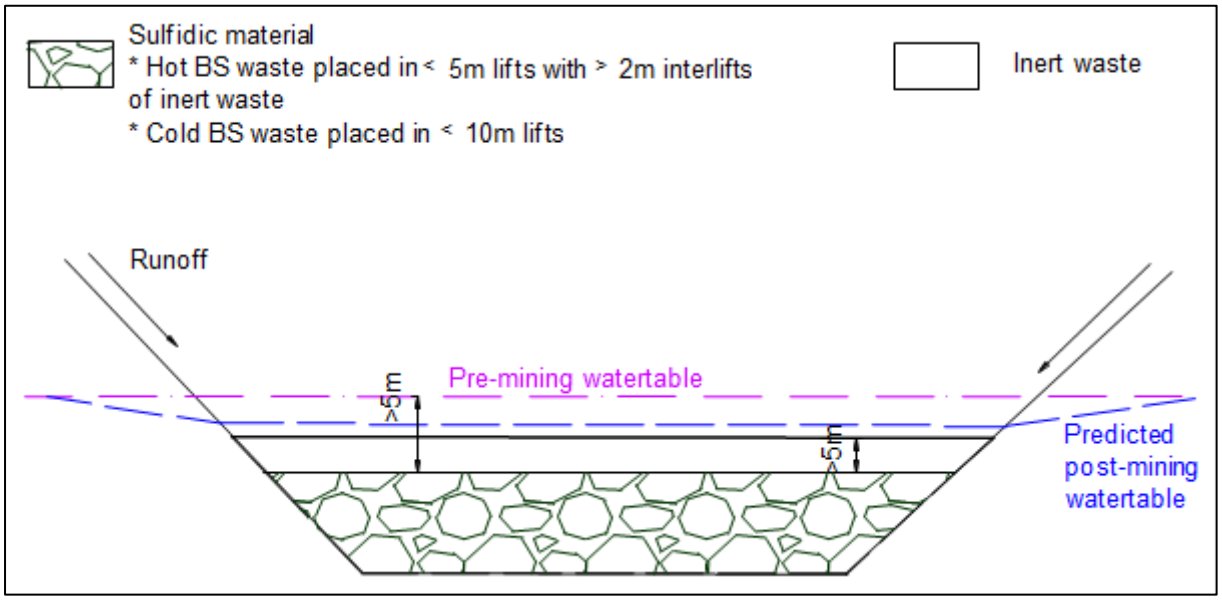

Figure 6: Example of PAF material placed below the water table and with the pit partially backfilled.

- The thickness of each hot black shale material lift must not exceed 5 metres followed by a minimum 2 metre lift of inert or net neutralising waste rock between each hot black shale layer.
- The thickness of each cold black shale material lift must not exceed 10 metres. No inert or net neutralising waste rock layer is needed between cold black shale lifts.
- The uppermost lift of both cold and hot black shale material must be covered with a minimum 5 metre layer of inert or net neutralising waste rock.
- Each lift must be placed so that it ties into the pit walls on all sides to minimise the risk of convective oxygen transport until the waste is flooded.
- If backfilled to above the post-mining water table, the upper inert waste rock surface must be revegetated.
- A store and release cover is not needed if all PAF material in a pit is placed below the water table.

In addition to the minimum design requirements listed above, the optimum design for in-pit disposal below the water table also includes:

- Enough inert or net neutralising backfill should be placed on top of the PAF waste to raise the fill level to at least above the post-mining water table (preventing the formation of a pit lake) and preferably above the pit walls so that runoff is not directed into the pit fill (see Figure 19).
- If required, flooding of the backfilled pit should be enhanced by diverting surface water flows into the pit or directing dewatering water from active open pits into the backfilled pit. The more rapidly the waste can be inundated, the less pyrite will ultimately oxidise. Rapid flooding will minimise the build-up of soluble sulfide oxidation products in the material. As long as geotechnical safety requirements are met, construction of waste lifts into standing water on the pit floor is acceptable. Figure 21 demonstrates that less than 50% of the sulfidic material oxidises if the water table is recovered within 100 years and less than 15% oxidises if the water table is recovered in 30 years. This may differ from site to site, however this example clearly demonstrates the advantage of BWT PAF storage and rapid water recovery.

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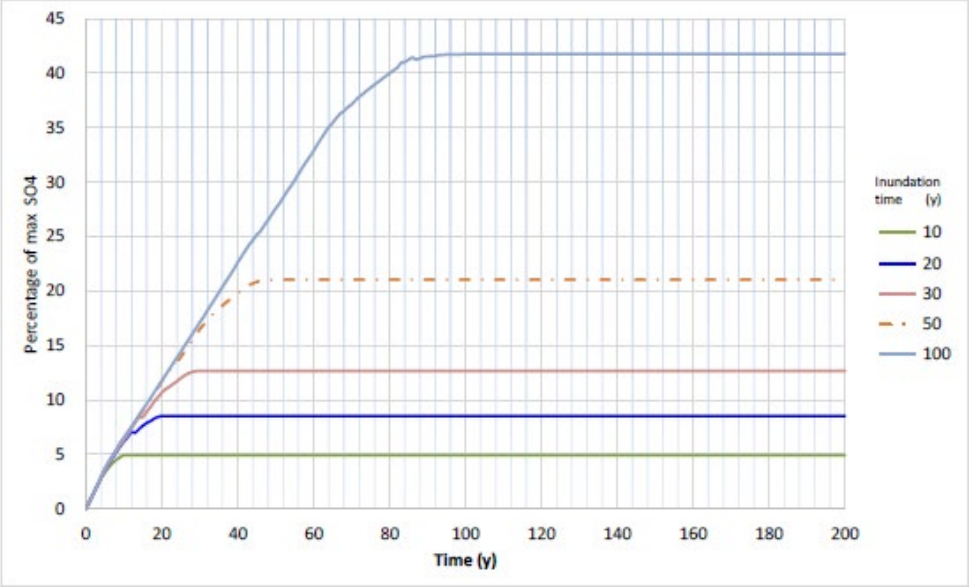

Figure 7: An example of modelling the effects of different inundation time on sulfate generation.

A4.2.2 In Pit Disposal Above the Water Table

If PAF material is placed above the post-mining water table, it must be ensured that long-term variations in the water table elevation do not allow water to rise into the overlying PAF material. Intermittent contact with infiltrating water from above must also be minimised. For PAF material placed above the post-mining water table the following minimum design criteria apply:

- The base of the PAF material backfill must be at least 5 metres above the predicted mean post-mining water table.
- At least 5 metres of inert or net neutralising waste rock must be placed at the base of the open pit before PAF backfill is placed. The most likely location for a perched water table to form is at the base of the backfilled pit because of the permeability contrast between the bedrock and the backfill.
- The thickness of each hot black shale material lift must not exceed 5 metres followed by a minimum 2 metre lift of inert or net neutralising waste rock between each hot black shale layer.
- The thickness of each cold black shale material lift must not exceed 10 metres. No inert or net neutralising waste rock layer is needed between cold black shale material lifts.
- The uppermost lift of both cold and hot black shale material must be covered with a minimum 2 metre layer of inert or net neutralising waste rock. This will prevent runoff water from contacting the underlying PAF material until the store and release cover can be constructed.
- If the pit can be completely backfilled so that no high walls are exposed above the inert waste rock fill, then each inert, cold and hot black shale material layer should tie into the pit walls on all sides to minimise the risk of convective oxygen transport (see Figure 22 and Figure 23 for examples).

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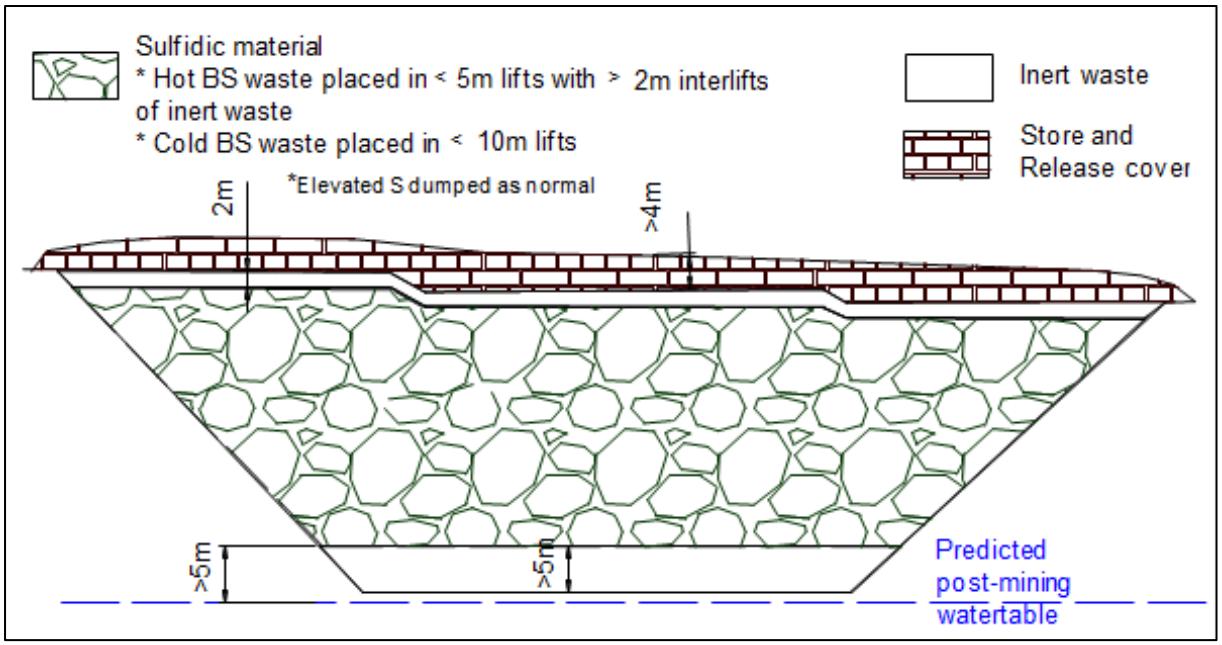

Figure 8: Example of PAF material placed in a dry pit that is completely backfilled.

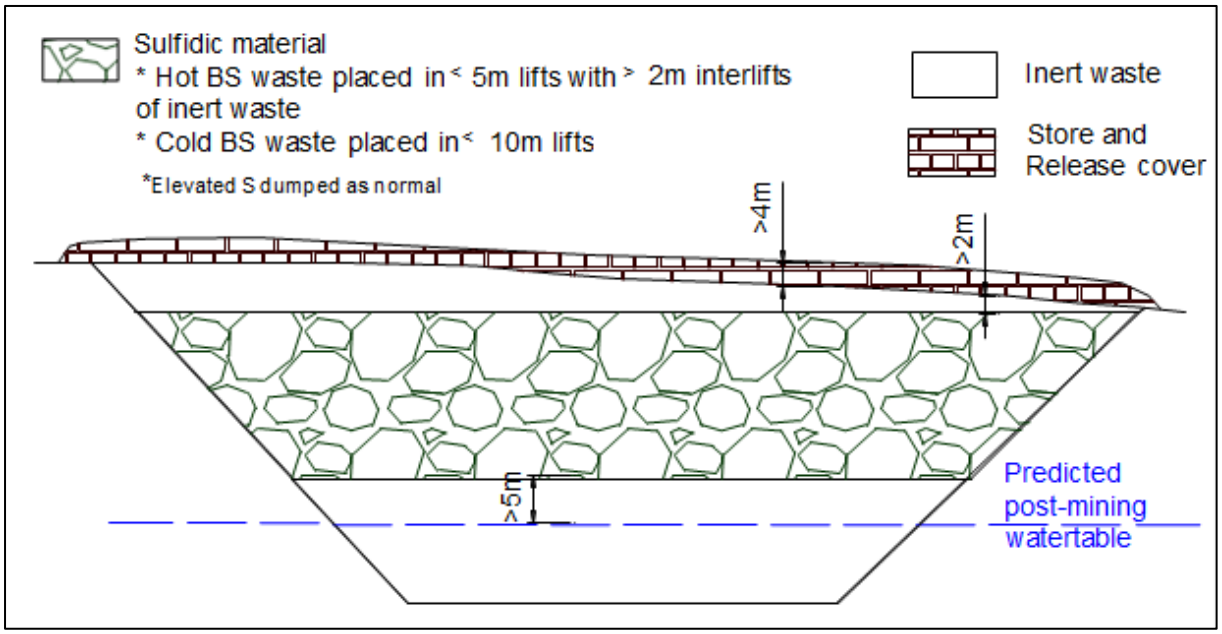

Figure 9: Example of PAF material placed above the water table and with the pit completely backfilled.

- If the pit will only be partially backfilled so that highwalls are exposed above the final backfill surface and that the runoff from the remaining highwalls will flow towards the backfill, a minimum five metre (measured both horizontally and vertically) buffer of inert waste rock must be placed between the pit walls and each PAF material lift where possible (see Figure 23 for an example). A 2 metre high by 5 metre wide abandonment bund will also need to be placed adjacent to the exposed high walls to prevent run on water from infiltrating into the cover over the PAF material.

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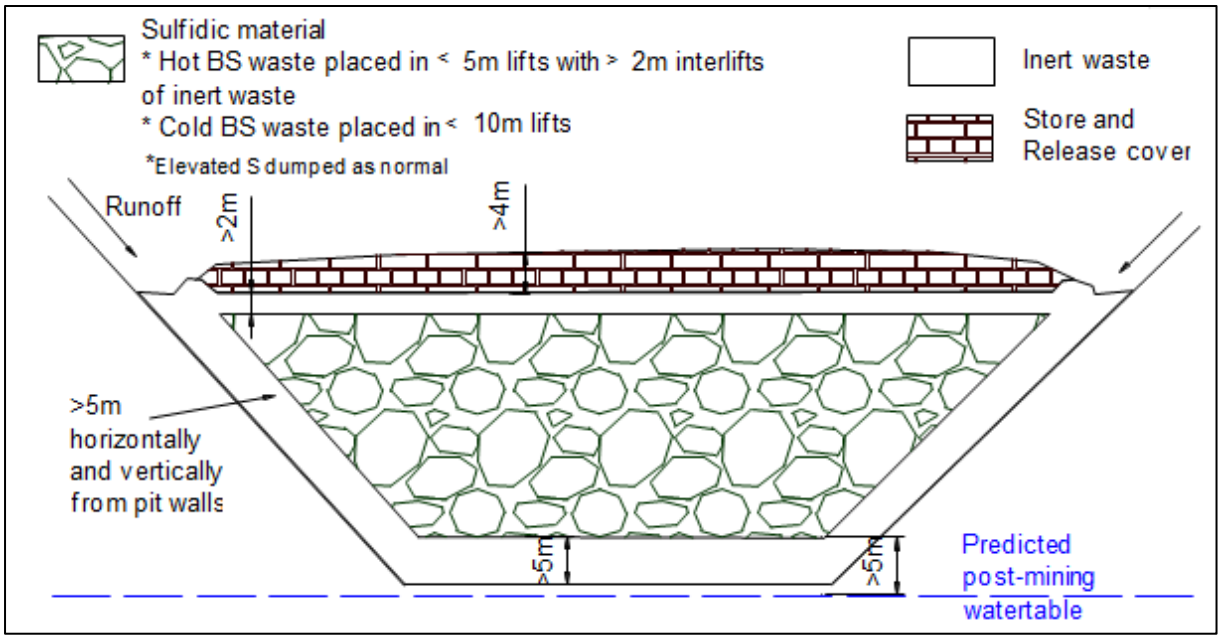

Figure 10: Example of PAF material placed above the water table and with the pit partially backfilled.

In addition to the minimum design requirements listed above, the optimum design for in-pit disposal above the water table also includes:

- If possible, the pit should be backfilled above the lowest point on the pits walls so that the final backfill surface can be sloped to allow runoff water to flow out of the pit footprint.
- The optimum design would be to backfill the pit so that there are no highwalls exposed that could direct runoff onto the store and release cover and underlying PAF material (see Figure 22 and Figure 23).

A1.3 Above Ground Disposal Requirements

If PAF material waste rock dumps are to be constructed on top of the original ground surface, more stringent design criteria are required than for in-pit disposal because of the risk of erosion exposing encapsulated PAF material and because of the likelihood of the convective transport of oxygen through the side slopes of the dump. Design criteria for hot black shale dumps are also more stringent than for cold black shale dumps and elevated-sulfur dumps.

A1.3.1 *Design of Outer Waste Rock Dump Slopes*

To the extent possible, cold and hot black shale material should be excluded from beneath final waste rock dump slopes. There are several issues associated with the placement of cold and hot black shale beneath waste rock dump slopes:

- There is an increased risk of slope erosion damaging vegetation and covers in the short term, or in the long term exposing the underlying material.
- The probability of convective oxygen transport to the sulfidic material is higher than for cold and hot black shale material only placed in the dump interior.
- Store and release covers cannot be built on slopes because they are constructed with more erodible fine-grained materials. It is likely that infiltration rates into the underlying cold and hot black shale material will be higher on slopes than on flat surfaces with a store and release cover, which could result in increased AMD.

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- Uncertainties with the requirements for final dump slopes may require the importation of additional inert material to achieve the final landform design to ensure the preservation of the minimum 5 metres of inert cover over the sulfidic material.
- The berm and batter design of final slopes would direct water through the slopes and into the underlying PAF material.

The minimum design criteria in the following section reduce but do not completely mitigate these risks. **For this reason, hot black shale should not be placed under final slopes, and the volume of cold black shale should be minimised wherever possible**[1]**.** The greatest benefit can be derived from excluding hot black shale material from beneath the slopes because it not only has the potential to spontaneously combust, but also has anywhere from 2 to 70 times more acid producing potential on average than the cold black shale material.

A1.3.2 *Hot Black Shale*

Figure 25 shows the optimum design for the waste rock dumps in which hot black shale is completely excluded from beneath the footprint of the final recontoured slope.

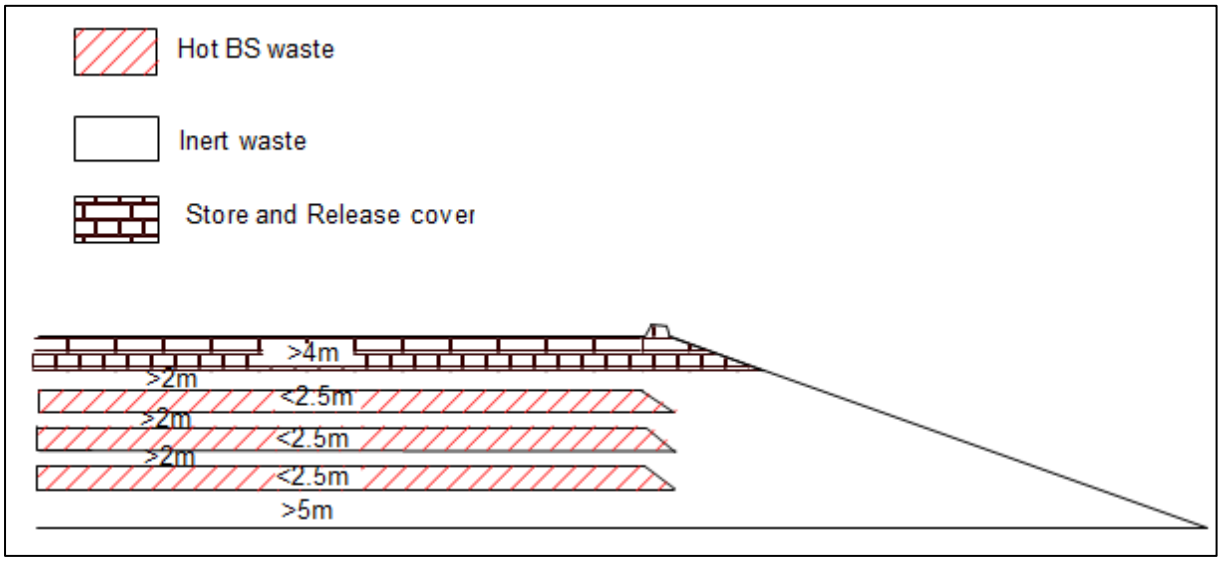

Figure 11: Example of the design for hot black shale dumps.

The minimum design criteria for hot black shale dumps are:

- A minimum of 5 metres of inert or net neutralising waste rock must be placed on the original land surface at the base of the dump.
- Enough inert waste rock must be placed against hillsides so that PAF material is not located within 5 metres of the hillside as measured both vertically and horizontally.
- The thickness of each hot black shale material lift must not exceed 2.5 metres followed by a minimum 2 metre lift of inert or net neutralising waste rock. Lifts are to be constructed by paddock dumping (or reverse paddock dumping and pushing out) so that the hot black shale can cool and so that incident vehicle traffic helps create a compacted layer every 2 to 2.5 metres to inhibit water movement and convective oxygen transport.
- Enough inert or net neutralising waste rock must be placed on the outer skin of the hot black shale waste rock dump so that no hot black shale material is located under the final slopes.[2]

[1] Effective from the 2016 SCARD update. Earlier designs and dumps can still contain hot black shale under slopes.

[2] Effective from the 2016 SCARD update. Dumps designed and built prior to 2016 can continue to dump hot black shale under slopes, however it must be located > 5 metres (measured across the shortest distance) from the final dump slope.

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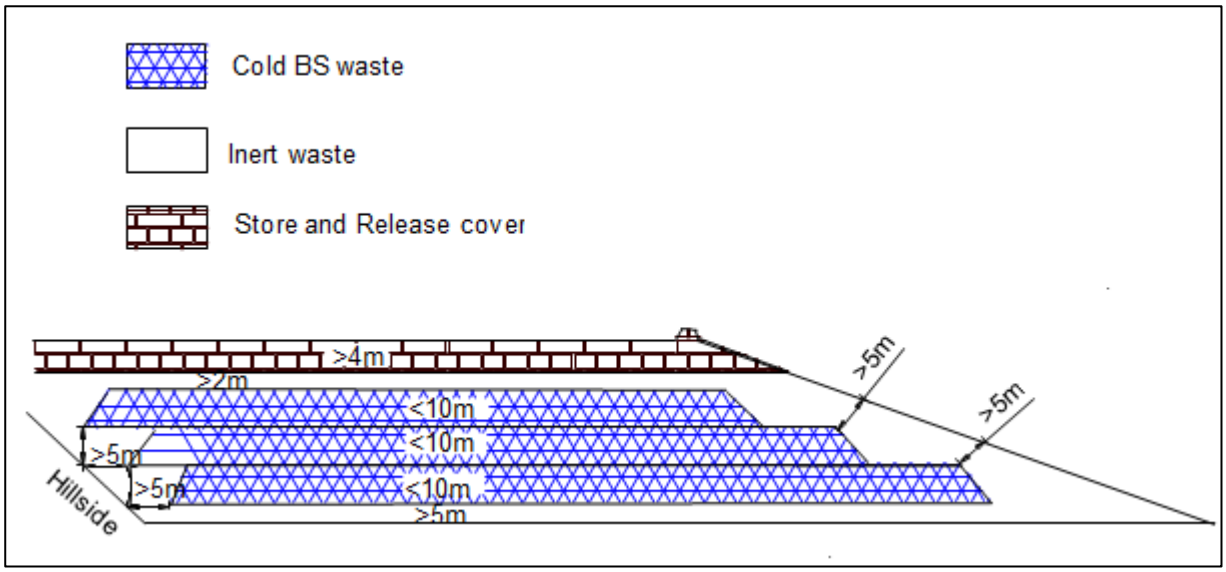
- Hot black shale may be mixed with Elevated S material in dumps, however elevated sulfur material should not be used on the outer slopes.
- The final lift on a hot black shale waste rock dump must be composed of a minimum 2 metre-thick inert or net neutralising layer. This will prevent runoff water from contacting the underlying PAF material until the minimum 4 metre-thick store and release cover can be constructed.
- During construction and at closure, the upper dump surface of the hot black shale waste dump should be designed so that it only receives incident rainfall with no run-on from adjacent areas.

A1.3.3 *Cold Black Shale*

An example of a cold black shale waste rock dump constructed according to the minimum dump design criteria is shown in Figure 26. The minimum design criteria for cold black shale dumps are:

- A minimum of 5 metres of inert or net neutralising waste rock must be placed on the original land surface at the base of the dump.
- Enough inert waste rock must be placed against hillsides so that cold black shale is not located within 5 metres of the hillside as measured both vertically or horizontally.
- The thickness of each lift of cold black shale must not exceed 10 metres. This will create a vehicle compacted layer every 10 metres in the dump to inhibit water movement and convective oxygen transport[3].
- No inert or net neutralising waste rock layer is needed between cold black shale lifts.
- Enough inert or net neutralising waste rock must be placed on the outer skin of the cold black shale waste rock dump so that no material is located within 5 metres of the final dump surface after the slope has been re-contoured at closure.
- The final lift on a cold black shale waste rock dump must be composed of a minimum 2 metre-thick inert or net neutralising layer. This will prevent runoff water from contacting the underlying material until the minimum 4 metre-thick store and release cover can be constructed.
- During construction and at closure, the upper dump surface of the cold black shale dump should be designed so that it only receives incident rainfall with no run-on from adjacent areas.



[3] Note that this has been changed from 5 m lifts as the gas movement through waste dumps has been shown during ANSTO testing to be diffusive and it is likely that the difference in ARD generation between 10 and 5 m lifts will be negligible.

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Figure 12: Example of the minimum design criteria for cold black shale dumps. *Error! Bookmark not defined.*

A1.3.4 *Elevated S*

An example of an Elevated S waste rock dump constructed according to the minimum dump design criteria is shown in Figure 27. The minimum design criteria for elevated-sulfur dumps are:

- Inert or net neutralising waste rock must be placed on the original land surface at the base of the dump.
- At least one (1) metre of inert material is located on the outer surface of the waste dump at closure.
- Elevated-sulfur material can be mixed with inert material and dumped accordingly.
- Co-disposal of elevated-sulfur waste with materials containing excess available neutralising capacity is recommended.
- During construction and at closure, the upper dump surface of the elevated-sulfur dump should be designed so that it only receives incident rainfall with no run-on from adjacent areas.

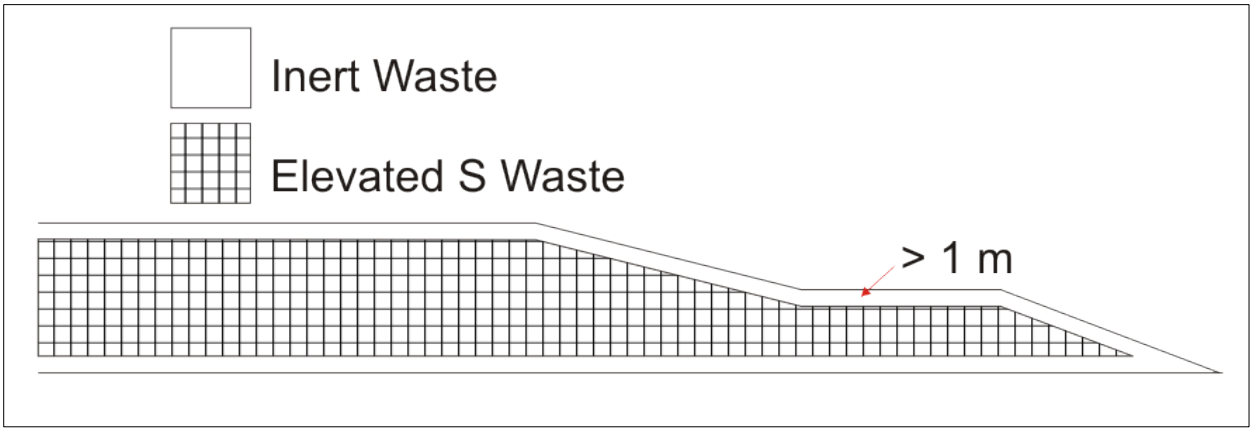

Figure 13: Example of the minimum design criteria for Elevated S dumps. No store and release cover is required and only 1 metre inert material cover at surface required.

A1.3.5 *Composite Designs*

Figure 28 shows an example of a composite hot and cold black shale dump in which hot black shale is excluded from the beneath the slope and cold black shale is placed below the slope. Composite dumps of this kind may significantly reduce the residual risk associated with the dump slopes without significantly reducing the total storage capacity for sulfidic material within the dump. There must be at least a one metre buffer (measured horizontally or vertically) between the hot and cold black shale material where they are in close contact on the outer slopes of the hot black shale repository.

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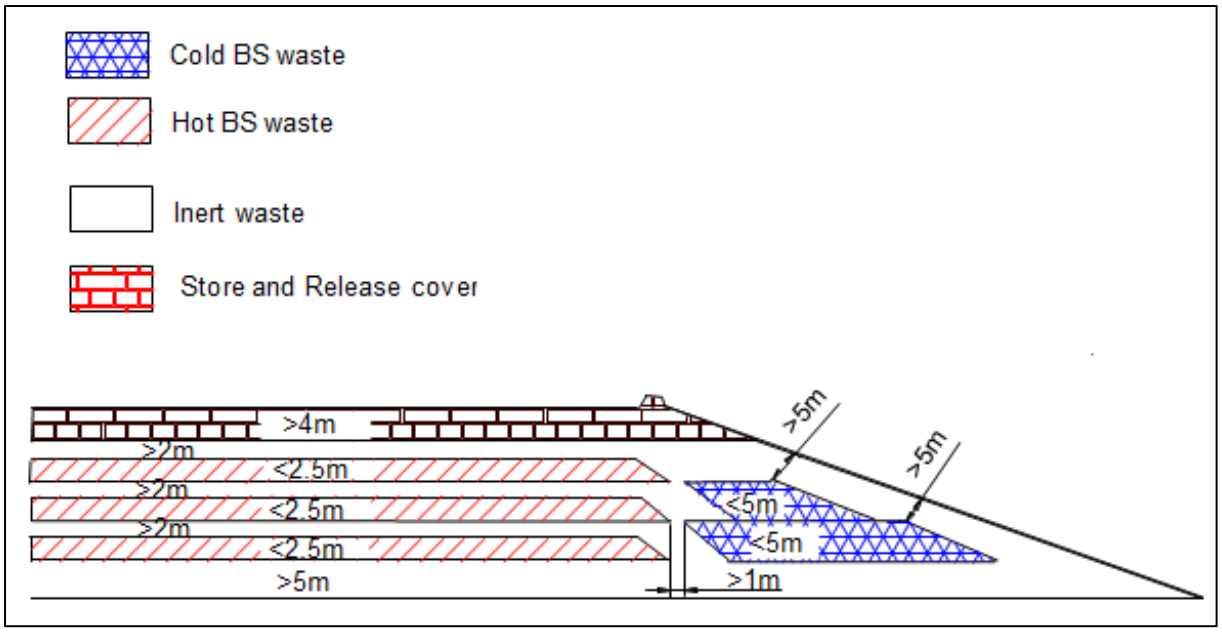

Figure 14: Example of optimum composite designs for cold and hot black shale dumps.

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Appendix 2 Dump Designs for Material with Neutralising Potential

A2.3 Dumping Scenarios

The following dump designs were developed specifically for cases where neutralising material is available. Calcrete is the preferred net neutralising material, however if calcrete is not available then dolomite from the Wittenoom Formation can be used as net neutralising waste. Please note that only the dolomite within the Wittenoom Formation has sufficient neutralising material and it is not mapped separately within geological models and could be difficult to source.

A2.3.1 *Above Ground Disposal Requirements*

An example of the minimum dump design criteria is shown in Figure 29.

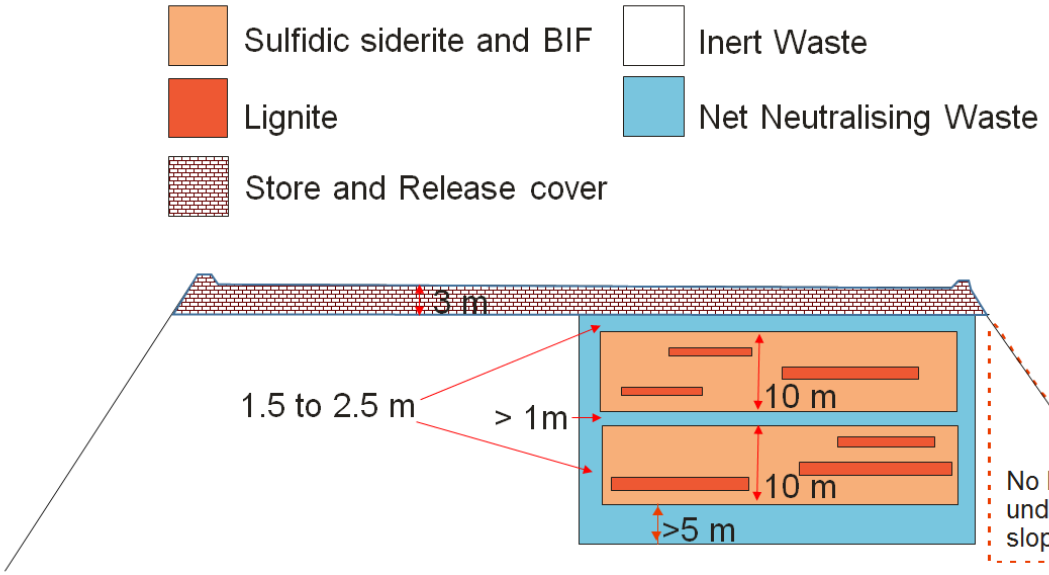

Figure 15: Example of minimum design for a combined sulfidic BIF and siderite with lignite dump – Permanent storage

The minimum design criteria for AWT PAF dumps are:

- No PAF material is to be placed under the final rehabilitation slopes of the waste dump.
- Minimum of 5 metre of net neutralising waste rock must be placed as a basal layer prior to PAF placement within the dump. This material can be end tipped. This basal layer can be reduced in thickness to 2.5m, if the PAF cell is located higher in the waste dump. The mineral waste team should assess this.
- A 1.5 – 2.5 metre layer of net neutralising waste should be placed at the top, sides and base of each PAF lift i.e. a net neutralising waste bund should be created prior to PAF placement. This will reduce the lateral flow of incident rainfall.
- If spontaneous combustion is a risk, the thickness of each lignite material lift must not exceed 2.5 metre followed by a 1.5 to 2.5 metre lift of net neutralising waste rock. Lifts are to be constructed by paddock dumping so that lignite material can cool and so that incident vehicle traffic helps create a compacted layer every 1.5 to 2.5 metres to inhibit water movement and convective oxygen transport.
- The thickness of each lift of sulfidic BIF and siderite material must not exceed 10 metre. A 1.5 – 2.5 metre paddock dumped layer of net neutralising waste should then be placed on top of the PAF lift.

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- The 10 metre PAF layer should be paddock dumped in a number of small lifts to limit the risk of material segregation and tightly compact the waste dump to prevent oxygen ingress i.e. 4 x 2.5 metre thick PAF layers. The dumping of PAF material during the wet season should be avoided, where possible.
- The final lift on the PAF waste rock dump must be composed of a minimum 1.5-2.5 metre thick inert or net neutralising layer. This will prevent runoff water from contacting the underlying sulfidic material until the minimum 3 metre thick store and release cover can be constructed.
- Only incident rainfall and no run-on from adjacent areas should pass through the dump.
- If there is insufficient PAF to create the 10 metre lift, the >1 metre net neutralising waste layer can be constructed at <10 metre.
- If spontaneous combustion is a risk, lignite material should be covered with net neutralising material within 1 month during the wet season (due to the spontaneous combustion risk). Where possible, the sulfidic BIF and sulfidic siderite material should be covered with net neutralising waste during the wet season.
- If PAF is temporarily stored within a waste dump, the previous criteria still applies, however PAF can be stored underneath the final slopes, as long as there is a 10 metre offset (consisting of calcrete closest to the PAF and inert waste) (Figure 30). If PAF is placed on 30m of inert material, it would need to be rehandled within 20 years. If there is a delay in rehandling then the placement of a temporary cover on the dump should be considered.

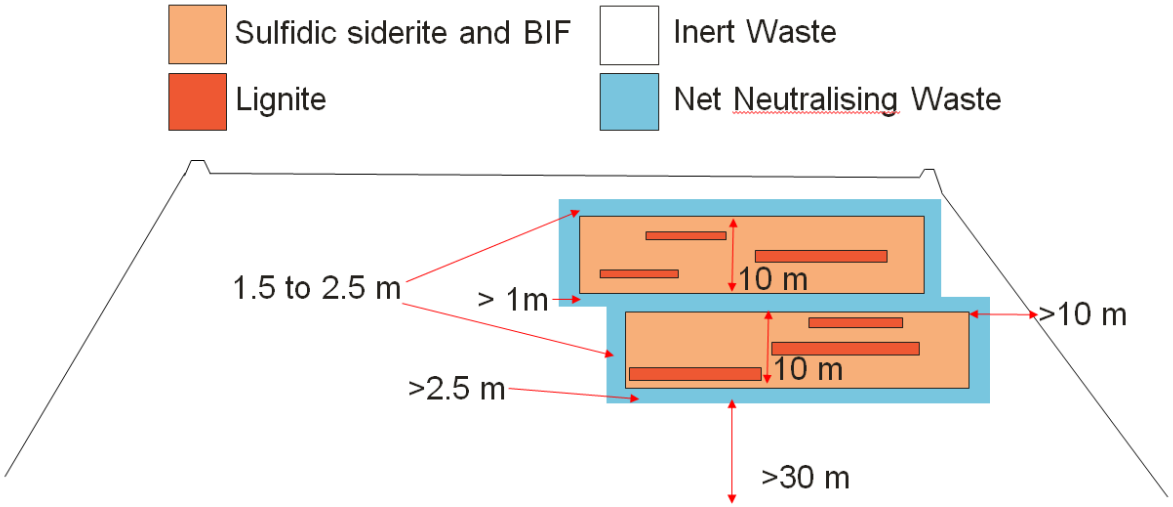

Figure 16: Example of minimum design for a combined sulfidic BIF and siderite with lignite – Temporary storage

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Appendix 3 Rehabilitation and Closure

A3.1 Final Landforms

To reduce the risk of erosion and to minimise infiltration, final landforms should be designed in accordance with the following criteria:

- Final landform design should be designed in accordance with the Rio Tinto Iron Ore (WA) Landform Design Guidelines.
- Final landforms must be designed so that runoff is not directed onto surfaces that are underlain by sulfidic material.
- A back-sloping crest bund must be placed around the top of each dump slope and berm. This will prevent runoff water flowing from the dump surface over the slopes and causing erosion.
- If PAF material is exposed during the re-contouring of waste rock dumps that were created before waste rock segregation was practiced, it must be covered with at least 2 metres of inert waste rock. This will help ensure that the entire final dump surface is able to support vegetation.
- Wrapping the PAF dump is preferred rather than dozing down the slope.

A3.2 Store and Release Covers

A3.2.1 *Design*

Store and release covers must be constructed on all flat surfaces over PAF waste dump repositories and over some sulfide/black shale exposures within open pits. Store and release covers are designed to limit infiltration into the underlying waste rock by maximising the evapo-transpiration of incident rain water. The cover is designed to store water near the surface during the wet season so that it can be removed from the cover material and returned to the atmosphere during the dry season by evaporation and plant transpiration.

Waste rock that is used to construct store and release covers must contain sufficient fine-grained material to have both a high moisture retention capacity and a relatively low permeability (i.e. large boulders should not be placed on the cover). Waste rock composed of well-graded clayey, silty, sandy gravel or clayey silty gravely sand makes the best store and release cover material. As a rough guide, waste rock containing more than 1/3 coarse sand size and finer particles (< 5 mm) will make a suitable cover material. **Blocky BIF composed of gravel with very little silt, sand or clay is not ideal** for use in cover construction and should be avoided if another more suitable waste type is available (Figure 31).

Where possible, 4 metres of oxidised shale should be used in preference to 4 metres of BIF on flat top covers. If detrital material is available, then a cover constructed out of 4 metres of detrital material overlying 2 metres of oxidised shale has been shown to reduce net percolation and salt uptake. Topsoil should be preferentially placed on covers as the vegetation can significantly reduce the amount of net percolation through the cover. If the cover will be less than 6 metres thick then advice should be sought from the mineral waste management team. For guidance on the covers on slopes please see the Rio Tinto Iron Ore (WA) Landform Design Guidelines.

A3.2.2 *Construction*

During construction there should be regular quality control checks to ensure large boulders have not been placed into the cover.

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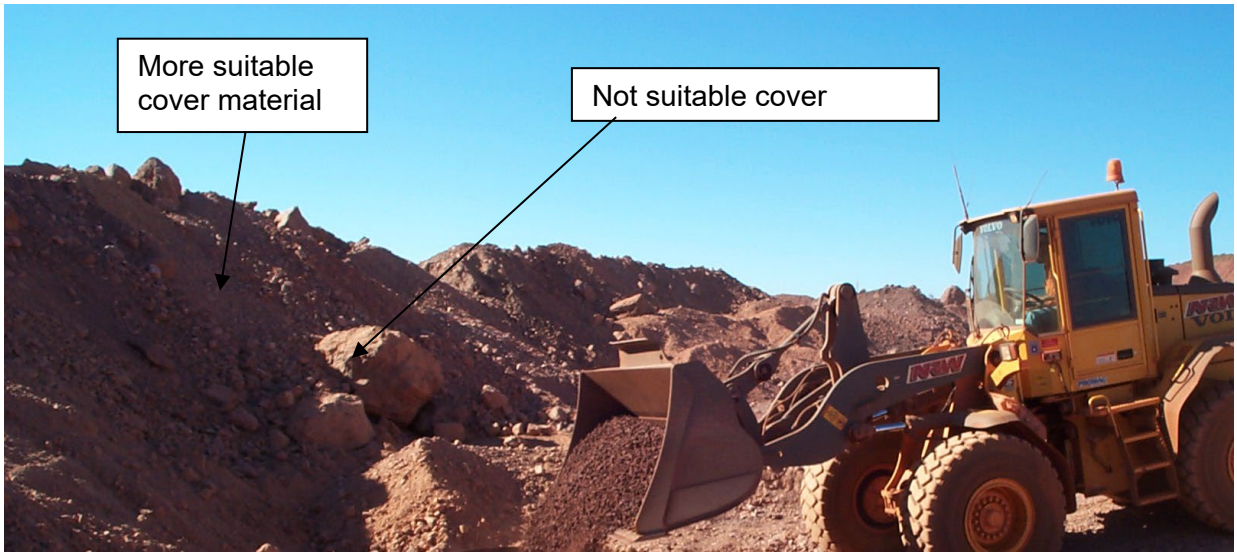

Figure 17: An example of suitable and not suitable material to be used in the construction of a store and release cover.

Waste rock that is used to construct store and release covers must also be able to support vegetation, so materials with high salinity, and acidic or very basic pH should be avoided. The waste rock should be placed in a manner that minimises segregation of the material into coarse and fine particles. For this reason covers should be paddock dumped, they should never be constructed by dumping in four metre lifts.

Store and release covers should be constructed as follows (Figure 32):

- Paddock-dump store and release cover material on top of a vehicle compacted surface so that the average depth of the cover material is greater than 2 metres.
- A dozer should then be used to knock down the crest of each paddock dump pile and to fill in the depressions between piles to create a trafficable surface.
- Paddock-dump a second layer of store and release cover material on top of the first lift so that the average depth of the second lift is greater than 2 metres. Vehicle traffic during this dumping will create a compacted layer on top of the first store and release cover layer.
- A dozer should again knock down the crest of each paddock dump pile in the second layer and fill in the depressions between piles to create a surface that is nearly planar.
- Topsoil should be placed on top of the second store and release cover layer. The surface should then be ripped and seeded. Ripping needs to be deep enough (> 0.3 metres) to mix in the topsoil and to ensure that there are not compacted zones that could inhibit plant growth and rooting on top of the upper layer.

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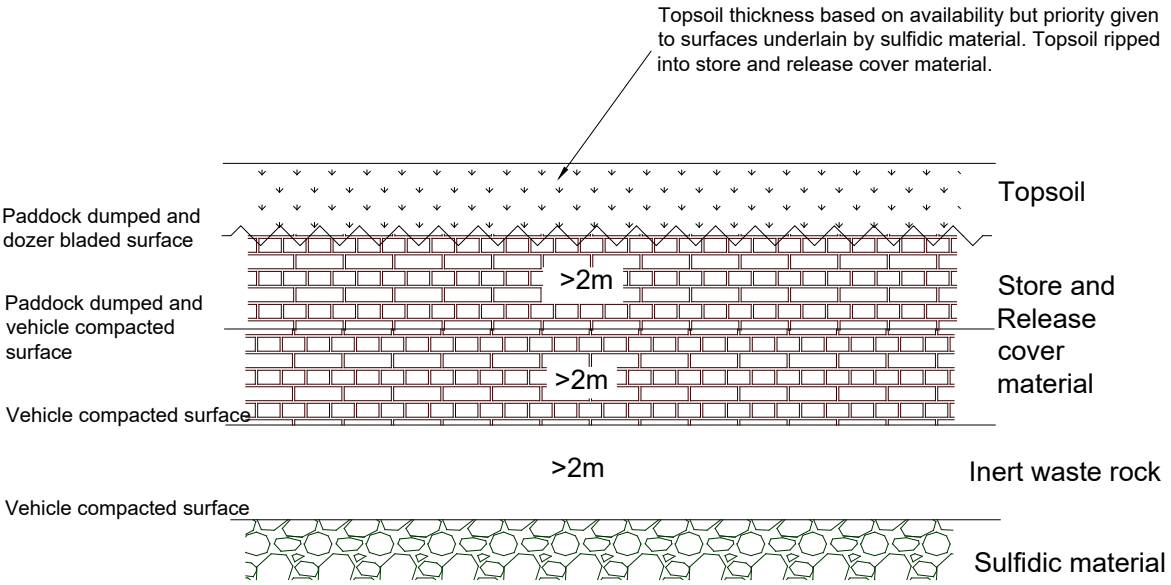

Figure 18: Detail of store and release cover design.

A3.3 Topsoil Management

Topsoil placement can greatly accelerate the establishment of native vegetation on waste rock surfaces. This in turn will help to maximise evapo-transpiration, minimise infiltration into the underlying waste rock and inhibit erosion on dump slopes. If topsoil resources are limited, the most benefit for ARD management can be gained by preferentially utilising topsoil for the revegetation of waste rock dumps that contain sulfidic material. In decreasing order of importance, topsoil should be placed on:

1. Dump slopes underlain by hot black shale/lignites material;

2. Dump slopes underlain by cold black shale/sulfidic BIF/sulfidic siderite material;

3. Flat store and release cover dump surfaces underlain by hot black shale/lignites material;

4. Flat store and release cover dump surfaces underlain by cold black shale/sulfidic BIF/sulfidic siderite material;

5. Store and release covers within open pits;

6. Waste rock dumps that were created before waste rock segregation was practiced and which may contain dispersed black shale or material containing sulfides;

7. Assessable inert waste rock surfaces within pits that contain black shale or sulfidic material exposures; and

8. Waste rock dumps that do not contain any black shale or sulfidic material.

For further information on topsoil management refer to the RTIO Soil Resource Management Work Practice.

A3.4 Open Pit Closure

The geology and hydrogeology of an open pit will largely control the potential closure issues associated with the final void. Open pits that are located above the water table and which do not contain any black shale or sulfidic material exposures should not pose any geochemical risks at closure. Open pits that intersect the water table but do not contain any black shale or sulfidic

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material exposures may ultimately contain saline water bodies with neutral pH that could impact down gradient groundwater. Open pits that contain black shale or sulfidic material exposures will likely contain ephemeral or permanent acidic and potentially saline water bodies that could impact down gradient groundwater and could represent a direct exposure risk to wildlife or humans.

Hypersaline pit lakes may be considered acceptable on relinquishment as long as down-gradient beneficial use is not impacted. Further consultation with stakeholders would be required for specific locations. Mitigation measures will likely be required if net acid generating materials such as pyritic black shale are exposed on the final pit walls. In pits with extensive exposures of pyritic black shale that will not be backfilled to above the water table, long term mitigation measures will likely be required to attain the proposed water quality criteria.

The hydrogeological and geochemical behaviour of each pit should be predicted so that it can be managed appropriately at closure to minimise significant groundwater impacts and surface water exposures to wildlife and humans. As discussed previously, the most protective pit closure strategy is to completely backfill the pit or to backfill the pit to above the estimated pre-mining water table where practicable. Backfilling to above the pre-mining water table should lead to a near complete recovery of the water table elevation and should cut off oxygen to the majority of black shale or sulfidic material exposed on the pit walls.

In order of decreasing benefit, pit backfilling should be prioritised as follows: 1) pits with black shale or sulfidic material exposures that intersect the water table and will discharge to groundwater at closure, 2) pits with black shale or sulfidic material exposures that intersect the water table but that will not discharge to groundwater at closure, 3) pits with black shale or sulfidic material exposures that are above the water table, 4) pits without black shale or sulfidic material exposures that intersect the water table and that will discharge water to groundwater at closure, 5) pits without black shale or sulfidic material exposures that intersect the water table but that will not discharge to groundwater at closure, and 6) pits that do not contain any black shale or sulfidic material exposures and that are above the water table. The proximity to nearby regionally significant aquifers or ecologically significant seeps and springs should also be considered when evaluating potential pit closure issues.

Extensive backfilling is not practicable for many open pits because of the size of the final void and because of pit sequencing issues. Where backfilling is not practicable the following actions should be taken:

- Haul roads and accessible benches that are underlain by inert waste rock should be ripped and seeded to minimise runoff, to promote vegetation establishment and to maximise evapo-transpiration.
- A minimum 4 metre store and release cover system should be constructed on top of accessible black shale or sulfidic material exposures for those portions of the pit that will be located above the water table and that will not be periodically flooded by cyclone events.
- A minimum 5 metre lift of inert or net neutralising rock should be placed on top of accessible black shale or sulfidic material exposures for those portions of the pit that will be located below the water table or that will be periodically flooded by cyclone events.
- Consideration should be given to covering black shale or sulfidic material exposed on pit highwalls with inert or net neutralising material pushed or dumped from the sides.

An example of these pit closure strategies is illustrated in Figure 33.

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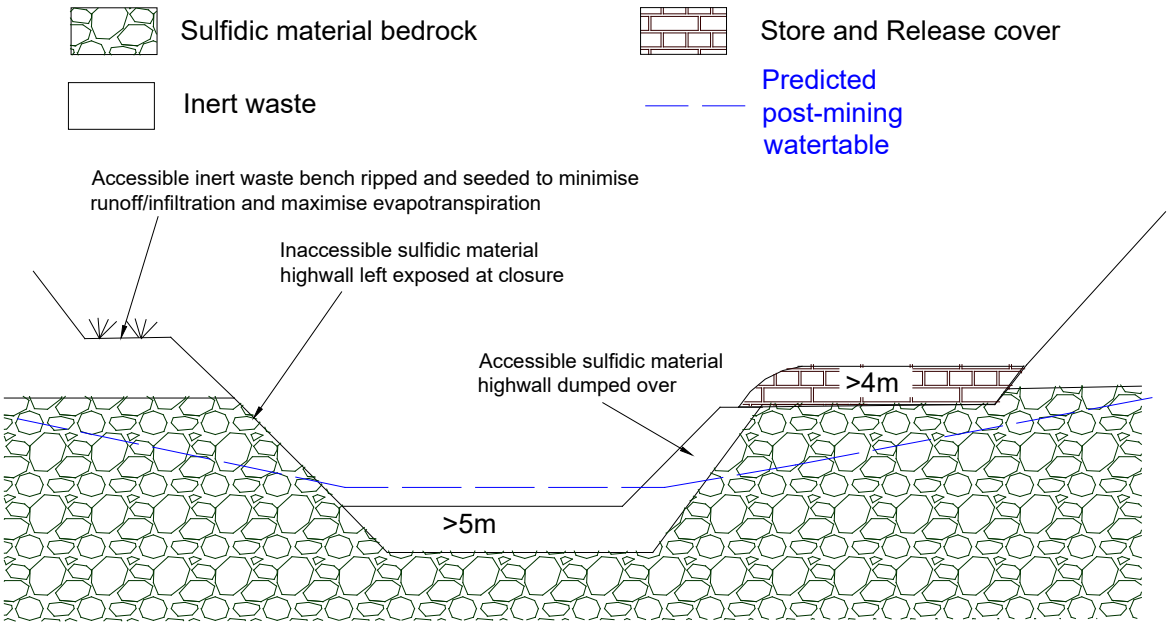

Figure 19: Examples of closure strategies for a pit with sulfidic material that will not be backfilled.

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Appendix 4 Contingency Planning

Contingency plans for most upset conditions and unexpected impacts related to sulfidic material management will need to be developed on a case by case basis. Contingency plans will generally be developed by the site Mineral Waste Management team or at a minimum they must be approved by the Team. Contingency plans for spontaneous combustion and inert materials shortages are outlined in the following sections.

A4.1 Spontaneous Combustion

Site specific pit safety procedures should be followed.

All occurrences of burning black shale or lignites must be reported to the mine supervisor and the pit safety team as soon as possible. If possible, fires should be extinguished by rapid burial of the burning material under at least five metres of inert waste rock (see relevant SWPs). For locations where this may be difficult such as beneath pit ramps, the black shale or lignite should be covered with as much inert material as practicable. The inert material should be placed so that the upper surface is well compacted and so that side slopes are adequately covered to prevent lateral convective transport of oxygen to the burning rock mass. If rapid coverage is not an option, the material can be excavated and transported to the toe of an advancing inert dump lift where it can be rapidly buried. Water should not be used to extinguish the fire because this could actually enhance the spontaneous combustion risk of black shale or lignite that is not already burning and because the volumes of water that would be required are generally prohibitively high.

A4.2 Inert Materials Shortages

Medium and short term mine plans should be designed so that inert waste rock is produced in adequate volumes and at appropriate times to allow timely encapsulation of PAF material. Hot black shale and lignite material requires the highest volumes of inert material (approximately 1:1) because of the requirement for an inert interlayer every 2.5 metres. If there were temporary shortages of inert material, hot black shale or lignite dumps could be designed with cold black shale or sulfidic BIF and siderite material if it contains a low sulfide concentration, some neutralising potential and low organic carbon (i.e. no black shale or lignite) material. The appropriate material to use in the heat dissipating interlayer should be confirmed as appropriate by Mine Geology. But under no circumstances should black shales or lignites with both elevated sulfide and organic carbon concentrations be used. If acid base accounting tests prove the material to be non-acid forming, coarse tails could be used as inert waste in dumps. If there is a shortage of inert material then inert waste in other waste dumps may need to be rehandled and transported to the black shale waste dump.

A4.3 Surface Water Management

Every endeavour should be made to divert surface water runoff from contacting black shale or sulfides exposed on pit walls. Site specific acid water and flood management plans should be developed that plan for the appropriate disposal of potentially acidic water in pits with PAF exposures. Some strategies to manage surface water runoff include:

- Slope pit floor away from pit PAF exposure
- A sump should be constructed below the PAF exposure to collect acidic water.
- Surface water runoff from inert exposures should be segregated from coming in contact with acidic water.

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- Bund upper catchment to run over competent material such as BIF rather than PAF exposures.

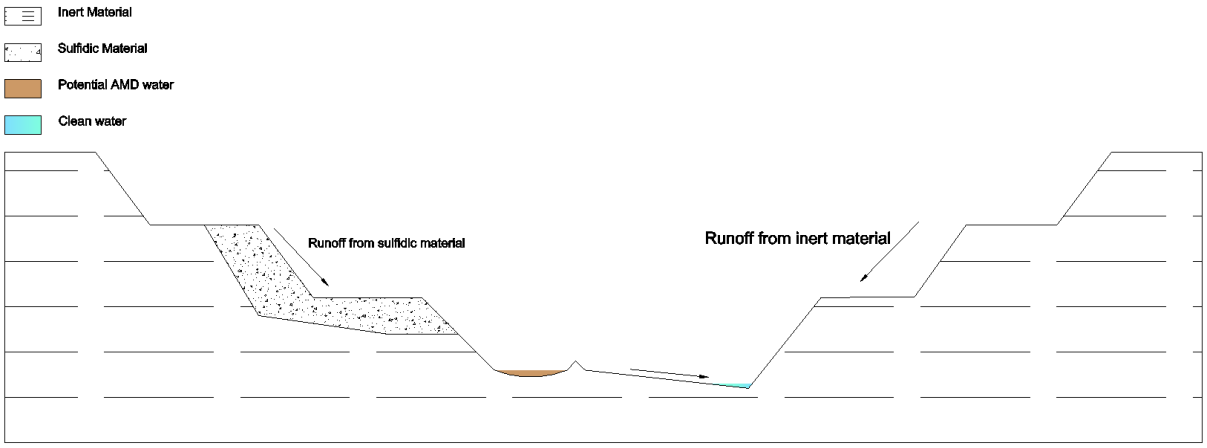

Figure 20: Suggested surface water management for sulfide exposures.

Where possible, PAF exposures in waste dumps should be covered with inert material during the wet season, particularly hot black shale and lignites. A bund at the top of the waste dump surface will reduce any surface water from travelling over the sulfidic material and transporting contaminated drainage into the surrounding environment.

Pipelines transporting acidic water should be shut down and repaired if there is a leak. Acid water pipelines should be labelled with purple stripes and non-acidic pipelines can be labelled with green stripes (as per Australian Standards).

A4.4 Geotechnical Stability

A6.4.1 Pit Walls

Pit walls excavated in MCS are designed with the same concept as for other stratigraphic units. That is, generally the design is for a Factor of Safety of at least 1.20 and a Probability of Failure of around 10% on the inter-ramp scale and up to 30% for the batter scale. The management of slopes excavated in MCS is therefore no different from that of any other stratigraphic unit, whereby a process called Geotechnical Design Management is utilised. This involves identifying hazards and hence risks associated with the geotechnical design and undertaking a risk management strategy to minimise these risks. Actions include design review, geotechnical investigation, mapping, conformance to design and monitoring. Contingency plans are established through Slope Management Plans in consultation with mine management.

The occurrence of MCS is of little consequence to the geotechnical management process.

A6.4.2 Dump failures

Whilst no specific stability analyses have been undertaken on black shale waste dumps, they can generally be considered stable due to the process of encapsulation of the material well within a dump. Also, the process of undertaking earthworks to prepare the encapsulation is considered to add a significant contribution to the stability of the dump location. It is anticipated that future stability analyses may be documented in a Waste Dump Management Plan.

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Appendix 12: Summary of Hydrology and Flood Protection

RioTinto

RTIO Water Resource Evaluation

Hope Downs 2 & Bedded Hilltop

Summary of hydrology and flood protection

December 2021

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1. OVERVIEW

The purpose of this report is to assess the potential surface water risks associated with the closure of Hope Downs 2 (HD2) and Bedded Hilltop (BHT) mine sites.

Two-dimensional hydraulic modelling has been used to characterise the surface flow regime associated with surrounding surface water catchments interacting with the Life of Mine (LOM) pit and dump designs for both deposits. Modelling presented in this report has considered design flood flows from rare to very rare flood events. These models will be used to assess the risk and suitability of final closure landforms as closure planning progresses.

2. HYDROLOGY SUMMARY

HD2 and BHT deposits are located within the upper reaches of the Weeli Wolli Creek catchment that forms part of the Fortescue River Region (BoM, 2012). Weeli Wolli Creek has a total catchment area of approximately 4,770 km^2 to Waterloo Bore gauging station and drains north into the Fortescue Marsh; an extensive, intermittent wetland. The upper reaches of the Weeli Wolli Creek catchment include Pebble Mouse Creek, a major tributary of Weeli Wolli Creek, which has a catchment area of 340 km^2. Locations of these catchments is illustrated in Figure 1 and the catchment areas are summarised in Table 1.

Table 1: Catchment areas of Weeli Wolli Creek

Catchment	Catchment Area	Downstream Location
Weeli Wolli Creek	4,770 km^2	Fortescue Marsh
Weeli Wolli Creek	1,340 km^2	Tarina gauging station
Pebble Mouse Creek	340 km^2	Confluence with Weeli Wolli Creek

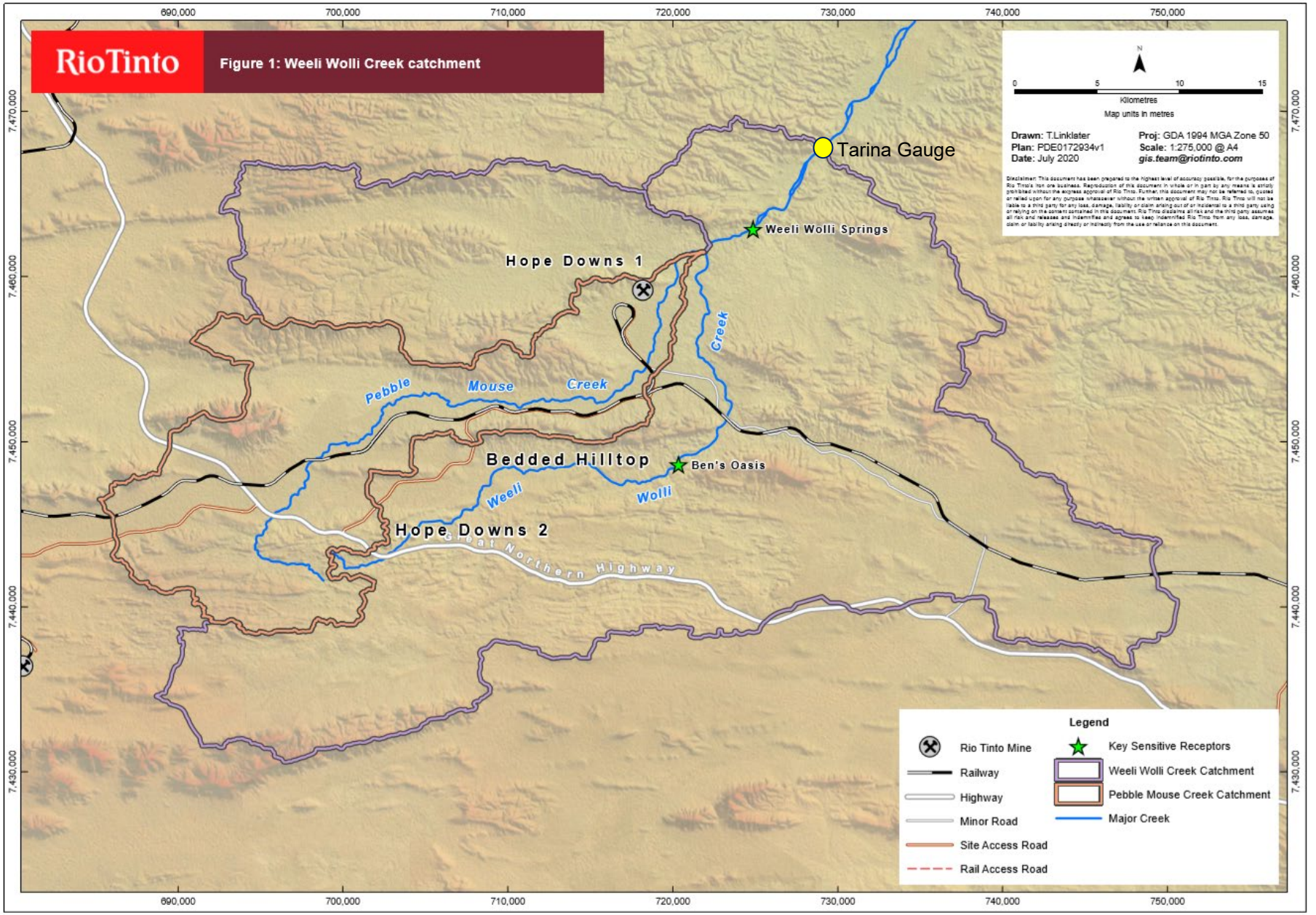

Figure 1: Weeli Wolli Creek catchment

Extensive surface water analysis of the Weeli Wolli Creek catchment has been undertaken in this and previous RTIO studies. A summary of regional and local catchment characteristics and hydrological modelling is provided below:

- Pilbara streamflow is predominantly short-lived, ephemeral and in direct response to rainfall, therefore it has a similar seasonality and variability to rainfall.
- There is a distinct lack of high quality, long-term streamflow data in the region.
- Pebble Mouse Creek catchment has a slope of 3.5 m/km, comparable with the Weeli Wolli Creek catchment (to Tarina gauge) with a slope of 3.65 m/km
- The Tarina gauging station is the closest stream flow gauge to the study area and is located on Weeli Wolli Creek, approximately 13 km downstream from the Pebble Mouse/Weeli Wolli Creek confluence (Figure 1).
- In the absence of local streamflow data, the streamflow regime in Pebble Mouse Creek is assumed to be similar to the flows at Tarina, which experienced two flow events per year (pre-mining record) on average.
- Gridded rainfall data indicates the study area experiences on average two rainfall events exceeding 35 mm per year which, compared with local streamflow data, suggests that 35 mm of rainfall is required in the catchment to produce flow. This result is also supported by Charles et. al. (2015) suggesting that the minimum rainfall required to produce flow in the catchment is 36 mm.
- Significant variation in estimated flood peaks of the 1:100 Annual Exceedance Probability (AEP) at Tarina is observed when comparing regional methods and Flood Frequency Analysis (FFA), with results ranging between 670 m^3/s and 3,180 m^3/s.
- A RORB rainfall-runoff routing model was developed for the Weeli Wolli catchment up to the Tarina gauge, with the Kc parameter calibrated using catchment rainfall and five recorded streamflow events at the gauge.
- The RORB model was configured to extract hydrographs at the BHT deposit by changing the design rainfall and areal reduction factor based on the Pebble Mouse Creek catchment upstream of BHT.

3. SURFACE WATER MANAGEMENT INFRASTRUCTURE

HD2 and BHT are bisected by the Pebble Mouse Creek and Weeli Wolli Creek catchment divide and do not interact with the flood plains of either creek (Figure 2). Proposed operational surface water management measures consist of levees, drains and culverts located across the active mining areas and are designed for flood magnitudes ranging between 1:20 and 1:100 AEP with design criteria adopted using a risk based approach.

Significant flood protection features include the Pebble Mouse Creek haul road crossing (Figure 3), with culverts designed for a 1:20 AEP event, which will be removed at closure; and the HD2 levee and diversion drains (Figure 4), designed to convey up to the 1:100 AEP flow rate, which will remain at closure.

There are three other potential crossings of Pebble Mouse Creek included in the HD2 proposal associated with options related to ore transport and the realignment of Great Northern Highway (GNH). These crossings include a conveyor crossing, an access road crossing and a bridge crossing on GNH. All these structures will be removed at closure, if constructed.

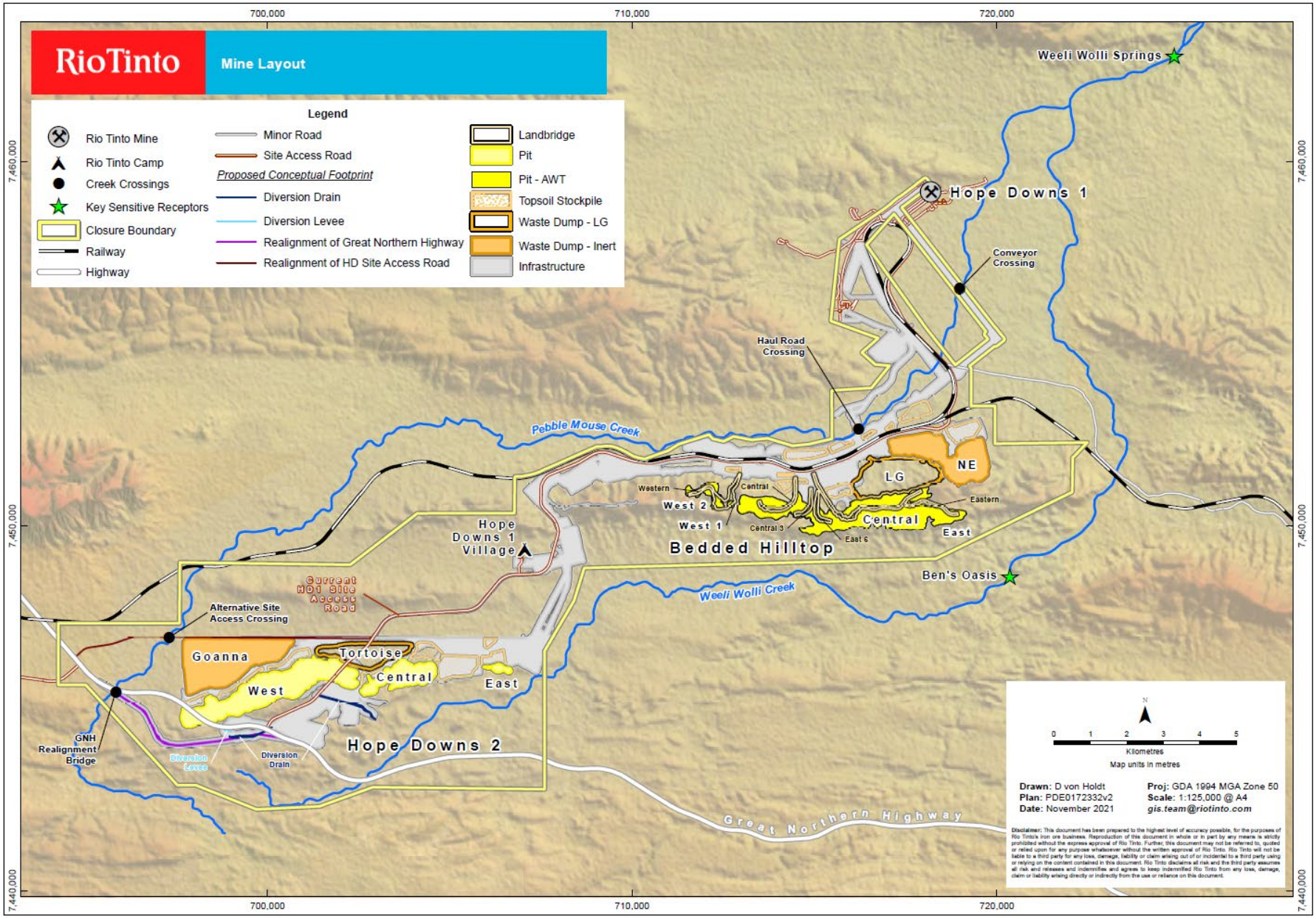

Figure 2: Hope Downs 2 & Bedded Hilltop Mine Layout

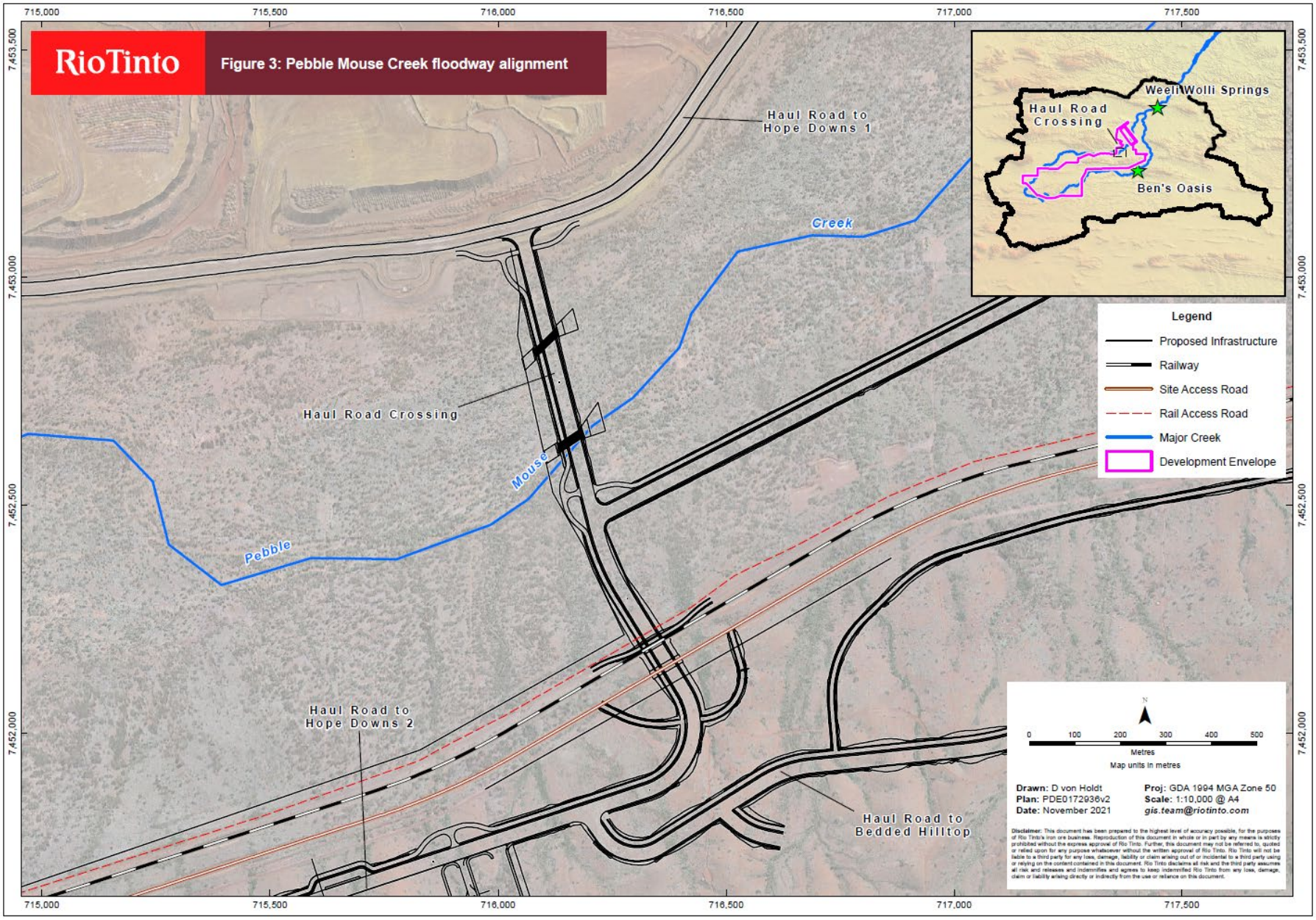

Figure 3: Pebble Mouse Creek floodway alignment

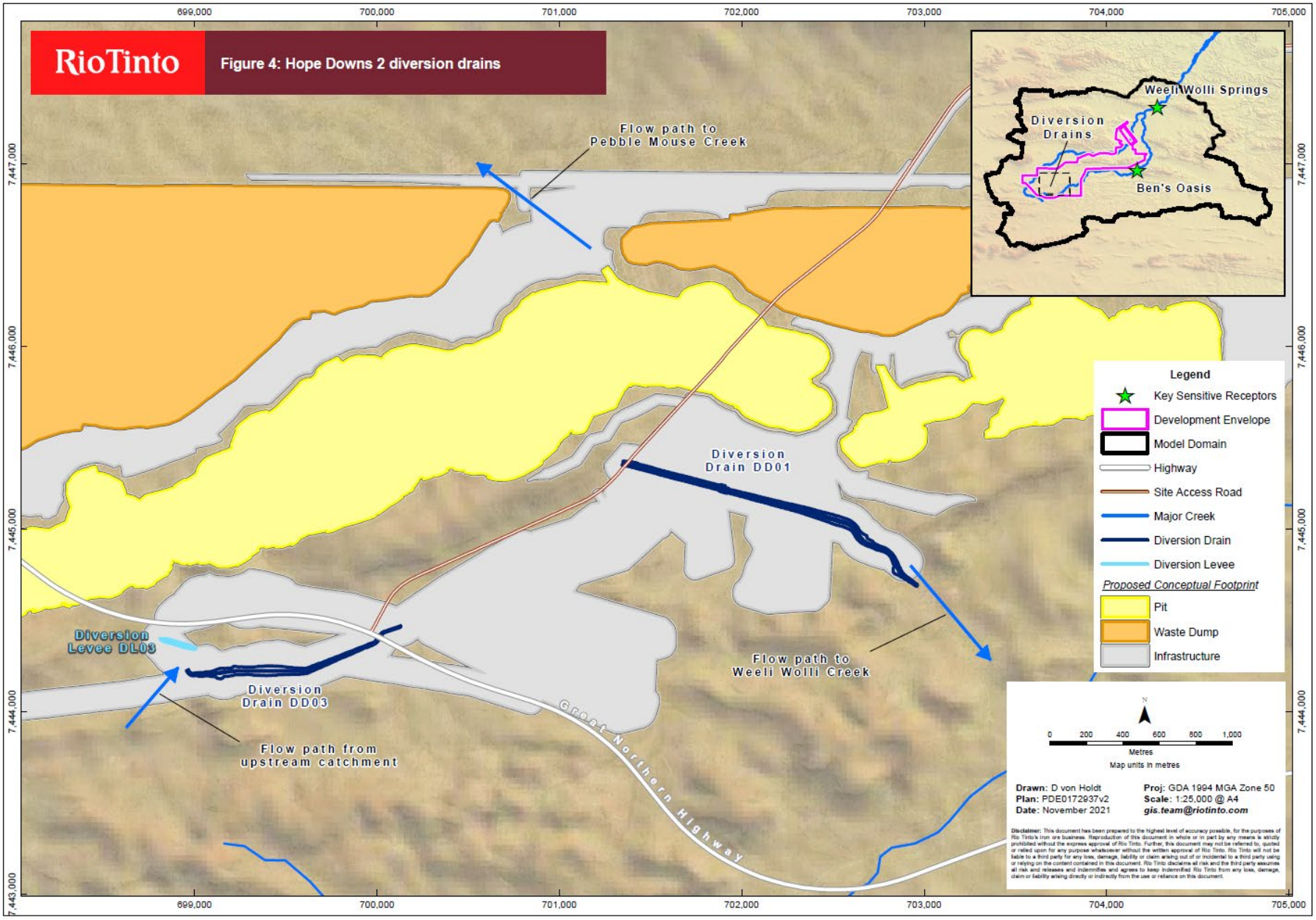

Figure 4: Hope Downs 2 diversion drains

4. DESIGN RAINFALL

Rainfall intensity frequency duration (IFD) data was extracted from the Bureau of Meteorology ARR2016 online data hub for a point located at the centroid of the Tarina RORB model. IFD data is available for durations between 1 minute and 168 hours and for AEPs between 63% and 1:2000. For rainfall AEPs over 1:200 and sub-daily durations the Jordan et al (2005) growth factors published in Book 8 of ARR2016 (Ball J 2016) were used to estimate rainfall depths. Areal reduction factors (ARFs) were adopted from the ARR data hub obtained for the Tarina catchment centroid.

The resultant rainfall IFD curves are shown in Figure 5.

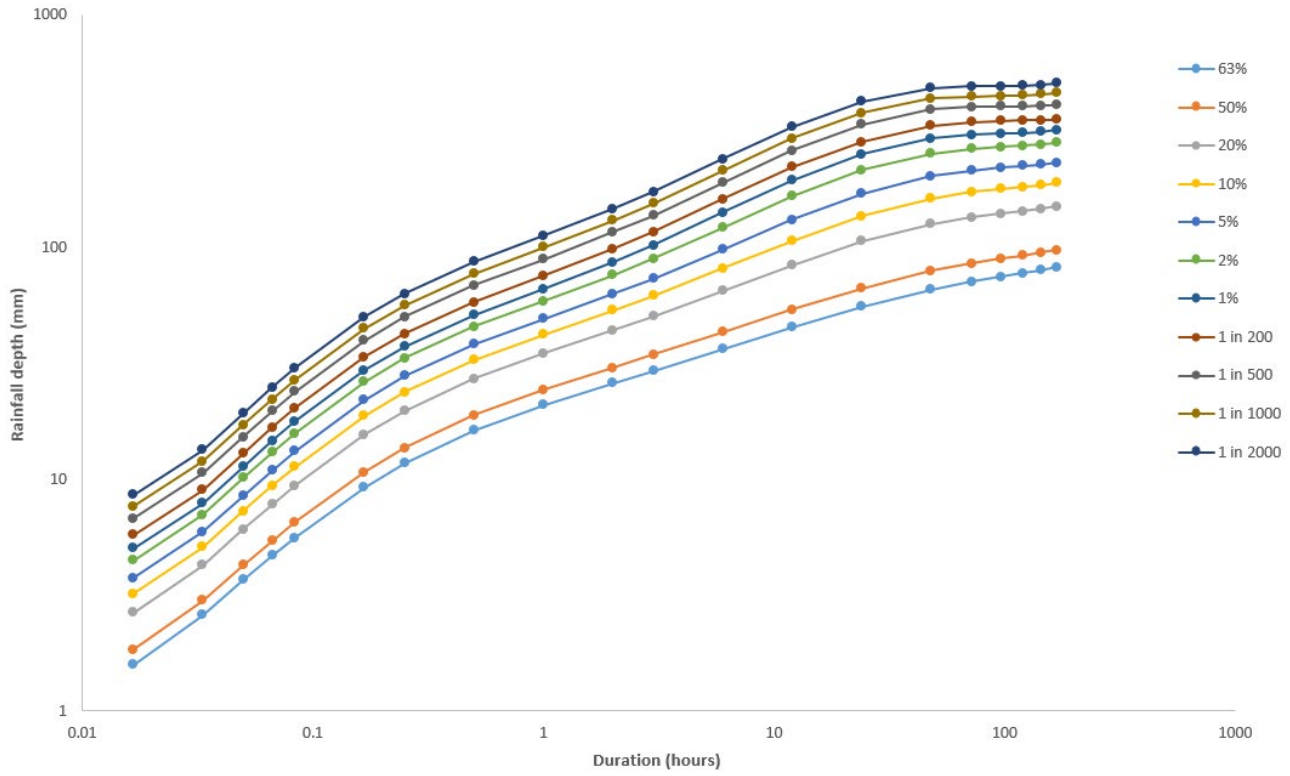

Figure 5: Design rainfall depths for AEPs used in the Tarina RORB model

5. FLOOD ESTIMATION

Using methods outlined in Australian Rainfall and Runoff (ARR2016), flood estimation of the upper Weeli Wolli Creek catchment was undertaken to provide site-wide estimates of design floods for rare to extreme events for Pebble Mouse Creek at the BHT deposit.

Catchment hydrological modelling (RORB) was combined with 2D hydraulic modelling (TUFLOW) to characterise the surface water flow regime across RTIO tenure at HD2 and BHT. Design flood quantiles were developed for the 1:2 AEP event up to the 1:1000 AEP event using a flood frequency analysis (FFA) at Department of Water and Environment (DWER) Tarina flow gauge and Monte Carlo simulation applied to a RORB model, which was calibrated to streamflow records at the same gauging station. The Tarina RORB model was refined to include a number of sub-catchments upstream of the area of interest (Pebble Mouse Creek) as recommended by Laurenson (2006) (Figure 6). This allowed estimates of design peak flows at the Bedded Hilltop deposit. Monte Carlo simulation was used to define design peak flows between the 1:5 AEP and the probable maximum precipitation flood (PMPF) using the regional RORB model with loss parameters calibrated to historical flood events, and a suite of design rainfalls and temporal patterns.

An ensemble rainfall simulation approach was used to calculate the Probable Maximum Flood (PMF) event, by determining the PMP storm pattern and duration which produces the largest peak flow with very low catchment losses.

The adopted peak flows used for inflow boundary in the BHT hydraulic simulations are listed in Table 2.

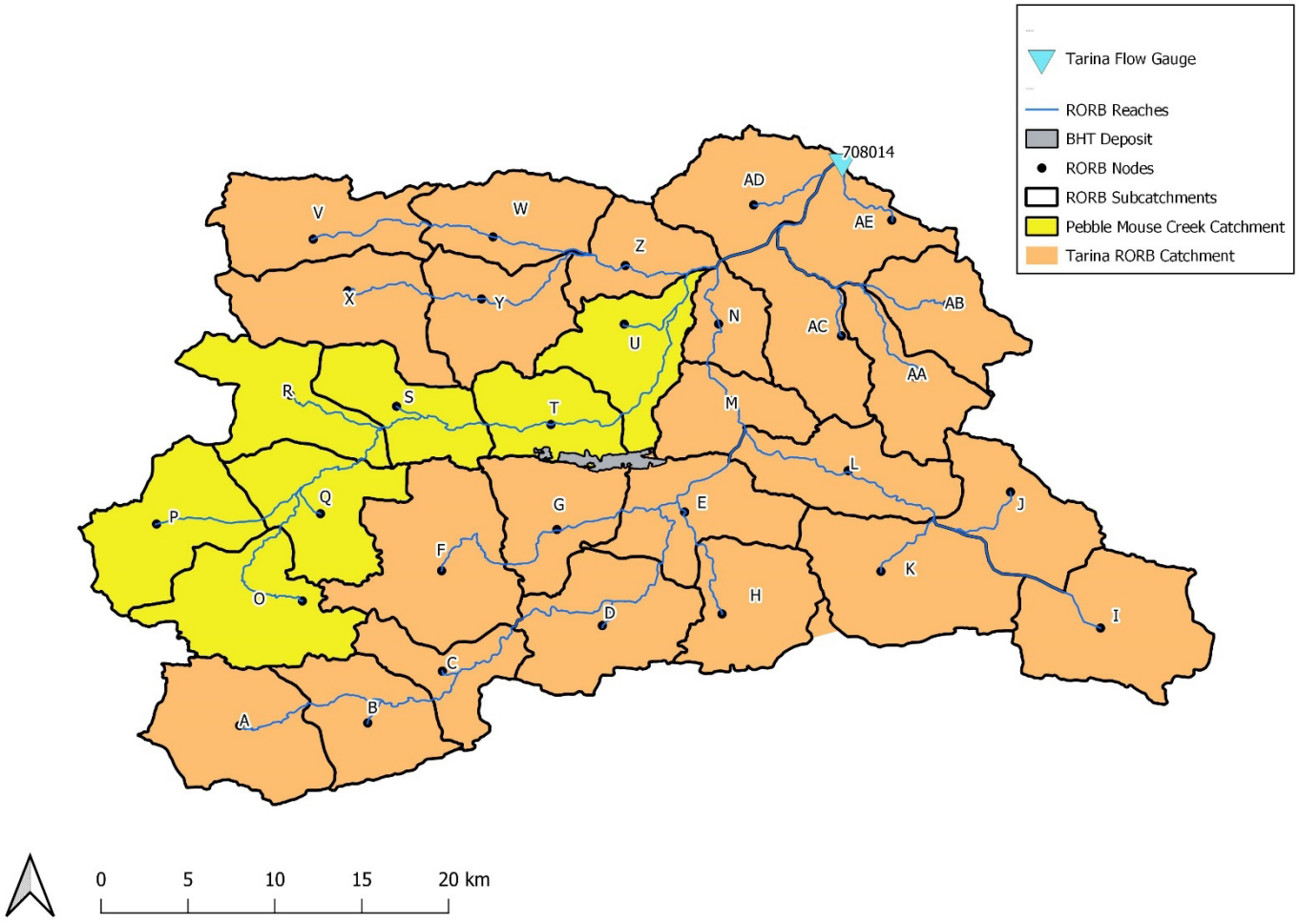

Figure 6: Pebble Mouse Creek/Tarina RORB model structure

Table 2: Adopted design peak flows for Pebble Mouse Creek upstream of Bedded Hilltop deposit

AEP (1:x)	5	10	20	50	100	1000	10,000	PMPF	PMF
PMC (m3/s)	69	190	370	618	858	1,722	3,353	9,373	10,860

There is a large uncertainty associated with peak flow estimates for the rare to extreme events, which are probabilistically unlikely to occur, with the result that there are limited, or no real-world examples of floods of this size. In order to put the magnitude of flood flows into perspective, the estimated design flood flows at Tarina gauging station were compared with the world maximum flood envelope curve (Rodier & Roche, 1984) and the largest recorded flood events for Australian catchments (Figure 7). The largest event recorded at Tarina gauging station reached a flow rate of 2,047 m^3/s, following rainfall from tropical cyclone John in December 1999, and this event was estimated at around a 1:50 AEP event.

For extreme events such as the 1:10,000 AEP, estimated peak flows fall above the world maximum flood envelope curve which is at 11,500 m^3/s for a 1,340 km^2 catchment. Although this does not rule out larger events as impossible, it does illustrate that the magnitude of flood flows considered for extreme events (1:10,000 AEP and above) is above the global precent set for catchments of this size. In particular, the peak flow estimated for the PMF event is more than four times the flow estimated by the curve.

Paleo flood investigations could be applied in the Weeli Wolli catchment to better constrain the limit of the extreme flood events but have not been commissioned by Rio Tinto at this stage.

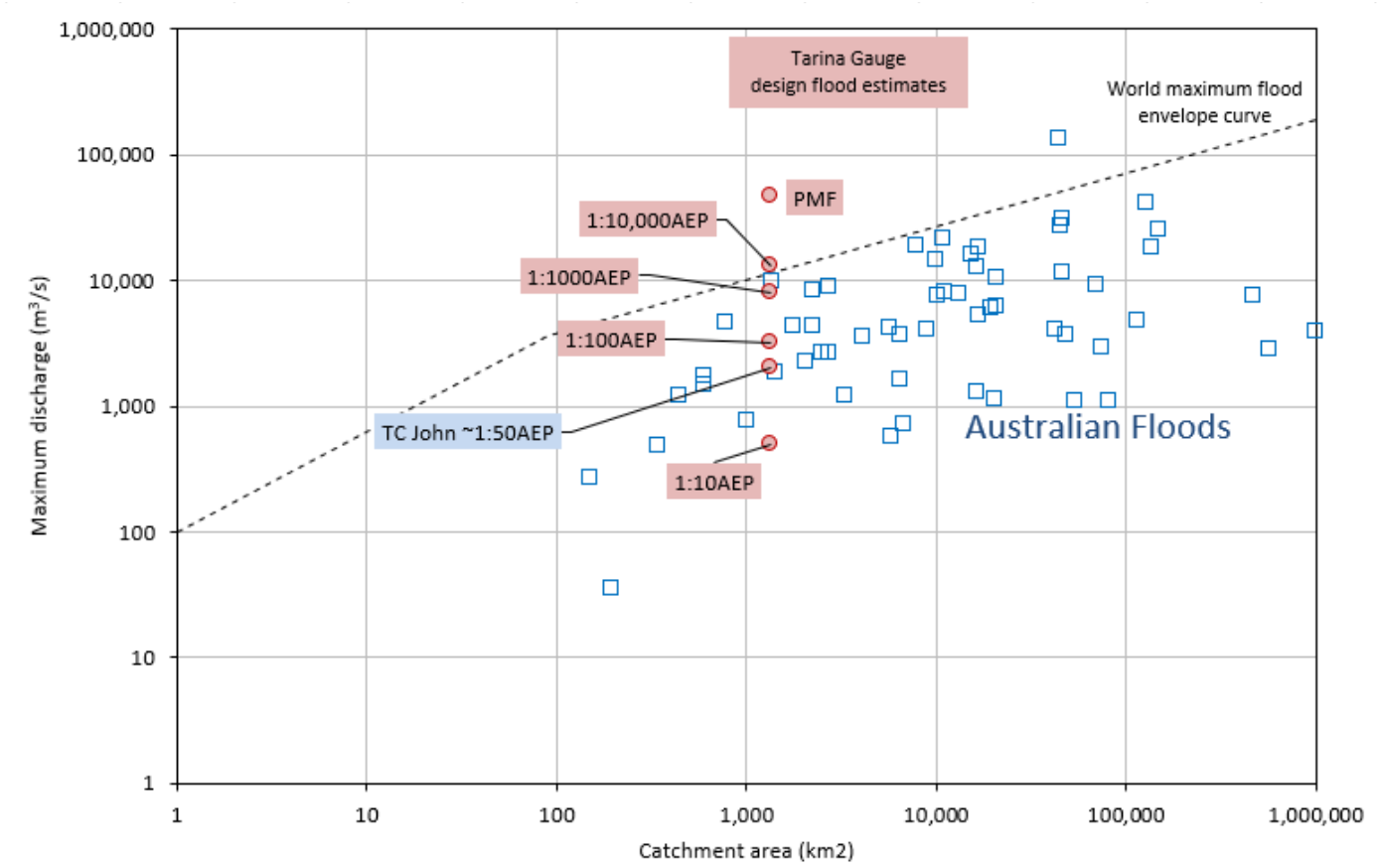

Figure 7: Select design peak flows for Weeli Wolli Creek catchment outlet, Tarina gauge, plotted against large Australian flood events and the world maximum flood envelope curve

5.1. Context for design flood estimates used in floodplain assessments

When considering the flood hazard associated with rare to extreme events, it is important to recognise the uncertainty and limitations in estimating flood events with a very low probability of occurrence. As noted in ARR2016 the uncertainties involved with the flood estimation process increase with increasing size of the flood. Events of between 1:100 AEP and 1:10,000 AEP are termed “very rare” but are considered within the range of largest direct observations and the credible limit of extrapolation (limit of plausible extrapolation from other sources of information). Extreme events are in the range between 1:10,000 AEP event and the PMF and represent the range of floods which borders on the ‘unknowable’, where even a high level of expertise cannot substantially reduce the level of uncertainty (ARR 2016). Figure 8 illustrates the nature of increasing uncertainty with increasing event size.

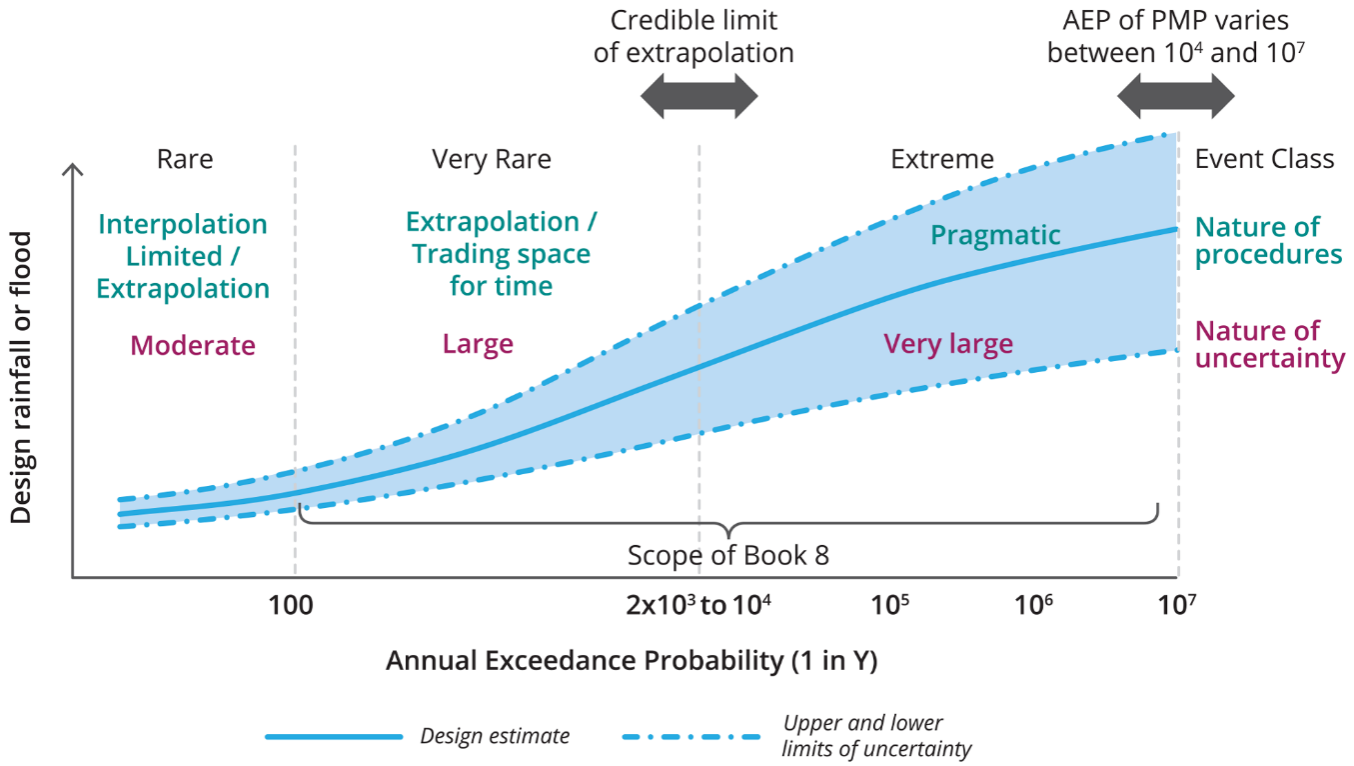

Figure 8: Design characteristics of notional event classes (ARR 2016)

The PMF is a design concept that notionally represents the upper limit on flood magnitude but for which an AEP cannot be readily assigned (ARR2016). Although it is possible to produce an estimate of the PMF and simulate the associated flood hydraulics, this needs to be viewed in an appropriate context. There is no precedent for events of this magnitude in a catchment of this size in Australia or globally. Furthermore, the probability of the PMP event occurring in a catchment this size (1,340 km^2) is 1:1,000,000, but the probability of the PMF cannot be reliably estimated as it requires both the PMP rainfall and extremely wet antecedent catchment conditions to coincide. Furthermore, it is possible that a catchment may change its behaviour when subjected to extreme rainfalls (ARR 2016), with geomorphological mechanisms and changes in storage and routing behaviour possible. Extreme floods can be landscape altering even in the natural (undeveloped) environment which can in turn alter the magnitude of the flood flows. Typically, estimates of the PMF would only be applied in very limited circumstances, for example, in the design of spillways for water or tailings dams which fall into a high-risk category.

Because of the reasons described above, it is suggested that the following events are appropriate for use in assessing performance of operational flood protection and to inform closure planning:

- The 1:100 AEP flood can be reliably estimated using the methods adopted and is appropriate for use in floodplain assessments for operational infrastructure.
- The 1:1,000 AEP flood is a realistic event to use when identifying risks associated with greater than design flood events for closure, as it falls within the credible limit of extrapolation, and below the world maximum flood envelope curve (for Weeli Wolli Creek catchment).
- As an extreme case, the 1:10,000 AEP flood event may be considered, as this event is at the upper end of the credible limit of extrapolation and falls just above the envelope curve.

Application of the PMF is not appropriate for a generalised site-wide floodplain assessment. It may be appropriate to further refine flood estimates of the PMF in future for application in risk assessments of specific infrastructure approaching closure.

6. HYDRAULIC MODELLING

Two-dimensional hydraulic models were developed, using TUFLOW hydraulic modelling software, in order to characterise the surface water flow regime around both HD2 and BHT mining infrastructure. The methodology and results are outlined below.

6.1. Modelling assumptions and limitations

Note the following modelling assumptions and limitations:

- All flood simulations consider only current land surfaces, and life of mine designs. As such they represent the approximate “end of mining” surface and are not closure landforms. Based on the proposed closure strategy for operational flood protection infrastructure at both sites, the PMC haul road crossing at BHT has been removed and the diversion structures at HD2 remain in place as permanent features.
- No consideration has been given to proposed backfill areas.
- Note that downstream flood hydrology may be significantly impacted by upstream closure strategies, and this inter-relationship has not been considered since only operational landforms have been included in simulations.
- Detailed drainage features such as smaller stormwater drains around mining infrastructure (such as buildings), culverts proposed for the haul road and mine access roads are only represented at a coarse level.
- This assessment identifies likely areas of initial over-topping of operational flood protection for above-design flows, and highlights locations where pit voids are proximal to the floodplain of creek systems. However, terrain surfaces are considered static and as such no erosion or infrastructure failure has been considered.

Despite these limitations, the operational flood modelling provides a reasonable indication of relative risk across operations at HD2 and BHT and highlights focus areas for closure planning.

6.2. BHT model domain

The model domain included the full extent of the BHT catchments to the south, Baby Hope (an existing mine providing sustaining tonnes to the HD1 mine operations) catchments to the north and the section of Pebble Mouse Creek that these surface water catchments discharge to (Figure 9). The eastern boundary extended to the HD1 rail line but this infrastructure has not been included.

6.3. BHT digital terrain model

The digital elevation model (DEM) was developed based on current topography (LIDAR datasets) and BHT and Baby Hope ultimate pit and dump designs, referred to as Life of Mine (LOM) designs. Terrain surfaces required to cover the full extent of the model domain varied in resolution. A 10 m computational grid was adopted for TUFLOW model simulations.

6.4. BHT boundary conditions and surface roughness

Boundary conditions in the model included an inflow hydrograph for PMC (extracted from the RORB model – see Section 5), an outflow boundary at the downstream (eastern) end of PMC but upstream of the HD1 rail line, and an open boundary along the southern extent of the model domain to account for a small section of an adjacent catchment that drains south, away from BHT and PMC, thus not impacting the mines.

Design rainfall applied as rain-on-grid to all active cells, using a representative rainfall temporal pattern equivalent to the adopted critical duration events for Pebble Mouse Creek, which is 18 hours for the 1:100 AEP and 12 hours for the 1:1000 AEP and 1:10,000 AEP. Model simulation time was set to 27 hours.

Losses were incorporated into the model through soil infiltration with no initial loss and a continuing loss of 5.5 mm/hr. These are significantly lower than the ARR2016 recommended loss values for this area however they were adopted based on a calibration to match RORB peak flows at a downstream location.

A global Manning's n roughness of 0.04 was applied across the model domain.

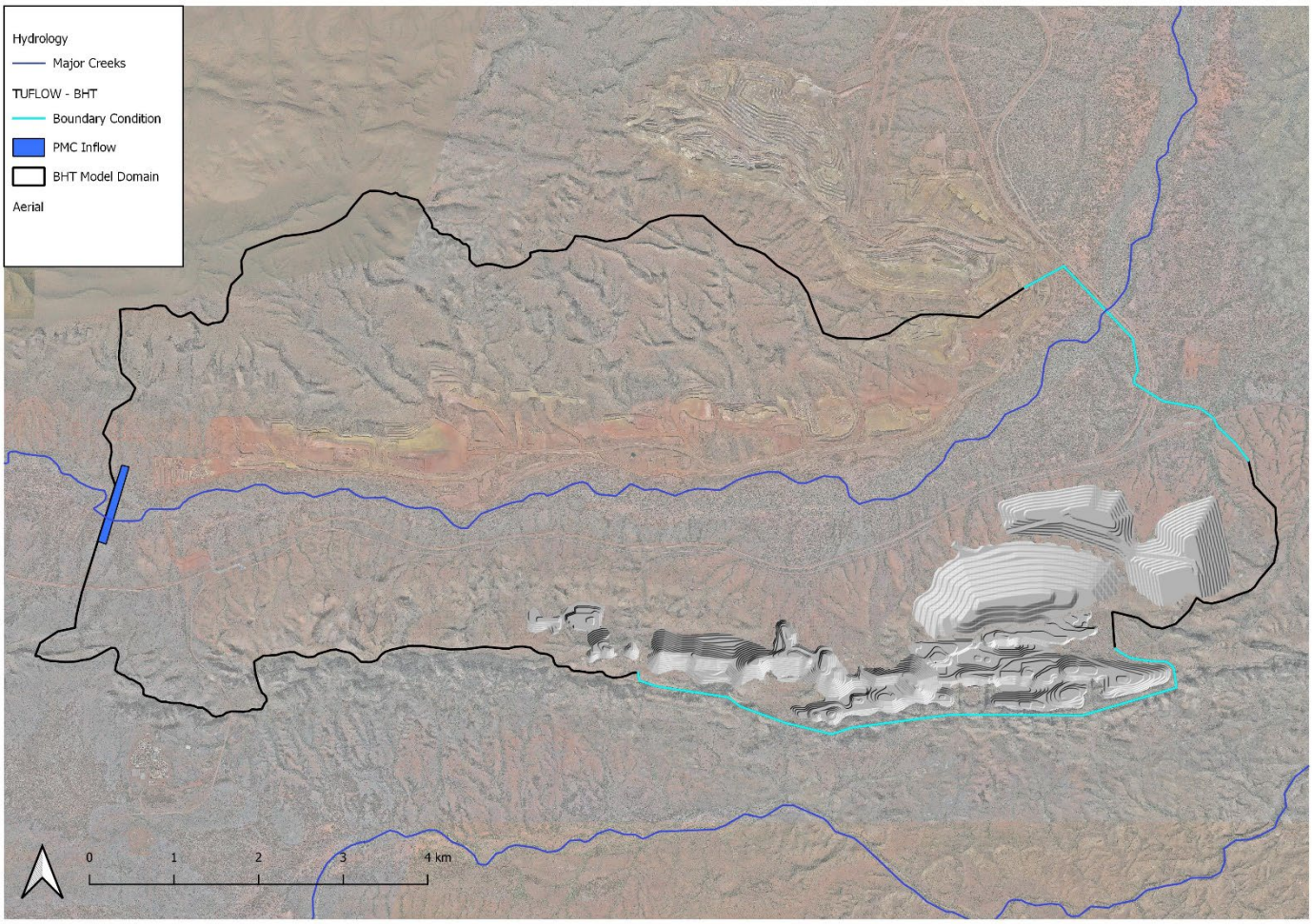

Figure 9: BHT hydraulic model extent, boundary conditions and modelled LOM designs

6.5. HD2 model domain

The model domain included the upper catchment of the named section of Weeli Wolli Creek, south of the HD2 mining area. The western boundary was limited to the extent of the western pit and waste dump but excluded the main flow channel of Pebble Mouse Creek to the north east. The northern boundary was limited to a natural ridgeline, dividing the Pebble Mouse Creek and Weeli Wolli Creek catchments (Figure 10).

6.6. HD2 digital terrain model

The DEM was developed based on current topography (LIDAR datasets) and HD2 LOM designs. Terrain surfaces required to cover the full extent of the model domain varied in resolution. A 10 m computational grid was adopted for TUFLOW simulations.

6.7. HD2 boundary conditions and surface roughness

Five critical outflow boundaries have been used in this model. Two along the western boundary to allow flow out to the west, and three along the eastern boundary, one of which represents flow from Weeli Wolli Creek.

Design rainfall was applied as rain-on-grid to all active cells, using a representative rainfall temporal pattern equivalent to the adopted critical duration events for Weeli Wolli Creek in that part of the catchment, which is 2 hours for the 1:100 AEP and 1 hour for the 1:1000 AEP and 1:10,000 AEP. Model simulation time was set to 6 hours.

Losses were incorporated into the model through soil infiltration with no initial loss and a continuing loss of 5.5 mm/hr. These are significantly lower than the ARR2016 recommended loss values for this area however they were adopted based on a calibration to match RORB peak flows at a downstream location.

A global Manning's n of 0.04 was applied across the model domain.

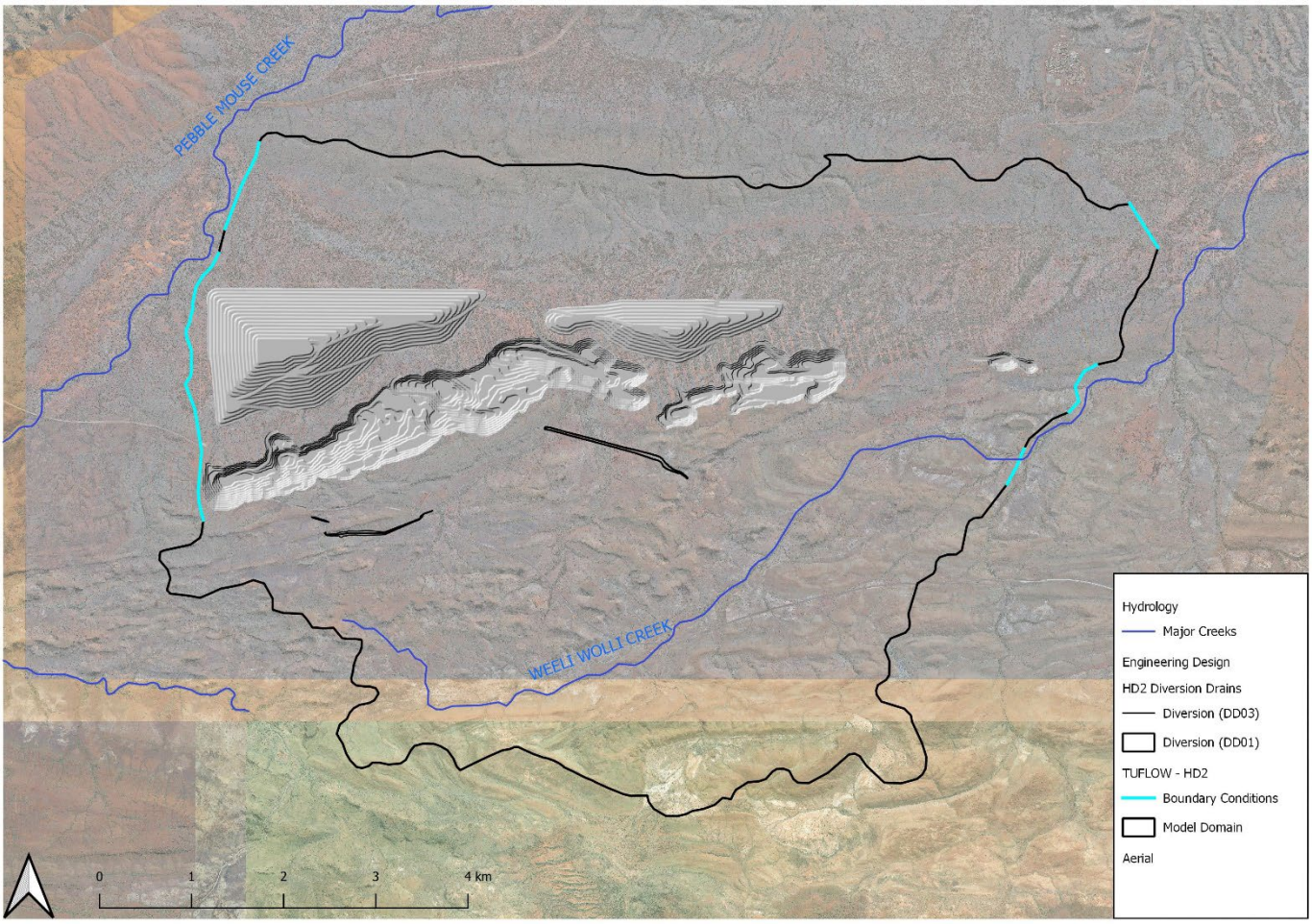

Figure 10: HD2 hydraulic model extent, boundary conditions and modelled LOM designs

7. RESULTS

This section presents the hydraulic modelling results for the 1:100, 1:1000 and 1:10,000 AEP for both models.

Results for the BHT model are presented in Figures 11 – 15, while results for the HD2 model are presented in Figures 16 – 22.

Maximum flood depths are shown for the full model domain extent for each model. Peak velocities are also presented for the full extent of the BHT model and the HD2 diversion structures in the HD2 model.

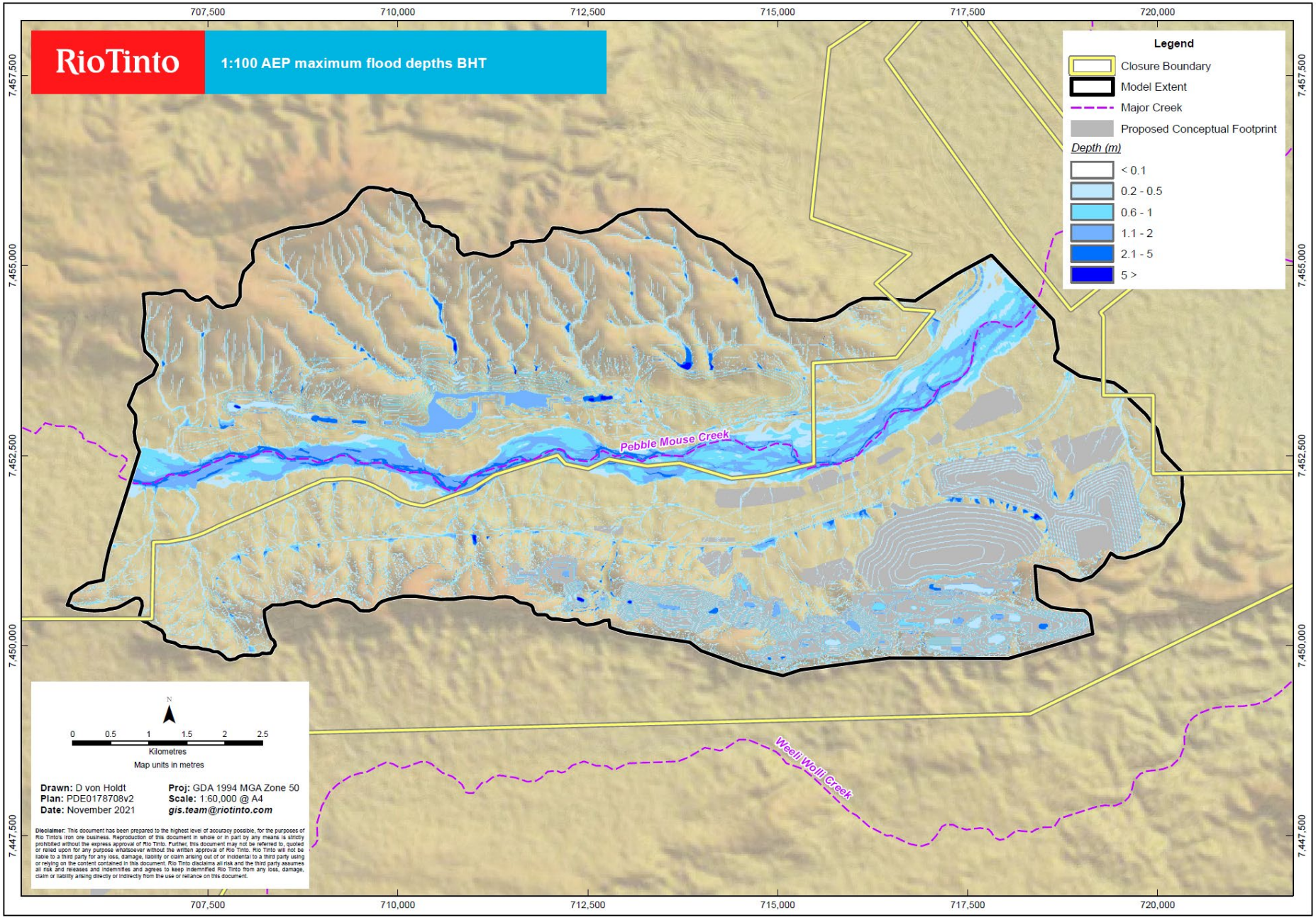

Figure 11: 1:100 AEP Maximum Flood Depths at BHT

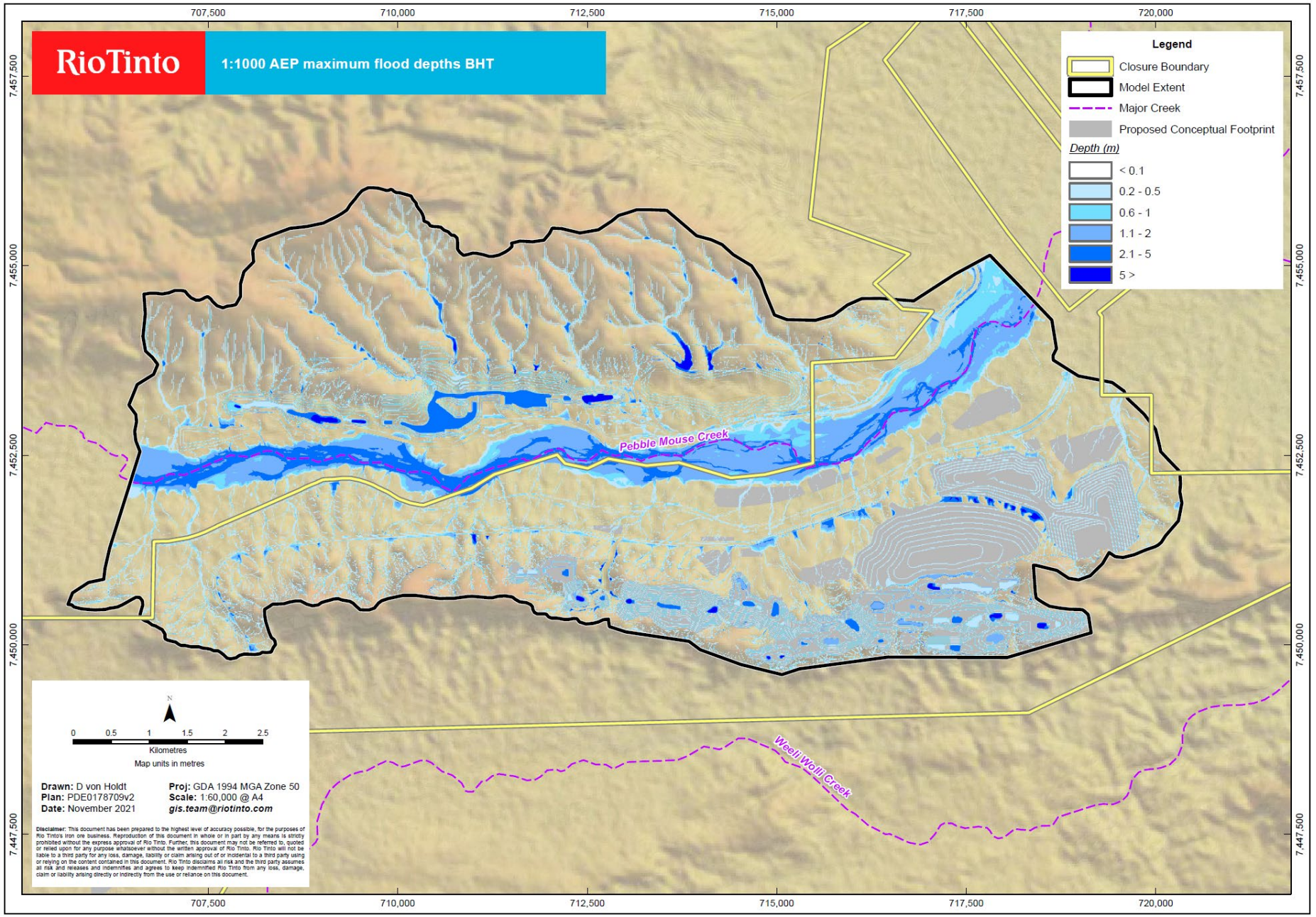

Figure 12: 1:1000 AEP Maximum Flood Depths at BHT

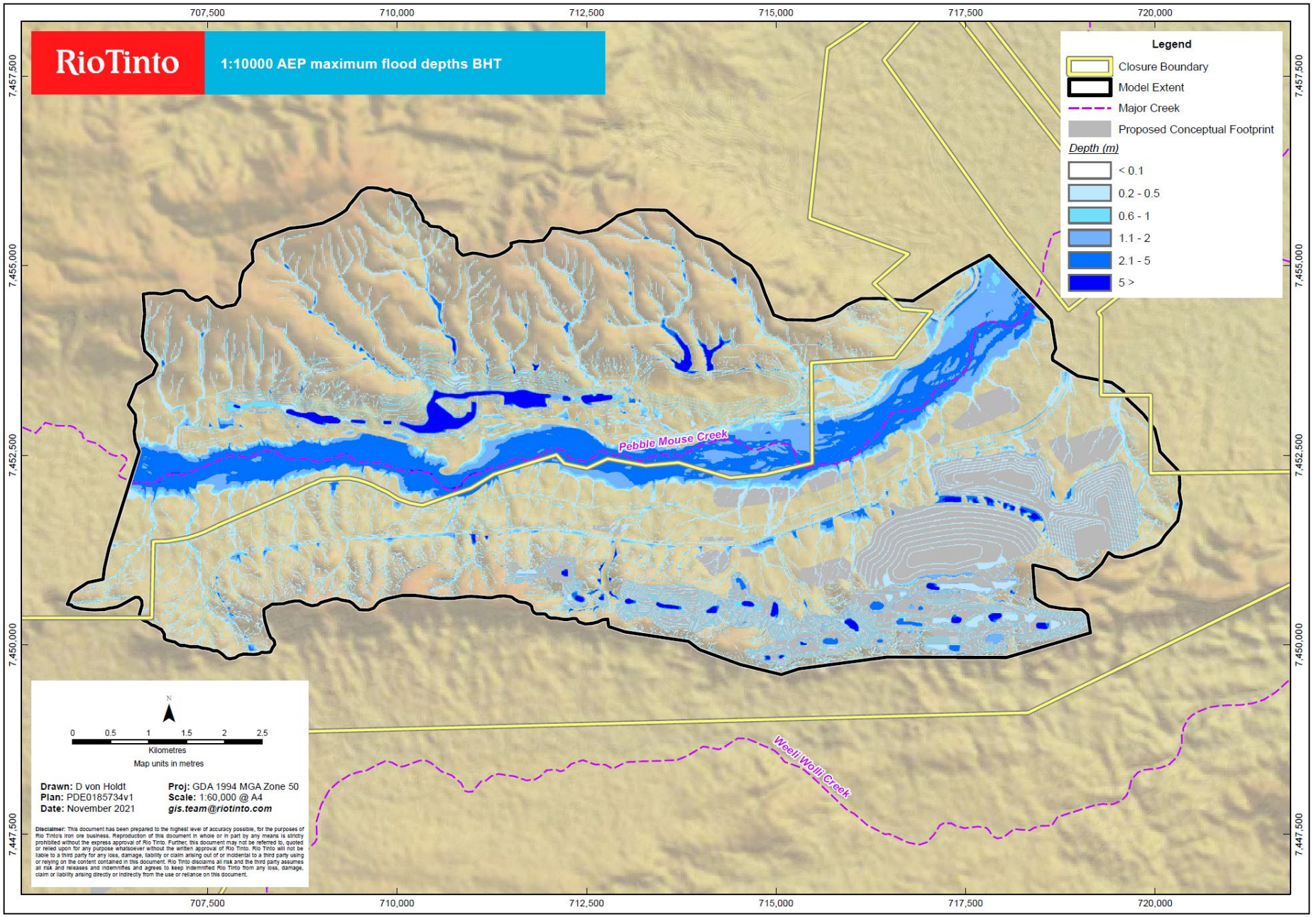

Figure 13: 1:10,000 AEP Maximum Flood Depths at BHT

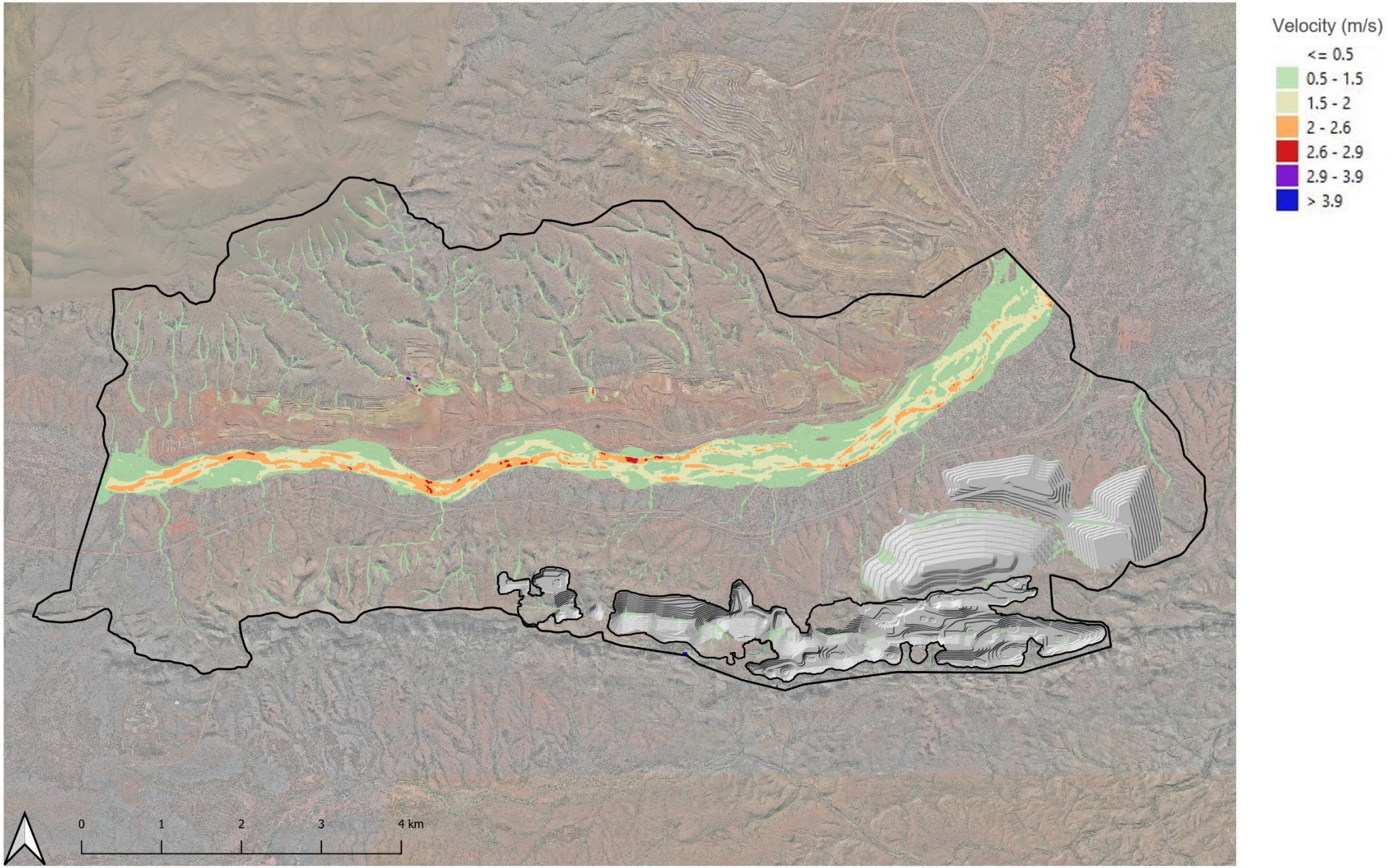

Figure 14: 1:100 AEP Maximum Velocities at BHT

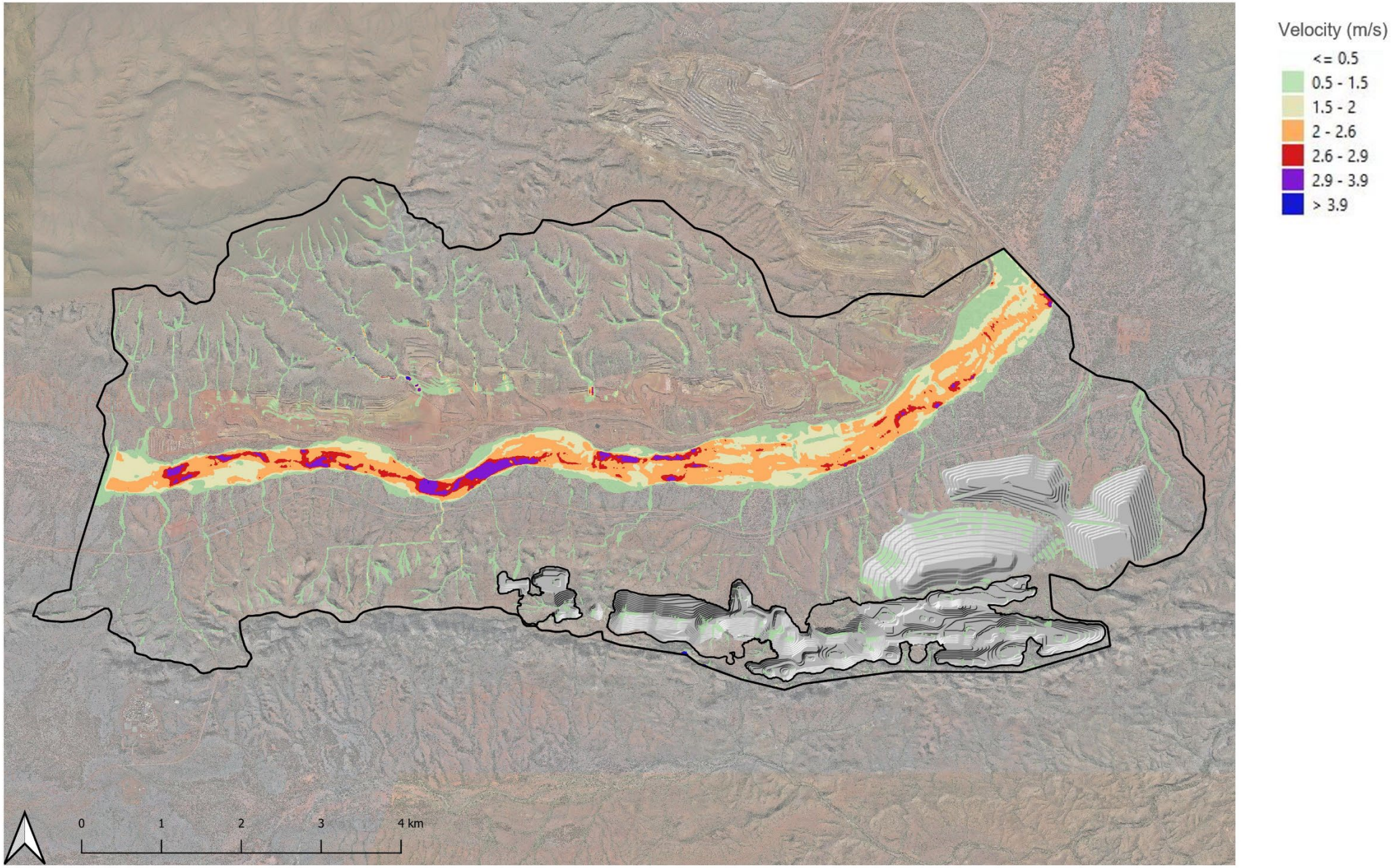

Figure 15: 1:1000 AEP Maximum Velocities at BHT

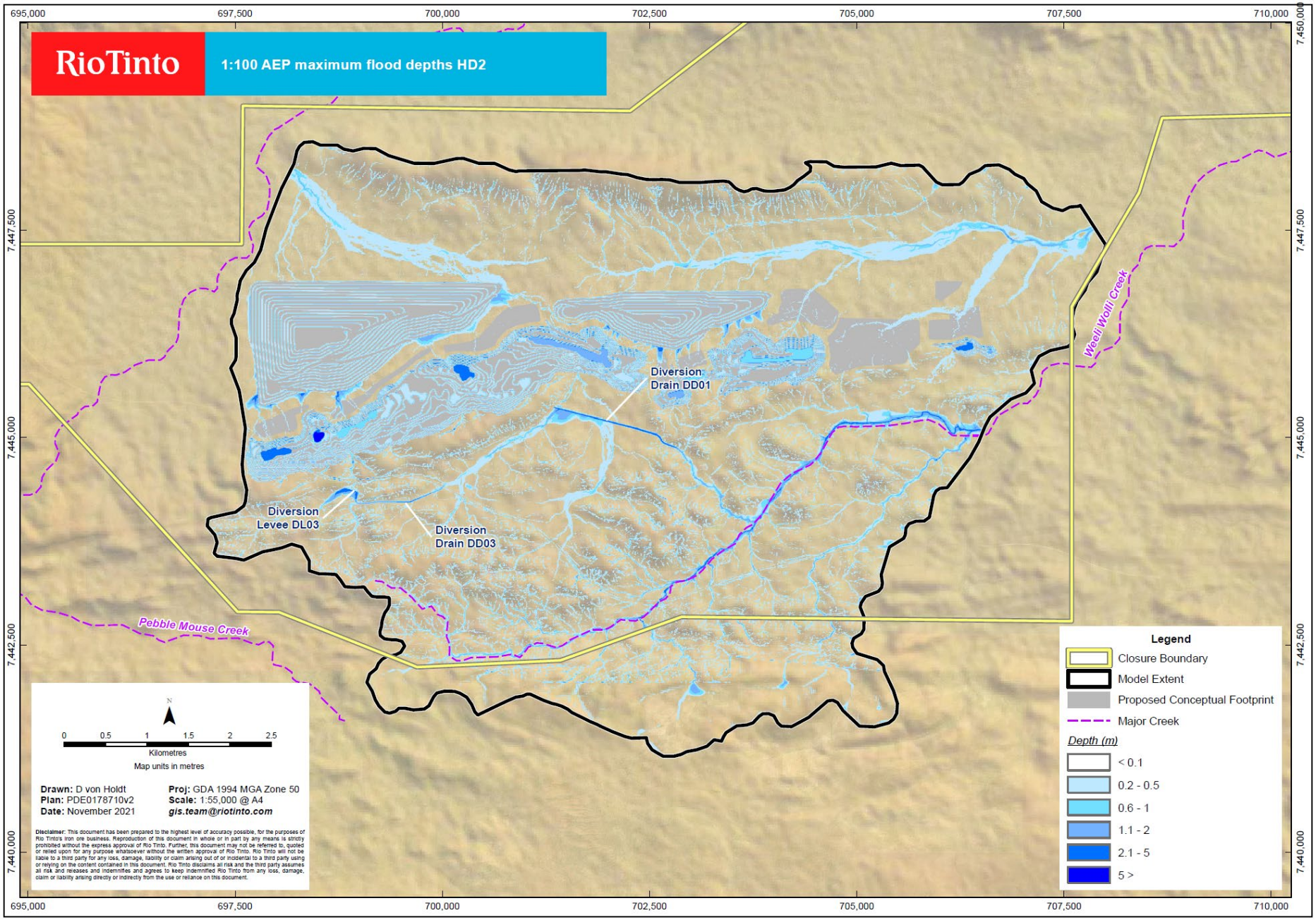

Figure 16: 1:100 AEP Maximum flood depths at HD2

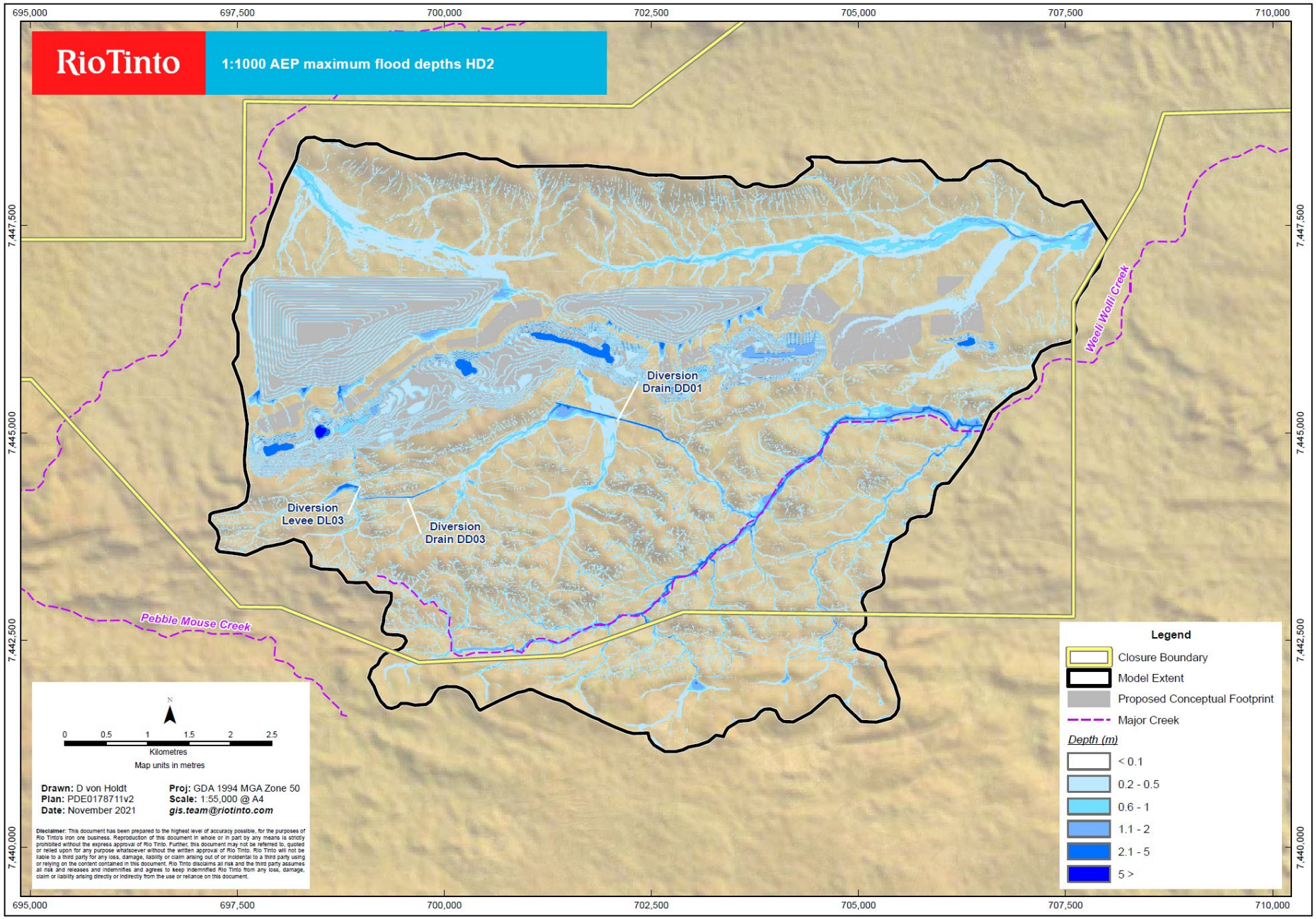

Figure 17: 1:1000 AEP Maximum flood depths at HD2

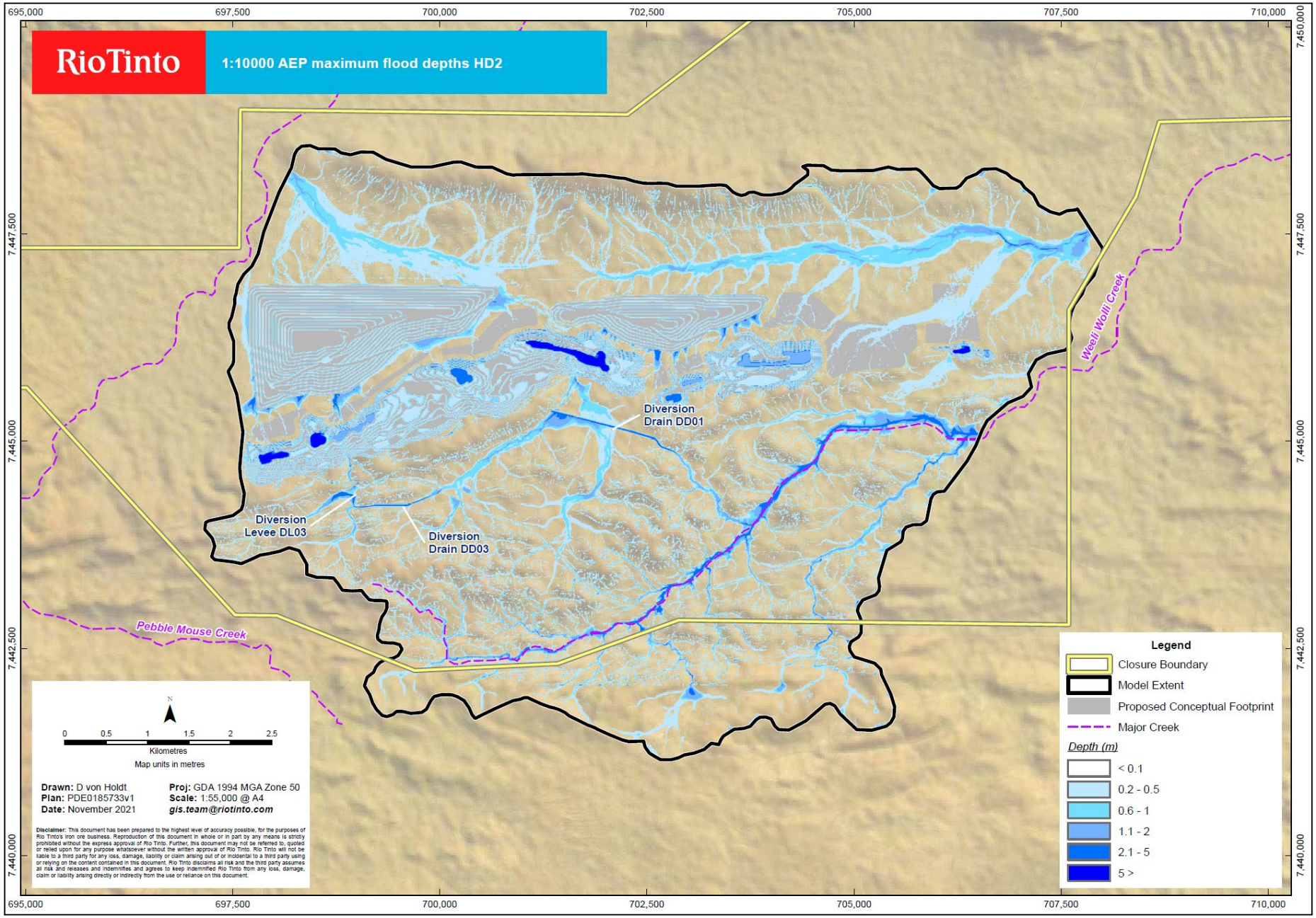

Figure 18: 1:10,000 AEP Maximum flood depths at HD2

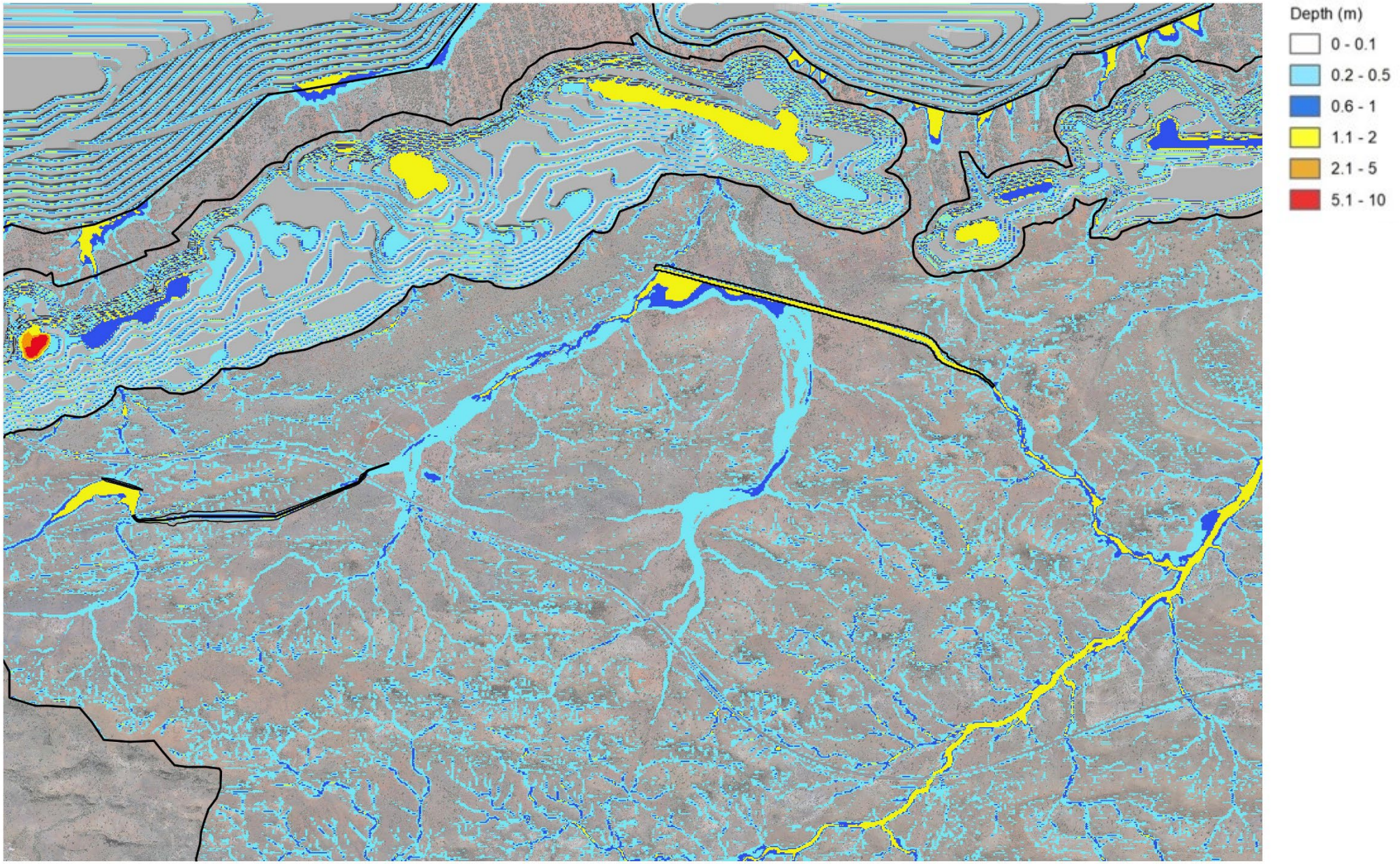

Figure 19: 1:100 AEP Maximum flood depths at HD2 diversion structures

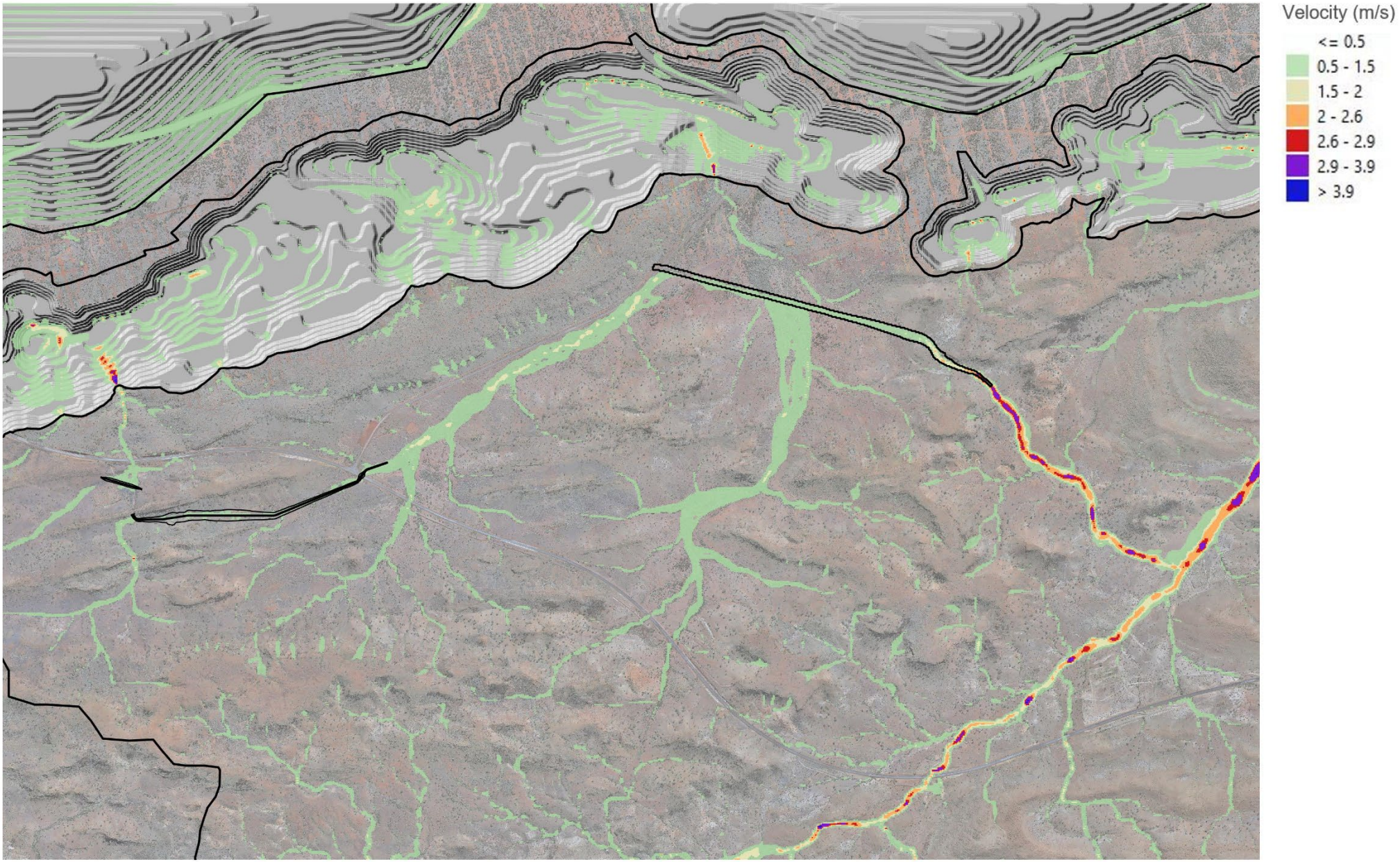

Figure 20: 1:100 AEP Maximum velocities at HD2 diversion structures

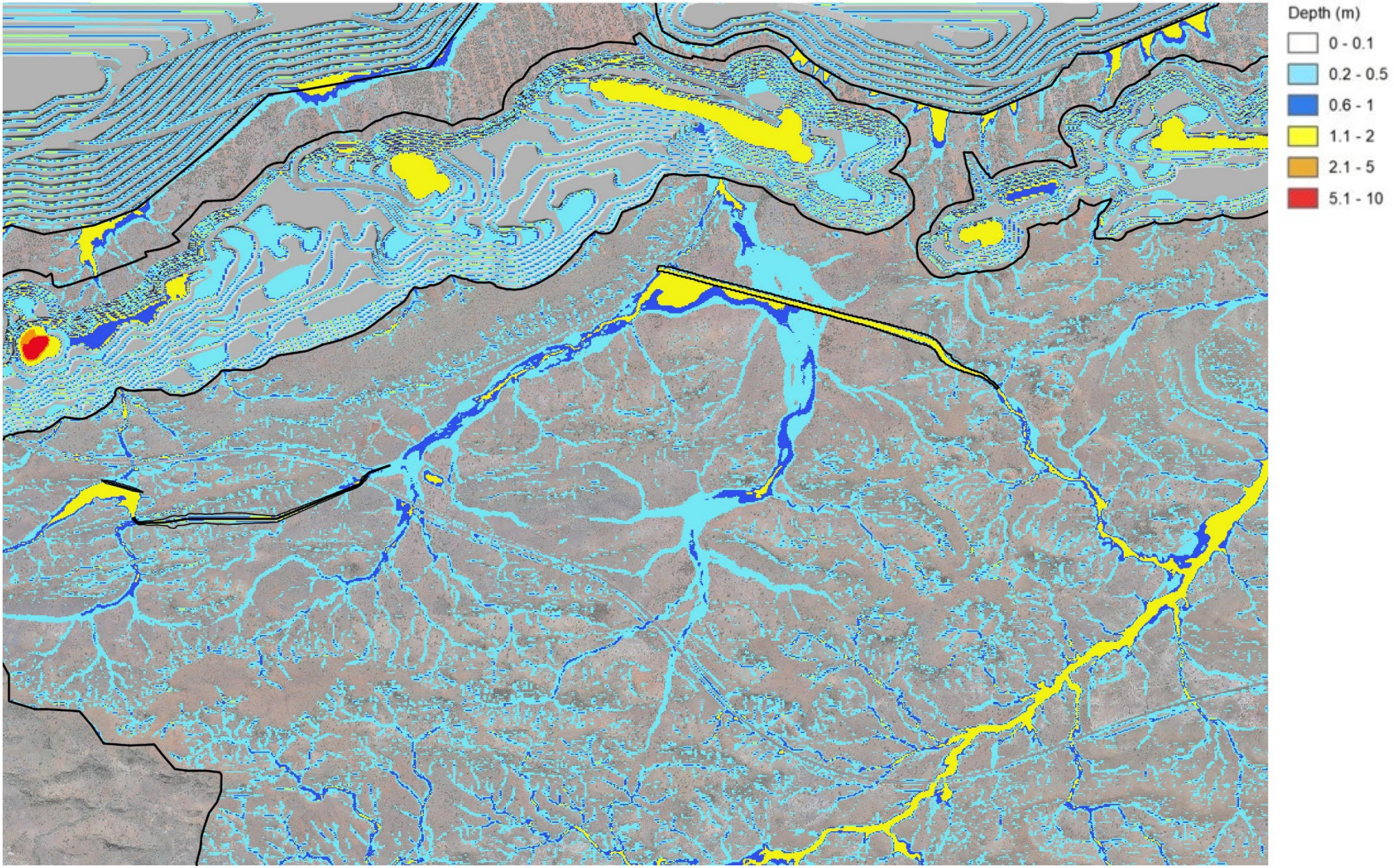

Figure 21: 1:1000 AEP Maximum flood depths at HD2 diversion structures

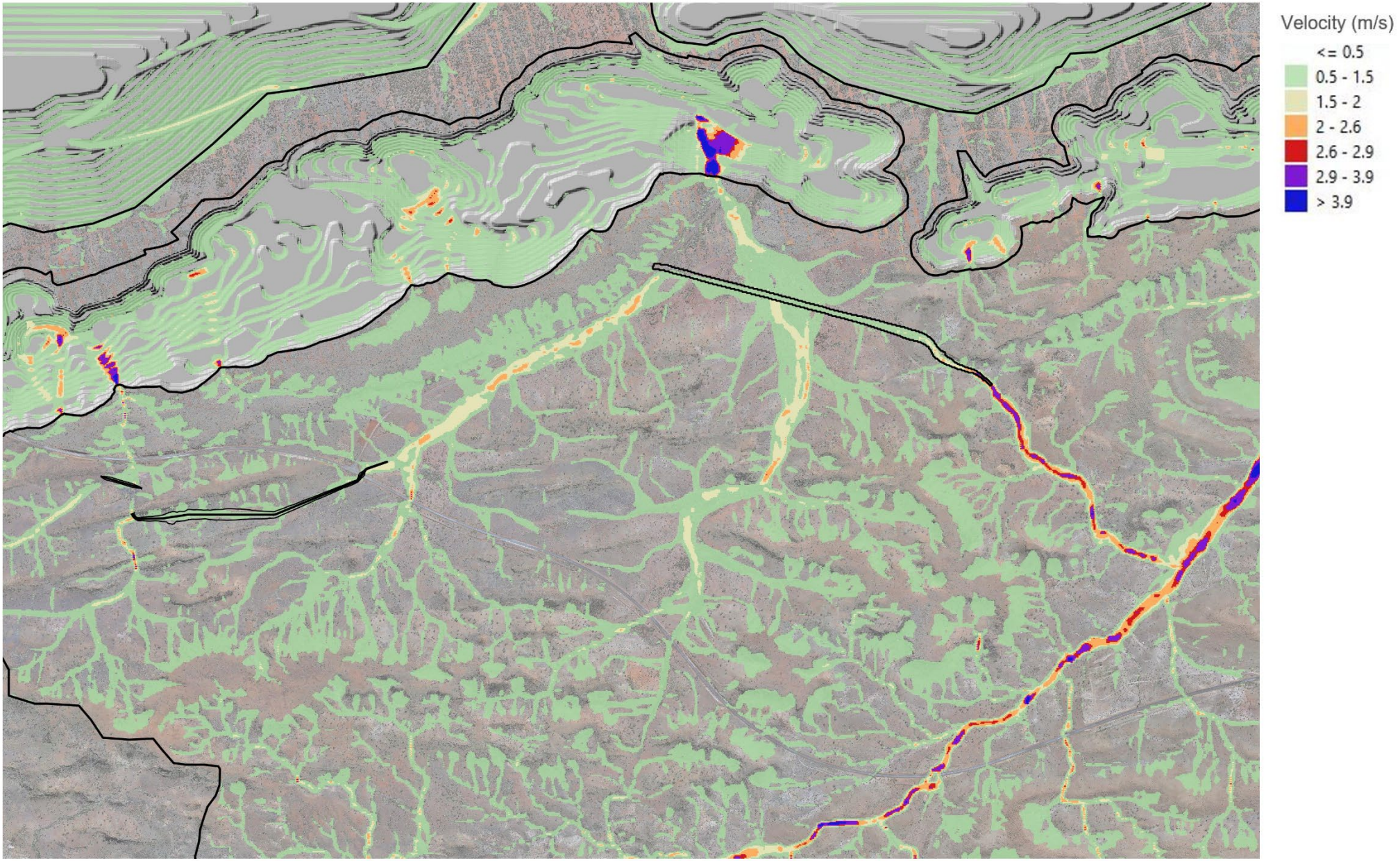

Figure 22: 1:1000 AEP Maximum velocities at HD2 diversion structures

8. SURFACE WATER RISKS

8.1. Bedded Hilltop

Rare (1:100 AEP), very rare (1:1000 AEP) and extreme (1:10,000 AEP) flood modelling of Pebble Mouse Creek indicates there are relatively low flood risks associated with the pit and waste dump designs at Bedded Hilltop. End of mine landforms associated with BHT do not interact directly with the floodplain of the creek. Results show no risk of pits overtopping or significant flooding around waste dumps, even in the very rare event.

Removal of the haul road crossing at Pebble Mouse Creek allows the creek to return its natural (pre mining) flow regime.

8.2. Hope Downs 2

Rare to extreme flood modelling of the catchments intersected by HD2 mine site also indicates relatively low flood risks associated with pit and waste dump designs.

The permanent feature of the diversion drains south of the western pit allow the upstream catchment to continue contributing runoff to Weeli Wolli Creek. Alternatively, if the diversions were to be removed this volume of water would be lost to the pit void.

The diversion structures are designed for the 1:100 AEP event, therefore in the very rare event results indicate overtopping of the drains with runoff flowing north into the western pit. Significantly high velocity rates are estimated at the pit crest during the very rare event, increasing the risk of erosion, potentially causing pit instability at these locations. As a result, it is recommended these drainage structures be designed to withstand a minimum 1:1000 AEP event at closure. This would allow for continued contribution of flows to the downstream WWC catchment and maintain the integrity of the diversion levee and drains.

9. POST CLOSURE MANAGEMENT

The hydrologic risks associated with the closure of Hope Downs 2 and Bedded Hilltop are relatively low.

Detailed closure landform designs are yet to be developed. But as part of future closure planning Rio Tinto plans to design, upgrade and/or construct landforms which will improve landform stability over closure time frames.

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Appendix 13: Assessment of Surface Water Impacts on Sensitive Receptors in the Weeli Wolli Creek Catchment

RioTinto

RTIO Water Resource Evaluation

Hope Downs 2 & Bedded Hilltop

Assessment of surface water impacts on sensitive receptors in the Weeli Wolli Creek catchment

May 2022

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EXECUTIVE SUMMARY

This report presents an assessment of the potential impacts on surface water quantity and quality at Weeli Wolli Spring and Ben's Oasis from mining infrastructure proposed for the HD2 Proposal which includes deposits at Bedded Hilltop (BHT) and Hope Downs 2 (HD2). Weeli Wolli Spring and Ben's Oasis are located within the Weeli Wolli Creek catchment and are referred to as sensitive receptors due to their Aboriginal heritage and environmental significance.

A two-dimensional (2D) hydraulic model was developed to characterise the surface water flow regime of Weeli Wolli Creek and Pebble Mouse Creek (a major tributary of Weeli Wolli Creek) in their existing conditions. This regional model was used to quantify the total volume and peak flows estimated at the sensitive receptors. An operational mining scenario was also modelled to simulate estimated surface water flows once HD2 and BHT mining infrastructure had been constructed. Comparison of results from the two scenarios highlighted areas within Weeli Wolli Creek and Pebble Mouse Creek that experienced a change in maximum water depths due to mining infrastructure, in particular the addition of diversion drains at HD2 and a haul road crossing at Pebble Mouse Creek.

The water quality component of the assessment considered the potential for sediments at the Pebble Mouse Creek haul road crossing to be transported 14 km downstream and impacting Weeli Wolli Spring. A refined, localised 2D hydraulic model was developed focusing on flows within Pebble Mouse Creek at the location of the floodway crossing as well as the HD1 rail crossing (consisting of multiple culverts and located 4 km downstream of the floodway). Evaluation of velocities at these crossings and assumptions of sediment transport behaviour formed the basis of the water quality analysis.

Results from the regional model indicated that mining operations associated with the HD2 Proposal (including pits, dumps and drainage infrastructure) truncated approximately 3.5% of the total catchment reporting to Weeli Wolli Spring. This resulted in the loss of 1 % of the total runoff volume at the Spring and a reduction of the peak flow by 1.4 %, based on the 1:100 annual exceedance probability (AEP) 24 hour rainfall event. At Ben's Oasis, the catchment reporting to this location was truncated by 0.2 %, which resulted in a reduction to peak flow of 1.1%.

Results from the localised model indicated that during frequent (1:5 AEP) and rare (1:100 AEP) rainfall events, flood depths are increased on the upstream side of the floodway and rail culverts due to the attenuation and backwater impacts of these structures. Velocities modelled at these locations are observed to be lower on the upstream side as flow is throttled by the crossing obstruction, with a distinct increase in velocity at and immediately downstream of the crossing as flow is concentrated through the floodway or culvert.

The slight loss of runoff demonstrated through the regional modelling is expected to have little effect on the flow regime at either sensitive receptor and is therefore expected to have insignificant impact of the environmental and heritage values of Weeli Wolli Spring or Ben's Oasis. This is further reinforced by the fact that water levels in Weeli Wolli Spring are supplemented by Hope Downs 1 dewatering discharge and Ben's Oasis is a groundwater sustained system.

High flood depths and low velocities observed on the upstream side of the rail crossing in results from the local model support the increased deposition of sediment at the rail culvert inlets and most likely poor transport of sediment through the culverts. Therefore, sediment transported from haul road crossings over Pebble Mouse Creek is considered unlikely to impact water quality at Weeli Wolli Spring.

1. INTRODUCTION

The purpose of this report is to assess the potential surface water impacts to the sensitive receptors, Weeli Wolli Spring and Ben's Oasis, within the Weeli Wolli Creek catchment from the mining infrastructure proposed for the HD2 Proposal which includes deposits at Bedded Hilltop (BHT) and Hope Downs 2 (HD2).

The cumulative effects of mining and interventions resulting from the HD2 Proposal in the Weeli Wolli Creek catchment have the potential to alter the flooding characteristics and flooding frequency of the creek system. Activities such as construction of diversion structures and haul/access road crossings can potentially modify the existing surface flow regimes. Existing pits at HD1 and development of future pits for the HD2 Proposal may also truncate local catchments thus reducing flow contribution to Weeli Wolli Creek and its tributaries. These changes in surface flow regime may result in reductions to peak and total flow volumes, with the potential to impact water quality through a change in sediment loading.

Two-dimensional hydraulic modelling has been utilised to characterise the surface flow regime in Weeli Wolli Creek and assess the changes in surface water quantity and quality, in particular at Weeli Wolli Spring and Ben's Oasis.

2. REGIONAL HYDROLOGY

HD2 and BHT deposits are located within the upper reaches of the Weeli Wolli Creek catchment that forms part of the Fortescue River Region (BoM, 2021). Weeli Wolli Creek has a total catchment area of approximately 4,770 km^2 to Waterloo Bore gauging station and drains north to the Fortescue Marsh.

The upper reaches of the Weeli Wolli Creek catchment include Pebble Mouse Creek, a major tributary of Weeli Wolli Creek, which has a catchment area of 340 km^2. HD2 and BHT deposits are bisected by the Pebble Mouse Creek and Weeli Wolli Creek catchment divide and do not interact with the flood plains of either creek.

The Tarina gauging station (operated by DWER) is the closest stream flow gauge to the study area and is located on Weeli Wolli Creek, about 7 km downstream of Weeli Wolli Spring. The Weeli Wolli Creek catchment area reporting to the Tarina gauge is about 1,530 km^2 and this area is illustrated in Figure 1.

Table 1: Catchment areas of Weeli Wolli Creek

Catchment	Area	Downstream Location
Weeli Wolli Creek	4,770 km^2	Fortescue Marsh
Weeli Wolli Creek	1,530 km^2	Tarina gauging station
Weeli Wolli Creek	1,340 km^2	Weeli Wolli Spring
Weeli Wolli Creek	420 km^2	Ben's Oasis
Pebble Mouse Creek	340 km^2	Confluence with Weeli Wolli Creek

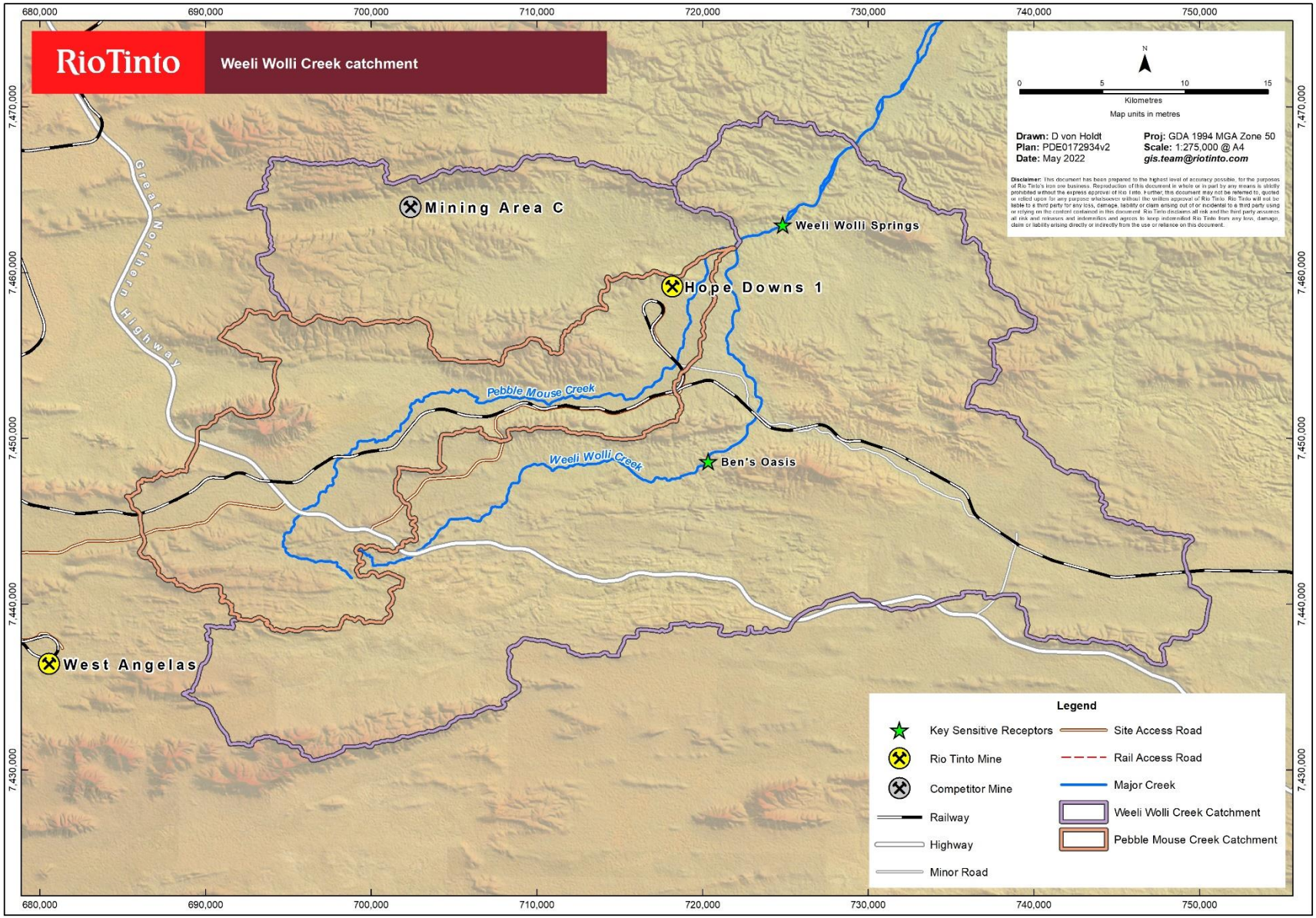

Figure 1: Weeli Wolli Creek catchment

3. MINING INFRASTRUCTURE

The proposed mine layout for HD2 and BHT is shown in Figure 2.

This report focused on the drainage infrastructure proposed to assist with surface water management at the HD2 and BHT pits, in particular the Pebble Mouse Creek Haul Road crossing, the Pebble Mouse Creek Road Train crossing and the diversion drains at HD2 as highlighted in Figure 2.

Consideration of additional waterway crossings proposed are also provided in this report. These crossings are associated with alternative transport options being explored as part of the study and include: the realignment of Great Northern Highway (GNH); an alternative mine access road; and an overland conveyor from HD2 to HD1.

Preliminary engineering designs for most of the infrastructure have been included in the hydraulic modelling undertaken for this report's analysis.

3.1. Pebble Mouse Creek Haul Road Crossing

Pebble Mouse Creek is a significant waterway separating the existing mining facilities at HD1 and the deposits of BHT and HD2. It is proposed that the haul road connecting the BHT deposit to the HD1 processing infrastructure will cross Pebble Mouse Creek. An engineered crossing will be constructed to manage flood risk and allow continuity of production. The width of Pebble Mouse Creek bed at the proposed crossing location is approximately 350 m, as shown in Figure 3**Error! Reference source not found.**.

During the development of the proposed engineered solution for the creek crossing a haul road with culverts was defined, and three different concept design options, providing varying levels of flood serviceability, were evaluated. These options along with their design criteria are summarised in Table 2.

Table 2: Pebble Mouse Creek haul road crossing design options

Option	Design AEP	Design flow rate	Crossing structure
1	1% (1:100)	827.3 m^3/s	41 x DN2700 culverts
2	5% (1:20)	257.7 m^3/s	13 x DN2700 culverts
3	Low flow (assumed 50%, 1:2)	Not specified	4 X DN900 relief culverts

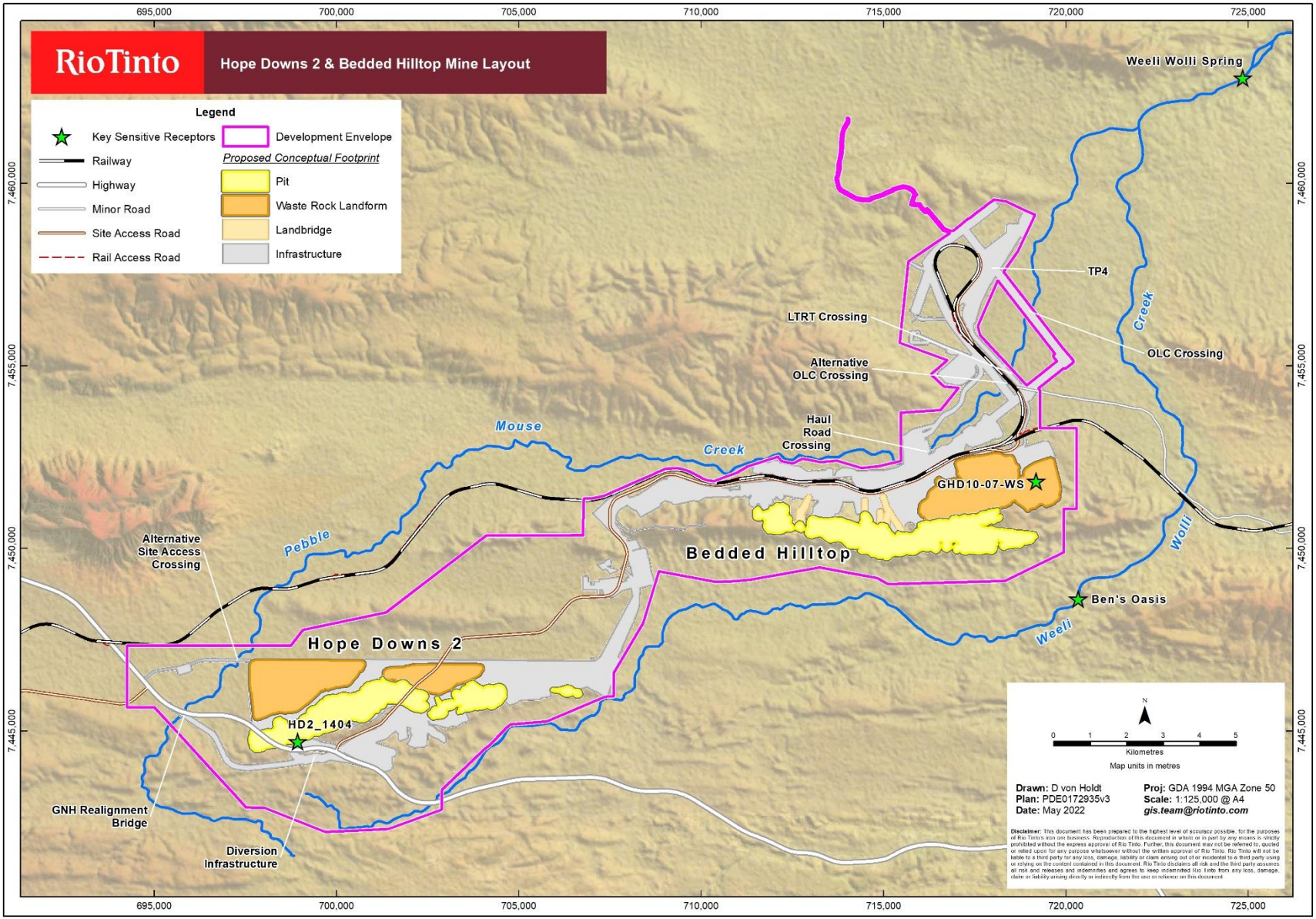

Figure 2: Hope Downs 2 & Bedded Hilltop Mine Layout

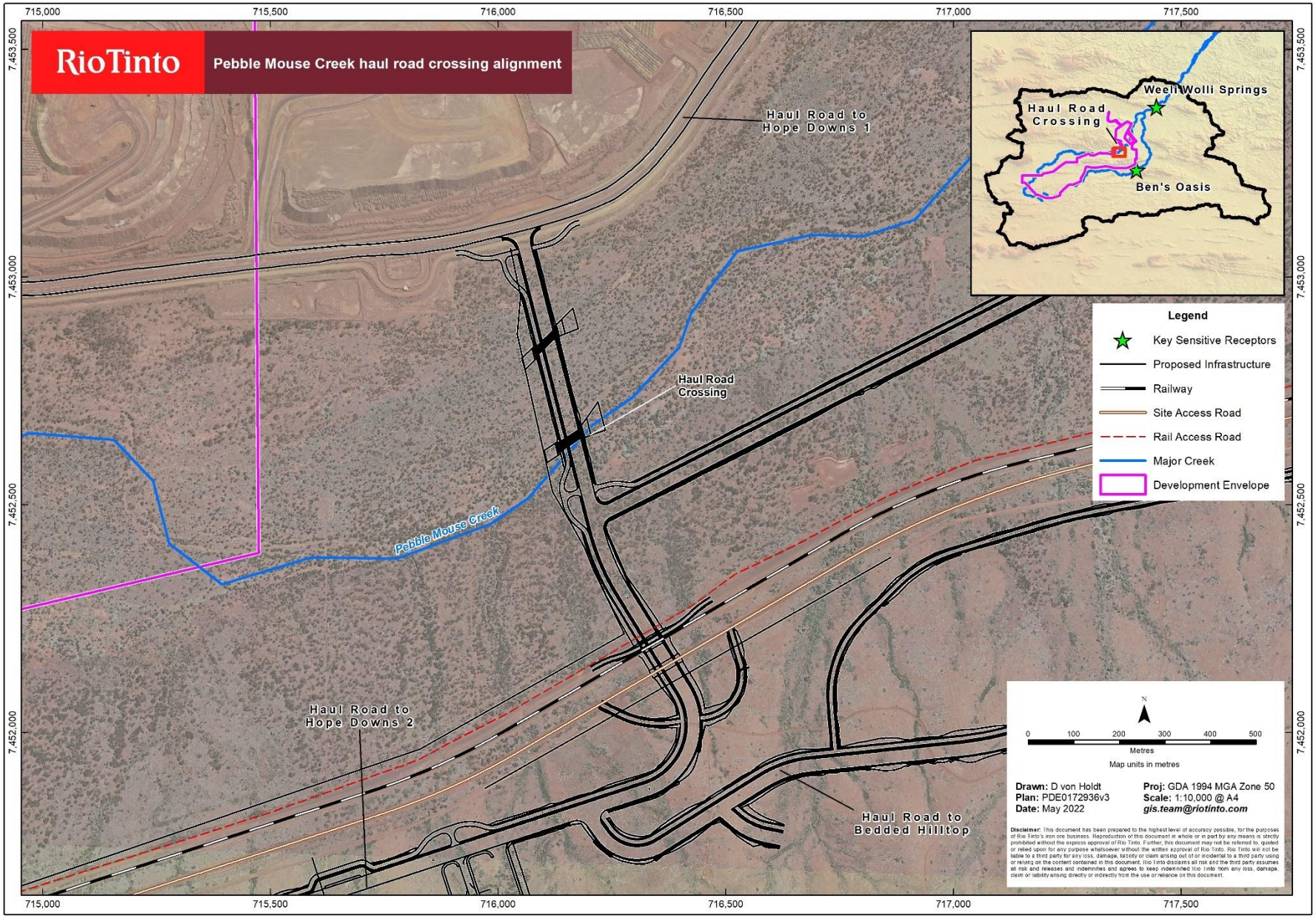

Figure 3: Pebble Mouse Creek haul road crossing alignment

3.2. HD2 Diversion Levee and Drains

Diversion infrastructure have been proposed at HD2 to manage the surface water flow around the pit. Several options were evaluated with the final design consisting of a levee (DL03) and two drains, referred to as DD01 and DD03. The drain configuration aims to divert flow from a tributary of Pebble Mouse Creek, that originally travelled north, towards Weeli Wolli Creek in the southeast. The levee and drains have been designed to convey the 1:100 AEP event. Proposed alignments of these structures are shown in Figure 4.

3.3. Pebble Mouse Creek Road Train Crossing

Long term road trains (LTRT) have been identified as the preferred ore transport option by the Prefeasibility Study (PFS). The proposed LTRT haul road will consist of a sealed road extending 27 km from HD2 to HD1 north crusher. Several options for the road alignment have been investigated and all options include a crossing over Pebble Mouse Creek, directly downstream of the existing rail line crossing.

LTRT Option 1 design includes multiple large culverts (aligned similarly to the existing railway culverts) at the creek crossing, designed to convey the 1:100 AEP flow rates. A transfer pad (TP4) will be located at the end of the haul road, close to the HD1 north crusher. Placement of TP4 has been restricted to be outside the 1% AEP flood extent of Pebble Mouse Creek.

Figure 5 includes the LTRT Option 1 road alignment and associated infrastructure (TP4).

3.4. Optional Waterway Crossings

3.4.1. Great Northern Highway Realignment

Due to the extent of the HD2 ore body, realignment of the GNH has been proposed to allow access to the ore currently situated under a section of the existing highway. Subsequently, to prevent the construction of road infrastructure that would ultimately become redundant once the GNH is realigned, an alternative mine access road has also been proposed. The GNH crossing will require a bridge structure, whereas the alternative mine access road crossing will require culverts. At this stage, preliminary designs are not available to model however the existing bridge along GNH currently crossing PMC provides the minimum design criteria expected for the new bridge on GNH. Austroads (1994) and Main Roads WA (MRWA, 2003) standard design guidelines dictate the design criteria for bridges along a main public highway, which include a serviceability design of 1% AEP and a survivability design of 1:2000 AEP.

3.4.2. Overland Conveyor (OLC)

An overland conveyor transport option was investigated, extending from HD2 to the HD1 north, as an alternative to the extensive haulage route required from HD2. The conveyor alignment requires a crossing over Pebble Mouse Creek. Several alignments were assessed including:

1. The OLC directly upstream of the existing HD1 rail line, running parallel to the rail crossing.
2. The OLC about 2 km downstream from the rail line.

The proposed design consists of an earth embankment with pipe culverts designed to convey the 1% AEP flow rates.

Figure 5 includes the OLC alignment positioned directly upstream of the rail line.

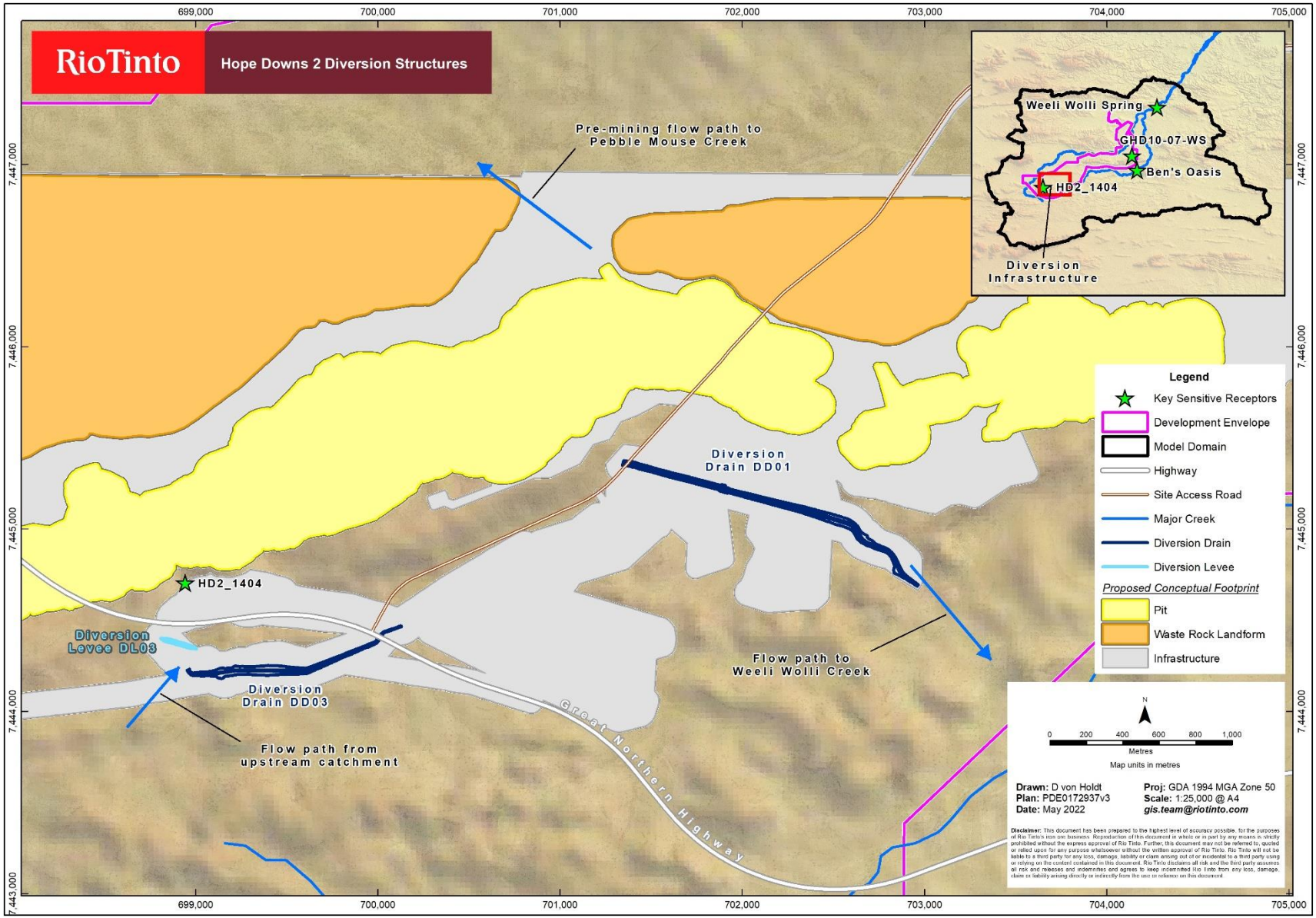

Figure 4: Hope Downs 2 diversion structures

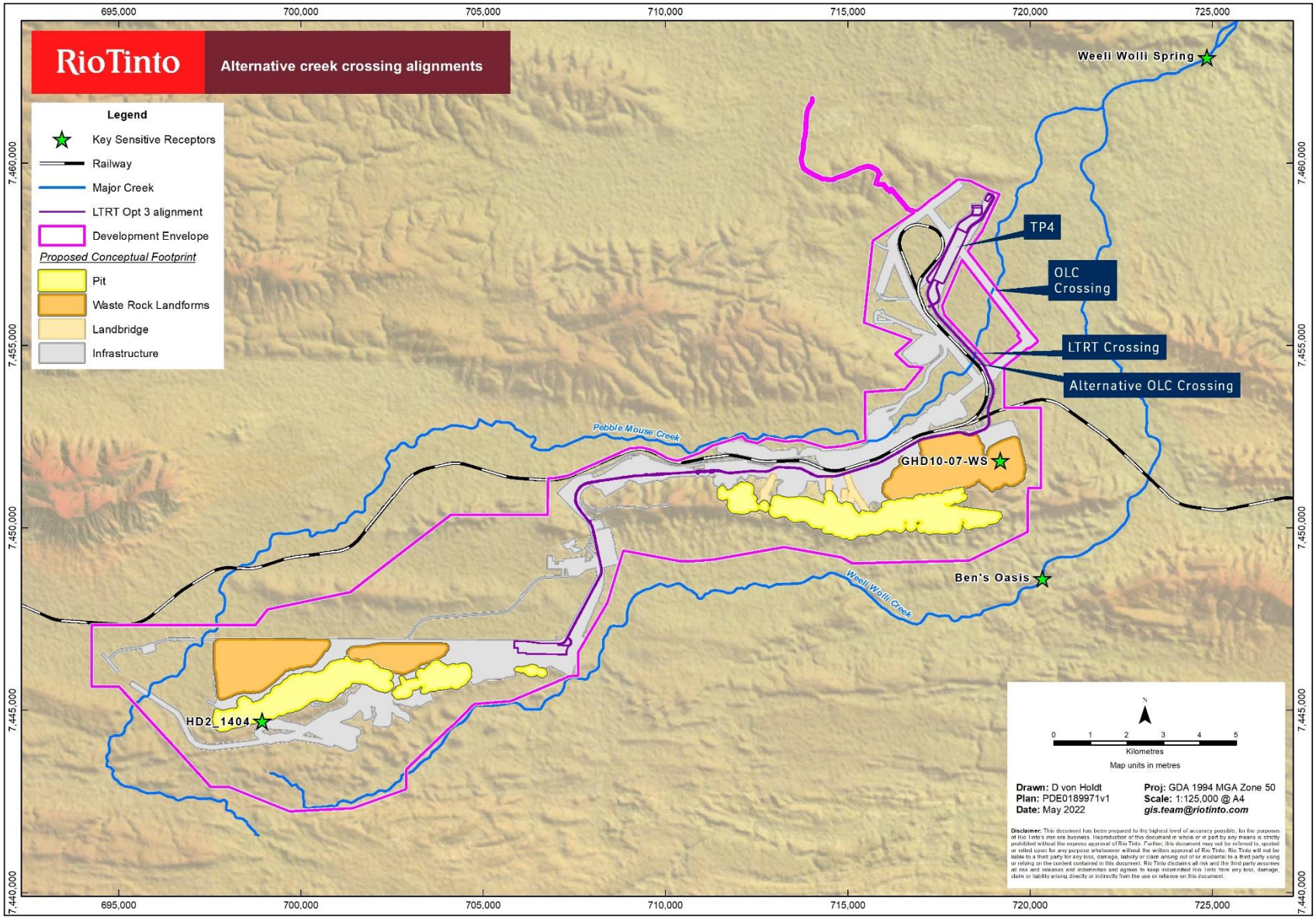

Figure 5: Alternative creek crossing alignments

4. KEY SENSITIVE RECEPTORS

Locations with heritage or environmental significance are referred to as sensitive areas or receptors. These locations require special consideration of the direct and potentially cumulative impact of all mining activities due to their high heritage or environmental value.

Regarding surface water, sensitive receptors may be impacted where modifications to the creek morphology or hydrologic regime adversely influence the heritage or environmental value of the site. The sensitive environmental receptors that have been identified as part of the HD2 Proposal are Weeli Wolli Spring and Ben's Oasis, and two waterholes situated within the Development Envelope. Locations for these sites are shown in Figure 2. The hydraulic modelling presented in this report was completed to assess the potential surface water impact on these receptors.

4.1. Weeli Wolli Spring

Weeli Wolli Spring is located approximately 7 km downstream of the confluence of Pebble Mouse Creek and Weeli Wolli Creek to the north-east of the study area. It is protected under the *Aboriginal Heritage Act 1972* and the riparian vegetation supported by the spring is categorised as a Priority 1 Ecological Community. The Spring was naturally groundwater controlled (pre-mining) and is currently maintained by discharge of surplus water from dewatering from HD1, which has occurred since 2007. Upstream of the permanent flowing portion of the Spring are several permanent and semi-permanent pools scattered over a distance of 2 km as illustrated in Figure 7.



Figure 6: Weeli Wolli Spring (photographed in October 2020)

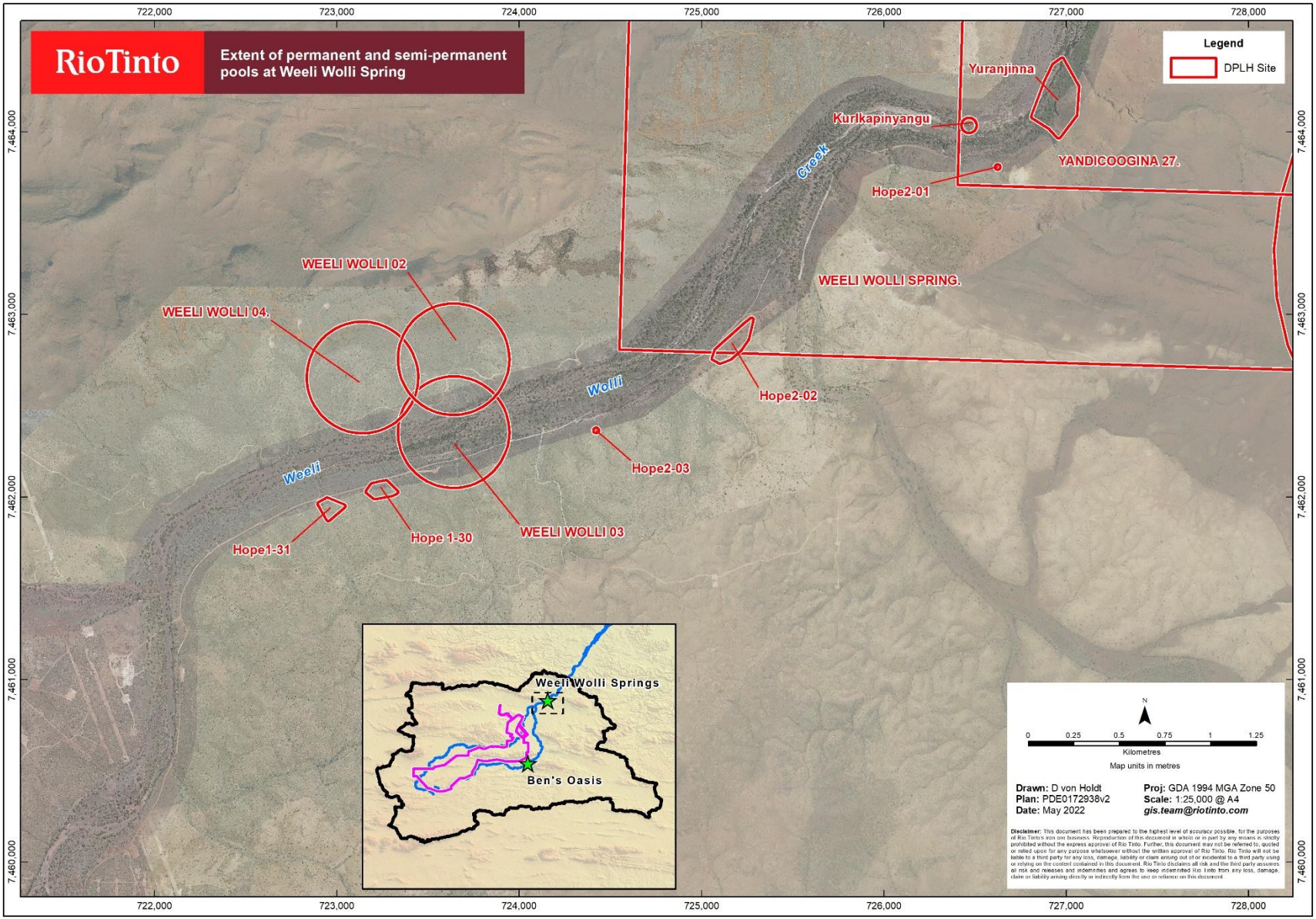

Figure 7: Extent of permanent and semi-permanent pools at Weeli Wolli Spring

Table 3 summarises the area reduction of the catchment reporting to Weeli Wolli Spring due to mining operations at both HD2 and BHT. The catchment area reduction incurred from mining the HD2 and BHT deposits will be approximately 45 km^2 based on the proposed pits and the placement of dumps provided in the current mine layouts. This area is equivalent to 3.5 % of the contributing catchment area to Weeli Wolli Spring. A catchment reduction of 3.5 % is considered relatively negligible and is therefore unlikely to impact the hydrological regime of this key sensitive receptor. Further validation of this assumption is provided in Section 6 where an impact assessment of peak flows and volumes is also discussed.

Table 3: Area reduction of catchment reporting to Weeli Wolli Spring

Mining Factor Affecting Catchment	Total Catchment Area (km^2)	Operational mining Catchment Area (km^2)	Area Reduction (km^2)	Difference (%)
HD2 & BHT pits, dumps	1,340	1,295	- 45	- 3.5

4.2. Ben's Oasis

Ben's Oasis is a significant environmental feature on Weeli Wolli Creek. Ben's Oasis is similar in function to Weeli Wolli Spring in that it is supported via groundwater expression as opposed to surface water.



Figure 8: Ben's Oasis (photographed in Jan 2019)

Table 4 summarises the area reduction of the catchment reporting to Ben's Oasis. The catchment area will be impacted by mining operations at only HD2. Proposed pits and dumps will result in approximately

6 km^2 catchment area reduction. However, this will be largely offset by the proposed HD2 diversion which would contribute an additional 5 km^2 of catchment reporting to Ben's Oasis. Therefore, the net contributing catchment area is reduced by 1 km^2, equivalent to 0.2 % of the total catchment. This is considered negligible and will have negligible impact to the flow regime at Ben's Oasis. This is discussed further in Section 6.

Table 4: Area reduction of catchment reporting to Ben's Oasis

Mining Factor Affecting Catchment	Total Catchment Area (km2)	Operational mining Catchment Area (km^2)	Area Reduction (km2)	Difference (%)
HD pits, dumps	420	414	- 6	- 1.4
HD2 diversion drains	420	425	+ 5	+1.2
	Net Changes	419	-1	- 0.2

4.3. Pebble Mouse Creek

Pebble Mouse Creek is considered to have cultural heritage significance, stemming from its use as a water source for people, plants, and animals and because it is a major tributary feeding into Weeli Wolli Creek. More consultation work is to be undertaken to completely understand the specific cultural heritage values and concerns associated with works impacting Pebble Mouse Creek.

Table 5 summarises the area reduction to Pebble Mouse Creek. About 8 % of this catchment will be reduced due to the proposed HD2 and BHT mining areas.

Table 5: Area reduction of the Pebble Mouse Creek catchment

Mining Factor Affecting Catchment	Total Catchment Area (km^2)	Operational mining Catchment Area (km^2)	Area Reduction (km^2)	Difference (%)
HD2 & BHT pits, dumps and diversion drains	340	26	314	- 7.6

4.4. Identified waterholes

Two water sources or waterholes are identified within the proposed Development Envelope: HD2_1404 and GHD19-07-WS. Their locations are shown in Figure 2.

HD2_1404 is in very close proximity to the HD2 deposit and has been described as a water source of ethnographic interest. The waterhole is 12 m by 17 m and is at least 1 m deep. The site was visited as part of the November 2021 Nyiyaparli Social Surroundings site visit. The waterhole was observed to be holding an indeterminate amount of water as shown in Figure 9.



Figure 9: Waterhole HD2_1404 (photographed in November 2021)

GHD19-17-WS is in relative proximity to the eastern end of the BHT deposit. The site is a series of five waterholes within a minor creek and measures 11 m by 17 m (covering 187 m^2). The site was also visited during the November 2021 Nyiyaparli Social Surroundings site visit. Two of the five waterholes were observed to be holding small amounts of water as shown in Figure 10.



Figure 10: Waterhole GHD19-07-WS (photographed in November 2021)

5. HYDRAULIC MODELLING

A two-dimensional hydraulic model was developed, using TUFLOW (build 2018-03-AB-iSP-w64 HPC), in order to characterise the surface water flow regime of Weeli Wolli Creek and Pebble Mouse Creek and assess potential impacts on water quantity at the sensitive receptors. The methodology and results are discussed below.

5.1. Methodology

A whole-of-catchment rain-on-grid hydraulic model was constructed for Weeli Wolli Creek, including the Pebble Mouse Creek catchment, to a downstream location of the Tarina gauge. An ensemble of simulations has been run with varying rainfall durations and temporal patterns for comparison with previous and updated rainfall-runoff model (RORB) results. However, for the purpose of this analysis, the adopted scenarios run for pre- and post-mining comparisons were the critical durations for the 1:5 and 1:100 AEP events.

The following input parameters were adopted for this assessment:

- Digital elevation model (DEM) – various LIDAR datasets mosaicked to cover the full model area
- Grid size – 20 m x 20 m, a coarse resolution was chosen to allow the full catchment to be adopted as the model domain, but limit model run times.
- Boundary conditions – height-flow (HQ) boundary downstream of Weeli Wolli Spring
- Roughness coefficient Manning's n – uniform 0.04
- Losses – initial loss of 35 mm/hr and continuing loss of 9 mm/hr (calibrated to match RORB peak flows)
- Scenarios run – pre-mining conditions and post-mining conditions including HD2 and BHT pits, haul roads, diversions and creek crossing
- Rainfall events – 1:5 AEP 12 hr TP04 and 1:100 AEP 24 hr TP02

Figure 11 illustrates the hydraulic model extent and downstream boundary location.

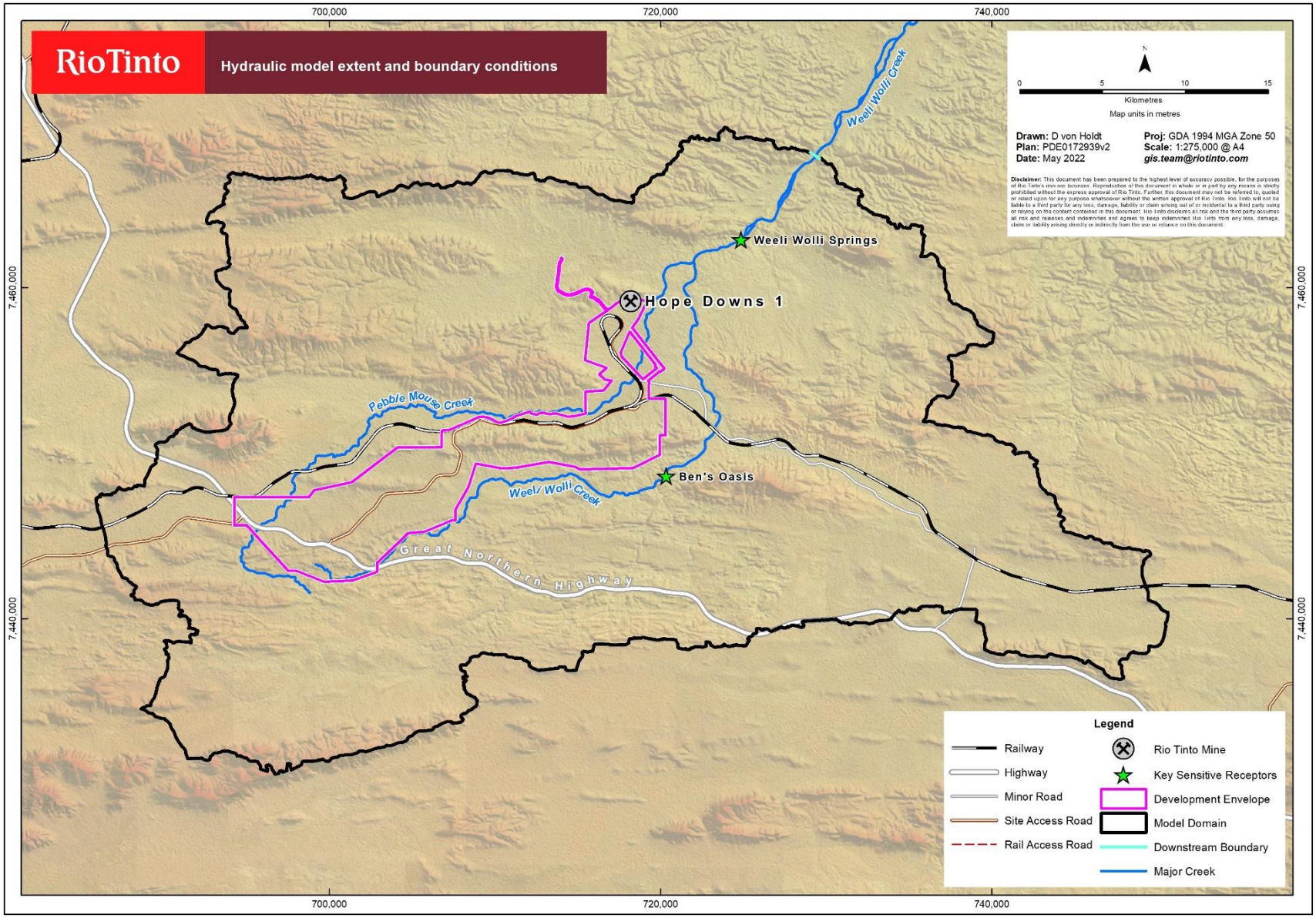

Figure 11: Hydraulic model extent and boundary conditions

5.2. Hydraulic Model Results

Results for the 1% AEP flood depths for pre mining, operational mining and a difference map are presented in Figure 12 to Figure 14. The difference map shows river reaches where modelled flood depths changed because of mining impacts.

Similar results for the 20% AEP flood depths are presented in Figure 15 to Figure 17.

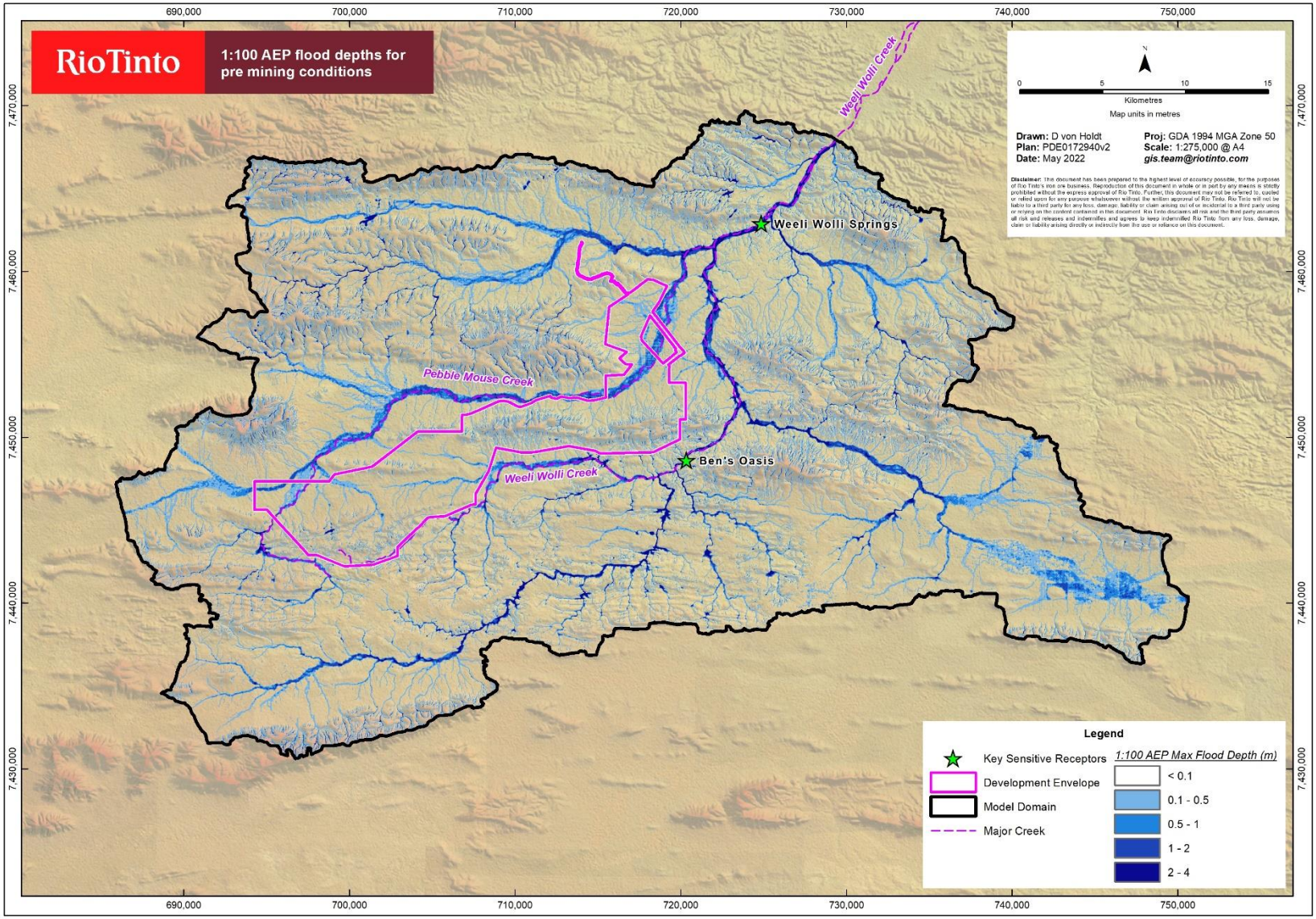

Figure 12: 1:100 AEP flood depths for pre mining conditions

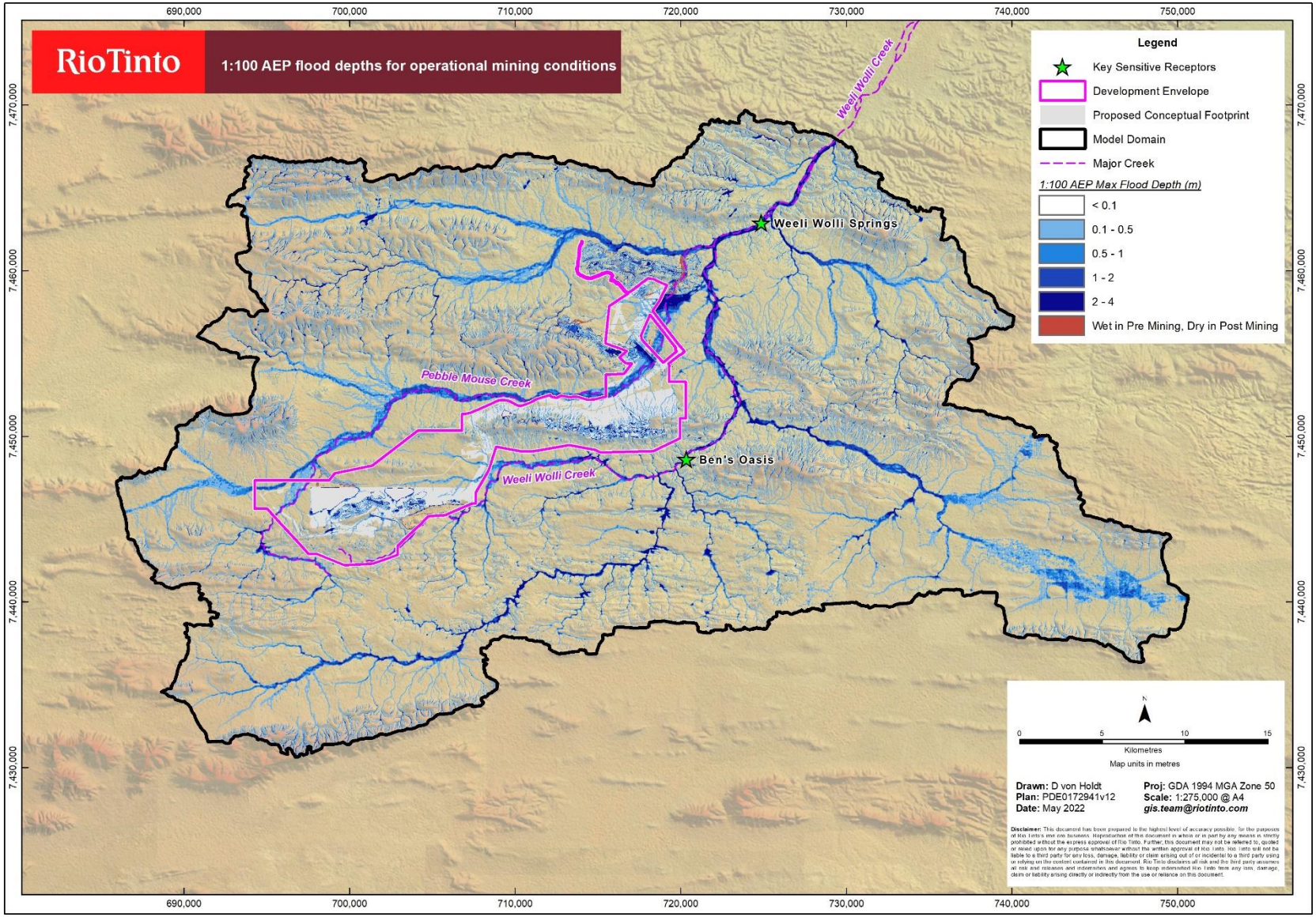

Figure 13: 1:100 AEP flood depths for operational mining conditions

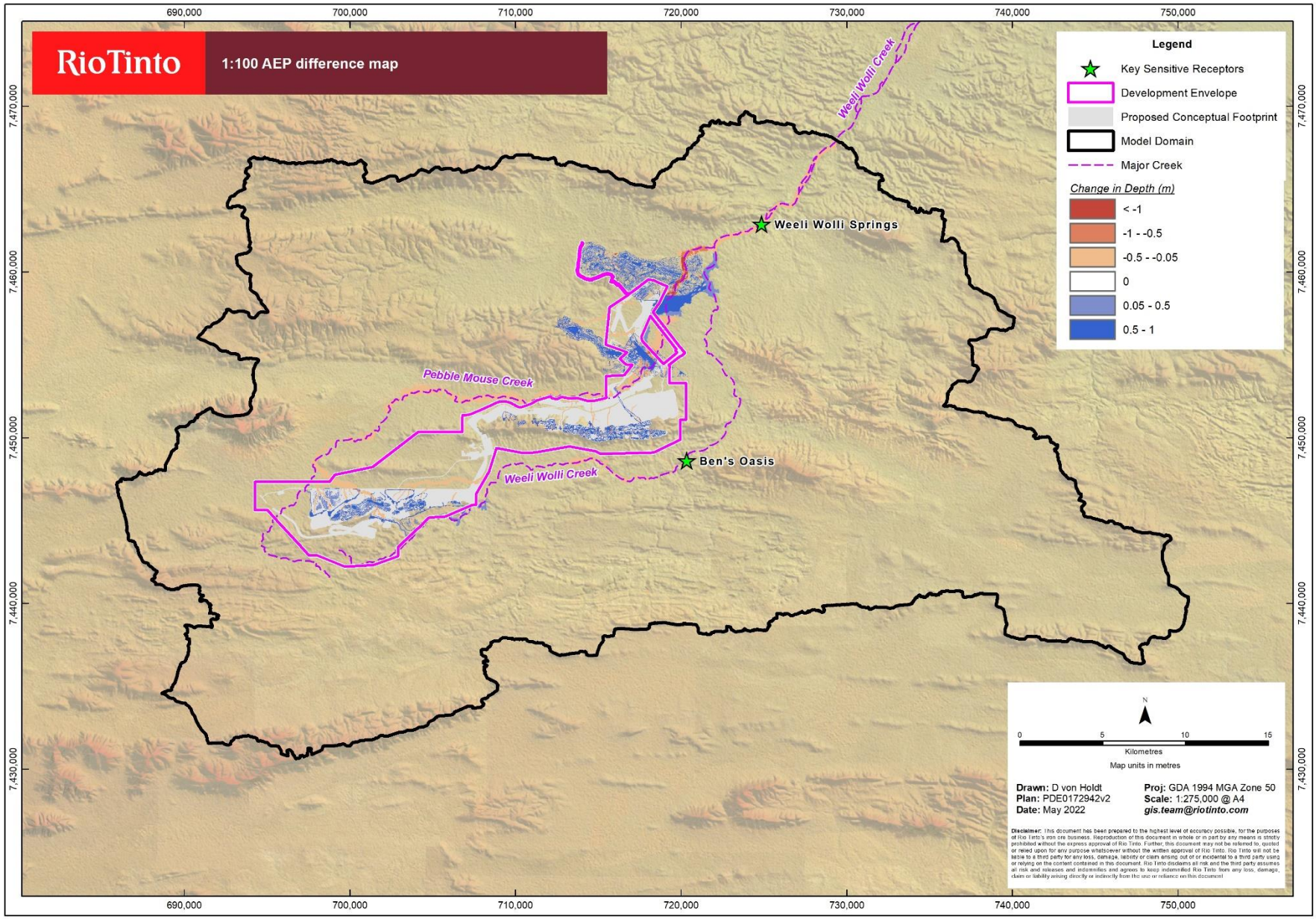

Figure 14: 1:100 AEP difference map

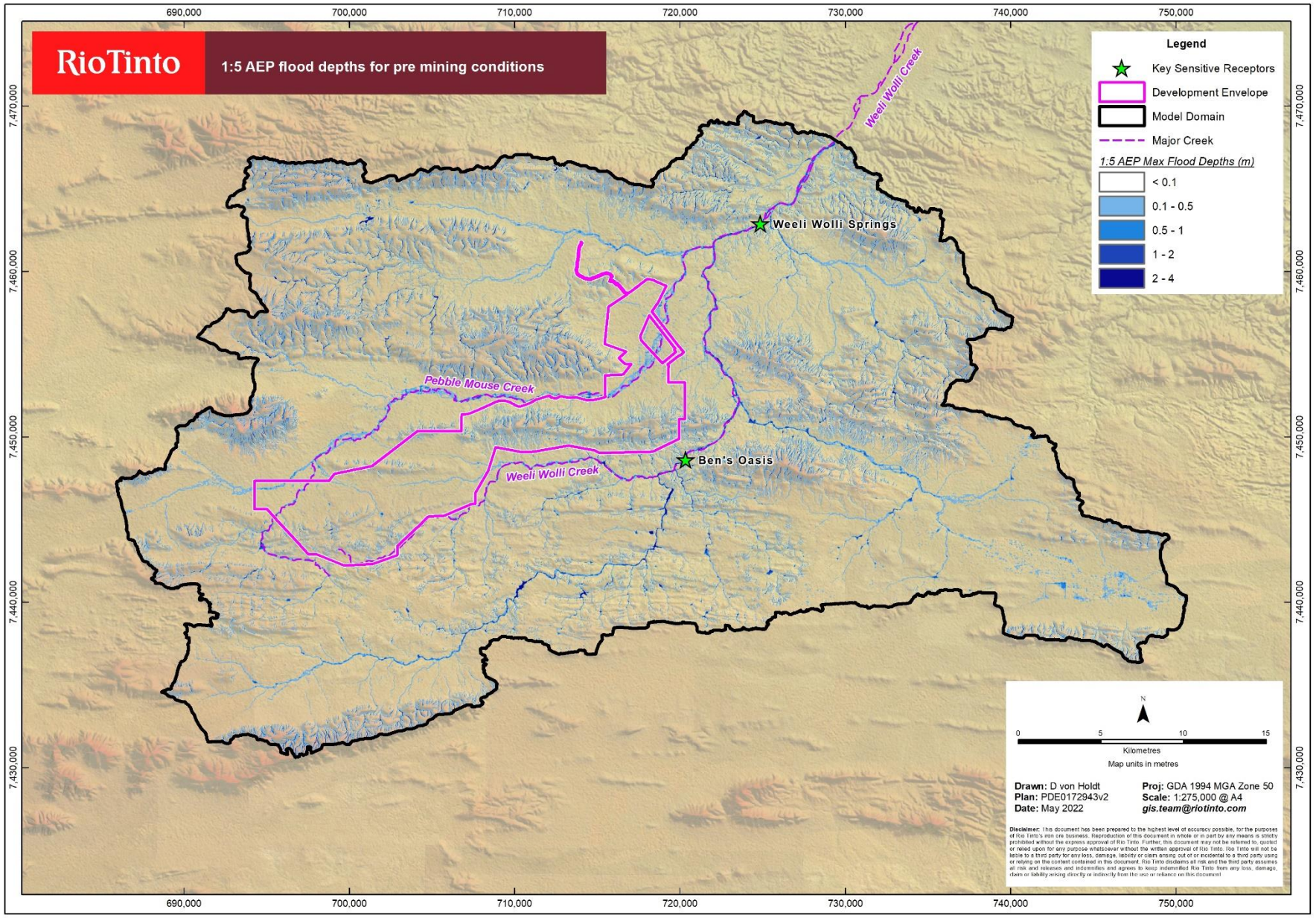

Figure 15: 1:5 AEP flood depths for pre mining conditions

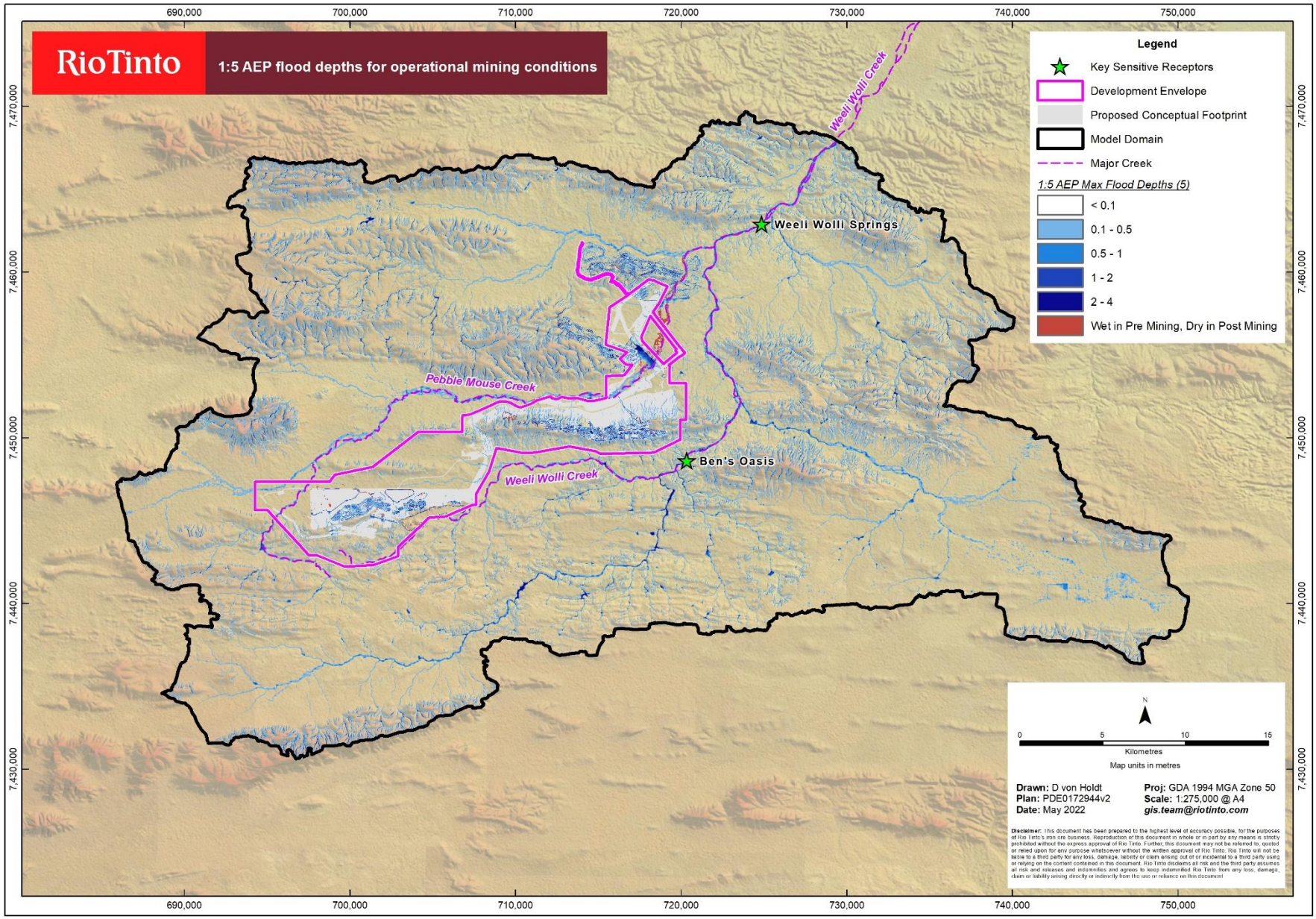

Figure 16: 1:5 AEP flood depths for operational mining conditions

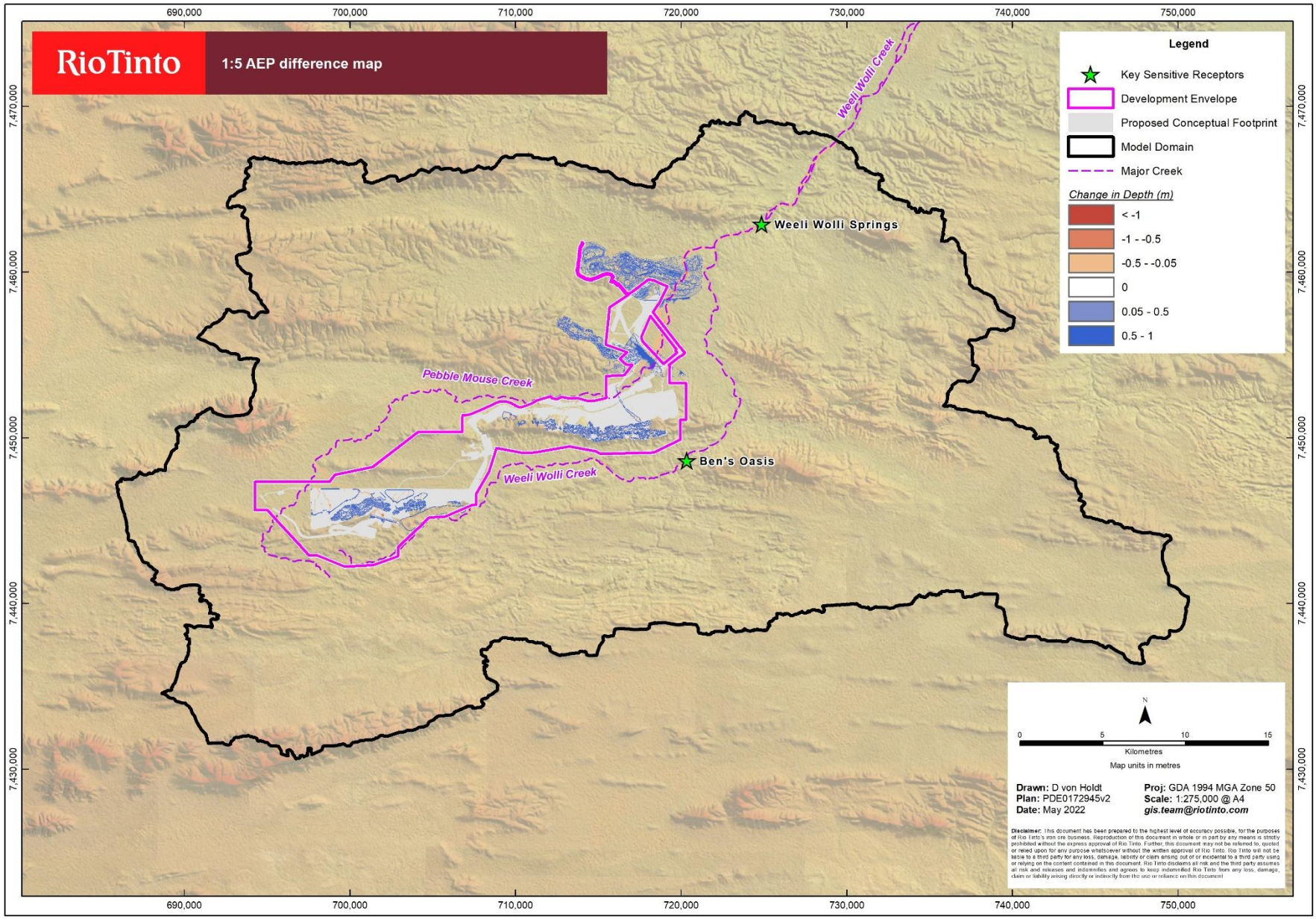

Figure 17: 1:5 AEP difference map

6. SURFACE WATER FLOW IMPACTS

6.1. Regional catchment

Difference mapping (discussed above) has highlighted the areas within Pebble Mouse Creek and Weeli Wolli Creek that are likely to experience a change in maximum surface water depths in the operational mining scenario. As expected, depths have increased at the location of HD2 diversion drains, which is predicted to result in a reduction to depths by less than 0.1 m in Pebble Mouse Creek directly north of the HD2 pits. The attenuation of surface water upstream of the Pebble Mouse Creek haul road crossing is predicted to result in an increase of depths in this area of up to 1 m. Depths downstream of the crossing appear to be impacted only slightly, with the difference map indicating a maximum decrease of 0.1 m for the 1:100 AEP.

6.2. Key sensitive receptors

A comparison of peak flows modelled, for critical duration storms at the key sensitive receptors for pre- and operational mining conditions. is provided in Table 5 and total volumes are compared in Table 6.

Table 5: Peak flows at the key sensitive receptors

Location	Event	Pre mining (m^3/s)	Operational mining (m^3/s)	Difference (m^3/s)	Difference (%)
Weeli Wolli Spring	1:100 AEP 24 hr	2,474	2,438	- 36	- 1.4
	1:5 AEP 12 hr	148	135	- 12	- 8.1
Ben's Oasis	1:100 AEP 24 hr	921	911	- 10	- 1.1
	1:5 AEP 12 hr	55	53	- 2	- 3.6

Table 6: Total modelled volumes at the key sensitive receptors

Location	Event	Pre mining (GL)	Operational mining (GL)	Difference (GL)	Difference (%)
Weeli Wolli Spring	1:100 AEP 24 hr	25.2	24.7	- 0.5	- 2
	1:5 AEP 12 hr	0.8	0.6	- 0.2	- 25
Ben's Oasis	1:100 AEP 24 hr	7.1	7.0	- 0.1	- 2
	1:5 AEP 12 hr	0.33	0.31	- 0.02	- 7

As previously discussed in Section 4.1, mining operations at HD2 and BHT (including proposed dumps) will truncate approximate 45 km^2 of the total catchment reporting to Weeli Wolli Spring. This equates to a reduction of 3.5 % in the catchment reporting to Weeli Wolli Spring. Modelling has shown that the truncation will result in the loss of approximately 2 % of the total runoff volume at the spring for the 1:100 AEP 24 hour flow event of Weeli Wolli Creek. Peak flows at the spring for this event will decrease by 36 m^3/s, equivalent to a 1.4 % reduction. Modelled flow reductions for the 1:5 AEP event is slightly higher, with an

estimated 8.1 % reduction in flow. It should be noted that this reduction is not only the result of the changes due to the proposed HD2 mining activities but a cumulative impact from both HD1 and HD2 mining activities. Water levels (and therefore volumes) at Weeli Wolli Spring are supplemented by dewatering discharge from a series of spur lines running off the main discharge pipe to Weeli Wolli Creek. There are several monitoring locations in this area used to ensure water levels at the Spring are maintained. This discharge to the creek and the spur lines will continue for the operating life of HD2 therefore the modelled reduction to flows at the Spring is unlikely to be observed and the environmental and heritage values associated with the Spring are expected to be maintained.

Regarding Ben's Oasis, the total net change to the catchment reporting to this location is a reduction of approximately 1 km^2. Modelling indicates this will result in a reduction to the peak flow at Ben's Oasis by approximately 10 m^3/s or 1.1 % during a 1:100 AEP. Flow (volume) reduction observed for the 1:5 AEP is equivalent to a 3.6 % reduction. This limited loss of runoff is not expected to impact the environmental value of Ben's Oasis as the main source of water at this location is sustained by the groundwater aquifer.

6.3. Waterholes

Although the physical location of the HD2 waterhole (HD2_1404) will remain during the operational mining period, flows to this location will be impacted. The HD2 diversion levee is directly upstream of HD2_1404 and will reduce flow rates and volumes experienced at the waterhole. Modelling results indicate that during a 1:5 AEP rainfall event, maximum flows at the waterhole are reduced by 28 %. During a 1:100 AEP event, maximum flows are reduced by 59 %.

Reductions to flow rates experienced at waterholes is not the only factor to consider when commenting on potential adverse impact. The capacity of the pool compared to the catchment yield volume is important to understand. Typically, waterholes of this size in the Pilbara will have relatively large upstream catchments contributing to the volume of water present in them. Direct rainfall onto the pool during heavy rainfall can have the ability to completely fill a small waterhole, with flow from the upstream catchment overtopping the pool and continuing to flow downstream. Analysis of multiple pools located in the Western Ranges, near Paraburdoo, using a long-term rainfall data set, demonstrated that, pending the size of catchment and capacity of waterhole, a pool can lose 80 – 85% of its upstream catchment and remain functioning in a wetting and drying cycle similar to historically cycles (undisturbed by mining activities). Therefore, similar modelling of HD2_1404 is recommended to understand the extent of impact it may experience due to the proposed HD2 mining activities. This worked is planned for the next study phase.

The BHT waterhole (GHD19-17-WS) will be directly impacted by proposed mining activities. The site is in the middle of a proposed waste dump; therefore, the waterhole will no longer exist.

Social, cultural and environmental values of both waterholes have been discussed with Traditional Owners through the Social Surroundings consultations. Significant work relating to pit and dump designs will be required if these sites are to remain unaffected by the proposed mining activities. These discussions are ongoing at the time of writing this report.

7. WATER QUALITY IMPACTS

Water quality in naturally occurring pools across the Pilbara can be highly variable due to the following factors: water supply (rainfall, creek flow, alluvial groundwater or groundwater structure); the preceding climate (drought/flood history, recent groundwater recharge); and interaction with livestock.

Furthermore, erosion is a naturally occurring process in Pilbara watercourses. This is indicated by the fact that the Pilbara ephemeral creeks typically have high sediment bed loads in their natural state and is further reflected by the range of turbidity values in water quality data collected in the region. Table 7 summarises the historic Department of Water and Regulation (DWER) water quality data collected across all Pilbara water courses. Figure 15 illustrates natural turbidity observed in Weeli Wolli Creek following rain event.

Table 7: Surface water quality values recorded across the Pilbara

	Pilbara Wide (DWER)	
	Minimum	Maximum
pH	5.2	9.4
EC (us/cm)	3	6090
Turbidity (NTU)	0.1	3200
TDS (mg/L)	22	3932



Figure 18: Examples of natural turbidity within Weeli Wolli Creek

7.1. Water quality assessment

The primary source of potential water quality impact to the key sensitive receptors is liberation of additional sediment load to the watercourse. The biggest risk is associated with the proposed haul road crossing of Pebble Mouse Creek, given waste dumps are located further away from the main creeks. Liberation of sediment could occur in the unlikely event that a haul road crossing is washed out during a heavy rainfall event. The pathway from this source to the key receptors is a significant distance of ephemeral creek line – the proposed Pebble Mouse Creek haul road crossing is 14 km upstream of the Weeli Wolli Spring; the proposed road train crossing is 11 km upstream; and the proposed transfer pad and creek diversion levee is 7 km. These distances provide significant opportunity for sediments to be captured within creek and floodplain prior to reaching Weeli Wolli Spring, therefore reducing sediment load expected to reach the Spring.

It is considered unlikely that water quality at the key sensitive receptors identified in this study will be impacted by mining development at HD2 and BHT. To assess the credibility of this potential risk, a qualitative analysis of potential sediment transport from the Pebble Mouse Creek haul road and road train crossings to Weeli Wolli Spring is presented here.

7.2. Sediment transport in ephemeral creeks

Sediment transport in ephemeral creeks generally occurs as a pulse in response to runoff generated by the short duration, high intensity rainfall events (typically rare rainfall events) (Levick et al. 2008). Due to the common presence of bed armouring in ephemeral creeks, in particular channels formed in unconsolidated alluvium comprised of sands and gravel, the bulk of sediment transported generally comprise of the channel bed material (made available for transport once the armour layer has been mobilised) and sediments stored in alluvial plains and floodplains.

Once the armour layer has been mobilised and bed flushing occurs, flows generated by high intensity rainfall events are more likely to contain heavy sediment loads with the potential to move large amounts of coarse sediment through the system. Two consequences of this occurring during such events include large transmission losses and decreasing discharge in the downstream direction, both of which promote the stepwise movement, deposition, and storage of sediment. The effect is a pulsing style of sediment movement that can be remobilised during the next flow (Levick et al. 2008).

This style of sediment movement is likely to be a characteristic of Pebble Mouse Creek in its pre mining condition. The application of this concept to the washout of an engineered crossing and mobilisation of significant loads, in addition to natural sediment loads, may be relevant due to the large amount of coarse material likely to be used in the construction of the crossing. However, it should be noted that rock armouring is likely to also feature in the construction of the crossing.

7.3. Factors affecting the Pebble Mouse Creek flow path

An important factor to consider when assessing the likelihood of sediment loading from the haul road and road train crossings impacting Weeli Wolli Spring is the flow path from the source to the receptor and existing infrastructure. The 14 km reach of Pebble Mouse Creek between the haul road crossing and Weeli Wolli Spring is intersected initially by the HD1 rail line; then the road train crossing directly downstream of the rail line; and then diverted by the HD1N levee (known as the “100 year levee”) before flowing to its confluence with Weeli Wolli Creek.

The HD1 rail line crossing is approximately 3 km downstream of the haul road crossing, consisting of 28 DN2700 culverts with projecting inlets. Experiments conducted by Faqiri (2014) found that, while projecting inlets typically provide a lower culvert capacity compared to winged wall or cut inlets, these culverts are

still capable of transporting sediment downstream. However, the inlet geometry is not the only factor affecting sediment transport through culverts. The flow condition directly upstream of the culvert (the area referred to as the expansion section) is also a determining factor. Low velocity, deeper flows were found to result in an increase of sediment deposition at the culvert expansion section compared to high velocity flows, mainly because of low velocities allowing sediments to drop out and settle. Hence, for sediment to be effectively transported through culvert barrels, flow regimes with high velocities and low depths are required. The HD1 rail line crossing is expected to reduce flow velocities, resulting in some sediment deposition upstream of and at the rail culverts, with reduced sediment loads carried downstream of the rail crossing.

The inclusion of the road train crossing (with culverts) directly downstream of the rail line presents an additional expansion section and compounds the effect of sediment deposition upstream of the culverts. Therefore, having a second set of culverts at this location would further reduce sediment loads carried downstream.

7.4. Hydraulic modelling

Hydraulic modelling has been used to assess the flow regime along Pebble Mouse Creek focussing on the characteristics of flow observed at the haul road crossing as well as the HD1 rail crossing. Using similar hydrological inputs to the regional model previously discussed, a refined model domain was adopted for this assessment as well as a higher resolution grid size (5 m). Pre and operational mining scenarios were run for the 1:5 and 1:100 AEP events.

Operational mining infrastructure included the Pebble Mouse Creek haul road crossing low flow design as this was considered the most credible scenario, compared to the other options, to release a source of increased sediment load to the creek system following a crossing failure.

A separate modelling scenario was run to assess the inclusion of the LTRT Option 3 alignment and its impact to flows in Pebble Mouse Creek.

Figure 19 illustrates the model extent and downstream boundary location of the refined model domain.

7.5. Results

Results of the maximum depths and velocities modelled at the haul road crossing and HD1 rail crossing for the 1:100 AEP and 1:5 AEP are shown in Figure 20-21 and Figure 22-23, respectively.

Results of the maximum depths and velocities modelled at the LTRT Option 3 creek crossing and transfer pad (TP4) for the 1:100 AEP are shown in Figures 24 and 25.

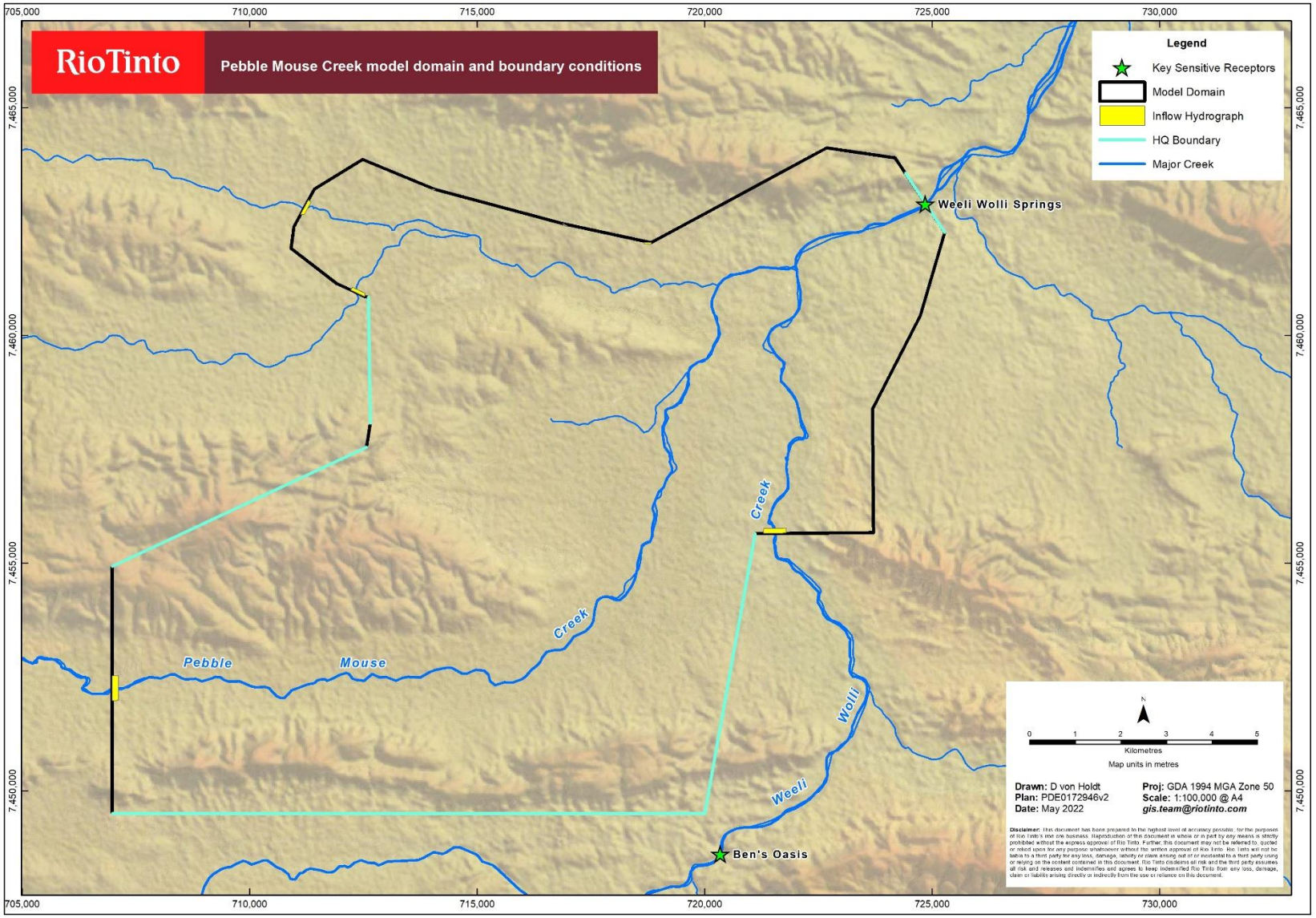

Figure 19: Pebble Mouse Creek model domain and boundary conditions

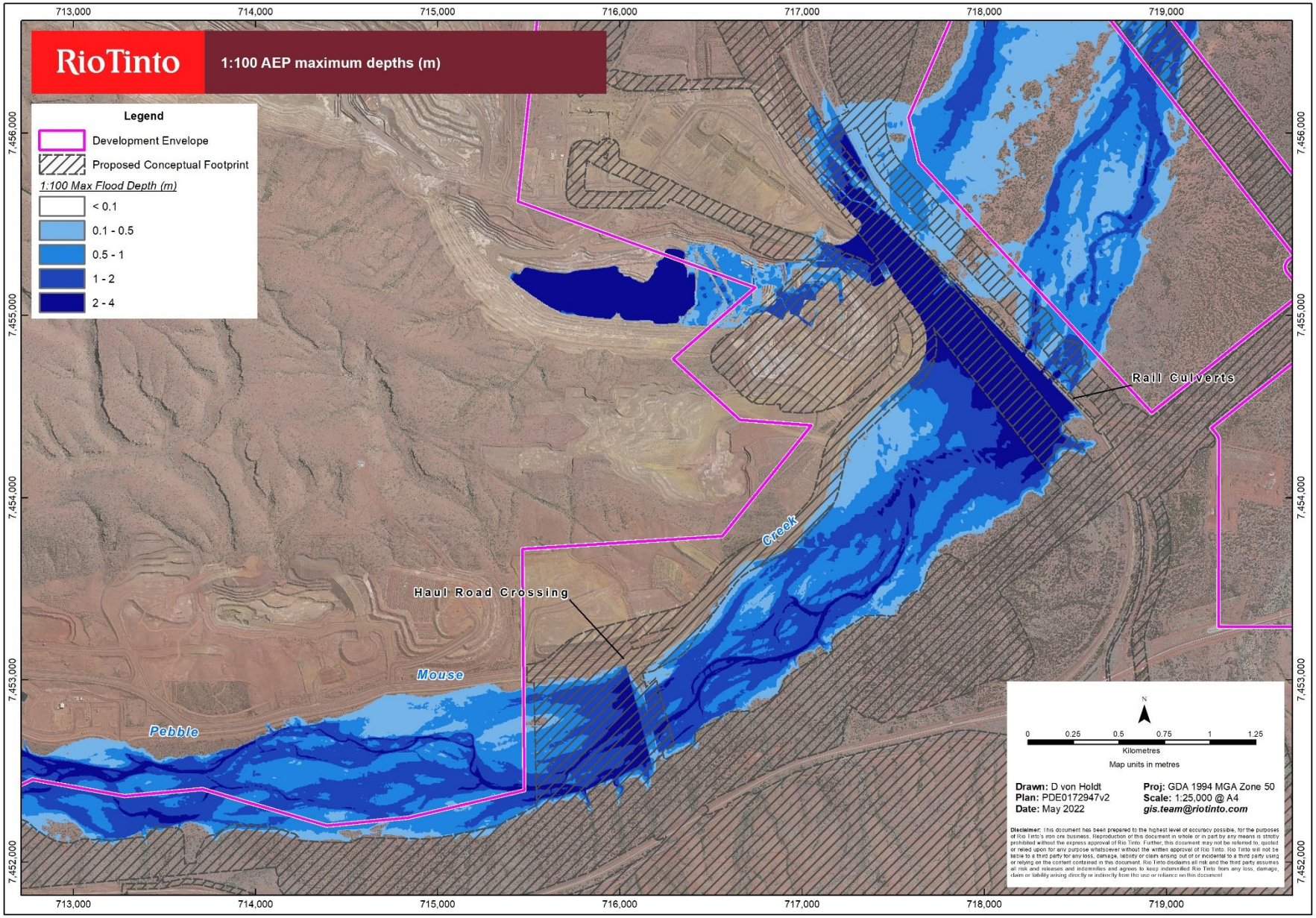

Figure 20: 1:100 AEP maximum depths (haul road crossing

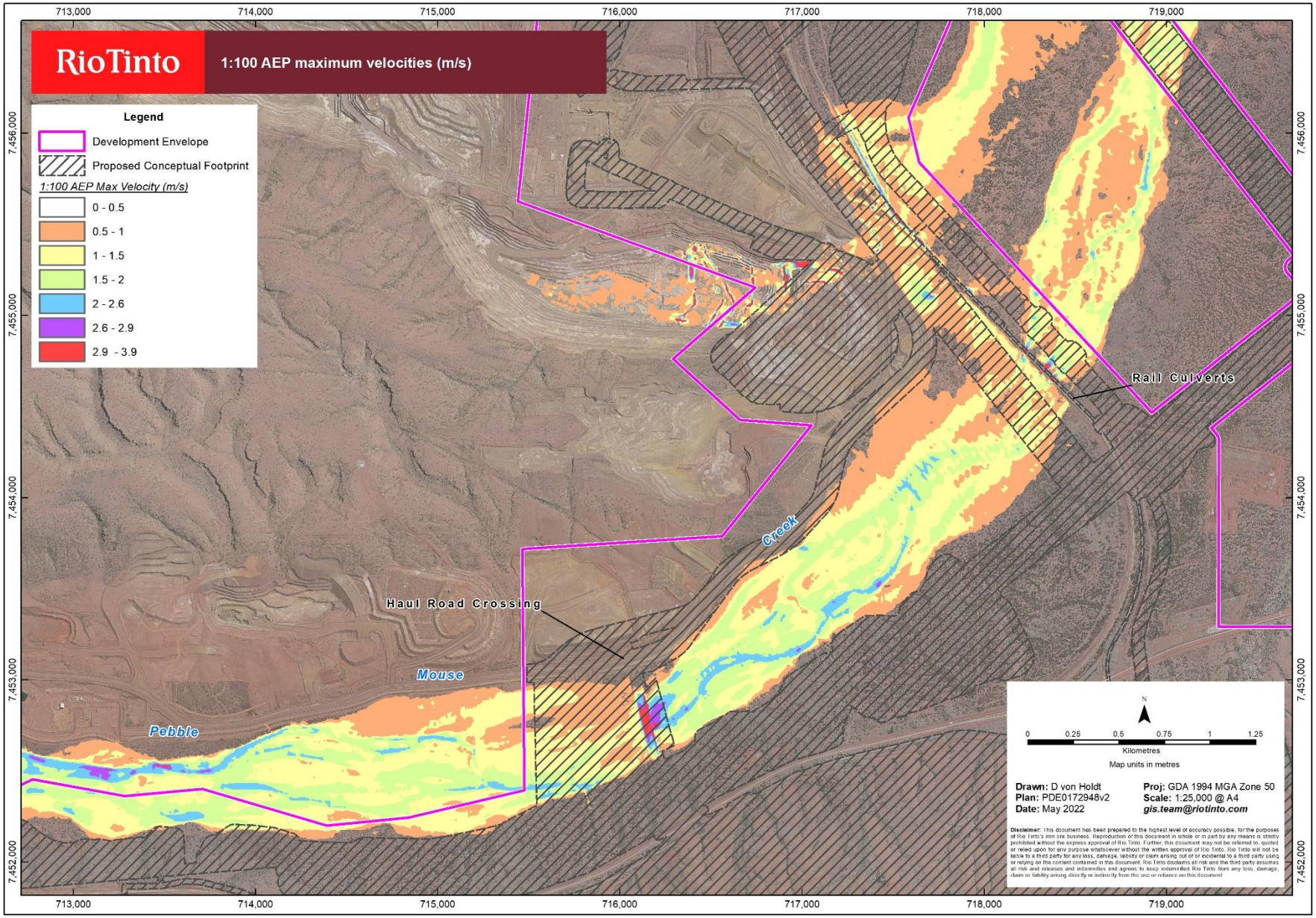

Figure 21: 1:100 AEP maximum velocities (haul road crossing)

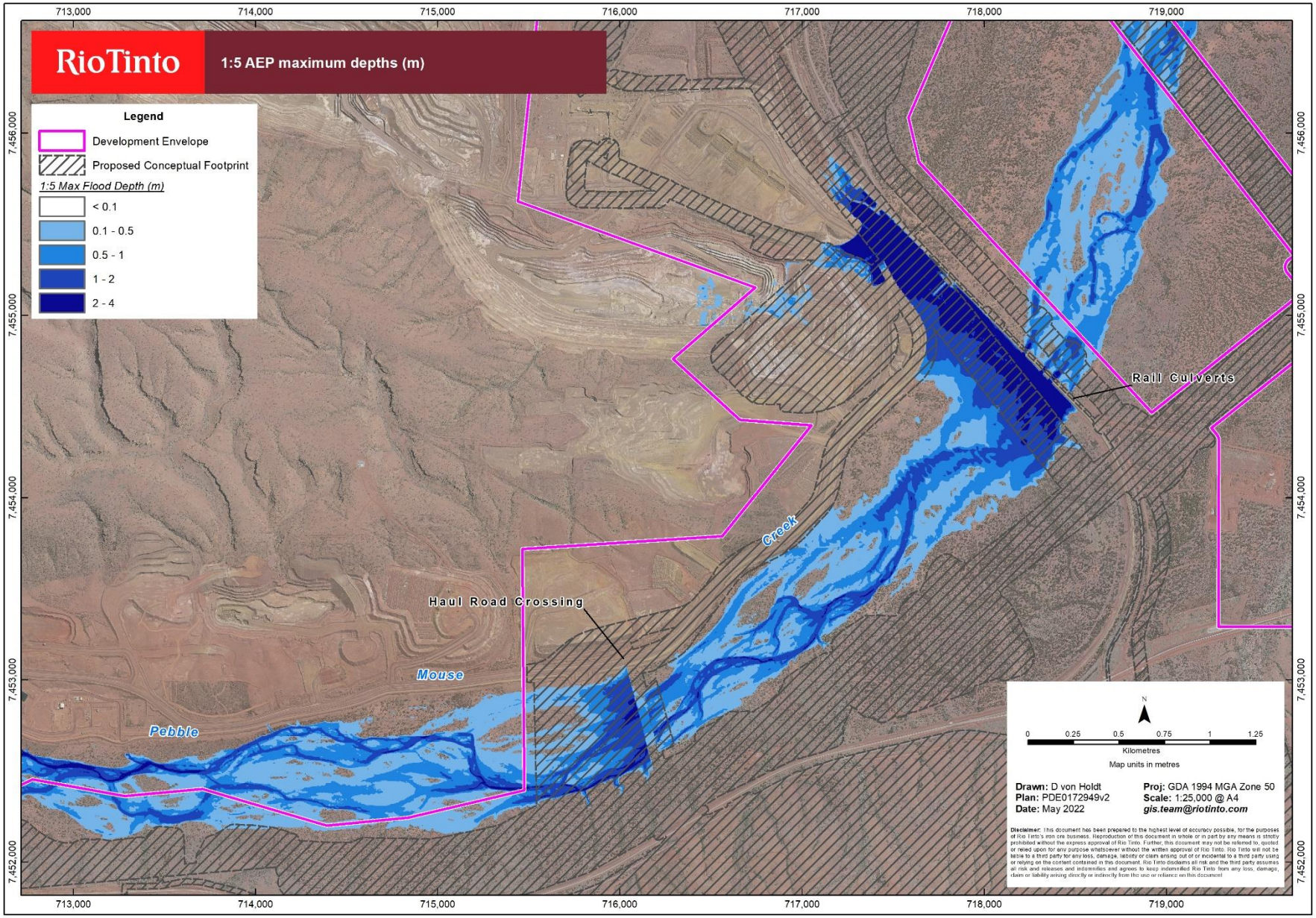

Figure 22: 1:5 AEP maximum flood depths (haul road crossing)

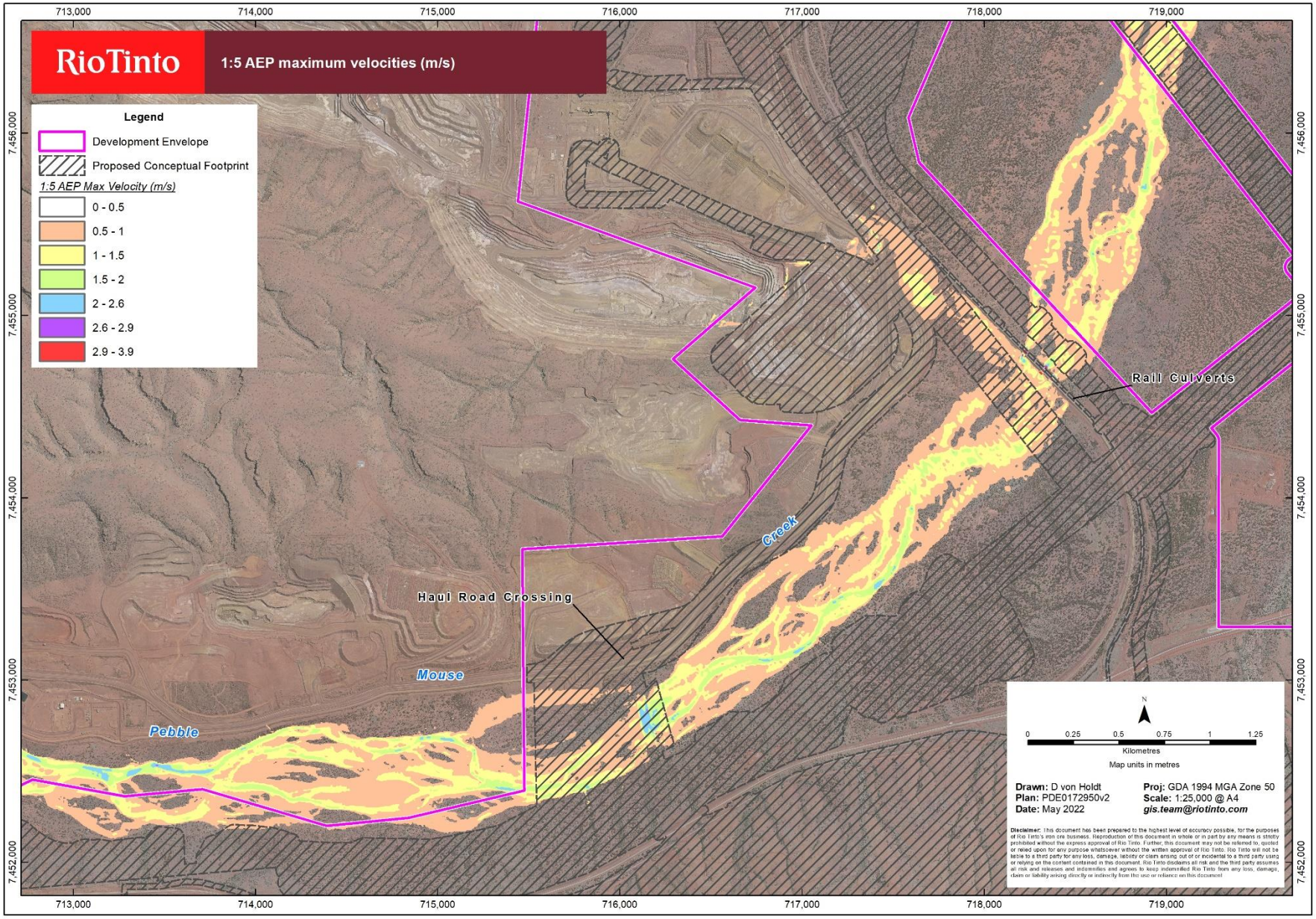

Figure 23: 1:5 AEP maximum velocities (haul road crossing)

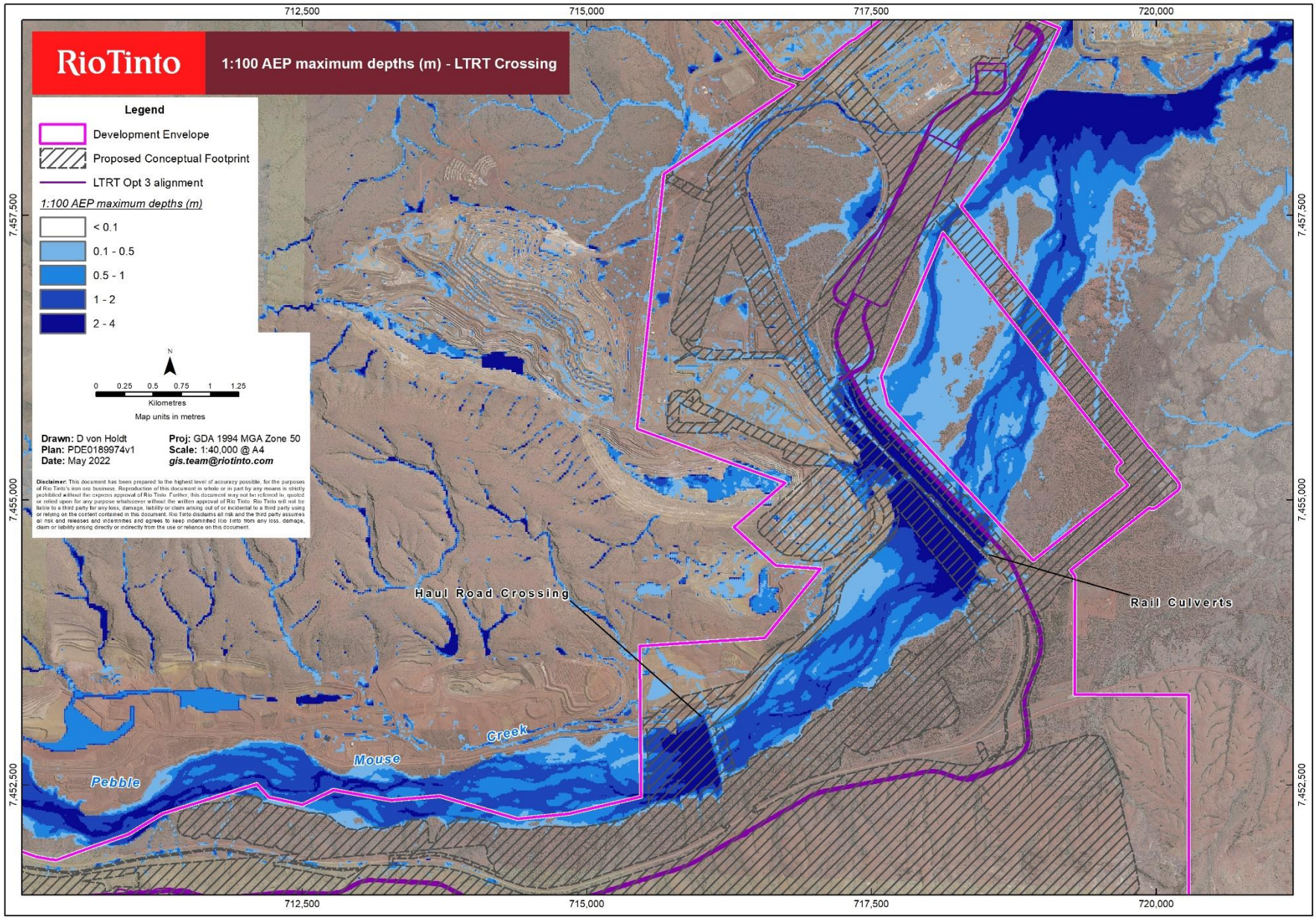

Figure 24: 1:100 AEP maximum depths (LTRT Crossing)

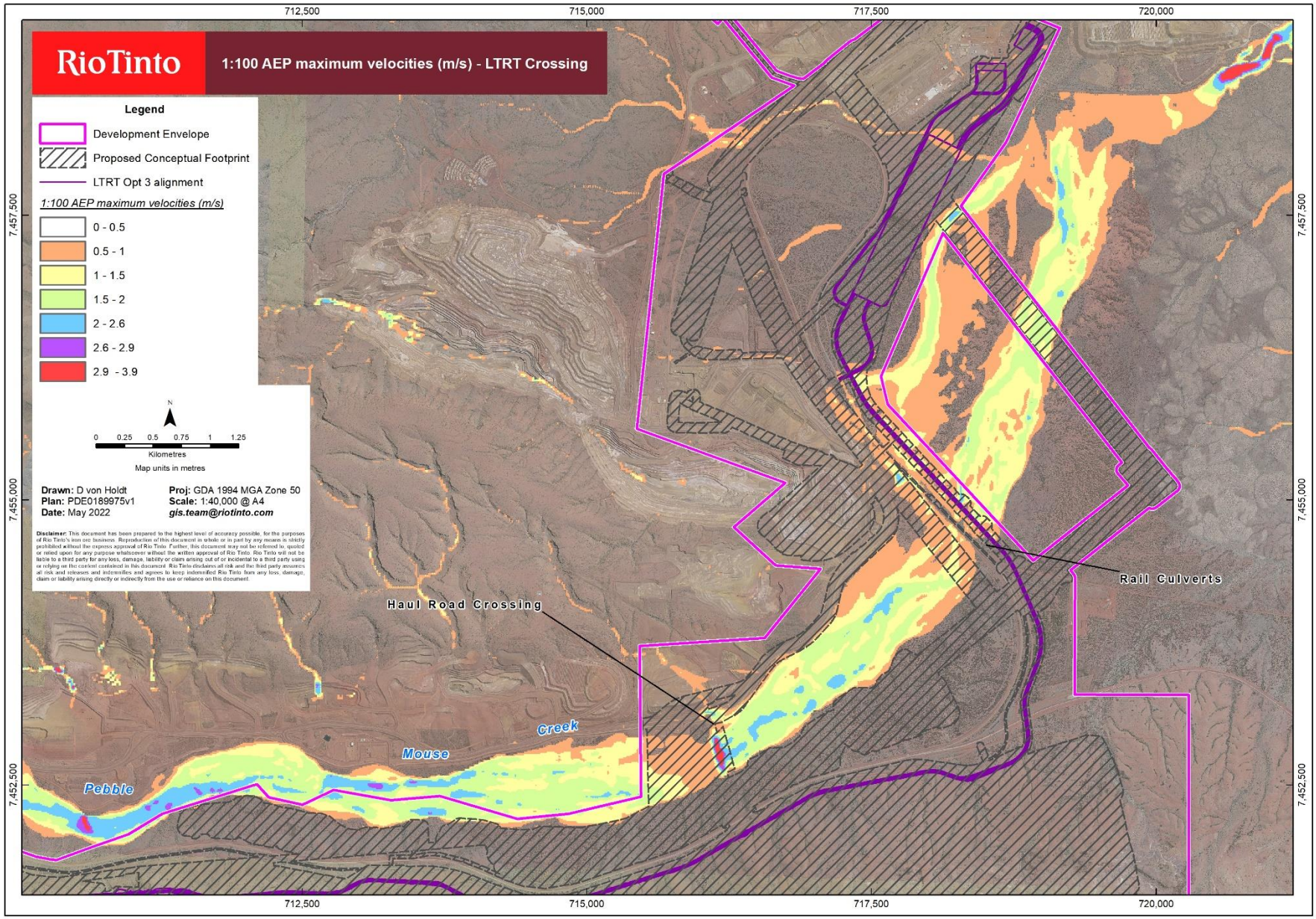

Figure 25: 1:100 AEP maximum velocities (LTRT Crossing)

7.6. Discussion

Hydraulic modelling indicates that during both frequent (1:5 AEP) and rare (1:100 AEP) events, maximum flow depths are observed upstream of the Pebble Mouse Creek haul road crossing as well as upstream of the rail line. This is expected due to the attenuation and backwater impacts of these structures. Velocity regimes at the crossing locations are typically characterised by a reduction in energy at the upstream side as flow is throttled by the crossing obstruction, with a distinct increase in the velocity at and immediately downstream of the crossing as flow is concentrated through the floodway or culvert.

Flow regimes at the crossing are likely to promote the mobilisation of sediment however it is difficult to comment on the extent of downstream sediment deposition without a detailed understanding of the crossing and bed load materials. Frequent event modelled velocities may have sufficient energy to overcome the shear stress of sediment directly at the crossing thus increasing erosion rates. Given the reduced flow velocities in the reach downstream of the crossing, the downstream flow regime is however unlikely to support the sediment loading for long distances, with sediment likely to start dropping out as flow velocities reduce. A crossing washout is more likely under a rare event, with increased velocities and higher energy potentially resulting in sediments transported over longer distances compared to frequent events.

The high flood depths and low velocities observed on the upstream side of the rail crossing supports the increased deposition of sediment at the culvert inlets and most likely poor transport of sediment through the culverts. Therefore, blockages are likely to occur at these culverts because of sediment transport from an upstream source thus reducing the culvert capacities and impacting downstream surface water flow regimes.

Based on this assessment it can be assumed that sediment transported from a potential washout of the Pebble Mouse Creek haul road crossing will most likely be because of a rare rainfall event, with sediments more likely to be deposited at / upstream of the rail crossing, causing some blockage of the culverts at this location. It is therefore considered unlikely that this sediment would have any significant impact on the water quality of Weeli Wolli Spring which is located 14 km downstream of the crossing (and 10 km downstream of the rail culverts).

A similar conclusion can be drawn regarding the LTRT Option 3 creek crossing. With the alignment running parallel to the existing rail line crossing and the culverts being identical (or bigger) than the existing culverts, the flow regime is not expected to change much downstream of the crossing.

Therefore, it is considered unlikely the LTRT Option 3 infrastructure will adversely impact the water quality of Weeli Wolli Spring, located 11 km downstream from the creek crossing and 7 km downstream of TP4.

7.7. Frequency analysis of Pebble Mouse Creek rainfall data

To qualitatively assess the likelihood of frequent and rare rainfall events occurring during the operational life of the Pebble Mouse Creek haul road crossing, a frequency analysis was undertaken. The long term flow data recorded at the DWER Tarina gauging station (located on Weeli Wolli Creek downstream of Weeli Wolli Spring) was used for the analysis. The flow rates measured at Tarina station are based on the Weeli Wolli Creek catchment (1,530 km^2) however the rainfall patterns and streamflow responses observed within this catchment are considered like that observed within the Pebble Mouse Creek catchment. Therefore, the Tarina gauge dataset was scaled to apply to Pebble Mouse Creek using a scaling factor of

0.46. The scaling factor was calculated using the ratio of the two catchment areas to the power of 0.7 (Grayson et al, 2004).

Using peak design flow rates for various AEP events, previously calculated as part of the RORB hydrological modelling, the dataset was interrogated to identify periods of flow at Pebble Mouse Creek responding to frequent to rare rainfall events.

The frequency analysis identified 18 rainfall events characterised as equal to or greater than the 1:5 AEP event occurring over the 30-year period of the dataset. Majority of events were in the 1:5 to 1:10 AEP range, with two 1:20 AEP events and one event greater than the 1:100 AEP.

If mainly rare events have the potential to mobilise significant bed load in a creek and demonstrating that Pebble Mouse Creek has only experienced five rare events over 30 years, the risk of the haul road crossing impacting a key sensitive receptor 14 km downstream of the washout site is considered unlikely to occur.

7.8. Consideration of optional waterway crossings

Based on the alignment of the overland conveyor crossing, environmental flow volumes (lower magnitude than a 1:5 AEP event) in Pebble Mouse Creek will not be impeded. There is potential for flow regimes during the rare events (1:100 AEP event and above) to be altered at the crossing location. However, engineering design of the conveyor crossing will ensure full conveyance of design flows and provide the appropriate level of scour protection downstream. Typical design solutions under consideration, as described in Section 3.4, are expected to result in negligible change from the baseline depth and velocity values and any changes should be confined to those areas a short distance up and downstream of the crossings. Overall flow volume and flow rates are typically unchanged for at-grade crossings and culvert installations. Therefore, given that appropriate scour protection will be provided it is considered unlikely that any sediment movement associated with this crossing would have any significant impact on the water quality of Weeli Wolli Spring, which is located 14 km downstream.

The bridges proposed at GNH and the alternative mine access road are approximately 34 km upstream of Weeli Wolli Springs. Modelling results presented in Section 7.5 indicated that a crossing 14 km upstream from the sensitive receptor would not significantly impact its water quality. Therefore, the addition of both these bridges will have no additional impact on Weeli Wolli Springs over and above those previously stated for the Pebble Mouse Creek haul road crossing.

8. CONCLUSIONS

Hydraulic modelling has shown that mining infrastructure related to the HD2 and BHT deposits will result in minor reductions to peak flows at the key sensitive receptors. The slight loss of runoff is expected to have little effect on the flow regime at Weeli Wolli Spring or Ben's Oasis and therefore is not expected to impact the environmental and heritage values of these areas.

A qualitative assessment of the potential for sediment transport from the Pebble Mouse Creek haul road crossing was undertaken to highlight the potential impacts on water quality at Weeli Wolli Spring. Hydraulic modelling demonstrated that velocities required to mobilise sediment load from the haul road crossing were more likely to be experienced during rare rainfall events. During the frequent events, sediment loading is unlikely to move far downstream due to the low energy estimated downstream of the haul road crossing. The significant distance between the sediment source and key sensitive receptor suggested it was unlikely that water quality would be impacted. This was further supported by the positioning of the HD1 rail line culvert crossing downstream of the haul road crossing through which sediment transport would be poor.

9. References

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A.5: Hope Downs 2 Proposal Consultation Register

APPENDIX A.5: STAKEHOLDER CONSULTATION REGISTER

Start date	Stakeholder	Consultation type/forum	Consultation stage	Summary of discussions relevant to the project	Response/action items
Traditional Owners					
22 May 2018	Weeli Wolli Creek Co-Management Board (now Weeli Wolli Creek Advisory Committee)	Meeting	ESD	•Introduction to the Project, including scope and proposed timing.	
5 September 2018	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli Heritage Sub-Committee meeting	Draft ERD	•Cultural heritage survey update provided for HD2 and BHT. •Discussion of the deposits and planned heritage work.	
6 September 2018	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli LIC meeting	ESD	•Introduction to the Proposal, including the HD2 and Bedded Hilltop (BHT) deposits and two potential ore transport options (haul and conveyor). •Studies will continue to investigate the most cost-effective way of transporting ore from these deposits. •Proposed first ore dates will depend on ongoing studies work. •KNAC expressed concerns that with BHT coming online, access to Weeli Wolli Creek (WWC) may become blocked. •KNAC requested updates on access to WWC at future LIC meetings.	•KNAC and the Nyiyaparli people will be kept informed about the progress of the Studies (i.e., new deposits) – particularly through the LIC forum. •The Proponent has committed to maintaining access to WWC - consultation will continue as the project is refined to better define Nyiyaparli preferred options for access to WWC during construction and operations.
10 October 2018	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga LIC meeting	ESD	•Introduction to the Proposal, including the portion potentially within the Ngarlawangga Native Title determination	
3 April 2019	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli Heritage Sub-Committee meeting		•Cultural heritage survey update provided for HD2 and BHT. •Discussion of the BDH16-03 very significant site and that additional geotechnical assessment will be required if blasting is to occur within 300m of the site. •The cultural values of BDH16-03 were discussed in detail.	•The Proponent has committed to avoiding direct impacts to BDH16-03 and managing the site in-situ.

Start date	Stakeholder	Consultation type/forum	Consultation stage	Summary of discussions relevant to the project	Response/action items
4 April 2019	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli LIC meeting	Other	•The Order of Magnitude study phase is complete, and the Pre-feasibility stage will commence later in 2019. •HD2 and BHT are within the Nyiyaparli native title determination and heritage survey work will continue to cover the proposed pits, waste dumps and infrastructure areas.	
23 September 2019	BNTAC/ Banjima Traditional Owners	Information provision (USB)	Other	•Copies of the biological reports undertaken in respect of the Project area, as well as an explanatory memo were provided to BNTAC	
23 September 2019	BNTAC/ Banjima Traditional Owners	Meeting with BNTAC staff	ESD	•Overview of Project, including that HD2 and BHT are on Nyiyaparli country, but that ore will be processed at the existing plant on Banjima country. •Overview of biological survey outcomes. •Overview of proposed Assessment on Referral Information approval process and timeline for the Project. •The potential interaction of the Proposal with Weeli Wolli Creek is likely to be a concern. •BNTAC requested that information about the Proposal be presented to the Weeli Wolli Creek Advisory Committee. BNTAC are looking at cumulative impacts of mining in the Pilbara.	•The Proponent advised that above water table mining only is proposed so there should be no impact to Weeli Wolli Creek. •It is proposed to build a crossing over Pebble Mouse Creek and modelling will be completed to ensure there are no downstream impacts to Weeli Wolli Creek. •The Proponent confirmed it would present information about the Proposal to the Weeli Wolli Creek Advisory Committee. •The Proponent will provide a copy of the referral to BNTAC at the time of submission to the EPA and will continue to consult with BNTAC. •In early 2021, the proposed approvals process for the Project was amended from an Assessment on Referral Information to a Public Environmental Review. The draft Referral and ESD were provided to KNAC, NAC and BNTAC on 23 April 2021 for review and feedback. The referral was lodged with the EPA in August 2021 and the ESD was lodged with the EPA in January 2022.
25 September 2019	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga LIC meeting	Draft ERD	•An overview of the Project scope was provided including that it involves above water table mining only of the HD2 and BHT deposits, external waste dumps, water supply and associated infrastructure, transport of ore (via conveyors or haulage) to HD1 for processing, access tracks and roads, rail crossing. •Noted that the only portion of the Project on Ngarlawangga country is the potential diversion of part of Great Northern Highway to develop the full extent of the HD2 deposits. Ngarlawangga are concerned about the impact of the potential Great Northern Highway diversion on their country and would like more information about the proposed highway alignment footprint. •Discussion of the proposed Assessment on Referral	•The Proponent will provide a copy of the referral to NAC at the time of submission to the EPA and will continue to consult with NAC. •In early 2021, the proposed approvals process for the Proposal was amended from an Assessment on Referral Information to a Public Environmental Review. The draft Referral and ESD were provided to KNAC, NAC and BNTAC on 23 April 2021 for review and feedback. The referral was lodged with the EPA in August 2021 and the ESD was lodged with the EPA in January 2022. The Proponent is continuing to consult with NAC about the Project and potential impacts to Ngarlawangga country. A

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Start date	Stakeholder	Consultation type/forum	Consultation stage	Summary of discussions relevant to the project	Response/action items
				Information approvals process and timeline for the Project •Ngarlawangga are interested in a scoping session to define the consultation pathway.	dedicated Social Surroundings consultation process has been jointly developed to support this consultation.
26 September 2019	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli LIC meeting	Draft ERD	•Overview of Project, including that it involves above water table mining only of the HD2 and BHT deposits, external waste dumps, water supply and associated infrastructure, transport of ore (via conveyors or haulage) to HD1 for processing , access tracks and roads, Pebble Mouse creek crossing, rail crossing, and the potential diversion of part of Great Northern Highway onto Ngarlawangga country. • Discussion of the proposed Assessment on Referral Information approval process and timeline for the Project and update on biological survey work and outcomes. •KNAC requested that the referral be provided to for it to review.	•The Proponent will provide the referral and ERD to the group at the time of submission to the EPA and will continue to consult with KNAC. •In early 2021, the proposed approvals process for the Proposal was amended from an Assessment on Referral Information to a Public Environmental Review. The draft Referral and ESD were provided to KNAC, NAC and BNTAC on 23 April 2021 for review and feedback. The referral was lodged with the EPA in August 2021 and the ESD was lodged with the EPA in January 2022.
16 October 2019	KNAC/ Nyiyaparli Traditional Owners	Meeting	Draft ERD	•Overview of Proposal and timing, and proposed approvals process and consultation. •Discussion included that the Proposal involves above water table mining only of the HD2 and BHT deposits, and as a result dewatering will not be required. •Discussion of water courses within the Development Envelope, along with known environmental values, including the known MNES. •The Proponent advised that additional biological reports are being prepared and will be provided to KNAC for review. •The Proponent provided an update on the proposed approvals process and timing. •Nyiyaparli raised concerns about maintaining access to sites during construction, operation, and closure (particularly Weeli Wolli Creek) and the importance of protecting water. •Suggestions regarding sharing of information to support social surroundings. •Nyiyaparli keen to undertake additional fieldwork and surveys with the Proponent, especially to identify important plants and bush foods.	•The Proponent has provided biological information and reports to KNAC and access to Weeli Wolli Creek by Traditional Owners has been considered as part of mine planning. •Access to Weeli Wolli Creek by Traditional Owners will be considered as part of mine planning. • Updated maps showing water sources and rock shelters to be provided to KNAC to assist its desktop review of the Proposal. Common names of flora and fauna (and images) to be added to maps ahead of the next consultation. •The Proponent indicated that it is keen to schedule additional surveys and fieldwork with Nyiyaparli people starting in February or March 2020. • In addition to Social Surroundings consultation, Ethnobotanical / Land management consultation has continued into 2022 to inform the ERD.

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Start date	Stakeholder	Consultation type/forum	Consultation stage	Summary of discussions relevant to the project	Response/action items
12 November 2019	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga Board of Directors meeting	ESD	•An overview of the Proposal was provided to the Ngarlawangga Board of Directors, noting that the only portion of the Project on Ngarlawangga country is the potential diversion of part of Great Northern Highway. •An overview of the Proposal scope was provided including that it involves above water table mining only of the HD2 and BHT deposits, external waste dumps, water supply and associated infrastructure, transport of ore (via conveyors or haulage) to HD1 for processing, access tracks and roads, rail crossing, and the potential diversion of part of Great Northern Highway on to Ngarlawangga country. •Discussion of the proposed Assessment on Referral Information approvals process and timeline for the Project. •An overview of the biological survey outcomes to date was also provided. •The Ngarlawangga Board asked if the potential diversion of Great Northern Highway will be surveyed. NAC asked what impact the highway diversion will have on Ghost Bats.	•The Proponent said heritage surveys will be conducted over the area of the potential diversion of the Great Northern Highway, and that it is not currently clear what impact the diversion may have on Ghost Bats, but that it would try to avoid disturbance to the bats where practicable. •The Proponent will provide biological reports to NAC for review and is available to attend further meetings to discuss the Proposal. • The Proponent will continue to consult with NAC in respect of the Proposal.
19 November 2019	BNTAC/ Banjima Traditional Owners	Banjima LIC	Other	•An overview of Proposal and biological survey outcomes was presented to the LIC, including that it will involve above water table mining only at HD2 and BHT, permanent external waste dumps, water supply from a small borefield and the transport of ore to HD1 for processing. •Infrastructure required by the Proposal will include a crossing over Pebble Mouse Creek, access tracks and roads, a rail crossing and the potential diversion of part of Great Northern Highway. •Discussion of the proposed Assessment on Referral Information approvals process and timeline for the Proposal. •An overview of the biological survey outcomes to date was also provided. •BNTAC noted that the Proponent presented information about the Proposal to BNTAC previously and this has been shared with the elders. Banjima LIC members noted that HD2 and BHT are on Nyiyaparli country, but the ore will be processed on Banjima country.	•The Proponent provided updated biological reports to BNTAC on 23 September 2020 and 3 March 2021.
24 February 2020	Weeli Wolli Creek Advisory Committee	Weeli Wolli Creek Advisory Committee meeting	Other	•Overview of the Proposal and summary of environmental studies to date. •NB - Committee did not meet quorum. •The Committee noted that continued access to Weeli Wolli Creek will be an important consideration, and Traditional Owner consultation will be appreciated.	•The Proponent is continuing to engage with Traditional Owners in respect of the Project and maintaining access to Weeli Wolli Creek, including via LICs and other forums.

Start date	Stakeholder	Consultation type/forum	Consultation stage	Summary of discussions relevant to the project	Response/action items
16 April 2020	KNAC, BNTAC, NAC	Information provision (Email)	Other	•The Proponent provided an explanatory memo and copies of the updated biological reports.	
1 July 2020	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli Executive Committee meeting	Draft ERD	•Overview of the Proposal and summary of the approvals process.	
19 August 2020	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga LIC meeting	ESD	•Overview of the Proposal scope including that it involves above water table mining only of the HD2 and BHT deposits, external waste dumps, water supply and associated infrastructure, transport of ore (via conveyors or haulage) to HD1 for processing, access tracks and roads, rail crossing, and the potential diversion of part of Great Northern Highway on to Ngarlawangga country. •New crossings of Pebble Mouse Creek will be required to transport ore to HD1. •Overview of biological surveys completed to date and outcomes and initial visual impact assessment work. •Discussion of the Social Surroundings consultation sought with Ngarlawangga. •Discussion of the approvals process. •Request for more information about Ghost Bats. Copies of additional biological reports to be provided to NAC.	•The Proponent is happy to meet with NAC and provide additional information about Ghost Bats. •Additional biological reports were provided to NAC on 9 October 2020.
21 August 2020	KNAC/ Nyiyaparli Traditional Owners	Teleconference with KNAC staff	Draft ERD	•Overview of the Project and approvals process and timing. •Discussion of the Social Surroundings consultation sought with Nyiyaparli.	
17 September 2020	BNTAC/ Banjima Traditional Owners	Meeting with BNTAC staff	Draft ERD	•Overview of the Project and approvals process and timing. •Update on biological reports. •Discussion of the Social Surroundings consultation sought with Banjima. •BNTAC noted that ore will be processed on Banjima country and that Banjima should be compensated for this impact. •BNTAC asked for more information about water use at HD1 and that water will be a focus for Banjima in future consultation. BNTAC also asked if traffic will increase in frequency.	•The Proponent and BNTAC have agreed an approach for further discussions about compensation. •Information about water use at HD1 was provided to BNTAC as part of environmental reports provided on 29 March 03, 2021, and 29 June 2021. •The Proponent advised that the process rate will be like now so traffic will be about the same frequency.
23 September 2020	BNTAC/ Banjima Traditional Owners	Information provision (USB)		•Additional biological reports and explanatory memos provided	

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Start date	Stakeholder	Consultation type/forum	Consultation stage	Summary of discussions relevant to the project	Response/action items
25 September 2020	NAC/ Ngarlawangga Traditional Owners	Meeting with NAC staff and representatives to plan pre-fieldwork meeting	Other	•Discussion and planning of Social Surroundings consultation sought and proposed timing. •Planning of pre-fieldwork meeting held on 9 October 2020. •This will be a collaborative approach to capture information for the Proponent to feed into the mine design and approval but also to make sure Ngarlawangga capture the information and knowledge for the group.	•The Proponent is continuing to work with Ngarlawangga to develop social surroundings consultation approach and capture relevant information.
1 October 2020	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli LIC meeting	Draft ERD	•Overview of the Proposal and approvals process and timing. Information on the HD2 Project, closure strategy and objectives. •Discussion of the proposed Social Surroundings consultation to feed into the approvals process. •The Proponent is seeking Nyiyaparli feedback to include in the Proposal design and the approvals process and would like to get feedback on the ore transport options (haul road or conveyor) and location of the proposed Pebble Mouse Creek crossing. •Initial information about the closure planning process. •Protecting water and heritage sites and places is important - especially Weeli Wolli Creek and maintaining the flow of Pebble Mouse Creek. Free and safe access to Weeli Wolli Creek needs to be considered in planning. •The proposed waste rock landform near Weeli Wolli Creek is too close. Impacts to water and cumulative impacts to water are a concern. •Nyiyaparli requested the Proponent work with other mining companies in the area on a combined water management approach. •Nyiyaparli want to be involved in environmental surveys and monitoring work. Nyiyaparli ladies and their plant knowledge should also be included in survey work (both environmental surveys and ethnobotanical surveys). • Nyiyaparli want to be consulted about closure of the Project, and an opportunity to explain to the Proponent what they would like.	•Feedback included in ongoing Proposal revision work, and to inform ongoing consultation. •The waste rock landform south of the HD2 pit was removed in subsequent mine designs and access to Weeli Wolli Creek will be maintained as part of the Project design. •Access to Weeli Wolli Creek will also be supported during construction of the Project. •The Proponent is developing a framework to work with BHP on water management. Ethnobotanical work with Nyiyaparli has commenced and will continue. •Closure consultation is ongoing as the project design is refined and developed.

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Start date	Stakeholder	Consultation type/forum	Consultation stage	Summary of discussions relevant to the project	Response/action items
2 October 2020	KNAC/ Nyiyaparli Traditional Owners	Social Surroundings pre-fieldwork workshop		•Whole-day workshop with KNAC staff and representatives and Nyiyaparli Traditional Owners. •Discussion of the approvals process and timing and what 'Social Surroundings' is, including key social and cultural values in the Proposal area. •Discussion of the Proposal scope and timing, including surface and ground water and water supply options, proposed Pebble Mouse Creek crossings, and the proposed surface water diversion near the proposed HD2 pit. •Discussion of initial closure planning and outcomes and heritage survey work to date. •Scoping for the first in-field consultation planned for late October 2020. •Key issues raised by the Nyiyaparli Traditional Owners to be considered in the Proposal design and discussed further included impacts to waterways and water flows, water use and management, increased dust and noise, impacts to heritage sites, access to country, ground disturbance and other impacts to country, closure and rehabilitation (including opportunities to backfill), Nyiyaparli involvement in environmental and other monitoring and business development and employment opportunities. •Meeting feedback also captured in the first Social Surroundings Short Report (provided in December 2020)	•Feedback considered and incorporated into the draft referral where relevant.
2 October 2020	KNAC/ Nyiyaparli Traditional Owners	Information provision (USB)		•Additional biological reports and explanatory memos provided to KNAC	
9 October 2020	NAC/ Ngarlawangga Traditional Owners	Information provision (USB)		•Additional biological reports and explanatory memos provided to NAC	
9 October 2020	NAC/ Ngarlawangga Traditional Owners	Social Surroundings pre-fieldwork workshop		•Whole-day workshop with NAC staff and representatives and Ngarlawangga Traditional Owners to discuss two Projects, including the HD2 Proposal. •Discussion of the approvals process and timing and what 'Social Surroundings' is. •Discussion of the Proposal scope and timing, including above water table mining of HD2 and BHT, ore transport infrastructure, proposed Pebble Mouse Creek crossings, water supply options and the potential realignment of part of Great Northern Highway. •Discussion of visual impacts from Ngarlawangga country and the biological survey work completed to date.	•Feedback from Ngarlawangga will be included in the mine design and approval. •In field consultation will be undertaken to visit the Project area and better understand important values and potential impacts to help guide work to avoid, reduce or manage impacts. •Pebble Mouse Creek crossings will be designed to allow water to flow through. Understanding what areas Ngarlawangga want to access will help options to be developed.

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				•Water is a main concern for Ngarlawangga, including impacts to waterways and waterholes and the animals that rely on waterholes. •Ngarlawangga would like more information about the Pebble Mouse Creek crossings. Dust, access to country and support for Ngarlawangga to access country are also important.	
22 October 2020	BNTAC/ Banjima Traditional Owners	Banjima LIC meeting	Draft ERD	•Update on the Proposal and scope, including that it involves above water table mining at HD2 and BHT, infrastructure for processing and transporting ore (via conveyors or haulage) to HD1, external waste rock landforms and stockpiles, potential realignment of part of Great Northern Highway, water supply (groundwater abstraction and / or existing HD1 dewatering water that is discharged via the gabion) •The Proposal will also include new Pebble Mouse Creek crossings for the haul road/conveyor, and potential new mine access road and realignment of Great Northern Highway. •Discussion of approvals process and timing, Social Surroundings consultation and the consultation sought with Banjima. •Discussion of the impacts on Pebble Mouse Creek and the cost of water from Weeli Wolli Creek versus Baby Hope.	•The Proponent will seek to ensure maintenance of Pebble Mouse Creek flows and prevent the banking-up of water upstream of crossings. •Water supply will be needed for the Proposal and several options are being investigated e.g., ground water at Baby Hope or using some of the water from dewatering at HD1 which would otherwise be discharged to Weeli Wolli Creek. •The Proponent is keen to receive feedback on the options. In looking at water supply options, the Proponent will take into consideration the impact of using that option and then the costs.
22 October 2020	KNAC/ Nyiyaparli Traditional Owners	First Social Surroundings in-field consultation	Draft ERD	•1.5 day in-field consultation with KNAC staff and representatives and Nyiyaparli Traditional Owners to visit areas within the Proposal and to discuss the Proposal in more detail. •Topics discussed included the importance of water, water use and management and water quality (diversions, discharge, drawdown, dust control), concerns about impacts of dust on country (particularly accumulation in water features/drainage), amenity, impacts to people and animals. •Discussed that access to country needs to be easy and not restricted by permit systems, fences, gates etc. More consultation is required to discuss closure planning. •Request that the Proponent investigate moving the proposed waste rock landform south of the HD2 pit further away from Weeli Wolli Creek. •Request for additional information and consultation about the size of the proposed pits and waste rock landforms, water use and management, expected dust levels and management, plant and animal studies in the Project area, closure planning, opportunities for Nyiyaparli involvement in on ground monitoring and management work and business development opportunities. • Short report from trip received 15 December 2020.	•Feedback and recommendations included in planning future in-field consultation. • Waste rock landform south of the HD2 pit removed in subsequent mine design updates.

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Start date	Stakeholder	Consultation type/forum	Consultation stage	Summary of discussions relevant to the project	Response/action items
9 December 2020	NAC/ Ngarlawangga Traditional Owners	Social Surroundings pre-fieldwork workshop	Draft ERD	•1.5-day workshop with NAC staff and representatives and Ngarlawangga Traditional Owners to discuss what Social Surroundings is, and to scope the first Social Surroundings field trip planned for early 2021 relating to 2 Projects, including the HD2 Proposal. •Joint planning of the first Social Surroundings field trip planned for early 2021. •Key concerns include protecting access to country, protecting animals and animal habitats, protecting water flows and waterways, water use and management, impacts to heritage sites, dust and visual impacts to country, rehabilitation of country after mining	•Feedback included in jointly planning the first in-field consultation with Ngarlawangga which was held in April 2021.
16 December 2020	KNAC/ Nyiyaparli Traditional Owners	Email	Draft ERD	•Short report from first Social Surroundings field trip provided by KNAC to the Proponent	•The Proponent is continuing to work with Nyiyaparli to joint plan future consultations including social surroundings and heritage surveys. •Recommendations have been considered in the draft ERD.
27 January 2021	BNTAC/ Banjima Traditional Owners	Meeting with BNTAC staff		•Meeting with BNTAC staff to discuss the Project, Social Surroundings consultation sought with Banjima Traditional Owners and approvals process and timing. •Discussion of the Proposal scope, including that it involves above water table mining at HD2 and BHT, infrastructure for processing and transporting ore (via conveyors or haulage) to HD1, external waste rock landforms and stockpiles, potential realignment of part of Great Northern Highway, water supply (groundwater abstraction and / or existing HD1 dewatering water that is discharged via the gabion). •The Project will also include new Pebble Mouse Creek crossings for the haul road/conveyor, and potential new mine access road and realignment of Great Northern Highway. • Discussion of biological survey work undertaken to date. •BNTAC has provided the biological survey reports to their consultant to review. BNTAC requested spatial data for the biological surveys.	•Project and biological survey spatial data provided on 8 July 2021.
3 March 2021	BNTAC/ Banjima Traditional Owners	Information provision (email)	Other	•Updated biological reports provided to BNTAC and its consultant.	

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11 March 2021	BNTAC/ Banjima Traditional Owners	Banjima LIC/LoMP meeting	Draft ERD	•Update on the Proposal scope, including that it involves above water table mining at HD2 and BHT, infrastructure for processing and transporting ore (via conveyors or haulage) to HD1, external waste rock landforms and stockpiles, potential realignment of part of Great Northern Highway, water supply (groundwater abstraction and / or existing HD1 dewatering water that is discharged via the gabion). •The Proposal will also include new Pebble Mouse Creek crossings for the haul road/conveyor, and potential new mine access road and realignment of Great Northern Highway. •Discussion of biological survey work undertaken to date. •Discussion of approvals process and timing, Social Surroundings consultation and the consultation sought with Banjima. •BNTAC requested more information on how deep and wide the pits will be. •Discussion on the Pebble Mouse Creek crossing and any disruption to the creek as well as dust and other impacts. •Discussion on the waste rock landform south of the HD2 pit and near Weeli Wolli Creek and the potential for it to be removed Discussion on the potential to reduce the Development Envelope and the importance of Visual impact assessment. •Concerns about lack of compensation to Banjima for impacts to country.	•The Proponent advised that the Pebble Mouse Creek crossings will be designed to allow water to flow through. • The Proponent will do more work to understand potential dust creation and how to reduce it. •The waste rock landform south of the HD2 pit near Weeli Wolli Creek was removed in subsequent mine designs, and the Development Envelope has been reduced in a number of areas as project planning has refined the footprint. • A process to support discussions about compensation to Banjima was agreed around mid-2021.
18 March 2021	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga LIC meeting	Draft ERD	•Update on the Project, that at this stage, there is a conceptual footprint. •The Proponent will consult with NAC and Ngarlawangga further in the next few months before the approvals process commences. •The Proponent is seeking Ngarlawangga involvement in Social Surroundings consultation.	•The Proponent and Ngarlawangga commenced first social surroundings trip on 8 April 2021.
29 March 2021	BNTAC/ Banjima Traditional Owners	Information provision (email)	Other	•Additional environmental reports provided to BNTAC and its consultant.	

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8 April 2021	NAC/ Ngarlawangga Traditional Owners	First Social Surroundings in-field consultation	Draft ERD	•3 day in-field consultation with NAC staff and representatives and Ngarlawangga Traditional Owners to visit areas within the Proposal's Development Envelope to discuss the Proposal in more detail. •This was a combined trip for 2 projects with only a small amount of time spent discussing the HD2 Proposal. •Topics discussed included the importance of water, and maintaining water flows, potential Pebble Mouse Creek crossings, concerns about dust creation, impact to country, impacts to people and animals. •Discussed biological survey work to date and that greater access to Country is desired •Key issues raised include impacts to water (including water abstraction, water flows and dust in waterways and waterholes), impacts to cultural heritage, Country, plants and animals and access, changes to the landscape and aesthetic values of Country. • Concerns about current and increased traffic on Great Northern Highway, and impacts the potential new bridge may have on water flows and existing water pools along Pebble Mouse Creek. •Request for ongoing consultation, including about the proposed Project footprint, cultural values mapping and Traditional Ecological Knowledge surveys, additional visual and sound modelling of the proposed Great Northern Highway realignment. Request for further consultation about closure planning and rehabilitation. Final Report finalised in July 2021.	•Report referenced and key feedback included in the Social Surroundings chapter.
23 April 2021	KNAC, BNTAC, NAC	Information provision (email and hard copy)	ESD	•Draft Referrals and draft ESD provided to Traditional Owner groups for review and feedback.	•Traditional Owner responses captured in the Social Surrounds chapter of the ERD
8 June 2021	NAC/ Ngarlawangga Traditional Owners	Information provision (email)	Draft ERD	•NAC provided draft Phase 1 SS report to the Proponent	
29 June 2021	BNTAC/ Banjima Traditional Owners	Information provision (email)	Other	•Additional environmental reports provided to BNTAC and its consultant.	
5 July 2021	KNAC/ Nyiyaparli Traditional Owners	Information provision (email)	Other	•Updated biological reports provided to KNAC.	

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7 July 2021	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli LIC meeting	Draft ERD	•Update on Project, discussion of Part IV process and timing, Social Surroundings and consultation to date and ongoing work/changes to project in response. •Nyiyaparli feedback sought in relation to ore transport options and Project design.	
8 July 2021	BNTAC/ Banjima Traditional Owners	Information provision (email)	Other	•Spatial data files for updated biological surveys provided.	
21 July 2021	BNTAC/ Banjima Traditional Owners	Banjima LOMP meeting	Draft ERD	•Brief discussion that the Proposal requires Social Surroundings consultation, and that the draft Referral and ESD for the Proposal has been provided to BNTAC and its consultant for review and feedback. • A dedicated Social Surroundings workshop is to be held for the Proposal to develop the consultation process and plan the consultation.	•Dates confirmed for first Social Surroundings in-field consultation, and confirmation of scope of work for trip discussed on 15 December 2021
22 July 2021	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli Social Surroundings workshop	Draft ERD	•2-day workshop. •Update on the Project and changes to the mine design based on feedback to date. Discussion of Part IV process and timing, Social Surroundings consultation to date and planned future consultation. •Discussion of approvals process, draft Referral and ESD •Discussion of key Social Surroundings issues including water, dust, restricted access to country, impacts to heritage sites, interfering with caring for country, increased opportunities to take part in on-groundwork to monitor and manage country. •Need to protect Weeli Wolli Creek, including reducing or removing the waste rock landform near it.	•Feedback included in ongoing mine design work. Feedback also included in Short Report for this workshop and the August Social Surrounding in-field consultation which was provided in November 2021
23 July 2021	BNTAC/ Banjima Traditional Owners	Information provision (email)	Other	•Peer review report prepared on behalf of BNTAC provided to the Proponent. •Feedback provided in respect of biological survey and other studies undertaken to date and additional work required to meet EPA guidance.	•Project design is continuing to be refined and additional biological survey and other studies will be undertaken to address any gaps in initial survey coverage and the coverage required for the refined project design. •Some changes were made to the draft Referral in response to this report.

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29 July 2021	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga Social Surroundings workshop	Draft ERD	•Workshop to discuss outcomes of Social Surroundings consultation to date (the first Social Surroundings in-field consultation), the approvals process and timing, and provide a Project update. •Social Surroundings consultation to continue. •Ngarlawangga requested additional consultation in respect of compensation for impacts to country as well as ongoing consultation about visual and other impacts.	•Social Surroundings consultation to continue. •Discussions regarding compensation are ongoing.
2 August 2021	BNTAC/ Banjima Traditional Owners	Information provision (email)	Other	•The Proponent provided a letter in response to the Peer review report provided by BNTAC.	
3 August 2021	NAC/ Ngarlawangga Traditional Owners	Information provision (email)	Draft ERD	•NAC provided final Phase 1 SS report to the Proponent	
7 and 9 August 2021	KNAC/ Nyiyaparli Traditional Owners	Information provision (email)	Draft ERD	•KNAC provided feedback to the Proponent on the draft Referral and ESD	•Feedback considered and incorporated into the draft referral and ESD where relevant.
9 August 2021	KNAC/ Nyiyaparli Traditional Owners	Second Social Surroundings in-field consultation	Draft ERD	•Second In-field consultation with Nyiyaparli Traditional Owners to visit key, discuss the Project and changes to date in response to Nyiyaparli feedback. •Discussion of key feedback to date, key Social Surroundings values and potential impacts including water, water management and water quality (diversions, drawdown, dust control). •Concerns about dust creation and impacts of dust on country (particularly accumulation in water features/drainage), amenity, animals, people, access to country: including optional access roads to highly significant heritage sites and important plants and animals, including biological surveys to date. •Discussion of key Social Surroundings values including water, dust, access to country, Weeli Wolli Creek and caring for country. Key issues raised include water impacts and water management, mine design, including waste rock landforms and the importance of mine closure and rehabilitation on impacts to country and visual amenity.	•Feedback included in ongoing mine design work. Feedback summarised in Short report received in November 2021.

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16 August 2021	BNTAC/ Banjima Traditional Owners	Meeting with BNTAC staff	Draft ERD	•Discussion of the information provided by the Proponent to date and the peer review report provided by BNTAC's consultant. •Discussion that the Proponent will make some changes to the Referral in response to the feedback received and that it will provide a copy of the updated Referral at the time of submission to the EPA. •BNTAC will prepare a letter providing feedback on the Referral document in respect of three key issues: troglofaunal, inland waters and the link between the HD1 mine and the HD2 Proposal.	•The Proponent is updating the referral document based on feedback from a number of parties and will consider the feedback from BNTAC and provide an updated copy of the referral at the time of lodging with the EPA.
17 August 2021	NAC/ Ngarlawangga Traditional Owners	Information provision (email)	Draft ERD	•NAC provided to feedback to the Proponent on the draft Referral and ESD •Feedback provided on the draft documents. •Request for ongoing consultation about the Proposal's footprint, request to reduce the Development Envelope where possible -particularly to remove key heritage and drainage features including Weeli Wolli Creek. •Additional information about access, noise, light and litter impacts from the potential diversion of Great Northern Highway. •Ngarlawangga desire for greater involvement in environmental survey, monitoring, and management work.	•The Proponent updated the Referral document based on feedback from several parties and also considered the feedback from NAC.
19 August 2021	BNTAC/ Banjima Traditional Owners	Information provision (Letter from BNTAC)	Draft ERD	•BNTAC provided the Proponent with a letter providing feedback on the draft referral. •Feedback provided in respect of the Inland Waters, Social Surroundings and Subterranean Fauna sections of the referral.	•The Proponent updated the referral document based on feedback from several parties and also considered the feedback from BNTAC.
3 September 2021	KNAC, BNTAC, NAC	Information provision (email)	Draft ERD	•Email from Proponent providing a response to feedback from KNAC and NAC on draft Referral, provision of updated Referral to KNAC, NAC and BNTAC	
8 September 2021	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga LoMP meeting	Draft ERD	•Update on Proposal and Social Surroundings consultation to date. •Discussion of next steps in the Social Surroundings consultation process and that the draft Referral and ESD were provided to NAC for review and feedback. •NAC and its consultants have reviewed the draft Referral and ESD and provided feedback to the Proponent. •Ngarlawangga want to progress discussions about compensation and want more information about water and potential impacts to the flow of Pebble Mouse Creek.	•NAC paused consultation for the Proposal while compensation issues were progressed between the parties. • A Social Investment package was developed and presented to the NAC Board in March 2022. This was well received, and consultation was scheduled to recommence with a further Social Surroundings in-field consultation in May 2022, but this had to be postponed due to severe weather and flooding in the Pilbara. •Additional information about water and potential impacts to the flow of Pebble Mouse Creek provided

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Start date	Stakeholder	Consultation type/forum	Consultation stage	Summary of discussions relevant to the project	Response/action items
					at the in-field consultation undertaken from 18-22 July 2022 and in subsequent Social Surroundings workshops
8 September 2021	KNAC/ Nyiyaparli Traditional Owners	Information provision (email)	Draft ERD	•KNAC provided consolidated feedback to the Proponent on the draft Referral	•Feedback considered and incorporated into the draft referral where relevant.
4 October 2021	BNTAC/ Banjima Traditional Owners	Meeting with BNTAC staff	Other	•Brief update on the approval process and timing. •Discussion of the Social Surroundings and consultation sought and proposed timing. •BNTAC requested that the Proponent provide copies of the heritage survey reports for the portion of the Proposal's Development Envelope in Banjima Country	•Copies of heritage reports were provided on 17 January 2022.
15 November 2021	KNAC/ Nyiyaparli Traditional Owners	Information provision (email)	Other	•Draft Short report from the second SS trip provided by KNAC to the Proponent	
22 November 2021	KNAC/ Nyiyaparli Traditional Owners	Third Nyiyaparli Social Surroundings in-field consultation	Draft ERD	•Third In-field consultation with Nyiyaparli Traditional Owners to visit key areas, discuss the Proposal and changes to date in response to Nyiyaparli feedback. •Further discussion of key topics including water and water management, dust and impacts of dust on country (particularly accumulation in water features/drainage), amenity, animals, people and closure and rehabilitation. •Discussion of key Social Surroundings values including water, dust, access to country, and closure and rehabilitation. Key issues raised include water impacts and water management, mine design, including waste rock landforms and the importance of mine closure and rehabilitation on impacts to country and visual amenity.	•Feedback included in ongoing mine design work. Feedback summarised in Short report received in November 2021.
26 November 2021	BNTAC/ Banjima Traditional Owners	Banjima LIC/LOMP meeting	Draft ERD	•Update on the Proposal scope. Discussion of Part IV process and timing, Social Surroundings and consultation sought •Discussion of proposed first Social Surroundings field trip and scope of work	•Scope of work developed for first in-field Social Surroundings consultation.
15 December 2021	BNTAC/ Banjima Traditional Owners	Banjima LIC/LOMP meeting	Draft ERD	•Confirmation of dates for first Social Surroundings in-field consultation, confirmation of scope of work for trip. •Scope of work agreed for Phase 1 of the Social Surroundings Assessment.	
17 December 2021	KNAC, BNTAC, NAC	Information provision (email)	ESD	•The Proponent provided a copy of updated draft ESD, and a summary of what feedback had been incorporated.	

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Start date	Stakeholder	Consultation type/forum	Consultation stage	Summary of discussions relevant to the project	Response/action items
17 January 2022	BNTAC/ Banjima Traditional Owners	First Social Surroundings in-field consultation	Draft ERD	•First in-field Social Surroundings consultation with Banjima Traditional Owners undertaken to identify and record social and cultural values and to identify key issues/concerns to be considered in project design and the approvals documents. • Project overview provided, and key locations visited. Feedback was sought on issues related to surface and ground water, dust, noise and vibration, access during and post mining, culturally significant plants and animals, any impacts from increased personnel and traffic, considerations related to mine closure and rehabilitation and visual impacts from the Proposal. •Feedback on ore transport options and water supply options was also sought.	•Information from the first in-field consultation and the draft Preliminary Advice will considered in ongoing mine design work as well as the Social Surroundings chapter.
15 February 2022	KNAC, BNTAC, NAC	Information provision (email)	ESD	•The Proponent provided a copy of updated draft ESD lodged with the EPA on 14 January 2022, as well as a copy of the further updated ESD (to better align with the new ESD template) lodged with the EPA on 2 February 2022.	
9 March 2022	KNAC/ Nyiyaparli Traditional Owners	Information provision (email)	Other	•KNAC provided draft short report from November 2011 SS trip to Proponent	
14 March 2022	KNAC/ Nyiyaparli Traditional Owners	Fourth Social Surroundings in-field consultation	Draft ERD	•Fourth in-field consultation to discuss the Proposal, changes to date in response to Nyiyaparli feedback. •Discussion of ore transport options, waterholes, closure and rehabilitation and ongoing work to refine the project and avoid, reduce, and manage impacts to social surroundings through the SCHMP and ongoing consultation. •Feedback in respect of ore transport options, discussion of the HD2 waterhole and BHT Rockhole, further discussion and feedback in respect of closure and rehabilitation.	•Feedback to be included in ongoing mine design work. Trip outcomes included in consolidated Social Surroundings report provided in August 2022.
22 March 2022	KNAC/ Nyiyaparli Traditional Owners	Information provision (email)	Other	•Updated spatial data for the Proposal provided to KNAC and consultants along with spatial data for biological survey work and copies of the biological survey reports.	

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Start date	Stakeholder	Consultation type/forum	Consultation stage	Summary of discussions relevant to the project	Response/action items
28 March 2022	BNTAC/ Banjima Traditional Owners	Information provision (email)	Draft ERD	•BNTAC provided the Proponent with the Preliminary Advice from the January 2022 SS trip •Draft Preliminary Advice provided by BNTAC to the Proponent. Key issues/values identified include water, plants, animals, hills/ranges, and people. Key themes included protecting country, capacity building and sustainable businesses, and Banjima governance and processes. Protecting water and the flow of water, as well as access to Weeli Wolli Creek were noted as particularly important.	•Pending an updated Final Report, this information has been incorporated into the draft HD2 Proposal Social Surroundings chapter.
10 April 2022	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli Ethnobotanical / Land Management survey	Other	•In field consultation to identify and record ethnobotanical and land management information in the vicinity of the HD2 Proposal.	•Consolidated report for the April 2022 and September 2022 trips is pending.
28 April 2022	KNAC/ Nyiyaparli Traditional Owners	Information provision (email)	Draft ERD	•Provision of working draft Social Surroundings chapter to KNAC and Nyiyaparli Traditional Owners for review and feedback.	•Feedback incorporated into updated draft Social Surroundings chapter •Feedback on working draft Social Surroundings chapter received 5 July 2022.
4 May 2022	KNAC/ Nyiyaparli Traditional Owners	Social Surroundings consolidation workshop	Draft ERD	•Three-day Social Surroundings workshop with Nyiyaparli Traditional Owners to discuss the Proposal, changes to date in response to Nyiyaparli feedback, discussion of residual impacts including to water, country and ongoing work to refine the project and avoid, reduce and manage impacts to Social Surroundings through the SCHMP and ongoing consultation. •Discussion of the content and purpose of the Social Surroundings chapter and SCHMP, feedback from Nyiyaparli to inform the SS chapter and joint development of the SCHMP. •Feedback in respect of Proposal scope and key issues, including initial option to avoid impacts to HD2 waterholes and BHT Rockhole, consolidated Social Surroundings report pending.	•Feedback to be included in ongoing mine design work. •Workshop outcomes reported in the consolidated Social Surroundings report received on 4 August 2022.
13 May 2022	NAC/ Ngarlawangga Traditional Owners	Information provision (email)	Other	•Updated spatial data for the Proposal provided to NAC and consultants.	
17 May 2022	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli LOMP meeting	Other	•Pre-read information provided and HD2 session planned but not held as meeting ran over time.	
3 June 2022	KNAC/ Nyiyaparli Traditional Owners	Information provision (email)	Other	•Proponent provided feedback on the first three short reports to KNAC and consultants.	

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Start date	Stakeholder	Consultation type/forum	Consultation stage	Summary of discussions relevant to the project	Response/action items
20 June 2022	BNTAC/ Banjima Traditional Owners	Banjima LIC/ LOMP meeting	Other	•Proponent provided a Study update. • Proponent advised in response to feedback from previous engagements, the proposed pits and associated activities have been relocated away from Weeli Wolli Creek. • Key approvals and timelines discussed, with conversation held regarding requirement for ongoing consultation at Study stage. •Proponent presented ore transport options and access to Weeli Wolli Creek during construction. • Discussions held regarding progressing social surroundings consultations. First consultation held in January 2021.	• Draft minutes to be finalised. • Commitment to continue working to progress Social Surroundings consultations.
20 June 2022	KNAC/ Nyiyaparli Traditional Owners	Mine Closure Workshop	Other	•Closure workshop focusing on HD1 Partial Closure Study. •General closure topics discussed. •Purpose of the workshop was to establish a baseline of Nyiyaparli expectations for closure design on their Country.	•KNAC provided Closure Principles • Proponent will utilise the closure principles as a baseline for future consultations.
27 June 2022	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga LOMP meeting	Other	• Proponent provided an overview of the HD1 Sustaining Study including proposed rock landform, pits, life of mine and key infrastructure areas. • Proponent provided an overview of the proposal to divert the Great Northern Highway. • NAC requested they receive the road options prior to the next field trip.	•Minutes drafted and provided to NAC for approval.
28 June 2022	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga Social Surroundings workshop	Draft ERD	•Joint Study (WANB2020 and HD1 S) SS workshop •Proponent provided an overview of what an ERD and SCHMP are and associated key approval documents. • Proponent confirmed approvals timings for both Studies are different. Conducting joint workshops to ensure alignment of approach between RTIO & NAC for input. • Proponent provided an overview of timing for approvals; intent to provide draft ERD to NAC in August/September.	Draft minutes to be finalised •Proponent to provide timeline to NAC for approvals inputs.
5 July 2022	KNAC/ Nyiyaparli Traditional Owners	Information provision (email)	Draft ERD	NA	KNAC provided feedback on working draft Social Surroundings chapter
18 July 2022	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga in-field consultation	Draft ERD	• Draft report • Short report from Social Surroundings field trip from 18-21 July, provided by NAC to the Proponent. • NAC provided feedback in the report that further detailed discussions and on-country visits would be required.	•Draft report provided by NAC on 8 September 2022. • Recommendations from the report are a preliminary summary of Ngarlawangga perspective. •Updated report expected to be provided late October 2022.

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Start date	Stakeholder	Consultation type/forum	Consultation stage	Summary of discussions relevant to the project	Response/action items
4 August 2022	KNAC/ Nyiyaparli Traditional Owners	Information provision (email)			•Draft consolidated Social Surroundings report received from KNAC •Feedback on draft consolidated SS report to be provided to KNAC.
10 August 2022	BNTAC/ Banjima Traditional Owners	Banjima HRG	Other	• Proponent provided an overview of the HD1 Sustaining Study. • Discussed next steps to finalising the preliminary advice from the Social Surroundings trip held in January 2022. Review and feedback are required from HRG members. • Proponent described the Social Surroundings process in relation to approvals. Key recommendation from the trip is for a joint discussion between Banjima and Nyiyaparli Elders regarding the Study. • Proponent noted that the Study seeks to co-develop the design where practicable. • Discussion of benefits payments and commencement of agreement modernisation process.	• Draft minutes to be finalised. •Proponent to investigate how infrastructure compensation negotiations might be advanced. • Proponent to discuss how a joint meeting might be facilitated with KNAC and BNTAC. • HRG members to review and provide feedback on the SS consultation report.
22 August 2022	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli LIC Social Surroundings workshop		• Three-day workshop. •Proponent provided a Study update including Heritage sites, road train ore transport, project design, access changes to Weeli Wolli Creek. • Discussion of Part IV approvals process including ERD, Social Surroundings chapter and SCHMP. Discussed co-design of SCHMP and agree on structure aligning with EPA expectations. • Discussion of timing for approvals. KNAC 3 months to review.	•Feedback will be included in the updated Consolidated Social Surroundings report to be provided in November 2022. •The LIC discussed the Proponent working with KNAC and its consultants.
8 September 2022	NAC/ Ngarlawangga Traditional Owners	Information provision (email)			•Draft short Social Surroundings report provided (NB subject to review by NAC and Preston)
13 September 2022	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga Social Surroundings workshop	Other	• One day workshop. • Discussions regarding approvals update, Great Northern Highway realignment, dust and noise and vibration.	•Feedback will be included in the updated Social Surroundings report expected to be provided late October 2022
19 September 2022	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli Ethnobotanical / Land Management survey	Other	NA	•Consolidated report for the April 2022 and September 2022 trips is pending

Start date	Stakeholder	Consultation type/forum	Consultation stage	Summary of discussions relevant to the project	Response/action items
12 October 2022	KNAC/ Nyiyaparli Traditional Owners	Nyiyaparli LIC meeting	Draft ERD	•Proponent provided an update on the Study including the number of pits, above water table mining, Great Northern Highway realignment options, ore transport options and the life of mine. •Proponent outlined the design changes to the Study scope because of the ongoing consultations with KNAC and Nyiyaparli. •Proponent advised the draft proposal will be provided to KNAC in November for review. • Proponent confirmed heritage sites have been reviewed during the infrastructure design to reduce impact where practicable	• Draft minutes to be finalised. • Proponent to provide KNAC with updated number of heritage sites impacted by the three ore transport options. • Proponent to provide KNAC with updated proposed timing for the environmental approval application.
23 November 2022	NAC/ Ngarlawangga Traditional Owners	Ngarlawangga Social Surroundings workshop	Other	Planned	
Others					
28 October 2022	Shire of East Pilbara	Meeting	Draft ERD	•The Proponent provided an outline of the Proposal to the Shire. • A map and conceptual layouts, proposed Hope Downs 2 Proposal was discussed. • The potential temporary closure (up to 24 months) of the HD2 mine access (private) road to begin construction was discussed. This road is occasionally accessed by the public travelling to Weeli Wolli Creek and/or Spring. •The Shire was receptive to the Proponent's offer to grade the initial 45km of the Shire owned Rhodes Ridge Road for the period that the HD 2 mine access road is closed.	•The Shire thanked RTIO and stated it was supportive of the road being maintained for the period that the mine access road was closed. • The Shire was happy to participate in further discussions on this matter as needs be.

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A.6: Draft Hope Downs 2 Greenhouse Gas Environmental Management Plan

Hamersley HMS

Greenhouse Gas Environmental Management Plan

Hope Downs 2 Proposal

Hamersley HMS Pty. Limited

November 2023

Hamersley HMS Pty. Limited

152-158 St Georges Terrace, Perth

GPO Box A42, Perth, WA 6837

Disclaimer and Limitation

This report has been prepared by Rio Tinto's Iron Ore Group (Rio Tinto), on behalf of Hamersley HMS Pty. Limited as manager of the Hope Downs Joint Venture (the Proponent), specifically for Hope Downs 2 Proposal (the Proposal). Neither the report nor its contents may be referred to without the express approval of Rio Tinto, unless the report has been released for referral and assessment of proposals.

Document Status				
Description	Prepared by	Reviewed by	Approved by	Approval Date
Draft submitted to DWER	Rio Tinto	Rio Tinto	Rio Tinto	December 2022
Draft submitted to DWER (this document)	Rio Tinto	Rio Tinto	Rio Tinto	November 2023

Corporate endorsement

I hereby certify that to the best of my knowledge, the provisions within this Hope Downs 2 Proposal Greenhouse Gas Environmental Management Plan are true and correct.

Name: Nathan Jacobs **Signed:**

Designation: General Manager, Greater Hope Downs **Date:** 15th **November 2023**

1. EXECUTIVE SUMMARY

Proposal name	Hope Downs 2 Proposal
Proponent name	Hamersley HMS Pty. Limited
Proposal description and scope	Hamersley HMS Pty. Limited (the Proponent) operates the existing Hope Downs 1 iron ore project, located approximately 80 km northwest of the township of Newman in the Pilbara Region of Western Australia. The Proposal is located adjacent to the existing Hope Downs 1 mining operations and involves the development of two above water table iron ore deposits; Hope Downs 2 (HD2) and Bedded Hilltop (BHT). Ore will be transported from these two deposits to existing infrastructure at Hope Downs 1 for processing.
Purpose of the GHG EMP	The GHG EMP has been prepared with due consideration to the Western Australian Government Greenhouse Gas Emissions Policy for Major Projects (State GHG Policy) and the Western Australian Environment Protection Authority (WA EPA) Greenhouse Gas Management Plan section of the Environmental Factor Guideline: Greenhouse Gas Emissions 2023 (Guideline) which requires a GHG EMP to be developed when a Proposal exceeds 100,000 tonnes CO_2-e of Scope 1 or Scope 2 emissions in any year. The GHG EMP demonstrates the Proponent's contribution towards the Western Australia aspiration of net zero emissions by 2050, making a commitment to implement initiatives that either avoid, reduce or offset emissions.
Emissions estimates	The principal source of emissions for the Proposal includes diesel consumption (Scope 1) and electricity supplied by the Pilbara Power Generation Network (Scope 2). Total emissions for the life of the Proposal without emissions abatement, equates to 2,467,984 t CO_2-e over the ~15-year project with an average emissions intensity value of 0.0075 t CO_2-e/ t SOP. Emissions estimates for the Proposal include: <u>Annual average</u> • 147,888 t CO_2-e Scope 1 emissions • 28,396 t CO2-e Scope 2 emissions • 25,783,235 t CO_2-e Scope 3 emissions <u>Total</u> • 2,070,437 t CO2-e Scope 1 emissions • 397,548 t CO2-e Scope 2 emissions

	• 360,965,289 t CO2-e Scope 3 emissions
Trajectory of emissions reductions	The Proponent proposes to align its emissions reduction targets to Rio Tinto corporate emissions reduction targets and from 2030 will reduce emissions along a linear trajectory to net zero by 2050. This is consistent with EPA expectations and results in the following emissions reductions for the Proposal; • Reduce or abate absolute emissions by 15% by 2025 (approximately 5,608 t CO_2-e); • Reduce or abate absolute emissions by 50% by 2030 (approximately 523,778 t CO_2-e); • Reduce or abate absolute emissions by 66% by 2035 (approximately 759,076 t CO_2-e); Applying the mitigation hierarchy, the Proponent proposes a combination of avoidance measures and offsets to meet the Proposals emissions reduction targets.
Other statutory decision-making processes which require reduction in GHG emissions	The Commonwealth of Australia regulates Scope 1 covered emissions from the Hope Downs 1 mine through the Safeguard Mechanism. It requires the Hope Downs 1 facility to keep emissions below a baseline (that rises and falls with production) or purchase Australian Carbon Credit Units (ACCUs) in the event of baseline exceedances. The Safeguard Mechanism baseline for Hope Downs 1 is now set on a combination of site-specific emissions intensity and the default industry average emissions intensity. The weighting towards the default industry average emissions intensity increases annually, rising to 100% in 2030. Concurrently, baselines also decline 4.9% year on year lowering the facility baselines each year. A facility can reduce Scope 1 covered emissions (e.g. diesel reductions) at the facility to avoid baseline exceedances or are required to purchase ACCUs. The Hope Downs 1 mine obtains power from the Pilbara Power Network which is subject to Commonwealth of Australia's Renewable Energy Target (RET). The RET is designed to reduce emissions of greenhouse gases in the electricity sector by encouraging additional generation of electricity from sustainable and renewable sources. Renewable Energy Certificates (RECs) must be surrendered based on the amount of electricity generated minus exemptions (e.g. electricity generated from renewables) multiplied by the Renewable Power Percentage (RPP) for the year. The 2023 RPP is 18.96%.
Key components in the GHG EMP	To achieve net zero by 2050, emission abatement projects could be implemented locally at Hope Downs 1 or throughout the Pilbara. This is focussed on displacement of gas in electricity generation throughout the Pilbara Power Network with renewable energy sources, including solar, wind and battery energy storage, along with energy efficiency opportunities, alternative fuels and technologies to reduce or replace diesel in mobile fleet (e.g. battery electric solutions). Future improvements in technology will be monitored and assessed for feasibility over the life of the Proposal. The Proponent expects that abatement will be sufficient to meet a portion of the interim and long-term targets. The Proponent also proposes to offset GHG emissions by retiring high integrity offset units (ACCUs) on an annual basis to meet the remaining portion of the cumulative 5 yearly targets (or if abatement is insufficient against the Proposal targets).

	Scope 3 emissions from steel making are the largest contribution to total emissions due to activities by customers outside of the Western Australia jurisdiction. Currently there is no proven process route at an industrial scale to produce primary net zero steel today, however the industry is developing and scaling a range of new technologies. Through the dedicated steel decarbonisation team within the Commercial team, Rio Tinto is advancing numerous projects in partnership with over 30 customers, universities, researcher institutes, and other industry stakeholders, to build options with the aim of net zero by 2050.
GHG EMP reviews and reporting	The Ministerial Statement Annual Compliance Assessment Report will include annual Proposal emissions, tonnes of iron ore produced and the emissions intensity. A summary report of performance against the Proposal targets will be detailed in the Ministerial Statement Annual Compliance Assessment Report every five years, with the first report taking place in 2025. Where either the five yearly review cycle is triggered, or if a significant change to either the facility, activity, or material risk is identified, a revised GHG EMP will be submitted to the WA EPA.
Proposed construction date	2025
GHG EMP required pre-construction?	Yes ☒ No ☐
Proposed project end of life/decommissioning date	2038

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Abbreviations and Definitions

Table 1-1 Abbreviations and Definitions

Abbreviation	Term
ACCU	Australia carbon credit unit
ANFO	Ammonium nitrate and fuel oil
AHS	Autonomous haul trucks
AWT	Above water table
BWT	Below water table
BESS	Battery energy storage system
BHT	Bedded Hilltop
BOF	Basic oxygen furnace
CH_4	Methane
CER	Clean Energy Regulator
CO_2	Carbon dioxide
CO_2-e	Carbon dioxide equivalent
Credible offset units	Offset units that meet offset integrity standards and principles outlined in ICROA's Technical Specification
CRI	Commercial readiness index
CCS	Carbon capture and storage
DMAs	Decision-making authorities
DRI	Direct reduced iron
EP Act	*Environmental Protection Act 1986*
EFH	Effective flat haul
ERD	Environmental Review Document
GHG	Greenhouse gas
GHG EMP	Greenhouse Gas Environmental Management Plan
GWP	Global warming potential
Ha	Hectares
HD1	Hope Downs 1
HD2	Hope Downs 2
HME	Heavy mobile equipment
HVO	Hydrotreated vegetable oil
ICROA	International Carbon Reduction and Offset Alliance
IPCC	Intergovernmental Panel on Climate Change
JV	Joint venture
LED	Light emitting diode
MS	Ministerial statement
Mtpa	Million tonnes per annum
MWh	Megawatt hour
NbS	Nature-based Solutions
NCC	National Construction Code
NGER	National Greenhouse and Energy Reporting

Abbreviation	Term
NGER Determination	*National Greenhouse and Energy Reporting (Measurement) Determination 2008*
N_2O	Nitrous oxide
NLW	Ngarlawangga people
NPI	Non-processing infrastructure
NYI	Nyiyaparli people
Proponent	Hamersley HMS Pty. Ltd as manager of the Hope Downs Joint Venture between Hope Downs Iron Ore Pty Ltd (a member of the Hancock Prospecting Group) and Hamersley WA Pty Ltd (a member of the Rio Tinto Group)
Proposal	The Proposal is located adjacent to the existing Hope Downs 1 mining operations and involves the development of two above water table iron ore deposits; Hope Downs 2 (HD2) and Bedded Hilltop (BHT).
REC	Renewable Energy Certificate
RET	Renewable Energy Target
RPM	Revolutions per minute
RTIO	Rio Tinto Iron Ore
Safeguard Mechanism	*National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015*
Scope 1	Emissions released into the atmosphere as a direct result of an activity, or series of activities, at a facility
Scope 2	Indirect emissions released into the atmosphere from the consumption of purchased energy
Scope 3	All other indirect GHG emissions (not included in Scope 2) that occur in the Company's value chain
SOP	Saleable ore product
State GHG Policy	*Greenhouse Gas Emissions Policy for Major Projects*
t CO_2-e	Tonnes of carbon dioxide equivalent
The Guideline	*Environmental Factor Guideline Greenhouse Gas Emissions 2023*
TMM	Total material movement
TRL	Technology readiness level
VSD	Variable speed drives
VSG	Variable speed generator
WA EPA	Western Australian Environment Protection Authority
WI	Work index

2. CONTEXT, SCOPE AND PURPOSE

The Hope Downs 2 Proposal (the Proposal) centres around the development of two new iron ore deposits, the Hope Downs 2 deposit and Bedded Hilltop deposit, and supporting infrastructure. Hamersley HMS Pty. Limited (the Proponent) operates the existing Hope Downs 1 iron ore mine which is located approximately 80 kilometres northwest of the township of Newman in the Pilbara Region of Western Australia (Figure 2-1). Iron ore mined from the Proposal deposits will be transported to the adjacent Hope Downs 1 operations and utilise existing infrastructure.

2.1. Proposal description and scope

The Hope Downs 2 Proposal (the Proposal) centres around the development of two new iron ore deposits, the Hope Downs 2 deposit and Bedded Hilltop deposit, and supporting infrastructure. Hamersley HMS Pty. Limited (the Proponent) operates the existing Hope Downs 1 iron ore mine which is located approximately 80 kilometres northwest of the township of Newman in the Pilbara Region of Western Australia (Figure 2-1). Iron ore mined from the Proposal deposits will be transported to the adjacent Hope Downs 1 operations and utilise existing infrastructure.

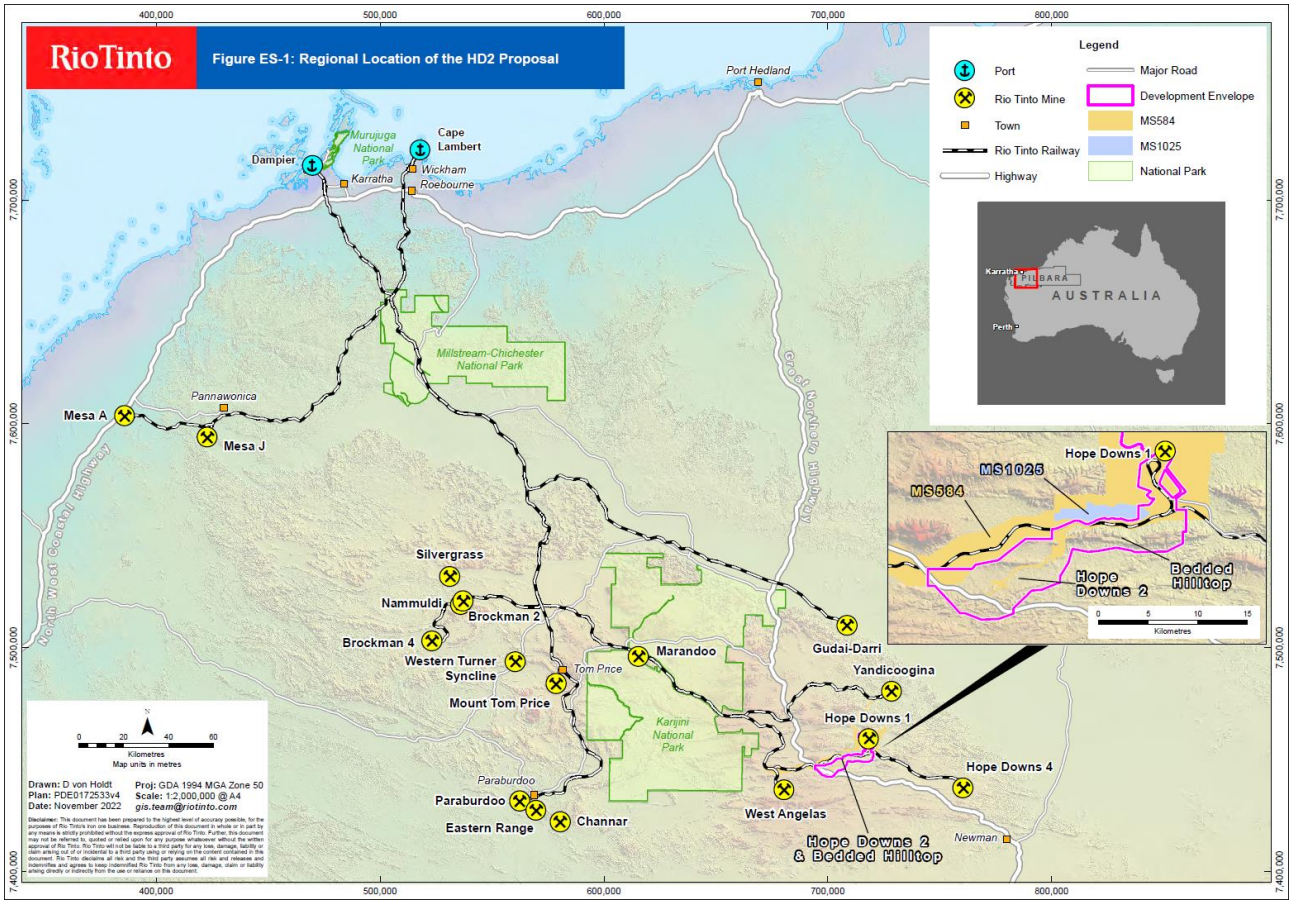

Figure 2-1 Location of the Hope Downs 2 Proposal

This Proposal is an integral part of the Rio Tinto Group's (Rio Tinto) integrated network of iron ore mines in the Pilbara. Current indicative layout of the key components of the Proposal are depicted in Figure 2-2, including the new proposed development envelope as per the Proposal.

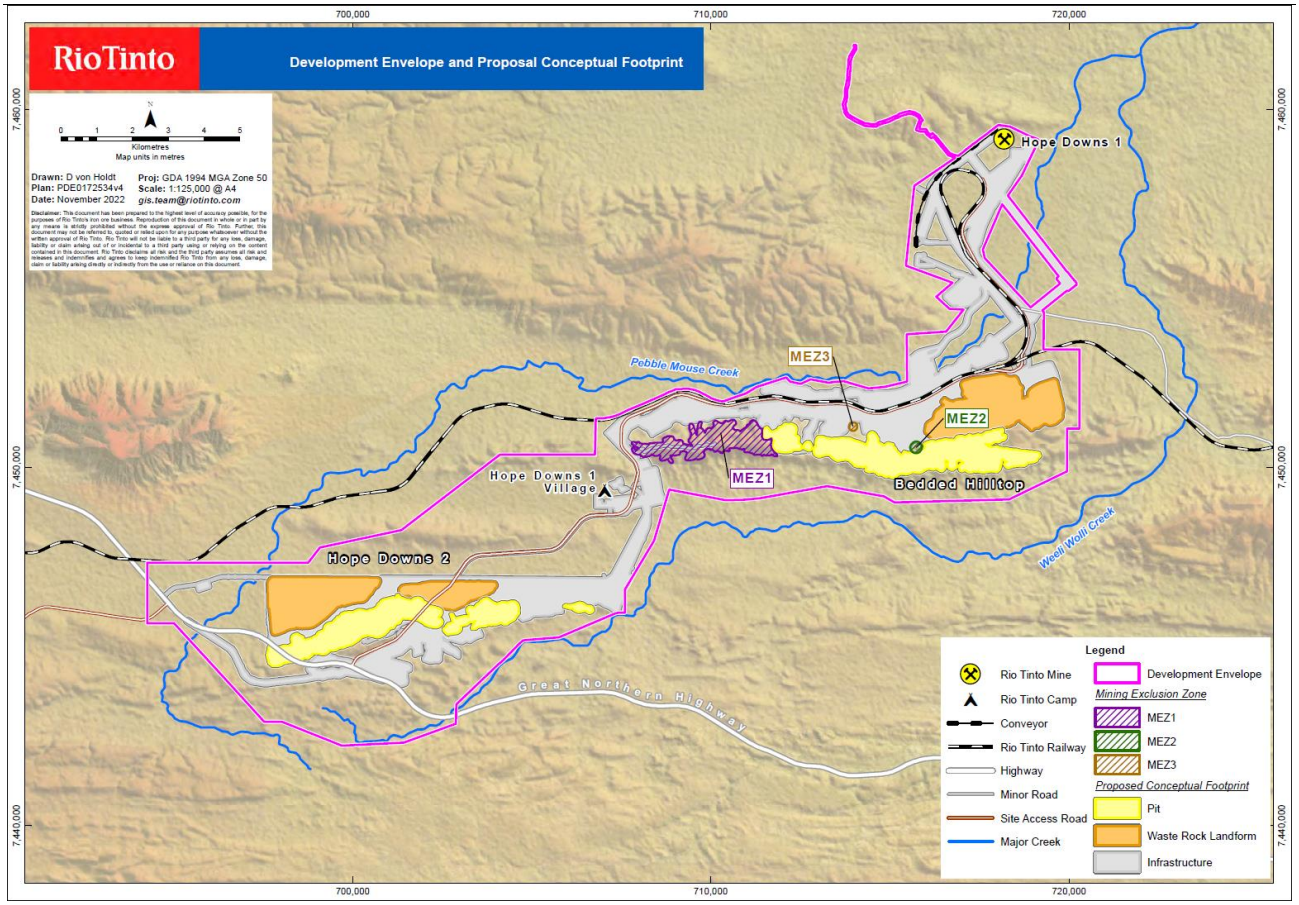

Figure 2-2 Development envelope and indicative location of key proposal elements

The Proposal includes, but is not limited to the following:

- Mine Pits: Development and operation of two new open cut above water table pits, adjacent to the Proponent's existing operations at Hope Downs encompassing: Hope Downs 2 and Bedded-Hill Top;
- Existing Hope Downs 1 central support facilities including train load out facilities and mining infrastructure to the extent utilised for the purpose of the proposed new mining operations;
- Re-alignment of a 6 km-long section of the Great Northern Highway;
- Infrastructure for water supply, groundwater abstraction, creek crossings, diversion drains, levees and culverts;
- Linear infrastructure including heavy and light vehicle access roads, railway crossings, conveyors, pipelines, power and communication distribution network;
- Mineral waste management including waste rock landforms, land bridges, low grade ore dumps and topsoil and subsoil stockpiles; and
- Other associated mine infrastructure and support facilities such as workshops, hydrocarbon storage areas, ANFO facilities, laydown areas, turkey nests, transfer pads, and offices.

The Proposal excludes activities that include but are not limited to:

- Low impact activities required to inform Part IV assessment of the Proposal, including drilling and associated activities for resource evaluation, geotechnical assessment and hydrogeological investigations. These activities will be subject to relevant provisions under Part V of the EP Act and the Rights in Water and Irrigation Act 1914 (RiWI Act);
- Activities that are part of, or required for continuation of, the existing mining operations at Hope Downs 1 (as approved under MS 584 and MS 1025);
- Existing Hope Downs 1 facilities not required to support the Proposal;

- Rail and port export facilities: these facilities are approved under other ministerial statements, support numerous operations in the area and are outside the Proposal boundary;
- Switchyard and high voltage transformers: network services several sites (i.e. not exclusive to Hope Downs 1 Hub and the Proposal and therefore excluded);
- Transmission and distribution emissions of electricity imported to site, these are outside the Proposal boundary;
- Mine closure and site rehabilitation;
- Emissions associated with landfill waste and wastewater effluent from the wastewater treatment plants are excluded as they are not reportable under the NGER framework and not material; and
- Environmental, heritage and other studies/ investigations involving fieldwork.

The scope of this GHG EMP is the Proposal as defined in the Environmental Review Document (ERD) (Rio Tinto, 2023). This GHG EMP applies to emissions from activities associated with deposits as outlined in the Proposal that are within the operational control of the Proponent (as defined under the National Greenhouse and Energy Reporting Act 2007 (NGER Act)). However, to provide context and where relevant, information is provided for the entire Hope Downs 1 hub.

2.2. Purpose of the GHG EMP

The purpose of this GHG EMP is to demonstrate:

- The interim and long-term emissions reductions targets the Proposal aims to achieve throughout the project;
- The best practice design, technology, management and reasonably practicable alternatives and measures appropriate to avoid, reduce or offset Scope 1 and 2 emissions from this Proposal;
- The partnerships and arrangements with third parties considered to reduce Scope 3 emissions;
- How the Proposal is consistent with achieving corporate emissions reduction targets; and
- The other legal and policy instruments that require GHG emissions reductions from the Proposal to meet the EPA's objectives.

A summary of key assumptions and uncertainties of the GHG EMP are presented in Table 2-1.

Table 2-1 Key assumptions and uncertainties of the Hope Downs 2 Proposal GHG EMP

Key Assumption / Uncertainty	Justification / Explanation
Production and mine strategy may be amended in the future, resulting in a change to the emissions.	Production and mine strategy are market driven and may result in changes. Pilbara facilities are operated as a vertically integrated system, potentially resulting in higher or lower emissions from the Proposal.
Alternative and/or innovative sources of energy may become available in the future that can avoid or minimise GHG emissions from the Proposal.	The Proponent is part of Rio Tinto which has robust study and development processes that ensure innovation and new technology developments are sought, assessed and developed where applicable. The Proponent will investigate relevant alternative and/or innovative energy sources when they become viable in the future.
GHG policy and approaches continue to evolve at State and Commonwealth levels	State and Commonwealth Government policies continue to evolve. Key uncertainties include: • State's contribution to Commonwealth targets versus other states; • Setting of sector specific targets for industry versus other sectors (e.g. power, transport, agriculture, buildings).
Market price (carbon)	Whilst Australia has no formal carbon price in place large emitters over 100 kt CO_2-e per year have an emission cap in place, called the Safeguard Mechanism. If a project exceeds this emission cap they are required to obtain Australian Carbon Credit Units (ACCUs) for the gap. Declines to this emission cap are now in place, which will create a cap and trade system aligned with current practice in Europe and other carbon markets. This will in effect place a price on carbon for these large emitters. The Proponent will continue to assess opportunities for future capital expenditure to avoid and/or reduce emissions.
Cost of technology for renewable energy	Cost of renewables has changed significantly over the last ten years, and further downward trends are expected.
Existing capital expenditure and life of asset	Significant investment has occurred in fixed infrastructure and mobile fleet, therefore asset life is a consideration when assessing and implementing abatement opportunities to avoid or reduce emissions.

3. GHG EMP COMPONENTS

3.1. Emissions estimates

A summary of estimated annual average, peak and total Scope 1, 2 & 3 emissions over an estimated 15-year life of the Proposal is presented in Table 3-1. A summary of estimated annual average, peak and total Scope 1, 2 & 3 emissions over the life of the mine for the Hope Downs 1 mine (including the Proposal) is presented in Table 3-2.

Nameplate capacity for Hope Downs 1 is 32 Mtpa. Expected operational throughput is scheduled to reach nameplate capacity during the life of the Proposal before declining as ore reserves are exhausted. Operational throughput estimates account for plant maintenance shutdowns, downtime, other operational inefficiencies and are based on historical experience. Scheduled operating hours for the Hope Downs 1 plant are approximately 6,500 hours per year.

The emissions forecast has been generated from the expected operational throughputs rather than nameplate capacity to reflect the emissions associated during operation where nameplate capacity is reached and then operational throughputs decline as Hope Downs 1 ore reserves deplete.

Table 3-1 Estimate of peak, annual and total Scope 1, 2 & 3 emissions for the Proposal

	Peak emissions (t CO_2-e)	Annual average emissions (t CO_2-e)	Total Emissions (t CO_2-e)
Scope 1	248,115 (2030)	147,888	**2,070,437**
Scope 2	47,790 (2032)[1]	28,396	**397,548**
Scope 3	43,391,934 (2032)[2]	25,783,235	**360,965,289**

Table 3-2 Estimate of peak, annual and total Scope 1, 2 & 3 emissions for the Hope Downs 1 mine (including the Proposal)

	Peak emissions (t CO_2-e)	Annual average emissions (t CO_2-e)	Total Emissions (t CO_2-e)
Scope 1	258,934 (2030)	174,227	**2,439,176**
Scope 2	46,368 (2029)	33,145	**464,025**
Scope 3	42,100,934 (2029)	30,094,649	**421,325,084**

3.1.1. Historic emissions

The Hope Downs 1 iron ore mine was opened in 2008 with production from the Hope North and Hope South deposits. Production has averaged 30 Mt/annum since 2010, with the Baby Hope deposit supplementing production for Hope Downs 1 in 2018 as Hope North and Hope South production decreased (Figure 3-1).

Emissions (Scope 1 & 2) were first reported in 2008, increasing to 2010 as nameplate capacity was reached (Figure 3-1). Since 2010 emissions have trended upwards year on year as deposits deepen and haulage distances increased to recover ore.

[1] Ex-pit tonnes from HD2 Proposal deposits used due to SOP breakdown for HD2 Proposal deposits not available. Some of this material is stockpiled and hence the slightly higher Scope 2 peak than for the Hope Downs 1 mine which is the true peak

[2] Ex-pit tonnes from HD2 Proposal deposits used due to SOP breakdown for HD2 Proposal deposits not available. Some of this material is stockpiled and hence the slightly higher Scope 3 peak than for the Hope Downs 1 mine which is the true peak

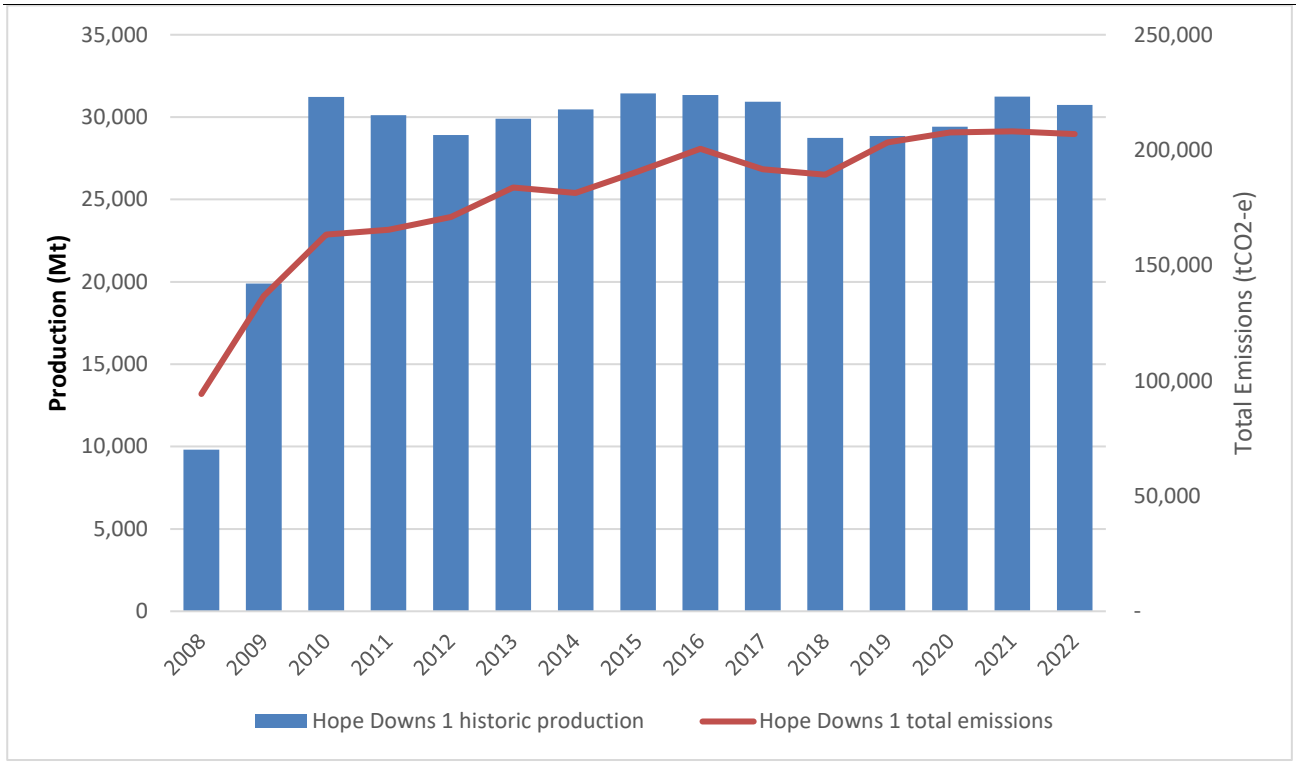

Figure 3-1 Hope Downs 1 historic production and emissions (Scope 1 & 2)

3.1.2. Proposed emissions baseline

The proposed emissions baseline scenario used to calculate baseline emissions, is the continuation of current technologies and practices involved at the current Hope Downs 1 mining operations. This scenario includes a diesel mining fleet and electricity generated from gas-fired power stations for the life of the project, using the most recent diesel, land clearing, production and electricity forecast data available.

The diesel forecast is a bottom-up calculation using operating hours from the fleet plan for Heavy Mobile Equipment (HME), generated from the current mine plan for the deposits. Historic fuel burn rates are applied to HME operating hours provided diesel usage. Non-HME diesel usage is calculated using a factor of historic non-HME diesel usage and Total Material Moved (TMM). Finally, diesel used in construction is included.

The electricity forecast uses the prior three years of historic electricity usage and throughputs to calculate a MWh/t SOP factor for Hope Downs 1. This assumes no additional changes to plant infrastructure is planned which is currently the case. This electricity factor is applied to future scheduled production to provide the electricity forecast.

Emissions are then calculated using appropriate factors in a similar method to how emissions are reported in the mining industry under the NGER framework. Due to the uncertainty on timing of large-scale diesel replacement technologies and the quantity of renewables in the Pilbara integrated power system, these abatement projects have not been included in the emissions baseline.

There are other methods to calculate emissions that have not been used, including;

- Work index
    - Total Material Moved (TMM) and Effective Flat Haul (EFH) can be used to calculate a Work Index (WI). EFH accounts for the distance from the mining area to the destination (e.g. crusher) and the change in elevation. An average fuel driver is calculated from actual diesel usage (total site usage which includes all heavy mining equipment through to light vehicles and generators) and WI from the prior three years. The average fuel driver is multiplied by WI in future years to calculate the annual diesel forecast. Given a detailed fleet plan is available

for the current mine plan the diesel forecast generated from this fleet plan was chosen for the forecast, however the total site usage was compared and found to be similar for both methods.

- Historic emissions intensity factor
    - Using a historic emissions intensity factor on future production is less accurate compared with the proposed emissions baseline. This is due to increasing haul distances (e.g. deeper mines and/or new deposits further from existing infrastructure) as the mine develops resulting in emissions intensities generally increasing over time. Therefore, using a historic emissions intensity for future years of operation could result in an under-estimation of emissions and not best represent the emissions generated from the Proposal.

3.1.3. Breakdown of emissions by source

The principal sources of emissions include:

- Stationary, mobile and transport diesel combustion (Scope 1);
- Land clearing (Scope 1) and
- Consumption of electricity from the Pilbara Power Generation Network (Scope 2).

It should be noted that no fugitive emissions are expected for the Proposal.

A summary of estimated peak[3], annual average[4] and total emissions over an estimated ~15-year life of the Proposal by source and scope is presented in Table 3-3. A summary of the estimated peak, annual average and total emissions from the Hope Downs 1 mine (including the Proposal) is presented in Table 3-4.

Table 3-3 Proposal Operational Peak, Annual Average and Total GHG Emissions by Source and Scope

Source	Scope 1 Emissions (t CO_2-e pa)	Scope 2 Emissions (t CO_2-e pa)
Diesel – Peak (2030)	246,048	-
Land Clearing – Peak (2030)	2,067	-
Electricity – Peak (2030)	-	46,550
Total (Scope 1 + Scope 2) – Peak (2030)	**294,666**	
Diesel – Annual Average Life of Proposal	144,989	-
Land clearing – Annual Average Life of Proposal	2,899	-
Electricity – Annual Average Life of Proposal	-	28,396
Total (Scope 1 + Scope 2) – Annual Average Life of Proposal	**176,285**	
Diesel – Total	2,029,850	-
Land Clearing – Total	40,587	-
Electricity – Total	-	397,548
Total (Scope 1 + Scope 2) – Life of Proposal	**2,467,984**	

[3] Peak emissions for diesel, land clearing and electricity consumption occur in different years however peak emissions across the Proposal occurs in 2030 which are the numbers reported.

[4] Annual average life of Proposal diesel and electricity emissions are from 2025 to 2038.

Table 3-4 Hope Downs 1 (including the Proposal) Operational Peak, Annual Average and Total GHG Emissions

Source	Scope 1 Emissions (tCO_2-e pa)	Scope 2 Emissions (tCO_2-e pa)
Diesel – Hope Downs 1 (including Proposal - 2030)	256,867	-
Land Clearing – Hope Downs 1 (including Proposal - 2030)	2,067	-
Electricity – Hope Downs 1 (including Proposal 2030)	-	46,300
Total (Scope 1 + Scope 2) – Peak (2030)	**305,234**	
Diesel – Annual Average Life of Hope Downs 1 (including Proposal)	171,328	-
Land clearing – Annual Average Life of Hope Downs 1 (including Proposal)	2,899	-
Electricity – Annual Average Life of Hope Downs 1 (including Proposal)	-	33,145
Total (Scope 1 + Scope 2) – Annual Average Life of Hope Downs 1 (including Proposal)	**207,372**	
Diesel – Total	2,398,589	**-**
Land Clearing – Total	40,587	**-**
Electricity – Total	**-**	464,025
Total (Scope 1 + Scope 2) – Life of Mine	**2,903,201**	

3.1.4. Type of GHG's emitted and Global Warming Potential

The major emission types from the Proposal are ~99% carbon dioxide (CO_2) along with minor amounts of methane (CH_4) and nitrogen oxide (N_2O). The Global Warming Potential (GWP) 100-year values for these three GHGs, according to the IPCC Fifth Assessment Report (AR5)[5], are;

- Carbon dioxide – 1
- Methane – 28
- Nitrous oxide – 265

3.1.5. Emissions baseline methodology and scope boundaries

The emissions baseline for diesel and electricity emissions has been calculated using methods and criteria in the National Greenhouse and Energy Reporting (Measurement) Determination 2008 (DoEE, 2008) (NGER Determination). The Australian Government's National Carbon Accounting methodology (FullCAM) has been used to determine emissions from land clearing.

Once calculated, emissions from the diesel forecast are calculated using the Clean Energy Regulator's Method 1 for emissions of carbon dioxide, methane and nitrous oxide from liquid fuels other than petroleum-based oils or greases; from the National Greenhouse Accounts national methodology. This is achieved by multiplying a (physical) quantity of fuel combusted by a fuel-specific energy content factor and a fuel-specific emission factor for each relevant greenhouse gas (in this case, carbon dioxide, methane and nitrous oxide)[6]. This methodology has a carbon dioxide emission factor uncertainty level of 2%.

[5] https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter08_FINAL.pdf

[6] https://www.cleanenergyregulator.gov.au/DocumentAssets/Documents/Estimating%20emissions%20and%20energy%20from%20fuel%20combustion%20guideline.pdf

Emissions associated with the forecast electricity usage is calculated using the CER Method 2 for emissions of carbon dioxide from the combustion of gaseous fuels. This allows a more accurate facility level calculation of emissions by sampling and analysing fuels for qualities that affect emissions levels when the fuel is combusted[7]. This methodology has a carbon dioxide emission factor uncertainty level of 4.3-4.5% across the Pilbara Power Network generators.

The boundary for the Proposal emissions inventory has been defined using an operational control approach consistent with the NGER Act. The following sources of Scope 1 and 2 emissions occur within the boundary of the Proposal:

- Development and operation of new deposits and associated infrastructure to sustain production from Hope Downs 1; and
- Existing mining operations including overland conveyors, central processing plant, train load out facilities and mining operations support infrastructure to the extent utilised for the purpose of the proposed new mining operations.

No boundary has been set for the calculation of Scope 3 emissions as they occur nationally and internationally outside the Proposal boundary, are not reportable under the NGER framework and are included in the assessment but not the mid or long-term targets.

The following sources of emissions are excluded from the Proposal:

- Hope Downs 1 Iron Ore mine (MS 584) and Baby Hope (MS 1025);
- Existing Hope Downs 1 facilities not required to support the Proposal;
- Rail and port export facilities: these facilities are approved under other ministerial statements, support several operations in the area and are outside the Proposal boundary;
- Switchyard and high voltage transformers: network services several sites (i.e. not exclusive to Hope Downs 1 and the Proposal and therefore excluded);
- Transmission and distribution emissions of electricity imported to site, these are outside the Proposal boundary;
- Emissions associated with mine closure and site rehabilitation; and
- Emissions associated with landfill waste and wastewater effluent from the wastewater treatment plants are excluded as they are not reportable under the NGER framework and not material.

3.2. Trajectory of emissions reductions

3.2.1. Scope 1 & 2 emissions trajectory

The estimated proposal Scope 1 and 2 emissions baselines (without abatement), displayed separately, is shown in Figure 3-2. This shows Scope 1 emissions above the 100,000 tonnes of CO_2-e emissions in any year threshold requiring assessment by the EPA. The combined Scope 1 and 2 emissions baseline (without abatement), is shown in Figure 3-3.

Rio Tinto has ambitious corporate emissions reductions targets, 15% reduction of absolute emissions by 2025 and 50% reduction of absolute emissions by 2030 (further detail in Section 3.7.1) and net zero by 2050. The Proposal emissions reduction targets are consistent with these targets and as per EPA expectations, from 2030 will reduce emissions along a linear trajectory to net zero by 2050.

The proposed annual emissions reduction targets required to meet the above targets is shown in Figure 3-3. The Proposal estimated annual and total Scope 1 & 2 emissions (without abatement) with 5 yearly cumulative totals and reduction commitments is shown in Figure 3-4 and Table 3-5.

[7] https://www.cleanenergyregulator.gov.au/DocumentAssets/Documents/Estimating%20emissions%20and%20energy%20from%20fuel%20combustion%20guideline.pdf

The Proposal aims to achieve its emissions reduction targets through a combination of avoidance measures and offsets (Figure 3-5), with abatement projects implemented from the Pilbara wide abatement pathway applied against emissions from the Proposal. Specific abatement initiatives (Section 3.4.1) implemented in Rio Tinto's Pilbara Power Generation Network, connected to the Proposal will be applied to achieve Scope 1 & 2 interim emissions reduction targets. The long-term emissions reduction target is anticipated to be achieved through implementation of a range of existing or potential future GHG abatement opportunities.

The Proposal estimated annual and total Scope 1 & 2 emissions (without abatement) with 5 yearly cumulative totals and reduction commitments in a tabular form is in Table 3-6.

Table 3-5 Interim and long-term emissions reductions targets for the Proposal

Target Year	2025	2030	2035	2040	2045	2050
Total Scope 1 & 2 Emissions (t CO_2-e)	37,387	1,047,556	1,151,910	231,131	-	-
Emission Reduction Target (t CO_2-e)	5,608	523,778	759,076	0	-	-
Percentage Reduction Emissions (%)	15%	50%	66%	0%	-	-

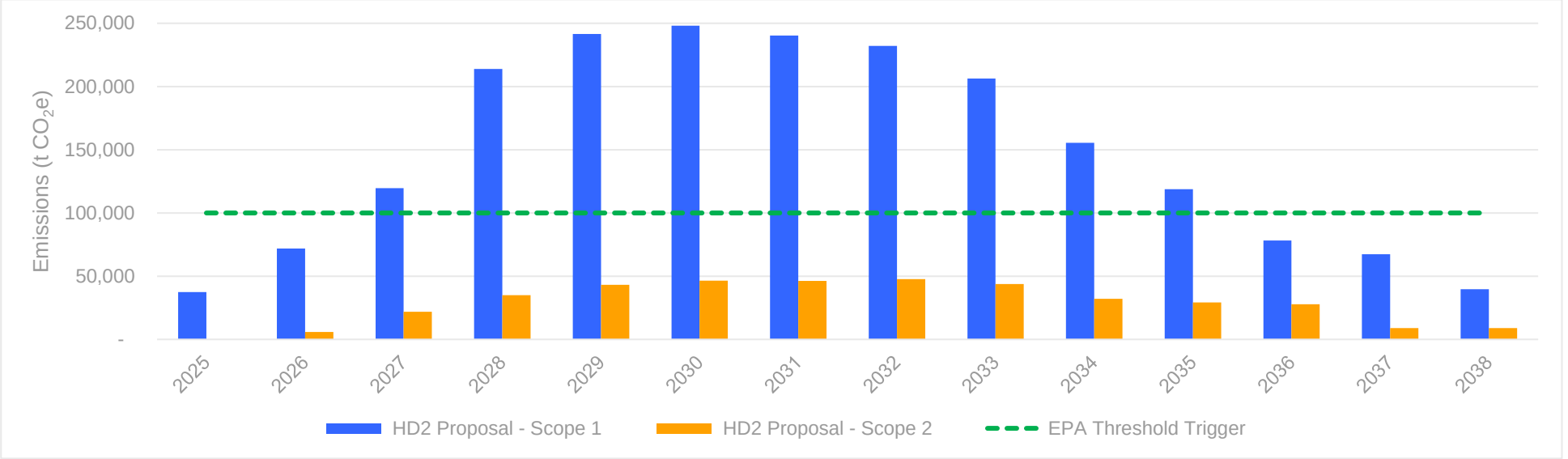

Figure 3-2 Proposal estimated annual Scope 1 & 2 (separate) baseline emissions (without abatement)

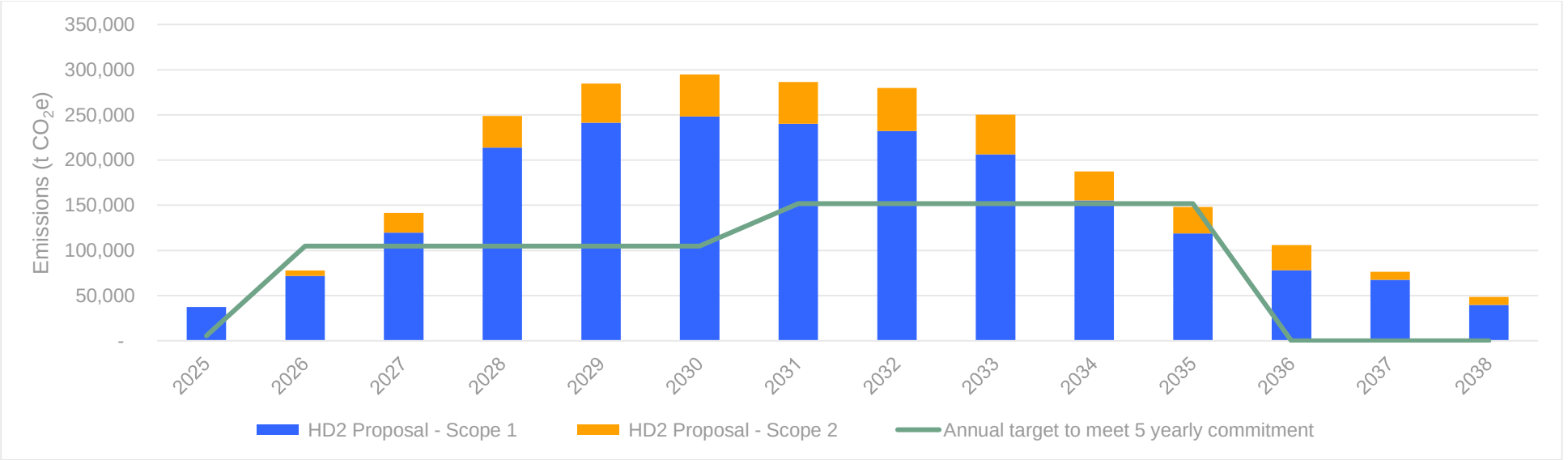

Figure 3-3 Proposal estimated annual Scope 1 & 2 (combined) baseline emissions (without abatement) with annual targets required to meet 5 yearly commitment

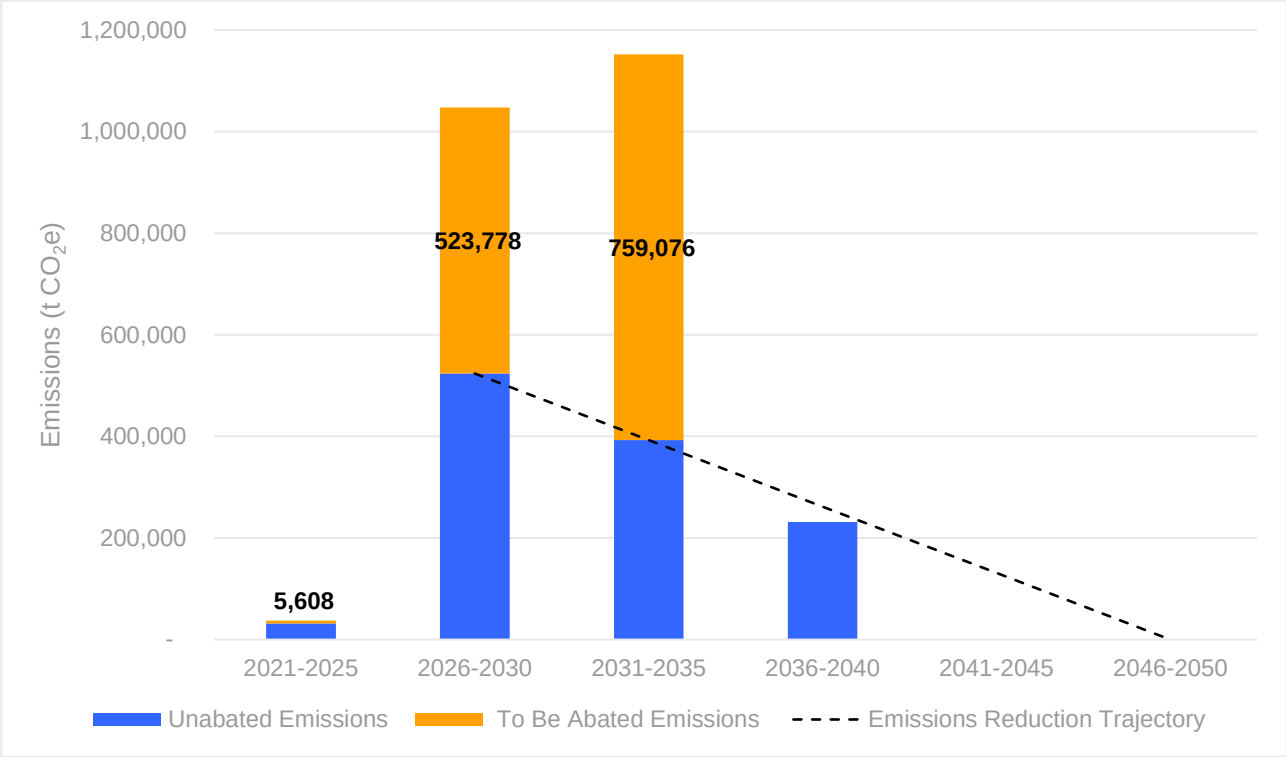

Figure 3-4 Proposal 5 yearly targets and commitments

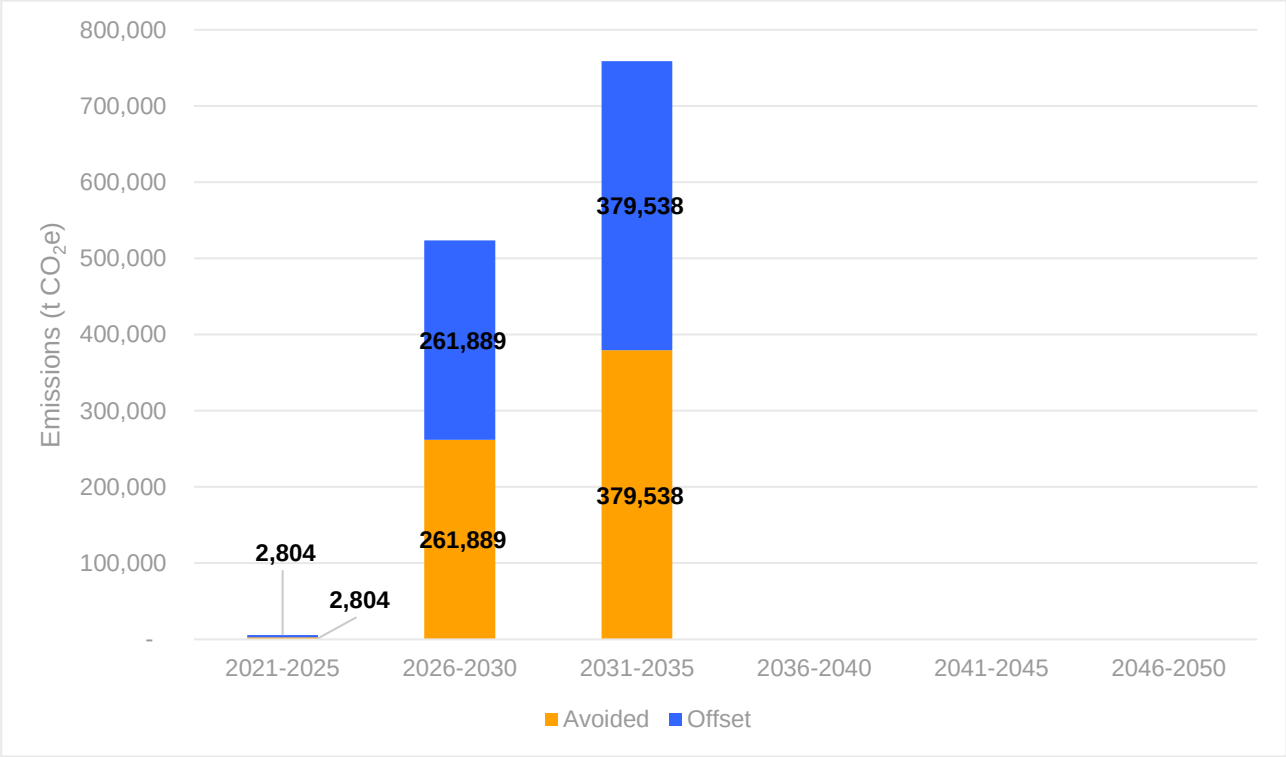

Figure 3-5 Trajectory of emissions which will be avoided, reduced and offset

Table 3-6 Proposal estimated annual and total Scope 1 & 2 emissions (without abatement) with 5 yearly cumulative totals and reduction commitments

Year	Scope 1 GHG emissions t CO_2-e	Scope 2 GHG emissions t CO_2-e	Total GHG emissions (Scope 1 & 2) t CO_2-e	Cumulative total GHG emissions 5 yearly t CO_2-e	Cumulative GHG emissions reduction commitments t CO_2-e
2025	37,387	-	37,387	37,387	5,608
2026	71,821	5,982	77,803	1,047,556	523,778
2027	119,641	21,877	141,518		
2028	213,928	34,945	248,873		
2029	241,473	43,223	284,696		
2030	248,115	46,550	294,666		
2031	240,253	46,179	286,431	1,151,910	759,076
2032	232,045	47,790	279,834		
2033	206,355	43,812	250,166		
2034	155,422	32,025	187,447		
2035	118,810	29,221	148,031		
2036	78,148	27,919	106,067	231,131	0
2037	67,374	9,024	76,398		
2038	39,666	9,000	48,666		
Total	**2,070,437**	**397,548**	**2,467,984**	**2,467,984**	**1,288,462**

3.2.2. Scope 3 emissions trajectory

The estimated proposal Scope 3 emissions baseline is shown in Figure 3-6 and Table 3-7.

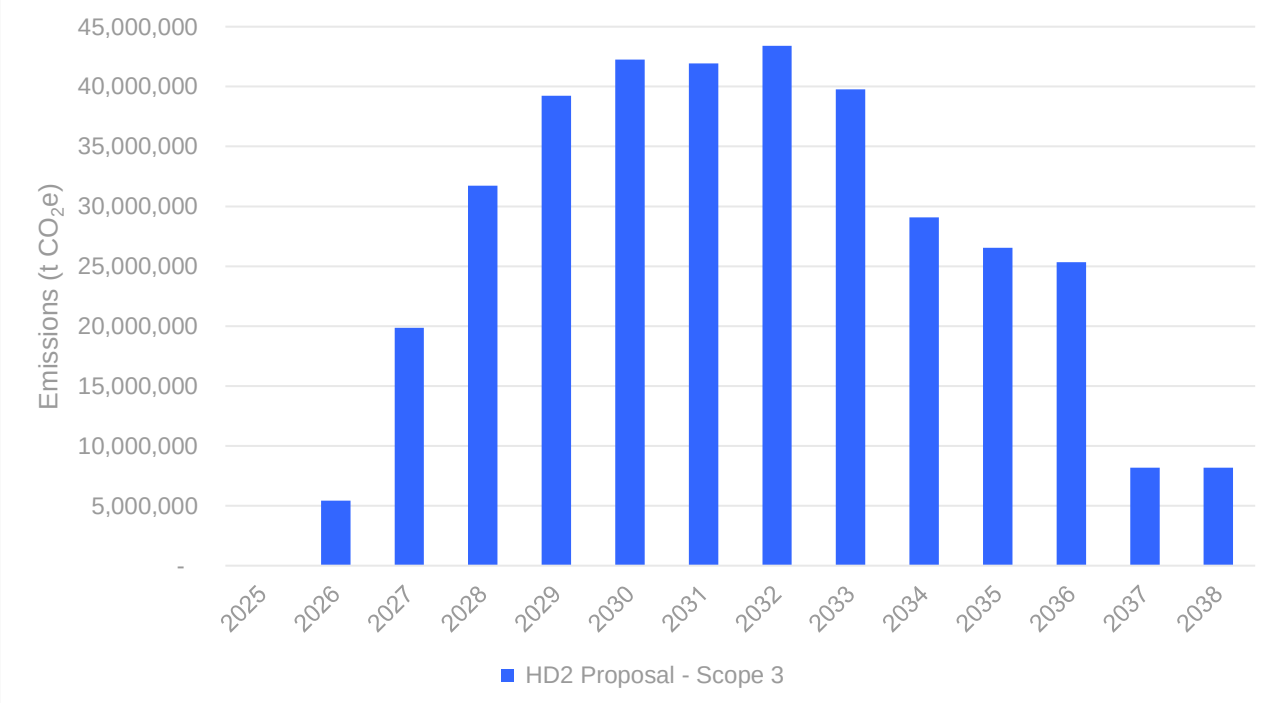

Figure 3-6 Proposal estimated annual Scope 3 emissions

Table 3-7 Proposal estimated annual and total Scope 3 emissions

Year	Scope 3 GHG Emissions t CO_2-e
2025	-
2026	5,431,981
2027	19,863,956
2028	31,729,504
2029	39,245,978
2030	42,266,892
2031	41,929,528
2032	43,391,934
2033	39,780,241
2034	29,078,124
2035	26,531,784
2036	25,350,006
2037	8,193,599
2038	8,171,762
Total	**360,965,289**

3.3. Scope 1 – Mitigation measures

3.3.1. Best practice design and operational Scope 1 emissions mitigation measures

Rio Tinto is exploring and implementing a range of short, medium and long-term low-carbon initiatives. Recently efforts have increased with the establishment of a dedicated abatement program for diesel reduction/elimination in 2022, in recognition of Rio Tinto's global diesel consumption in trucks, trains and other mobile equipment of approximately 1.3 billion litres annually, accounting for 13% of Rio Tinto's emissions[8].

The solutions to transition mobile fleet from diesel to low/no emissions energy are in the early stages of research and development with limited commercial and technical viability at this stage. Rio Tinto has an aspiration of no new purchases of diesel-powered haul trucks by 2030[9] and is therefore committed to trials and pilots through partnerships to develop new technological solutions to decarbonise diesel emissions.

Battery electrification is currently the target technology to eliminate diesel emissions from mining equipment, which is expected could be mass deployed from around the mid-2030s, however it is recognised that other technologies will be important. For example, investigation of sustainable biofuels as an interim step as well as

[8] https://www.riotinto.com/invest/reports/climate-change-report

[9] https://www.riotinto.com/en/news/releases/2022/scania-and-rio-tinto-agree-to-develop-autonomous-haulage-solutions-supporting-a-pathway-to-lower-emissions-mining

working with equipment manufacturers to introduce smaller and more energy-efficiency equipment into mine sites is ongoing.[10]

Given the current limited commercial and technical viability of diesel replacement technologies, the deployment schedule for diesel reduction/elimination technologies for Pilbara mine sites is not yet defined and is currently under investigation. Therefore, in some cases, approvals may be sought, with diesel emissions abatement projects implemented at alternative locations, to ensure maximum abatement is realised as soon as practical.

At a project specific level, road trains instead of haul trucks (for transporting material from HD2 to HD1), procurement of fuel-efficient trucks and dig units, fixed power supply to bores along with diesel generator plus batteries to power bores are proposed to reduce emissions from the project. A list of best practice design and operational measures for the project and under assessment for the Pilbara is contained in Table 3-8.

[10] https://www.riotinto.com/invest/reports/climate-change-report

Table 3-8 Scope 1 mitigation projects for the Proposal and under assessment in the Pilbara

Description	Mitigation Hierarchy	Indicative Implementation Timeframe	Estimated Emissions Savings ($t CO_2$-e per annum)	Context
Project specific mitigation projects				
Mine Design	Reduce	Project Implementation	To be confirmed	The ongoing design and mine plan optimisation process assesses the following opportunities: • Mining areas, pit exits and waste dumps are optimised to reduce haul distances. • Progressive backfill to minimise rehandling of material post mining. • Haul road layout design – designed to smooth truck speeds to minimise stop/start and hence improve diesel use efficiency.
Variable speed generators (VSG) for water supply bores	Reduce	Project Implementation	250	13 bores are required for water supply to the Proposal and will include VSG's. A VSG driven pump consumes less fuel than a conventional standard generator and variable speed drive (VSD) driven pump set, by 0% to 24% depending on pump speed and generator load. (Note: estimated emissions savings have already been included in the emissions baseline)
Mains powered water supply bores	Reduce	Project Implementation	700	Powering ex-pit bores with a fixed power supply (currently gas-fired electricity) has lower emissions than powering the same bores with diesel generators. Estimated emissions savings assume all 13 bores are able to be connected to the Pilbara Power Network rather than diesel generators. With the installation of renewables, these bores will eventually be powered by green electrons and will result in further emissions savings. (Note: estimated emissions savings have already been included in the emissions baseline)
Diesel generator plus battery powered bores	Reduce	Project Implementation	1,000	For bores that cannot be connected to a fixed power supply, new bore power supply configurations exist with batteries connected to diesel generators that reduce overall diesel usage. It is estimated that diesel savings could be ~20% less than diesel generators alone. Estimated emissions savings assume all 13 bores use battery/generator systems rather than diesel generators. This option can also be used as an interim measure if bores are required before a fixed power supply is available. (Note: estimated emissions savings not yet included in emissions baseline due to awaiting Pilbara trial data to confirm fuel savings and also which bores will be grid connected at commissioning)

Description	Mitigation Hierarchy	Indicative Implementation Timeframe	Estimated Emissions Savings (t CO_2-e per annum)	Context
Engine upgrades to existing haul truck fleet	Reduce	Complete	8,500	830E-1's have undergone upgrades that have increased fuel efficiency by ~10% compared to original as build configuration, which includes; • Komatsu fuel saver kit (reducing engine RPM during low, high idle and retarding) • Engine upgrade to QSK60 Modular Common Rail System (from High Pressure Injection – Tier 1-2 technology platform) platform (Note: estimated emissions savings have already been included in the emissions baseline)
Procurement of fuel-efficient haul trucks	Reduce	2027-2029	1,500	29 new haul trucks are required to replace existing fleet at Hope Downs 1 early in the Proposal. Hope Downs 1 currently uses Komatsu 830E-1's. New model 830E-5 (Diesel) trucks come fitted with above engine upgrade improvements, are Tier 4 ready and have further fuel efficiency benefits (~2%) via product improvements reducing parasitic load (for example variable speed clutch for engine fan, electrically operated high voltage on demand cooling).
Procurement of fuel-efficient dig units	Reduce	~2028 and 2030	600 (2028-30) 1,300 (from 2030)	Hope Downs 1 currently uses a mix of Hitachi -6 and -7 dig units. The -7 units use ~10-20% less fuel than -6 units. Two -6 (EX3600's) are due for replacement in 2028 and 2030. These units are scheduled to be replaced with the more fuel efficient -7 unit. Opportunities to bring forward early replacement of these units exist subject to operational and commercial considerations.
Use of road trains instead of haul trucks	Reduce	Project Implementation	~21,000	Current base case for the HD2 deposit is utilising road trains to transport ore from HD2 to the existing Hope Downs 1 processing plant (~25km). Road trains reduce diesel consumption that otherwise would have been consuming in haul trucks and deliver emissions savings. (Note: estimated emissions savings have already been included in the emissions baseline)
Pilbara wide mitigation projects under assessment				
Energy efficiency	Reduce	TBC	To be confirmed	Reduction of diesel in existing assets makes business sense due to fuel cost savings. A number of opportunities exist and are under investigation (e.g. utilising the engine shut off feature of autonomous fleet during certain idling instances and installing secondary power systems for dig units to be shut off when idling) to be rollout out Pilbara wide.

Description	Mitigation Hierarchy	Indicative Implementation Timeframe	Estimated Emissions Savings (t CO_2-e per annum)	Context
Biofuels for Heavy Mining Equipment	Avoid	~2030	To be confirmed	Rio Tinto has successfully completed the full transition of its heavy machinery from fossil diesel to renewable diesel at its Boron, California operation[11] and Rio Tinto continues to investigate biofuels as an interim step. Rio Tinto has completed validation work with mining fleet engine vendors, testing engines for suitability to transition to HVO with all engines suitable to substitute diesel with HVO.
Trolley assist option	Avoid	TBC	To be confirmed	Rio Tinto is investigating the development of a viable trolley assist option for existing haul fleet to enable substantial reduction in diesel use while on trolley[12]
Zero emissions haul truck fleet	Avoid	~mid-2030s onwards	To be confirmed	In separate partnerships with Komatsu and Caterpillar, Rio Tinto is working to develop and implement battery electric haul solutions including haul trucks. Rio Tinto intends to trial the first large scale battery truck in the Pilbara in 2024-25[13] Rio Tinto and Scania have been trialling 40-tonne-payload agile autonomous haul trucks at Rio Tinto's Channar mine with options for the future transition to electric powered vehicles[14] An innovative partnership with industry and Austmin, Rio Tinto is a founding partner in 'Charge On Challenge', a collaboration initiative to identify and develop mobile fleet charging solutions.

[11] https://www.riotinto.com/en/news/releases/2023/rio-tinto-u_s_-borax-becomes-first-open-pit-mine-to-transition-to-renewable-diesel

[12] https://www.riotinto.com/invest/reports/climate-change-report

[13] https://www.riotinto.com/invest/reports/climate-change-report

[14] https://www.riotinto.com/en/news/releases/2022/scania-and-rio-tinto-agree-to-develop-autonomous-haulage-solutions-supporting-a-pathway-to-lower-emissions-mining

3.3.2. Best practice review process

Rio Tinto has completed and continues to assess numerous technologies to transition away from diesel powered mining equipment. Technologies are more progressed for some equipment than others with the emissions reduction/elimination pathway for each equipment type analysed. The mining equipment assessed includes;

- Haul trucks
- Excavators
- Drill rigs
- Auxiliary vehicles (loaders, bulldozers, water trucks, fuel trucks, etc)
- Generators
- Light vehicles

The current best practice alternative energy sources to power mining equipment includes (but is not limited to);

- Electric (including trailing cables, overhead catenary and/or batteries)
- Hydrogen fuel cell electric
- Renewable diesel
- LPG
- Additives
- CNG/LNG
- Biodiesel

The selection criteria used to identify best practice diesel reduction/elimination measures and their effectiveness included a Technology Readiness Level (TRL) and Commercial Readiness Index (CRI) assessment. TRL is a globally accepted benchmarking assessment for tracking technology progress from early-stage research (TRL1) through to actual system demonstration (TRL9). The Australian Renewable Energy Agency (ARENA) has developed a CRI to be used in parallel with the TRL framework. This assessment allows emerging technologies to be assessed based on Hypothetical Commercial Proposition (CRI1) through to Bankable Grade Asset Class (CR6).

Following the assignment of TRL and CRI values for each technology available and associated emissions reduction benefits for different equipment types, a multi-criteria assessment is underway to determine what Pilbara sites are appropriate for deployment of various diesel reduction/elimination technologies. This assessment includes considerations such as, current fleet replacement schedules, mine planning requirements, site infrastructure, power demand/supply, maintenance, information systems,

environmental/heritage considerations, etc. to determine future deployment scenarios and timings for individual sites and technologies.

Given the assessments completed to date, battery electrification of mine equipment has been adopted as the preferred long-term pathway however assessments continue for all available and future technologies as the diesel reduction/elimination pathway is likely to change and evolve over time.

3.3.3. Benchmarking Scope 1 emissions intensity review

Emissions intensity is expressed as tonnes CO_2-e (Scope 1 emissions not including emissions released directly from land management as per NGER Determination 2008) per unit of production. Production for the iron ore industry is currently defined as "*tonnes of iron ore, on a wet basis, that is produced as part of carrying on the iron ore mining activity at the facility and is of saleable quality*"[15].

[15] https://www.dcceew.gov.au/sites/default/files/documents/safeguard-mechanism-document-production-variable-definitions-2022.pdf

The Scope 1 emissions intensity for the Proposal was calculated from annual average emissions and production over the life of the project and is presented in Table 3-9.

Table 3-9 Proposal Scope 1 emissions intensity

Proposal	Average Scope 1 emissions (diesel only) ($t CO_2$-e)	Average emissions intensity ($t CO_2$-e / t iron ore)
Hope Downs 2 Proposal	144,989	0.0075

A GHG emissions intensity benchmarking assessment was undertaken to compare emissions performance of the Proposal against other comparable open cut iron ore mining proposals located in Western Australia's Pilbara region and the default iron ore industry emissions intensity (Table 3-10 and Figure 3-7). The default iron ore industry emissions intensity value is set by the CER and defined in Schedule 2 of the Safeguard Mechanism. It represents the industry average emissions intensity of production over five years (FY2012-13 to FY2016-17).

Emissions intensity allows the comparison of different sized mining operations normalised by a relevant measure of production. Despite this normalisation, comparable benchmarking of emissions from individual mining operations is challenging, as it does not consider the site-specific circumstances which impact on GHG emissions intensity. Waste to ore ratios, grade characteristics and topography have a significant influence on GHG emissions intensity. Below water table mining requires dewatering infrastructure to be operated and a greater amount of waste material moved per tonne of iron ore.

Boundary conditions present a further challenge to benchmarking across facilities. Some aspects of mining, processing and transport may be contracted to a third party that assumes operational control and hence ownership of a portion of a facility's emissions. The Proponent has made every effort to present a comparable benchmarking assessment with consideration of the above challenges.

The benchmarking shown in Figure 3-7 indicates that the performance of the Proposal is comparable to other recent iron ore developments in the Pilbara.

Table 3-10 Scope 1 emissions intensity benchmarking against comparable iron ore mines in the Pilbara, WA

Facility	Average annual Scope 1 emissions (diesel only) (tCO_2-e)	Average Iron Ore production (Mt/annum)	Scope 1 emissions intensity (tCO_2-e/t iron ore)
HD2 Proposal	**144,989**	**19**	**0.0075**
Default Emission Intensity Iron Ore Mining Safeguard Mechanism	-		0.0048
FMG – Eliwana[16]	272,315	39[17]	0.0070
BHP – Western Ridge[18]	138,926	19[19]	0.0073

[16] FMG Fortescue Metals Group (2018), Eliwana Iron Ore Mine Project, Environmental Review Document, EW-RP-EN-0003-0. Table 57

[17] Back calculated from average emissions and emissions intensity

[18] https://www.epa.wa.gov.au/sites/default/files/Referral_Documentation/Appendix%2012%20-%20Western%20Ridge%20Greenhouse%20Gas%20Management%20Plan%20v1%20January%202023.pdf

[19] Back calculated from average emissions and emissions intensity

Facility	Average annual Scope 1 emissions (diesel only) (tCO_2-e)	Average Iron Ore production (Mt/annum)	Scope 1 emissions intensity (tCO_2-e/t iron ore)
Roy Hill – Roy Hill Revised Proposal	430,981	59	0.0076

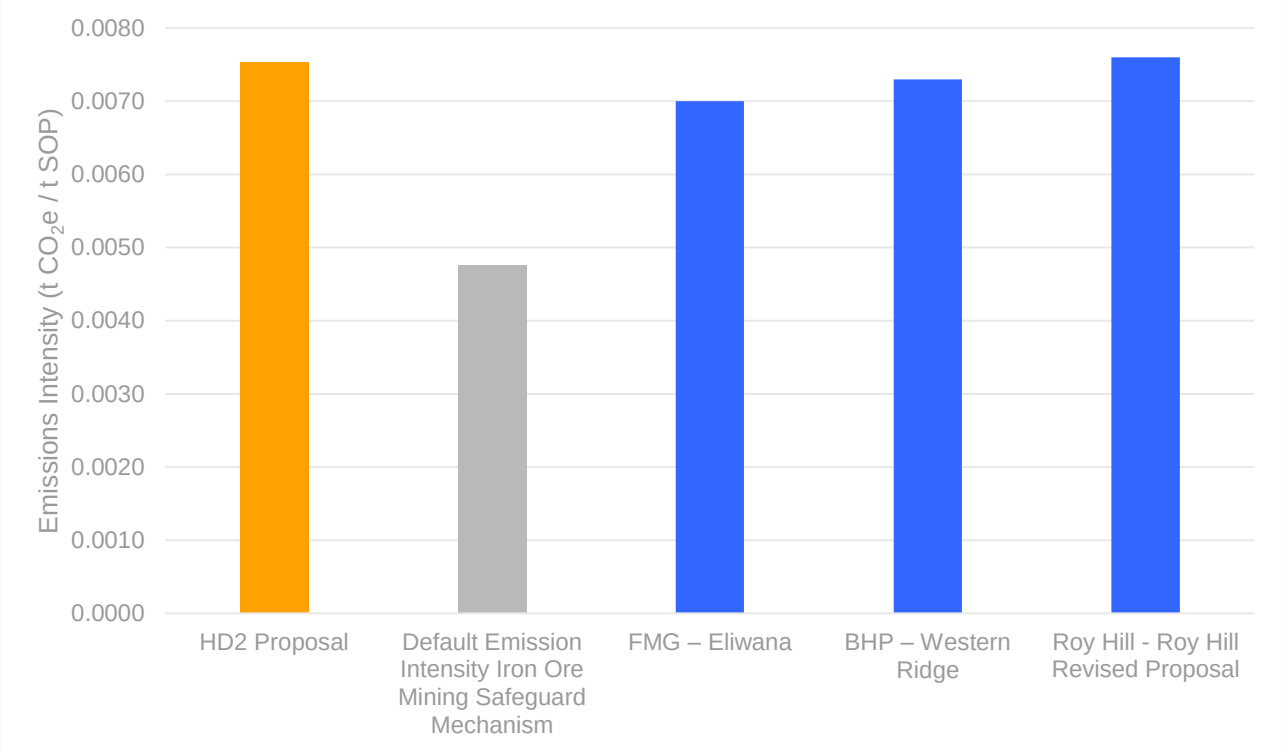

Figure 3-7 Scope 1 emissions intensity benchmarking against comparable iron ore mines in the Pilbara, WA

A similar benchmarking process against international iron ore mines was undertaken however the data was found to be unreliable due to different reporting and disclosure requirements in other jurisdictions. For example, emissions intensity values were obtained for iron ore operations in Canada however were for Scope 1 and 2 emissions, as they cannot be separated, they cannot be compared against Pilbara Scope 1 emissions intensities. Brazilian iron ore emission intensity values were also aggregated with non-iron ore mining operations and presented as a single emissions intensity also including both Scope 1 and 2 emissions, resulting in data that cannot be compared.

3.4. Scope 2 – Mitigation measures

3.4.1. Alternative energy options assessment

Rio Tinto has completed numerous studies and assessments of alternative energy options, testing a range of technologies available and suitability for implementation in the Pilbara region of Western Australia. Similar to Scope 1 mitigation technology assessment, this has included multi-criteria analysis (MCA) on various technologies, with consideration factors including economic viability (e.g. payback period), GHG emission reduction, speed of implementation, technological risk and environmental/heritage considerations.

Technologies assessed include (but not limited to);

- Solar PV
- Wind
- Battery technology for spinning reserve or standalone storage
- Pumped hydro storage
- Solar thermal plant

- Waste heat recovery
- Wave/tidal
- Geothermal

For technologies that scored well during the MCA, further development and interrogation was undertaken with more detailed consideration of locations, local climatic factors, size and scale, existing infrastructure, and conceptual network integration.

Based on these assessments, the short to medium term low-carbon transition strategy initiatives focussed on displacement of gas in electricity generation are solar, wind and battery storage solutions given economics, technological maturity and speed of deployment of these solutions. Under assessment are renewable energy studies focused on deployment of 1GW of wind and solar power, to replace natural gas power for plant and infrastructure and support early electrification of mining equipment[20]. Rio Tinto is focusing on the delivery of the Tom Price Battery Energy Storage System (BESS) to act as immediate back-up power generation, commissioning of 34MW Solar PV at Gudai-Darri and 100MW Solar PV at the Pilbara coast[21] (Table 3-11). Full decarbonisation of the Pilbara including electrification of mobile and rail equipment beyond 2030 is estimated to require up to 3GW of installed renewable energy assets[22].

Scope 2 mitigation projects will be implemented at a Pilbara system level depending on the technical constraints of the network to ensure security, reliability and stability is upheld. This Pilbara wide approach enables abatement projects to service multiple developments and is a more cost efficient / flexible approach. Given the fast-evolving nature of renewable energy technologies, Rio Tinto is continuing to monitor numerous alternative energy options to determine suitability for implementation in the Pilbara and our interconnected electricity grid.

At the Proposal specific level, VSD's on existing plant motors and energy efficiency considerations for new infrastructure are important emissions reduction measures for the project (Table 3-11).

[20] https://www.riotinto.com/en/news/releases/2021/rio-tinto-to-strengthen-performance-decarbonise-and-grow

[21] https://www.riotinto.com/en/news/releases/2022/rio-tinto-plans-further-investment-in-renewable-energy-in-the-pilbara

[22] https://www.riotinto.com/en/news/releases/2022/rio-tinto-plans-further-investment-in-renewable-energy-in-the-pilbara

Table 3-11 Scope 2 mitigation projects for the Proposal and under assessment, construction or operation, in the Pilbara

Description	Mitigation Hierarchy	Indicative Implementation Timeframe	Estimated Emission Savings ($t CO_2$-e per annum)	Context
Proposal specific mitigation projects				
VSD's on existing low voltage plant motors	Reduce	Existing	TBC	Existing Hope Downs 1 fixed plant low voltage motors that include variable speed drives (VSD's); • 10 conveyor motors • 2 x vibrating feeders • Shuttle drive motor • Stacker and reclaimer long travel and slew drives Any fixed plant high voltage motors do not have VSD's installed due to, excessive cost, space limitations or ineffectiveness in installation (e.g. hydraulic drives) (Note: any emissions savings have been included in the emissions baseline with the calculation of these savings of low value to include due to the time required to collect and collate the data)
NPI and construction camp building designs	Reduce	Project Implementation	TBC	Rio Tinto Iron Ore company specifications (including Environmental design criteria – Permanent and temporary facilities, DC-N001) apply to non-processing infrastructure (NPI) and the construction camp required for the Proposal. All buildings must meet thermal comfort and energy efficiency requirements of Section J of the National Construction Code (NCC) as well as a minimum NatHERS 6-star rating. For the Proposal, this includes; • Energy efficiency a key design criterion for all electrical loads • Buildings orientated (wherever practical) to suit the climatic conditions • High efficiency air-conditioning units and heat pump hot water units • LED lighting • Natural lighting incorporated into designs where practical to reduce lighting requirements • Verandas installed where practical to reduce thermal loading on building doors/windows (Note: estimated emissions saving not currently available, an independent energy efficiency report will be completed for all buildings after the engineering design process)

Description	Mitigation Hierarchy	Indicative Implementation Timeframe	Estimated Emission Savings ($t CO_2$-e per annum)	Context
Pilbara wide mitigation projects in operation				
Wind Monitoring	N/A	Underway	N/A	A wind monitoring program is underway at various locations in the Pilbara. The multi-year monitoring program will inform the viability of establishing wind farms as part of our overall efforts to transition our Pilbara operations to renewable energy sources.
Pilbara wide mitigation projects under construction[23]				
Battery Energy Storage System (BESS)	Avoid	2023	~33,000	To support the Pilbara Power Network, the Tom Price BESS will provide spinning reserve generating capacity to support a stable and reliable network[24], reducing emissions through the direct displacement of gas that otherwise would be consumed to provide the same function
Solar PV at Gudai-Darri Mine	Avoid	2023	~50,000	Consists of approximately 90,000 solar panels made up of photovoltaic cells to convert sunlight into electricity. Solar PV reduces emissions through direct displacement of gas in electricity generation with renewable energy sources
Pilbara wide mitigation projects under assessment[25]				
Solar PV at Pilbara Coast	Avoid	~2026	~111,000	Consists of approximately 225,000 solar panels made up of photovoltaic cells to convert sunlight into electricity. Solar PV reduces emissions through direct displacement of gas in electricity generation with renewable energy sources
Solar PV (TBD)	Avoid	~2027	~165,000	Solar PV reduces emissions through direct displacement of gas in electricity generation with renewable energy sources
Pilbara Renewable Energy Studies	Avoid	~ 2030	TBA	Additional renewable energy projects are in study phase to deliver substantial emissions abatement across all Pilbara assets, in many cases by 2030.

[23] Note: t CO_2-e per annum savings are the Pilbara wide savings as a result of the project

[24] https://www.riotinto.com/en/news/releases/2020/rio-tinto-to-build-first-solar-plant-in-western-australia-to-power-iron-ore-mine

[25] Note: t CO_2-e per annum savings are the Pilbara wide savings as a result of the project

3.4.2. Scope 2 emissions regulation

Scope 2 emissions associated with the Proposal are not reported as Scope 2 emissions under NGERs and are reported under Scope 1 emissions due to Rio Tinto owning and operating its own gas-fired electricity grid. These emissions are regulated under the Renewable Energy Target (RET) with further information on this regulation provided in Section 3.6.3.

3.5. Scope 3 – Mitigation measures

Scope 3 emissions include, processing of produced iron ore to iron and steel, purchased goods, transport of materials, fuels and personnel to and from site. The steel making process is by far the largest contributor to emissions, with these emissions making up 96% of total Scope 1, 2 and 3 emissions from Rio Tinto Iron Ore (RTIO).

RTIO products from the Pilbara are processed via the blast furnace/basic oxygen furnace (BOF) steelmaking route. This process uses iron ore, metallurgical coal and other additives to produce steel. The other process for producing steel sees the electric arc furnace use recycled steel scrap and natural gas based direct reduced iron (DRI). Steel industry participants have announced a range of emission reduction targets. These targets vary by country and company but are largely aligned and have tiered reduction to achieve net zero by 2050.

There is no proven process route at an industrial scale to produce primary net zero steel today. The industry is developing and scaling a range of new technologies. These include hydrogen-based DRI feeding into an electric arc furnace or into a BOF via an intermediary melt step, direct smelting, the use of sustainable biomass, and carbon capture and storage (CCS), as well as more speculative technologies such as electrolysis. The deployment of these new technologies will depend on technical breakthroughs, capital intensity improvements, consumer recognition of green products and government policy that encourages deployment, such as carbon prices.

In 2021, Rio Tinto established a dedicated steel decarbonisation team within our Commercial Group, to:

- Support the reduction of Rio Tinto's iron ore Scope 3 emissions to net zero by 2050.
- Protect the long-term value of Rio Tinto's iron ore through development and scale up of cost-effective technologies that utilise our iron ores in the future low-carbon steel industry.
- To position Rio Tinto to participate in the nascent green iron market.
- To provide steel decarbonisation analysis and intelligence to support decisions on Rio Tinto's future iron ore resource portfolio, product strategy, and renewable energy development.

In 2022, the Rio Tinto Steel Decarbonisation team,

- Extended collaboration with key customers including Baowu, POSCO, Nippon Steel Corporation and Shougang, with potential carbon emissions reductions of up to 30%.
- Successfully piloted the BioIron™ innovative low carbon iron making process, suitable for Pilbara iron ore.
- Collaborated with industry participants such as BlueScope and Salzgitter Flachstahl to test direct reduction of our products using green hydrogen and develop cleaner processing options.

Rio Tinto is currently advancing 49 projects in partnership with over 30 customers, universities, researcher institutes, and other industry stakeholders, to build options with the aim of net zero by 2050.

RTIO's main customers are in the Asia-Pacific region, where a significant portion of global steelmaking occurs. China is the largest producer of steel, with over half of the worlds annual production, and as a primary customer of RTIO's a significant quantity of Scope 3 emissions will be emitted in China with the balance in other Asian steelmaking hubs (e.g. Japan, Korea, India, etc). These countries are all subject to emissions reduction targets, with net zero pledges ranging from 2050 to 2070 (China has pledged a 2060 net zero target).

3.6. Other statutory decision-making processes which require reduction in GHG emissions

3.6.1. Other relevant statutory decision-making processes – Western Australia State GHG Policy

In 2019, the Western Australian Government announced its State GHG Policy to guide Government decision making for major projects that are assessed by the Western Australian Environmental Protection Authority (WA EPA). The WA EPA released an updated Guideline in April 2023. Table 3-12 details how the contents of this GHG EMP addresses the State GHG Policy.

Table 3-12 Addressing State GHG policy requirements

State GHG Policy Considerations on Contents of a GHG EMP	Proponent Response
The policy supports the development of GHG EMPs for proponents which: Outline strategies to avoid, reduce, mitigate and offset the project's emissions contributing towards the State's aspiration of net zero by 2050	The Proponent is committed to contributing towards the State's aspiration of net zero by 2050 through achievement of interim and long-term targets. Strategies to avoid, reduce, mitigate and offset Scope 1 & 2 emissions from the Proposal are outlined in Section 3.3.1 and 3.4.1.
Are unique to a proposal's specific circumstances	The GHG EMP has been developed specifically to support the Proposal, which consists of the extension and development of new deposits and associated activities to extend the life of existing iron ore operations at Hope Downs 1. The Proposal includes: • 4,900 ha of clearing • Transport of ore to existing processing facilities at Hope Downs 1 via haul and road trains. • Power supplied by existing 33 kV transmission lines and additional substations.
Allow proponents to take account of opportunities at either facility level or across national operations	In some cases, emission abatement projects may be implemented at alternative locations to the Proposal, depending on a range of criteria applicable both to energy supply (e.g. renewable energy facilities, topology and technical constraints) and energy demand (e.g. technology readiness). Using the Rio Tinto owned and operated interconnected Pilbara Power Network, it is anticipated that Rio Tinto will account for emissions abatement at various Pilbara locations to meet the abatement requirements of the Proposal. Rio Tinto's emissions reduction projects in Western Australia are outlined in Section 3.3.1 and 3.4.1. Local or national credible offset units (ACCUs) may be sourced to offset Proposal emissions to meet targets set out in Section 3.8.
Allow proponents to propose their own timeframes and targets; Include requirements for periodic public reporting against their targets; and Account for and align with Commonwealth requirements.	The GHG EMP includes reduction targets and abatement initiatives that either avoid, minimise or offset emissions from the Proposal (Section 3.3.1 and 3.4.1). The Proponent is committed to contributing towards the State's aspiration of net zero by 2050 through achievement of interim and long-term targets. Performance against the Proposal target will be reported in the Ministerial Statement Annual Compliance Assessment Report every five years, with the first review taking place in the 2025 report, as outlined in Section 4.1. Emissions from Hope Downs 1 (including the Proposal) will also be reported annually through NGER, in accordance with the NGER Act.
Consistent with the Government's focus on economic development and diversification, plans that include undertakings to develop Western Australian expertise, carry out research, pilot new initiatives and technologies, and	Rio Tinto is implementing and further developing a range of abatement initiatives in Western Australia, leveraging local expertise and ensuring benefits to local communities and industry participants. In addition, the ongoing activities of the Proponent, and more broadly Rio Tinto in the Pilbara, will continue to support social and economic development projects, including: • continued education, training, employment and business opportunities for local people, including local Aboriginal people; and

support local communities are encouraged.	• continued funding for a range of organisations in the region, including sporting and cultural groups.

3.6.2. Other relevant statutory decision-making processes – Safeguard Mechanism

The National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015 applies baselines to large GHG-emitting facilities, to ensure that net emissions are kept below a defined emissions limit (baseline) aligned with Australia's climate targets. It is administered by the CER and applies to facilities with Scope 1 emissions (covered emissions) of more than 100,000 t CO_2-e per year.

Baselines are calculated by multiplying the quantity of product by an emissions intensity (existing products from facilities will transition from a 'facility-specific' emissions intensity value to 'industry average' values by FY2029-30). The current iron ore industry average emissions intensity is 0.0047 t CO_2-e/t iron ore. A default decline rate of 4.9% per annum is also applied to the baselines from FY2023-24. If a facility reduces its emissions below their baseline Safeguard Mechanism Credits can be generated to be sold to other Safeguard facilities or banked for future use.[26]

Differences in the emissions baseline or reduction trajectory of the Safeguard Mechanism compared with those proposed by the EPA include;

- Baseline emissions covered under Safeguard Mechanism only apply to Scope 1 covered emissions, for Hope Downs 1 this does not include Scope 1 land clearing emissions.
- Safeguard Mechanism baselines rise and fall with production.
- Baselines decline annually due to the 4.9% annual decline and could be higher for certain facilities if they have a current production specific baseline higher than the default industry average due to the transition of all facilities to the default industry average by 2030.
- Declines continue annually until a facility reaches a baseline of 100,000 t CO_2-e.

The emissions reduction required under Safeguard Mechanism compared with that of the EPA include;

- Scope 1 emissions reduction must occur at the facility where Scope 1 emissions occur
- Baseline exceedances under Safeguard Mechanism require the purchase of Australian Carbon Credit Units (ACCUs). No other offsets are currently allowed under this scheme (e.g. international carbon credits).
- Production productivity measures (e.g. more production for the same emissions) results in an increase in the baseline and a decrease in liability (if over baseline)

3.6.3. Other relevant statutory decision-making processes – Renewable Energy Target (RET)

Rio Tinto is the owner-operator of the Pilbara Power Network and is subject to the Renewable Energy Target (RET). The RET is administered by CER and designed to reduce emissions of greenhouse gases in the electricity sector by encouraging additional generation of electricity from sustainable and renewable sources[27]. Renewable Energy Certificates must be surrendered based on the amount of electricity generated minus exemptions (e.g. electricity generated from renewables) multiplied by the Renewable Power Percentage (RPP) for the year. The 2023 RPP is 18.96%.

The RET differs to the proposed EPA reduction trajectory due to it being an incentive to add renewable electricity generation (currently legislated to 2030) rather than reduce emissions. However, the intent is by increasing renewables, electricity generated from fossil fuels should reduce along with emissions. The RPP

[26] https://www.cleanenergyregulator.gov.au/NGER/The-Safeguard-Mechanism/The-Safeguard-Mechanism-for-financial-years-commencing-on-or-after-1-July-2023

[27] https://www.cleanenergyregulator.gov.au/RET/About-the-Renewable-Energy-Target

has generally increased annually however as it is calculated annually, it is not possible to compare trajectories between the RET and the EPA proposal.

3.6.4. Monitoring and reporting requirements – National Greenhouse and Energy Reporting (NGER)

The NGER Act is a single national framework for reporting GHG emissions, energy production and energy consumption. The objectives of the NGER scheme are to:

- Inform government policy and the Australian public;
- Help meet Australia's international reporting obligations;
- Assist Commonwealth, State and Territory government programs and activities; and
- Avoid duplicating reporting requirements in the states and territories.

The methods and criteria for calculating GHG emissions and energy data under the NGER Act are detailed in the National Greenhouse and Energy Reporting (Measurement) Determination 2008 (Department of the Environment and Energy (DoEE), 2008) (NGER Determination). Hope Downs 1 emissions are reported annually under the NGER Act.

Emissions from the Proposal will contribute to the Hope Downs 1 NGER report inventories and be accounted against its baselines under the Safeguard Mechanism. Results of monitoring and reporting against Safeguard Mechanism baselines are made available to the public on the CER website.

3.7. Consistency with other (non-statutory) GHG reduction instruments

3.7.1. Corporate emissions reduction targets

Rio Tinto has announced its ambition to reach net zero emissions by 2050 across all operations. To support this ambition, medium-term global targets have been introduced for Scope 1 and 2 emissions, effective from 2021, to:

- Reduce absolute emissions by 15% by 2025 (approximately 4.9 Mt CO_2-e equity basis)
- Reduce absolute emissions by 50% by 2030 (approximately 16.3 Mt CO_2-e equity basis).

The target is measured against a 2018 global equity baseline, currently 32.6 Mt CO_2-e, which will be adjusted for divestments and acquisitions.

3.7.2. Industry transition strategy

Scenarios for the decarbonisation of the steel sector exist, such as the one presented in the Net-Zero Steel Sector Transition Strategy report published in October 2021 by the Net Zero Steel Initiative (NZSI). NZSI is an industry platform, part of the Mission Possible Partnership, that brings together stakeholders across the whole steel supply chain to help put the sector on a path to net zero emissions by mid-century. In this report, NZSI considers 20 technology archetypes and the decision-making process to deploy these at individual steel plants based on lowest total cost of ownership. The analysis compares two pathways that deliver net zero emissions from the steel sector by 2050 against a baseline business-as-usual scenario:

- Carbon Cost scenario: with a global carbon price (or policies equivalent to a carbon price) applied across all emissions and all geographies, rising globally from \$9/t CO_2 in 2023 to \$250/t CO_2 by 2050.
- Tech Moratorium scenario: restricting major investment decisions post-2030 to technologies that are compatible with reaching a net zero outcome by 2050.

The two scenarios result in different carbon emission pathways ranging from 15 % to 37% emissions reduction by 2030. The analysis is a useful illustration of the complexity and challenges faced by the steel industry to reach net zero by 2050. Our approach is to pursue and support a range of decarbonisation options aligned with the technology pathways highlighted by the NZSI analysis, through proactive partnerships with our customers, suppliers, universities and research institutes.

3.8. Offsets

In 2022, Rio Tinto increased investment in the Nature Solutions team in recognition that high quality offsets will play a significant role in our decarbonisation strategy this decade[28]. The Proponent aims to achieve its emissions reduction targets through a combination of avoidance measures and offsets. The Proponent proposes to offset GHG emissions by retiring high integrity offset units on an annual basis, for example to meet Safeguard Mechanism obligations, to also meet cumulative 2025, 2030, 2035 and 2040 targets.

Rio Tinto defines high integrity as projects that balance positive outcomes for people, nature and climate and take an integrated landscape perspective with the intent to secure permanent, additional carbon emissions reductions. Using an assessment criterion based on existing standards for the voluntary market and in conjunction with this high integrity definition two workstreams are underway;

- Developing Nature-based Solutions (NbS) at, or near our assets (including Australia)
- Securing high-quality carbon credits from the market

The assessment criteria in use ensures a defensible carbon baseline and accounts for real carbon reductions focusing on permanence, additionality and quantification along with the ability to deliver biodiversity and social benefits. This aligns with integrity principles of the International Carbon Reduction and Offset Alliance (ICROA) in relation to the sourcing and use of credible offset units based on the principles of real, measurable, permanent, additional, independently verified, and unique[29].

Where offsets are required, the Proponent proposes to use Australian Carbon Credit Units (ACCUs), that may have also been retired to meet any Safeguard Mechanism obligations, to meet any EPA commitments. ACCUs must be surrendered in the Australia National Registry of Emissions Unit (ANREU) of which the CER is the certifying body. Rio Tinto is focused on securing high quality 'nature-based' ACCUs, with a vintage year from 2018 and onwards, that meet our high-quality thresholds due to the potential for strong carbon, nature and social benefits. Given this focus our investments prioritise the development and sourcing of ACCUs generated by methods including but not limited to;

- Environmental planting
- Savanna burning
- Human induced regeneration (to be replaced by integrated farm method Q4 2023)

Rio Tinto is ramping up commercial activities to ensure high-quality carbon credits are available in the volumes required to meet any Safeguard Mechanism obligations (ACCUs) as well as interim and long-term targets for the Proposal. A range of upstream partnership models (including long-term offtakes, co-investment, and co-development) with high-quality partners and developers is currently being explored.

As part of annual NGERs reporting (due end of October each year), CER provide a position statement of any Safeguard Mechanism exceedance and resultant liability. The Proponent has until February the following year to surrender the appropriate quantity of ACCUs in the event of a liability. This information is recorded on the CER website as evidence as part of the Safeguard Mechanism facility data. Any offsets purchased to meet Safeguard Mechanism obligations which the Proponent proposes to also use against interim targets for the Proposal will be included in the 2025 Ministerial Statement Annual Compliance Assessment Report (and five yearly post this report).

3.9. Projects operating beyond 2050

The Proposal is not expected to be operating beyond 2050.

[28] https://www.riotinto.com/invest/reports/climate-change-report

[29] "ICROA Code of Best Practice, Version 2.1, July 2023", published by ICROA, downloaded from https://icroa.org/wp-content/uploads/2023/07/ICROA_Code_Best_Practice_v2.1_04072023.pdf on 11th September 2023

4. ADAPTIVE MANAGEMENT, CONTINUOUS IMPROVEMENT AND REVIEW OF THE GHG EMP

The GHG EMP will nominally be reviewed at least every five years, with the first review taking place at the beginning of 2026 (unless required before this date), to ensure that it reflects the current situation with regards to GHG management and monitoring. Re-submission of the most recent confirmed GHG EMP shall be included with the 2025 Ministerial Statement Annual Compliance Assessment Report by 30th April 2026.

In line with the concept of adaptive management (Table 4-1), the management actions presented in the GHG EMP shall be monitored, reviewed, evaluated and updated as required considering:

- If new abatement technology is proposed to achieve interim and long-term targets in Section 3.3.1 or 3.4.1 not already considered
- If a new process or activity is proposed to be introduced that has the potential to significantly change the emissions from the Proposal, and that was not already considered (and that is not in accordance with this GHG EMP)
- Comments from the WA EPA and other decision-making authorities (DMAs) during the Public Environmental Review (PER) approval process;
- Changes in State or Commonwealth climate change legislation or policy; and
- Material change in risk (opportunities, processes and procedures) related to climate change identified by Rio Tinto.

Where either the five yearly review cycle is triggered, or if a significant change to either the facility, activity, or risk is identified, a revised GHG EMP will be submitted to the WA EPA.

Table 4-1 Adaptive management based provisions for the GHG EMP

Objective Based Management - Provisions Greenhouse Gas Emissions				
WA EPA Factor: Greenhouse Gas Emissions **Key impacts and risks:** Emissions and subsequent contribution to climate change				
Management-based provisions				
Objective: To reduce net greenhouse gas emissions to minimise the risk of environmental harm associated with climate change				
Management Actions	**Management Targets**	**Monitoring**	**Timing / Frequency**	**Reporting**
Achieve emissions reduction trajectory as defined in Figure 3-4 and Table 3-5	*Interim and Long-term Targets* Interim and long-term emissions reduction targets for the Proposal (as outlined in Section 3.2) are to: • Reduce or abate emissions by 15% by 2025 (approximately 5,608 t CO_2-e); • Reduce or abate absolute emissions by 50% by 2030 (approximately 523,778 t CO_2-e); • Reduce or abate absolute emissions by 66% by 2035 (approximately 759,076 t CO_2-e); Implementation of the Pilbara emissions abatement projects in Section 3.2.1 & 3.4.1 as required to achieve interim and long-term targets described in Section 3.2.	Monitoring of Proposal emissions and quantification of realised emissions reductions in accordance with NGER Act and NGER Determination.	Five yearly with the first report taking place in the 2025 Ministerial Annual Compliance Assessment Report.	A summary report of performance against the Proposal interim and long-term emissions reduction targets in Section 3.2 will be reported in the Ministerial Statement Annual Compliance Assessment Report every five years, with the first report taking place in the 2025 Report. For details refer to Section 4.1. Retirement of Credible Offset Units (ACCUs) to meet EPA commitments, that may have also been retired to meet any Safeguard Mechanism obligations, in relation to the Proposal for 2025, 2030 and 2035 compared to interim and long-term targets in Section 3.2. Summary of purchased and retired credible offset units over the previous 5 years will be included in the Ministerial Statement Annual Compliance Assessment Report as described in Section 4.1.

Objective Based Management - Provisions Greenhouse Gas Emissions				
WA EPA Factor: Greenhouse Gas Emissions **Key impacts and risks:** Emissions and subsequent contribution to climate change				
Management-based provisions				
Objective: To reduce net greenhouse gas emissions to minimise the risk of environmental harm associated with climate change				
Management Actions	**Management Targets**	**Monitoring**	**Timing / Frequency**	**Reporting**
Continuously work towards achieving net zero emissions by 2050 for the Proposal.	Implementation of reasonable and practicable measures to avoid, reduce and offset Proposal Scope 1 & 2 GHG emission described in Section 3.2.	Review of identified reasonable and practicable measures to avoid, reduce, mitigate and offset the Proposal's Scope 1 & 2 emissions completed.	Five-yearly, with the first review taking place in the 2025 Ministerial Annual Compliance Assessment Report.	A summary of delivered Pilbara abatement projects will be presented in the Ministerial Statement Annual Compliance Assessment Report every five years, as described in Section 4.1.
Implement GHG monitoring and reporting	Monitor and report all Scope 1 and Scope 2 (if applicable) emissions	Monitoring in accordance with NGER Measurement Determination.	Annually	Annual reporting of emissions is performed in accordance with the NGER Act. Summary of Scope 1 emissions published as part of annual Safeguard Mechanism data tables by the CER.
Operate under Safeguard Mechanism to maintain net emissions at or below Hope Downs 1 baselines	Hope Downs 1 (including the Proposal) operates under the Safeguard Mechanism baseline.	Monitoring of net emissions performed in accordance with Safeguard Mechanism. Purchase and surrender Australian Carbon Credit Units (if required) in accordance with Safeguard Mechanism.	Annually	Summary of any surrendered Australian Carbon Credit Units published as part of annual Safeguard Mechanism data tables by the CER.
Undertake review and re-submission of GHG EMP	Update GHG EMP every five years as a minimum or as required following significant changes as described in Section 4.1.	Review and re-submission of the GHG EMP completed every five years as a minimum or as required following significant changes.	Five-yearly, with the first review taking place in 2026. Re-submission shall be completed by 30th April 2026.	Submission of revised GHG EMP for WA EPA approval.

4.1. Continuous improvement processes

4.1.1. Integrating GHG Considerations in Project Development Design

In line with the Rio Tinto's ambition to reach net zero emissions by 2050 across all operations and carbon neutral growth, internal guidelines are in place to integrate GHG considerations into design and planning of development projects.

Strategic decisions are made throughout the development of projects to ensure energy efficient lower emission solutions are prioritised where practicable. Each project, in conjunction with the Rio Tinto Study Definition Guidelines, and aligned with the State GHG Policy and Guideline, considers throughout design, construction and operational phases:

- Application of a mitigation hierarchy to avoid, reduce and offset emissions;
- Contribution to emissions reduction targets;
- Adoption of best practice design, technology and management appropriate to the mitigation measures implemented; and
- Continuous improvement to reduce emissions over the life of the project and across the Pilbara in a holistic, measured and consistent manner.

4.1.2. Integrating GHG considerations in existing operations

In accordance with Business Improvement Process, assets are required to develop optimised production improvements which identifies and implements opportunities to improve production and energy efficiency whilst minimising emissions.

The process outlines a framework for structured decision making, planning, governance and delivery approach to ensure opportunities are matured based on knowledge-based decisions, and account for uncertainty and residual risk.

5. REPORTING

An annual report will be included in the Ministerial Statement Annual Compliance Assessment Report that will include the following;

- Quantity of the Proposal GHG emissions
- The number of tonnes of iron ore produced
- The emissions intensity (including calculation and calculation methodology)

A consolidated report of performance against the Proposal targets will be detailed in the Ministerial Statement Annual Compliance Assessment Report every five years (e.g. 2025, 2030, 2035, etc), with the first report taking place in the 2025 Report. The consolidated report will include the following:

- Quantity of total GHG emissions from the facility;
- Net GHG emissions
- GHG emission reduction measures, the source of these measures and the accounting methodology that has been implemented to avoid or reduce GHG emissions;
- Quantity of offsets required to meet interim targets (if required)
- Performance (emissions intensity) against benchmarking for comparable facilities;
- Statement whether interim targets have been achieved;

Actual emissions for the Proposal will be compared against targeted forecast emissions. If total actual emissions reductions for the Proposal are less than the target emission reduction in 2025, 2030, 2035 and 2040, abatement projects implemented from the Pilbara wide abatement pathway will be applied against total actual emissions from the Proposal. Rio Tinto has identified specific abatement initiatives (Table 3-11) which will be implemented in Rio Tinto's Pilbara Power Generation Network, connected to the Proposal where the abatement from these projects will be applied to achieve Scope 1 & 2 interim emissions targets. The long-term

emissions reduction target is anticipated to be achieved by the implementation of a range of existing or potential future GHG abatement opportunities.

This GHG EMP will also be made publicly available on the Rio Tinto website at the following location;

- https://www.riotinto.com/Operations/australia/pilbara

6. STAKEHOLDER CONSULTATION

A summary of stakeholders and consultation outcomes to date regarding the Proposal GHG EMP is located in Table 6-1.

The opportunities for stakeholder consultation during the life of the Hope Downs 2 Proposal GHG EMP is continuing to evolve and current opportunities to discuss the GHG EMP includes;

- Department of Water and Environmental Regulation – Environmental Compliance and Enforcement
    - Informal monthly meeting with Senior Environmental Officer
- Ngarlawangga (NLW)
    - Quarterly Local Implementation Committee meetings (planned from 2024)
- Nyiyaparli (NYI)
    - Quarterly Local Implementation Committee meetings (planned from 2024)

Table 6-1 Hope Downs 2 Proposal GHG EMP stakeholder consultation and outcomes

Stakeholder	Date	Topics/issues discussed	Rio Tinto response
NLW		Draft ERD – Greenhouse Gas Emissions Estimates • Emissions estimates don't include construction • Should include maximum and expected annual/total	The GHG emissions in the ERD includes construction and operations, further detail is provided in the GHG EMP. The GHG EMP includes maximum, annual average and total Scope 1 and 2 emissions.
NLW		Draft ERD – Mitigation • Avoidance measure non-specific • Offset focus • Decarbonisation strategy for RTIO focuses on power generation	Rio Tinto's decarbonisation agenda is led by the Chief Decarbonisation Officer who was appointed in February 2023 to drive the Group's climate strategy, manage decarbonisation investment and deliver carbon abatement through Global Decarbonisation Programs. Our decarbonisation work is delivered under six Global Decarbonisation Programs that address 99% of the source of Scope 1 & 2 emissions. Each program has identified a pathway to progressively reduce emissions to achieve net zero Scope 1&2 emissions by 2050, though much of the technology required does not yet exist. • Repowering our Australian east coast aluminium smelting operations (Pacific Operations) • Electricity • Diesel use • Process heat in alumina processing • Process heat in minerals processing • Anodes consumed in aluminium smelting The largest sources of emissions from our WA iron ore operations are the diesel fuel used in haul and rail fleets and electricity generated by fossil fuel sources. • Rio Tinto's Diesel Transition team is working on a roadmap to transition our fleets away from diesel use by purchasing more fuel-efficient equipment, investigating the use of biofuels of our fleets while also continuing to partner with equipment suppliers such as Caterpillar and Komatsu to develop and then pilot battery electric haul trucks. • Rio Tinto's Renewable Energy team is developing a plan to reduce reliance on gas-generated electricity by developing up to 1GW of renewable energy assets (solar, wind and storage) in the Pilbara region. The updated GHG EMP will include avoidance measures from the above work streams and the proposed quantity of emissions avoided versus the quantity of emissions offset.

NLW		Draft ERD – Mitigation • Environmental outcomes section represents outcomes for the Proposal not outcomes for the environment • No discussion of the significance of the proposal on WA or Australia's emissions. Assessment of impact significance absent	This section has been updated to align with the EPA's new GHG Environmental Factor Guideline and the Greenhouse EMP template, which does not require the information noted. Section 10.4 of the GHG chapter of the ERD has been updated to include: The Proposal peak emissions represent 0.26% of WA emissions (using the 2020-21 WA GHG inventory from the Australia's National Greenhouse Accounts, which is the latest available data)
NYI		Draft ERD – Greenhouse Gas Emissions Estimates • XX% of WA emissions not included	Noted, Section 10.4 of the GHG chapter of the ERD has been updated to include: The Proposal peak emissions represent 0.26% of WA emissions (using the 2020-21 WA GHG inventory from the Australia's National Greenhouse Accounts, which is the latest available data)
EPA	23 June 2023	The Greenhouse Gas (GHG) management plan requires updates Actions • Update all references in the ERD to the GHG management plan to be Appendix A8, noting there is no Appendix A6 in the attachments (see further comments below in Other). • Refer to the EPA GHG EMP TEMPLATE APRIL 2023.pdf (epa.wa.gov.au) and the Template Greenhouse Gas Environmental Management Plan -Summary Plan April 2023.pdf (epa.wa.gov.au) when updating the GHG management plan. • Update the GHG management plan: ○ Refer to the most recent Environmental Factor Guideline: Greenhouse Gas Emissions 2023 (EFG – GHG 2023) for the Executive Summary. See also Attachment 1 of the GHG Template 2023 – Executive summary. If it is proposed that the GHG management plan is to not be updated so as to comply with EFG – GHG 2023, then justification should be provided. ○ See Attachment 2 Template Table Section 3 of the GHG EMP Template 2023 for guidance on the information and evidence required. ○ Include stakeholder consultation. ○ Include a change control table (Attachment 3 in GHG EMP Template 2023). ○ Indicate the GHG management plan will be publicly available on the RTIO website.	Due to the change in guidelines, the Proponent is currently in the process of updating and aligning in-flight Greenhouse Gas management plans into the new format, including new data and information to meet the updated requirements. The Proponent has also engaged a third-party reviewer to undertake the peer review component as required by the updated Guideline. The Proponent is currently updating the plan in accordance with the new guidance and seeks application of transitional requirements to allow for time to adjust to new guidance requirements.

		○ Update the 14-year mine life of the proposal to the estimated 15 years stated in the PCD ○ Use the definition of Scope 3 as defined in the EFG – GHG 2023. ○ Check calculations for peak Scope 2 emissions identified in Table 3.1.1, which are greater than the peak allowed Scope 2 emissions stated in the PCD. ○ Clarify peak annual production for the Proposal and operational peak emissions. See also, Attachment 2 of GHG EMP Template 2023 – estimates should be based on throughput at maximum nameplate/nominal capacity and annual average operational design capacity, incorporating shutdowns for maintenance and other likely inefficiencies. ○ Correct errors throughout the document where “Error! Reference source not found…” is stated. ○ Remove duplicate Figure 4-1 from the GHG management plan Section 4.1.2 and remove the incorrect references to Table 4-1 for these figures.	

7. CHANGES TO GHG EMP

Complexity of changes	Minor revisions ☐	Moderate revisions ☐	Major revisions ☒
Date revision submitted to EPA: November 2023			
Is the change proposed to be implemented under condition C3-3? If so, the proponent must provide a copy to the CEO at least 20 days before commencing implementation Yes ☐ No ☒			
Proponent's operational requirement timeframe for approval of revision Reason for Timeframe: < One Month ☐ < Six Months ☒ > Six Months ☐ None ☐			

Item no.	GHG EMP section no.	GHG EMP page no.	Summary of change (separate track changes document to be provided)	Reason for change	New or increased adverse impacts to the environment? Risk to the achievement of limits, outcomes or objectives?
1.	All	All	New GHG EMP to align with latest Environmental Factor Guideline - GHG	New GHG EMP to align with latest Environmental Factor Guideline - GHG	Emissions forecast has been updated with total emissions increasing primarily due to an update of the power forecast. The achievement of emission reduction objectives will be met with a combination of avoidance measures and offsets.
2.					
3.					

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A.6: Draft Hope Downs 2 Greenhouse Gas Environmental Management Plan

Hamersley HMS

Matters of National Environmental Significance (MNES) Fauna Environmental Management Plan

Hope Downs 2 Proposal

November 2023

DRAFT

RTIO-HSE-0344371

Hamersley HMS Pty Ltd

152-158 St Georges Terrace, Perth

GPO Box A42, Perth WA 6837

Disclaimer and Limitation

This Matters of National Environmental Significance (MNES) Fauna Environmental Management Plan has been prepared by Rio Tinto's Iron Ore group (Rio Tinto), on behalf of Hamersley HMS Pty Ltd (the Proponent), specifically for the Hope Downs 2 Proposal. Neither the document nor its content may be referred to without the express approval of Rio Tinto unless the document has been submitted by Rio Tinto and approved by the relevant government regulator in connection with the Hope Downs 2 Proposal.

Document Status					
Rev	Author	Reviewer/s	Date	Approved for Issue	
				To Whom	Date
1	Approvals	Rio Tinto	December 2022	DWER - EPA	December 2022
2	Approvals	Rio Tinto	August 2023	DWER - EPA	August 2023
3	Approvals	Rio Tinto	November 2023	DWER - EPA	November 2023

DRAFT

EXECUTIVE SUMMARY

This Matters of National Environmental Significance (MNES) Fauna Environmental Management Plan (EMP) has been prepared by Rio Tinto on behalf of Hamersley HMS Pty Limited (the Proponent) for the Hope Downs 2 (HD2) Proposal (the Proposal). This EMP specifically addresses the following environmental factors associated with the Proposal:

- Terrestrial fauna
    - Specifically, fauna species listed under both the Western Australian Biodiversity Conservation Act 2016 (BC Act) and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (Matters of National Environmental Significance (MNES)) and their high value / critical habitat.

High value / critical habitat mapped within the Proposal area comprises Gorge/Gully and Breakaway habitats, including caves which are used by Ghost Bats and Pilbara Leaf-nosed Bats. High value / critical habitat is considered potentially suitable for denning, roosting and/or shelter and has been identified within the Development Envelope for the following MNES fauna:

- Northern Quoll
- Ghost Bat
- Pilbara Olive Python

Supporting habitat is considered potentially suitable for foraging and dispersal and has been identified within the Development Envelope for the following MNES fauna:

- Northern Quoll
- Ghost Bat
- Pilbara Leaf-nosed Bat
- Grey Falcon

No Critical habitat for Grey Falcon was identified within the Development Envelope and while potentially suitable Supporting habitat is present within the Development Envelope, no significant residual impacts to Supporting habitat have been defined within the Development Envelope. No Critical or Supporting habitat for Night Parrot was defined within the Development Envelope.

This EMP includes actions to minimise impacts associated with threatening processes associated with implementation of the Action, to EPBC Act listed MNES fauna species:

- Northern Quoll (*Dasyurus hallucatus*);
- Ghost Bat (*Macroderma gigas*);
- Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*); and
- Pilbara Olive Python (*Liasis olivaceus barroni*).

The overall management strategy for these MNES fauna species is to maintain the integrity of the high value / critical habitat. This is proposed to be achieved through the establishment of MEZs and outcome-based provisions to measure and report potential impacts. Given the known presence of Ghost Bat within the Proposal area, additional management-based provisions are proposed for this species. However, all proposed provisions, including maintaining high value / critical habitat in the MEZs and feral animal management will have flow-on benefits for all MNES fauna species.

Executive summary Table 1 presents the relevant approval/s, and the purpose of this EMP. Executive summary Table 2 presents the environmental outcomes and objectives for each environmental factor to be met through implementation of this EMP, as well as the environmental criteria and management targets to measure the achievement of the associated environmental outcomes and objectives.

ES Table 1: Summary of Approvals and Purpose of this EMP

Item	Details
Proposal title	HD2 Proposal
Proponent	Hamersley HMS Pty Ltd
Ministerial Statement	TBD
EPBC decision notice	2021/9035
Purpose of this EMP	This EMP provides management for MNES fauna values with the potential to be impacted by the Proposal. This EMP fulfills the anticipated requirements of a new Ministerial Statement and EPBC Decision Notice (as an accredited assessment).
Key environmental factor	The key environmental factor addressed in this EMP is Terrestrial Fauna. The outcomes and objectives for the values associated with this factor is outlined in ES Table 2
Condition clause (if applicable)	TBD
Proposed construction date	Estimated 2024/2025
EMP required pre-construction	Yes

ES Table 2: Environmental Criteria to Measure Achievement of Environmental Outcomes and Objectives

Terrestrial Fauna – Ghost Bat (*Macroderma gigas*), Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*), Northern Quoll (*Dasyurus hallucatus*) and Pilbara Olive Python (*Liasis olivaceus barroni*) **Condition clauses:** TBD **EPA Objective**: *To protect terrestrial fauna so that biological diversity and ecological integrity are maintained*.		
Outcomes based provisions	**Environmental Outcome**	No disturbance within MEZ1 and MEZ2 other than existing and approved[1]. No significant impact to the structural integrity of the Ghost Bat cave for Ghost Bat use, retained with the MEZs (including Caves 5 and 10) as a result of mine excavation and blasting associated with the Proposal.
	Early response criteria	**1.** Direct disturbance, including mining excavation, within 30 m of the MEZ1 and MEZ2, other than existing and approved[2].

[1] No more than 5% of the total area covered by the MEZs can be cleared for low impact activities. There is to be no clearing of high value / critical MNES habitat (Gorge/gully and Breakaway types) and no impact to Ghost Bat caves within MEZs

[2] Approved disturbance refers to activities as described in the HD2 ERD and as per the definition for a MEZ (Rio Tinto 2023).

Terrestrial Fauna – Ghost Bat (*Macroderma gigas*), Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*), Northern Quoll (*Dasyurus hallucatus*) and Pilbara Olive Python (*Liasis olivaceus barroni*) **Condition clauses:** TBD **EPA Objective**: *To protect terrestrial fauna so that biological diversity and ecological integrity are maintained*.		
	Trigger criteria	**1.** Direct disturbance, including mining excavation, within 20 m of the MEZ1 and MEZ2, other than existing and approved[2]. **OR** **2.** Vibration levels exceed 10 mm/s peak particle velocity (PPV) during breeding months (1 October to 31 December), or 25 mm/s PPV in non-breeding months attributable to the Proposal (Cave 10). **OR** **3.** Decline in the visual structural integrity[3] of any retained Ghost Bat caves within the MEZs (Caves 5 and 10), attributable to the Proposal.
	Threshold criteria	**1.** Direct disturbance, including mining excavation, within the MEZ1 and MEZ2, other than existing and approved. **OR** **2.** Significant damage[4] to structure of any retained Ghost Bat caves within the MEZs (Caves 5 and 10), attributable to the Proposal.

[3] Decline in structural integrity is defined as a negative change to the integrity of the cave. The trigger will be exceeded where changes are observed after a blast event, including rockfalls and a significant step change microclimate as measured by temperature and humidity (in comparison to baseline data).

[4] Significant damage of a cave is defined as damage that negatively impacts the structural integrity and microclimate of the cave such that future Ghost Bat use of the site is prevented

Corporate endorsement

I hereby certify that to the best of my knowledge, the provisions within this Matters of National Environmental Significance (MNES) Fauna Environmental Management Plan for the Hope Downs 2 Proposal are true and correct.

Name: Nathan Jacobs **Signed:** 

Designation: General Manager, Hope Downs **Date:** 15th November 2023

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Abbreviations and Terminology

Abbreviation	Description
ACAR	Annual Compliance Assessment Report
AWT	Above water table
BC Act	*Biodiversity Conservation Act 2016*
BHT	Bedded Hilltop
Cave	A naturally occurring structure that bats may utilise for feeding or roosting
CEO	The Chief Executive Officer of the Department of the Public Service of the State responsible for the administration of Section 48 of the *Environmental Protection Act 1986*, or their delegate.
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Cwth)
DWER	Department of Water and Environmental Regulation
EMP	Environmental Management Plan
EP Act	*Environmental Protection Act 1986*
EPA	Environmental Protection Authority (WA)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ERD	Environmental Review Document
Framework for EMPs	Rio Tinto Framework for development of EMPs as described in Appendix 1.
HD2 Proposal	Hope Downs 2 Proposal
Management level	Level of management appropriate for an environmental value, as determined by assessment described in the Framework for the Development of Rio Tinto Environmental Management Plans
MEZ	Refers to an area within the Development Envelope where no mining excavation will occur, and only low impact activities associated with environmental and cultural heritage monitoring and management may be implemented. No more than 5% of the total area covered by the MEZ can be cleared for low impact activities. There is to be no clearing of high value / critical MNES habitat (Gorge/gully and Breakaway types), no impact to Ghost Bat caves and no clearing of P2 flora within MEZ
MNES	Matters of National Environmental Significance
Proponent	Hamersley HMS Pty Ltd
Roost	The area within a roost structure (i.e. cave, adit, or artificial structure) where bats aggregate during roosting.
SPR	A '*casual pathway conceptual model*' (Stressor, Pressure, Receptor) approach for potential impacts due to project (refer to Appendix 1).

1. CONTEXT, SCOPE AND RATIONALE

This Matters of National Environmental Significance (MNES) Fauna Environmental Management Plan (EMP) has been prepared by Rio Tinto on behalf of Hamersley HMS Pty Ltd (the Proponent) for the Hope Downs 2 (HD2) Proposal (the Proposal). This EMP was produced to support assessment of the Proposal under the Western Australian (WA) *Environmental Protection Act 1986* (EP Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This EMP was developed according to the Conceptual Framework for the Development of Rio Tinto Environmental Management Plans (internal guidance described in Appendix 1). This framework provides a standardised approach to environmental management at Rio Tinto's Pilbara Iron Ore Operations, in accordance with Western Australian (WA) Policy and Guidance, including:

- *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2021* (EPA 2021a);
- Environment Protection Authority's (EPA) *Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans* (EPA 2021b);
- EPAs *Interim Guidance for Environmental outcomes and outcomes-based conditions* (EPA, 2021c);
- *Environmental Impact Assessment (Divisions 1 and 2) Procedures Manual* (EPA 2021).

This EMP also addresses Commonwealth requirements, described in the *Environmental Management Plan Guidelines* (Australian Government 2014), as presented in Table 1-1.

This EMP is expected to meet future conditions and therefore will be subject to approval prior to implementation by the WA Environmental Protection Authority (EPA) and the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW).

Table 1-1: Commonwealth (EPBC Act) Content Requirements within the EMP

Commonwealth Requirement	Section of this EMP
Conditions of the Approval reference table	N/A
Project Description	Section 1.1
Objectives	Section 2
Roles and Responsibilities	Environmental Operation Team
Reporting	Section 2.2
Potential Environmental Impacts and Risks	Table 1-2 in Section 1.2
Environmental Management Measures: Environmental Management Activities Performance Targets Environmental Monitoring Corrective Actions	Outcome-based Provisions Table 2-1 to Table 2-2 in Section 2
Maps and Diagrams	Figure 1-1 to Figure 2-1
Audit and Review	Section 3

1.1 Proposal

The Proposal is located in the Pilbara Region of Western Australia, approximately 80 km northwest of Newman in the Shire of East Pilbara. The Proposal is located within the Native Title Determination Area of the Nyiyaparli, Ngarlawangga and Banjima People (Figure 1-1).

The Proposal includes, but is not limited to the following:

- Development and operation of two Above Water Table (AWT) iron ore deposits: Bedded Hilltop (BHT) and HD2.
- Activities required to facilitate mining which may include, but are not limited to, the following:
    - Mineral waste management infrastructure: including waste rock landforms, landbridges, low grade ore dumps, and topsoil and sub-soil stockpiles.
    - New processing infrastructure: including processing facility at HD2 and/or BHT deposits.
    - Support facilities: including workshops, hydrocarbon storage areas, Ammonium Nitrate Fuel Oil facilities, laydown areas, turkeys nests, transfer pads and offices.
    - Linear infrastructure: including heavy and light vehicle access roads, railway crossing, conveyors, pipelines, power distribution network (including sub-stations), communications distribution network and associated communications infrastructure.
    - Renewable energy: including renewable energy generation, energy storage and associated ancillary infrastructure.
    - Realignment of approximately 6 km of the Great Northern Highway.
    - Infrastructure for surface water management: including Pebble Mouse Creek crossings, diversion drains, levees and culverts.
    - Infrastructure for water supply: including abstraction of groundwater and or use of surplus water from local sources and adjacent operations.
    - Accommodation, including installation of an upgrade of existing accommodation and/or new construction camp.

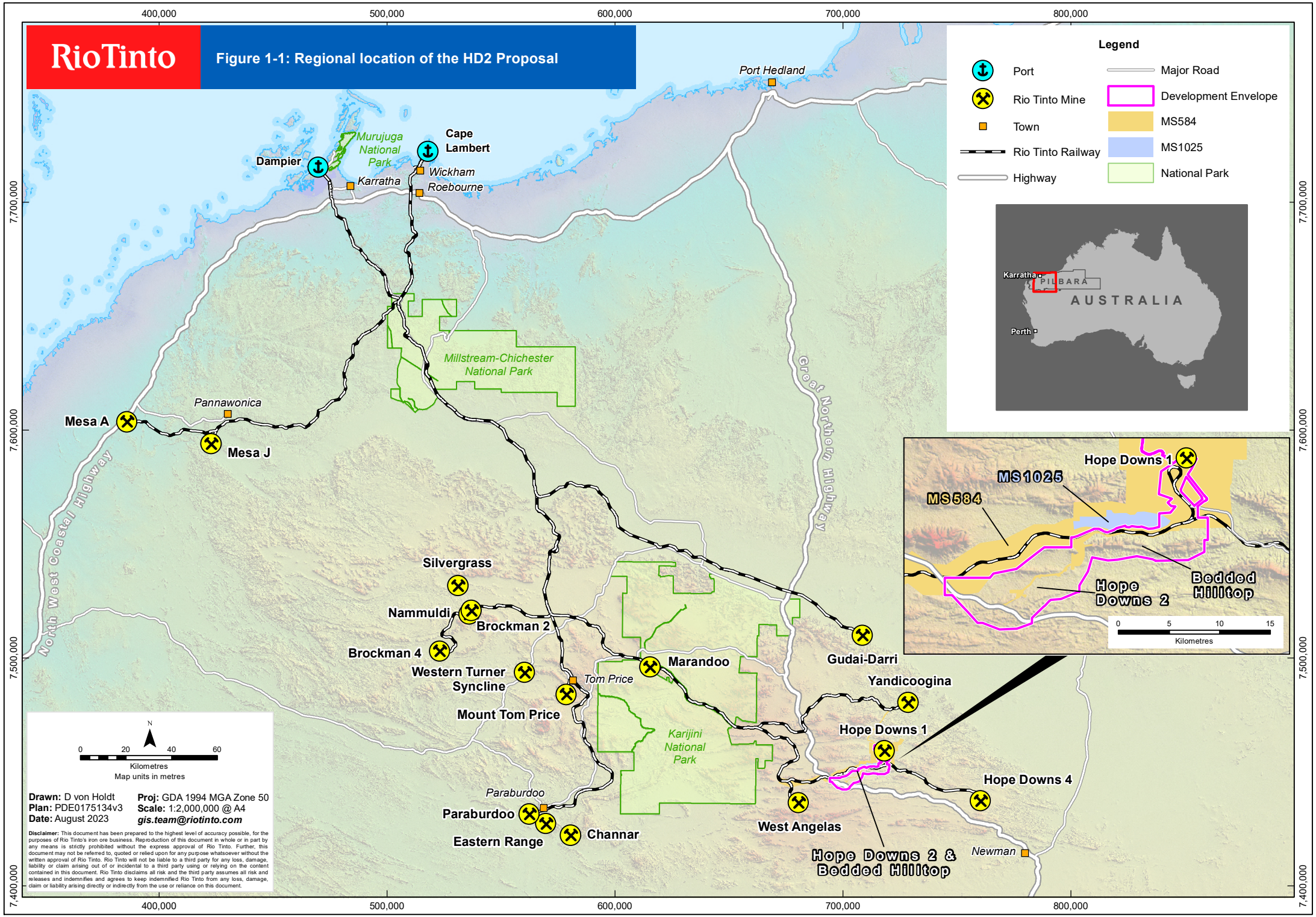
Three Mining Exclusion Zones (MEZs) are included as part of the Proposal, two of which (MEZ1 and MEZ2) are specifically to protect the following terrestrial fauna values:

- MEZ1 (233 ha) – established to protect:
    - Northern Quoll:
        - Known locations for Northern Quoll recorded at the southern extent of the range of the species (as identified in the baseline surveys); and
        - 55 ha of potential high value / critical habitat and 178 ha of potential supporting habitat
    - Ghost Bat:
        - One category 3 (Cave 5) and two category 4 caves (Caves 3 and 6); and
        - 55 ha of potential high value / critical habitat and 225 ha of supporting habitat
    - Pilbara Leaf-nosed Bat:
        - Three category 4 caves (Cave 3, 5 and 6) considered supporting habitat
- MEZ2 (8 ha) established to protect:
    - Ghost Bat:

- the integrity of the category 2 cave (Cave 10) a potential maternity Ghost Bat roost, which is considered high value / critical habitat, and the 150 m surrounding supporting habitat.

- Pilbara Leaf-nosed Bat:
  - The category 4 cave (Cave10) considered supporting habitat

Figure 1-2 shows proposed conceptual elements of the Proposal and MEZs.


RioTinto
Figure 1-1: Regional location of the HD2 Proposal
Legend
Port
Rio Tinto Mine
Town
Rio Tinto Railway
Highway
Major Road
Development Envelope
MS584
MS1025
National Park
Karratha
PILBARA
AUSTRALIA
Perth
Port Hedland
Cape Lambert
Dampier
Murujuga National Park
Karratha
Wickham
Roebourne
Millstream-Chichester National Park
Great Northern Highway
North West Coastal Highway
Pannawonica
Mesa A
Mesa J
Silvergrass
Nammuldi
Brockman 2
Brockman 4
Western Turner Syncline
Tom Price
Mount Tom Price
Marandoo
Gudai-Darri
Yandicoogina
Karijini National Park
Hope Downs 1
Hope Downs 4
Paraburdoo
Eastern Range
Channar
West Angelas
Hope Downs 2 & Bedded Hilltop
Newman
MS1025
MS584
Hope Downs 1
Bedded Hilltop
Hope Downs 2
0 5 10 15
Kilometres
N
0 20 40 60
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: PDE0175134v3
Date: August 2023
Proj: GDA 1994 MGA Zone 50
Scale: 1:2,000,000 @ A4
gis.team@riotinto.com
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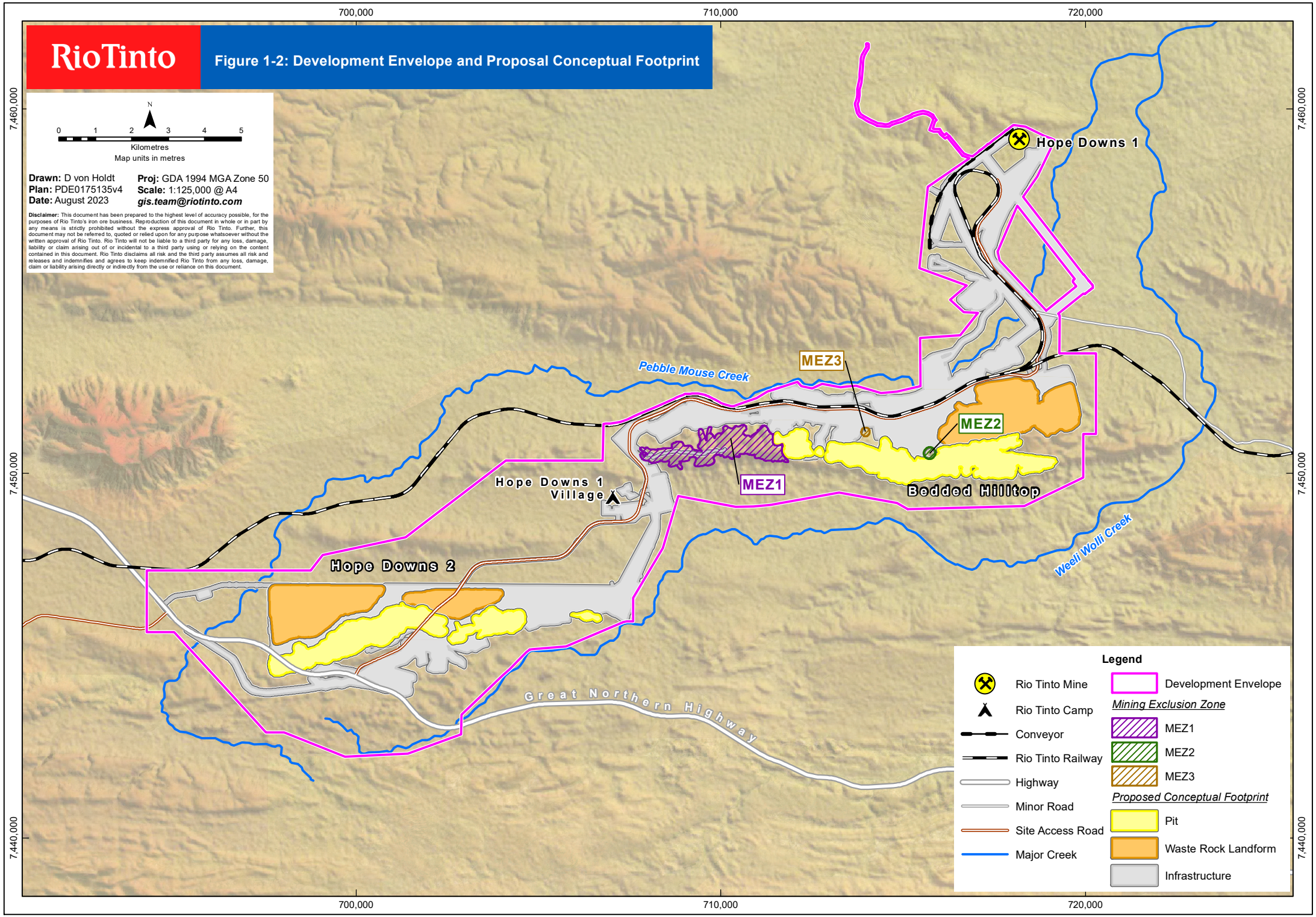
400,000
500,000
600,000
700,000
800,000
7,700,000
7,600,000
7,500,000
7,400,000


Rio Tinto
Figure 1-2: Development Envelope and Proposal Conceptual Footprint
N
0 1 2 3 4 5
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: PDE0175135v4
Date: August 2023
Proj: GDA 1994 MGA Zone 50
Scale: 1:125,000 @ A4
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700,000
710,000
720,000
7,460,000
7,450,000
7,440,000
Hope Downs 1
Pebble Mouse Creek
MEZ3
MEZ2
MEZ1
Bedded Hilltop
Hope Downs 1 Village
Hope Downs 2
Weeli Wolli Creek
Great Northern Highway
Legend
Rio Tinto Mine
Rio Tinto Camp
Conveyor
Rio Tinto Railway
Highway
Minor Road
Site Access Road
Major Creek
Development Envelope
Mining Exclusion Zone
MEZ1
MEZ2
MEZ3
Proposed Conceptual Footprint
Pit
Waste Rock Landform
Infrastructure

1.2 Key Environmental Factors

The key environmental factors relevant to the Proposal, as identified in the Environmental Review Document (ERD) (Rio Tinto 2023) and addressed in this EMP, are Terrestrial Fauna, including BC Act listed fauna and EPBC Act MNES listed fauna. The environmental factor, values and potential impacts of the Proposal are outlined in Table 1-2.

Table 1-2: Environmental factor and values, with predicted and potential impacts from the Proposal[5].

Environmental value (receptor)	Predicted impacts (stressor, pressure, receptor)		Potential impacts Not predicted to occur	
	Direct (stressor, pressure)	**Indirect (stressor, pressure)**	**Direct (stressor, pressure)**	**Indirect (stressor, pressure)**
Terrestrial Fauna Northern Quoll (*Dasyurus hallucatus*) and potential high value / critical habitat	**Conceptual footprint**	**BHT**	**Development Envelope**	**MEZ1**
	Proposed clearing and ground disturbance • Reduction of potential high value / critical and supporting habitat.	**Increase in feral animals** • Feral animals (particularly cats) predating on, and/or competing (food source and habitat) with native animals.	**Fauna interactions** • Fauna injury or death.	**Other threatening processes (noise, dust, light and fauna interactions)** • Changes to the environment from general activities associated with the Proposal may degrade habitats, and/or influence/change species use of habitats in the Development Envelope.
Terrestrial Fauna Ghost Bat (*Macroderma gigas*) and confirmed and potential high value / critical habitat	**Conceptual footprint**	**Caves 2 and 4[6]**	**Development Envelope**	**Caves 3, 5 and 6 (within MEZ1)**
	Proposed clearing and ground disturbance • Removal of two Ghost Bat caves (Cave 1 (category 3) and Cave 8 (category 4)) • Reduction of confirmed and potential high value / critical and supporting habitat.	**Vibration** • Blasting and/or mine pit construction causing structural damage to caves, including collapse or generation of new openings at the back of caves changing the microclimate (i.e., temperature and humidity).	**Fauna interactions** • Fauna injury or death.	**Vibration** • Blasting and/or mine pit construction causing structural damage to caves, including collapse or generation of new openings at the back of caves changing the microclimate (i.e., temperature and humidity). **Other threatening processes (increased presence of introduced fauna, noise, dust, light and fauna interactions)** • Changes to the environment from general activities may influence/change behaviour, and/ or use of habitats in the Development Envelope.
		Cave 10		**Cave 10 (within MEZ2)**
		Threatening processes (noise, dust, light and fauna interactions) • Changes to the environment from general activities may		**Vibration** • Blasting and/or mine pit construction causing structural damage to caves, including collapse or generation of new openings at the back of caves

[5] A '*casual pathway conceptual model*' (Stressor, Pressure, Receptor [SPR]) approach for potential impacts due to project (Appendix 1).

[6] Potential impacts to Caves 2 and 4 are not proposed to be specifically mitigated or managed.

Environmental value (receptor)	Predicted impacts (stressor, pressure, receptor)		Potential impacts Not predicted to occur	
	Direct (stressor, pressure)	**Indirect (stressor, pressure)**	**Direct (stressor, pressure)**	**Indirect (stressor, pressure)**
		influence/change behaviour, and/ or use of habitats in the Development Envelope.		changing the microclimate (i.e., temperature and humidity).
Terrestrial Fauna Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)	**Conceptual footprint**	**Not Applicable (NA)**	**Development Envelope**	**NA**
	Proposed clearing and ground disturbance • Removal of two Pilbara Leaf-nosed Bat caves (Cave 1 and Cave 8) both category 4 caves • Reduction of potential supporting habitat	• NA	**Fauna interactions** • Fauna injury or death.	• NA
Terrestrial Fauna Pilbara Olive Python (*Liasis olivaceus barroni*) and potential high value / critical habitat	**Conceptual footprint**	**NA**	**Development Envelope**	**NA**
	Proposed clearing and ground disturbance • Reduction of potential high value / critical habitat.	• NA	**Fauna interactions** • Fauna injury or death.	• NA
Terrestrial Fauna Grey Falcon (*Falco hypoleucos*) and potential supporting habitat	**Conceptual footprint**	**NA**	**Development Envelope**	**NA**
	Proposed clearing and ground disturbance • No high value / critical habitat and no significant residual impact to potential supporting habitat.	• NA	**Fauna interactions** • Fauna injury or death.	• NA
Terrestrial Fauna Night Parrot (*Pezoporus occidentalis*)	**Conceptual footprint**	**NA**	**Development Envelope**	**NA**
	Proposed clearing and ground disturbance • No high value / critical or supporting habitat.	• NA	**Fauna interactions** • Fauna injury or death.	• NA

1.3 Condition Requirements

The Proposal is currently being assessed under Part IV of the EP Act, and the EPBC Act. Considering the information provided in the ERD (Rio Tinto 2023), this EMP proposes environmental management and monitoring to ensure environmental outcomes are achieved.

1.4 Approach

This EMP has been developed in accordance with the Conceptual Framework for the Development of Rio Tinto Environmental Management Plans (Appendix 1). This conceptual approach to management considers the conservation significance of the environmental value (receptor) based on conservation status at local, state, and regional levels. Management level (low, moderate, or high) is assigned in order to achieve the environmental outcome according to the conservation significance of the environmental value and the significance of impacts predicted over spatial and temporal scales. Assessment of the pathways over which impacts may occur provides the rationale for choice of provisions and appropriate indicators to measure against the environmental outcome or objective. A summary of the identified proposed and potential impacts (direct and indirect) to relevant environmental values is presented in Table 1-2.

This EMP provides provisions for potential impacts to environmental values specific to the Proposal. The significance of all potential threats to environmental values that may be impacted by the Proposal, including threatening processes to MNES fauna (that is: presence of weed species and fauna, vibration, dust, light, noise, fire and fauna interactions), are considered during the conceptual framework assessment to ensure appropriate measures.

This EMP addresses the key environmental factors and their associated values that have been identified as potentially being impacted by the Proposal and requiring management, as outlined in the ERD (Rio Tinto 2023).

As outlined in the ERD, maximum clearing limits are proposed for the clearing of fauna habitats of potential high value / critical habitat. These clearing limits will be included in the Ministerial Statement and Decision Notice for the Proposal and compliance with these conditions will be reported annually. No further specific management or monitoring is proposed in relation to those limits and hence they are not addressed in this EMP.

1.5 Management Rationale

This EMP adopts a combination of outcome based and management-based provisions, in order to achieve the proposed environmental outcomes and objectives.

Outcome-based provisions are applied where sufficient information exists to establish an achievable environmental outcome which is measurable (EPA 2021c). Environmental criteria are defined to assess performance against the environmental outcome. These are:

Early response criteria	Provide information on changes that are precursors to an environmental impact, used to initiate early response actions before or at the onset of environmental impacts.
Trigger criteria	Measures set at a conservative level to forewarn the approach of threshold criteria and ensure trigger level actions are implemented well in advance of the compromised environmental outcome.
Threshold criteria	Framed to represent the limit of acceptable impact beyond which there is likely to be a significant effect on the environment. This indicates there is risk that the environmental outcome will not be met.

Management-based provisions are applied where a level of uncertainty exists that prevents setting outcome and measurable criteria. In this case, management targets are established to measure success of management actions in achieving the environmental objective.

Complementary provisions (including both outcome and management-based) may be applied to address values where a High[7] level of management is required, and/or a degree of uncertainty and complexity exists. The rationale for the choice of provisions is provided in Table 1-3.

[7] According to the Framework for the Development of Rio Tinto EMPs (Appendix 1).

Table 1-3: Rationale for choice of provisions

Current knowledge and description of impacts	Key assumptions and uncertainties	Rationale for choice of provisions, indicators and/or management actions
Environmental value: Terrestrial Fauna – MNES fauna species and high value / critical habitat		
Level of Management: High (see Appendix 2)		
Key surveys and studies: Astron (2019), Astron (2020a), Astron (2023a), Astron (2023b), Astron (2023c) and Astron (2023d)		
Northern Quoll (*Dasyurus hallucatus*) **Population** • Northern Quoll was recorded 14 times from within the Development Envelope during baseline surveys (2017 – 2019), including ten records from the BHT deposit. This is consistent with a high-density population, however, no evidence of denning was recorded within the Development Envelope. There were no records of Northern Quoll from the HD2 deposit. • The targeted MNES survey failed to record the Northern Quoll in 2019 and subsequent camera monitoring in 2020, 2021 and 2022 has not recorded Northern Quolls at BHT. High feral cat activity recorded within the Development Envelope at the time may have contributed to these findings, along with other factors such as climate (rainfall). **High value / critical habitat (potential denning and shelter habitat)** • The Proposal will result in clearing of high value / critical habitat within the Development Envelope. High value / critical habitat comprises Gorge/Gully and Breakaway habitats which are representative of potential denning and sheltering habitat for Northern Quoll. High value / critical habitat is largely present at the BHT deposit, with little high value / critical habitat present at the HD2 deposit, or elsewhere in the Development Envelope. • MEZ1 has been designated to retain potential denning and sheltering habitat at the BHT deposit. Direct disturbance will be limited to up to 5% of the MEZ for environmental monitoring and management purposes. Further, the MEZ will mitigate indirect impacts and threatening processes, including dust, noise, vibration, and fauna interactions. **Ghost Bat (*Macroderma gigas*)** **Population** • Nine records of Ghost Bat have been recorded from within the Development Envelope during baseline surveys (2017 -2019). This is consistent with low foraging numbers on the ridges at the HD2 and BHT deposits. However, subsequent to these results a category 2 Ghost Bat roost (Cave 10) was identified at BHT in February 2020. **High value / critical habitat (potential breeding, denning and roosting habitat)** • High value / critical habitat within the Development Envelope comprising Gorge/Gully and Breakaway habitats used by Ghost Bats for breeding, denning and roosting. • Nine Ghost Bat caves have been recorded within the Development Envelope, comprising: ○ Cave 1 (category 3) and Cave 8 (category 4) which occur within proposed pits at the BHT and HD2 deposits respectively. These caves will not be retained. ○ Cave 2 (category 4) and Cave 4 (category 4) which occur on the boundary of proposed pits at the BHT deposit. These caves will be retained. However, as they are low usage, blast management measures are not proposed, and it is likely they will be indirectly impacted by vibrations from blasting. ○ Cave 3 (category 4), Cave 5 (category 3) and Cave 6 (category 4) will be retained within the MEZ1 at BHT. Caves 3, 5 and 6 each occur greater than 700 m west of the proposed pits at the BHT deposit. These caves are not expected to be impacted (directly or indirectly). ○ Cave 7 (category 4) occurs more than 350 m from the HD2 deposit. This cave is not expected to be impacted (directly or indirectly). ○ Cave 10 (category 2) will be retained within a MEZ (MEZ 2) at the BHT deposit. MEZ2 will provide a 150 m buffer around Cave 10, and blast management measures will be	**Assumptions:** • Protection of potential high value / critical habitat (including roosting caves) will enable the persistence of MNES fauna species within the Development Envelope. • Feral cat activity likely contributed to no records of Northern Quoll in 2019. **Uncertainties:** • The potential Ghost Bat maternity roost (Cave 10) was identified in February 2020. No further acoustic monitoring has been conducted at the cave due to access requirements of Nyiyaparli Traditional Owners. • Limited regional population studies for Ghost Bat and Northern Quoll to assist in understanding the long-term natural population variability and movements of these species. • Limited data on the sensitivity of MNES fauna species to increases in dust, noise and vibration. • Geotechnical assessments of Ghost Bat caves have not yet been completed.	A high management level has been assigned to manage impacts (direct and indirect) to MNES fauna species and high value / critical habitat within the Development Envelope. The overall management strategy for all MNES species is to maintain the integrity of the high-quality habitat, which is achieved through the establishment of MEZs and outcome-based provisions. Given the elevated management level required for Northern Quoll and Ghost Bat, based on known presence, additional management measures are proposed for those species as outlined below. All proposed provisions, including maintaining the MEZs and feral cat trapping, will have flow-on benefits for all MNES species. The outcome and management-based provisions to be applied are described below. The targets and criteria presented in Table 2-1 and Table 4-1 will be updated as required with consideration of additional baseline data and adaptive management (as described in Section 3). **High value / critical habitat (potential denning, sheltering, breeding and roosting habitat)** The following environmental outcomes will be applied for the Proposal: **1.** No disturbance within MEZ1 and MEZ2 other than existing and approved[8]. **2.** No significant impact to the structural integrity of the Ghost Bat cave for Ghost Bat use, retained with the MEZs (including Caves 5 and 10) as a result of mine excavation and blasting associated with the Proposal. The protection of cave stability and habitat (including microclimate) is easily measurable and reportable; therefore, an outcome-based provision was suitable. For the MEZ1 provisions include measures to monitor activities near the boundary of, and within the MEZ. No impact from vibrations are predicted for retained caves (geotechnical surveys will be conducted to confirm). As such, provisions to monitor caves within this MEZ include parameters to detect changes in internal (microclimate readings: temperature and humidity) and external (visual assessment) stability, to confirm no impacts. The MEZ2 provisions also include measures to monitor activities. As Cave 10 is located within close proximity to the proposed pits, vibration level limits triggers will be set and blast management will be applied for all blasts within 300 m of the Cave. Further, parameters to detect changes in internal (microclimate readings: temperature and humidity) and external (visual assessment) stability of Cave 10 will also be applied. **Population** The following environmental objectives will be applied for the Proposal[9]: **1.** The Proponent shall improve knowledge of Ghost Bat presence and utilisation of high value / critical habitat (Gorge/Gully and Breakaway habitat) within the Development Envelope. The environmental objectives aim to increase knowledge of Ghost Bat behaviour, with the view to maintaining the population within the Development Envelope. Management-based provisions have been proposed, as current application of population criteria (trigger or threshold) would be arbitrary and not statically robust as: • Northern Quoll and Ghost Bat population numbers and use of habitat are known to fluctuate on both annual and inter-annual cycles (How et al. 2009, Bat Call 2020). • Surveys to date have not recorded a consistent presence of Northern Quoll in the Development Envelope (none were recorded during 2019). • The category 2 Ghost Bat roost (Cave 10) was identified in 2020 and has not yet been subject to monitoring due to access requirements of Nyiyaparli Traditional Owners. Monitoring to meet the environmental objectives will be targeted at the BHT deposit as this area had the greatest number of Northern Quoll and Ghost Bat records and the majority of the high value / critical habitats. Vegetation clearing can increase access of feral predators to fauna habitats, resulting in increased predation causing injury or mortality to MNES fauna species, particularly Northern Quoll. To reduce these potential impacts within the MEZs, a feral cat control will be implemented and the presence of cats at the BHT deposit will be monitored to provide supporting data to the management objectives. MNES fauna species present within the Development Envelope may also be vulnerable to injury or mortality from increased activity in the Development Envelope. Supporting/complementary provisions have been included below to mitigate these potential impacts.

[8] No more than 5% of the total area covered by the MEZs can be cleared for low impact activities. There is to be no clearing of high value / critical MNES habitat (Gorge/Gully and Breakaway types) and no impact to Ghost Bat caves within MEZs

[9] Specific management-based provisions have not been proposed for Pilbara Leaf-nosed Bat and Pilbara Olive Python. Presence of these species within the Development Envelope were low during baseline surveys and therefore protection of high value / critical habitat is considered the most appropriate strategy (see Appendix 2)

Current knowledge and description of impacts	Key assumptions and uncertainties	Rationale for choice of provisions, indicators and/or management actions
Environmental value: Terrestrial Fauna – MNES fauna species and high value / critical habitat		
Level of Management: High (see Appendix 2)		
Key surveys and studies: Astron (2019), Astron (2020a), Astron (2023a), Astron (2023b), Astron (2023c) and Astron (2023d)		
implemented for any blast within 300 m radius of Cave 10 to prevent structural damage to the cave. **Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)**. • Nine category 4 Pilbara Leaf-nosed Bat caves have been recorded within the Development Envelope, These caves will be managed as noted above under Ghost Bat. • Calls recorded within the Development Envelope indicate low activity and were consistent with foraging individuals. **Pilbara Olive Python (*Liasis olivaceus barroni*)** • Pilbara Olive Python was considered likely to occur, due to presence of suitable high value / critical denning and shelter habitat (Gorge/Gully and Breakaway habitats). However, none were recorded during surveys (2017-2019).		Implementation of MEZs and retention of high value / critical habitat within them, are expected to mitigate remaining threatening processes on MNES species behaviour, including, dust, light and noise.

2. EMP Provisions

This section of the EMP identifies the provisions that the Proponent will implement to ensure that the environmental outcomes are met during implementation of the Proposal. Outcomes are detailed in Table 2-1, whilst general provisions in relation to EPBC Act listed species in relation to threatening processes are described in Table 2-2.

2.1 Outcome-based Provisions

Table 2-1: EMP Outcome-based Provisions – Terrestrial Fauna (MNES fauna species and high value / critical habitat (Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat and Pilbara Olive Python))

Rationale: Confirm the prediction that the Proposal will not impact high value / critical habitat (Gorge/Gully and Breakaway habitat, including caves) retained within the MEZ1 or the MEZ2.

EPA Factor: Terrestrial Fauna

Outcome: The Proponent will ensure no direct disturbance, attributable to the Proposal, within the MEZ1 and MEZ2, other than existing and approved.

The Proponent will ensure no significant impact to the structural integrity of the Ghost Bat caves for Ghost Bat use, retained within the MEZs (Caves 5 and 10) as a result of mine excavation and blasting associated with the Proposal.

EPA objective: To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.

Key environmental values: MNES fauna species and high value / critical habitat – Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat and Pilbara Olive Python.

Key impacts and risks: Potential adverse long-term (post operational phase) impact on MNES species or high value / critical habitat attributable to the Proposal.

Outcome-based provisions

HIGH MANAGEMENT (see Figure 1-2 and Appendix 2)

Indicators: Breach of mining exclusion zones; vibration monitoring; and changes to cave structural integrity.	**Response Actions**	**Monitoring (**Error! Reference source not found.**)**	**Timing/frequency**	**Monitoring Responsibility**	**Reporting**
Early response criteria: **1.** Direct disturbance, including mining excavation, within 30 m of the MEZ1 and MEZ2, other than existing and approved[10].	**Early response action:** **Investigate potential cause of exceedance by review of:** • in-field inspections (UAV or visual), including signage and fencing (where in place); • site specific observations: clearing extent, blast vibration predictions; and • review of mine plan.	• Land clearing reconciliation (against GIS exclusion and disturbance layers) to ensure the cave buffers are not impacted or entered without authorisation • Aerial image capture (satellite or Remotely Piloted Aircraft). • Annual review of internal incident reporting and internal approval request process.	Annual, or as triggered by clearing reconciliation Annual imagery capture and analysis.	• Rio Tinto	• N/A
Trigger criteria: **1.** Direct disturbance, including mining excavation, within 20 m of the MEZ1 and MEZ2, other than existing and approved[9] **OR** **2.** Vibration levels exceed 10 mm/s peak particle velocity (PPV) during breeding months (1 October to 31 December), or 25 mm/s PPV in non-breeding months attributable to the Proposal (Cave 10). **OR** **3.** Decline in the visual structural integrity [11] of any retained Ghost Bat caves within the MEZs (Caves 5 and 10), attributable to the Proposal.	**Trigger criteria action:** **Investigate potential cause of exceedance by review of:** • internal incident reports relating to clearing; • in-field inspections (UAV or visual); • site specific observations: clearing extent; blast vibration predictions • blast monitoring levels; • temperature and humidity monitoring data (Caves 5 and 10) to determine if the cave microclimate has been compromised; and • monitoring and supporting data (e.g., mine plan, seasonal, climatic, monitoring for management actions).	• Review of site induction material to ensure inclusion of current information regarding the value of the MEZs, and restrictions associated with entry.	• Annual or as triggered	• Rio Tinto	• The environmental outcome will be reported against the trigger criteria for each calendar year by 30 April in the ACAR. • If any trigger criterion was exceeded during the reporting period, the ACAR will discuss potential reasons for exceedance of the trigger criterion and include a description of the effectiveness of trigger level actions.
		• Land clearing reconciliation (against GIS avoidance layers and disturbance layers) to ensure the Mining Exclusion Zones are not impacted or entered without authorisation. • Aerial image capture (satellite or Remotely Piloted Aircraft).	• Annual, or as triggered by clearing reconciliation • Annual imagery capture and analysis		

		• Blast vibration monitoring to ensure vibration trigger is not exceeded, including:
		  • Modelling of peak particle velocity prior to blast.
		  • Vibration monitoring of actual peak particle velocity.
		  • Analysis of modelled versus actual peak particle velocity.
			• Event-based, all blasts within 300 m of Cave 10.		

[10] Approved disturbance refers to activities as described in the ERD and in line with the MEZ definition (Rio Tinto 2023).

[11] Decline in structural integrity is defined as a negative change to the integrity of the cave. The trigger will be exceeded where changes are observed after a blast event, including rockfalls (in comparison to baseline data).

EPA Factor: Terrestrial Fauna

Outcome: The Proponent will ensure no direct disturbance, attributable to the Proposal, within the MEZ1 and MEZ2, other than existing and approved.

The Proponent will ensure no significant impact to the structural integrity of the Ghost Bat caves for Ghost Bat use, retained within the MEZs (Caves 5 and 10) as a result of mine excavation and blasting associated with the Proposal.

EPA objective: To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.

Key environmental values: MNES fauna species and high value / critical habitat – Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat and Pilbara Olive Python.

Key impacts and risks: Potential adverse long-term (post operational phase) impact on MNES species or high value / critical habitat attributable to the Proposal.

Outcome-based provisions

HIGH MANAGEMENT (see Figure 1-2 and Appendix 2)

Indicators: Breach of mining exclusion zones; vibration monitoring; and changes to cave structural integrity.	**Response Actions**	**Monitoring (**Error! Reference source not found.**)**	**Timing/frequency**	**Monitoring Responsibility**	**Reporting**
	If investigations indicate that the trigger exceedance is due to the Proposal, implement trigger level actions, for example: • cease disturbance near relevant MEZ; • cease blasting activities within 300 m of Cave 10; • update relevant clearing procedures; • reassess work practices and training needs; • conduct geotechnical assessment of the site to assess structural stability of the cave; • update blast model and blast management procedures; • investigate potential for rehabilitation, or roost construction; and • monitor to ensure control measures have been successful. **If assessments indicate threshold criteria likely to be exceeded and due to the Proposal then consult with DWER and other relevant stakeholders to investigate further contingency actions[12].**	• Inspections (on-ground or UAV) for structural damage to cave entrance or opening.	• Quarterly, or as triggered, for Cave 10 within MEZ2 • Bi-annual, or as triggered, for retained Ghost Bat caves within MEZ1 (Caves 3, 5 and 6).	• Rio Tinto	• As above
		• Cave temperature and humidity logging and data analysis correlated against ambient temperature; and timing of mine pit development / blasting data in adjacent pits, to identify potential changes in internal cave structure.	• Continuous (device dependant) monitoring, with quarterly analysis for Cave 10 within MEZ2 • Continuous (device dependant) monitoring, with bi-annual analysis for retained Ghost Bat caves within MEZ1 (Caves 3, 5 and 6).		

[12] Consultation will include potential to rehabilitate, or by other means manage disturbed habitat.

EPA Factor: Terrestrial Fauna

Outcome: The Proponent will ensure no direct disturbance, attributable to the Proposal, within the MEZ1 and MEZ2, other than existing and approved.

The Proponent will ensure no significant impact to the structural integrity of the Ghost Bat caves for Ghost Bat use, retained within the MEZs (Caves 5 and 10) as a result of mine excavation and blasting associated with the Proposal.

EPA objective: To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.

Key environmental values: MNES fauna species and high value / critical habitat – Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat and Pilbara Olive Python.

Key impacts and risks: Potential adverse long-term (post operational phase) impact on MNES species or high value / critical habitat attributable to the Proposal.

Outcome-based provisions

HIGH MANAGEMENT (see Figure 1-2 and Appendix 2)

Indicators: Breach of mining exclusion zones; vibration monitoring; and changes to cave structural integrity.	**Response Actions**	**Monitoring (**Error! Reference source not found.**)**	**Timing/frequency**	**Monitoring Responsibility**	**Reporting**
Threshold Criteria: **1.** Direct disturbance, including mining excavation, within the MEZ1 and MEZ2, other than existing and approved. **OR** **2.** Significant damage [13] to structure of any retained Ghost Bat caves within the MEZs (Caves 5 and 10), attributable to the Proposal.	**Threshold Criteria Action:** **Implement previously determined threshold contingency actions within twenty-four (24) hours, for example**: • cease disturbance in relevant MEZ; • update relevant clearing procedures; • re-assess work practices and training needs; • rehabilitation, or roost construction; • implement revision to mine plan (subject to additional approval by DWER if required) to ensure there is no future disturbance to high value / critical habitat or Ghost Bat caves within the MEZs; and • measures as agreed by relevant stakeholders. Continue to implement threshold contingency actions until the CEO has confirmed by notice in writing that is has been demonstrated that the threshold criteria are being met. Monitor threshold contingency actions to validate success of mitigation strategy.	• As above	• As above	• Rio Tinto	• In the event that monitoring, tests, surveys or investigations indicate exceedance of threshold criteria as a result of the Proposal, the exceedance will be reported in writing to the CEO within seven (7) days and to the DCCEEW within seven (7) business days of the exceedance being identified. • The Proponent will provide a stand-alone report to the DWER within 21 days of any reporting against exceedance of the threshold criteria; a stand-alone report will also be produced for the DCCEEW within 21 business days of any reporting against exceedance of the threshold criteria relevant to MNES values (in line with Decision Notice requirements). • The environmental outcome will be reported against the threshold criterion for each calendar year in the ACAR • If the threshold criterion was exceeded during the reporting period, the ACAR will include a description of the effectiveness of threshold contingency action/s that have been implemented to manage the potential impact
Supporting/Complementary Provisions for Threatened Fauna Management					
Management of clearing of native vegetation	Restrict clearing of high value / critical habitat to authorised extents and ensure compliance by means of continuous implementation of the Proponent's Approvals Request system.	• Annual land clearing reconciliation against relevant MEZ and upper clearing limits for critical MNES habitat types (Gorge/gully and Breakaway), as mapped in the ERD.	• Land clearing reconciliation – annual	Rio Tinto	• Reported against the MS conditions for each calendar year by 30 April in the ACAR.
Management of Mining Exclusion Zones	Restrict clearing within the Mining Exclusion Zones 1 & 2 to authorised extents and ensure compliance by means of continuous implementation of the Proponent's Approvals Request system. No clearing/disturbance activities to occur within the Mining Exclusion Zones 1 & 2 during the breeding season and ensure compliance by means of continuous implementation of the Proponent's Approvals Request system. Signage of existing access tracks	• Land clearing reconciliation (against GIS exclusion and disturbance layers) to ensure the Mining Exclusion Zones 1 & 2 are not impacted or entered without authorisation	• Annual or as triggered by clearing reconciliation • Annual imagery capture and analysis.	Rio Tinto	• Reported against the MS conditions for each calendar year by 30 April in the ACAR.

[13] Significant damage of a cave is considered to be damage that negatively impacts the structural integrity and microclimate of the cave such that future Ghost Bat use of the site is prevented'

EPA Factor: Terrestrial Fauna

Outcome: The Proponent will ensure no direct disturbance, attributable to the Proposal, within the MEZ1 and MEZ2, other than existing and approved.

The Proponent will ensure no significant impact to the structural integrity of the Ghost Bat caves for Ghost Bat use, retained within the MEZs (Caves 5 and 10) as a result of mine excavation and blasting associated with the Proposal.

EPA objective: To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.

Key environmental values: MNES fauna species and high value / critical habitat – Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat and Pilbara Olive Python.

Key impacts and risks: Potential adverse long-term (post operational phase) impact on MNES species or high value / critical habitat attributable to the Proposal.

Outcome-based provisions

HIGH MANAGEMENT (see Figure 1-2 and Appendix 2)

Indicators: Breach of mining exclusion zones; vibration monitoring; and changes to cave structural integrity.	**Response Actions**	**Monitoring (**Error! Reference source not found.**)**	**Timing/frequency**	**Monitoring Responsibility**	**Reporting**
Demonstrate ongoing presence of Ghost Bats within the Development Envelope	Undertake monitoring of Ghost Bats and indicate how Ghost Bats use caves within the Proposal area (e.g., diurnal versus potential maternal caves) If non-achievement is attributable to the Proposal, implement the following: • review of Proposal activities and mine plan • review of blast data and management plan • re-assess work practices and procedures • re-assess training needs • re-assess management of feral animals on site.	• Acoustic monitoring and assessment (call data using bat audio recorder will be used to determine usage by bats) during operational phase for Ghost Bats use of Caves 5 and 10. • Review of Ghost Bat populations persistence within the Development Envelope.	• Bi-annual analysis (device dependant) • Annual or opportunistic	Rio Tinto	N/A
Collection of local climatic data at Hope Downs	Supporting parameter, review will inform assessment of targets and actions.	Weather station at Hope Downs, including rainfall data and wind direction, to determine local climatic conditions	Continuous.	Rio Tinto	
Management of feral animals on site	Feral animal presence managed on site including: • Regional feral animal control • prohibiting feeding animals • prohibiting keeping pets • appropriate waste disposal for food scraps and other wastes as per the Rio Tinto waste management guidelines.	• Camera trap monitoring around significant / high risk areas within the MEZ's (including Cave 10) • record opportunistic observations within the Development Envelope and/or at significant environmental features • record number of animals removed through control programs • inspection of waste disposal areas within the Development Envelope	Continuous	Rio Tinto	
Management of fauna interactions on site	Fauna interactions managed on site including: • personnel are to be informed of BC Act and EPBC Act listed threatened species (Ghost Bat, Pilbara Leaf-nosed Bat, Northern Quoll, Pilbara Olive Python, Grey Falcon and Night Parrot) that may occur on site • EPBC Act listed threatened species encountered on site are to be recorded and records maintained for the Proposal. This will include locations and animal status (alive or dead).	• review of inductions, training and awareness material • inspection of records, related to sightings, recordings, encounters and fauna removal • inspection to assess whether any unauthorised barbed wire is being utilised on site.	As triggered.	Rio Tinto	

Table 2-2: EMP Provisions – General Provisions for EPBC Act listed threatened species

Key environmental values: EPBC Act listed threatened species – Ghost Bat, Northern Quoll, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Grey Falcon and Night Parrot **Objective:** Manage threatening processes associated with implementation of the Action, where relevant to minimising impacts to EPBC Act listed threatened species (Ghost Bat, Northern Quoll, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Grey Falcon and Night Parrot) **Key impacts and risks**: Potential loss or degradation of high value / critical habitat, or injury to MNES fauna, as a result of implementation of the Action **Outcome:** Minimise impacts to EPBC Act listed threatened species (Ghost Bat, Northern Quoll, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Grey Falcon and Night Parrot) associated with implementation of the Action					
Management-based provisions					
Management Target	**Management Actions**	**Monitoring**			
		Method	**Location**	**Frequency/Timing**	**Responsibility**
Threatening Process - Fire					
1. Provision and maintenance of firefighting equipment in accordance with the relevant fire safety standards 2. Firefighting emergency response procedures are in place.	1. Appropriate firefighting equipment is to be available to control localised outbreaks of fire. Regular inspection and maintenance of firefighting equipment will be implemented to comply with relevant fire safety standards. 2. Emergency response (firefighting) procedures are to be implemented to control fires arising as a result of implementation of the Project. 3. Hot work permit system required to authorise all work scopes that are likely to produce a source of ignition (e.g., cutting, grinding, welding etc.).	• Inspection of firefighting equipment to ensure availability and compliance with fire safety standards • Inspection of hazard/incident records • Inspection of permit to work system records.	Development Envelope	Annual, or as appropriate, during the operational mine life	Rio Tinto
Threatening Process – Vehicle and Machinery Movement					
1. No incidents of vehicles being used off designated roads outside operational areas unless in the case of emergency or for necessary activities, that result in significant impacts to high value MNES habitat. 2. Implementation of speed limits in areas identified as having high value for MNES fauna.	1. Vehicles and machinery to remain on designated roads unless in the case of emergency or for undertaking necessary activities. 2. Implement speed limits within the Development Envelope based on a risk assessment that considers environmental values (in addition to safety/other required legislation). 3. Speed limits on unsealed roads 4. Roads and tracks signposted with speed limits and warnings of fauna in areas identified as having an MNES population and / or high value for MNES fauna. 5. Prior to commencing clearing in high value / potentially critical value habitats, consideration is given to planning/staging progressive clearing to allow fauna to safely leave the vicinity of clearing.	• Inspection of incident records • Inspection of risk assessment	Development Envelope	Annual, or as appropriate, during the operational mine life	Rio Tinto
Threatening Process – Fauna Encounters/Interactions					

Key environmental values: EPBC Act listed threatened species – Ghost Bat, Northern Quoll, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Grey Falcon and Night Parrot

Objective: Manage threatening processes associated with implementation of the Action, where relevant to minimising impacts to EPBC Act listed threatened species (Ghost Bat, Northern Quoll, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Grey Falcon and Night Parrot)

Key impacts and risks: Potential loss or degradation of high value / critical habitat, or injury to MNES fauna, as a result of implementation of the Action

Outcome: Minimise impacts to EPBC Act listed threatened species (Ghost Bat, Northern Quoll, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Grey Falcon and Night Parrot) associated with implementation of the Action

Management-based provisions

Management Target	Management Actions	Monitoring			
		Method	Location	Frequency/Timing	Responsibility
1. Induction material contains information relating to Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat, Pilbara Olive Python, Grey Falcon and Night Parrot. 2. Records of all EPBC Act listed threatened species observed are appropriately maintained. 3. Fauna handling is undertaken in accordance with Rio Tinto's Wildlife Interaction Guidelines and the requirements of the BC Act. 4. No incidents of native fauna feeding, hunting, or keeping of firearms or pets on site. 5. Access to the MEZs (which potentially contain significant roosts or caves) is restricted to authorised personnel and there are no incidents of unauthorised access. 6. No use of barbed wire on site, except in the case of statutory requirements. 7. Where barbed wire is used in accordance with statutory requirements, reflectors are installed.	1. All site personnel to be informed during their site induction of EPBC Act listed threatened species (Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat, Pilbara Olive Python, Grey Falcon and Night Parrot) that may occur on site, associated high value habitats and measures to be taken to minimise impacts to these values. 2. Any EPBC Act listed threatened species encountered on site are to be recorded and records maintained for the Project. This will include locations, and animal status (alive/dead). EPBC Act listed threatened species' injury or fatality to be documented as an incident. 3. If EPBC Act listed threatened fauna species are required to be moved, fauna are to be handled and transported in accordance with Rio Tinto's Wildlife Interaction Guidelines and the requirements of the BC Act. 4. Feeding of native fauna, hunting [14], keeping of firearms [15] or pets on site is prohibited. 5. Each MEZ is to be demarcated on online systems. Consideration will be given to on ground demarcation where in operational areas and where demarcation does not introduce potential risk to MNES species (and subject to Traditional Owner engagement) and access restricted to authorised personnel. 6. Barbed wire use is to be avoided in the Development Envelope, except where there is a legislative requirement to do so. Where barbed wire is required by legislation, reflectors are to be installed on the barbed wire	• Inspection of records, related to sightings, records, encounters and fauna removal • Inspection of MEZs demarcation and procedures restricting access to the MEZs (where applicable) • Inspections to assess whether any unauthorised barbed wire is being utilised on site. • Inspection of barbed wire installation to ensure reflectors are in place	Development Envelope	Annual, or as appropriate, during the operational mine life	Rio Tinto
Threatening Process - Weeds					

[14] Excluding activities undertaken by Traditional Owners

[15] Excluding firearms for use in pastoral management activities or by licensed and authorised personnel (e.g., feral animal control contractors etc.)

Key environmental values: EPBC Act listed threatened species – Ghost Bat, Northern Quoll, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Grey Falcon and Night Parrot

Objective: Manage threatening processes associated with implementation of the Action, where relevant to minimising impacts to EPBC Act listed threatened species (Ghost Bat, Northern Quoll, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Grey Falcon and Night Parrot)

Key impacts and risks: Potential loss or degradation of high value / critical habitat, or injury to MNES fauna, as a result of implementation of the Action

Outcome: Minimise impacts to EPBC Act listed threatened species (Ghost Bat, Northern Quoll, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Grey Falcon and Night Parrot) associated with implementation of the Action

Management-based provisions

Management Target	Management Actions	Monitoring			
		Method	Location	Frequency/Timing	Responsibility
1. Compliance with equipment hygiene procedures. 2. Weed control is informed and targeted. 3. Induction material contains information relating weed management and control.	1. Weed management measures, including equipment hygiene procedures, are to be implemented to ensure weeds are recorded and controlled and equipment is cleaned to minimise the spread of weeds. • Equipment hygiene and inspection certificate required for all earth moving vehicles, heavy machinery and drill rig equipment entering and leaving the Development Envelope or moving between identified weed infestation areas to areas that are not infested. • No transfer or relocation of material potentially harbouring weeds/weed seeds is permitted from identified weed infested areas to areas with no/low weed infestation (e.g., transfer of topsoil from identified weed infested areas to areas with no/low weed infestation). • Infested or potentially infested material will be quarantined to areas with existing infestations. 2. A consultant will be engaged to assist in the development of a weed control program to ensure a robust approach to identifying and managing introduced species within the Development Envelope. • The weed control program will include a review to identify and target high risk areas (e.g., environmental value, existing weed presence, status of weeds that are present, and potential for further transfer/dispersal e.g., waterways and high trafficable areas). • Implement the targeted survey and control program at target high risk areas. • Use the results of the survey and control program to inform targeted management. • The results of the survey and outcomes of weed management will be reported annually in the Annual Compliance Assessment Report (including to DCCEEW). All site personnel to be informed during their site induction of risk of weeds and requirements for weed management to ensure risk of introduction and weed spread are minimised.	• Inspection of earth moving equipment and hygiene certificates. • Inspections to assess material storage. • Targeted monitoring and management in high-risk areas (as identified by consultant). • Inspection of induction material and records.	High risk areas (as identified by consultant)	• Inspection of earth moving equipment and hygiene certificates will be undertaken for the life of the Proposal. • Monitoring and management frequency as determined by development of a survey and control program	Rio Tinto
Threatening Process – Feral Animals					
1. Feral animal control is informed and targeted. 2. Feral animal control actions are implemented. 3. Feral animal presence is discouraged. 4. Induction material contains information relating feral animals.	1. A consultant will be engaged to assist in the development of a feral animal control program to ensure a robust approach to identifying and managing feral animals, including feral cats, cane toads and European Red Fox within the Development Envelope. • The feral animal control program will consider opportunities to utilise automated feral cat control technology (e.g., Felixers), or other technologies on the advice of consultants and regulators, in high value areas (subject to regulatory approval). • Survey results and incidental sightings will inform further targeted management. • Traditional trapping utilised as required in readily accessible areas (e.g., accommodation and waste storage facilities). • Survey results and incidental sightings will be reported in the Annual Compliance Assessment Reports to regulators (including to DCCEEW). • Cane toads are not currently known within the nearby area; if cane toads are identified within the Development Envelope in the future, they will be reported to the appropriate Western Australian authorities including DBCA and monitoring techniques and control technology at the time will be reviewed, in consult with consultants and regulators, to consider the most effective way to manage cane toads. 2. Feral animal presence will be discouraged on site by: • Prohibiting feeding animals. • Prohibiting keeping pets. • Appropriate waste disposal for food scraps and other wastes as per the Rio Tinto waste management guidelines. 3. All site personnel to be informed during their site induction of potential feral animal species (including feral cats, European Red Fox, and cane toad) that may occur on site, and requirement to report sites immediately to site environmental representative.	• Targeted monitoring and management in high-risk areas (as identified by consultant). • Inspection of records, related to sightings, records, encounters and fauna removal. • Inspection of induction material and records.	High risk areas (as identified by consultant). Construction village, plant and administration areas	• Frequency as determined by development of a survey and control program	Rio Tinto

Key environmental values: EPBC Act listed threatened species – Ghost Bat, Northern Quoll, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Grey Falcon and Night Parrot

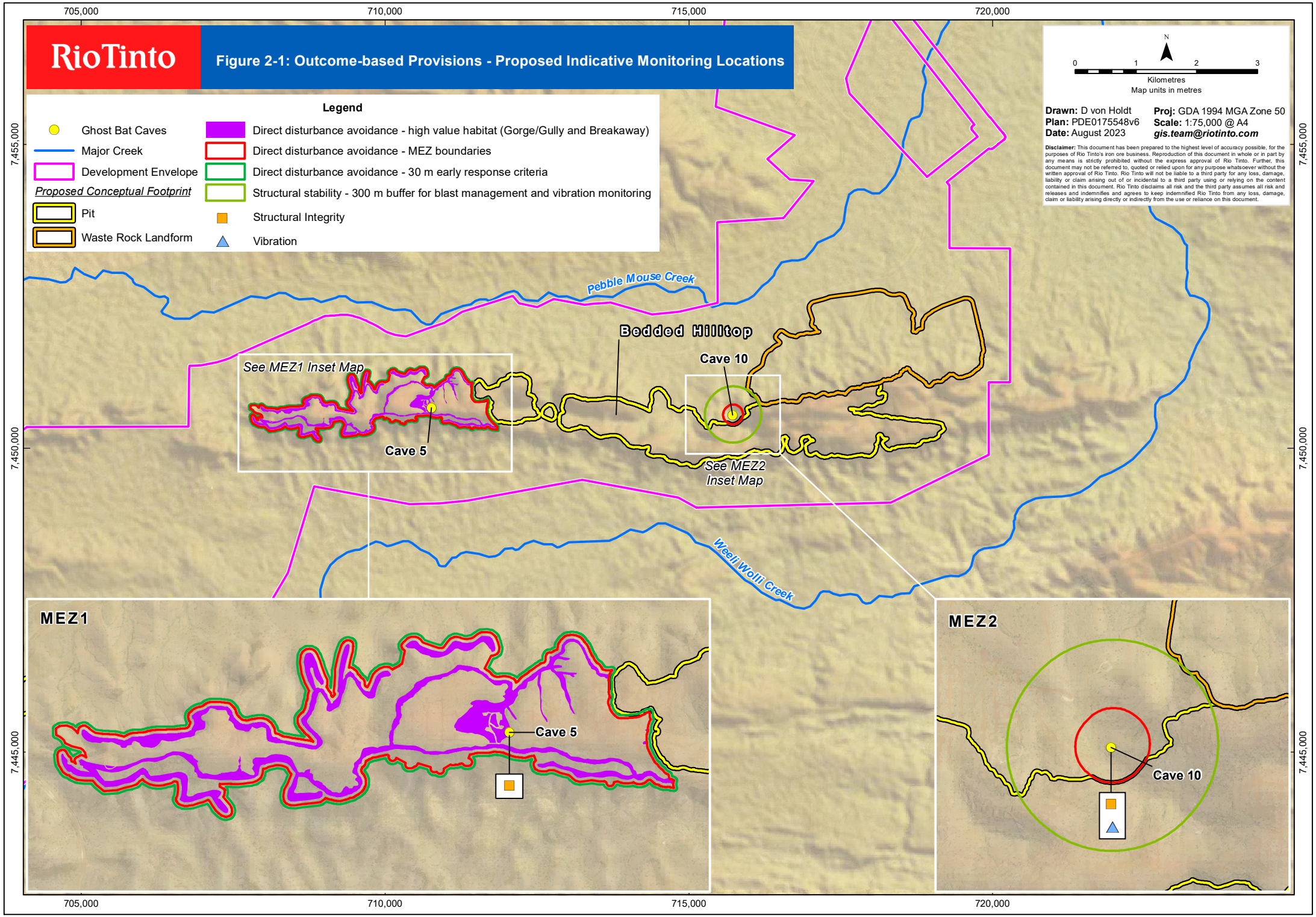
Objective: Manage threatening processes associated with implementation of the Action, where relevant to minimising impacts to EPBC Act listed threatened species (Ghost Bat, Northern Quoll, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Grey Falcon and Night Parrot)

Key impacts and risks: Potential loss or degradation of high value / critical habitat, or injury to MNES fauna, as a result of implementation of the Action

Outcome: Minimise impacts to EPBC Act listed threatened species (Ghost Bat, Northern Quoll, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Grey Falcon and Night Parrot) associated with implementation of the Action

Management-based provisions

Management Target	Management Actions	Monitoring			
		Method	Location	Frequency/Timing	Responsibility
Threatening Process – Noise and Vibrations					
1. No disturbance, other than existing and approved clearing (up to 5%), in the MEZ. 2. Implementation of blast management controls for Category 2 Ghost Bat cave (Cave 10) within 300 m of proposed pits. 4. No blasting undertaken outside of daylight hours.	1. Implement MEZs to ensure retention of potential high value / critical MNES habitat. 2. Implement blast management where relevant to minimise potential impacts to the Category 2 Ghost Bat cave (Cave 10) from noise and vibration associated with mining activities. 3. All site personnel to be informed during their site induction of requirements for no blasting to be undertaken outside of daylight hours.	• Annual land clearing reconciliation against relevant MEZ • Blast vibration monitoring for all blasts within 300 m of the Category 2 Ghost Bat cave (Cave 10).	Proposal Development Envelope	• Annual land clearing reconciliation • Blast vibration monitoring – as required by distance from Category 2 Ghost Bat cave (Cave 10).	Rio Tinto
Threatening Process – Dust and Light					
1. No disturbance, other than existing and approved clearing (up to 5%), in the MEZ. 5. Lighting and dust management actions are implemented.	• Delineate MEZ in online systems to ensure potential high value MNES habitat is retained. Consideration will be given to on ground demarcation where in operational areas and where demarcation does not introduce potential risk to MNES species (and subject to Traditional Owner engagement) and access restricted to authorised personnel. • Install permanent lighting only where required, that is, mainly in-pit and operational areas. • Permanent and temporary lighting will be shielded to minimise light spill. Permanent lighting will be directed away from sensitive areas (e.g., MEZ, caves etc). Temporary lighting (e.g., trailer mounted units) may be required to provide safe working environments for short periods of time; where practicable and while still providing a safe work environment, these will be positioned to minimise direct light spill to sensitive areas. • Manage dust emissions through: • Application of dust suppression methods including water sprays, where applicable; and • Implementing blast management protocols where relevant to minimise potential impacts of dust to bat caves. 4. All site personnel to be informed during their site induction of requirements for no clearing to be undertaken outside of daylight hours.	• Annual land clearing reconciliation against relevant MEZ • Monitoring of wind direction for all blasts within 300 m of Category 2 Ghost Bat cave (Cave 10)	Proposal Development Envelope	• Land clearing reconciliation – annual • Wind direction monitoring – as required by distance from Category 2 Ghost Bat cave (Cave 10)	Rio Tinto


RioTinto
Figure 2-1: Outcome-based Provisions - Proposed Indicative Monitoring Locations
Legend
Ghost Bat Caves
Major Creek
Development Envelope
Proposed Conceptual Footprint
Pit
Waste Rock Landform
Direct disturbance avoidance - high value habitat (Gorge/Gully and Breakaway)
Direct disturbance avoidance - MEZ boundaries
Direct disturbance avoidance - 30 m early response criteria
Structural stability - 300 m buffer for blast management and vibration monitoring
Structural Integrity
Vibration
N
0 1 2 3
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: PDE0175548v6
Date: August 2023
Proj: GDA 1994 MGA Zone 50
Scale: 1:75,000 @ A4
gis.team@riotinto.com
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705,000
710,000
715,000
720,000
7,455,000
7,450,000
7,445,000
Pebble Mouse Creek
Bedded Hilltop
Cave 10
Cave 5
See MEZ1 Inset Map
See MEZ2 Inset Map
Weeli Wolli Creek
MEZ1
Cave 5
MEZ2
Cave 10

2.2 Reporting

For each calendar year, during the operational phase (refer to Section 2), the environmental outcomes and objectives will be reported against their associated trigger and threshold criteria in the Annual Compliance Assessment Report (ACAR) for the Proposal (Table 4-1).

In the event that trigger and threshold criteria are exceeded during the reporting period, the ACAR will include a description of the effectiveness of any management contingency actions that have been implemented to manage the impact.

In the event that monitoring, tests, surveys, or investigations indicate exceedance of threshold criteria as a result of the Proposal, the exceedance will be reported in writing to the CEO within seven (7) days and to the DCCEEW within seven (7) business days of the exceedance being identified.

A stand-alone report will also be produced for the DWER within 21 days of any reporting against exceedance of the threshold criteria. A follow up report detailing the adequacy of the response actions will also be submitted to the DWER within 12 months of the initial notification. A copy of the report will be provided to DCCEEW.

3. ADAPTIVE MANAGEMENT AND REVIEW OF THIS EMP

The conceptual framework for the development of Rio Tinto EMPs provides details of the review and adaptive management process (Appendix 1). The approach will include evaluation of:

- Monitoring data and comparison to baseline and reference site data on a regular basis to verify responses to potential impacts.
- The effectiveness and relevance of trigger and threshold contingency actions against environmental objectives, on an annual basis, to determine if any changes to the criteria, monitoring or response actions are required.
- The effectiveness and relevance of management actions and targets against environmental objectives, on an annual basis, to determine if any changes to actions, targets or monitoring are required.

Based on the results of the review process the Proponent will update and adjust the management measures and strategies in consultation with DWER (Table 4-2).

4. STAKEHOLDER CONSULTATION

Consistent with the DCCEEW and DWER expectations for this EMP to align with the principles of EIA, the Proponent will consult with stakeholders, including but not limited to the Department of Biodiversity, Conservation and Attraction - Park and Wildlife Service (DBCA), the DWER EPA Services and Compliance and Reporting and DCCEEW during the environmental impact assessment of the Proposal.

To date, no specific consultation, relevant to this EMP, has been undertaken, however the approach and provisions relating to monitoring and management of Ghost Bat caves and MNES species and their associated high value / critical habitats have been extensively consulted with DWER, DBCA and DCCEEW through 2021 and 2022 as part of the broader Rio Tinto Group’s development of other Iron Ore Operations EMP’s.

Table 4-1: Proposal Environmental Management Plan Reporting Table

Key environmental factors: Terrestrial Fauna – MNES fauna species and high value habitat (Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat and Pilbara Olive Python)	
Environmental outcomes and objectives with associated criteria and management targets.	**Reporting periods 1 January-31 December**
Trigger Criteria	**Status report:** Trigger criteria not exceeded Trigger criteria exceeded
1. Direct disturbance, including mine excavation, within 20 m of the MEZ1 and MEZ2, other than existing and approved	
2. Vibration levels exceed 10 mm/s peak particle velocity (PPV) during breeding months (1 October to 31 December), or 25 mm/s PPV in non-breeding months attributable to the Proposal (Cave 10).	
3. Decline in the visual structural integrity of any retained Ghost Bat caves within the MEZs (Caves 5 and 10), attributable to the Proposal.	
Threshold criteria:	**Status report:** Threshold criteria not exceeded Threshold criteria exceeded
1. Direct disturbance, including mine excavation, within the MEZ1 and MEZ2, other than existing and approved.	
2. Significant damage to structure of any retained Ghost Bat caves within the MEZs (Caves 5 and 10), attributable to the Proposal.	

Table 4-2: Changes to the Matters of National Environmental Significance (MNES) Fauna Environmental Management Plan

Complexity of Changes	**Minor Revisions** ☐	**Moderate Revisions** ☐	**Major Revisions** ☐	
Number of Key Environmental Factors	**One** ☐	**Two – Three** ☐	**> Three** ☐	
Date Revision submitted to EPA: DD/MM/YYYY				
Proponent's Operational Requirement Timeframe for approval of revision **Reason for Timeframe:**	**< One Month** ☐	**< Six Months** ☐	**> Six Months** ☐	**None** ☐

Item No.	EMP Section No.	EMP Page No.	Summary of Change	Reason for Change

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6. APPENDICES

Appendix 1: Conceptual Framework for the Development of Rio Tinto Environmental Management Plans

For the development of Environmental Management Plans (EMPs), a conceptual framework model has been applied (Figure A-1). The framework ensures linkages between current understanding, potential impacts, outcomes, adaptive management, and consistent monitoring and management practices. The framework is a stepwise process that considers the environmental values as identified in the Proposal's Environmental Impact Assessment Documents, in order to implement appropriate management measures and actions to ensure the environmental objective can be achieved.

The first step of the framework examines in detail the current knowledge of the environmental value(s) associated with the Proposal. This is compiled from information provided in the EIA documents, any additional environmental surveys and examined with input from internal experts. Environmental values associated with the Proposal are evaluated based on their conservation status at local, State, and regional levels.

The second step of the framework is to define relevant indicators, level of management and type of provisions (outcome vs management-based) and associated criteria and/or targets.

A source-pathway receptor (SPR) conceptual modelling approach is used to inform the selection of indicators, as recommended by national and international guidance (DIIS 2016). The SPR conceptual model sets out the collective knowledge, experience and perspective on the environmental value (system of interest) and illustrates assumptions about how the value (system) functions and what is believed to be the important or dominant processes and their linkages. This includes factors that are perceived to be driving changes in the value (system) and the consequences of changes in these factors. The conceptual model also includes factors such as spatial boundaries as well as temporal and seasonal variations.

The number and type of indicators selected to monitor and measure changes in individual environmental values will depend on several factors including; the conservation status of the environmental value; the level of management required; the environmental outcome or objectives; location; and the types of pressures and stressors identified.

The required level of management (Low, Moderate or High) is determined using an matrix assessment with four factors relating to predicted impacts from the Proposal including: likelihood; consequence; spatial extent; and temporal duration (Table A-1). The higher the level of management, the more lines of evidence may be deemed necessary to meet the environmental outcome or objective (that is more indicators and / or more frequent monitoring schedules).

Draft (interim) trigger and threshold criteria and/or draft management targets will be determined for each environmental value. Early response criteria (if appropriate) may be defined for indicators for the environmental value (e.g., groundwater depth) or the environmental value itself (e.g., vegetation status). Trigger and threshold criteria will directly relate to the environmental value and objective itself.

The number of trigger criteria, and the sensitivity of both trigger and threshold criteria, will be determined by the associated management level for the environmental value.

The third step of the framework is to undertake an evaluation of the baseline and/ or current data to assess against criteria and determine whether the environmental outcome or objectives are likely to be met with existing proposed indicators. This step should also occur as part of reporting requirements when criteria are exceeded. Where criteria are not being met the adaptive management process should be implemented.

The fourth step of the framework is to implement the EMP. To ensure successful implementation, relevant internal and external (regulatory) stakeholders are consulted to ensure the EMP meets management expectations and can be implemented for the associated Proposal.

The fifth, final step of the framework considers a revision of or alternatives of management objectives, indicators and/ or criteria. This step is considered where monitoring and assessment indicates objectives are not being met. Where data suggests that objectives cannot be met using current associated indicators and criteria, repeat the second to fifth step of the framework, with consideration of the additional information gained through monitoring.

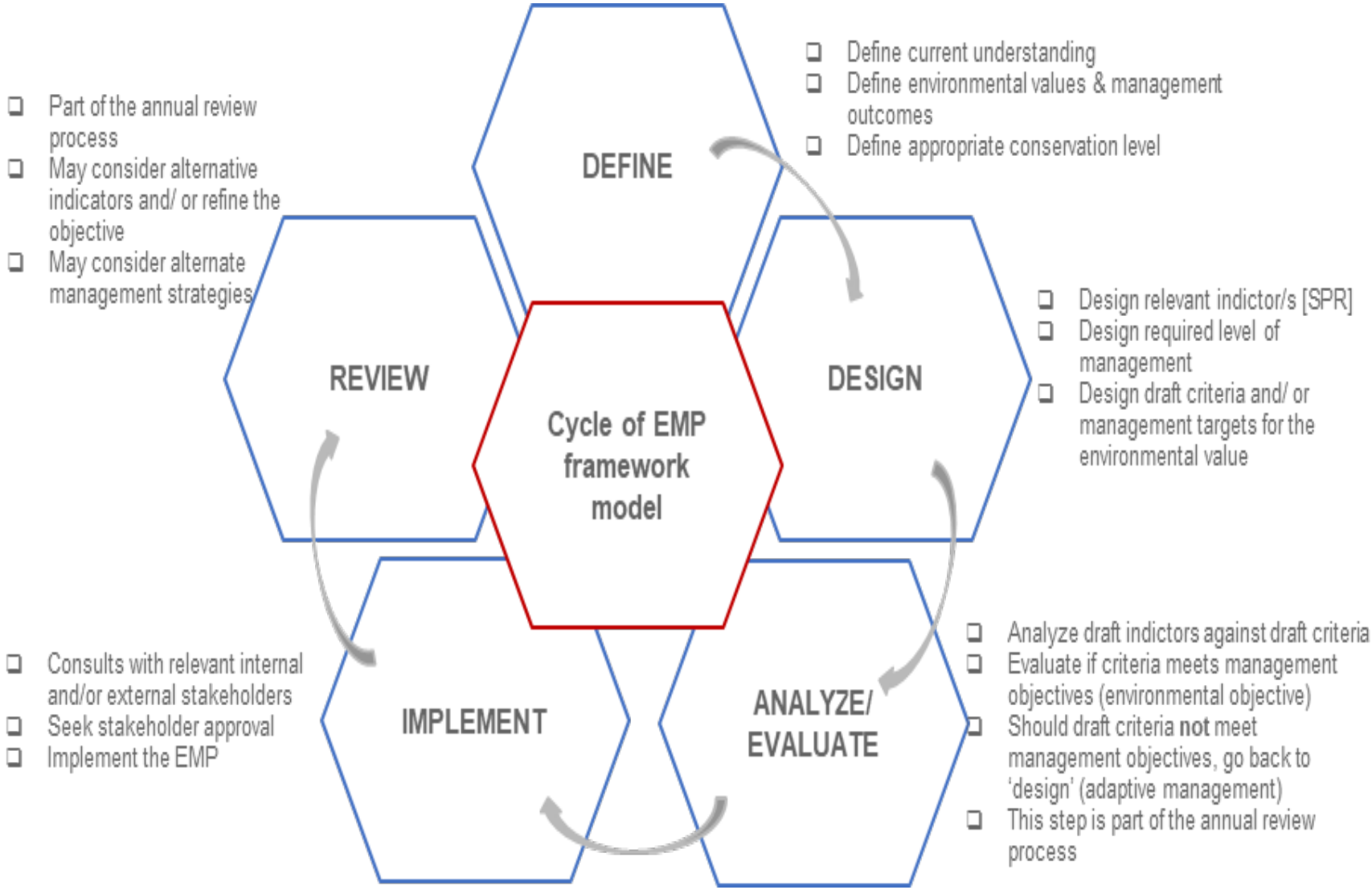

Figure A-1: Cycle of the conceptual Environmental Management Plan framework model

Table A-1: Management level assessment matrix

Factor	Level of required management (increasing to right)				
Likelihood	Rare	Unlikely	Possible	Likely	Almost Certain
Consequence	Environmental values (species, communities /ecosystems) with no formal recognition for conservation purposes	Environmental values (species, communities /ecosystems) with no formal recognition for conservation purposes but may hold local environmental significance	Environmental values (species, communities /ecosystems) recognised as being of conservation interest	Environmental values (species, communities /ecosystems) directly protected under State and Commonwealth legislation	Environmental values (species, communities /ecosystems) directly protected under State and Commonwealth legislation (with potential severe consequence).
Extent	Immediate	Surrounds	Local	Catchment	Sub-regional
Duration	Days	Months	Years	Decades	Centuries

- The factors act independently of one another, and an increased risk of one factor will not necessarily result in other factors with higher risk.
- Level/s of management gives an indication of potential importance, however important to note that regulatory focus, cumulative impact, and heritage values may impact the way the environmental values are treated/ managed.

Reference

DIIS (2016). Leading Practice Sustainable Development Program for the Mining Industry - Preventing Acid and Metalliferous Drainage Handbook Department of Industry, Innovation and Science (DIIS), Canberra, Australia.

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Appendix 2: Summary of assessment for required level of management assigned

Each environmental value, described in Section 1.4, was assigned a management level based on matrix level assessment (Appendix 1; Step 2). A summary of the assessment for the Proposal, which takes into account information provided in Table 1-1 and Table 1-2, is provided in the table below along with the resulting management level for each environmental value relevant to this EMP.

The assessment considers all impacts collectively (direct, indirect and including threatening processes) and assigns the highest level of management.

Four MNES fauna species have been recorded in the Development Envelope: Northern Quoll (*Dasyurus hallucatus*), Ghost Bat (*Macroderma gigas*), Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) and Oriental Plover (*Charadrius veredus*) and three additional species were not recorded in the Development Envelope Pilbara Olive Python (*Liasis olivaceus barroni*), which has a moderate likelihood of occurrence, the Grey Falcon (*Falco hypoleucos*) and Night Parrot (*Pezoporus occidentalis*), have a low likelihood of occurrence, (Astron 2019). The following species are not expected to experience significant residual impacts from the Proposal and are not considered for further management, these include: the Pilbara Olive Python, Pilbara Leaf-nosed Bat, Night Parrot, Grey Falcon and the Oriental Plover (Rio Tinto 2023).

Assessment of management level for the remaining four species is described in the Table below. The presence of each species and their habitats has been assessed against the risks associated with proposed impacts as described by Rio Tinto (2023), and a management level has been assigned. A conservative approach has been applied in this EMP, and the highest management level ('High') has been utilised to manage impacts to all MNES species recorded, or likely to occur. This approach is appropriate as the MNES species listed utilise the same high value / critical habitats within the Development Envelope (Gorge/Gully and Breakaway habitats). The assigned management level informed the outcomes and objectives presented in this EMP.

The overall management strategy for MNES fauna is to maintain the integrity of the high value / critical habitat. This is achieved through the establishment of exclusion zones and outcome-based provisions to measure and report potential impacts. . All proposed provisions, including maintaining the exclusion zones and feral cat control should have flow-on benefits for all MNES species.

Table A-2: Summary of assessment of management level

Environmental Value	Predicted and potential impact (s)	Assessment				Management level
		Likelihood	Consequence	Extent	Duration	
Terrestrial Fauna						
Ghost Bat and their habitats	Direct and indirect	**Almost Certain** Implementation of the Proposal will result in clearing of sheltering and foraging habitat (Gorge/Gully and Breakaway), including the removal of two Ghost Bat caves, and a further two caves will be exposed to indirect impacts (blasting). Six caves are not expected to be impacted; five occur greater than 300 m from blasting activities. Blast management measures will be conducted for blasts within 300 m of Cave 10 (Category 2). Two exclusion zones have been delineated: MEZ1, for retention of Caves 3, 5 and 6 and potential high value / critical habitat; and MEZ2 for retention of Cave 10 (Category 2).	**Major** Ghost Bats and their habitats have statutory protection under the BC Act and the EPBC Act as a Vulnerable species.	**Immediate** The Proposal has the potential to cause a reduction in the area of occupancy. However, given the retention of habitat locally (i.e., MEZ) and availability of habitat regionally, the Proposal is not expected to interfere with the recovery of Ghost Bat or affect its conservation status. Therefore, potential impacts will be confined to the Development Envelope	**Years** The Proposal is not expected to cause a long-term decrease in the size of populations of Ghost Bat; as caves will be retained the assumption is that these will continue to be suitable habitat after mining ceases.	HIGH
Northern Quoll and their habitats	Direct and indirect	**Almost Certain** Northern Quoll has been recorded from the BHT deposit and implementation of the Proposal will result in clearing of potential high value / critical sheltering and foraging habitat (Gorge/Gully and Breakaway) from the Development Envelope. MEZ1 has been delineated for the retention of potential high value / critical habitat.	**Major** Northern Quoll and their habitats have statutory protection under the BC Act and the EPBC Act as an Endangered species.	**Immediate** The Proposal has the potential to cause a reduction in the area of occupancy. However, given the retention of habitat locally (i.e., MEZs) and availability of habitat regionally, the Proposal is not expected to interfere with the recovery of Northern Quoll or affect its conservation status. Therefore, potential impacts will be confined to the Development Envelope.	**Years** The Proposal is not expected to cause a long-term decrease in the size of populations of Northern Quoll; as high value / critical habitat will be retained; the assumption is that this will continue to be suitable habitat after mining ceases.	LOW
Pilbara Leaf-nosed Bat and their habitats	Direct and indirect	**Rare** No category 1, 2 or 3 Pilbara Leaf-nosed Bat roosts have been identified within the Development Envelope. However, potential moderate value sheltering and foraging / supporting habitat is present and calls recorded from within the Development Envelope are consistent with foraging individuals.	**Major** Pilbara Leaf-nosed Bat and their habitats have statutory protection under the BC Act and the EPBC Act as a Vulnerable species.	**Immediate** The Proposal is not expected to cause a reduction in the area of occupancy, a decline in, or interfere with the recovery of MNES species. Therefore, no significant residual impacts are predicted.	**Years** The Proposal is not expected to cause a long-term decrease in the size of populations of Pilbara Leaf-nosed Bat; due to the low density of records within the Development Envelope and presence of only moderate value habitat of which a significant portion will be retained, and the assumption is that this will continue be suitable habitat after mining ceases.	VERY LOW
Pilbara Olive Python and their habitats	Direct and indirect	**Rare** There have been no records of Pilbara Olive Python within the Development Envelope**.** However, potentially suitable high value / critical (Gorge/Gully and Breakaway) habitat is present and species may occur.	**Major** Pilbara Olive Python and their habitats have statutory protection under the BC Act and the EPBC Act as a Vulnerable species.	**Immediate** The Proposal is not expected to cause a reduction in occupancy, a decline in, or interfere with the recovery of MNES species. Therefore, no significant residual impacts are predicted.	**Years** The Proposal is not expected to cause a long-term decrease in the size of populations of Pilbara Olive Python; as high value habitat will be retained; the assumption is that this will continue to be suitable habitat after mining ceases.	VERY LOW

Appendix 3: Detailed Descriptions of Proposed Monitoring Programs, Baseline Data and Proposed Analyses.

3.1 Outcome-based Provisions

Outcome-based provisions have been proposed to manage presence of high value / critical habitat within the MEZs (Northern Quoll and Cave 10) in the Development Envelope. Monitoring to ensure the environmental outcomes are met include:

- Annual inspection of MEZs demarcation and signage in the field will be undertaken to ensure maintenance.
- Annual review of site induction material to ensure inclusion of current information regarding the value/s within the MEZs, and restrictions associated with entry.
- Annual land clearing reconciliation using GIS disturbance layers will be undertaken to monitor disturbance within the MEZs.
- Blast vibration shall be predicted using a 'scaled distance' blast vibration model for every blast within 300 m of Cave 10. Blasts shall not proceed where predicted blast vibration exceeds criteria to ensure that the caves are protected from significant damage (damage that negatively impacts the integrity of the cave such that future Ghost Bat use of the site is prevented). Blast vibration monitoring shall be implemented for all blasts within 300 m of Cave 10 to confirm blast vibration predictions are met, to ensure that blast vibration does not exceed criteria and that the caves are protected from significant damage.
- Temperature and humidity will be monitored on a continuous basis and calibrated with ambient temperature and humidity. These monitoring actions will be used to verify that blasting and mine pit development within adjacent pits do not inadvertently generate new openings at the back of the roost caves, which may change the cave microclimate. Caves subject to monitoring include Caves 5 and 10.
- Visual inspections of Ghost Bat roosts will be conducted to confirm management measures are protecting the structural integrity of the caves. Conducted quarterly for Cave 10 (category 2) and bi-annually for Cave 5 (category 3)[16]. Decline will be assessed based on changes in structural integrity including, cracks in rock, falling material, change in internal or external structure. Significant damage of a cave is defined as negative impact to the integrity of the cave such that future Ghost Bat use of the site is prevented. Additional geotechnical assessments to reassess cave stability will be conducted as triggered.

3.2 Management-based Provisions

Management-based provisions have been proposed to increase understanding of Ghost Bat population size and habitat usage within the Development Envelope. Monitoring of Ghost Bat presence / absence has been undertaken during baseline surveys (Astron 2019, 2020a and 2020b).

Ghost Bat use of the caves (Monitoring Caves) will continue to be monitored, during operational mine life, including Cave 5 within MEZ1 and Cave 10 within MEZ2, and reference sites[17].

Monitoring protocols for the field surveys have been based on the protocols established at other Rio Tinto sites (i.e., Greater Paraburdoo), so that data from the programs are comparable.

Ghost Bat use of Monitoring Caves will be monitored by on-going remote detection (dependant on device)[16]. Bat auto monitoring detectors (or other equipment where deemed appropriate and/or

[16]Noting that access to caves will be subject to Traditional Owner engagement and consultation to enable access to caves where heritage values may be present.

[17]Reference sites are to be determined and will be investigated in accordance with current methodologies and subject to Traditional Owner engagement and consultation

recommended by experts) will be placed in the entrance of the Monitoring Caves (where safe access is available). Data analysis will be conducted bi-annually.

Categorisation of the Monitoring Caves is based on the results of the most recent survey and/or on the advice of independent experts, and following definitions provided in Astron (2023e).

Presence data will be considered with reference to all other relevant data (e.g., cave structure and microclimate, seasonal, climatic) to increase knowledge of the population and their use of caves within the Development Envelope.

Monitoring program will be reviewed biennially. However, the Proponent reserves the right to align with current methodologies and understanding as appropriate, in consultation with external experts and/or regulators (i.e., DBCA).

Monitoring of Northern Quoll presence / absence has been undertaken during baseline surveys (Astron 2019, 2020a and 2020b) and during targeted Northern Quoll monitoring programs in 2020, 2021 and 2022 (Astron 2023a, Astron 2023b, Astron 2023c). Due to the above survey effort and low-density numbers, further monitoring of Northern Quoll presence / absence is not proposed.

APPENDIX B FLORA AND VEGETATION

B.1: Hope Downs 2 Proposal Flora and Vegetation Survey Report

Hope Downs 2 Proposal
Flora and Vegetation Survey
May 2019

Prepared for Rio Tinto



astron

Report Reference: 14292-19-BISR-2Rev1_191125

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Hope Downs 2 Proposal
Flora and Vegetation Survey

Prepared for
Rio Tinto

Job Number: 14292-19

Reference: 14292-19-BISR-2Rev1_191125

Revision Status

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B	7/11/2019	Revised Draft Issued for Client Review	B. Eckermann	J. Atkinson
0	14/11/2019	Final Issued for Information	J. Atkinson	B. Eckermann
1	25/11/2019	Updated final Issued for Information	B. Eckermann	J. Atkinson

Approval

Rev	Date	Issued to	Authorised by	
			Name	**Signature**
A	11/10/2019	T. Savage	B. Lucas	
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1	25/11/2019	T. Savage	B. Lucas	

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Abbreviations

Abbreviation	Definition
Astron	Astron Environmental Services
BAM Act	*Biosecurity and Agriculture Management Act 2007*
BC Act	*Biodiversity Conservation Act 2016*
BHT	Bedded Hilltop
BoM	Bureau of Meteorology
DBCA	Department of Biodiversity, Conservation and Attractions
DRF	Declared Rare Flora
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESA	Environmentally Sensitive Area
GDA	Geocentric Datum of Australia
GDE	Groundwater Dependent Ecosystem
GIS	Geographic Information System
GPS	Global Positioning System
ha	Hectare
HD1	Hope Downs 1
HD2	Hope Downs 2
IBRA	Interim Biogeographic Regionalisation for Australia
Km	Kilometre
m	metre
mm	millimetre
MGA	Map Grid of Australia
MNES	Matters of National Environmental Significance
NVIS	National Vegetation Information System
P	Priority
PEC	Priority Ecological Community
PFC	Percentage Foliar Cover
sp.	Species (singular)
spp.	Species (plural)
subsp.	Subspecies
Survey area	Hope Downs 2 Development Envelope, which includes two deposits: Hope Downs 2 and Bedded Hilltop (10,817.7 ha)
T	Threatened
TEC	Threatened Ecological Community
TPFL	Threatened and Priority Flora Database
TP List	Threatened and Priority Flora List
WA Herbarium	Western Australian Herbarium
WoNS	Weeds of National Significance

Executive Summary

Rio Tinto is evaluating the potential development of additional iron ore deposits at Hope Downs 2 (HD2) in the Pilbara region of Western Australia. Astron Environmental Services was commissioned to undertake a Detailed flora and vegetation survey of the HD2 Development Envelope (10,817.7 hectares; herein referred to as the survey area) over three separate phases.

Twenty-three vegetation units were recorded in the survey area. No vegetation units within the survey area represent a threatened ecological community. One vegetation unit (P2) was associated with the Wannamunna land system and held some affinity with the priority 1 priority ecological community '*West Angelas Cracking-Clays*', however is unlikely to represent the community due to differences in species composition, habitat and scale. Vegetation unit P2 accounted for 155.6 hectares (1.4%) of the survey area and consisted of a fine scale mosaic vegetation patterning that comprised tussock grassland patches on cracking clay depressions between patches of scattered *Acacia* shrubs. Interpretation of this vegetation was inhibited by the poor seasonal conditions during the surveys. Although it is unlikely to represent the priority ecological community it may be a locally restricted vegetation community. The Department of Biodiversity, Conservation and Attractions mapped buffer for the priority 1 priority ecological community '*Weeli Wolli Spring Community*' intersects the survey area, although Weeli Wolli Creek does not intersect the survey area. Four vegetation units were considered to have local conservation significance due to their likelihood to act as refugia habitat (H2, D3), having restricted occurrence within the survey area (H2, P2, D3), and/or association with conservation significant flora species (H2, P2, D3, D4). All other vegetation units are considered well represented beyond the survey area and do not support assemblages of species that are unique, located on restricted landforms, or of high conservation significance.

Vegetation condition ranged from Excellent to Completely Degraded. An estimated 81.4% of the survey area was rated in Excellent condition; an estimated 7.7% of the survey area was cleared and rated as Completely Degraded. Weed diversity and abundance was highest in drainage lines and alluvial plains with the hilltops and slopes generally having lower or no weed abundance. Other minor disturbances included grazing by cattle and camels in the drainage lines and associated plains, significant sections of the survey area being burnt during 2015 and 2016, and minor evidence of dust on vegetation, usually in association with exploration tracks through bulldust soils.

There were 411 confirmed vascular flora taxa, from 52 families and 161 genera recorded during the current survey. The most represented families were Fabaceae, Poaceae, Malvaceae, Asteraceae and Myrtaceae.

No threatened flora taxa were recorded. Eleven State-listed priority flora taxa were recorded: *Eremophila* sp. West Angelas (S. van Leeuwen 4068) Priority 1; *Aristida lazaridis* Priority 2, *Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708) Priority 2; *Eremophila* sp. Hamersley Range (K. Walker KW 136) P3; *Grevillea saxicola* Priority 3; *Rhagodia* sp. Hamersley (M. Trudgen 17794) Priority 3; *Triodia* sp. Mt Ella (M.E. Trudgen 12739) Priority 3; *Acacia bromilowiana* Priority 4; *Eremophila magnifica* subsp. *magnifica* Priority 4; *Lepidium catapycnon* Priority 4; and *Ptilotus mollis* Priority 4.

One taxon (*Tinospora smilacina)* was considered a range extension of greater than 50 kilometres from its currently known distribution.

Seventeen introduced flora species (weeds) were recorded from current and previous surveys, none of which are listed as a Weed of National Significance or as a Declared Pest. **Bidens bipinnata* (bipinnate beggartick) and **Cenchrus ciliaris* (buffel grass) were the most abundant weed species recorded.

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Appendix A: Geological Units, Land Systems and Pre-European Vegetation of the Survey Area

Appendix B: Conservation Categories for Flora and Ecological Communities and Categories for Introduced Flora

Appendix C: Database Searches and Priority Ecological Communities Previously Recorded in Proximity to the Survey Area.

Appendix D: Previous Survey Area Locations

Appendix E: Threatened and Priority Flora Species Likelihood of Occurrence within the Survey Area

Appendix F: Vegetation Classification and Condition Scales

Appendix G: Fire Mapping

Appendix H: Vegetation Unit Mapping and Site Locations

Appendix I: Vegetation Sample Site Data

Appendix J: Vegetation Condition Mapping

Appendix K: Floristic Analysis

Appendix L: Vascular Flora Species List and Site by Species Matrix

Appendix M: Survey Effort

Appendix N: Conservation Significant Flora Locations and Descriptions

Appendix O: Introduced Flora Species (Weed) Locations and Descriptions

1 Introduction

1.1 Project Background

Rio Tinto is evaluating the potential development of additional iron ore deposits at Hope Downs 2 (HD2) in the Pilbara region of Western Australia, approximately 68 km north-west of Newman. Astron Environmental Services (Astron) was commissioned to undertake a multiple-phase detailed flora and vegetation survey of the 10,817.7 ha HD2 Development Envelope, which includes two deposits: HD2 and Bedded Hilltop (BHT), and herein is referred to as the survey area (Figure 1). This report presents the findings of the detailed surveys completed in November 2017, May 2018 and May 2019.

1.2 Scope and Objectives

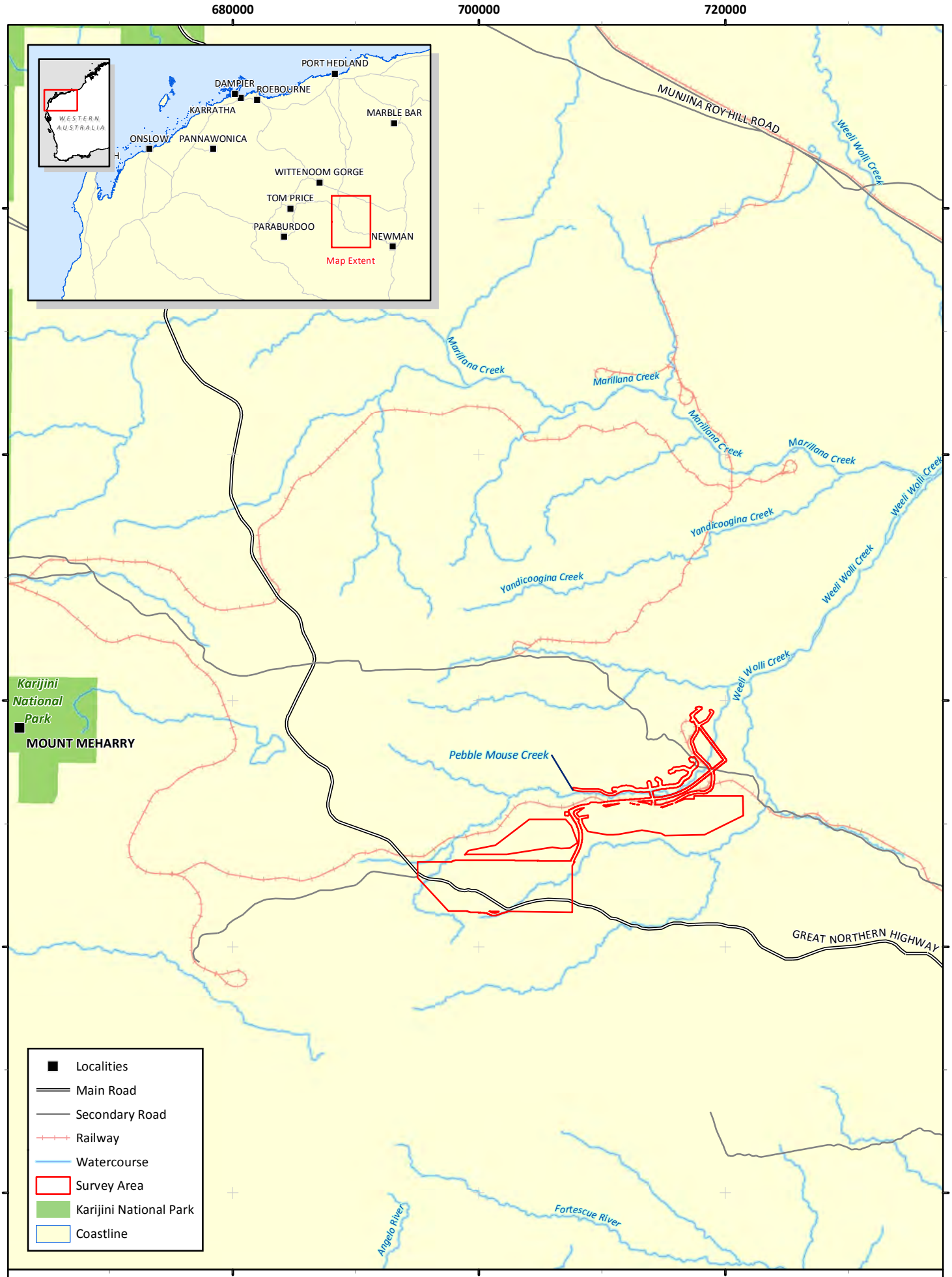
The objective was to undertake a detailed assessment of flora and vegetation values through a desktop assessment and field survey with incorporation of data from previous biological surveys conducted in the vicinity of the survey area. The resultant data has been utilised to produce this report, which is intended to support and inform the environmental assessment process in accordance with the requirements of the Environmental Protection Authority (EPA). The scope of work was to undertake a:

- Desktop assessment, including database searches and literature review of available resources
- Flora and vegetation assessment, including:
    - establish new quadrats to ensure adequate replication within vegetation units and rescore these quadrats
    - ground-truth, verify and refine existing vegetation mapping using quadrats, relevés and mapping notes
    - targeted searches for the presence of threatened (T) and priority (P) flora and vegetation of conservation significance
    - map vegetation condition and disturbance
    - generate a vascular flora species list
    - record introduced flora (weed) species where encountered.

The scope and key limitations of the survey are outlined in Table 1. Section 3.5 of this report provides more detail on the limitations of the survey.

Table 1: Summary of Astron's vegetation and flora assessment.

Level of survey	Survey area size	Survey timing	Relevant regulatory guidance documents	Key survey limitations
Detailed survey	10,817.7 ha	1 to 12 November 2017 (Phase 1) 18 to 30 May 2018 (Phase 2) 20 to 31 May 2019 (Phase 3)	• Technical Guidance – Flora and Vegetation Surveys for Environmental Impact (Environmental Protection Authority 2016b) • Position Statement No. 3 (Environmental Protection Authority 2002) • Guidance Statement No. 51 (Environmental Protection Authority 2004) • Environmental Factor Guideline - Flora and Vegetation (Environmental Protection Authority 2016a)	• Seasonal conditions for ephemeral taxa were below average during all three phases of the field survey. • Fire had affected 5,221.4 ha (48.3%) of the survey area in the previous five years (2015-2019). No fire was recorded in 2018 and 2019. The 2015 fire was the most widespread with 30.2% of the survey area burnt (Darwin Centre for Bushfire Research 2018).



Rio Tinto

Hope Downs 2 Proposal – Flora and Vegetation Survey

Figure 1: Survey area location

astron
delivering environmental intelligence™

Author: B. Eckermann	Date: 05-11-2019
Drawn: C. Dyde	Figure Ref: 14292A-19-BIDR-3RevB_191105_Fig01_Locn

Datum: GDA 1994 - Projection: MGA Zone 50

0 5 10 15 20 Km

N

2 Environmental Context

2.1 Physical Environment

2.1.1 Climate

The climate of the Pilbara region of Western Australia is classified as arid tropical with two distinct seasons: a hot, wet summer (October – April) and a mild, dry winter (May – September) (Bureau of Meteorology 2019).

Based on long-term climatic data from the nearest Bureau of Meteorology weather station at Newman Aero (Station 007176) (approximately 90 km south-east of the survey area) the mean annual rainfall since 1971 is 329.5 mm. The mean maximum daily temperatures since 1996 range between 23.0°C and 39.2°C, and average above 30°C for much of the year (Bureau of Meteorology 2019) (Figure 2).

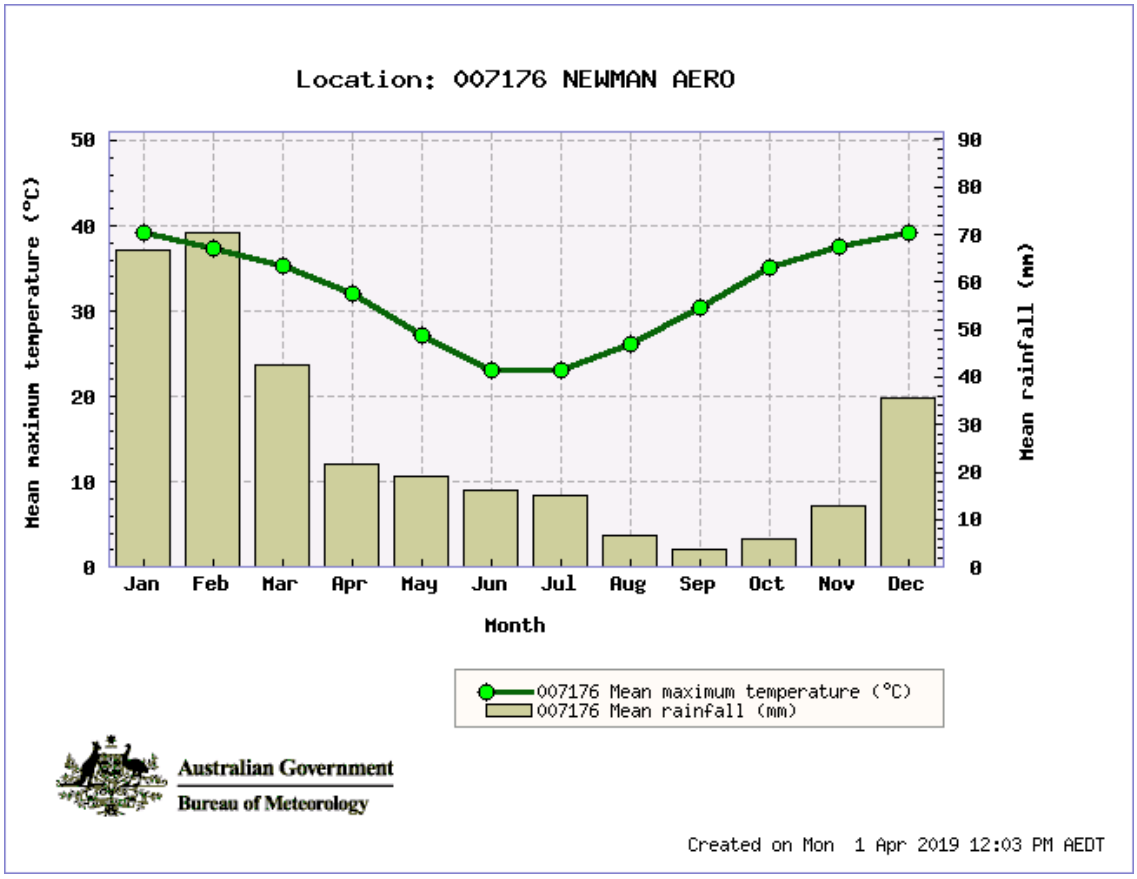


Figure 2: Climate data for Newman Aero Station (Station 007176).

Mean annual rainfall data has been calculated from 1971 – 2019 and mean maximum temperature has been calculated from 1996 – 2019 (Bureau of Meteorology 2019).

2.1.2 Geology and Soils

The surface geology of the survey area is comprised of 10 units (Stewart et al. 2008), with Colluvium 3841 being the most dominant (Table 2). Geological mapping of the survey area and surrounds is presented in Figure A.1 (Appendix A).

Table 2: Geological units of the survey area (Stewart et al. 2008).

Geological name	Label	Area (ha)
Alluvium 38485: Channel and flood plain alluvium; gravel, sand, silt, clay, locally calcreted.	Qa	431.4
Brockman Iron Formation: banded iron-formation, chert, mudstone and siltstone.	Lchk	681.7
calcrete 38497: Pisolitic, nodular or massive calcrete; ferruginous inclusions; calcareous cementing of bedrock and transported materials; locally with intercalated chalcedony; as low mounds, in playa lakes, or as valley calcrete; locally dissected and karstified	Czk	18.1
Colluvium 38491: Colluvium, sheetwash, talus; gravel piedmonts and aprons over and around bedrock; clay-silt-sand with sheet and nodular kankar; alluvial and aeolian sand-silt-gravel in depressions and broad valleys in Canning Basin; local calcrete, reworked laterite.	Qrc	2,587.8
Fortescue Group: Metadolerite, dolerite, gabbro; medium to coarse grained, massive grey-green rock, usually foliated.	Adf	763.6
Jeerinah Formation: Shale, sandstone, siltstone, mudstone, dolomite, local microbanded chert, jaspilite, conglomerate; fine-grained massive rhyolite; mafic tuff with local accretionary lapilli and agglomerate; thin basalt/dolerite and andesitic basalt flows.	Awfj	1,443.9
Marra Mamba Iron Formation: Chert, ferruginous chert, jaspilite, banded iron-formation, minor shale, siltstone, mudstone.	Achm	2,328.3
Mount McRae Shale and Mount Sylvia Formation: Interbedded shale, chert, banded iron-formation.	Ashm	1,212.5
Weeli Wolli Formation: Banded iron-formation (commonly jaspilitic), mudstone, siltstone; common interlayered metadoleritic sills.	Lchw	1,036.1
Wittenoom Formation: Calcitic dolomite, interbedded chert and shale in upper and lower parts, volcaniclastic sandstone.	Alhw	314.3

2.1.3 Surface Water and Hydrology

No Wetlands of International Importance (i.e. Ramsar wetlands) or Nationally Important Wetlands occur within the survey area (Department of the Environment and Energy 2017b, 2017c). The nearest Nationally Important Wetland is Fortescue Marshes, located 40 km north of the survey area, which has been nominated as a proposed Ramsar site. Pebble Mouse Creek passes through a large proportion of the survey area. One of the upper tributaries of Weeli Wolli Creek passes through the survey area (Figure 1).

2.2 Biological Environment

2.2.1 Interim Biogeographic Regionalisation of Australia

The Interim Biogeographic Regionalisation for Australia (IBRA version 7) divides the Australian continent into 89 bioregions and 419 subregions (Department of the Environment and Energy 2017d). The IBRA regions represent a landscape-based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and fauna. The survey area occurs in the Pilbara bioregion, of which 8.4% is represented in the national reserve system (Department of the Environment and Energy 2016b).

The biodiversity of the 53 subregions recognised in Western Australia was documented as part of a national audit to provide priorities for conservation action (Department of Conservation and Land Management 2002). The survey area occurs within the Hamersley subregion. This subregion is described in the audit as:

- Hamersley PIL3 – dissected bold plateaux and ranges of flat lying, moderately folded sandstone and quartzite with vegetation described as Mulga low woodland over tussock grasses occurring on fine textured soils in valley floors, with scattered Snappy gum (*Eucalyptus leucophloia*) over *Triodia brizoides* on skeletal soils of the ranges (Kendrick 2001).

2.2.2 Land Systems

Land systems of the Western Australian rangelands have been mapped and described by the Department of Primary Industries and Regional Development (formerly the Department of Agriculture and Food) outlining the distributions and providing comprehensive descriptions of biophysical resources, including soil and vegetation condition. A total of 102 land systems occur in the Pilbara bioregion, covering 181,723 km^2. Nine land systems occur in the survey area (Table 3). The Newman land system is the most widespread land system in the survey area and is characterised by ranges dominated by hard spinifex. The distribution of these land systems within the survey area is shown in Figure A.2 (Appendix A).

Table 3: Distribution of land systems within the survey area.

Land system	Total area within bioregion (ha)	Total area (ha) (proportion of survey area (%))
Boolgeeda - stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands.	961,847	1,486.0 (13.7)
Calcrete - Low calcrete platforms and plains supporting shrubby hard spinifex grasslands.	134,834	4.9 (<0.1)
Egerton - Highly dissected plains and slopes with sparse mulga shrublands or shrubby hard spinifex grasslands.	66,849	1.4 (<0.1)
McKay - Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands with acacias and occasional eucalypts.	426,124	326.7 (3.0)
Newman - rugged jaspilite plateaux, ridges and mountains with hard spinifex.	1,994,339	4,647.2 (43.0)
Pindering - Gravelly hardpan plains supporting groved mulga shrublands with hard and soft spinifex.	38,738	410.5 (3.8)
Platform - dissected slopes and raised plains supporting shrubby hard spinifex grasslands.	236,390	2,522.2 (23.3)
Rocklea - basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.	2,880,288	1,314.2 (12.1)
Wannamunna - Hardpan plains and internal drainage tracts supporting mulga shrublands and woodlands and occasionally eucalypt woodlands.	63,004	104.5 (1.0)

2.2.3 Pre-European Vegetation

Beard (1975) completed broad-scale (1:1,000,000) pre-European vegetation mapping at association level. The Beard mapping was later used by the Department of Agriculture and Food (Shepherd, Beeston, and Hopkins 2002) to compile vegetation units that assisted with identifying pre-European and current extents of vegetation throughout Western Australia.

Three pre-European vegetation units, 82, 18 and 29 (Shepherd, Beeston, and Hopkins 2002), are associated with the survey area (Figure A.3, Appendix A). Table 4 summarises the current and pre-European extent of these three vegetation units in the Pilbara bioregion and the survey area.

Vegetation associations 82 and 18 each account for approximately 50% of the survey area, indicating that spinifex hummock grasslands and mulga woodlands are widespread throughout.

Table 4: Extent of pre-European vegetation in the survey area (Government of Western Australia 2018).

Vegetation association	Mapping unit (Beard 1975)	Description	Total area (ha) (proportion of survey area (%))	Pre-European extent (ha)	Current extent in bioregion (ha)	Proportion of pre-European extent remaining (%)	Pre-European extent with formal protection (%)
82	e16Lr t3Hi	Hummock grasslands, low tree steppe; snappy gum over *Triodia wiseana*	5,452.2 (50.4)	2,168,702	2,156,558	99.4	13.7
18	a1Li	Low woodland, open low woodland or sparse woodland; mulga (*Acacia aneura*)	5,339.0 (49.4)	580,512	576,389	99.3	29.6
29	a1Lp	Mulga (*Acacia aneura*) and associated species.	26.5 (0.2)	172,083	171,975	99.9	12.8

2.3 State and Commonwealth Conservation Categories and Management

Commonwealth and State regulatory authorities maintain databases of the locations and conservation status of significant flora, fauna and ecological communities in Western Australia.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage Matters of National Environmental Significance (MNES) including listed flora, fauna and ecological communities. These listed flora, fauna and ecological communities are allocated a conservation category, which are outlined in Tables B.1 and B.2 (Appendix B).

Ecological communities may be subject to processes that threaten to destroy or significantly modify it across much of its range. These communities are identified as threatened ecological communities (TECs) and are listed at both Commonwealth level under the EPBC Act and State level under the *Biodiversity Conservation Act 2016* (BC Act) [1](Table B.3, Appendix B). The Department of Biodiversity, Conservation and Attractions (DBCA) maintains a list of priority ecological communities (PECs), which may also be under threat and are assigned one of four priority rankings according to the criteria outlined in Table B.4 (Appendix B).

Under Western Australian legislation, all native flora is protected and it is an offence to 'take' protected flora. The BC Act also provides for native flora to be gazetted as threatened or extinct. Under the BC Act threatened species may be listed as one of three categories: critically endangered, endangered or vulnerable (Table B.5, Appendix B). In addition, due to the diversity of Western Australia's flora, many species are known from only a few collections or locations, but have not been adequately surveyed. Such flora may be threatened, but cannot be considered for declaration as threatened flora until adequate surveys have been undertaken. These flora species are included on a supplementary conservation list managed by DBCA called the *Priority Flora List* (Table B.6, Appendix B).

2.4 Introduced Flora (Weeds)

Significant weed species are identified at both the state and national level. The Australian Weeds Strategy (Australian Weeds Committee 2012a) identifies Weeds of National Significance (WoNS) which have the potential to impact primary industry and/or environmental and social values. The management of weeds in Western Australia is primarily regulated through the *Biosecurity and Agriculture Management Act 2007* (BAM Act), with some provision under the BC Act. Species listed under this act are allocated one of three declared pest categories which define the required level of management (Department of Agriculture and Food Western Australia 2016). Declared pest categories and listed weed species' priority ratings are presented in Table B.7 (Appendix B).

2.5 Land Use and Tenure

The survey area is located within the Shire of East Pilbara. The local area is mainly used for mineral exploration and mining activity. The survey area is not under a current active pastoral lease. Karijini National Park is the nearest conservation reserve, located approximately 35 km to the west of the survey area (Figure 1).

[1] From 1 January 2019, the *Wildlife Conservation Act 1950* has been replaced by the *Biodiversity Conservation Act 2016* (BC Act) and its regulations. Phase 1 and 2 of this survey were completed in 2017-18, prior to the BC Act being enacted.

3 Methods

3.1 Desktop Assessment

3.1.1 Database Searches

Environmentally Sensitive Areas (ESAs) are declared by the Minister for Environment under Section 51B of the *Environmental Protection Act 1986* to prevent incremental degradation of important environmental values such as declared rare (T) flora, TECs or significant wetlands. A search for ESAs in the vicinity of the survey area was conducted using Western Australian government datasets (Department of Water and Environmental Regulation 2017) and the Register of the National Estate dataset (Department of the Environment and Energy 2008).

Database searches were conducted to identify listed conservation significant flora and ecological communities within, or in close proximity to, the survey area. Conservation categories for ecological communities and flora are presented in Appendix B. Database search results are presented in Appendix C. Introduced flora species were compared to the Department of Primary Industries and Regional Development list, to determine if any have been listed as declared pests (Department of Primary Industries and Regional Development 2018), and the WoNS list (Australian Weeds Committee 2012b). Declared pest categories are presented in Table B.7 (Appendix B). DBCA database searches for threatened and priority flora and TECs and PECs in the vicinity of the survey area were received in November 2017, to inform the surveys. Additional DBCA database search results obtained for another project in the immediate vicinity were also considered in 2019, as the broader search area listed some additional species worth considering in survey design and also included up to date results. Details of the 2017 database searches conducted prior to all phases of survey are summarised in Table 5.

Table 5: Database searches undertaken.

Database	Date search results received	Search focus	Search area
NatureMap (Department of Biodiversity, Conservation, and Attractions 2018b)	26/06/2018	Flora of conservation significance	40 km radius from an approximate survey area centre point defined by the coordinates: 23°04'04" S, 119°01'56" E
Threatened and Priority Ecological Communities Database (Department of Biodiversity, Conservation, and Attractions 2017b)	16/11/2017	Listed threatened and priority ecological communities	20 km radius from the survey area boundary
Threatened and Priority Flora Database (TPFL) (Department of Biodiversity, Conservation, and Attractions 2017c)	06/11/2017	Listed threatened and priority flora	40 km radius from the survey area boundary
Threatened and Priority Flora List (TP List) (Department of Biodiversity, Conservation, and Attractions 2017d)			
Western Australian Herbarium Database (Department of Biodiversity, Conservation, and Attractions 2017e)			

Database	Date search results received	Search focus	Search area
Protected Matters Search Tool (Department of the Environment and Energy 2018)	26/06/2018	MNES – flora	40 km radius from an approximate survey area centre point defined by the coordinates: -23.06752, 119.03234 (MGA50, GDA94)
Rio Tinto Database search (custom search) (Rio Tinto Iron Ore 2019)	23/01/2019	Listed threatened and priority flora	40 km radius from the survey area boundary

3.1.2 Literature Review

Flora and vegetation surveys have previously been commissioned by Rio Tinto within the vicinity of the survey area and supplied to Astron for the desktop assessment. The previous survey areas in relation to the current survey area are shown on Figure D.1 (Appendix D).

Previous reports that presented vegetation site data and were used for the broader regional floristic analysis as part of this assessment include:

- Hope Downs Rail Corridor (Juna Downs Section). Vegetation and Flora Survey (Biota Environmental Sciences 2006)
- Flora and Vegetation on the Hope Downs 4 Lease Area (Mattiske Consulting 2008b)
- Flora and Vegetation on the Hope Downs 4 Mine Pipeline Corridor to Ophthalmia Dam (Mattiske Consulting 2009b)
- Flora and Vegetation of the Hope Downs 2 Area (Mattiske Consulting 2010)
- Rio Tinto Greater West Angelas Vegetation and Flora Assessment (Ecologia Environment 2013)
- Baby Hope Downs Flora and Vegetation Survey (Biota Environmental Sciences 2014).

Additional reports that provided contextual information but were not used in the floristic analysis are:

- Flora and vegetation – Southern Transport Corridor – Yandicoogina Junction Project Area (Mattiske Consulting 1995)
- Flora and Vegetation of the Hope Downs 4 Mine Infrastructure Corridor (Mattiske Consulting 2008a)
- Flora and Vegetation of the Hope Downs 1 Area (Mattiske Consulting 2009a).

Data provided in a custom search of the survey area from Rio Tinto (2019) included conservation significant flora and/or weed results from the following sources:

- Hope Downs Proposed Rail SO-06-01466 (Pilbara Iron 2006b)
- Hope Downs Rail Corridor (Juna Downs Section) Vegetation and Flora Survey (Biota Environmental Sciences 2006)
- Flora and Vegetation of the Hope Downs 2 Area (Mattiske Consulting 2010)
- Rare Flora Survey for Dales Gorge Target Drilling (Rio Tinto 2012)
- Flora and Vegetation Survey at Hope Downs 1 (Rio Tinto 2013)

- Baby Hope Downs Flora and Vegetation Survey (Biota Environmental Sciences 2014)
- Hope Downs 2 and Bakers East Flora & Fauna Assessment (Astron Environmental Services 2014)
- Hope Downs 2 AR-13-11444 and Bakers East SO-13-11013 Biological Assessment (Astron Environmental Services 2014)
- Systematic Flora Survey at Hope Downs 1 Bedded Hilltop Drilling AR-15-13090 (Rio Tinto 2015)
- Weed Control Program – Inland Operations – Brockman 2 and Hope Downs 1 (Astron Environmental Services 2015)
- Weed Control Program - Inland Operations, Hope Downs 1 - 2016 Annual Summary Report (Astron Environmental Services 2016)
- Rio Tinto Flora Database - Newman Highway (No Report Observation) (Rio Tinto Iron Ore 2019)
- Weed Control Program – Inland Operations, Hope Downs 1 – 2017 Annual Summary Report (Astron Environmental Services 2018).

3.1.3 Likelihood of Occurrence Assessment

Prior to conducting the field survey, aerial imagery was interpreted to identify potential habitat types. The conservation significant flora taxa identified from the database searches and recorded within previous projects in the vicinity of the survey area were then categorised according to the criteria in Table 6 for potential occurrence within the survey area.

Table 6: Criteria used to assess the likely presence of conservation significant flora in the survey area.

Likelihood of occurrence	Occurrence criteria
Likely	Taxa previously recorded within the survey area or within 10 km of the survey area and suitable habitat appears to be present in the survey area
Potential	Taxa previously recorded within 10 km to 20 km of the survey area and/or suitable habitat appears to be present in the survey area
Unlikely	No suitable habitat appears to be present in the survey area
Recorded	Taxa recorded within the survey area during the current survey
Previously recorded	Taxa recorded from a previous survey within the survey area but not recorded during the current survey

Following all phases of the field survey, the likelihood of occurrence of conservation significant flora taxa not encountered within the survey area was reassessed. Taxa identified during the desktop assessment as having potential to occur were categorised post-field visit based on: the proximity of known populations to the survey area, the presence and level of inspection of suitable habitats within the survey area and the life form, preferred habitat and flowering times for each taxon (Appendix E). The TP list (Department of Biodiversity, Conservation, and Attractions 2019d) is generated according to place names as opposed to locality; as such conservation significant flora may be recorded that occur beyond the 50 km search area. These taxa have been retained in the assessment of likelihood of occurrence (Appendix E).

3.2 Field Survey

3.2.1 Survey Timing and Personnel

Survey timing for each of the three phases, the personnel involved and their collection licence numbers are shown below in Table 7. Each botanist involved with the survey is familiar with undertaking flora and vegetation assessments in the Pilbara region.

Table 7: Personnel involved in survey.

Phase and date	Personnel	Qualifications and experience	Licence numbers
Phase 1 1 to 12 November 2017	Ben Eckermann - Senior Botanist	BSc (Environmental Science) Grad Cert Sc (Land & Water Mgt) 13 years of botanical experience	Flora Permit SL012181; DRF Permit 48-1617
	Lucy Dadour - Botanist	BSc (Conservation Biology) 7 years botanical experience	Flora Permit SLO12123
	Linda Vaughan - Botanist	BSc (Botany & Geography) 14 years of botanical experience	Flora Permit SL011984
	Melissa Hay - Botanist	BSc Hon. (Environmental Biology) 14 years of botanical experience	Flora Permit SL012248
Phase 2 18 to 30 May 2018	Ben Eckermann - Senior Botanist	See above	Flora Permit SL012249; DRF Permit 66-1718
	Lucy Dadour – Botanist	See above	Flora Permit SL012252
	Linda Vaughan – Botanist	See above	Flora Permit SL012241
	David Leach - Botanist	BSc Hon. (Conservation & Park Management) PhD (Plant Biology) 11 years of botanical experience	Flora Permit SL012379
Phase 3 20 to 31 May 2019	Ben Eckermann - Senior Botanist	See above	Flora Permit SL012522; DRF Permit 75-1819
	Dr Kellie McMaster - Senior Botanist	BSc (Zoology) PhD (Zoology) 11 years of botanical experience	Flora Permit SL012520; DRF Permit 56-1819
	Daniel Roocke - Senior Botanist	BSc (Botany & Ecology) 9 years of botanical experience	Flora Permit SL012517
	Lucy Dadour – Botanist	See above	Flora Permit SL012524; DRF Permit 44-1819

3.2.2 Weather

Daily observations for rainfall and temperature were recorded by Rio Tinto at the HD1 Weather Station; however there was a period between 13 and 31 January 2018 where data was not recorded. Data was substituted for this period from the nearby Hope Downs 4 Weather Station which is approximately 48 km south-east of the HD1 Weather Station. Long term rainfall and temperature observations were sourced from the Newman Aero Bureau of Meteorology station (number 007176), approximately 90 km south-east of the survey area and 87 km south-east of the HD1 Weather Station. Local rainfall and temperatures preceding the survey are presented in Figure 3.

Rainfall recorded in the 12 months prior to the Phase 1 survey in November 2017 was 494.8 mm, 174.5 mm more than the long-term mean of 320.3 mm. The majority of this rain fell during an active summer cyclone season, with 340.6 mm being recorded between January and February 2017. In the three months preceding the Phase 1 survey, 2 mm was recorded, the long term mean for the same period was 16.5 mm. The mean maximum temperature of 36.9°C for November 2017 was slightly below the long term maximum temperature of 37.5°C.

Rainfall recorded in the 12 months prior to the Phase 2 survey in May 2018 was 208.8 mm, 111.5 mm less than the long-term mean. In the three months preceding the Phase 2 survey, 75.6 mm was recorded, the long term mean for the same period was 136.1 mm. The mean maximum temperature of 26.6°C for May 2018 was slightly below the long term maximum temperature of 27.1°C.

Rainfall recorded in the 12 months prior to the Phase 3 survey in May 2019 was 110.1 mm, 210.2 mm less than the long-term mean. In the three months preceding the Phase 3 survey, 71.8 mm was recorded, 62.6 mm less than the long-term mean for the same period. The mean maximum temperature of 27.9°C for May 2019 was slightly above the long term maximum temperature of 27.2°C.

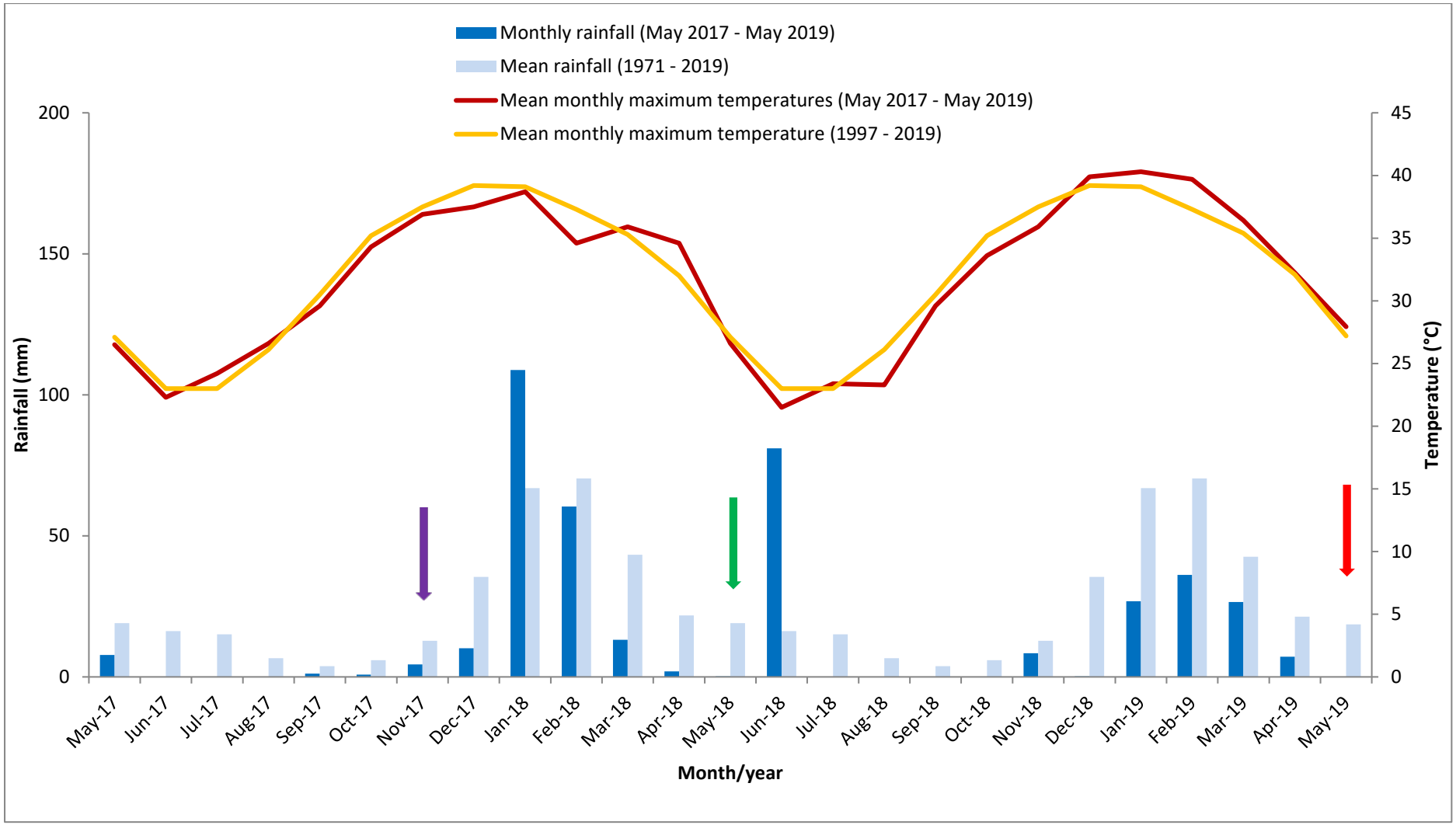


Figure 3: Mean monthly and recorded monthly rainfall (mm) and mean monthly and recorded monthly maximum temperatures (°C).

Daily records supplied by Rio Tinto and long term records supplied by the Bureau of Meteorology from the Newman Aero station (number 007176) (Bureau of Meteorology 2019). The purple arrow displays the timing for the Phase 1 survey, the green arrow displays the timing for the Phase 2 survey and the red arrow displays the timing for the Phase 3 survey.

3.2.3 Vegetation and Flora Assessment

The survey was undertaken over three phases in accordance with the requirements outlined in the provided Scope of Works, dated 18 September 2017 (Phase 1), 7 March 2018 (Phase 2) and 13 December 2018 (Phase 3), as well as the requirements of the EPA and Rio Tinto policy and guidance documents (Environmental Protection Authority 2002, 2004, 2016a, 2016b; Rio Tinto Iron Ore 2019).

Information acquired during the desktop assessment assisted in the design of the field survey prior to Phase 1 in 2017. Pre-survey planning involved the examination of 1:10,000 scale aerial photographic images to identify potentially different landforms, habitat and vegetation units. It also involved a review of the flora and vegetation assessments previously completed in the vicinity of the survey area to provide context and identify data gaps. Proposed quadrat locations were identified prior to the field survey according to the replicates required to support the previous vegetation mapping; these were adjusted on site as appropriate.

None of the existing quadrats from previous surveys were able to be relocated for resampling during Phase 1 and Phase 2. Two quadrats (BHD05 and BHD10) in the Baby Hope area (Biota Environmental Sciences 2014) were able to be located during Phase 3 and were rescored.

Seventy sites were installed during Phase 1, comprising 55 quadrats and 15 relevés. A total of 69 sites established in Phase 1 were rescored during Phase 2, with an additional two relevés sampled. The Phase 3 survey installed 23 quadrats and four relevés and rescored the one remaining site from Phase 1. The total number of quadrats and relevés surveyed was 99 (Table 8).

Quadrats were positioned by measuring a square of 50 m by 50 m, where terrain allowed, with the four corners marked with a fence dropper positioned in the north-west and south-east corners and flagging tape in the alternate corners. Dimensions of the quadrat were adjusted where required, according to terrain, drainage and landform features, to represent an estimated 2,500 m^2.

Relevés were used where the installation of quadrats was limited, such as gorges, drainage lines, steep slopes and in vegetation units affected by recent fires. Data from relevé locations were sampled from an area of approximately 2,500 m^2. Mapping notes were also taken to support the vegetation mapping, these varied in detail but generally included location coordinate, photograph, vegetation description, dominant species, vegetation condition and fire history.

The following information was collected for each quadrat and relevé:

- Location – coordinates measured using a handheld global positioning system (GPS) unit (MGA50, GDA94) at each of the four corners of the site.
- Recorder and date –personnel involved in sampling that site and the survey date.
- Habitat – a broad description of the surrounding landscape based on landform, topography and soil.
- Soil – including colour and texture.
- Rock type and abundance – general description of surface geology and amount of ground covered by rocks.
- Vegetation description – vegetation described according to level V of the NVIS (Department of the Environment and Energy 2017a) and classified according to the Aplin (1979) modification of the vegetation classification system of Specht (1970) (Appendix F).
- Vegetation condition – assessed according to the vegetation condition classification adapted from Trudgen (1988) (Appendix F).

- Species list – percentage foliar cover (PFC) and maximum height were recorded for each vascular plant taxon present within the site. The inventory was comprehensive for relevé locations, with an estimated quadrat dimension searched intensively.
- Disturbances – records of any obvious disturbances such as fire, tracks or grazing.
- Photographs – a photograph was taken at the north-west and south-east corners of each quadrat or from a representative location for relevés.

Table 8: Number of sites surveyed in each phase within the survey area.

Phase of survey	Number of sites	Name of sites
Two phases of survey:	55 quadrats 15 relevés	Quadrats: HD01, HD02, HD03, HD04, HD05, HD06, HD07, HD08, HD09, HD10, HD11, HD12, HD13, HD14, HD15, HD16, HD17, HD18, HD19, HD20, HD21, HD22, HD23, HD24, HD25, HD26, HD27, HD28, HD29, HD30, HD31, HD32, HD33, HD34, HD35, HD37, HD38, HD39, HD40, HD41, HD42, HD43, HD44, HD46, HD47, HD48, HD49, HD50, HD51, HD52, HD53, HD54, HD55, BHD05-AR, BHD10-AR Relevés: HDR01, HDR02, HDR03, HDR04, HDR05, HDR06, HDR07, HDR08, HDR09, HDR10, HDR11, HDR12, HDR13, HDR14, HDR16
One phase of survey	23 quadrats 6 relevés	Quadrats: GH01, GH02, GH03, GH04, GH05, GH06, GH07, GH08, GH09, GH11, GH12, GH13, GH15, GH17, GH19, GH20, GH21, GH22, GH23, GH24, GH25, GH26, GH27 Relevés: HDR18, HDR19, GHR10, GHR16, GHR28, GHR30

Quadrat distribution was designed to have spatial spread over the survey area. There were limitations on the ability to establish quadrats in parts of the survey area affected by recent fire and also within drainage lines, gorges and on slopes where access was limited. Unburnt vegetation was preferentially targeted for installing quadrats to show climax vegetation assemblages, however a number of relevés were established in recently burnt areas where necessary to achieve survey site replication.

Due to its restricted occurrence one vegetation unit (H5) did not have any sites sampled from within the survey area. Vegetation unit H5 was noted in four small areas which had a total area of < 2 ha; as such it was difficult to adequately sample the vegetation without capturing influences from adjacent habitats and vegetation. Vegetation unit H5 was described using data collected from outside of the survey area (quadrats GH18 and GH31) in adjacent similar habitats. The data from these sites is presented to assist in interpretation, but they were not located within the survey area.

Vegetation unit H9 occurred on two small hills in HD2 associated with the Rocklea land system. This area was affected by fire in 2016 and the single quadrat was placed in an area of unburnt vegetation. There was insufficient unburnt vegetation to place further quadrats and as such, H9 had fewer than the recommended three site replication.

Vegetation unit D7 occurred on floodplain terraces surrounding Pebble Mouse Creek, a major drainage line near Baby Hope Downs within the survey area. There were only two locations where the survey area intersected this vegetation unit with enough space to establish quadrats. As such, D7 had fewer than the recommended minimum three sites replication.

Vegetation unit D8 was described following post-survey assessment of quadrat data. The presence of *Eucalyptus xerothermica* as a dominant upper stratum species separated the two sampled sites

from other mulga vegetation units it had been mapped as during the field visit and as such had fewer than the recommended minimum three sites replication.

Vegetation unit P4 occurred on open hardpan plains near major drainage lines within the survey area. There were only two locations where the survey area intersected this vegetation unit with enough space to establish quadrats. As such, P4 had fewer than the recommended minimum three sites replication.

3.2.4 Vegetation Description and Mapping

Existing vegetation mapping conducted by Mattiske Consulting (2009a, 2009b, 2010) in the survey area was ground-truthed and assessed during the initial stages of the Phase 1 survey and found to be a poor representation of the vegetation in situ. Rather than attempting to consolidate the previous work, it was considered the best approach to conduct new vegetation mapping across the survey area during the Phase 1 and Phase 2 surveys.

Vegetation codes using an alpha prefix were applied based on the position in the landscape, e.g. H for hills and slopes, P for plains and D for drainage lines. Vegetation units were described at NVIS Level V – Association level using the data collected from quadrats, relevés and mapping notes and boundaries were refined through foot traverses. Printed colour aerial photographic images at a scale of 1:10,000 were used in the field to assist in navigation and for delineating boundaries between vegetation units.

Fire had affected 5,221.4 ha (48.3%) of the survey area within the previous five years (2015-2019). No fire was recorded in 2018 and 2019. The effects of the 2015 fire were the most widespread with 30.2 % of the survey area burnt (Darwin Centre for Bushfire Research 2018). Fire-responsive regenerator species occurred in these areas and climax vegetation was often difficult to infer. In recently burnt areas, the vegetation mapping was extrapolated from surrounding unburnt areas by comparing flora species presence and relevant landform features (Figure G.1, Appendix G).

3.2.4.1 Vegetation Condition Mapping

Vegetation condition was generally mapped according to vegetation unit boundaries throughout the survey area using a combination of quadrat, relevé and mapping note data, opportunistic weed observations and the mean condition rating for each vegetation unit. Vegetation condition was rated at each survey site using the five point Trudgen (1988) scale and the condition rating was generally applied to the whole vegetation unit polygon in which it was mapped. In landforms where weed and disturbance presence was consistent, e.g. drainage lines, condition was generally applied across the entire landform. A mean condition rating for each vegetation unit was extracted from the data collected at survey sites and this information was then used to apply condition ratings in polygons not already attributed with a rating.

3.2.5 Targeted Flora Survey

Previously recorded conservation significant flora records and associated habitat preference information assisted in identifying vegetation units and habitat within the survey area that had potential to support conservation significant flora. Habitats and vegetation units in the survey area considered to have the greatest potential to support conservation significant flora were preferentially targeted in the field. Traverses were spaced according to the accessibility of habitats, but generally observers were 30 m to 50 m apart. Where conservation significant flora was encountered, a waypoint was recorded to represent one or a number of individuals within a 20 m radius, along with notes about the habitat and reproductive status of the population. During the Phase 2 survey priority was given to conducting searches in areas considered most likely to support

P1 and P2 taxa. In particular, the south facing upper slopes and gorges and the drainage lines were targeted. The Phase 3 survey focused on creeks likely to support *Aristida lazaridis* P2 and an area in the east of BHT within the H2 vegetation unit considered likely to support *Eremophila* sp. West Angelas (S. van Leeuwen 4068) P1.

3.3 Taxonomy and Nomenclature

Plant specimens that were not identified in the field were identified in Perth by Ben Eckermann following Phase 1, by Dr Palitha Jayasekara (Astron Botanist) following Phase 2, and by Lucy Dadour and Dr Palitha Jayasekara following Phase 3. These botanists have worked extensively in the Pilbara and are highly familiar with the flora of the region. The assigned nomenclature is consistent with the current listing of scientific names recognised by the Western Australian Herbarium (WA Herbarium) and was used for the species list and associated species information collected. Where specimens had inadequate descriptive material to allow confident identification, they were assigned a 'sp.' (species) epithet, indicating that identification could not be confirmed beyond genus level. Data from each quadrat, relevé and mapping note were entered into a customised database (Spatial Networks Inc 2000 - 2018). Range extensions and conservation significant taxa were submitted to the Rio Tinto sponsored taxonomist Steven Dillon at the WA Herbarium for confirmation.

3.4 Floristic Analysis

A species accumulation curve was created in order to examine the adequacy of survey effort, while a numerical cluster analysis using species PFC and presence/absence of perennial native taxa was conducted to identify statistically significant floristic groups. The species accumulation curve was completed using R 3.2.1 (R Development Core Team 2015) while the cluster analysis was completed using PRIMER v6 software (Clarke and Gorley 2006). Both analyses were performed by Astron Senior Scientist Dr Aaron Gove.

Cluster analyses were completed to examine the relationship between:

- floristic groups and structural vegetation units within the survey area
- survey area quadrats and relevés and broader local scale quadrats and relevés.

Following normal convention, statistically significant clusters were those distinguished by a P-value <0.05. Square root transformation of the PFC data from the 99 quadrats and relevés was used to examine the relationship of sites within the survey area. An analysis of presence/absence data from the 99 quadrats and relevés within the survey area was also undertaken.

A further analysis of perennial native taxa was conducted using the presence/absence data of 856 sites, made up of the 99 sites from the survey area and 757 sites from previous surveys in the vicinity. This analysis was conducted in order to provide a broader regional comparison (Biota Environmental Sciences 2006; Mattiske Consulting 2008b, 2009b, 2010; Ecologia Environment 2013; Biota Environmental Sciences 2014).

3.5 Limitations

Following completion of the desktop assessment and field surveys, a review of any limitations that may have affected a complete assessment of the data collected was conducted. The limitations listed in Table 9 are based on those suggested as considerations in the EPA Guidance Statements 51 (Environmental Protection Authority 2004) and current Technical Guidance for Flora and Vegetation Surveys (Environmental Protection Authority 2016b).

Table 9: Statement of limitations.

Potential limitation	Statement regarding potential limitation
(i) Sources of information and availability of contextual information Is the region well documented?	Previous biological surveys have been conducted in the broader locality, and broad-scale information is available from Beard (1975) and Payne et al. (1980). There is a recognised lack of plot based databases to compare floristic data within the Pilbara region. The broader regional data used in the contextual analysis of projects from the vicinity of the survey area highlighted the differing standards of biological surveys previously conducted. Nine previous biological reports were considered for providing relevant contexual information for floristic analysis and vegetation mapping for the survey area (Section 3.1.2). Despite there being varying biological focus, intensity of survey and quality of the previous work, contextual information is not considered a limiting factor of this survey.
(ii) Scope The level of survey and detail required to undertake the survey. Was there adequate time to complete the survey to the desired standard?	All parts of the survey area were able to be accessed, although some habitats, such as steep rugged hillslopes, were not able to be thoroughly traversed. There was adequate time to complete the flora and vegetation surveys, vegetation mapping, and targeted searches for threatened and priority flora within the survey area that could be safely accessed, as outlined in the scope of works. The time available to complete the survey is not considered a limiting factor of the assessment.
(iii) Proportion of flora and fauna identified, recorded and/or collected Was the survey sampling, timing and intensity considered adequate? Was the survey conducted at what was considered an appropriate time of the year for plant identification? Were any taxonomic groups considered to be under-represented?	The field surveys were conducted during late spring in November 2017 and late autumn, in May 2018 and May 2019. Sampling intensity was considered adequate, with a minimum of three sampling sites achieved in most vegetation units. Most flora taxonomic groups expected within the survey area were well represented; the total floristic richness was considered comparable to other surveys in the area and the species accumulation curve indicated that between 76% and 90% of the total flora expected in the survey area was sampled. Twenty of the conservation significant flora taxa listed in database search results were assessed as still having the potential to occur in the survey area following all phases of the field survey (Appendix E). Eight of these are annual or short-lived perennial species. The dry seasonal conditions may have contributed to these taxa not being observed within the survey area.
(iv) Completeness Is there further work which may be required i.e. was the relevant area fully surveyed?	The survey area was considered adequately surveyed to the level required to compile a representative list of species, (including the majority of conservation significant and introduced flora taxa) as well as to describe and map vegetation at a level appropriate for possible future management decisions. Five vegetation units (H5, H9, P4, D7, D8) in the survey area did not meet EPA (2016a) requirements for quadrat replication; this was generally due to either a lack of area within accessible parts of the survey area large enough to establish suitable quadrats, or theavoidance of burnt vegetation. One vegetation unit was described post-survey on assessment of the data and had not achieved three replicate quadrats during the survey. The recorded distribution and estimated abundance of the conservation significant taxa within the survey area is not exhaustive and is only a representation of the targeted nature of the surveys. Completeness is therefore considered a minor limitation of this survey but is unlikely to have significantly affected the outcomes of the assessment. .

Potential limitation	Statement regarding potential limitation
(v) Mapping reliability Were the aerial photographs, satellite images and site maps available considered adequate to fully understand the area surveyed? Was the mapping generated considered to have a high degree of reliability?	Colour aerial photography at a scale of 1: 10,000 was used to locate the survey area and to assist in navigation and delineation of vegetation boundaries. The aerial photography was of sufficient resolution and, in general, accurately represented ground conditions. The disturbance mapping layers provided post-survey did not completely align with observations made by the field team, and as such there may be some discrepancies between the reported and current disturbed area; small anomalies in condition mapping are not unusual for a survey area of this size and in this instance is not considered to affect the outcomes or interpretation of survey results.
(vi) Timing When was the survey conducted in terms of season, rainfall, severe weather events etc.? Was the survey conducted at an appropriate time for access, observation of the optimal suite of species and for identification of flowering and fruiting species?	There was below average rainfall for the three months preceding the Phase 1 survey in November 2017, and no significant rainfall since April 2017. Seasonal conditions were considered below average for the Phase 2 survey in May 2018, with below average rainfall for the three months preceding the survey including a drier than average wet season. Seasonal conditions were considered below average for the Phase 3 survey in May 2019, with below average rainfall for both the 12 and three months preceding the survey. As a result, few ephemeral taxa were recorded during the Phase 2 and 3 surveys. There is potential that annual or short-lived perennial conservation significant species may occur but were not present at the time of the survey. Identification of grasses was unreliable across all phases, in particular affecting the interpretation of the grass species assemblage in the P2 vegetation unit. The diversity of species was considered representative, however the spatial distribution of annual and herbaceous species was likely to be reduced and as such timing is considered a limiting factor of this survey.
(vii) Disturbance Had the survey area been impacted by any disturbance which may have limited the survey, i.e. fire, flood, accidental human intervention etc.?	A number of tracks within the survey area had been cleared for exploration drilling. Areas in the vicinity of the central northen part of the survey area were being cleared during the Phase 3 survey. Significant areas within the survey area had been burnt between 2015 and 2016. The upland plateaux and north-facing upper slopes of BHT and the undulating spinifex plains and dolerite habitats of HD2 were the most affected, limiting targeted flora searches, vegetation mapping and quadrat site selection. The vegetation had begun to regenerate in these areas and was dominated by post-fire colonising species, however the structural vegetation units were often difficult to assess. Disturbance is therefore considered a minor limitation of this survey.
(viii) Intensity In retrospect, was the intensity considered to be adequate?	Despite the seasonal conditions and survey timing being sub-optimal, the intensity of the survey was considered adequate to compile a representative species list and map the vegetation of the survey area to association level. The majority of habitat likely to support the P1 and P2 conservation significant flora taxa was surveyed adequately. Habitat supporting large numbers of conservation significant flora on BHT were rugged south-facing upper slopes and gorges which were difficult to access and conduct targeted searches efficiently, however areas with potential for conservation significant flora that could be safely accessed were traversed.

Potential limitation	Statement regarding potential limitation
(ix) Resources Were the appropriate tools and materials available to complete the task effectively?	Resources were adequate to complete the survey and all appropriate tools and materials required to complete the task were available. Only two previous quadrats within the survey area (BHD05 and BHD10 from Biota (2014)) were able to be located for rescoring. No other existing quadrats from Mattiske (2009a, 2009b, 2010) were able to be located within the survey area; as such new sites had to be installed to achieve the desired replication although this did not affect the outcomes of the survey. Resources are therefore not considered to be a limitation of this survey.
(x) Access Were there any factors limiting access to the survey area?	Parts of the survey area cleared for exploration drilling tracks were able to be accessed by vehicle, with areas unable to be reached by vehicle being accessed and traversed by foot. The hot conditions encountered during Phase 1 in particular made this challenging and parts of the survey area were poorly visited due to this restriction. The rugged south-facing slopes of BHT were difficult to safely traverse due to the challenging terrain and therefore could not be thoroughy searched for conservation significant flora in their entirety. Access at Baby Hope Downs was limited due to mining activity and required an escort. There were areas that could not be accessed due to mining infrastructure. Access is therefore considered a minor limiting factor of this survey but is unlikely to have significantly impacted the results of the survey.
(xi) Experience Were personnel undertaking the field survey and plant identification trained and/or experienced in undertaking the required tasks?	The botanists responsible for undertaking the field survey have considerable experience in conducting flora and vegetation surveys in the Pilbara. The identification of specimens collected in the field during Phase 1 was conducted by Ben Eckermann (Senior Botanist), with Phase 2 being conducted by Dr Palitha Jayasekara (Botanist), and Phase 3 by Lucy Dadour and Dr Palitha Jayasekara (Botanists), all of whom have extensive Pilbara botanical experience. Conservation significant flora specimens were confirmed by Steven Dillon at the WA Herbarium. Experience is not considered a limiting factor of this survey.

4 Results

4.1 Desktop Assessment

4.1.1 Environmentally Sensitive Areas

No ESAs intersect the survey area. The nearest ESA is Hamersley Range National Park (1977 boundary), now referred to as Karijini National Park, the nearest boundary of which occurs approximately 35 km west of the survey area (Department of the Environment and Energy 2008).

4.1.2 Vegetation and Flora

No EPBC Act listed MNES TECs or State-listed TECs have been previously recorded within 50 km of the survey area. Eight State-listed PECs have previously been recorded within 50 km of the survey area (Figure C.1, Appendix C, Table 10).

The DBCA mapped buffer for the State-listed priority 1 PEC '*Weeli Wolli Spring Community'* extends over 1,679.4 ha in the eastern and north-eastern part of the survey area (Department of Biodiversity, Conservation, and Attractions 2019b).

The DBCA mapped buffer for the State-listed priority 1 PEC '*West Angelas Cracking-Clays'* occurs approximately 9km south of the survey area. This PEC is composed of open tussock grasslands of *Astrebla pectinata, A. elymoides* and *Aristida latifolia*, in combination with low scattered shrubs of *Sida fibulifera*, on basalt derived cracking-clay loam depressions and flowlines (Department of Biodiversity, Conservation, and Attractions 2019b).

The DBCA mapped buffers for the State-listed priority 1 PEC '*Coolibah – Lignum Flats, sub type 2*' occur approximately 9 km north of the western end of the survey area. The priority 1 '*Coolibah – Lignum Flats, sub type 2*' PEC is composed of woodland or forest of *Eucalyptus victrix* (coolibah) over thicket of *Duma florulenta* (lignum) on red clays in run-on zones. Associated species include *Eriachne benthamii, Themeda triandra, Aristida latifolia, Eulalia aurea* and *Acacia aneura* (Department of Biodiversity, Conservation, and Attractions 2019b).

Table 10: Priority ecological communities previously recorded within 50 km of the survey area.

Ecological community description	Conservation category	Distance from survey area (km)
Weeli Wolli Spring Community	P1	Buffer overlaps survey area
West Angelas Cracking-Clays	P1	9 km south-west
Coolibah - Lignum Flats, sub type 2	P1	10 km north-west
Kumina Land System	P3	21 km east
Brockman Iron Cracking Clay Communities	P1	33 km west
Fortescue Valley Sand Dunes	P3	38 km north-east
Fortescue Marsh	P1	45 km north
Freshwater Claypans of the Fortescue Valley	P1	67 km north

The DBCA TPFL, TP List, WA Herbarium database searches, NatureMap, the Protected Matters Search Tool and a review of the previous projects conducted within the vicinity of the survey area (Section 3.1.2) indicated a total of 82 conservation significant flora taxa have been previously recorded within 80 km of the survey area (Table E.1, Appendix E) (Department of Biodiversity,

Conservation, and Attractions 2019a, 2019d, 2019c, 2019e; Department of the Environment and Energy 2019; Rio Tinto Iron Ore 2019). This includes two threatened, 13 P1, 17 P2, 43 P3 and seven P4 listed taxa. The pre-survey desktop assessment indicated 27 of the listed conservation significant flora species were considered likely to occur (including 14 previously recorded species) and a further 17 were considered to have the potential to occur within the survey area (Table E.1, Appendix E).

4.1.3 Literature Review

Results of the literature review indicate that no TECs and two PECs: '*Weeli Wolli Spring Community*' and '*West Angelas Cracking-Clays*' have been previously recorded from projects within 50 km of the survey area. Twenty-four currently listed conservation significant taxa have been previously recorded from previous projects either inside or within 50 km of the survey area (Table 11) (Biota Environmental Sciences 2006; Ecologia Environment 2013; Mattiske Consulting 1995, 2008b, 2009b, 2009a, 2010; Biota Environmental Sciences 2014).

Table 11: Summary of relevant vegetation and flora surveys in the vicinity of the survey area.

Survey parameter	Mattiske (1995) Flora and vegetation – Southern Transport Corridor – Yandicoogina Junction Project Area	Biota (2006) Hope Downs Rail Corridor (Juna Downs Section) Vegetation and Flora Survey	Mattiske (2008b) Flora and Vegetation on the Hope Downs 4 Lease Area	Mattiske (2008d) Hope Downs 4 Mine Infrastructure Corridor	Mattiske (2009a) Flora and vegetation of the Hope Downs 1 Area	Mattiske (2009b) Flora and Vegetation on the Hope Downs 4 Mine Pipeline Corridor to Ophthalmia Dam	Mattiske (2010) Flora and Vegetation of the Hope Downs 2 Area	Ecologia (2013) Rio Tinto Greater West Angelas Vegetation and Flora Assessment	Biota Environmental Sciences (2014) Baby Hope Downs Flora and Vegetation Survey
Survey area size (ha)	26,500	~100,000	Not presented	Not presented	Not presented	Not presented	Not presented	17,596	1,652
Survey focus	Level 2 – Single phase	Level 2 – Single phase	Vegetation mapping (expanding work presented in Mattiske (2005))	Vegetation mapping (expanding work presented in Mattiske (2005, 2008b, 2009b))	Vegetation mapping (expanding work presented in Mattiske (1995, 2005, 2008c, 2008d, 2009c))	Vegetation mapping (expanding work presented in Mattiske (2005, 2008c, 2008d))	Vegetation mapping (expanding work presented in Mattiske (1995, 2005, 2008c, 2008d, 2009a, 2009c))	Level 2 – Reported as two phase but both field trips in the same season	Level 2 – Two phase
Survey timing	January and March 1994, February 1995	September and October 2005, February 2006	December 2004, January 2005, February 2005, May 2005, September 2007, April 2008 and May 2008	May 2008	June 2009	April 2009	September 2007	July and August 2012	October and November 2014
Seasonal conditions	Not presented	Average to favourable	Average to favourable	Favourable	Not presented	Optimal	Average	Favourable	Favourable
Survey effort (quadrats/relevés)	116 sites	37 quadrats and 1 relevé (also presented 4 sites from Halpern Glick Maunsell (2000))	267 permanent sites: 10 sites – Jan 2005 47 sites – Feb 2005 63 sites – May 2005 17 sites – Sep 2007 105 sites – Apr 2008 25 sites – May 2008	139 permanent sites	32 additional permanent sites (also presented 139 sites from Mattiske (2008d))	83 additional permanent sites (also presented 139 sites from Mattiske (2008d))	118 permanent sites	150 quadrats	29 quadrats 13 relevés
Total vegetation units mapped	32	25	17	25	18	23	16	22	12
Conservation significant ecological communities recorded	0	0	0	1 PEC - *Weeli Wolli Spring Community*	1 PEC - *Weeli Wolli Spring Community*	1 PEC - *Weeli Wolli Spring Community*	0	1 PEC - *West Angelas Cracking Clays*	0
Total taxa recorded	392	382	472	392	217	262	212	441	354
Conservation significant flora species recorded (currently listed - as at August 2018)	2	1	5	5	7	0	1	11	5
Aristida lazaridis P2								✓	
Eremophila pusilliflora P2								✓	
Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2									✓
Acacia subtiliformis P3					✓			✓	
Aristida jerichoensis var. *subspinulifera* P3								✓	
Eremophila forrestii subsp. *viridis* P3				✓					
Eremophila magnifica subsp. *velutina* P3					✓				✓

Survey parameter	Mattiske (1995) Flora and vegetation – Southern Transport Corridor – Yandicoogina Junction Project Area	Biota (2006) Hope Downs Rail Corridor (Juna Downs Section) Vegetation and Flora Survey	Mattiske (2008b) Flora and Vegetation on the Hope Downs 4 Lease Area	Mattiske (2008d) Hope Downs 4 Mine Infrastructure Corridor	Mattiske (2009a) Flora and vegetation of the Hope Downs 1 Area	Mattiske (2009b) Flora and Vegetation on the Hope Downs 4 Mine Pipeline Corridor to Ophthalmia Dam	Mattiske (2010) Flora and Vegetation of the Hope Downs 2 Area	Ecologia (2013) Rio Tinto Greater West Angelas Vegetation and Flora Assessment	Biota Environmental Sciences (2014) Baby Hope Downs Flora and Vegetation Survey
Eremophila sp. Hamersley Range (K. Walker KW 136) P3									✓
Goodenia lyrata P3									✓
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727) P3		✓	✓		✓				
Gymnanthera cunninghamii P3			✓						
Indigofera gilesii P3								✓	
Rhagodia sp. Hamersley (M. Trudgen 17794) P3	✓		✓	✓				✓	
Rostellularia adscendens var. *latifolia* P3					✓				
Sida sp. Barlee Range (S. van Leeuwen 1642) P3								✓	
Stylidium weeliwolli P3	✓			✓	✓				
Themeda sp. Hamersley Station (M.E. Trudgen 11431) P3			✓					✓	
Triodia sp. Mt Ella (M.E. Trudgen 12739) P3								✓	
Acacia bromilowiana P4					✓				
Eremophila magnifica subsp. *magnifica* P4					✓				✓
Eremophila youngii subsp. *lepidota* P4			✓	✓					
Goodenia nuda P4								✓	
Lepidium catapycnon P4				✓				✓	
Ptilotus mollis P4							✓		

4.2 Field Survey

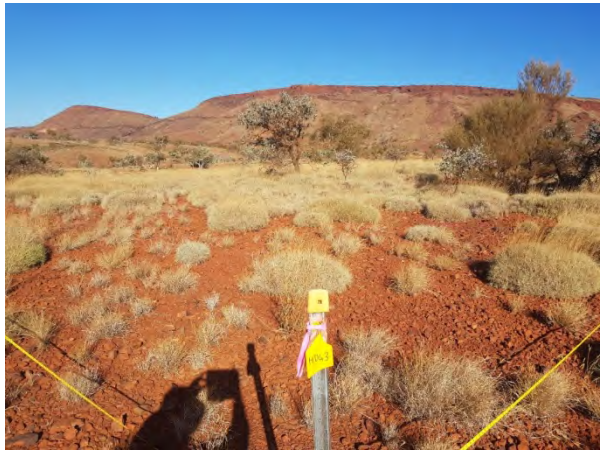
4.2.1 Vegetation

There were 23 vegetation units recorded across the survey area; these were broadly categorised according to three landform types: hills and slopes, plains, and drainage lines. Areas where vegetation had been removed for roads, tracks and mining activities were mapped as 'cleared'. Vegetation mapping, quadrat and relevé locations are presented in Figure H.1 – H.26 (Appendix H), survey site data is provided in Appendix I, and vegetation unit descriptions and representative photos are presented in Table 12.

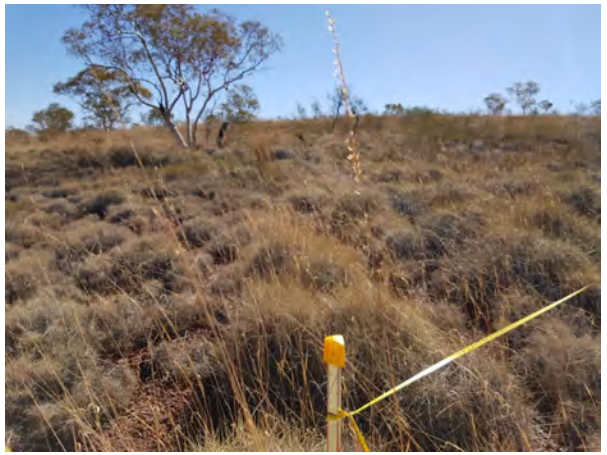
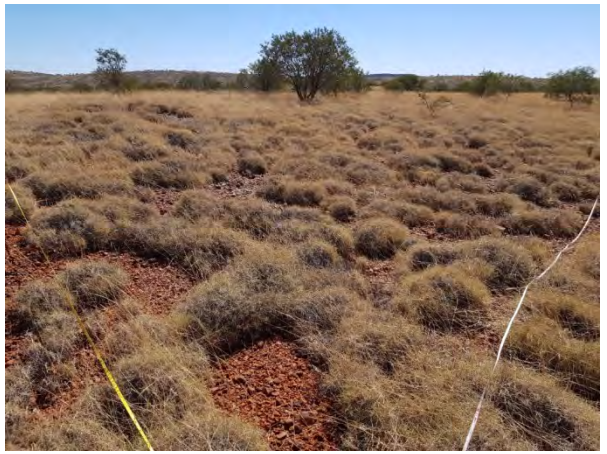
Table 12: Vegetation units described for the survey area.

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
Vegetation of Hills and Slopes				
H1 – *Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia hamersleyana* sens. lat. scattered low trees to low open woodland over *Petalostylis labicheoides, Senna glutinosa* subsp. *glutinosa* scattered tall shrubs over *Gompholobium oreophilum*, *Acacia hilliana, A. spondylophylla* low open shrubland to low shrubland over *Triodia vanleeuwenii*, *T. wiseana*, *T. pungens* open hummock grassland with *Amphipogon sericeus* scattered tussock grasses **Associated species:** *Acacia pyrifolia*, *Codonocarpus cotinifolius*, *Corchorus lasiocarpus* subsp. *parvus*, *Cymbopogon ambiguus*, *Duperreya commixta*, *Goodenia stobbsiana*, *G. triodiophila*, *Hakea chordophylla*, *Ptilotus calostachyus*, *Scaevola browniana*, *Senna glaucifolia*, *Sida* sp. Excedentifolia (J.L. Egan 1925)	HD04, HD13, HD15	Excellent	H1: 624.3 (5.8)	 **Plate 1: Vegetation unit H1.**

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
H2 – *Eucalyptus repullulans* scattered low mallees over *Acacia catenulata* subsp. *occidentalis*, *A. aptaneura*, (*Grevillea saxicola*) tall shrubland to tall open scrub over *Scaevola acacioides, Dodonaea pachyneura, Eremophila latrobei* subsp. *filiformis* scattered shrubs to open shrubland over *Triodia pungens* scattered hummock grasses to very open hummock grassland with *Eriachne mucronata* scattered tussock grasses to very open tussock grassland **Associated species:** *Acacia mulganeura, A. pruinocarpa*, *Aristida contorta*, **Bidens bipinnata*, *Cheilanthes lasiophylla*, *Duperreya commixta*, *Dysphania rhadinostachya* subsp. *rhadinostachya, Enchylaena tomentosa* var. *tomentosa, Enneapogon lindleyanus*, *Enneapogon polyphyllus, Eremophila platycalyx subsp. pardalota, Eriachne pulchella*, *Eucalyptus leucophloia* subsp. *leucophloia, Paraneurachne muelleri*, *Paspalidium clementii*, *Psydrax suaveolens*, *Ptilotus exaltatus*, *Ptilotus obovatus*, *Santalum lanceolatum*, *Senna glutinosa* subsp. ×*luerssenii*, *Solanum lasiophyllum*, *Triodia vanleeuwenii, T. wiseana*	HD03, HD07, HD52, GH11	Very Good-Excellent	H2: 314.8 (2.9)	 Plate 2: Vegetation unit H2.

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
H3 – *Corymbia deserticola* subsp. *deserticola* scattered low trees over *Acacia inaequilatera*, *Hakea chordophylla* scattered tall shrubs to tall open shrubland over *Senna glutinosa* subsp. *pruinosa* scattered shrubs over *Triodia vanleeuwenii* open hummock grassland with *Amphipogon sericeus* scattered tussock grasses to very open tussock grassland **Associated species:** *Acacia bivenosa*, *Corchorus lasiocarpus* subsp. *parvus*, *Cymbopogon obtectus*, *Dampiera candicans*, *Eucalyptus leucophloia* subsp. *leucophloia*, *Gompholobium oreophilum*, *Goodenia stobbsiana*, *Hibiscus sturtii* var. *campylochlamys*, *Indigofera monophylla*, *Paraneurachne muelleri*, *Polycarpaea holtzei*, *Ptilotus astrolasius*, *Ptilotus calostachyus*, *Ptilotus exaltatus*, *Ptilotus rotundifolius*, *Senna glutinosa* subsp. *glutinosa*, *S. glutinosa* subsp. ×*luerssenii*, *Sida arenicola*, *Solanum lasiophyllum*	HD05, HD43, HDR14, HDR16, GH19	Excellent	H3: 445.2 (4.1)	 Plate 3: Vegetation unit H3.
H4 – *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Senna glutinosa* subsp. *glutinosa*, *S. glutinosa* subsp. *pruinosa* scattered shrubs over *Triodia vanleeuwenii* and/or *T. wiseana* open hummock grassland to hummock grassland **Associated species:** *Acacia bivenosa*, *A. pruinocarpa*, *Amphipogon sericeus*, *Cymbopogon ambiguus*, *Enneapogon caerulescens*, *Eriachne pulchella*, *Gomphrena cunninghamii*, *Goodenia stobbsiana*, *Maireana georgei*, *Paraneurachne muelleri*, *Paspalidium clementii*, *Pterocaulon sphacelatum*, *Ptilotus calostachyus*, *Ptilotus exaltatus*, *Ptilotus obovatus*, *Scaevola acacioides*, *Schizachyrium fragile*, *Senna glutinosa* subsp. ×*luerssenii*, *Senna stricta*, *Sida* sp. Excedentifolia (J.L. Egan 1925), *Sida* sp. Pilbara (A.A. Mitchell PRP 1543), *Tribulus suberosus*	HD48, HDR04, HDR10, HDR11, HDR12, GHR30	Excellent	H4: 703.6 (6.5)	 Plate 4: Vegetation unit H4.

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
H5 – *Eucalyptus socialis* subsp. *eucentrica* scattered low mallees to low open mallee woodland over *Acacia bivenosa* scattered tall shrubs to tall open shrubland over *Senna glutinosa* subsp. × *luerssenii* scattered shrubs over *Ptilotus obovatus* scattered low shrubs over *Triodia wiseana* very open hummock grassland to open hummock grassland **Associated species:** *Acacia pruinocarpa, A. sibirica, Androcalva luteiflora, Eremophila fraseri* subsp. *fraseri, Senna artemisioides* subsp. *helmsii, S. artemisioides* subsp. *oligophylla, Solanum lasiophyllum, Triodia pungens*	GH18, GH31 (outside of survey area)	Very Good-Excellent	H5: 1.9 (<0.1)	 **Plate 5: Vegetation unit H5.**
H6 – *Acacia aptaneura*, *A. catenulata* subsp. *occidentalis* tall open shrubland to tall shrubland over *Eremophila forrestii* subsp. *forrestii*, *Senna stricta* scattered shrubs to open shrubland over *Triodia pungens* and/or *T. vanleeuwenii* and/or *T. wiseana* scattered hummock grasses to very open hummock grassland with *Eriachne mucronata* scattered tussock grasses **Associated species:** *Acacia pruinocarpa*, *Aristida contorta*, *A. inaequiglumis*, *Capparis lasiantha*, *Cymbopogon ambiguus*, *Duperreya commixta*, *Dysphania rhadinostachya* subsp. *rhadinostachya*, *Enneapogon caerulescens*, *E. lindleyanus*, *E. polyphyllus*, *Eremophila latrobei* subsp. *glabra*, *Eriachne pulchella*, *Eucalyptus leucophloia* subsp. *leucophloia*, *Grevillea berryana*, *G. saxicola*, *Maireana georgei*, *Paspalidium clementii*, *Ptilotus obovatus*, *Scaevola acacioides*, *Schizachyrium fragile*	HD23, HD40, HD42, HDR03, HDR06, GHR16	Excellent	H6: 144.8 (1.3)	 **Plate 6: Vegetation unit H6.**

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
H7 – *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees to low open woodland over *Senna glutinosa* subsp. *glutinosa, Acacia maitlandii* scattered shrubs over *Triodia wiseana* and/or *T. vanleeuwenii* and/or *T. pungens* open hummock grassland to hummock grassland **Associated species:** *Acacia aptaneura*, *A. bivenosa*, *A. catenulata* subsp. *occidentalis, A. pruinocarpa, A. tenuissima*, *Amphipogon sericeus*, *Capparis lasiantha*, *Cymbopogon ambiguus*, *Enneapogon polyphyllus*, *Eremophila latrobei* subsp. *glabra*, *Eriachne mucronata*, *Eriachne pulchella*, *Gompholobium oreophilum*, *Goodenia stobbsiana*, *Hakea chordophylla*, *Indigofera monophylla*, *Jasminum didymum* subsp. *lineare*, *Paraneurachne muelleri*, *Ptilotus calostachyus*, *Scaevola acacioides*, *Schizachyrium fragile*, *Senna glutinosa* subsp. ×*luerssenii*, *Sida* sp. Pilbara (A.A. Mitchell PRP 1543), *Solanum lasiophyllum*	HD01, HD14, HD46, HDR05, HDR09, HDR13, BHD05-AR	Good - Excellent	H7: 1,840.6 (17.0)	 Plate 7: Vegetation unit H7.
H8 – *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees to low open woodland over *Acacia pruinocarpa*, *Hakea chordophylla* scattered tall shrubs to tall open shrubland over *Triodia vanleeuwenii*, (*T. pungens*) open hummock grassland to hummock grassland with *Amphipogon sericeus* scattered tussock grasses **Associated species:** *Acacia aptaneura*, *A. bivenosa*, *Cymbopogon ambiguus*, *Duperreya commixta*, *Eriachne mucronata, E. pulchella*, *Eucalyptus gamophylla*, *Goodenia stobbsiana, G. triodiophila*, *Indigofera monophylla*, *Jasminum didymum* subsp. *lineare*, *Pterocaulon sphacelatum*, *Ptilotus calostachyus, Ptilotus rotundifolius*, *Senna artemisioides* subsp. *oligophylla, S. glutinosa* subsp. *glutinosa*, *S. glutinosa* subsp. × *luerssenii, S. glutinosa* subsp. *pruinosa*, *Solanum lasiophyllum*	HD12, HD39, HD41, HD50, HD53, HDR02, BHD10-AR, GH24	Good - Excellent	H8: 1,056.7 (9.8)	 Plate 8: Vegetation unit H8.

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
H9 – *Acacia arida, Grevillea wickhamii* subsp. *hispidula* open shrubland over *Triodia wiseana* open hummock grassland with *Themeda* sp. Mt Barricade (M.E. Trudgen 2471) very open tussock grassland **Associated species:** *Androcalva luteiflora, Corymbia hamersleyana* sens. lat., *Cymbopogon ambiguus*, *Gossypium australe*	HD16	Excellent	H9: 32.4 (0.3)	 Plate 9: Vegetation unit H9.
H10 – *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees with *E. repullulans* and/or *E. socialis* subsp. *eucentrica* and/or *E. pilbarensis* scattered low mallees to low open mallee woodland over *Acacia bivenosa* scattered shrubs over *Triodia wiseana, (T. angusta)* open hummock grassland to hummock grassland **Associated species:** *Acacia synchronicia, Aristida contorta*, *Capparis lasiantha*, *Cymbopogon ambiguus*, *Enneapogon caerulescens*, *Maireana georgei*, *Paraneurachne muelleri*, *Ptilotus exaltatus*, *Ptilotus obovatus*, *Salsola australis*, *Senna artemisioides* subsp. *oligophylla*, *Senna glutinosa* subsp. *glutinosa*, *Senna glutinosa* subsp. ×*luerssenii, Solanum lasiophyllum*, *Sporobolus australasicus*	HD21, HD44, HDR01, HDR07, GH06	Very Good - Excellent	H10: 824.4 (7.6)	 Plate 10: Vegetation unit H10.

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
H11 – *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees with *E. gamophylla* low open mallee woodland over *Acacia ancistrocarpa* scattered tall shrubs to tall open shrubland over *A. hilliana* scattered low shrubs to low open shrubland over *Triodia vanleeuwenii*, (*T. pungens*) open hummock grassland to hummock grassland **Associated species:** *Acacia adoxa* var. *adoxa, A. aptaneura*, *A. bivenosa*, *A. maitlandii*, *A. pachyacra, A. pruinocarpa*, *A. tenuissima, Amphipogon sericeus*, *Anthobolus leptomerioides*, *Aristida holathera* var. *holathera*, *Aristida inaequiglumis*, *Capparis lasiantha*, *Cymbopogon ambiguus*, *Duperreya commixta*, *Enneapogon polyphyllus*, *Gompholobium oreophilum*, *Goodenia stobbsiana*, *Hakea chordophylla*, *Halgania gustafsenii* var. *gustafsenii*, *Indigofera monophylla*, *Jasminum didymum* subsp. *lineare*, *Paraneurachne muelleri*, *Pterocaulon sphacelatum*, *Ptilotus calostachyus*, *Ptilotus rotundifolius*, *Scaevola parvifolia* subsp. *pilbarae*, *Senna glutinosa* subsp. *glutinosa, Solanum lasiophyllum, Themeda triandra, Triodia wiseana*	HD11, HD54, GH12, GH27	Very Good - Excellent	H11: 229.0 (2.1)	 **Plate 11: Vegetation unit H11.**

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
H12 – *Corymbia hamersleyana* sens. lat. scattered low trees over *Acacia inaequilatera*, *Hakea chordophylla*, *A. bivenosa* scattered tall shrubs to tall open shrubland over *Senna artemisioides* subsp. *oligophylla* scattered low shrubs over *Triodia wiseana* open hummock grassland to hummock grassland with *Themeda* sp. Mt Barricade (M.E. Trudgen 2471), *Cymbopogon ambiguus* scattered tussock grasses and *Heliotropium ovalifolium, Corchorus lasiocarpus* subsp. *parvus* scattered herbs **Associated species:** *Acacia arida*, *A. dictyophleba*, *A. pyrifolia*, *Aristida contorta*, *Aristida holathera* var. *holathera*, *Bonamia pilbarensis*, *Cheilanthes lasiophylla*, *Dodonaea coriacea*, *Enneapogon caerulescens*, *Eriachne mucronata*, *Eulalia aurea*, *Euphorbia careyi*, *Goodenia prostrata*, *Hibiscus sturtii* var. *campylochlamys*, *Indigofera monophylla*, *Jasminum didymum* subsp. *lineare*, *Paraneurachne muelleri*, *Polycarpaea corymbosa* var. *corymbosa*, *Pterocaulon sphacelatum*, *Ptilotus astrolasius*, *Ptilotus calostachyus*, *Scaevola amblyanthera* var. *centralis*, *Schizachyrium fragile*, *Senna glutinosa* subsp. *glutinosa*, *Senna glutinosa* subsp. *pruinosa*, *Sida echinocarpa*, *Solanum phlomoides*, *Swainsona maccullochiana*, *Trichodesma zeylanicum* var. *zeylanicum*, *Tricoryne* sp. Hamersley Range (S. van Leeuwen 915)	HD19, HD33, HD47, GH05	Good - Excellent	H12: 656.1 (6.1)	 Plate 12: Vegetation unit H12.

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
Vegetation of Plains				
P1 – *Acacia aptaneura*, *A. catenulata* subsp. *occidentalis*, (*A. pruinocarpa*) tall shrubland to tall open scrub over *Eremophila forrestii* subsp. *forrestii* open shrubland to shrubland over *Triodia pungens*, (*T. vanleeuwenii*) scattered hummock grasses to very open hummock grassland **Associated species:** *Abutilon otocarpum*, *Acacia ayersiana*, *Aristida contorta*, *Aristida obscura*, **Bidens bipinnata*, *Cheilanthes sieberi* subsp. *sieberi*, *Chrysopogon fallax*, *Corchorus lasiocarpus* subsp. *parvus*, *Enneapogon caerulescens*, *E. lindleyanus*, *E. polyphyllus*, *Eremophila latrobei*, *Eriachne pulchella*, *Hibiscus burtonii*, *Iseilema vaginiflorum*, *Maireana tomentosa* subsp. *tomentosa*, *Paspalidium clementii*, *Perotis rara*, *Psydrax suaveolens*, *Ptilotus exaltatus*, *Senna artemisioides* subsp. *helmsii*, *Sida* sp. dark green fruits (S. van Leeuwen 2260), *Sporobolus australasicus*	HD02, HD06, HD10, HD27, HD37, GH15, GH20	Very Good - Excellent	P1: 369.2 (3.4)	 Plate 13: Vegetation unit P1.

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
P2 – *Acacia aptaneura*, *A. pruinocarpa, A. tetragonophylla* scattered tall shrubs to tall open shrubland over *Eremophila forrestii* subsp. *forrestii, A. synchronicia* scattered shrubs over *Ptilotus obovatus, Sida fibulifera* scattered low shrubs over *Aristida latifolia*, *Astrebla elymoides*, *Eragrostis xerophila* open tussock grassland to tussock grassland **Associated species:** *Alternanthera nana, Aristida contorta*, *Chrysopogon fallax, Cleome viscosa*, *Crotalaria medicaginea* var. *neglecta*, *Cynodon convergens*, *Enchylaena tomentosa* var. *tomentosa*, *Enneapogon caerulescens*, *Enneapogon polyphyllus*, *Eragrostis setifolia*, *Eremophila longifolia, Eriachne obtusa, Evolvulus alsinoides* var. *villosicalyx*, *Fimbristylis dichotoma*, *Panicum decompositum*, *Rhagodia eremaea*, *Rhynchosia minima*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *×artemisioides*, *Solanum lasiophyllum*, *Sporobolus australasicus*, *Streptoglossa bubakii*, *Themeda triandra*, *Tragus australianus*	HD09, HD29, HD30, GH08	Very Good - Excellent	P2: 155.6 (1.4)	 **Plate 14: Vegetation unit P2.**

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
P3 – *Acacia aptaneura*, *A. catenulata* subsp. *occidentalis*, *A. pruinocarpa* tall open shrubland to tall shrubland over *Eremophila forrestii* subsp. *forrestii* scattered shrubs to open shrubland over *Triodia pungens* open hummock grassland to hummock grassland **Associated species:** *Acacia ayersiana, A. pachyacra*, *Aristida contorta*, *Aristida inaequiglumis*, *Aristida obscura*, *Cheilanthes sieberi* subsp. *sieberi*, *Codonocarpus cotinifolius*, *Corymbia deserticola* subsp. *deserticola*, *Cymbopogon ambiguus*, *Enneapogon polyphyllus*, *Eremophila latrobei*, *Eriachne pulchella*, *Hibiscus burtonii*, *Maireana tomentosa* subsp. *tomentosa*, *M. villosa*, *Petalostylis labicheoides*, *Psydrax suaveolens*, *Ptilotus obovatus, Sida* sp. dark green fruits (S. van Leeuwen 2260), *Solanum lasiophyllum, Triodia vanleeuwenii*	HD20, HD28, HD32, HD55, GH02, GH07	Degraded - Excellent	P3: 1,301.0 (12.0)	 **Plate 15: Vegetation unit P3.**
P4 – *Acacia pruinocarpa, A. aptaneura*, *A. catenulata* subsp. *occidentalis* tall open shrubland to tall shrubland over *Rhagodia eremaea* scattered shrubs **Associated species:** *Acacia macraneura, A. synchronicia, Anthobolus leptomerioides, Aristida contorta, Aristida ingrata, Cheilanthes sieberi* subsp. *sieberi, Duperreya commixta, Enchylaena tomentosa* var. *tomentosa, Enneapogon lindleyanus, Eremophila forrestii* subsp. *forrestii, Eucalyptus xerothermica, Evolvulus alsinoides* var. *villosicalyx, Grevillea berryana, Hibiscus sturtii, Maireana tomentosa* subsp. *tomentosa, Ptilotus obovatus, Salsola australis, Sclerolaena cornishiana, Sida fibulifera, Sida platycalyx, Solanum lasiophyllum*	GH21, GH26	Very Good	P4: 39.2 (0.4)	 **Plate 16: Vegetation unit P4.**

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
Vegetation of Drainage Lines				
D1 – *Corymbia hamersleyana* sens. lat., *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees to low open woodland over *Petalostylis labicheoides*, *Acacia monticola, A. maitlandii* scattered tall shrubs to tall shrubland over *Dodonaea lanceolata* var. *lanceolata, Androcalva luteiflora* scattered shrubs to open shrubland over *Triodia pungens* very open hummock grassland to open hummock grassland with *Themeda triandra*, *Eriachne mucronata* very open tussock grassland to open tussock grassland **Associated species:** *Acacia aptaneura*, *A. bivenosa*, *A. hamersleyensis, A. pruinocarpa*, *A. pyrifolia, Aristida contorta*, *Aristida holathera* var. *holathera*, *Capparis lasiantha*, *Corchorus lasiocarpus* subsp. *parvus*, *Cymbopogon ambiguus*, *Duperreya commixta*, *Enneapogon polyphyllus*, *Eucalyptus gamophylla*, *Gompholobium oreophilum*, *Gossypium robinsonii*, *Jasminum didymum* subsp. *lineare*, *Paraneurachne muelleri*, *Pterocaulon sphacelatum*, *Ptilotus calostachyus*, *Ptilotus exaltatus*, *Ptilotus obovatus*, *Santalum lanceolatum*, *Senna glutinosa* subsp. *glutinosa*, *Seringia elliptica*, *Sida* sp. spiciform panicles (E. Leyland s.n. 14/8/90), *Triodia vanleeuwenii*	HD25, HD34, HD35, HD38, HD51, GHR28	Very Good - Excellent	D1: 784.0 (7.2)	 Plate 17: Vegetation unit D1.

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
D2 – *Acacia aptaneura, A. catenulata* subsp. *occidentalis*, *A. pruinocarpa* tall shrubland to tall open scrub over *Petalostylis labicheoides* scattered shrubs to open shrubland over *Triodia pungens* very open hummock grassland with *Chrysopogon fallax* scattered tussock grasses **Associated species:** *Acacia ayersiana*, *A. citrinoviridis*, *A. tenuissima, Aristida contorta*, **Bidens bipinnata, Capparis lasiantha*, *Cheilanthes sieberi* subsp. *sieberi*, *Duperreya commixta*, *Enchylaena tomentosa* var. *tomentosa*, *Enneapogon polyphyllus*, *Eriachne mucronata, Eriachne pulchella*, *Eucalyptus leucophloia* subsp. *leucophloia*, *Eucalyptus xerothermica*, *Maireana villosa*, *Paraneurachne muelleri, Psydrax latifolia*, *Psydrax suaveolens*, *Ptilotus obovatus*, *Salsola australis*, *Senna artemisioides* subsp. *oligophylla*, *Sida fibulifera*, *Solanum lasiophyllum*, *Sporobolus australasicus, Themeda triandra*	HD08, HD49, HDR19, GH03, GH09	Very Good - Excellent	D2: 190.3 (1.8)	 **Plate 18: Vegetation unit D2.**
D3 – *Corymbia ferriticola*, *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Petalostylis labicheoides*, *Acacia hamersleyensis, Dodonaea viscosa* subsp. *spatulata* tall open shrubland over *Triodia pungens* very open hummock grassland with *Eriachne mucronata*, *Themeda* sp. Mt Barricade (M.E. Trudgen 2471), *Cymbopogon ambiguus* very open tussock grassland to tussock grassland **Associated species:** *Acacia aptaneura*, *A. catenulata* subsp. *occidentalis*, *A. mulganeura, A. pruinocarpa*, *Bulbostylis barbata*, *Clerodendrum tomentosum* var. *lanceolatum*, *Corymbia hamersleyana* sens. lat., *Dodonaea pachyneura, D. petiolaris*, *Duperreya commixta*, *Eremophila jucunda* subsp. *pulcherrima*, *Ficus brachypoda*, *Grevillea wickhamii* subsp. *hispidula*, *Indigofera fractiflexa* subsp. *fractiflexa*, *Jasminum didymum* subsp. *lineare*, *Psydrax latifolia*, *Ptilotus exaltatus*, *Senna glutinosa* subsp. *glutinosa*, *Sida* sp. Shovelanna Hill (S. van Leeuwen 3842), *Triodia wiseana*	HD24, HD26, HDR08, GHR10	Good - Excellent	D3: 51.8 (0.5)	 **Plate 19: Vegetation unit D3.**

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
D4 – *Eucalyptus victrix*, (*E. camaldulensis* subsp. *obtusa*) low open woodland to open woodland over *Acacia citrinoviridis*, *Petalostylis labicheoides* scattered tall shrubs to tall shrubland over *Androcalva luteiflora*, *Gossypium sturtianum* var. *sturtianum* scattered shrubs to open shrubland over *Triodia longiceps* scattered hummock grasses to very open hummock grassland with *Themeda triandra*, *Eulalia aurea*, (**Cenchrus ciliaris*) very open tussock grassland to tussock grassland and **Bidens bipinnata* scattered herbs **Associated species:** *Acacia bivenosa*, *A. dictyophleba*, *A. maitlandii*, *A. pyrifolia*, *Alternanthera nana*, *Aristida holathera* var. *holathera*, *Aristida lazaridis*, **Cenchrus setiger*, *Cleome viscosa*, *Corchorus lasiocarpus*, *Cymbopogon ambiguus*, *Cyperus vaginatus*, *Dichanthium sericeum* subsp. *humilius*, *Duperreya commixta*, *Enteropogon ramosus*, *Eragrostis tenellula*, *Eremophila longifolia*, *Eriachne mucronata*, *Eucalyptus xerothermica*, **Flaveria trinervia*, *Glycine canescens*, *Gossypium robinsonii*, *Jasminum didymum* subsp. *lineare*, **Malvastrum americanum*, *Paraneurachne muelleri*, *Phyllanthus maderaspatensis*, *Pluchea rubelliflora*, *Pterocaulon sphacelatum*, *Ptilotus obovatus*, *Rhynchosia minima*, *Santalum lanceolatum*, *Scaevola amblyanthera* var. *centralis*, *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186), *Triodia pungens*, *Triodia wiseana*	HD17, HD18, HD31, GH04, GH23	Good – Very Good	D4: 60.6 (0.6)	 Plate 20: Vegetation unit D4.

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
D5 – *Eucalyptus xerothermica* scattered low trees to low open woodland over *Petalostylis labicheoides, Acacia maitlandii, A. pyrifolia* tall open shrubland to tall shrubland over *Androcalva luteiflora* scattered shrubs over *Triodia longiceps* very open hummock grassland to open hummock grassland with *Themeda triandra*, *Eulalia aurea* open tussock grassland to tussock grassland and **Bidens bipinnata* scattered herbs **Associated species:** *Abutilon otocarpum*, *Acacia aptaneura*, *A. bivenosa, A. dictyophleba*, *Alternanthera nana*, *Aristida contorta*, *Boerhavia coccinea*, *Chrysocephalum apiculatum* subsp. *pilbarense*, *Chrysopogon fallax*, *Cleome viscosa*, *Crotalaria medicaginea* var. *neglecta*, *Dichanthium sericeum* subsp. *humilius*, *Duperreya commixta*, *Enneapogon lindleyanus, E. polyphyllus*, *Eragrostis cumingii*, *Eragrostis tenellula*, *Euphorbia biconvexa*, *Evolvulus alsinoides* var. *villosicalyx*, **Flaveria trinervia*, *Gossypium sturtianum* var. *sturtianum*, *Indigofera monophylla*, *Jasminum didymum* subsp. *lineare*, **Malvastrum americanum*, *Paraneurachne muelleri*, *Pterocaulon sphacelatum*, *Rhynchosia minima*, *Senna artemisioides* subsp. *×artemisioides*, *Stemodia grossa*	HD22, HDR18, GH01	Good - Excellent	D5: 52.9 (0.5)	 Plate 21: Vegetation unit D5.

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
D7 – *Acacia citrinoviridis, A. aptaneura, A. pruinocarpa* scattered tall shrubs to tall shrubland over *Senna artemisioides* subsp. *oligophylla* scattered low shrubs over *Triodia longiceps* open hummock grassland to hummock grassland **Associated species:** *Acacia pyrifolia*, *Androcalva luteiflora, Cleome viscosa, Duperreya commixta, Eremophila longifolia, Eucalyptus xerothermica, Hibiscus sturtii, Indigofera georgei, *Malvastrum americanum, Ptilotus obovatus, Rhagodia eremaea, Sida fibulifera, Solanum lasiophyllum, Triodia pungens*	GH22, GH25	Very Good - Excellent	D7: 64.2 (0.6)	 **Plate 22: Vegetation unit D7.**
D8 – *Eucalyptus xerothermica* scattered low trees to low open woodland over *Acacia aptaneura, A. catenulata* subsp. *occidentalis* tall open shrubland to tall open scrub over *Triodia pungens* scattered hummock grasses to very open hummock grassland with *Themeda triandra* very open tussock grassland to open tussock grassland **Associated species:** *Acacia pruinocarpa, *Bidens bipinnata, Capparis lasiantha, Chrysopogon fallax, Cleome viscosa, Dipteracanthus australasicus* subsp. *australasicus, Duperreya commixta, Maireana tomentosa* subsp. *tomentosa, *Malvastrum americanum, Ptilotus obovatus*	GH13, GH17	Very Good	D8: 42.6 (0.4)	 **Plate 23: Vegetation unit D8.**

Vegetation unit code and description	Sites(s)	Vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
Cleared	N/A	Completely Degraded	832.7 (7.7)	**N/A**

4.2.1.1 Vegetation Condition

Vegetation in the survey area ranged from 'Excellent' to 'Good' condition, with cleared areas assigned a condition of 'Completely Degraded' (Trudgen 1988) (Table 13; Figure J.1 – J.26, Appendix J). The most prevalent vegetation condition observed was 'Excellent' with 81.4% coverage, with much of the survey area free from introduced flora and grazing evidence. Vegetation of the major drainage lines (vegetation units D4 and D5) were generally in 'Good' to 'Very Good' condition due to the presence of introduced flora, in particular **Cenchrus* species. The presence of **Cenchrus* spp. within the survey area was generally low and restricted to major drainage lines and disturbed areas. **Bidens bipinnata* was the most abundant introduced flora species encountered within the survey area and was generally found in stands of mulga (*Acacia aneura* sens. lat.) and in drainage lines associated with upper slopes.

An extensive network of drill lines, drill pads, tracks and active mining areas existed throughout the survey area. This cleared vegetation accounts for 832.7 ha (7.7%) in the survey area, however the disturbance layer provided for the reporting did not include the majority of the tracks and pads associated with recent exploration drilling at HD2 and clearing at Baby Hope. A number of colonising species were observed regenerating on tracks associated with the exploration drilling, but most tracks remain cleared of vegetation. Other minor disturbances included grazing by cattle and camels in the drainage lines and associated plains, significant sections of the survey area being burnt during 2015 and 2016 (Section 3.2.4), and minor evidence of dust on vegetation, usually in association with exploration tracks through bulldust areas.

Table 13: Vegetation condition recorded for the survey area.

Vegetation condition	Total mapped area within the survey area (ha)	Proportion of the survey area (%)
Excellent	8,805.1	81.4
Very Good	1,147.5	10.6
Good	32.4	0.3
Completely Degraded	832.7	7.7

4.2.1.2 Threatened and Priority Ecological Communities

The buffer of the priority 1 PEC '*Weeli Wolli Spring Community*' intersects the survey area. No vegetation is considered to have affinity with the priority 1 PEC '*Weeli Wolli Spring Community*' within the survey area.

The buffer of the priority 1 PEC '*West Angelas Cracking-Clays*' occurs approximately 9 km to the south-west of the survey area. The P2 vegetation unit which occurred as a fine scale mosaic of shrublands and tussock grasslands on cracking-clays and alluvial plains is considered to share similarities with the PEC, however is unlikely to represent the PEC. The degree to which P2 aligns with the PEC was difficult to determine given the poor seasonal conditions and therefore limited occurence and/or poor condition of annual and short-lived perennial species which characterise the community, however the mosaic and small scale nature of the tussock grasslands is not consistent with mapped occurrences of the PEC. The tussock grasslands component of the P2 mosaic vegetation (which shares most affinity with the PEC) occurred in isolated patches of cracking clay soils in slight depressions. These areas were too small to be mapped individually. The presence of *Aristida latifolia* and *Astrebla elymoides* and a number of other *Aristida* spp. characterised the tussock grasslands of the P2 vegetation, as is typical of the PEC. Similarly, *Sida fibulifera,* which is also typical of the PEC, was present in this vegetation.

During the Phase 1 and Phase 2 surveys the presence of *Astrebla* spp. was unable to be confirmed in sites installed in the P2 vegetation unit. During the Phase 3 survey the presence of *Astrebla elymoides* was confirmed in the newly installed quadrat GH08 and other previously surveyed sites (HD09, HD29, HD30) were reviewed and found to support an unidentifiable *Astrebla* spp. previously misidentified as sterile *Eulalia aurea*. Surrounding these small patches of tussock grasslands (and within the same mapped vegetation habitat) were open shrublands on slightly elevated soils with a stony mantle that were typically characterised by scattered *A. aptaneura, A. pruinocarpa* and/or *A. tetragonophylla*; these areas do not have the same affinity to the PEC. A number of other herbaceous species typical of clay habitats may be expected to occur in the PEC, including: *Senna hamersleyensis, Tephrosia* sp. clay soils (S. van Leeuwen et al. PBS 0273), *Lotus cruentus, Neptunia dimorphantha, Panicum laevinode, Sida spinosa, Hibiscus verdcourtii, Operculina aequisepala, Ipomoea lonchophylla, Desmodium campylocaulon, Desmodium muelleri, Euphorbia inappendiculata, Oldenlandia* sp. Hamersley Station (A.A. Mitchell PRP 1479) and *Swainsona thompsoniana* P3 (H. Ajduk, Rio Tinto, pers.comm). Most of these species were not observed, however the majority are annuals or short-lived perennial species and therefore are unlikely to have been detected during the poor seasonal conditions if they occurred.

The buffer of the '*Coolibah – Lignum Flats*' PEC occurs within 10 km of the survey area. The indicator species *Duma florulenta* (lignum) was not recorded and there are no previous records of this species within the survey area. No vegetation units recorded had affinity with this PEC and as such it is considered unlikely that this PEC occurs within the survey area.

No other vegetation that has affinity to a listed TEC or PEC was observed in the survey area.

4.2.1.3 Ecosystems at Risk

As part of the biodiversity audit of each IBRA bioregion carried out by the then Department of Conservation and Land Management, a number of ecological communities were identified as 'ecosystems at risk' (McKenzie, May, and McKenna 2002). This audit was conducted prior to the formal PEC listing process and many of the ecological communities highlighted were subsequently raised to PEC status. There were a number of ecological communities not raised to PEC status that were identified through this audit, three of which have relevance to the survey area (Kendrick 2001).

- Grove/inter-grove mulga, Eastern Hamersley Range –this community was represented by the vegetation unit P1 within the survey area where the banded mulga is pronounced. Impacts from existing drill lines, cattle grazing and non-aggressive weeds were present in this vegetation unit and there is an ongoing risk of changed surface water flows from clearing for exploration. Despite these impacts the majority of this vegetation unit ranged from 'Excellent' to 'Very Good' condition.
- Valley floor mulga –this community was represented by the vegetation unit P3 within the survey area. Condition ranged from 'Very Good' to 'Excellent' and very little to no disturbance was noted. Scattered non-invasive weeds and low-level grazing were recorded in some areas.
- Lower-slope mulga – this community was represented by the vegetation unit H2 within the survey area. Condition ranged from 'Very Good' to 'Excellent' and very little to no disturbance was noted beyond some scattered non-invasive weeds.

4.2.1.4 Groundwater Dependent Ecosystems

Of the 23 vegetation units within the survey area, one (D4) was considered to be a potential groundwater dependent ecosystem (GDE) due to the presence of *Eucalyptus camaldulensis* subsp.

obtusa and *E. victrix. Eucalyptus camaldulensis* subsp*. obtusa* and *E. victrix* are considered facultative phreatophytes and use groundwater opportunistically during periods of drought or some life stages and therefore have some dependence on groundwater (Lamontagne et al. 2005). Permanent pools of water were not observed within the D4 vegetation unit.

4.2.1.5 Vegetation of Local Significance

The vegetation units associated with conservation significant flora species were assessed against the rating scale prepared and provided by Rio Tinto, to assess local significance (Table F.3, Appendix F). Vegetation units were rated as high, moderate, low or negligible according to the criteria. Vegetation units rated as high or moderate local significance are described below.

The H2 vegetation unit occurred on the south-facing upper debris slopes of BHT and supported conservation significant flora in relatively dense populations, in particular *Eremophila* sp. West Angelas (S. van Leeuwen 4068) P1 and *Eremophila* sp. Hamersley Range (K. Walker KW 136) P3. This vegetation unit was largely unaffected by recent fires and may act as refuge habitat for conservation significant flora taxa. Vegetation unit H2 also has affinity to the Ecosystem at Risk 'lower-slope mulga' referred to in Section 4.2.1.3. As such the H2 vegetation unit has high conservation significance at a local scale (Table F.3, Appendix F).

The D3 vegetation unit occurred on the deeper incised gorges of BHT and supported a number of conservation significant flora taxa including *Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2 and *Eremophila* sp. Hamersley Range (K. Walker KW 136) P3. This vegetation unit was largely unaffected by recent fires and may act as refuge habitat for conservation significant flora taxa; as such, the D3 vegetation unit has moderate conservation significance at a local scale (Table F.3, Appendix F).

The P2 vegetation unit occurred on the cracking clays and alluvial plains within HD2 and supported a number of populations of *Aristida lazaridis* P2. This cracking clay habitat appeared to be locally restricted and although not likely to represent a PEC it appears to have a specific habitat requirement and assemblage of species not otherwise observed in the local area; as such it may be restricted. Vegetation unit P2 has moderate conservation significance at a local scale (Table F.3, Appendix F).

The D4 vegetation unit occurred on major drainage lines that supported the potential GDE species *Eucalyptus camaldulensis* subsp*. obtusa* and *E. victrix,* and the P2 taxa *Aristida lazaridis;* it is therefore considered to have high conservation significance at a local scale (Table F.3, Appendix F). To a lesser extent the D5 vegetation unit also supported *E. camaldulensis* subsp*. obtusa, E. victrix* and *A. lazaridis* P2*,* and has moderate to high conservation significance at a local scale (Table F.3, Appendix F).

The remaining vegetation associations recorded in the survey area represent what may be expected on similar landforms in the broader Hamersley subregion and are not considered locally restricted.

4.2.1.6 Floristic Groups – Current Survey

There were 23 significant clusters identified in the dendrogram examining the square root transformation of PFC data of the 99 sites from within the survey area. The number of significant clusters aligned with structural interperation of vegetation diversity and thus the results of the dendrogram were considered when describing vegetation units. Eight of these clusters were represented by a single survey site (Table 14; Figure K.2, Appendix K).

Table 14: Floristic groups identified by one site in the PFC analysis with square root transformation and corresponding structural vegetation unit.

Quadrat /relevé	Quadrat/relevé description	Vegetation unit code
GH13	*Eucalyptus xerothermica* low open woodland over *Acacia aptaneura* tall open shrubland over *Ptilotus obovatus* scattered low shrubs over *Themeda triandra* open tussock grassland	D8
HD16	*Acacia arida, Grevillea wickhamii* subsp. *hispidula, Androcalva luteiflora* open shrubland over *Triodia wiseana* open hummock grassland with *Themeda* sp. Mt Barricade (M.E. Trudgen 2471) very open tussock grassland	H9
HD29	*Acacia aptaneura*, (*A. pruinocarpa*, *Eremophila longifolia*, *A. pteraneura*) tall shrubland over *E. forrestii subsp. forrestii* scattered shrubs over *Ptilotus astrolasicus, E. lanceolata, P. obovatus* low open shrubland over *Chrysopogon fallax, Aristida* sp., (*Aristida latifolia, Eriachne obtusa, E. benthamii, Themeda triandra*) tussock grassland	P2
HD42	*Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia sibirica*, *A. incurvaneura, A. catenulata* subsp. *occidentalis* tall shrubland over *Senna stricta* open shrubland over *Triodia vanleeuwenii*, (*T. pungens, T. angusta*) open hummock grassland	H6
HD44	*Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees with *E. repullulans*, (*E. socialis* subsp. *eucentrica*) low open mallee woodland over *Acacia synchronicia* scattered shrubs over *Maireana georgei*, *M. eriosphaera* low open shrubland over *Triodia wiseana*, *T. brizoides* hummock grassland	H10
HDR07	*Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia inaequilatera, A. synchronicia* open shrubland over *Eremophila jucunda* subsp. *pulcherrima, Senna artemisioides* subsp. *oligophylla* scattered low shrubs over *Triodia wiseana* hummock grassland with *Cymbopogon ambiguus, Eulalia aurea* very open tussock grassland	H10
HDR14	*Acacia inaequilatera*, *Hakea chordophylla* tall open shrubland over *Gompholobium oreophilum, Dampiera candicans* low open shrubland over *Triodia vanleeuwenii* open hummock grassland with *Amphipogon sericeus* scattered tussock grasses	H3
BHD05-AR	*Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia hamersleyana* sens. lat. low open woodland over *Petalostylis labicheoides*, *Grevillea wickhamii* subsp. *hispidula* tall shrubland over *Mirbelia viminalis* low open shrubland over *Triodia wiseana*, *T. vanleeuwenii* very open hummock grassland	H7

Site GH13 occurred in the drainage vegetation unit D8 to the north-east of HD2. Drainage units may not cluster together when assessed using multivariate analysis; this can be partially attributed to flora species from the surrounding vegetation being present that may not be representative of the drainage vegetation.

Site HD16 occurred in the hills and slopes vegetation unit H9 in HD2 and represented a reasonably species-poor vegetation unit that occurred on low dolerite hills. No other sites showed affinity to this vegetation unit structurally and the landform was considered poorly represented within the survey area. As such the site would be expected to group on its own floristically and is consistent with the structural observations.

Site HD29 occurred in the plains vegetation unit P2 in HD2. Although structurally similar to the other sites in this vegetation unit, HD29 had exposed clay soils that appeared more preferential for grazing. As such a number of species not present at the other sites were recorded, including **Chloris virgata, Aristida obscura, Capparis lasiantha* and *Cuscuta victoriana*.

Site HD42 occurred in the hills and slopes unit H6 in HD2. Occurrences of H6 in this area of HD2 were restricted and surrounded by H7. There was higher cover of *Eucalyptus leucophloia* subsp. *leucophloia* and *Triodia* spp. than were normally recorded in H6, probably influenced by the surrounding H7 vegetation. Site HD42 grouped in a significant cluster adjacent to other H6 sites in the PFC analysis (Figure K.2, Appendix K) and within the same significant cluster as other H6 sites in the presence/absence analysis (Figure K.3, Appendix K).

Site HD44 occurred in the hills and slopes vegetation unit H10 in HD2. This site occurred in an area with minor drainage and denser *Triodia* spp., *Eucalyptus* spp. and a high cover of *Maireana* spp. than was normally associated with H10. These factors may have contributed to its unique cluster.

Site HDR07 also grouped in vegetation unit H10 due to the presence of *E. repullulans* and *E. leucophloia* subsp. *leucophloia.* A number of species more typical of drainage lines, such as *Eriachne benthamii* and *Eulalia aurea*, were recorded in this hills and slopes vegetation unit and are likely to have caused the floristic separation of this site. Specimens of these taxa were not collected from the site and therefore there is potential that they could have been misidentified in the field.

Site HDR14 occurred in the hills and slopes unit H3 on the low undulating hills north of BHT. This site was established in an area affected by fire in 2015 and close to minor drainage line D1 vegetation. The vegetation had not recovered well from fire and had much lower cover of *Triodia vanleeuwenii* than other H3 sites in the nearby area. Site HDR14 grouped in the adjacent significant cluster to other H3 sites in the PFC analysis (Figure K.2, Appendix K) and within the same significant cluster as all other H3 sites in the presence/absence analysis (Figure K.3, Appendix K).

BHD05-AR occurred in the hills and slopes unit H7 at Baby Hope Downs. This quadrat was originally established in Biota (2014),and rescored during the Phase 3 field visit. This area was burnt during 2016 and the resampling recorded a high density of *Petalostylis labicheoides*.

There were 22 significant clusters identified within the presence/absence dendrogram of the 99 sites, eight of which were represented by a single survey site (GH06, GH13, GH23, HD16, HD21, HD29, HD33 and HDR07) (Table 15; Figure K.3, Appendix K). The presence/absence analysis identified a similar number of groups (22 clusters) to the structural interpretation (23 vegetation units). The sites within clusters generally grouped similarly to the structural vegetation units described within the survey area and related to similar landforms.

Table 15: Floristic groups identified by one site in the presence/absence analysis and corresponding structural vegetation unit.

Quadrat /relevé	Quadrat/relevé description	Vegetation unit code
GH06	*Eucalyptus socialis* subsp. *eucentrica, E. repullulans* low open woodland over *Acacia bivenosa* scattered tall shrubs over *Triodia wiseana* open hummock grassland	H10
GH13	*Eucalyptus xerothermica* low open woodland over *Acacia aptaneura* tall open shrubland over *Ptilotus obovatus* scattered low shrubs over *Themeda triandra* open tussock grassland	D8
GH23	*Eucalyptus victrix* scattered low trees over *Acacia citrinoviridis*, (*Atalaya hemiglauca*) tall shrubland over *Corchorus lasiocarpus* subsp. *lasiocarpus* open shrubland over *Triodia longiceps*, *T. pungens* very open hummock grassland	D4
HD16	*Acacia arida*, *Grevillea wickhamii* subsp. *hispidula*, *Androcalva luteiflora* open shrubland over *Triodia wiseana* open hummock grassland with *Themeda* sp. Mt Barricade (M.E. Trudgen 2471) very open tussock grassland	H9
HD21	*Eucalyptus socialis* subsp. *eucentrica*, (*E. pilbarensis*) low open mallee woodland over *Triodia wiseana*, *T. angusta*, (*T. vanleeuwenii*) hummock grassland	H10
HD29	*Acacia aptaneura*, (*A. pruinocarpa*, *Eremophila longifolia*, *A. pteraneura*) tall shrubland over *E. forrestii* subsp. *forrestii* scattered shrubs over *Ptilotus astrolasicus*, *E. lanceolata*, *P. obovatus* low open shrubland over *Chrysopogon fallax*, *Aristida* sp., (*Aristida latifolia*, *Eriachne obtusa*, *E. benthamii*, *Themeda triandra*) tussock grassland	P2
HD33	*Corymbia hamersleyana* scattered low trees over *Acacia inaequilatera* tall open shrubland over *Corchorus lasiocarpus* subsp. *parvus*, *Indigofera monophylla* scattered low shrubs over *Triodia wiseana* hummock grassland with *Heliotropium ovalifolium* scattered herbs	H12
HDR07	*Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia inaequilatera*, *A. synchronicia* open shrubland over *Eremophila jucunda* subsp. *pulcherrima*, *Senna artemisioides* subsp. *oligophylla* scattered low shrubs over *Triodia wiseana* hummock grassland with *Cymbopogon ambiguus*, *Eulalia aurea* very open tussock grassland	H10

Site GH06 occurred in the hills and slopes vegetation unit H10 to the south of HD2. This site was species poor with 12 taxa recorded and the placement of the quadrat intersecting the corner of the neighbouring D1 drainage unit was not optimal. This site did present next to other H10 sites in the PFC dataset presented in Figure K.2 (Appendix K).

Site GH23 occurred in the drainage vegetation unit D4 to the north of BHT. This site lacked some of the taxa present in other D4 sites in the survey area and was defined by taxa typical of drier drainage lines. It is possible that this site represented a new vegetation unit occurring along Pebble Mouse Creek that was not described during the assessment. This site did present next to the cluster that contained all of the other D4 and D5 units in Figure K.3 (Appendix K).

Site HD21 occurred in the hills and slopes of vegetation unit H10 in HD2. The other sites in the H10 vegetation unit (HD44, HDR01, HDR07 and GH06) had an upper stratum typically dominated by *Eucalyptus repullulans, E. leucophloia* subsp. *leucophloia* and/or a presence of *E. socialis* subsp. *eucentrica*. *Eucalyptus pilbarensis* and *E. socialis* subsp. *eucentrica* dominated the upper stratum in site HD21 and no *E. repullulans* or *E. leucophloia* subsp. *leucophloia* were present, showing some floristic diversity in this mallee-dominated vegetation unit.

Site HD33 occurred in the hills and slopes vegetation unit H12 in HD2. HD33 was the only site to record a tree upper stratum (*Corymbia hamersleyana* sens. lat.) and did not have a tussock grass understorey present at the time of the surveys, unlike the other sites from that vegetation unit. A number of species unique to this site, but not unusual for the habitat, were also recorded including *Heliotropium tenuifolium, Scaevola amblyanthera* var. *centralis* and *Eremophila longifolia.*

Sites GH13, HD16, HD29 and HDR07 also occupied significant clusters in the PFC analysis and are interpreted in Table 14 above.

4.2.1.7 Floristic Groups – Broader Regional Context

Data from the 99 quadrats and relevés from the survey area was combined with that from the 757 permanent sites from a selection of projects within the vicinity of the survey area to provide a broader regional dataset for contextual analysis (Biota Environmental Sciences 2006; Mattiske Consulting 2008b, 2009b, 2010; Ecologia Environment 2013; Biota Environmental Sciences 2014). Multivariate floristic analysis using the presence/absence of perennial native taxa identified 118 significant clusters within this broader regional dataset (Figure K.4a - K.4j Appendix K). Sites from the current survey were present in 31 of these significant clusters, with three clusters consisting exclusively of sites from the current survey. There were two sites (GH23 and HD29) that did not group with any other regional sites (Table 16). Neither of these sites grouped with any other quadrat or relevé in either the PFC and/or the presence/absence analysis and are further explained in Section 4.2.1.6.

Table 16: Significant clusters from the broader regional dataset formed exclusively by a single current survey site.

Survey site(s)	Vegetation unit code	Quadrat/relevé description
GH23	D4	*Eucalyptus victrix* scattered low trees over *Acacia citrinoviridis*, (*Atalaya hemiglauca*) tall shrubland over *Corchorus lasiocarpus* subsp. *lasiocarpus* open shrubland over *Triodia longiceps*, *T. pungens* very open hummock grassland
HD29	P2	*Acacia aptaneura*, (*A. pruinocarpa*, *Eremophila longifolia*, *A. pteraneura*) tall shrubland over *E. forrestii* subsp. *forrestii* scattered shrubs over *Ptilotus astrolasicus*, *E. lanceolata*, *P. obovatus* low open shrubland over *Chrysopogon fallax*, *Aristida* sp., (*Aristida latifolia*, *Eriachne obtusa*, *E. benthamii*, *Themeda triandra*) tussock grassland

To understand the regional context and validate concerns about previous data, key results from the floristic analysis for the current and previous surveys are summarised in Table 17. The species lists assembled for each site and used in the broader regional dataset was also used to calculate the average number of taxa occurring per site for each project.

Table 17: Summary of sites for each project included in the broader regional dataset.

Project	No. of sites in dataset	No. of significant clusters occupied[1]	No. of significant clusters exclusively occupied[1]	No. of significant clusters sharing at least one current survey site[1]	Mean number of native taxa per site[2]	No. of sites surveyed per team per day[3]
Biota (2006)	42	17	1	12	31.7 ±2.0	2.5
Mattiske (2008b)	267	46	14	3	17.6 ±0.4	8.1
Mattiske (2009b)	139	39	9	6	17.5 ±0.6	8.2
Mattiske (2010)	118	29	3	3	17.5 ±0.5	16.9
Ecologia (2013)	150	39	13	16	34.1 ±0.9	3.3
Biota (2014)	25	12	2	5	33.8 ±2.6	2.5
Survey area – Phase 1/2	73	25	2	N/A	34.7 ±1.7	2.8
Survey area – Phase 3	30	18	1	N/A	26.1 ±1.5	2.2

[1] – see broader regional context dendrogram presented in Figure K.4a - K.4j (Appendix K).

[2] – taken from the broader regional dataset, includes ephemeral taxa but does not include unconfirmed and hybrid taxa and weeds.

[3] – taken from raw site data provided for each project, team may be single or multiple observers. Figures imply that each survey day was committed entirely to quadrat establishment, so these numbers are likely an overestimate and presented here for comparative purposes.

4.2.2 Flora

The survey area had 411 confirmed vascular flora taxa, from 52 families and 161 genera. There were 48 specimens that could not be identified to species level due to lack of identification material and may represent additional taxa for the survey area. None of these are suspected to represent conservation significant taxa. An additional eight specimens were considered hybrid taxa, seven of which were either *Acacia* or *Senna*, genera known to hybridise regularly, and one a suspected hybrid of *Eucalyptus xerothermica*. None of these are currently considered to represent conservation significant taxa. An additional two taxa (*Acacia aptaneura* sens. lat. and *Corymbia hamersleyana* sens. lat.) are considered to be part of wider complexes (S. van Leeuwen, pers. comm, 1 July 2019), and have not been included in the confirmed taxa count. There were three specimens left unresolved: *Eremophila* aff. *clarkei*, *Goodenia* sp. (of interest) and *Polymeria* aff. *longifolia*. Details of these specimens are presented in Section 4.2.2.4.

Of the unidentified specimens 14 were from the Poaceae family. The dominant confirmed native plant families were Fabaceae and Poaceae. *Acacia* was the most frequently recorded genus (Table 18). Although a number of herbaceous species were recorded, it is likely that diversity of annual and short-lived perennial species would be greater and their occurrence more widespread, following rainfall. A species list for the survey area and a matrix indicating species recorded within each quadrat or relevé is presented in Appendix L.

There was a complex association noted between the spinifex taxa *Triodia wiseana* and *T. angusta* within the survey area. These two taxa are closely related and share morphological similarities that

can make them difficult to separate, particularly when looking at the different variations of *T. wiseana* forms.

The species accumulation curve indicates that between 76% and 90% of the potential total species pool was available at the time of each phase of survey. The species accumulation curve indicates that the total number of species has reached asymptote, and that sampling has been near-exhaustive (Figure K.1, Appendix K).

Table 18: Taxa most frequently recorded in the survey area.

Family	Number of taxa
Fabaceae	74
Poaceae	74
Malvaceae	44
Asteraceae	21
Myrtaceae	18
Genus	**Number of taxa**
Acacia	37
Eremophila	16
Senna	16
Ptilotus	14
Sida	13

4.2.2.1 Conservation Significant Flora

Targeted searches and opportunistic recordings within the survey area identified 11 State-listed priority flora taxa: *Eremophila* sp. West Angelas (S. van Leeuwen 4068) P1, *Aristida lazaridis* P2, *Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2, *Eremophila* sp. Hamersley Range (K. Walker KW 136) P3, *Grevillea saxicola* P3, *Rhagodia* sp. Hamersley (M. Trudgen 17794) P3, *Triodia* sp. Mt Ella (M.E. Trudgen 12739) P3, *Acacia bromilowiana* P4, *Eremophila magnifica* subsp. *magnifica* P4, *Lepidium catapycnon* P4 and *Ptilotus mollis* P4. No EPBC Act or State-listed threatened flora was recorded.

Survey effort, as shown by track log traverses within the survey area, is presented in Figure M.1 - M.2 (Appendix M). Photographs and descriptions of conservation significant flora within the survey area are presented in Table N.1 (Appendix N). Conservation significant flora locations are presented in Table 19, Table N.2 (Appendix N) and mapped in Figure N.1 - N.6 (Appendix N). Habitat and abundance details for these taxa are summarised in the below text and Table 19. Three additional State-listed priority flora taxa were previously recorded within the survey area but not encountered during the current survey: A*cacia subtiliformis* P3, *Goodenia lyrata* P3 and *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) P3.

Eremophila sp. West Angelas (S. van Leeuwen 4068) P1 was recorded from three populations on the south facing slopes of BHT in vegetation unit H2. Records have been taken from the current survey and Rio Tinto (2015). Suitable habitat on the steep hillslopes was searched, however access in some parts was limited and it is possible more individuals may occur within this area, on slopes not able to be safely traversed. As such the population estimates presented in Table 19 are likely to have captured the majority of individuals that occur, but may not be completely comprehensive.

Aristida lazaridis P2 was recorded from drainage lines and associated flood out areas including the surrounding plains and lower hillslopes. Systematic searches were conducted in the majority of habitats likely to support this taxon within the survey area. The population numbers presented in Table 19 are considered a relatively comprehensive assessment of the abundance occurring in the survey area.

Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2 was associated with south facing slopes, gorges and gullies. Thorough searches were conducted for this taxon in accessible habitat where it was encountered. The population estimates presented in Table 19 are considered to be representative of the total abundance in the survey area.

Acacia subtiliformis P3 was previously recorded on the elevated plateau in BHT (Rio Tinto 2012). This area was burnt in 2015 (after the record had been made) and despite the site of the previous record being revisited, this taxon was unable to be relocated within the survey area.

Eremophila sp. Hamersley Range (K. Walker KW 136) P3 was recorded from four populations within the survey area. Two populations were recorded at BHT on south facing slopes in the H2 vegetation unit, and another two populations were recorded in nearby gorges in vegetation unit D3. Thorough searches were conducted for this taxon throughout the H2 vegetation unit, however the steep and rugged nature made accessing all potential habitat impossible. As such, the population details presented in Table 19 are considered to be a good representation of the total occurrence but may not be completely comprehensive.

Goodenia lyrata P3 was previously recorded from a single location within the survey area from the Baby Hope Downs Flora and Vegetation Survey (Biota Environmental Sciences 2014). The previous location was within mulga plains (P3) habitat adjacent to areas being cleared, as such the record was not accessible during the survey and could not be verified. *Goodenia lyrata* P3 was not recorded during the current survey.

Goodenia sp. East Pilbara (A.A. Mitchell PRP 727) P3 was previously recorded from three points in a single area (Biota Environmental Sciences 2006). The population occurs in vegetation unit P2 and was revisited during the survey but unable to be relocated, possibly due to its ephemeral habit. *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) P3 was not recorded in the current survey.

Grevillea saxicola P3 occurred in the survey area and was predominantly associated with south facing slopes, gorges and occasionally drainage features. Systematic searches were not conducted for this taxon and the population estimates presented in Table 19 are not a comprehensive assessment of the total abundance in the survey area.

Rhagodia sp. Hamersley (M. Trudgen 17794) P3 was recorded from three populations within the survey area and known from a further two populations from previous surveys. *Rhagodia* sp. Hamersley (M. Trudgen 17794) P3 is generally associated with mulga plains and was recorded in similar vegetation in HD2, however it was also recorded on the south facing slopes of BHT. None of the populations were systematically searched and as such the abundance presented in Table 19 is not a comprehensive representation of the total occurrence in the survey area. It may occur elsewhere in suitable habitat not targeted during the current survey.

Triodia sp. Mt Ella (M.E. Trudgen 12739) P3 was recorded in high abundance in association with a large gorge system with east and south-east facing slopes below ironstone escarpment on BHT. Smaller populations of *Triodia* sp. Mt Ella (M.E. Trudgen 12739) P3 were also recorded on south and north facing slopes below the escarpment. Systematic searches were not carried out in the eastern and northern most populations, while the other populations were thoroughly searched. The population numbers presented in Table 19 are not a comprehensive assessment of the total

abundance occurring in the survey area. It may occur elsewhere in suitable habitat not targeted during the current survey.

Acacia bromilowiana P4 was recorded in gorges and gullies. Systematic searches were not conducted for this taxon and as such the abundance presented in Table 19 is not a comprehensive assessment of the total abundance occurring in the survey area. It may occur elsewhere in suitable habitat not targeted during the current survey.

Eremophila magnifica subsp. *magnifica* P4 was previously recorded in close proximity to the survey area in the Baby Hope Downs area (Pilbara Iron 2006a, 2006c; Biota Environmental Sciences 2014; Department of Biodiversity, Conservation, and Attractions 2019e). The current survey recorded three additional locations near to the previous locations, within the survey area. It may occur elsewhere in suitable habitat not targeted during the current survey.

Lepidium catapycnon P4 was recorded from four populations and is generally associated with the steep slopes and rocky outcrops of ironstone hills. None of the known populations were systematically searched and as such the abundance presented in Table 19 is not a comprehensive assessment of the total occurrence in the survey area. It may occur elsewhere in suitable habitat not targeted during the current survey.

Ptilotus mollis P4 was recorded from four populations and was associated with hillslopes below small breakaways. None of the known populations have been systematically searched and as such the abundance presented in Table 19 is not a comprehensive assessment of the total occurrence in the survey area. It may occur elsewhere in suitable habitat not targeted during the current survey.

Table 19: Conservation significant flora recorded in the survey area and regionally.

Species	Survey area		All records	Habitat in survey area	Vegetation unit/s in survey area
	Recorded abundance from current survey	Abundance from all surveys[1]			
Eremophila sp. West Angelas (S. van Leeuwen 4068) P1	532	777	1,040	Very steep hillslopes, base of breakaways. High in the landscape	H1, H2
Aristida lazaridis P2	2,765	2,765	4,316	Plains, drainage lines, associated flood out areas.	D1, D4, H8, P2, P3, Cleared
Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2	386	488	1,548	Near summit of hills, high in landscape, gorges. gullies	D1, D3, H1, H2, H7, Cleared
Acacia subtiliformis P3[3]	0	2	93,366	On rocky calcrete plateaux, rocky slopes.	H1
Eremophila sp. Hamersley Range (K. Walker KW 136) P3	1,344	1,872	6,740	High in the landscape, cliff tops, gorge tops, steep rocky slopes.	D3, H1, H10, H2, H6
Goodenia lyrata P3[3]	0	1	127	Plains	P3
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727) P3[3]	0	80	80,290	Calcrete flats and rises	P2
Grevillea saxicola P3	1,669	1,898	2,514	Low rocky hills and associated slopes, footslopes and drainage features.	D1, D3, H1, H10, H2, H4, H6, H7, H8, Cleared
Rhagodia sp. Hamersley (M. Trudgen 17794) P3	77	84	7,446	Mulga plains, south facing slopes of ironstone hills.	D2, D5, D8, H2, P1, P2, P3, Cleared
Triodia sp. Mt Ella (M.E. Trudgen 12739) P3	3,542	4,457	46,851	Amongst rocks and outcrops, east and south-east facing gorge slopes, south facing breakaways.	D3, H1, H2, H7
Acacia bromilowiana P4	132	362	1,956	Rocky hills, breakaways, scree slopes, gorges, creek beds.	D1, D3, H1, H4, Cleared
Eremophila magnifica subsp. *magnifica* P4	3	22	1,690	Rocky hills, breakaways, slopes and gorges	D3, H7
Lepidium catapycnon P4	4,723	11,455	49,070	Hill top, slopes and drainage features.	D1, H1, H2, H3, H4, H7, Cleared

Species	Survey area		All records	Habitat in survey area	Vegetation unit/s in survey area
	Recorded abundance from current survey	Abundance from all surveys[1]			
Ptilotus mollis P4	50	432	946	Stony hills and screes, hillslopes below small breakaways.	D1, H1, H2, H4, H6, Cleared

[1] – Includes all current points that occur within the survey area and previous points occurring in the locality (Table N.2, Appendix N)

[2] – Includes all records compiled from Rio Tinto database, the current survey, all previous surveys in a 50 km radius and records supplied from the DBCA database searches.

[3] – Species not observed in current survey, but previous records exist within the survey area (Table N.2, Appendix N).

4.2.2.2 Post-survey Likelihood of Occurrence of Conservation Significant Flora

Following the survey, and with greater understanding of the landforms, soils and habitats of the survey area, 20 conservation significant flora taxa that have been previously recorded within the vicinity of the survey area are considered to have the potential to occur: *Vittadinia* sp. Coondewanna Flats (S. van Leeuwen 4684) P1, *Eremophila pusilliflora* P2, *Ipomoea racemigera* P2, *Isotropis parviflora* P2, *Oxali*s sp. Pilbara (M.E. Trudgen 12725) P2, *Teucrium pilbaranum* P2, *Amaranthus centralis* P3, *Aristida jerichoensis* var. *subspinulifera* P3*, Eremophila magnifica* subsp. *velutina* P3, , *Gymnanthera cunninghamii* P3, *Indigofera gilesii* P3, *Oldenlandia* sp. Hamersley Station (A.A. Mitchell PRP 1479) P3, *Pilbara trudgenii* P3, *Rostellularia adscendens* var. *latifolia* P3, *Sida* sp. Barlee Range (S. van Leeuwen 1642) P3, *Sida* sp. Hamersley Range (K. Newbey 10692) P3, *Swainsona thompsoniana* P3, *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) P3, *Eremophila youngii* subsp. *lepidota* P4 and *Goodenia nuda* P4 (Appendix E).

Eight of the 20 taxa (*Vittadinia* sp. Coondewanna Flats (S. van Leeuwen 4684) P1, *Ipomoea racemigera* P2, *Isotropis parviflora* P2, *Oxalis* sp. Pilbara (M.E. Trudgen 12725) P2, *Amaranthus centralis* P3, *Oldenlandia* sp. Hamersley Station (A.A. Mitchell PRP 1479) P3, *Swainsona thompsoniana* P3 and *Goodenia nuda* P4) are considered annuals and/or short lived perennials and were not encountered during the survey efforts; this may be due to the below average rainfall for all three site visits. The remaining 12 taxa: *Eremophila pusilliflora* P2, *Teucrium pilbaranum* P2, *Aristida jerichoensis* var. *subspinulifera* P3, *Eremophila magnifica* subsp. *velutina* P3, *Gymnanthera cunninghamii* P3, *Indigofera gilesii* P3, *Pilbara trudgenii* P3, *Rostellularia adscendens* var. *latifolia P3*, *Sida* sp. Barlee Range (S. van Leeuwen 1642) P3, *Sida* sp. Hamersley Range (K. Newbey 10692) P3, *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) P3 and *Eremophila youngii* subsp. *lepidota* P4 are perennial species and still have the potential to occur in the survey area. This is because the entire area was not systematically searched with only certain high-likelihood habitats targeted. Challenging terrain was also a limiting factor for traversing some parts of the survey area.

4.2.2.3 Range Extensions

One taxon recorded within the survey area, *Tinospora smilacina,* was considered a range extension of greater than 50 km from its currently known distribution. This taxon was recorded at one quadrat (HD26) within BHT.

4.2.2.4 Flora of Taxonomic Interest

The previously recorded location of *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) P3, located in HD2, was revisited during the Phase 3 field visit. The previous population was not relocated, possibly due to the dry seasonal conditions, however a flowering collection was made in nearby cracking clay and identified as *Goodenia* sp. (of interest). This specimen had characteristics similar to *G.* sp. East Pilbara (A.A. Mitchell PRP 727) P3 but this identification was unable to be confirmed due to a lack of seed. A critical identification character needed for confirming *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) P3 is the width of the wing on the seed (S. Dillon, pers. comm., 1st July 2019). It is possible that this specimen represents a species of conservation significance, as if it is not *G.* sp. East Pilbara (A.A. Mitchell PRP 727) P3 it may potentially be an undescribed taxon.

One specimen was identified as *Eremophila* aff. *clarkei*. *Eremophila clarkei* is a slender, erect shrub found in a variety of habitats throughout the Mid-West and Murchison regions to the south, with only a handful of records occurring in the southern Pilbara in the vicinity of Newman. *Eremophila clarkei* is a morphologically variable taxon and the specimen collected in the survey area was a low shrub with no reproductive material available for confirmation. This specimen was assigned the name *E.* aff. *clarkei* based on sterile leaf characters, leaf folding patterns and resinous nature (R. Davis, pers. comm., 1st July 2019). It is unlikely to represent a taxon of conservation significance.

One specimen was identified as *Polymeria* aff. *longifolia* from the survey area. *Polymeria* taxonomy is not clear at present and the material collected was not in good condition. The specimen appeared to be rhizomatous, which limits it to two taxa, only one of which (*P. longifolia*) has been recorded in Western Australia. The specimen had a corolla which was smaller and leaves which were not as sericeus as for *P. longifolia* (S. Dillon, pers. comm., 1st July 2019). Both of these characters are variable in *Polymeria* and this specimen was assigned the name *P.* aff. *longifolia*. It is unlikely to represent a taxon of conservation significance.

4.2.2.5 Introduced Flora (Weeds)

Weed diversity in the survey area was considered moderate with 17 weed taxa recorded from the current survey and previous surveys. Habitat and abundance details for these taxa are summarised in Table 20.

Bidens bipinnata* (bipinnate beggartick) was the most frequently recorded weed species, and was typically associated with creeks, mulga-dominated vegetation and, to a lesser degree, hillslopes. **Cenchrus* spp. (buffel grass and birdwood grass) were not as abundant as they are in the broader region, likely to be due to the dry seasonal conditions and rocky habitats of the survey area. None of the weed species recorded are listed as WoNS (Australian Weeds Committee 2012b), or as Declared Pest plants in Western Australia under the BAM Act (Department of Primary Industries and Regional Development 2018). Each of the weed species has been previously recorded in the Pilbara region. Eight of the species (Brassica tournefortii, *Cenchrus ciliaris*, **C. setiger*, **Chloris virgata*, **Cynodon dactylon, *Malvastrum americanum, *Setaria verticillata* and **Vachellia farnesiana*) have a high ecological impact and rapid invasiveness, according to the Pilbara prioirtisation process for weed management (Department of Biodiversity, Conservation, and Attractions 2018a) (Table 20).

Photographs and descriptions of weeds within the survey area are presented in Table O.1 (Appendix O). Indicative weed locations are mapped in Figure O.1 and presented in Table O.2 (Appendix O). Locations presented are indicative only and weed distribution was much higher, particularly in the disturbed and cleared areas.

Table 20: Introduced flora species (weeds) and associated habitats recorded within the survey area.

Species	Family	Survey area		Habitat in the survey area	Vegetation unit	Invasiveness rating[3]	
		Recorded abundance from current survey	Abundance from all surveys[1]			Ecological impact	Invasiveness
**Bidens bipinnata* (bipinnate beggartick)	Asteraceae	36,295	37,484	Drainage features, mulga plains, hillslopes	D1, D2, D4, D5, D7, D8, H2, H6, H7, H8, P1, P2, P3, Cleared	Unknown	Rapid
**Brassica tournefortii* (Mediterranean turnip)[2]	Brassicaceae	0	2	Major drainage line	Not recorded in current survey	High	Rapid
**Cenchrus ciliaris* (buffel grass)	Poaceae	11,634	11,651	Disturbed, plains, major and minor drainage, base of low hills	D1, D4, D5, H10, H12, P2, Cleared	High	Rapid
**Cenchrus setiger* (birdwood grass)	Poaceae	1,154	1,156	Major and minor drainage	D4, D5, H10, P2, Cleared	High	Rapid
**Chloris virgata* (feathertop Rhodes grass)	Poaceae	2	4	Plains	D4, P2	High	Rapid
**Conyza bonariensis* (flaxleaf fleabane)	Asteraceae	1	1	Footslopes/drainage feature	D4	No rating	No rating
**Cynodon dactylon* (couch)	Poaceae	5	5	Plains and drainage features including Weeli Wolli Creek	D5	High	Rapid
**Datura leichhardtii* subsp. *leichhardtii* (native thornapple)	Solanaceae	22	22	Plains, drainage features and near infrastructure	D5, P2	Unknown	Unknown
**Flaveria trinervia* (speedy weed)	Asteraceae	112	112	Major and minor drainage	D1, D4, D5, Cleared	No rating	No rating
**Lactuca serriola* (prickly lettuce)	Asteraceae	2	4	Plains	Cleared	No rating	No rating
**Malvastrum americanum* (spiked malvastrum)	Malvaceae	374	578	Major and minor drainage, footslopes	D2, D4, D5, D7, D8, P1, P2, Cleared	High	Rapid

Species	Family	Survey area		Habitat in the survey area	Vegetation unit	Invasiveness rating[3]	
		Recorded abundance from current survey	Abundance from all surveys[1]			Ecological impact	Invasiveness
**Rumex vesicarius* (ruby dock)[2]	Polygonaceae	0	17	Minor drainage line	Cleared	No rating	No rating
**Setaria verticillata* (whorled pigeon grass)	Poaceae	66	67	Major and minor drainage, plains	D1, D4, P2	High	Rapid
**Sigesbeckia orientalis* (Indian weed)	Asteraceae	1	8	Minor drainage	D4	Unknown	Rapid
**Solanum nigrum* (black berry nightshade)[2]	Solanaceae	0	8	Plains/ disturbed	Cleared	Low	Rapid
**Sonchus oleraceus* (common sowthistle)	Asteraceae	61	134	Major drainage	D4, D5, P3, Cleared	Low	Rapid
**Vachellia farnesiana* (mimosa bush)	Fabaceae	289	291	Major and minor drainage, plains, hillslopes	D1, D4, D5, H8, H10, P1, P2, Cleared	High	Rapid

[1] - An assumption of one individual was made where no abundance data was collected.

[2] - Taxa not observed in current survey (Phase 1, 2 or 3), but previously recorded within the survey area (Table O.2, Appendix O) (Astron Environmental Services 2014, 2016, 2018; Biota Environmental Sciences 2006; Mattiske Consulting 2010; Rio Tinto 2015).

[3] – Based on Department of Biodiversity, Conservation and Attractions (2018a).

5 Discussion

5.1 Overview of the Survey Area

The survey area was characterised by a low ironstone ridge that extends in a roughly east to west direction, and associated undulating low hills draining north towards Pebble Mouse Creek and its tributaries. The alluvial plains supported tussock grassland dominated vegetation units with some areas of cracking clays. Vegetation units on the undulating plains were mulga (*Acacia aneura* sens. lat.) dominated, with some areas of banded mulga. Geology differed in the south and east of HD2, with dolerite dominated geology featuring in the uplands and other minor mudstone and calcrete areas occurring in highly eroded low hills and lowlands.

5.2 Vegetation

Previously surveyed quadrats outside of the work conducted by Biota 2014 were not able to be located and re-sampled during the survey and new quadrats were installed to achieve the required spatial coverage for each vegetation unit. Five vegetation units occurring within the survey area (H5, H9, P4, D7, D8) did not achieve the minimum sampling replication effort of three quadrats per vegetation unit. This was generally due to limited areas within the survey area large enough to establish quadrats without influence from surrounding vegetation, restricted access, and the avoidance of burnt vegetation. One vegetation unit was described after completion of the field surveys and had not achieved three replicate quadrats.

Much of the previous vegetation mapping within and adjacent to the survey area poorly represented the vegetation and landforms observed in situ. This limited the ability to ground-truth and consolidate existing vegetation mapping (Mattiske Consulting 2009a, 2009b, 2010). Previous vegetation unit boundaries appeared to have been created post-survey and a number of discrepancies, such as ridge lines being mapped as drainage lines, limited attempts to consolidate it with new work. As such it was considered the best approach to conduct new vegetation mapping across the survey area to ensure consistency. The Biota (2006, 2014) vegetation mapping that intersected parts of the survey area at Baby Hope Downs was found to be a good representation of the vegetation observed in situ and was better able to be utilised in this assessment.

Twenty-three vegetation units were described and mapped within the survey area based on visual structural interpretation and aerial photography analysis. The multivariate floristic analysis of the 99 quadrats and relevés within the survey area found 22 significant clusters when presence of perennial native taxa was analysed, and 23 significant clusters when the PFC of perennial native taxa was analysed. The number of structural vegetation units described appears comprehensive and comparable to the number of significant clusters identified. The significant clusters generally grouped in support of the structural vegetation units described within the survey area; minor exceptions included different drainage units grouping together, hills and slopes sites forming large floristic clusters, and mulga-dominated sites across different landforms grouping together (Appendix K).

There were no Commonwealth or State listed TECs recorded within the survey area. One vegetation unit (P2) was associated with the Wannamunna land system and held some affinity with the priority 1 PEC '*West Angelas Cracking-Clays*'. Due to the below average seasonal conditions prior to all phases of survey, a number of the grass taxa occurring within this vegetation unit were unable to be identified to species level; this limited the ability to compare against the characteristic grass species of the PEC. Likewise, herbaceous species were likely to have been under-represented due to the poor seasonal conditions. Despite the seasonal limitation, it is considered likely that athough P2

shares some affinity with the PEC itis not of a large enough scale and floristically diverse enough to represent the PEC. The occurrence of *Astrebla* spp. within P2 is patchy and does not form the dense tussock grasslands typified by the PEC. Surveying in better seasonal conditions and finer scale vegetation mapping to separate the component vegetation types within the P2 mosaic would refine the current boundaries for the vegetation unit. The main threats to this community are disturbance footprints increasing from mining, future infrastructure development, possible weed invasion and changes in fire regime (Department of Biodiversity, Conservation, and Attractions 2017a).

Three mulga-dominated vegetation units recorded in the survey area may represent Ecosystems at Risk (Kendrick 2001). The 'grove/inter-grove mulga, Eastern Hamersley Range' ecosystem, represented by vegetation unit P1, and the 'valley floor mulga' ecosystem, represented by vegetation unit P3, are both described regionally as threatened by grazing from cattle and feral animals, weed invasion (particularly from ruby dock **Rumex vesicarius*) and changes in the surface hydrology such as water shadowing from linear infrastructure. Both P3 and H2, which represent the 'lower-slope mulga ecosystem', may also be threatened by fires which kill stands of mulga and/or prevent regeneration. Mulga-dominated vegetation was widespread throughout the survey area, and vegetation units P1, P3 and H2, account for 369.2 ha (3.4%), 1,301.0 ha (12.0%) and 314.8 ha (2.9%) of the survey area respectively.

The dominant tree species of vegetation unit D4, *Eucalyptus camaldulensis* subsp*. obtusa* and *E. victrix*, are considered facultative phreatophytes and therefore may have some reliance on groundwater. No permanent pools of water were observed within the areas surveyed in the D4 vegetation unit, and based on reviews of aerial imagery it is considered unlikely that these drainage lines would support pools outside of the wet season.

The survey area lies within the Pre-European vegetation associations 82, 18 and 29 (Beard 1975), all of which have above 99% pre-European extent remaining. This is well above the Australian and New Zealand Environment and Conservation Council 30% retention target (Commonwealth of Australia 2001) and the criteria for 10% level of pre-clearing extent as representing 'endangered' adopted by the EPA (Environmental Protection Authority 2000).

5.3 Flora

The suite of flora species recorded was considered typical of what may be expected in the area (Beard 1975; Kendrick 2001) and aligns with what has been previously recorded in surrounding areas (Biota Environmental Sciences 2006, 2014; Mattiske Consulting 1995, 2005, 2008b, 2008c, 2008d, 2009a, 2009b, 2010; Ecologia Environment 2013). Despite below average rainfall preceding all phases of survey, the floristic diversity was comparable with previous surveys in the region. It is likely however, that many of the annuals, short-lived perennials, grasses and herbaceous species that were noted would have been more widespread throughout suitable habitats in better seasonal conditions. Specimens generally had adequate material to allow confident identification, however a number of specimens collected were unable to be identified to species level.

The survey area was considered to have a relatively high diversity of conservation significant flora. The majority of priority flora points were recorded from the BHT ridge that runs through the centre of the survey area, although calcrete flats and rises, mulga plains and drainage lines also provided habitat for priority flora.

Six vouchered specimens are listed for *Eremophila* sp. West Angelas (S. van Leeuwen 4068) P1 (Western Australian Herbarium 1998-2019). Most of these records occur in the general locality of the survey area, with collections from West Angelas and Mount Robinson. The approximate range of the five specimens listed on NatureMap is 75 km (Department of Biodiversity, Conservation, and

Attractions 2019a). *Eremophila* sp. West Angelas (S. van Leeuwen 4068) P1 has been previously recorded high in the landscape on steep hills, similar to the habitat where the 532 individuals were recorded in the survey area (Table N.2, Appendix N). This accounts for 51.1% of the population known from records within a 40 km radius (Department of Biodiversity, Conservation, and Attractions 2017c, 2017e; Rio Tinto Iron Ore 2019). *Eremophila* sp. West Angelas (S. van Leeuwen 4068) P1 is difficult to distinguish from the common *Eremophila latrobei* subsp. *filiformis* which occurs in similar habitats; as such there is potential that this taxon has been misidentified in previous surveys in the vicinity and given its preference for habitat that is difficult to access it may have a greater distribution than is currently recognised. However, based on the records from this survey the habitat for this taxon appears to be quite specific and not widely distributed. As such there is potential that more populations may occur beyond the survey area but these may be limited in distribution.

Twenty vouchered specimens are listed for *Aristida lazaridis* P2 (Western Australian Herbarium 1998-2019). Vouchered specimens have been recorded from an approximately 130 km linear range, including in the general vicinity of the survey area (particularly near Mount Robinson), and near Mount Meharry in Karijini National Park and Newman. One record occurs approximately 545 km east of the normal range on NatureMap (2019a), however according to location details on the vouchered specimen the location coordinate appears to be incorrect. This species has been previously recorded on plains and floodplains with clay soils. A total of 2,765 individuals were recorded from the survey area (Table N.2, Appendix N). This accounts for 64.1% of the population known from records within a 40 km radius (Department of Biodiversity, Conservation, and Attractions 2017c, 2017e; Rio Tinto Iron Ore 2019). This species may be difficult to identify in poor seasonal conditions and/or following grazing, and therefore may not have been recorded from previous surveys in the vicinity. It is likely that further suitable habitat for *A.lazaridis* P2 occurs beyond the survey area in areas which have not been previously surveyed.

The majority of the 20 vouchered records of *Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2 are from the Karijini and Turee Syncline localities, however there are also two records in the vicinity of the survey area, at HD1 and West Angelas (Western Australian Herbarium 1998-2019). Records occur over an approximately 195 km linear range (Department of Biodiversity, Conservation, and Attractions 2019a). Vouchered specimens were generally collected from rocky gullies; the 386 individuals from the survey area were typically recorded on rocky slopes and gorges (Table N.2, Appendix N). This accounts for 24.9% of the population known from records within a 40 km radius (Department of Biodiversity, Conservation, and Attractions 2017c, 2017e; Rio Tinto Iron Ore 2019). Given the considerable range for this taxon, it is likely that further habitat occurs beyond the survey area in areas which have not been previously surveyed.

Twenty-three vouchered specimens are listed for *Acacia subtiliformis* P3 (Western Australian Herbarium 1998-2019), over a range of approximately 130 linear km (Department of Biodiversity, Conservation, and Attractions 2019a). Previous locations of *A. subtiliformis* P3 occur in the general vicinity of the survey area, including Hope Downs, Marillana, Weeli Wolli Springs, Giles Point and Rhodes Ridge. It has been previously associated with calcrete hills, rises and plains, similar habitat to where the two individuals were previously recorded from in the survey area (Table N.2, Appendix N). This accounts for <0.1% of the population known from records within a 40 km radius (Department of Biodiversity, Conservation, and Attractions 2017c, 2017e; Rio Tinto Iron Ore 2019). Although *A. subtiliformis* P3 has quite a specific habitat, it is likely to have further occurrences beyond the survey area in areas which have not been previously surveyed.

There are 17 vouchered specimens of *Eremophila* sp. Hamersley Range (K. Walker KW 136) P3 listed at the WA Herbarium (Western Australian Herbarium 1998-2019), over a range of approximately 215 linear km (Department of Biodiversity, Conservation, and Attractions 2019a). Location details of

these records indicate that the two main areas of occurrence are in the vicinity of Paraburdoo, near Turee Syncline and Channar, and hills close to the survey area, with records near Yandicoogina, West Angelas, Weeli Wolli Creek and Coondewanna. A total of 1,344 individuals were recorded from the survey area (Table N.2, Appendix N). This accounts for 19.9% of the population known from records within a 40 km radius (Department of Biodiversity, Conservation, and Attractions 2017c, 2017e; Rio Tinto Iron Ore 2019). Given the considerable range for this taxon, it is likely that further habitat occurs beyond the survey area in areas which have not been previously surveyed.

There are 17 vouchered specimens of *Goodenia lyrata* P3 listed at the WA Herbarium (Western Australian Herbarium 1998-2019) over an east to west range of approxiantely 940 km and north to south range of approximately 700 km (Department of Biodiversity, Conservation, and Attractions 2019a). This species has a relatively widespread distribution throughout Western Australia, but seems to be restricted to a few locations within the Pilbara region, near Mount Bruce Flats, Coondewanna Flats and West Angelas. The single previous record of *G. lyrata* P3 accounts for 0.8% of the population known from records within a 40 km radius (Department of Biodiversity, Conservation, and Attractions 2017c, 2017e; Rio Tinto Iron Ore 2019). Given the wide distribution of this taxon there is likely to be suitable habitat for *G. lyrata* P3 beyond the survey area in areas which have not been previously surveyed.

There are 37 vouchered specimens of *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) P3 listed at the WA Herbarium (Western Australian Herbarium 1998-2019), over a range of approximately 350 linear km (Department of Biodiversity, Conservation, and Attractions 2019a). Localities include Paraburdoo, Newman, Balfour Downs Station, Tom Price, Weeli Wolli Spring, Hope Downs, Rhodes Ridge and Noreena Downs Station. The 80 individuals that occur within the survey area account for <0.1% of the population known from records within a 40 km radius (Department of Biodiversity, Conservation, and Attractions 2017c, 2017e; Rio Tinto Iron Ore 2019). Although *G.* sp. East Pilbara (A.A. Mitchell PRP 727) P3 has quite a specific habitat, it is likely to have further occurrences beyond the survey area in areas which have not been previously surveyed.

Grevillea saxicola P3 has 37 vouchered records at the WA Herbarium (Western Australian Herbarium 1998-2019), over a range of approximately 225 linear km (Department of Biodiversity, Conservation, and Attractions 2019a). Distribution ranges from Mount Wall, the Paraburdoo area, Tom Price, Mount Meharry and in the vicinity of the survey area at West Angelas. Voucher records indicate that *G. saxicola* P3 has been previously recorded from a number of habitats, including slopes, gorges and drainage features, similar to the habitats it was associated with in the survey area. Current surveys recorded 1,669 individuals of *G. saxicola* P3 in the survey area (Table N.2, Appendix N). This accounts for 66.4% of the population known from records within a 40 km radius (Department of Biodiversity, Conservation, and Attractions 2017c, 2017e; Rio Tinto Iron Ore 2019). Given the wide distribution of this taxon there is likely to be suitable habitat for *G. saxicola* P3 beyond the survey area in areas which have not been previously surveyed.

Sixty-three vouchered specimens are listed for *Rhagodia* sp. Hamersley (M. Trudgen 17794) P3 (Western Australian Herbarium 1998-2019) over a range of approximately 275 linear km (Department of Biodiversity, Conservation, and Attractions 2019a). This species has a reasonably broad distribution, spanning Roy Hill Station, Shovelanna Hill, north of Tom Price, to the vicinity of the survey area, around Rhodes Ridge, Coondewanna and Weeli Wolli Spring. *Rhagodia* sp. Hamersley (M. Trudgen 17794) P3 is typically associated with alluvial plains with clay soils. According to the WA Herbarium collection database the majority of specimens were collected from plains, although some were also recorded on hillslopes, crests and a cliff (Western Australian Herbarium 1998-2019). Current surveys recorded 77 individuals from mulga plains and hillslopes in the survey area (Table N.2, Appendix N). This accounts for 1.0% of the population known from records within a 40 km radius (Department of Biodiversity, Conservation, and Attractions 2017c, 2017e; Rio Tinto

Iron Ore 2019). There are extensive alluvial plains in the broader area which have not been previously surveyed and are likely to provide suitable habitat for *R.* sp. Hamersley (M. Trudgen 17794) P3.

There were 35 vouchered specimens of *Triodia* sp. Mt Ella (M.E. Trudgen 12739) P3, over a range of approximately 380 linear km (Department of Biodiversity, Conservation, and Attractions 2019a). Occurrences span from Mount Robinson in the west to Shovelanna Hill in the east, and the species therefore has a relatively narrow band of distribution in the Hamersley Ranges, with one disjunct record near Rudall River. It has been previously recorded in similar habitats to those of the 3,542 individuals recorded in the survey area, including gorges, hilltops and slopes (Western Australian Herbarium 1998-2019) (Table N.2, Appendix N). This accounts for 7.6% of the population known from records within a 40 km radius (Department of Biodiversity, Conservation, and Attractions 2017c, 2017e; Rio Tinto Iron Ore 2019). *Triodia* sp. Mt Ella (M.E. Trudgen 12739) P3 can be difficult to distinguish from other resinous *Triodia* species (particularly when sterile) and may have been misidentified previously; its distribution could therefore be wider than currently recognised. The habitat that *T.*sp. Mt Ella (M.E. Trudgen 12739) P3 prefers is relatively widespread in the broader region and there are likely to be further occurrences of this taxon beyond the survey area in areas which have not been previously surveyed.

Twenty-nine vouchered records of *Acacia bromilowiana* P4 are listed, with a range of approximately 430 linear km (Department of Biodiversity, Conservation, and Attractions 2019a). The distribution of these records span from Brockman to Balfour Downs station, and in the vicinity of the survey area near Hope Downs, West Angelas and Mount Robinson (Western Australian Herbarium 1998-2019). The previous records are typically associated with gullies, slopes and hilltops, similar to the gully and gorge habitats it was recorded from in the survey area. The 132 individuals observed in the survey area were all recorded from the breakaways, scree slopes, gorges and drainage lines associated with BHT (Table N.2, Appendix N). This accounts for 6.7% of the population known from records within a 40 km radius. The habitat that *A.bromilowiana* P4 prefers is relatively widespread in the broader region and there are likely to be further occurrences of this taxon beyond the survey area in areas which have not been previously surveyed.

The 46 vouchered records of *Eremophila magnifica* subsp. *magnifica* P4 occur over a range of approximately 315 linear km (Department of Biodiversity, Conservation, and Attractions 2019a) and are localised to the Hamersley Range and surrounding hills, including areas in the vicinity of the survey area. The three individuals recorded in the survey area were located on hills and breakaways in the north-east and account for 0.2% of the population known from records within a 40 km radius (Department of Biodiversity, Conservation, and Attractions 2017c, 2017e; Rio Tinto Iron Ore 2019). Given the wide distribution of *E.magnifica* subsp. *magnifica* P4 there is likely to be suitable habitat beyond the survey area in areas which have not been previously surveyed.

Lepidium catapycnon P4 has 35 vouchered records, over a range of approximately 300 linear km (Department of Biodiversity, Conservation, and Attractions 2019a). Distribution ranges from Tom Price to Newman to Nullagine, with numerous records in the vicinity of the survey area, around Mount Robinson, Rhodes Ridge and Weeli Wolli Creek. Habitat information associated with the vouchers indicates a preference for hillslopes and tops, similar habitats to where *L. catapycnon* P4 was recorded from in the survey area (Western Australian Herbarium 1998-2019). The 4,723 individuals recorded in the survey area were located on hillslopes in BHT (Table N.2, Appendix N). This accounts for 9.6% of the population known from records within a 40 km radius (Department of Biodiversity, Conservation, and Attractions 2017c, 2017e; Rio Tinto Iron Ore 2019). *Lepidium catapycnon* P4 was previously listed as T and as such considerable targeted survey effort for this taxon has been previously undertaken in the broader region.

The WA Herbarium lists 36 vouchered specimens of *Ptilotus mollis* P4, over a range of approximately 650 linear km (Department of Biodiversity, Conservation, and Attractions 2019a). Distribution of *P. mollis* P4 is broad, with records spanning from Panorama Station to Cane River to Turee Creek, and including records in the vicinity of the survey area, near Mount Robinson (Western Australian Herbarium 1998-2019). The majority of vouchered specimens were collected from rocky hillslopes, the same habitat as the 50 individuals recorded in the survey area (Table N.2, Appendix N). This accounts for 5.3% of the population known from records within a 40 km radius (Department of Biodiversity, Conservation, and Attractions 2017c, 2017e; Rio Tinto Iron Ore 2019). Given the wide distribution of *P. mollis* P4 there is likely to be suitable habitat beyond the survey area in areas which have not been previously surveyed.

The amount of time conducting targeted searches for conservation significant flora within the survey area was limited and focused on areas likely to support the largest populations of P1 and P2 taxa. The ridge at BHT where many of the conservation significant flora taxa occur is steep, rugged and difficult to access safely on foot. Hot conditions were experienced during the Phase 1 survey, as such the majority of targeted search effort throughout the survey area was conducted during the Phase 2 survey. Phase 3 searches focused on the eastern end of the rugged south facing hills of BHT as well as searches of the D4 drainage unit for populations of *Aristida lazaridis* P2. Given the limitations of safe access in some areas of BHT, the possible distribution of conservation significant flora populations and the abundance estimates may be under-represented within the survey area.

There remains the possibility of further conservation significant flora taxa occurring within the survey area; 20 taxa have been previously recorded within 50 km, from habitats similar to those within the survey area and are considered to still have the potential to occur. Of these, eight taxa (*Vittadinia* sp. Coondewanna Flats (S. van Leeuwen 4684) P1, *Ipomoea racemigera* P2, *Isotropis parviflora* P2, *Oxalis* sp. Pilbara (M.E. Trudgen 12725) P2, *Amaranthus centralis* P3, *Oldenlandia* sp. Hamersley Station (A.A. Mitchell PRP 1479) P3 *Swainsona thompsoniana* P3 and *Goodenia nuda* P4) are considered annuals and/or short lived perennials. The below average rainfall preceding each of the three phases of survey meant seasonal conditions were not optimal for detecting these species should they occur, as they were likely to have senesced.

Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684) P1, *O.* sp. Hamersley Station (A.A. Mitchell PRP 1479) P3 and *Swainsona thompsoniana* P3 are associated with cracking clay soils such as those that were recorded in vegetation unit P2. *Ipomoea racemigera* P2, *Amaranthus centralis* P3 and *G. nuda* P4 typically occur in ephemeral watercourses and as such are most likely to occur within vegetation units D4 and D5. *Oxalis* sp. Pilbara (M.E. Trudgen 12725) P2 has a habitat preference of gullies and outcropping and is most likely to be associated with vegetation units D3, H1 and H2. *Isotropis parviflora* P2 has been previously recorded from slopes of stony hills and is most likely to be associated with vegetation units H3, H8 and H11, and possibly with H4, H7 and H10.

The other 12 potential priority flora taxa (*Eremophila pusilliflora* P2, *Teucrium pilbaranum* P2, *Aristida jerichoensis* subsp. *subspinulifera* P3, *E. magnifica* subsp. *velutina* P3, *Gymnanthera cunninghamii* P3, *Indigofera gilesii* P3, *Pilbara trudgenii* P3, *Rostellularia adscendens* var. *latifolia* P3, *Sida* sp. Barlee Range (S. van Leeuwen 1642) P3, *S.* sp. Hamersley Range (K. Newbey 10692) P3, *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) P3 and *E. youngii* subsp. *lepidota* P4 are perennial species. These taxa are low shrubs, grasses or herbs that may occur in areas of the survey area difficult to access safely on foot or in small populations that could be overlooked during survey. *Eremophila pusilliflora* P2, *E. youngii* subsp. *lepidota* P4 and *Gymnanthera cunninghamii* P3 are associated with alluvial plains and are most likely to occur within vegetation units D4, D5, D7 and D8 in the survey area. *Aristida jerichoensis* subsp. *subspinulifera* P3 is associated with hardpan plains and is most likely to occur in vegetation units P1, P2, P3 and P4. *Teucrium pilbaranum* P2 and *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) P3 are associated with drainage lines and clay

flats and are most likely to occur within vegetation units D4, D5, D7 and P2. *Eremophila magnifica* subsp. *velutina* P3, *I. gilesii* P3, *P.trudgenii* P3, *R. adscendens* var. *latifolia, S.* sp. Barlee Range (S. van Leeuwen 1642) P3 and *S.* sp. Hamersley Range (K. Newbey 10692) P3 have a habitat preference of gullies, gorges and breakaways associated with the Hamersley Ranges and therefore have greatest potential to occur in vegetation units D3, H1 and H2. This habitat was often challenging to safely traverse along the steep slopes, with some areas of BHT not being able to be thoroughly traversed, therefore there is potential that conservation significant individuals may occur but were not observed during the survey.

Although *Euphorbia clementii* P3 has suitable habitat in the survey ara and meets the distance criteria to be considered potential, it is noted that the majority of records for this species have been previously recorded north of Fortescue Marsh in the Chichester and Roebourne IBRA subregions, so the Rio Tinto record of *E. clementii* P3 15 km from the survey area is considered unusual and the species is therefore considered unlikely to occur.

The range of variation within *Triodia wiseana* and *T. angusta* presented some complex morphological similarity between different forms of the two species within the survey area. These two taxa are closely related and share morphological similarities that can make them difficult to separate, particularly when looking at the different variations of *T. wiseana* forms. There were also a number of unidentified grass taxa recorded within the survey area, due to the below average seasonal conditions encountered prior to all phases of survey. In particular there is expected to be further diversity within the *Aristida* genus than has been recorded.

Weed diversity was considered moderate with 17 introduced flora species recorded. The weed species recorded are not unusual for the Hamersley subregion. Many of the weed species recorded (**Bidens bipinnata, *Cenchrus ciliaris, *C. setiger, *Malvastrum americanum* and **Vachellia farnesiana*) are frequently recorded as dominant species in a variety of habtiats throughout the broader region. Some species, such as **Chloris virgata, *Conyza bonariensis, *Flaveria trinervia, *Lactuca serriola, *Setaria veriticillata, *Sigesbeckia orientalis, *Solanum nigrum* and **Sonchus oleraceus* are less widespread in habitat preference and distribution but are often associated with the clay soils of mulga habitats, as was observed in the survey area. **Brassica tournefortii, *Datura leichhardtii* subsp. *leichhardtii* and **Rumex vesicarius* are typically associated with human disturbances such as vegetation clearing. Weed density was generally low and mainly restricted to areas of previous disturbance and drainage lines. The evidence of grazing pressure was also low and there appears to be minimal impact from cattle and other feral herbivores. The vegetation condition is generally Excellent throughout the majority of the survey area.

5.4 Contextual Analysis

The process of placing vegetation units described within the survey area in a regional context by assessing and analysing site based data from surrounding projects had significant limitations, due to concerns with some previous specimen identifications and vegetation delineations. The data collected during the current survey clustered most closely with that from Biota (2006, 2014) and Ecologia (2013), but had limited affinity with Mattiske (2008d, 2009b, 2010). This is largely suspected to be a result of these previous Mattiske surveys having significantly fewer taxa recorded per site (Table 17).

Vegetation unit D3 occurs in the deeper incised gorges of the central ridge and was only associated with the Newman land system. Vegetation in these landforms was generally long unburnt and may act as refuge habitat for conservation significant flora taxa. Populations of *Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2, *Eremophila* sp. Hamersley Range (K. Walker KW 136) P3, *Grevillea saxicola* P3, *Triodia* sp. Mt Ella (M.E. Trudgen 12739) P3, *Acacia bromilowiana* P4 and

Eremophila magnifica subsp. *magnifica* P4 were recorded within D3. The Newman land system is the most prevalent in the survey area, and is also widespread and well-represented in the broader area, accounting for approximately 12% of the Pilbara bioregion. There was 51.8 ha (0.5%) of the survey area mapped as D3.

Vegetation unit D4 is associated with major drainage lines that supported the potential GDE species *Eucalyptus camaldulensis* subsp*. obtusa* and *E. victrix*. *Aristida lazaridis* P2 also occurred within this vegetation. Vegetation unit D4 occurs within five land systems in the survey area, including Boolgeeda, Egerton, Newman, Rocklea and Wannamunna; the majority (40.0 ha, 64% of D4) of which is associated with the Rocklea land system. The Rocklea land system is widespread throughout the broader area, and accounts for 16% of the Pilbara bioregion. Vegetation unit D4 was mapped over 60.6 ha (0.6%) of the survey area.

Vegetation unit H2 had a high incidence of priority flora recorded, with *Eremophila* sp. West Angelas (S. van Leeuwen 4068) P1, *Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2, *Eremophila* sp. Hamersley, Range (K. Walker KW 136) P3, *Grevillea saxicola* P3, *Rhagodia* sp. Hamersley (M. Trudgen 17794) P3, *Triodia* sp. Mt Ella (M.E.Trudgen 12739) P3, *Lepidium catapycnon* P4 and *Ptilotus mollis* P4 recorded from the south-facing upper slopes of BHT. The steep and elevated habitat was long unburnt, and as such it may act as refugia. This vegetation also has affinity with 'lower-slope mulga' which is considered an 'ecosystem at risk' (Kendrick 2001). H2 is mapped in three land systems in the survey area: McKay, Newman and Platform; the majority (272.6 ha, 87% of H2) of which is in the Newman land system. Vegetation unit H2 is mapped over 314.8 ha (2.9%) of the survey area.

Vegetation unit P2 may be locally restricted and had a dominance of tussock grasses not seen elsewhere in the survey area or local area. *Aristida lazaridis* P2, *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) P3 (previous surveys and *Rhagodia* sp. Hamersley (M. Trudgen 17794) P3 were also recorded within this vegetation. The P2 vegetation occurs in the Boolgeeda, Newman, Platform, Rocklea and Wannamunna land systems, with the majority (95.3 ha, 58% of P2) occurring in the Wannamunna land system which accounts for less than 1% of the Pilbara bioregion. This land system consists of hardpan plains and internal drainage tracts which support mulga shrublands and woodlands, and occasionally eucalypt woodlands (van Vreeswyk et al. 2004). There was 155.6 ha (1.4%) of the survey area mapped as P2.

Other vegetation units within the survey area are typical of those associated with similar landforms and previously described vegetation in the nearby area and are not considered to have conservation significance.

The vegetation condition was generally Excellent within the survey area, with the main impacts being weeds and grazing affecting drainage vegetation units and the clearing of vegetation for mining and drilling activities.

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Appendix A: Geological Units, Land Systems and Pre-European Vegetation of the Survey Area

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Rio Tinto

Hope Downs 2 Proposal – Flora and Vegetation Survey

Figure A.1: Geological units of the survey area.

Scale: 1:80,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 29-10-2019 | Figure Ref: 14292A-19-BIDR-3RevB_191029_FigA1_Geo

700000 710000 720000

7460000

7450000

Survey Area

Land System

- Boolgeeda System
- Calcrete System
- Egerton System
- McKay System
- Newman System
- Oakover System
- Pindering System
- Platform System
- River System
- Rocklea System
- Spearhole System
- Wannamunna System

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 2 Proposal – Flora and Vegetation Survey

Figure A.2: Land systems of the survey area

Scale: 1:80,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 29-10-2019 | Figure Ref: 14292A-19-BIDR-3RevB_191029_FigA2_LSys

700000 710000 720000

7460000

7450000

Survey Area

Pre-European Vegetation

System Association

HAMERSLEY_18

HAMERSLEY_29

HAMERSLEY_82

HAMMERSLEY_18

HAMMERSLEY_82

HAMMERSLEY_18

HAMMERSLEY_82

HAMMERSLEY_82

HAMMERSLEY_18

HAMMERSLEY_18

HAMMERSLEY_82

HAMMERSLEY_29

HAMMERSLEY_29

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 2 Proposal – Flora and Vegetation Survey

Figure A.3: Pre-European vegetation of the survey area

Scale: 1:80,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 29-10-2019 Figure Ref: 14292A-19-BIDR-3RevB_191029_FigA3_PreEuroVeg

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Appendix B: Conservation Categories for Flora and Ecological Communities and Categories for Introduced Flora

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Table B.1: Categories and definitions for threatened flora and fauna species listed under the *Environment Protection and Biodiversity Conservation Act 1999.*

Conservation category	Definition
Extinct	Taxa with no reasonable doubt that the last member of the species has died.
Extinct in the wild	Taxa known to survive only in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriated seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (E)	Taxa are not critically endangered; and are facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (V)	Taxa are not critically endangered or endangered; and are facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

Table B.2: Definitions and criteria for threatened ecological communities under the *Environment Protection and Biodiversity Conservation Act 1999.*

Categories of ecological communities	
Critically endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

Table B.3: Categories of threatened ecological communities (Department of Environment and Conservation 2013)

PD: Presumed Totally Destroyed
An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant **and either** of the following applies (A or B): A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats **or** B) All occurrences recorded within the last 50 years have since been destroyed.
CR : Critically Endangered
An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as **Critically Endangered** when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting **any one or more of** the following criteria (A, B or C): A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% **and either or both** of the following apply (i or ii): i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii): i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

En: Endangered

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

An ecological community will be listed as **Endangered** when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting **any one or more** of the following criteria (A, B, or C):

A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement **and either or both** of the following apply (i or ii):

i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);

ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);

ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;

iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

VU: Vulnerable

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting **any one or more of** the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Possible Threatened Ecological Communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5 (Table B.4).

Table B.4: Definitions and criteria for priority ecological communities (Department of Environment and Conservation 2013)

P1: Priority One – Poorly-known ecological communities
Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2: Priority Two – Poorly-known ecological communities
Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3: Priority Three – Poorly-known ecological communities
(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4: Priority Four
Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
P5: Priority Five – Conservation dependent ecological communities
Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Table B.5: Conservation codes for threatened Western Australian flora and fauna under the *Biodiversity Conservation Act 2016* (Department of Biodiversity, Conservation, and Attractions 2019).

Conservation category	Conservation category	Definition
Critically endangered (CR)	Schedule 1 of the *Wildlife Conservation*.	Taxa "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines."
Endangered (EN)	Schedule 2 of the *Wildlife Conservation*.	Taxa "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines."
Vulnerable (VU)	Schedule 3 of the *Wildlife Conservation*.	Taxa "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines."
Extinct (EX)	Schedule 4 of the *Wildlife Conservation*.	"there is no reasonable doubt that the last member of the species has died."
Extinct in the wild (EW)	Listing in accordance with Ministerial Guidelines (Section 25 of the BC Act)	Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form". Currently there are no threatened flora species listed as EW. If listing of a species as EW occurs, then a schedule will be added to the applicable notice.

Taxa that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora and Priority Fauna Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as Threatened flora or fauna. Taxa that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These taxa require regular monitoring.

Table B.6: Priority species codes for Western Australian flora (Department of Biodiversity, Conservation, and Attractions 2019)

P1: Priority One – Poorly known taxa
Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2: Priority Two – Poorly known taxa
Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3: Priority Three – Poorly known taxa
Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4: Priority Four: Rare, near threatened and other taxa in need of monitoring
(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

The management of introduced flora species in Western Australia is now regulated through the *Biosecurity and Agriculture Management Act 2007* (BAM Act). A list of declared pests, including 'pest' plants is provided under the BAM Act, which has been updated to incorporate a number of other Acts that are administered by Department of Agriculture and Food Western Australia (Department of Agriculture and Food Western Australia 2016). Declared pests can fall into two categories: one that relates to the prevention of introducing the species or eradicating it; and the other relates to managing the species and whether it can be kept (i.e. for scientific purposes, education or other purpose).

The threat and risk posed to site-specific biodiversity values, influences to rehabilitation success, primary production, infrastructure assets or human health will differ depending on the unique characteristics of each site and the associated land management practice or operation. Therefore site or project specific weed assessments and priorities should be reviewed for each project.

As per introduced flora species, the BAM Act seeks to establish a modern biosecurity regulatory scheme to prevent serious animal pests from entering the State and becoming established, and to minimise the spread and impact of any that are already present within the State. Declared animal pests fall into three categories as Gazetted under the *Biosecurity and Agriculture Management Regulations 2013*. These categories are outlined in Table B.7.

Table B.7: Declared pests control categories as gazetted under the *Biosecurity and Agriculture Management Regulations 2013*.

Category	Description
C1 (Exclusion)	Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2 (Eradication)	Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3 (Management)	Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

References

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Appendix C: Database Searches and Priority Ecological Communities Previously Recorded in Proximity to the Survey Area

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650000

700000

750000

7500000

7450000

River/Creek

Survey Area

Priority Ecological Community

Brockman Iron Cracking Clay Communities - P1

Coolibah - Lignum Flats, sub type 2 - P1

Fortescue Marsh - P1

Freshwater Claypans of the Fortescue Valley - P1

Weeli Wolli Spring Community - P1

West Angelas Cracking-Clays - P1

Kumina Land System - P3

Fortescue Valley Sand Dunes - P3

FORTESCUE RIVER

FORTESCUE MARSH

MARILLANA CREEK

TUREE CREEK

WEELI WOLLI CREEK

PERRIE MOUSE CREEK

TUREE CREEK EAST BRANCH

COONDINER CREEK

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 2 Proposal – Flora and Vegetation Survey

Figure C.1: Priority ecological communities recorded in proximity to the survey area

Scale: 1:400,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 5 10 15 20 25 30 Kilometres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 29-10-2019 | Figure Ref: 14292A-19-BIDR-3RevB_191029_FigC1_PriEcComm

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

Your Ref: **92256-17**
Our Ref: **05-01117FL**
Enquiries: Steve Martin
Phone: (08) 9219 9522
Email: flora.data@dbca.wa.gov.au

Astron Environmental Services
129 Royal Street
East Perth WA 6004

Attention: Kellie McMaster

Dear Kellie McMaster,

REQUEST FOR THREATENED AND PRIORITY FLORA INFORMATION

I refer to your request of 25 October 2017 for Threatened (Declared Rare) and Priority Flora information in the Hope Downs area. The search was conducted within the area of the shapefile you submitted with an additional 20km buffer.

A search was undertaken for this area of **(1)** the Department's *Threatened (Declared Rare) and Priority Flora* database (for results, see "TPFL" – coordinates are GDA94), **(2)** the *Western Australian Herbarium Specimen* database for Threatened and Priority flora species opportunistically collected in the area of interest (for results, see "WAHERB"- coordinates are GDA94 – see condition number 4 in the attached 'Conditions in Respect of Supply') and **(3)**, the Department's *Threatened and Priority Flora List* [this list is searched using 'place names'. This list, which may also be used as a species target list, contains species that are declared rare (Conservation Code R or X for those presumed to be extinct), poorly known (Conservation Codes 1, 2 or 3), or require monitoring (Conservation Code 4) – for results, *if any*, see "TP List"]. The results are attached electronically to this email.

Attached also are the conditions under which this information has been supplied. Your attention is specifically drawn to the ninth point, which refers to the requirement to undertake field investigations for the accurate determination of Threatened and Priority flora occurrence at a site. *The information supplied should be regarded as an indication only of the Threatened and Priority flora that may be present and may be used as a target list in any surveys undertaken.*

The information provided does not preclude you from obtaining and complying with, where necessary, land clearing approvals from other agencies.

An invoice for $ 300 (plus GST) to supply this information will be forwarded.

It would be appreciated if any populations of Threatened and Priority flora you encounter in the area could be reported to this Department to ensure their ongoing management.

If you require any further details, or wish to discuss Threatened and Priority flora management, please contact Dr Ken Atkins, Manager, Species and Communities Branch, on (08) 9219 9511.

Yours faithfully

Steve Martin
.....
THREATENED FLORA DATABASE OFFICER
for the Director General

6 November 2017

Species and Communities Branch
17 Dick Perry Avenue, Technology Park, Kensington
Phone: (08) 9219 9511
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Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

THREATENED AND PRIORITY FLORA INFORMATION

Conditions with Respect to the Supply of Information

- The data supplied may not be provided to any other organisations, nor be used for any purpose other than for the project for which it has been originally provided for; without the prior consent of the Executive Director, Department of Biodiversity, Conservation and Attractions.
- Specific locality information for threatened flora is regarded as confidential, and should be treated as such by receiving organisations. Specific locality information for threatened flora may not be used in reports without the written permission of the Executive Director, Department of Biodiversity, Conservation and Attractions. Reports may only show generalised locations at a low resolution or, where necessary, show specific locations without identifying species. Species and Communities Branch is to be contacted for guidance on the presentation of threatened flora information.
- The Department of Biodiversity, Conservation and Attractions respects the privacy of private landowners who may have threatened and priority flora on their property. Threatened and priority flora locations identified in the data as being on private property should be treated in confidence, and contact with property owners must only be made through the Department of Biodiversity, Conservation and Attractions.
- The development of the Perth Herbarium database was not originally intended for electronic mapping (eg. GIS ArcView). The latitude and longitude coordinates for each entry are not verified prior to being data based. It is only in recent times that collections have been submitted with GPS coordinates. Therefore, be aware when using this data in ArcView that some records may not plot to the locality description given with each collection.
- Acknowledgment of the Department Biodiversity, Conservation and Attractions as the source of data is to be made in any published material and cited as Biodiversity, Conservation and Attractions (2017) Threatened and Priority Flora Database Search for [search area] accessed on the [date of search]. Prepared by the Species and Communities Branch for [Requesters name and company] for [purpose of search].
- Copies of all such publications are to be forwarded to the Department of Biodiversity, Conservation and Attractions, Attention; the Manager, Species and Communities Branch.

Disclaimers with Respect to the Supply of Information

- Receiving organisations should note that while every effort has been made to prevent errors and omissions in the data, they may be present. The Department of Biodiversity, Conservation and Attractions accepts no responsibility for this.
- Receiving organisations must also recognise that the database is subject to continual updating and amendment, and such considerations should be taken into account by the user.
- It should be noted that the supplied data does not necessarily represent a comprehensive listing of the threatened flora of the area in question. Its comprehensiveness is dependent on the amount of surveys carried out within a specified area. The receiving organisation should consider engaging a botanist, if required, to undertake a survey of the area under consideration.

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

ABBREVIATIONS USED IN THREATENED AND PRIORITY FLORA DATABASE

VESTING

AAP	Aboriginal Planning Authority
AGR	Chief Executive, Dep. of Agriculture
ALT	Aboriginal Land Trust
APB	Agricultural Protection Board of WA
BGP	Botanical Gardens & Parks Authority
BSA	Boy Scouts Association
CC	Conservation Commission – NPNCA - LFC
CGT	Crown Grant in Trust
COM	Commonwealth of Australia
CRO	Crown Freehold-Govt Ownership
CRW	Crown
DAG	Dep. of Agriculture
DOW	Dep. of Water
DPI	Dep. of Planning
EXD	Exec Direc CALM
FES	Fire and Emergency Services Aust.
HOW	Dep. of Housing/State Housing Commission
ILD	Industrial Lands Develop. Auth
LAC	LandCorp
LGA	Shire/LGA
MAG	Minister for Agriculture
MCB	Metropolitan Cemeteries Board
MED	Ministry of Education
MHE	Minister for Health
MIN	Minister for Mines
MPL	Ministry for Planning
MPR	Minister for Prisons
MRD	Main Roads WA
MTR	Minister for Transport
MWA	Minister for Water Resources
MWO	Minister for Works
NAT	Natural Trust of Australia WA
NON	Not Vested
PLB	Pastoral Lands Board
PRI	Private/Freehold
RAI	Public Transport Authority
REL	Religious Organisation
SPC	State Planning Commission
SYN	Synergy (ex Western Power)
SWA	State of Western Australia
TEL	Telstra
UNK	Unknown
WAT	Water Corporation
WEL	Minister Community Welfare
WRC	Water & Rivers Commission
XPL	Ex-Pastoral Lease

PURPOSES

ABR	Aboriginal Reserve
ACC	Access Track
AER	Aerodrome
AIR	Airport
ARS	Agricultural Research Station
BAP	Baptist Union of WA
CAM	Camping
CAR	Caravan park
CEM	Cemetery
CFA	Conservation of Fauna
CFF	Conservation Of Flora & Fauna
CFL	Conservation of Flora
CHU	Church
CMN	Communications
COM	Common
CON	Conservation Park
CPK	Car Park
CRM	Conservation & Resource Management
DEF	Defence
DRA	Drain
EDE	Educational Endowment
EDU	Educational purposes
UWA	
ENE	Enjoyment of Natural Environ.
EPL	Ex-pastoral Lease (Sect 33(2) CALM Act)
EPS	Explosives
EXC	Excepted from sale
EXL	Exploration Lease
EXP	Experimental Farm
FIR	Firing Range
FOR	State Forest
FP	Foreshore Purposes
GE	General Lease
GHA	Grain Handling
GOL	Golf
GRA	Gravel Pit
GVT	Government Requirements
HAR	Harbour Purposes
HEP	Heritage Purposes
HER	Heritage trail
HOS	Hospital
KEN	Kennels
LGA	LGA/Shire Requirements
LPR	Landscape Protection
MIN	Mining lease
MUN	Municipal Purposes
NPK	National Park
NRE	Nature Reserve
OTH	Other
PAR	Parkland (& Recreation)
PAS	Pastoral lease
PCR	Proposed for Conservation
PFF	Protection of Flora & Fauna
PFL	Protection of Flora
PIC	Picnic ground
PLA	Plantation
PMC	Protection of Meteorite Crater
POS	Public Open Space
PPA	Public parkland
PRS	Prison site
PUR	Purchase Lease
PUT	Public Utility
QUA	Quarry
RAC	Racecourse
RAD	Radio Station
REC	Recreation
REH	Rehabilitation/Re-establish Native Plants
RRE	Railway Reserve
RUB	Rubbish
SAL	Saleyards
SAN	Sand
SCH	School-site
SET	Settlers requirements
SHO	Showgrounds
SNN	Sanitary
SOI	Soil Conservation
STO	Stopping place
STK	Stock Route
TIM	Timber
TOU	Tourism
TOW	Town-site
TRA	Training Ground
TRI	Trig station
UCL	Unallocated Crown Land
UNK	Unknown
VER	Road Verge
VPF	Vermin Proof Fence
WAT	Water
WLS	Wildlife Sanctuary
WOO	Firewood

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

ABBREVIATIONS USED IN THE WESTERN AUSTRALIAN HERBARIUM DATABASE

Geocode Method - The method that was used to record the latitude and longitude.

Auto - Indicates that the coordinate data in the record was created automatically (i.e. by software), usually by creating a coordinate from information provided in the Nearest Named Place or Locality textual description fields.

GAP - Acronym for "Generalised Arbitrary Point" as used in HISPID. GAP indicates that the coordinate data was obtained manually from the Nearest Named Place or Locality textual description fields.

GPS - Acronym for "Global Positioning System". GPS indicates that the coordinate data in the record was obtained from a GPS unit by the collector of the specimen.

MAN - Shorthand for manual. MAN indicates that the coordinate data was created by hand using some method not allowed for by one of the other manual Geocode Method values, in particular, TOPO, GAP, or GPS.

TOPO - Shorthand for topographic map. TOPO indicates that the coordinate data was obtained by plotting textual locality details against a topographic map.

None - Indicates that no coordinate data has been supplied by the collector.

Unknown - Indicates that there is no known method for determining the coordinate data. Should be used if the collector provided no indication of how they sampled the specimen's coordinate data.

PREC (Precision) - precision ratings for coordinates.

Precision 1: Absolutely precise (to nearest 100m or nearest second) and must be GPS determined. For example 35°26'42"S 123°40'26"E

Precision 2: Falling within a diameter of 3km (ca 2 minutes) or if no GPS mentioned in collecting notes. (The location must be able to be pinpointed on a 1:250 000 map, a spot locality. For example 35°26'42"S 123°40'26"E

Precision 3: Falling within a diameter of 10km (ca 7 minutes) or for degrees and minutes, where seconds have not been given. For example 35°26'_"S 123°40'_"E

Precision 4: Falling within a diameter of ca 50km (30 minutes). For example 35°26'_"S 123°40'_"E

Precision 5: Where a location is a prescribed large geographical area within a state or only the state is given. Diameter is greater than 50km. For example 35°_'_"S 123°_'_"E

Precision 6: used when localities are New Holland, Eastern Australia or Not given. Fields will be left blank.

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

CONSERVATION CODES

For Western Australian Flora and Fauna

T Threatened species

Listed as Specially Protected under the *Wildlife Conservation Act 1950,* published under Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora).

- Fauna that is rare or likely to become extinct are declared to be fauna that is in need of special protection
- Flora that are extant and considered likely to become extinct, or rare and therefore in need of special protection, are declared to be rare flora

Species* which have been adequately searched for and are deemed to be, in the wild, either rare, at risk of extinction, or otherwise in need of special protection, and have been gazetted as such.
The assessment of the conservation status of these species is based on their national extent.

X Presumed extinct species

Listed as Specially Protected under the *Wildlife Conservation Act 1950,* published under Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora (which may also be referred to as Declared Rare Flora).

Species which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such.

IA Migratory birds protected under an international agreement

Listed as Specially Protected under the *Wildlife Conservation Act 1950,* listed under Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice.

Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), relating to the protection of migratory birds.

S Other specially protected fauna

Listed as Specially Protected under the *Wildlife Conservation Act 1950.* Fauna declared to be in need of special protection, otherwise than for the reasons mentioned for Schedules 1, 2 or 3, are published under Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice.

Threatened Fauna and Flora are ranked according to their level of threat using IUCN Red List categories and criteria. *For example:* Carnaby's Cockatoo (*Calyptorynchus latirostris*) is listed as 'Specially Protected' under the *Wildlife Conservation Act 1950,* published under Schedule 1, and referred to as a 'Threatened' species with a ranking of 'Endangered'.

CR Critically Endangered - considered to be facing an extremely high risk of extinction in the wild.

EN Endangered - considered to be facing a very high risk of extinction in the wild.

VU Vulnerable - considered to be facing a high risk of extinction in the wild.

A list of the current rankings can be downloaded from the Parks and Wildlife Threatened Species and Communities webpage at http://dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

P Priority species

Species that maybe threatened or near threatened but are data deficient, have not yet been adequately surveyed to be listed under the Schedules of the Wildlife Conservation (Specially Protected Fauna) Notice or the Wildlife Conservation (Rare Flora) Notice, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Conservation dependent species that are subject to a specific conservation program are placed in Priority 5.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

1: Priority One: Poorly-known species

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

2: Priority Two: Poorly-known species

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

3: Priority Three: Poorly-known species

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

4: Priority Four: Rare, Near Threatened and other species in need of monitoring

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.
(b) Near Threatened. Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

5: Priority Five: Conservation Dependent species

Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

*Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies, variety or forma).

Threatened and Priority Ecological Community buffers and boundaries in WA

UNDER NO CIRCUMSTANCES IS THIS DATA TO BE PROVIDED TO ANY THIRD PARTIES, for more details see conditions for the supply of this information.

Citation

Title: Threatened and Priority Ecological Community buffers and boundaries in WA

Custodian: Department of Biodiversity, Conservation and Attractions

Description

Abstract: Ecological communities throughout WA that are "Presumed Totally Destroyed", "Critically Endangered", "Endangered", "Vulnerable", "Priority 1-5", "Lower Risk" and "Not evaluated". Communities are based on various life-forms including plants, invertebrates and micro-organisms.

Geographical Bounding Box

North: -14.788854

South: -35.005719

East: 128.870214

West: 113.765525

Data Currency and Status

Beginning Date: 1/1/94

Ending Date: 30/10/2017

Maintenance/Update: As requested

Access

Stored Data Format: ESRI shapefile

Coordinate System: GCS_GDA_1994

Access Constraints: Digital data is only available with written permission of the custodian.

Data Quality

Positional Accuracy: Point location data within occurrences usually from GPS location, (usually within 100 metres).

Attribute Accuracy: Not documented.

Logical Consistency: Not documented.

Completeness: Information on specific communities was obtained from regional, subregional or specific habitat surveys of floristic communities, invertebrate communities, wetland assemblages and communities of micro-organisms.

Attributes List:

Name	Description
BDY_ID	Associated boundary polygon unique identifier
OCC_UNIQUE	Unique occurrence identifier
COM_ID	Shortened community name identifier
COM_NAME	Community name
STATE_CATE	State listed category of threat
COMM_CATE	Commonwealth listed category of threat
S_ID_COUNT	Number of Site IDs within a buffer
FIRST_S_ID	First site identifier
LAST_S_ID	Last site identifier
BUFFER	Buffer radius from site ID or boundary in metres

General Information:

Buffers

- A buffer is included around each occurrence of a TEC or PEC to help ensure:
  - that nearby developments with potential for impact are taken into account
  - for ecological communities driven by hydrological processes, buffers are applied to ensure essential ecological functions are maintained and/or potential impact of nearby developments is minimised.
  - mapping inaccuracies are accounted for

Contact Information

Contact Organisation: Department of Biodiversity, Conservation and Attractions

Contact Position: TEC Database Ecologist - Species and Communities Branch

Mail Address: Locked Bag 104, Bentley Delivery Centre, Kensington WA 6983

Telephone: (08) 9219 9157

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NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 26/06/2018

Current Names Only Yes
Core Datasets Only Yes
Species Group Vascular Plants
Method 'By Circle'
Centre 119° 01' 56" E,23° 04' 04" S
Buffer 40km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	4886	*Abutilon amplum*			
2.	4889	*Abutilon cryptopetalum*			
3.	9080	*Abutilon cunninghamii*			
4.	4891	*Abutilon fraseri (Lantern Bush)*			
5.	4895	*Abutilon lepidum*			
6.	4896	*Abutilon leucopetalum (Desert Chinese Lantern)*			
7.	4898	*Abutilon macrum*			
8.	4899	*Abutilon malvifolium (Bastard Marshmallow)*			
9.	4901	*Abutilon otocarpum (Desert Chinese Lantern)*			
10.	43020	*Abutilon oxycarpum subsp. Prostrate (A.A. Mitchell PRP 1266)*			
11.		*Abutilon sp.*			
12.	42920	*Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)*			
13.	14113	*Abutilon sp. Pilbara (W.R. Barker 2025)*			
14.	11215	*Acacia adoxa var. adoxa*			
15.	3205	*Acacia adsurgens*			
16.	44579	*Acacia adsurgens x rhodophloia*			
17.	3209	*Acacia ampliceps*			
18.	3214	*Acacia ancistrocarpa (Fitzroy Wattle)*			
19.	3217	*Acacia aneura (Mulga, Wanari)*			
20.	37260	*Acacia aptaneura*			
21.	3228	*Acacia atkinsiana*			
22.	3232	*Acacia ayersiana*			
23.	3241	*Acacia bivenosa*			
24.	29571	*Acacia bromilowiana*		P4	
25.	19571	*Acacia catenulata*			Y
26.	23524	*Acacia catenulata subsp. occidentalis*			
27.	3260	*Acacia citrinoviridis*			
28.	17013	*Acacia colei var. colei*			
29.	13502	*Acacia coriacea subsp. pendens*			
30.	3272	*Acacia cowleana (Halls Creek Wattle)*			
31.	3300	*Acacia dictyophleba (Sandhill Wattle, Ngarkalya)*			
32.	3316	*Acacia effusa*		P3	
33.	16174	*Acacia elachantha*			
34.	3360	*Acacia hamersleyensis*			
35.	3370	*Acacia hilliana*			
36.	3377	*Acacia inaequilatera (Baderi)*			
37.	36418	*Acacia incurvaneura*			
38.	3399	*Acacia kempeana (Witchetty Bush, Ilykuwara)*			
39.	37240	*Acacia macraneura*			
40.	3434	*Acacia maitlandii (Maitland's Wattle)*			
41.	3435	*Acacia marramamba*			
42.	12952	*Acacia minyura*			
43.	3447	*Acacia monticola (Gawar, Lilwardi)*			
44.	36416	*Acacia mulganeura*			
45.	3475	*Acacia pachyacra*			
46.	15724	*Acacia paraneura*			
47.	3500	*Acacia pruinocarpa (Gidgee)*			
48.	36800	*Acacia pteraneura*			
49.	29016	*Acacia pyrifolia var. morrisonii*			
50.	29015	*Acacia pyrifolia var. pyrifolia*			
51.	3519	*Acacia rhodophloia*			
52.	44584	*Acacia rhodophloia x sibirica*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
53.	13078	*Acacia sclerosperma subsp. sclerosperma*			
54.	3544	*Acacia sibilans*			
55.	8949	*Acacia sibirica (Bastard Mulga)*			
56.	3553	*Acacia spondylophylla*			
57.	23526	*Acacia steedmanii subsp. borealis*			
58.	23529	*Acacia subcontorta*			
59.	23528	*Acacia subtiliformis*		P3	
60.	13070	*Acacia synchronicia*			
61.	3573	*Acacia tenuissima*			
62.	3577	*Acacia tetragonophylla (Kurara, Wakalpuka)*			
63.	23521	*Acacia trudgeniana*			
64.	20319	*Acacia tumida var. pilbarensis*			
65.	3598	*Acacia wanyu*			
66.	172	*Acrachne racemosa*			
67.	17454	*Adriana tomentosa var. hookeri*			
68.	17422	*Adriana tomentosa var. tomentosa*			
69.	2646	*Aerva javanica (Kapok Bush)*	Y		
70.	4739	*Alectryon oleifolius*			
71.	2648	*Alternanthera denticulata (Lesser Joyweed)*			
72.	2651	*Alternanthera nana (Hairy Joyweed)*			
73.	34810	*Amaranthus centralis*		P3	
74.	2660	*Amaranthus cuspidifolius*			
75.	2663	*Amaranthus interruptus (Native Amaranth)*			
76.	20018	*Amaranthus undulatus*			
77.	5277	*Ammannia baccifera*			
78.	19835	*Amphipogon sericeus*			
79.	2372	*Amyema fitzgeraldii (Pincushion Mistletoe)*			
80.	11614	*Amyema gibberula var. gibberula*			
81.	2374	*Amyema hilliana*			
82.	2383	*Amyema preissii (Wireleaf Mistletoe)*			
83.	29080	*Amyema sanguinea var. pulchra*			
84.	11874	*Amyema sanguinea var. sanguinea*			
85.	40910	*Androcalva luteiflora (Yellow-flowered Rulingia)*			
86.	2333	*Anthobolus leptomerioides*			
87.	43104	*Apowollastonia hamersleyensis*			
88.	2961	*Argemone ochroleuca (Mexican Poppy)*	Y		
89.	204	*Aristida burbidgeae*			
90.	207	*Aristida contorta (Bunched Kerosene Grass)*			
91.	12063	*Aristida holathera var. holathera*			
92.	212	*Aristida inaequiglumis (Feathertop Threeawn)*			
93.	213	*Aristida ingrata*			
94.	17918	*Aristida jerichoensis var. subspinulifera*		P3	
95.	215	*Aristida latifolia (Feathertop Wiregrass)*			
96.	216	*Aristida lazaridis*		P2	
97.	217	*Aristida nitidula (Flat-awned Threeawn)*			
98.	218	*Aristida obscura (Brush Threeawn)*			
99.	221	*Aristida pruinosa (Gulf Feathertop Wiregrass)*			
100.		*Aristida sp.*			
101.	227	*Astrebla elymoides (Weeping Mitchell Grass)*			
102.	229	*Astrebla pectinata (Barley Mitchell Grass)*			
103.	6202	*Astrotricha hamptonii (Ironplant)*			
104.	4740	*Atalaya hemiglauca (Whitewood)*			
105.	2476	*Atriplex semilunaris (Annual Saltbush)*			
106.	33030	*Austrobryonia pilbarensis*			
107.	7854	*Bidens bipinnata (Bipinnate Beggartick)*	Y		
108.	46338	*Bidens subalternans var. simulans*	Y		
109.	7866	*Blumea tenella*			
110.	2770	*Boerhavia coccinea (Tar Vine, Wituka)*			
111.	2773	*Boerhavia paludosa*			
112.	2774	*Boerhavia repleta*			
113.	11167	*Bonamia erecta*			
114.	6606	*Bonamia media*			
115.	44782	*Bonamia pilbarensis*			
116.	239	*Bothriochloa bladhii (Forest Bluegrass)*			
117.	240	*Bothriochloa ewartiana (Desert Bluegrass)*			
118.	12716	*Brachychiton acuminatus*			
119.	7878	*Brachyscome iberidifolia*			
120.	7413	*Brunonia australis (Native Cornflower)*			
121.	19070	*Brunonia sp. Long hairs (D.E. Symon 2440)*			
122.	14312	*Bulbine pendula*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
123.	750	*Bulbostylis barbata*			
124.	752	*Bulbostylis turbinata*			
125.	2860	*Calandrinia polyandra (Parakeelya)*			
126.	2864	*Calandrinia ptychosperma*			
127.	2865	*Calandrinia pumila*			
128.	2868	*Calandrinia reticulata*			
129.	31073	*Calandrinia sp. The Pink Hills (F. Obbens FO 19/06)*			
130.	8466	*Callitris columellaris (White Cypress Pine)*			
131.	14090	*Calocephalus beardii*			
132.	7891	*Calocephalus francisii (Fine-leaf Beauty-heads)*			
133.	7893	*Calocephalus knappii*			
134.	7895	*Calocephalus multiflorus (Yellow-top)*			
135.	48223	*Calocephalus pilbarensis*			
136.	7903	*Calotis hispidula (Bindy Eye)*			
137.	7904	*Calotis latiuscula*		P3	
138.	7905	*Calotis multicaulis (Many-stemmed Burr-daisy)*			
139.	7906	*Calotis plumulifera*			
140.	5446	*Calytrix carinata*			
141.	2976	*Capparis lasiantha (Split Jack, Balqarda)*			
142.	2978	*Capparis mitchellii (Wild Orange)*			
143.	2981	*Capparis spinosa*			
144.	2949	*Cassytha capillaris*			
145.	2950	*Cassytha filiformis (Love Vine, Jirawan)*			
146.	258	*Cenchrus ciliaris (Buffel Grass)*	Y		
147.	259	*Cenchrus echinatus (Burrgrass)*	Y		
148.	19762	*Centipeda minima subsp. macrocephala*			
149.	7921	*Centipeda thespidioides (Desert Sneezewood)*			
150.	31	*Cheilanthes austrotenuifolia*			
151.	33	*Cheilanthes contigua*			
152.	37	*Cheilanthes lasiophylla (Woolly Cloak Fern)*			
153.	12815	*Cheilanthes sieberi subsp. pseudovellea*			
154.	12818	*Cheilanthes sieberi subsp. sieberi*			
155.		*Cheilanthes sp.*			
156.	8462	*Cheilanthes tenuifolia (Rock Fern)*			
157.	2485	*Chenopodium auricomum (Queensland Bluebush)*			
158.	269	*Chloris pectinata (Comb Chloris)*			
159.	272	*Chloris virgata (Feathertop Rhodes Grass)*	Y		
160.	47174	*Chrysocephalum apiculatum subsp. pilbarense*			
161.	33516	*Chrysocephalum gilesii*			
162.	12614	*Chrysocephalum pterochaetum*			
163.	273	*Chrysopogon fallax (Golden Beard Grass)*			
164.	7370	*Citrullus lanatus (Pie Melon)*	Y		
165.	2985	*Cleome oxalidea*			
166.	2988	*Cleome viscosa (Tickweed, Tjinduwadhu)*			
167.	13692	*Clerodendrum floribundum var. angustifolium*			
168.	13689	*Clerodendrum tomentosum var. lanceolatum*			
169.	2778	*Codonocarpus cotinifolius (Native Poplar, Kundurangu)*			
170.	1165	*Commelina ensifolia (Wandering Jew, Buargu)*			
171.	6612	*Convolvulus clementii*			
172.	13560	*Corchorus crozophorifolius*			
173.	17405	*Corchorus lasiocarpus*			
174.	18409	*Corchorus lasiocarpus subsp. lasiocarpus*			
175.	18408	*Corchorus lasiocarpus subsp. parvus*			
176.		*Corchorus sp.*			
177.	4865	*Corchorus tridens*			
178.	16783	*Corymbia candida*			
179.	17083	*Corymbia deserticola subsp. deserticola*			
180.	17077	*Corymbia ferriticola*			
181.	17093	*Corymbia hamersleyana*			
182.	17092	*Corymbia opaca*			
183.	3144	*Crassula peduncularis (Purple Stonecrop)*			
184.	3783	*Crotalaria medicaginea*			
185.	20179	*Crotalaria medicaginea var. neglecta*			
186.	3785	*Crotalaria novae-hollandiae (New Holland Rattlepod)*			
187.	11231	*Crotalaria novae-hollandiae subsp. novae-hollandiae*			
188.	16189	*Cryptandra monticola*			
189.	7371	*Cucumis melo (Ulcardo Melon)*			
190.	41722	*Cucumis picrocarpus*			
191.	41721	*Cucumis variabilis*			
192.	17117	*Cullen cinereum*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
193.	17436	*Cullen graveolens*			
194.	17119	*Cullen leucochaites*			
195.	17116	*Cullen martinii*			
196.	17217	*Cullen pallidum*			
197.	17120	*Cullen pogonocarpum*			
198.	3010	*Cuphonotus andraeanus*			
199.	13733	*Cuscuta victoriana*			
200.	279	*Cymbopogon ambiguus (Scentgrass)*			
201.	281	*Cymbopogon obtectus (Silkyheads)*			
202.	6584	*Cynanchum floribundum (Dumara Bush, Tjipa)*			
203.	46558	*Cynodon convergens*			
204.	777	*Cyperus bulbosus (Bush Onion, Tjanmata)*			
205.	12811	*Cyperus cunninghamii subsp. cunninghamii*			
206.	789	*Cyperus difformis (Rice Sedge)*			
207.	12808	*Cyperus hesperius*			
208.	798	*Cyperus iria*			
209.	799	*Cyperus ixiocarpus*			
210.	814	*Cyperus squarrosus*			
211.	818	*Cyperus vaginatus (Stiffleaf Sedge)*			
212.	290	*Dactyloctenium radulans (Button Grass)*			
213.	7424	*Dampiera candicans*			
214.	20378	*Dampiera metallorum*		P3	
215.	47241	*Datura leichhardtii subsp. leichhardtii*	Y		
216.	6218	*Daucus glochidiatus (Australian Carrot)*			
217.	17140	*Daviesia eremaea*			
218.	3856	*Desmodium muelleri*			
219.	13741	*Dichanthium sericeum subsp. humilius*			
220.	13740	*Dichanthium sericeum subsp. polystachyum*			
221.	11964	*Dichanthium sericeum subsp. sericeum*			
222.	7164	*Dicladanthera forrestii*			
223.	6754	*Dicrastylis cordifolia*			
224.	308	*Digitaria ammophila (Silky Umbrella Grass)*			
225.	310	*Digitaria brownii (Cotton Panic Grass)*			
226.	312	*Digitaria coenicola*			
227.	313	*Digitaria ctenantha (Comb Finger Grass)*			
228.	48378	*Diplachne fusca subsp. fusca*			
229.	2395	*Diplatia grandibractea*			
230.	11320	*Dipteracanthus australasicus subsp. australasicus*			
231.	2499	*Dissocarpus paradoxus (Curious Saltbush)*			
232.	4759	*Dodonaea coriacea*			
233.	4767	*Dodonaea lanceolata (Pirrungu)*			
234.	11406	*Dodonaea lanceolata var. lanceolata*			
235.	4772	*Dodonaea pachyneura*			
236.	4773	*Dodonaea petiolaris*			
237.	4782	*Dodonaea viscosa (Sticky Hopbush)*			
238.	11674	*Dodonaea viscosa subsp. mucronata*			
239.	11202	*Dodonaea viscosa subsp. spatulata (Sticky Hop-bush)*			
240.	44508	*Duma florulenta*			
241.	31274	*Duperreya commixta*			
242.	2500	*Dysphania glandulosa*			
243.	11632	*Dysphania glomulifera subsp. eremaea*			
244.	2502	*Dysphania kalpari (Rat's Tail, Kalpari)*			
245.	33479	*Dysphania melanocarpa (Black Crumbweed)*			
246.	33596	*Dysphania melanocarpa forma leucocarpa*			
247.	33597	*Dysphania melanocarpa forma melanocarpa (Black Goosefoot)*			
248.	2506	*Dysphania rhadinostachya*			
249.	11653	*Dysphania rhadinostachya subsp. inflata*			
250.	11890	*Dysphania rhadinostachya subsp. rhadinostachya*			
251.	328	*Echinochloa colona (Awnless Barnyard Grass)*	Y		
252.	7057	*Elacholoma hornii*			
253.	823	*Eleocharis atropurpurea*			
254.	827	*Eleocharis geniculata*			
255.	355	*Elytrophorus spicatus (Spikegrass)*			
256.	2511	*Enchylaena tomentosa (Barrier Saltbush)*			
257.	12064	*Enchylaena tomentosa var. tomentosa (Barrier Saltbush)*			
258.	357	*Enneapogon caerulescens (Limestone Grass)*			
259.	360	*Enneapogon lindleyanus (Wiry Nineawn, Purple-head Nineawn)*			
260.	365	*Enneapogon polyphyllus (Leafy Nineawn)*			
261.	20377	*Enneapogon robustissimus*			
262.	368	*Enteropogon ramosus (Windmill Grass, Curly Windmill Grass)*			

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263.	375	*Eragrostis cumingii (Cuming's Love Grass)*			
264.	377	*Eragrostis desertorum (Desert Lovegrass)*			
265.	378	*Eragrostis dielsii (Mallee Lovegrass)*			
266.	380	*Eragrostis eriopoda (Woollybutt Grass, Wangurnu)*			
267.	381	*Eragrostis falcata (Sickle Lovegrass)*			
268.	388	*Eragrostis leptocarpa (Drooping Lovegrass)*			
269.	392	*Eragrostis pergracilis*			
270.	393	*Eragrostis setifolia (Neverfail Grass)*			
271.		*Eragrostis sp.*			
272.	20243	*Eragrostis sp. Mt Robinson (S. van Leeuwen 4109)*		P1	Y
273.	398	*Eragrostis tenellula (Delicate Lovegrass)*			
274.	399	*Eragrostis xerophila (Knotty-butt Neverfail)*			
275.	14509	*Eremophila caespitosa*			
276.	15167	*Eremophila canaliculata*			
277.	7189	*Eremophila clarkei (Turpentine Bush)*			
278.	7190	*Eremophila compacta*			
279.	7192	*Eremophila cuneifolia (Pinyuru, T'iranju)*			
280.	7205	*Eremophila exilifolia*			
281.	7208	*Eremophila forrestii (Wilcox Bush)*			
282.	15052	*Eremophila forrestii subsp. forrestii*			
283.	7209	*Eremophila fraseri (Burra)*			
284.	16696	*Eremophila fraseri subsp. fraseri*			
285.	29532	*Eremophila galeata*			
286.	17519	*Eremophila jucunda subsp. pulcherrima*			
287.	7228	*Eremophila lachnocalyx (Woolly-calyxed Eremophila)*			
288.	16940	*Eremophila lanceolata*			
289.	7230	*Eremophila latrobei (Warty Fuchsia Bush, Mintjingka)*			
290.	17597	*Eremophila latrobei subsp. filiformis*			
291.	17576	*Eremophila latrobei subsp. latrobei*			
292.	7234	*Eremophila longifolia (Berrigan, Tulypurpa)*			
293.	14893	*Eremophila magnifica subsp. magnifica*		P4	
294.	14894	*Eremophila magnifica subsp. velutina*		P3	
295.	18570	*Eremophila oppositifolia subsp. angustifolia*			
296.	15164	*Eremophila petrophila subsp. petrophila*			
297.	17283	*Eremophila phyllopoda subsp. obliqua*			
298.	15160	*Eremophila platycalyx subsp. pardalota*			
299.	15058	*Eremophila platycalyx subsp. platycalyx*			
300.		*Eremophila sp.*			
301.	40643	*Eremophila sp. Hamersley Range (K. Walker KW 136)*		P1	
302.	20256	*Eremophila sp. West Angelas (S. van Leeuwen 4068)*		P1	Y
303.	400	*Eriachne aristidea*			
304.	403	*Eriachne benthamii (Swamp Wanderrie)*			
305.	408	*Eriachne flaccida (Claypan Grass)*			
306.	411	*Eriachne helmsii (Buck Wanderrie Grass)*			
307.	13660	*Eriachne lanata*			
308.	413	*Eriachne mucronata (Mountain Wanderrie Grass)*			
309.	415	*Eriachne ovata*			
310.	16485	*Eriachne pulchella subsp. dominii*			
311.	16486	*Eriachne pulchella subsp. pulchella*			
312.		*Eriachne sp.*			
313.	421	*Eriachne tenuiculmis*			
314.	4335	*Erodium cygnorum (Blue Heronsbill)*			
315.	35345	*Eucalyptus camaldulensis subsp. obtusa (Blunt-budded River Red Gum)*			
316.	35343	*Eucalyptus camaldulensis subsp. refulgens*			
317.	5641	*Eucalyptus ewartiana (Ewart's Mallee)*			
318.	5655	*Eucalyptus gamophylla (Twin-leaf Mallee, Warilu)*			
319.	5684	*Eucalyptus kingsmillii (Kingsmill's Mallee)*			
320.	5698	*Eucalyptus leucophloia (Snappy Gum, Migum)*			
321.	18088	*Eucalyptus leucophloia subsp. leucophloia*			
322.	5744	*Eucalyptus pilbarensis*			
323.	18058	*Eucalyptus repullulans*			
324.	5773	*Eucalyptus socialis (Red Mallee, Altarpa)*			
325.	19576	*Eucalyptus socialis subsp. eucentrica*			
326.	18219	*Eucalyptus tephrodes*			
327.	29733	*Eucalyptus trivalva (Victoria Spring Mallee)*			
328.	14548	*Eucalyptus victrix*			
329.	15592	*Eucalyptus xerothermica*			
330.	11011	*Eulalia aurea*			
331.	4617	*Euphorbia australis (Namana)*			
332.	42844	*Euphorbia australis var. hispidula*			

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333.	35303	*Euphorbia australis var. subtomentosa*			
334.	4619	*Euphorbia biconvexa*			
335.	4620	*Euphorbia boophthona (Gascoyne Spurge)*			
336.	4622	*Euphorbia clementii*		P2	
337.	4623	*Euphorbia coghlanii (Namana)*			
338.	4626	*Euphorbia drummondii (Caustic Weed, Piwi)*			
339.	42846	*Euphorbia ferdinandi*			
340.	42847	*Euphorbia ferdinandi var. ferdinandi*			
341.		*Euphorbia sp.*			
342.	4646	*Euphorbia stevenii (Caustic Bottletree)*		P3	
343.	12097	*Euphorbia tannensis subsp. eremophila (Desert Spurge)*			
344.	42879	*Euphorbia trigonosperma*			
345.	13281	*Euphorbia vaccaria*			
346.	42877	*Euphorbia vaccaria var. erucoides*			
347.	42876	*Euphorbia vaccaria var. vaccaria*			
348.	6617	*Evolvulus alsinoides (Tropical Speedwell)*			
349.	11200	*Evolvulus alsinoides var. villosicalyx*			
350.	10765	*Exocarpos sparteus (Broom Ballart, Djuk)*			
351.	19648	*Ficus brachypoda*			
352.	1753	*Ficus platypoda (Native Fig, Makartu)*			
353.	842	*Fimbristylis cardiocarpa*			
354.	850	*Fimbristylis depauperata*			
355.	851	*Fimbristylis dichotoma (Eight Day Grass)*			
356.	859	*Fimbristylis littoralis*			
357.	862	*Fimbristylis microcarya*			
358.	882	*Fimbristylis sieberiana*		P3	
359.	12159	*Fimbristylis simulans*			
360.		*Fimbristylis sp.*			
361.	35558	*Flaveria trinervia (Speedy Weed)*	Y		
362.	3903	*Gastrolobium grandiflorum (Wallflower Poison)*			
363.	7060	*Glossostigma diandrum*			
364.	3938	*Glycine canescens (Silky Glycine)*			
365.	7988	*Gnephosis arachnoidea (Cobwebby-headed Gnephosis)*			
366.	20856	*Gompholobium karijini*		P2	
367.	41245	*Gompholobium oreophilum*			
368.	2676	*Gomphrena canescens (Batchelors Buttons)*			
369.	2680	*Gomphrena cunninghamii*			
370.	18367	*Gomphrena kanisii*			
371.	18372	*Gomphrena lanata*			
372.	12517	*Goodenia cusackiana*			
373.	12529	*Goodenia lyrata*		P3	
374.	7526	*Goodenia microptera*			
375.	12552	*Goodenia muelleriana*			
376.	7530	*Goodenia nuda*		P4	
377.	12571	*Goodenia pascua*			
378.	12574	*Goodenia prostrata*			
379.	7545	*Goodenia scaevolina (Ngurubi)*			
380.	29381	*Goodenia sp. East Pilbara (A.A. Mitchell PRP 727) (O'Meara's Goodenia)*		P3	
381.	7550	*Goodenia stellata*			
382.	10982	*Goodenia stobbsiana*			
383.	7556	*Goodenia tenuiloba*			
384.	7558	*Goodenia triodiophila*			
385.	4910	*Gossypium australe (Native Cotton)*			
386.	4918	*Gossypium robinsonii (Wild Cotton)*			
387.	4919	*Gossypium sturtianum (Sturt's Desert Rose)*			
388.	11559	*Gossypium sturtianum var. sturtianum*			
389.	1963	*Grevillea berryana*			
390.	2079	*Grevillea pyramidalis (Caustic Bush, Tjungu)*			
391.	19570	*Grevillea pyramidalis subsp. leucadendron*			
392.	44441	*Grevillea saxicola*		P3	
393.	2096	*Grevillea stenobotrya*			
394.	2121	*Grevillea wickhamii (Wickham's Grevillea)*			
395.	19478	*Grevillea wickhamii subsp. hispidula*			
396.	12832	*Gymnanthera cunninghamii*		P3	
397.	2138	*Hakea chordophylla*			
398.	2177	*Hakea lorea (Witinti)*			
399.	2200	*Hakea rhombales*			
400.	6687	*Halgania cyanea (Rough Halgania)*			
401.	29840	*Halgania cyanea var. Allambi Stn (B.W. Strong 676)*			
402.	6690	*Halgania gustafsenii*			

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403.	30294	*Halgania gustafsenii var. Mid West (G. Perry 370)*			
404.	17493	*Halgania gustafsenii var. gustafsenii*			
405.	30258	*Halgania solanacea var. Mt Doreen (G.M. Chippendale 4206)*			
406.	6174	*Haloragis gossei*			
407.	23465	*Haloragis gossei var. gossei*			
408.	23464	*Haloragis gossei var. inflata*			
409.	20669	*Haloragis maierae*			
410.	6180	*Haloragis trigonocarpa*			
411.	17722	*Hannafordia bissillii subsp. bissillii*			
412.	17325	*Harnieria kempeana subsp. muelleri*			
413.	17301	*Heliotropium chrysocarpum*			
414.	6706	*Heliotropium cunninghamii*			
415.	10992	*Heliotropium glabellum*			
416.	6712	*Heliotropium heteranthum*			
417.	17307	*Heliotropium inexplicitum*			
418.	17309	*Heliotropium pachyphyllum*			
419.	17313	*Heliotropium skeleton*			
420.		*Heliotropium sp.*			
421.	6720	*Heliotropium ventricosum*			
422.	5128	*Hibbertia glaberrima*			
423.	4922	*Hibiscus brachychlaenus*			
424.	4923	*Hibiscus brachysiphonius*			
425.	4924	*Hibiscus burtonii*			
426.	4925	*Hibiscus coatesii*			
427.	4931	*Hibiscus haynaldii*			
428.	4933	*Hibiscus leptocladus*			
429.	43022	*Hibiscus sp. Gardneri (A.L. Payne PRP 1435)*			
430.	40560	*Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708)*		P2	
431.	40640	*Hibiscus sp. Mt Robinson (G. Byrne 3537)*			
432.	4942	*Hibiscus sturtii (Sturt's Hibiscus)*			
433.	11651	*Hibiscus sturtii var. campylochlamys*			
434.	11385	*Hibiscus sturtii var. grandiflorus*			
435.	11477	*Hibiscus sturtii var. platychlamys*			
436.	11893	*Hibiscus sturtii var. truncatus*			
437.	43081	*Hibiscus verdcourtii*			
438.	5215	*Hybanthus aurantiacus*			
439.	45473	*Indigofera fractiflexa subsp. fractiflexa*			
440.	3974	*Indigofera georgei (Bovine Indigo)*			
441.	17716	*Indigofera gilesii*		P3	
442.	3978	*Indigofera hirsuta (Hairy Indigo)*			
443.	3980	*Indigofera linifolia*			
444.	3982	*Indigofera monophylla*			
445.	3985	*Indigofera rugosa*			
446.	3987	*Indigofera trita*			
447.	6621	*Ipomoea calobra (Weir Vine)*			
448.	6631	*Ipomoea lonchophylla (Cowvine)*			
449.	6633	*Ipomoea muelleri (Poison Morning Glory, Yumbu)*			
450.	6636	*Ipomoea plebeia (Bellvine)*			
451.	6637	*Ipomoea polymorpha*			
452.	6639	*Ipomoea racemigera*		P2	
453.	12663	*Ischaemum albovillosum*			
454.	458	*Iseilema dolichotrichum*			
455.	459	*Iseilema eremaeum*			
456.	461	*Iseilema fragile*			
457.	464	*Iseilema membranaceum (Small Flinders Grass)*			
458.	465	*Iseilema vaginiflorum (Red Flinders Grass)*			
459.	7397	*Isotoma petraea (Rock Isotome, Tundiwari)*			
460.	3989	*Isotropis atropurpurea (Poison Sage)*			
461.	17790	*Isotropis parviflora*		P2	
462.	48615	*Isotropis sp. Arid zone (G. Byrne 2775)*			
463.	8088	*Ixiochlamys cuneifolia*			
464.	6501	*Jasminum didymum*			
465.	12059	*Jasminum didymum subsp. lineare (Desert Jasmine)*			
466.	7118	*Josephinia eugeniae (Josephinia Burr)*			
467.	14322	*Josephinia sp. Marandoo (M.E. Trudgen 1554)*		P1	
468.	29046	*Lactuca serriola forma serriola*	Y		
469.	5846	*Lamarchea sulcata*			
470.	19726	*Leiocarpa semicalva*			
471.	19236	*Leiocarpa tomentosa*			
472.	3022	*Lepidium catapycnon (Hamersley Lepidium)*		P4	

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473.	3025	*Lepidium echinatum*			
474.	3032	*Lepidium muelleri-ferdinandii*			
475.	3033	*Lepidium oxytrichum*			
476.	3035	*Lepidium pedicellosum*			
477.	3037	*Lepidium phlebopetalum (Veined Peppercress)*			
478.	3038	*Lepidium pholidogynum*			
479.	37480	*Lobelia arnhemiaca*			
480.	7403	*Lobelia heterophylla (Wing-seeded Lobelia)*			
481.	36863	*Lobelia heterophylla subsp. heterophylla*			
482.	36880	*Lobelia heterophylla subsp. pilbarensis*			
483.	4061	*Lotus cruentus (Redflower Lotus)*			
484.	2396	*Lysiana casuarinae*			
485.	2398	*Lysiana murrayi (Mistletoe, Parka-Parka)*			
486.	2538	*Maireana carnosa (Cottony Bluebush)*			
487.	2544	*Maireana georgei (Satiny Bluebush)*			
488.	2551	*Maireana melanocoma (Pussy Bluebush)*			
489.	2556	*Maireana planifolia (Low Bluebush)*			
490.	2566	*Maireana thesioides (Lax Bluebush)*			
491.	2571	*Maireana villosa*			
492.	4962	*Malvastrum americanum (Spiked Malvastrum)*	Y		
493.	12949	*Marsdenia australis*			
494.	74	*Marsilea drummondii (Common Nardoo)*			
495.	75	*Marsilea exarata*			
496.	76	*Marsilea hirsuta (Nardoo)*			
497.		*Marsilea sp.*			
498.	19500	*Maytenus sp. Mt Windell (S. van Leeuwen 846)*			
499.	5875	*Melaleuca argentea (Silver Cadjeput, Bandaran)*			
500.	5908	*Melaleuca eleuterostachya*			
501.	5915	*Melaleuca glomerata*			
502.	5051	*Melhania oblongifolia*			
503.	14985	*Melinis repens*	Y		
504.	3054	*Menkea villosula*			
505.	7082	*Mimulus gracilis*			
506.	8110	*Minuria leptophylla (Minnie Daisy)*			
507.	4105	*Mirbelia viminalis*			
508.	490	*Monachather paradoxus*			
509.	17158	*Myoporum montanum (Native Myrtle)*			
510.	17925	*Myriocephalus oldfieldii*			
511.	3614	*Neptunia dimorphantha (Sensitive Plant)*			
512.	20252	*Newcastelia sp. Hamersley Range (S. van Leeuwen 4264)*			
513.	6971	*Nicotiana benthamiana (Tjuntiwari)*			
514.	6976	*Nicotiana occidentalis (Native Tobacco)*			
515.	11331	*Nicotiana occidentalis subsp. obliqua*			
516.	11856	*Nicotiana occidentalis subsp. occidentalis*			
517.	6977	*Nicotiana rosulata (Rosetted Tobacco)*			
518.	11410	*Nicotiana rosulata subsp. ingulba*			
519.	11734	*Nicotiana rosulata subsp. rosulata*			
520.	6979	*Nicotiana simulans*			
521.	38423	*Notoleptopus decaisnei var. Orbicularis (A.B. Craig 428)*			
522.	7338	*Oldenlandia crouchiana*			
523.	19640	*Oldenlandia sp. Hamersley Station (A.A. Mitchell PRP 1479)*		P3	
524.	12635	*Olearia fluvialis*			
525.	12638	*Olearia mucronata*		P3	
526.	8151	*Olearia stuartii*			
527.	8153	*Olearia xerophila*			
528.	17	*Ophioglossum lusitanicum (Adders Tongue)*			
529.	30374	*Oxalis sp. Pilbara (M.E. Trudgen 12725)*		P2	
530.	7117	*Pandorea pandorana*			
531.	503	*Panicum decompositum (Native Millet, Kaltu-kaltu)*			
532.	504	*Panicum effusum (Hairy Panic Grass)*			
533.	505	*Panicum laevinode*			
534.	43	*Paraceterach reynoldsii*			
535.	515	*Paraneurachne muelleri (Northern Mulga Grass)*			
536.	12670	*Parietaria cardiostegia*			
537.	10975	*Paspalidium basicladum*			
538.	518	*Paspalidium clementii (Clements Paspalidium)*			
539.	519	*Paspalidium constrictum (Knottybutt Grass)*			
540.	521	*Paspalidium gracile (Slender Panic)*			
541.	522	*Paspalidium jubiflorum (Warrego Grass)*			
542.	523	*Paspalidium rarum (Rare Paspalidium)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
543.	42160	*Pentalepis trichodesmoides subsp. trichodesmoides*			
544.	12486	*Peplidium aithocheilum*			
545.	7092	*Peplidium muelleri*			
546.	18462	*Peplidium sp. E Evol. Fl. Fauna Arid Aust. (A.S. Weston 12768)*			
547.	34997	*Peripleura arida*			
548.	34998	*Peripleura obovata*			
549.	35001	*Peripleura virgata*			
550.	546	*Perotis rara (Comet Grass)*			
551.	3675	*Petalostylis labicheoides (Slender Petalostylis)*			
552.	9056	*Phyllanthus baccatus*			
553.	17626	*Phyllanthus erwinii*			
554.	4680	*Phyllanthus maderaspatensis*			
555.	4687	*Phyllanthus virgatus*			
556.	20311	*Pilbara trudgenii*		P3	
557.	5245	*Pimelea forrestiana*			
558.	5250	*Pimelea holroydii*			
559.	11185	*Pimelea microcephala subsp. microcephala*			
560.	35276	*Plectranthus scutellarioides*			
561.	8167	*Pluchea dentex*			
562.	17816	*Pluchea ferdinandi-muelleri*			
563.	6491	*Plumbago zeylanica (Native Plumbago)*			
564.	45239	*Podolepis eremaea*			
565.	45242	*Podolepis remota*			
566.	12075	*Polycarpaea corymbosa var. corymbosa*			
567.	2901	*Polycarpaea holtzei*			
568.	2903	*Polycarpaea longiflora*			
569.	41365	*Polygala glaucifolia*			
570.	6653	*Polymeria ambigua (Morning Glory)*			
571.	17513	*Polymeria lanata*			
572.	12964	*Pomax rupestris*			
573.	43981	*Portulaca decipiens*			
574.	2884	*Portulaca oleracea (Purslane, Wakati)*			
575.	2886	*Portulaca pilosa (Djanggara)*	Y		
576.	12707	*Prostanthera albiflora*			
577.	6912	*Prostanthera campbellii*			
578.	8189	*Pseudognaphalium luteoalbum (Jersey Cudweed)*			
579.	18154	*Psydrax latifolia*			
580.	18210	*Psydrax rigidula*			
581.	18155	*Psydrax suaveolens*			
582.	41221	*Pterocaulon serrulatum var. velutinum*			
583.	8192	*Pterocaulon sphacelatum (Apple Bush, Fruit Salad Plant)*			
584.	8193	*Pterocaulon sphaeranthoides*			
585.	2690	*Ptilotus aervoides*			
586.	2696	*Ptilotus astrolasius*			
587.	2698	*Ptilotus auriculifolius*			
588.	2704	*Ptilotus calostachyus (Weeping Mulla Mulla)*			
589.	2706	*Ptilotus carinatus*			
590.	2711	*Ptilotus clementii (Tassel Top)*			
591.	2718	*Ptilotus drummondii (Narrowleaf Mulla Mulla)*			
592.	2725	*Ptilotus fusiformis*			
593.	2727	*Ptilotus gaudichaudii*			
594.	2728	*Ptilotus gomphrenoides*			
595.	2731	*Ptilotus helipteroides (Hairy Mulla Mulla)*			
596.	2734	*Ptilotus incanus*			
597.	2741	*Ptilotus macrocephalus (Featherheads)*			
598.	2744	*Ptilotus mollis*		P4	
599.	2746	*Ptilotus nobilis (Tall Mulla Mulla)*			
600.	41001	*Ptilotus nobilis subsp. nobilis (Yellow Tails)*			
601.	2747	*Ptilotus obovatus (Cotton Bush)*			
602.	2751	*Ptilotus polystachyus (Prince of Wales Feather)*			
603.	2754	*Ptilotus roei*			
604.	2755	*Ptilotus rotundifolius (Royal Mulla Mulla)*			
605.	2757	*Ptilotus schwartzii*			
606.	15855	*Ptilotus schwartzii var. schwartzii*			
607.	2582	*Rhagodia eremaea (Thorny Saltbush)*			
608.	20168	*Rhagodia sp. Hamersley (M. Trudgen 17794)*		P3	
609.	13308	*Rhodanthe charsleyae*			
610.	13301	*Rhodanthe floribunda*			
611.	13246	*Rhodanthe humboldtiana*			
612.	13310	*Rhodanthe margarethae*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
613.	42011	*Rhodanthe polakii*			
614.	13251	*Rhodanthe propinqua*			
615.	6599	*Rhyncharrhena linearis (Bush Bean, Wintjulanypa)*			
616.	4190	*Rhynchosia australis (Rhynchosia)*			
617.	4191	*Rhynchosia minima (Rhynchosia)*			
618.		*Rhynchosia sp.*			
619.	45148	*Roebuckiella ciliocarpa*			
620.	45178	*Roebuckiella similis*			
621.	11556	*Rostellularia adscendens var. latifolia*		P3	
622.	2443	*Rumex vesicarius (Ruby Dock)*	Y		
623.	8198	*Rutidosis helichrysoides (Grey Wrinklewort)*			
624.	30434	*Salsola australis*			
625.	2356	*Santalum acuminatum (Quandong, Warnga)*			
626.	2357	*Santalum lanceolatum (Northern Sandalwood, Yarnguli)*			
627.	12578	*Scaevola acacioides*			
628.	12723	*Scaevola amblyanthera*			
629.	13179	*Scaevola amblyanthera var. amblyanthera*			
630.	13178	*Scaevola amblyanthera var. centralis*			
631.	12579	*Scaevola browniana*			
632.	13150	*Scaevola browniana subsp. browniana*			
633.	13172	*Scaevola parvifolia subsp. pilbarae*			
634.	7644	*Scaevola spinescens (Currant Bush, Maroon)*			
635.	41660	*Schenkia australis*			
636.	599	*Schizachyrium fragile (Senale Redgrass)*			
637.	13285	*Schoenia ayersii*			
638.	48355	*Schoenoplectiella dissachantha*			
639.	48362	*Schoenoplectiella laevis*			
640.	16257	*Schoenoplectus subulatus*			
641.	2602	*Sclerolaena convexula*			
642.	2603	*Sclerolaena cornishiana (Cartwheel Burr)*			
643.	2604	*Sclerolaena costata*			
644.	2607	*Sclerolaena densiflora*			
645.	2611	*Sclerolaena eriacantha (Tall Bindii)*			
646.	2631	*Sclerolaena tetragona*			
647.	8213	*Senecio magnificus (Showy Groundsel)*			
648.	17645	*Senna artemisioides*			
649.	12279	*Senna artemisioides subsp. helmsii*			
650.	12280	*Senna artemisioides subsp. oligophylla*			
651.	17558	*Senna artemisioides subsp. x artemisioides*			
652.	12283	*Senna artemisioides subsp. x sturtii*			
653.	18448	*Senna cuthbertsonii*			
654.	18443	*Senna ferraria*			
655.	18449	*Senna glaucifolia*			
656.	18346	*Senna glutinosa*			
657.	12305	*Senna glutinosa subsp. chatelainiana*			
658.	12307	*Senna glutinosa subsp. glutinosa*			
659.	12309	*Senna glutinosa subsp. pruinosa*			
660.	12308	*Senna glutinosa subsp. x luerssenii*			
661.	18451	*Senna hamersleyensis*			
662.	12312	*Senna notabilis*			
663.	12315	*Senna pleurocarpa var. angustifolia*			
664.	19347	*Senna sericea*			
665.	18595	*Senna sp. Karijini (M.E. Trudgen 10392)*			
666.	14577	*Senna sp. Meekatharra (E. Bailey 1-26)*			
667.	18445	*Senna stricta*			
668.	12319	*Senna venusta*			
669.	46816	*Seringia elliptica (Showy fire-bush)*			
670.	46821	*Seringia nephrosperma (Free carpel fire-bush)*			
671.	4196	*Sesbania cannabina (Sesbania Pea)*			
672.	606	*Setaria dielsii (Diels' Pigeon Grass)*			
673.	612	*Setaria surgens (Pigeon Grass)*			
674.	613	*Setaria verticillata (Whorled Pigeon Grass)*	Y		
675.	4966	*Sida arenicola*			
676.	4970	*Sida calyxhymenia (Tall Sida)*			
677.	4971	*Sida cardiophylla*			
678.	4972	*Sida clementii*			
679.	4976	*Sida echinocarpa*			
680.	31759	*Sida ectogama*			
681.	4977	*Sida fibulifera (Silver Sida)*			
682.	4986	*Sida platycalyx (Lifesaver Burr)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
683.	4988	*Sida rohlenae*			
684.	18149	*Sida rohlenae subsp. rohlenae*			
685.	31859	*Sida sp. Articulation below (A.A. Mitchell PRP 1605)*			
686.	16616	*Sida sp. Barlee Range (S. van Leeuwen 1642)*		P3	
687.	31854	*Sida sp. Excedentifolia (J.L. Egan 1925)*			
688.	31857	*Sida sp. Golden calyces glabrous (H.N. Foote 32)*			
689.	33697	*Sida sp. Hamersley Range (K. Newbey 10692)*		P1	
690.	33698	*Sida sp. Pilbara (A.A. Mitchell PRP 1543)*			
691.	20253	*Sida sp. Shovelanna Hill (S. van Leeuwen 3842)*			
692.	19712	*Sida sp. dark green fruits (S. van Leeuwen 2260)*			
693.	16617	*Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)*			
694.	18144	*Sida sp. tiny glabrous fruit (A.A. Mitchell PRP1152)*			
695.	16948	*Sida sp. verrucose glands (F.H. Mollemans 2423)*			
696.	4989	*Sida spinosa (Spiny Sida)*			
697.	16923	*Sida trichopoda*			
698.	8223	*Sigesbeckia orientalis (Indian Weed)*	Y		
699.	6995	*Solanum centrale (Desert Raisin, Kampurarpa)*			
700.	6997	*Solanum chippendalei*			
701.	6998	*Solanum cleistogamum*			
702.	42544	*Solanum elatius*			
703.	7008	*Solanum ferocissimum*			
704.	7009	*Solanum gabrielae*			
705.	7014	*Solanum horridum*			
706.	42542	*Solanum kentrocaule*		P3	
707.	7018	*Solanum lasiophyllum (Flannel Bush, Mindjulu)*			
708.	9258	*Solanum morrisonii*			
709.	7022	*Solanum nigrum (Black Berry Nightshade)*	Y		
710.	7026	*Solanum orbiculatum (Wild Tomato)*			
711.	11241	*Solanum orbiculatum subsp. orbiculatum (Round-leaved Solanum)*			
712.	7029	*Solanum phlomoides*			
713.	42546	*Solanum piceum*			
714.	7036	*Solanum sturtianum (Thargomindah Nightshade)*			
715.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
716.	13575	*Spermacoce brachystema*			
717.	629	*Sporobolus australasicus (Fairy Grass)*			
718.	4731	*Stackhousia intermedia*			
719.	19555	*Stackhousia muricata subsp. annual (W.R. Barker 2172)*			
720.	18405	*Stackhousia sp. swollen gynophore (W.R. Barker 2041)*			
721.	12488	*Stemodia glabella*			
722.	7098	*Stemodia grossa (Marsh Stemodia, Mindjaara)*			
723.	7102	*Stemodia viscosa (Pagurda)*			
724.	16199	*Stenanthemum petraeum*			
725.	3074	*Stenopetalum anfractum*			
726.	3075	*Stenopetalum decipiens*			
727.	3078	*Stenopetalum nutans*			
728.	3082	*Stenopetalum velutinum (Velvet Thread Petal)*			
729.	8234	*Streptoglossa adscendens*			
730.	8235	*Streptoglossa bubakii*			
731.	8237	*Streptoglossa decurrens*			
732.	8238	*Streptoglossa liatroides*			
733.	12492	*Striga squamigera*			
734.	18123	*Stylidium weeliwolli*		P3	
735.	3182	*Stylobasium spathulatum (Pebble Bush)*			
736.	12353	*Stylosanthes hamata (Verano Stylo)*	Y		
737.	4220	*Swainsona canescens (Grey Swainsona)*			
738.	13596	*Swainsona complanata*			
739.	4223	*Swainsona decurrens*			
740.	13595	*Swainsona elegantoides*			
741.	12356	*Swainsona formosa*			
742.	4231	*Swainsona kingii*			
743.	4233	*Swainsona leeana*			
744.	4234	*Swainsona maccullochiana (Ashburton Pea)*			
745.	4238	*Swainsona oroboides (Variable Swainsona)*			
746.	13585	*Swainsona tenuis*			
747.	42142	*Swainsona thompsoniana*		P3	
748.	25902	*Symphyotrichum squamatum (Bushy Starwort)*	Y		
749.	7363	*Synaptantha tillaeacea*			
750.	48206	*Synostemon rhytidospermus*			
751.	4252	*Templetonia egena (Round Templetonia)*			
752.	41986	*Tephrosia oxalidea*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
753.	41825	*Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)*			
754.	17768	*Tephrosia sp. Bungaroo Creek (M.E. Trudgen 11601)*			
755.	41811	*Tephrosia sp. Fortescue (A.A. Mitchell 606)*			
756.	42442	*Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)*			
757.	42225	*Tephrosia sp. Newman (A.A. Mitchell PRP 29)*			
758.	40060	*Tephrosia sp. clay soils (S. van Leeuwen et al. PBS 0273)*			
759.	4287	*Tephrosia virens*			
760.	25768	*Tetratheca fordiana*		P1	
761.	48313	*Teucrium disjunctum*			
762.	19366	*Teucrium pilbaranum*		P2	
763.	48603	*Teucrium teucriiflorum*			
764.	17820	*Themeda sp. Hamersley Station (M.E. Trudgen 11431)*		P3	
765.	17819	*Themeda sp. Mt Barricade (M.E. Trudgen 2471)*			
766.	673	*Themeda triandra*			
767.	674	*Thyridolepis mitchelliana (Mulga Grass)*			
768.	1329	*Thysanotus exiliflorus*			
769.	6278	*Trachymene oleracea*			
770.	19043	*Trachymene oleracea subsp. oleracea*			
771.	19053	*Trachymene pilbarensis*			
772.	678	*Tragus australianus (Small Burrgrass)*			
773.	44241	*Trianthema glossostigmum*			
774.	44305	*Trianthema pilosum*			
775.	4374	*Tribulus astrocarpus*			
776.	4376	*Tribulus forrestii*			
777.	4377	*Tribulus hirsutus*			
778.	4379	*Tribulus macrocarpus*			
779.	18072	*Tribulus suberosus*			
780.	6727	*Trichodesma zeylanicum (Camel Bush, Kumbalin)*			
781.	29483	*Tricoryne sp. Hamersley Range (S. van Leeuwen 915)*			
782.	8252	*Tridax procumbens (Tridax, Tridax Daisy)*	Y		
783.	48201	*Trigastrotheca molluginea*			
784.	4316	*Trigonella suavissima (Sweet Fenugreek)*			
785.	17886	*Triodia biflora*			
786.	681	*Triodia brizoides*			
787.	690	*Triodia longiceps (Giant Grey Spinifex)*			
788.	17877	*Triodia melvillei*			
789.	696	*Triodia pungens (Soft Spinifex)*			
790.	17873	*Triodia schinzii*			
791.		*Triodia sp.*			
792.	41101	*Triodia sp. Karijini (S. van Leeuwen 4111)*		P1	
793.	19534	*Triodia sp. Mt Ella (M.E. Trudgen 12739)*		P3	
794.	48463	*Triodia vanleeuwenii*			
795.	704	*Triodia wiseana (Limestone Spinifex)*			
796.	48319	*Tripogonella loliiformis*			
797.	706	*Triraphis mollis (Needle Grass)*			
798.	4879	*Triumfetta leptacantha*			
799.	14942	*Triumfetta maconochieana*			
800.	29268	*Urochloa occidentalis*			
801.	717	*Urochloa piligera*			
802.	718	*Urochloa pubigera*			
803.	30716	*Vachellia farnesiana (Mimosa Bush)*	Y		
804.	7654	*Velleia connata (Cup Velleia)*			
805.	4323	*Vigna lanceolata (Maloga Vigna, Wega)*			
806.	11576	*Vigna lanceolata var. lanceolata*			
807.		*Vigna sp.*			
808.	31391	*Vigna sp. Hamersley Clay (A.A. Mitchell PRP 113)*			
809.	11788	*Vittadinia dissecta var. hirta*			
810.	8265	*Vittadinia eremaea*			
811.	33026	*Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684)*		P1	
812.	20153	*Vittadinia sp. Earaheedy (D.J. Edinger 3106)*			
813.	7386	*Wahlenbergia gracilenta (Annual Bluebell)*			
814.	7393	*Wahlenbergia tumidifructa*			
815.	5106	*Waltheria indica*			
816.	48251	*Xerochrysum boreale*		P3	
817.	48250	*Xerochrysum interiore*			
818.	44861	*Xerochrysum macranthum*			
819.	732	*Yakirra australiensis*			
820.	18140	*Zygophyllum eichleri*			
821.	4392	*Zygophyllum iodocarpum*			
822.	4396	*Zygophyllum tesquorum*			

Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

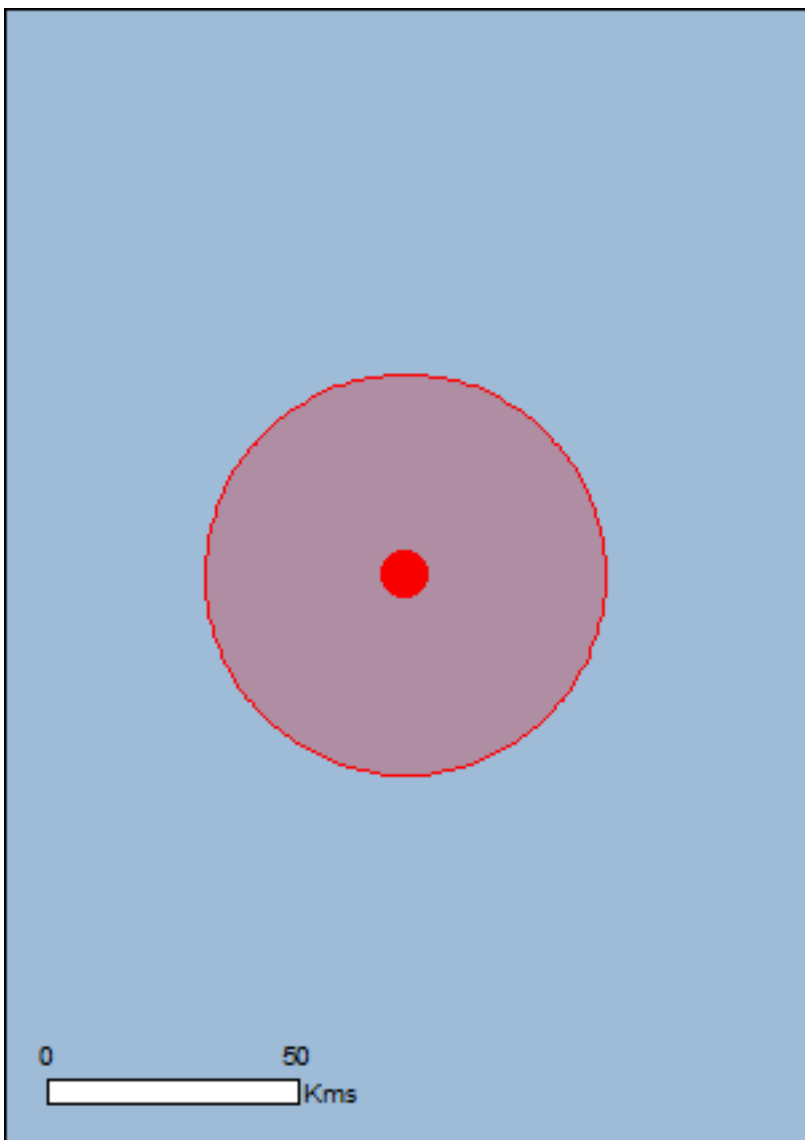
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 26/06/18 15:57:07

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



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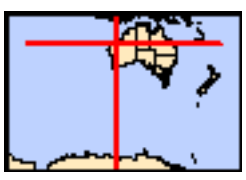
Coordinates
Buffer: 40.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	8
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	13
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	9
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Pezoporus occidentalis		
Night Parrot [59350]	Endangered	Species or species habitat likely to occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus hallucatus		
Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Macroderma gigas		
Ghost Bat [174]	Vulnerable	Breeding known to occur within area
Macrotis lagotis		
Greater Bilby [282]	Vulnerable	Species or species habitat may occur within area
Rhinonicteris aurantia (Pilbara form)		
Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Liasis olivaceus barroni		
Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundo rustica		
Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Mammals		
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-23.06752 119.03234

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix D: Previous Survey Area Locations

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680000 700000 720000 740000 760000

7460000 7440000 7420000

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Mattiske (1995)

Mattiske (2009a)

Biota (2014)

Biota (2006)

Mattiske (2008a)

Mattiske (2009b)

Mattiske (2010)

Ecologia (2013)

Mattiske (2008b)

- Survey Area
- Biota (2006) Hope Downs Rail Corridor (Juna Downs Section) Vegetation and Flora Survey
- Mattiske (2008b) Flora and Vegetation of the Hope Downs 4 Lease Area
- Mattiske (2009b) Flora and Vegetation of the Hope Downs 4 Mine Pipeline Corridor to Ophthalmia Dam
- Mattiske (2010) Flora and Vegetation of the Hope Downs 2 Area
- Ecologia (2013) Rio Tinto Greater West Angelas Vegetation and Flora Assessment
- Biota (2014) Baby Hope Downs Flora and Vegetation Survey
- Mattiske (1995) Flora and Vegetation – Southern Transport Corridor
- Mattiske (2008a) Flora and Vegetation of the Hope Downs 4 Mine Infrastructure Corridor
- Mattiske (2009a) Flora and Vegetation Of The Hope Downs 1 Area

Rio Tinto

Hope Downs 2 Proposal – Flora and Vegetation Survey

Figure D.1. Previous flora surveys conducted in the vicinity of the survey area

Coordinate System: GDA 1994 MGA Zone 50

0 5 10 15 20 Kilometres

N

astron delivering environmental intelligence™

Author: B. Eckermann Drawn: C. Dyde Date: 30-10-2019 Figure Ref: 14292A-19-BIDR-3RevB_191030_FigD1_PrevSurveys

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Appendix E: Threatened and Priority Flora Species Likelihood of Occurrence within the Survey Area

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Table E.1: Likelihood of occurrence of conservation significant flora recorded within 50 km of the survey area (NatureMap (Department of Biodiversity, Conservation, and Attractions 2019a), PMST (Department of the Environment and Energy 2019), TPFL (Department of Biodiversity, Conservation, and Attractions 2019b), TP List (Department of Biodiversity, Conservation, and Attractions 2019c), WA Herbarium (Department of Biodiversity, Conservation, and Attractions 2019d) and the Rio Database custom search (Rio Tinto Iron Ore 2019)). The TP List database is searched using place names, as a result, many of the records obtained from this database may occur beyond 50 km of the survey area.

Species	Habit and flowering information[1]	Life form[1]	Habitat[1]	Distance from survey area (km)	Likelihood of occurrence	
					Pre-survey	Post-survey
Threatened						
Pityrodia augustensis	Bushy shrub to 1 m. Flowers purple-red, August to September.	Perennial	Amongst rocks on slopes, or in drainage lines, gullies. Sandstone substrate or yellow brown sandy loam over granite. Within open *Acacia* shrublands or scrub.	>200	Unlikely	Unlikely
Thryptomene wittweri	Spreading, rounded, conifer- like, aromatic shrub, 0.5-1.5 (-2.1) m high. Leaves with conspicuous oil glands. White-cream flowers in April or July or August.	Perennial	Skeletal red stony soils. Breakaways, stony creek beds. Only known from high mountain peaks, in stony creek beds and water channels.	33	Unlikely	Unlikely
Priority 1						
Calotis squamigera	Procumbent, branches, hairy annual herbs to 0.25 m high. Yellow flowers in July.	Annual	Pebbly/stony red brown loam in a poorly defined flow line.	38	Unlikely	Unlikely
Cochlospermum macnamarae	Spreading, multi-stemmed shrubs to 2 m high and 3 m wide with digitately lobed leaves and large yellow flowers.	Perennial	Granite outcrops, hills with exposed granite faces and domes. Plants grow as isolated shrubs over very open *Triodia* spp. hummock grassland.	~100	Unlikely	Unlikely
Dicrastylis mitchellii	Shrubs to 0.3 m with a very dense, white indumentum of short and long dendritic hairs. White or cream flowers, with dots or stripes in throat of corolla.	Perennial	Sand or clay soils. Around dunes.	63	Unlikely	Unlikely

Species	Habit and flowering information[1]	Life form[1]	Habitat[1]	Distance from survey area (km)	Likelihood of occurrence	
					Pre-survey	Post-survey
Euphorbia inappendiculata var. *queenslandica*	Spreading, much-branched, procumbent herb to 0.3m long. Leaves opposite, petiolate, obovate, very small sinuate-denticulate and glabrous.	Annual	Cracking clay (gilgai) flats and depressions, quartzite. Can be found in hummock grasslands of *Triodia* spp.	20	Potential	Unlikely - no suitable habitat
Eragrostis sp. Mt Robinson (S. van Leeuwen 4109)	Tussock-forming grass with woolly base to 0.3 m high. Flowers September.	Perennial	Red-brown skeletal soils, ironstone, Brockman Iron Formation. Steep slopes, summits on Mt Robinson. Found within *Eucalyptus* mallee shrubs and *Acacia* spp. over hummock grasses.	46	Unlikely	Unlikely
Eremophila sp. West Angelas (S. van Leeuwen 4068)	Erect-branched spindly whip shrub with narrow leaves to 3 m high. Flower purple with corolla medial lobe of lower lip completely closes the throat.	Perennial	Rocky hills or ridges and mulga bands in clay soil between rocky ridges. Very steep hillslope of brown silty loam. Breakaways, skeletal red gritty soil over massive banded iron.	0	Likely	Recorded
Eremophila spongiocarpa	Intricately spreading, compact, succulent-leaved shrub, to 1 m high, non-resinous. Fruit with a spongy skeletal network. Flowers white, May or September.	Perennial	Sub-saline red clay loams in the Fortescue Marsh	48	Unlikely	Unlikely
Goodenia pedicellata	Single-stemmed perennial herb, (with dense cottony and strigose hairs), to 0.25 m high. Flowers yellow, June	Perennial	Rocky clayey soils, rocky slopes and crests of low hills.	38	Unlikely	Unlikely
Hibiscus sp. Mt Brockman (E. Thoma ET 1354)	Shrub to 3 m high. Flowers purple, February to August.	Perennial	Hill summit, gorge, sheltered or rocky drainage lines below associated cliff-lines or rocky ridges. Red - brown sand, skeletal soils.	10	Potential	Unlikely - suitable habitat searched

Species	Habit and flowering information[1]	Life form[1]	Habitat[1]	Distance from survey area (km)	Likelihood of occurrence	
					Pre-survey	Post-survey
Rhodanthe ascendens	Ascending herb, daisy with narrow cauline leaves to 0.1 m high. Flowers yellow, August.	Annual	Flat terrain, low in landscape, stony gibber with red cracking clay soils or sandy soils.	34	Unlikely	Unlikely
Synostemon hamersleyensis	Glabrous, monoecious or dioecious subshrub from a perennial woody rootstock with stems much-branched to 1 m tall. Flowers in spring (observations are limited to August, October and November)	Perennial	Breakaway formations and rock outcrops either side of incised gully systems and upper slopes on wide undulating ridges adjacent to large deeply incised gullies. Occurs most commonly at altitudes of 500 m to 700 m above sea level. (Telford and Naaykens, 2015)	32	Unlikely	Unlikely
Triodia sp. Karijini (S. van Leeuwen 4111)	Hummock grass to 1 m high. Non-resinous to weakly resinous, soft-type foliage.	Perennial	On or near outcropping ironstone, on summits or steep hillslopes of mountains.	39	Unlikely	Unlikely
Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684)	Erect herb.	Annual	Flat plain, cracking clay, low in landscape, red sandy clay loam with some stone.	9	Likely	Potential – habitat present, poor seasonal conditions
Priority 2						
Adiantum capillus-veneris	A soft, cascading fern with fronds arising from a creeping rhizome 3 mm to 8 mm thick.	Perennial	Moist, sheltered sites in gorges and on cliff walls.	~170	Unlikely	Unlikely
Aristida lazaridis	Densely clumped grass with clumps to 1.4 m high. Leaf-blade surface scaberulous. Flowers April.	Perennial	Sand, loam, clayey soils. Plains, ironstone hills in *Triodia* spp. hummock grassland with sparse overstorey of *Eucalyptus leucophloia*. Mulga Shrublands.	<1	Likely	Recorded

Species	Habit and flowering information[1]	Life form[1]	Habitat[1]	Distance from survey area (km)	Likelihood of occurrence	
					Pre-survey	Post-survey
Arthropodium sp. Ironstone (J. Bull & J. Waters ONS PJ 36.01)	Herb to 1 m high	Short-lived perennial	Slope. Outcropping of banded iron formation, red-brown loam soil.	43	Unlikely	Unlikely
Cladium procerum	Densely tufted grass-like or herb (sedge) to 2 m high. Nodding Inflorescences. Flowers November.	Perennial	Perennial streams and pond edges and along streams in deep gorges of the Hamersley Range.	11	Potential	Unlikely – no suitable habitat
Eremophila pusilliflora	Low spreading shrub. Flowers purple, July to April.	Perennial	Seasonally inundated alluvial plains between Turee Creek, Pingandy Creek and drainage systems leading into the Ashburton River, growing in red-brown sandy loam soils in open low shrubland with *Acacia aneura*, *Ptilotus nobilis*, *Goodenia* spp. and *Triodia* spp. (Buirchell and Brown 2016).	19	Potential	Potential – habitat present, poor seasonal conditions
Euphorbia australis var. *glabra*	Prostrate herb, stems much-branched, prostrate sometimes ascending c. 50 mm to 30 mm long, usually green or reddish.	Annual or short-lived perennial	Sump, low in landscape. Saline flats on alluvial cracking clay loamy soil, gritty with ironstone fragments. Associated with low forest of *Eucalyptus victrix* over low scrub of *Muehlenbeckia florulenta*.	36	Unlikely	Unlikely
Gompholobium karijini	Shrub to 0.7 m high.	Perennial	Low undulating hills, skeletal soils on the edges of deep ravines or plateaux on banded ironstone.	~90	Unlikely	Unlikely
Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708)	Spindly upright shrub to 3 m high. Flowers May to July.	Perennial	Near summit of hill, high in landscape, skeletal red-brown stony soil over massive ironstone of the Brockman Iron Formation. Sheltered or rocky drainage lines below associated cliff lines or rocky ridges.	0	Likely	Recorded

Species	Habit and flowering information[1]	Life form[1]	Habitat[1]	Distance from survey area (km)	Likelihood of occurrence	
					Pre-survey	Post-survey
Indigofera ixocarpa	Shrub, to 1 m high. Flowers pink, May.	Perennial	Skeletal red soils over massive ironstone. Gorge, gully, hilltop. Creekline.	~90	Unlikely	Unlikely
Ipomoea racemigera	Creeping herb or climber. Flowers white, flowers throughout the year, mainly March-August	Annual	Flats with brown silty loam soil, major drainage. Creekline. Basalt uplands.	26	Potential	Potential - habitat present, poor seasonal conditions
Isotropis parviflora	Compact sub-shrub, 0.1 m high. Flowers white/pink, pea-like, March.	Short-lived perennial	Valley slope of ironstone plateau. Associated with Mallee on slopes or with hard spinifex on ironstone.	10	Potential	Potential – habitat present, poor seasonal conditions
Kohautia australiensis	Erect sparsely or much-branched annual, herb, 0.1 m to 0.5 m high. Flowers blue.	Annual	Low rise or hill. Calcrete	38	Unlikely	Unlikely
Oxalis sp. Pilbara (M.E. Trudgen 12725)	Small, trailing or tufted, three leaved herb. Leaves purplish below. Flowers yellow, May to September.	Annual or short-lived perennial	Shaded areas around rock outcropping, gullies and gully walls.	14	Potential	Potential – habitat present, poor seasonal conditions
Pentalepis trichodesmoides subsp. *hispida*	Multi-stemmed shrub to 0.8 m high. Flowers July to October.	Perennial	Summit of ridge, cobbled slopes, outcrops, high in landscape, steep terrain, skeletal brown gritty soil, banks of creeks and edges of basalt screes.	59	Unlikely	Unlikely
Tetratheca fordiana	Dwarf twiggy leafless shrub with large obvious hairs on the stem, grows to 0.4 m high. Flowers, pink, June to July, September.	Perennial	Shale pocket amongst ironstone. Cliff faces, crests, ridges and outcrops in upper rocky ironstone ridgelines, skeletal soils.	22	Unlikely	Unlikely
Rhodanthe frenchii	Upright herb, to 0.35 m high. Flowers yellow, August to October.	Annual	Stony hills, rocky river banks & outcrops.	21	Unlikely	Unlikely

Species	Habit and flowering information[1]	Life form[1]	Habitat[1]	Distance from survey area (km)	Likelihood of occurrence	
					Pre-survey	Post-survey
Teucrium pilbaranum	Upright shrub, 0.2 m high. Flowers white, May or September.	Perennial	Clay. Crab hole plain in a river floodplain, margin of calcrete table.	14	Potential	Potential - habitat present, poor seasonal conditions
Priority 3						
Acacia daweana	Low-spreading, often more or less flat-topped shrubs to 1.5 m tall and 2 m to 5 m across. Flowers yellow, July to September.	Perennial	Rocky red skeletal loam with *Triodia* spp. on lower scree slopes and bajada outwash fans of rocky banded ironstone ranges and ridges (often along diffuse but well incised drainage lines).	33	Unlikely	Unlikely
Acacia effusa	Low, dense, spreading (0.6 m to 3 m across), domed or flat-topped somewhat viscid shrub, to 1.2 m high, bark 'minniritchi'. Flowers yellow, May to August.	Perennial	Rocky red loam with surface strew of rocks with *Triodia* spp. On lower scree slopes of low rocky ranges (often along diffuse drainage lines) or on the bajada alluvial plain at the base of large banded ironstone mountains and ranges such as Mt Bruce.	17	Potential	Unlikely – suitable habitat searched
Acacia subtiliformis	Spindly, slender, erect shrub, to 3.5 m high, new growth slightly viscid, resinous, aromatic. Flowers yellow, June.	Perennial	Low, undulating country on calcareous rises adjacent to drainage lines.	0	Likely	Previously recorded
Amaranthus centralis	Herb, decumbent or erect to 0.6 m high. Stems angular, sometimes reddish. Flowers throughout the year	Annual	Red sand in ephemeral watercourses, sandy to clayey loam on river banks and edges of permanent pools in *Eucalyptus* lined channels or *Acacia* shrubland. It also occurs in areas of permanent water such as bore overflows, gardens and cultivation.	20	Potential	Potential – some habitat present, poor seasonal conditions
Ampelopteris prolifera	Rhizomatous herb (fern), to 4 m high.	Perennial	Near water or in wet ground, along shaded perennial stream banks.	~70	Unlikely	Unlikely

Species	Habit and flowering information[1]	Life form[1]	Habitat[1]	Distance from survey area (km)	Likelihood of occurrence	
					Pre-survey	Post-survey
Aristida jerichoensis var. *subspinulifera*	A compactly tufted grass-like or herb with lemma groove muricate. It grows 0.30 m to 0.80 m in height, leaf blade wire-like.	Perennial	Hardpan plains with deep soil with open *Acacia* woodlands over *Triodia* and other grasses.	4	Likely	Potential - habitat present, not all suitable habitat searched, poor seasonal conditions.
Atriplex flabelliformis	Monoecious, erect, rounded herb, (with grey-green leaves) to 0.35 m high.	Perennial	Clay loam, loam. Saline flats or marshes, saline soils that are seasonally inundated.	52	Unlikely	Unlikely
Dampiera anonyma	Multi-stemmed diffuse to straggling herb, 0.3 - 0.5 (1) m high. Whitish, dendritic hairs on most parts, becoming glabrescent. Flowers and fruit recorded from June - September.	Perennial	Hummock grasslands on hills slopes and summits above 1,000 m, in skeletal, red-brown soil over massive banded ironstone of the Brockman Iron Formation. Also meta-basalt, shale and jaspilite.	~100	Unlikely	Unlikely
Dampiera metallorum	Rounded, multistemmed shrub to 0.5 m high with dense, appressed, whiteish, dendritic hairs on most parts but becoming glabrescent with age. Flowers blue, April, June or October.	Perennial	Hill summits or upper slopes (above 1,000 m) in skeletal, red-brown gravelly soil over massive banded ironstone of the Brockman Iron Formation.	3	Likely	Unlikely - suitable habitat searched
Dysphania congestiflora	Erect herb to 0.1 m. Flowers June to August following favourable late summer rainfall events that inundate the Fortescue Marsh	Short-lived annual	Flats on the margin and towards the centre of seasonally inundated flood plains and lake beds, on saline, deep, light-medium to heavy clay soils (Dillion and Markey 2016).	60	Unlikely	Unlikely
Eremophila forrestii subsp. *viridis*	Much-branched shrub, to 1 m high with leaves deep green and very sparsely pubescent. Flowers pink-cream, August.	Perennial	Red sand dunes, gully of mesa, shallow, gravelly sandy clay loam soils.	>600	Unlikely	Unlikely

Species	Habit and flowering information[1]	Life form[1]	Habitat[1]	Distance from survey area (km)	Likelihood of occurrence	
					Pre-survey	Post-survey
Eremophila magnifica subsp. *velutina*	Aromatic shrub to 1.3 m high. Velutinous. Flowers blue-purple, June to September.	Perennial	Skeletal soils on the slopes and summits of ironstone hills in the Hamersley Range area.	<1	Likely	Potential – habitat present, not all suitable habitat searched
Eremophila rigida	Erect, very rigid shrubs to 1.2 m high with rigid to leathery ovate leaves. Flower cream, June - September.	Perennial	Red sand alluvium, hardpan plains, stony clay depressions with Acacia and *Eremophila* spp.	46	Unlikely	Unlikely
Eremophila sp. Hamersley Range (K. Walker KW 136)	Erect shrub. Flowers white-cream-yellow-pink-purple, August to September.	Perennial	High in the landscape, cliff tops, gorge tops, steep rocky slopes, gullies and rock faces associated with large hills and cliffs. Skeletal red-brown soils.	0	Likely	Recorded
Eucalyptus rowleyi	Lignotuberous mallee 3 m to 5 m high, bark smooth throughout, not powdery. Flowers November to June.	Perennial	Occurs on red sandy loams on plains and very minor and broad flood-out plains often in small pure stands or in open mallee vegetation with other eucalypt species including *E. gamophylla - E. odontocarpa intergrades* and *E. victrix* usually over a *Triodia* spp. hummock grassland.	~60	Unlikely	Unlikely
Euphorbia clementii	A hard, decumbent, pale stemmed herb to 0.1 m high.	Annual or short-lived perennial	Gravelly hillsides, stony grounds. Clay plains, rocky ironstone slopes, drainage lines on red brown sand.	15	Potential	Unlikely – normal distribution is north of Fortescue Marsh, identification of nearest record is questionable.

Species	Habit and flowering information[1]	Life form[1]	Habitat[1]	Distance from survey area (km)	Likelihood of occurrence	
					Pre-survey	Post-survey
Euphorbia stevenii	Glabrous, upright, succulent perennial (? Biennial) herbaceous subshrub to 0.5 m high. Likely to flower throughout the year, in response to rainfall.	Perennial (? Biennial)	Sandy, or clay-loam soils, floodplains	22	Potential	Unlikely - suitable habitat searched
Fimbristylis sieberiana	Shortly rhizomatous, tufted, grass-like or herb (sedge), 0.25 m to 0.6 m high. Flowers brown, May to June.	Perennial	Mud, skeletal soil pockets. Pool edges, sandstone cliffs.	9	Potential	Unlikely – habitat not found to occur in survey area
Geijera salicifolia	Tree, 1.5 m to 6 m high with large leathery, aromatic (Citrus smell) ovate leaves. Flowers white, September.	Perennial	Skeletal soils, stony soils, massive rock scree, gorges.	26	Unlikely	Unlikely
Glycine falcata	Mat-forming herb. Flowers May to July.	Perennial	Drainage depressions in crabhole plains on river floodplains. Black clayey sand. Along drainage depressions in crabhole plains on river floodplains.	54	Unlikely	Unlikely
Goodenia lyrata	Prostrate herb, with lyrate leaves. Flowers yellow, August.	Short-lived perennial	Red sandy loam. Near claypan. Plains. In sand and clay on poorly drained flats often occurring with various *Calandrinia* spp. and *Eucalyptus victrix.* Mulga.	0	Likely	Previously recorded
Goodenia purpurascens	Erect herb, 0.1 m to 0.3 m high. Flowers blue-purple/white/yellow, January to December.	Annual or short-lived perennial	Clay, mud. Swamps & seasonally wet depressions.	>300	Unlikely	Unlikely

Species	Habit and flowering information[1]	Life form[1]	Habitat[1]	Distance from survey area (km)	Likelihood of occurrence	
					Pre-survey	Post-survey
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727)	Small rosetted herb (with spathulata leaves), to 0.2 m high. Flowers yellow, March to September.	Annual or short-lived perennial	Red-brown clay soil, calcrete pebbles. Low undulating plain, swampy plains, stony plains, hill slopes.	0	Likely	Previously recorded
Grevillea saxicola	Erect shrub to 2.5 m high. Flowers February, April, November.	Perennial	Low rocky hill, red-brown sandy loam with ironstone pebble cover, steep scree slopes often associated with banded iron formation. Mulga woodlands.	0	Likely	Recorded
Gymnanthera cunninghamii	An erect shrub that grows between 1 m and 2 m in height. Flowers cream-yellow-green, January to December.	Perennial	Red / brown / white sand in and adjacent to drainage lines, riverine brown loam-clay, ironstone scree slopes adjacent to drainage lines, floodplains with sandy soil, foot of low limestone ridge adjacent to mudflats, beach sand.	8	Likely	Potential - habitat present, not all suitable habitat searched
Indigofera gilesii	Shrub, to 1.5 m high. Flowers purple-pink, June to October.	Perennial	Pebbly loam. Amongst boulders and outcrops, hills.	4	Likely	Potential – habitat present, not all suitable habitat searched
Iotasperma sessilifolium	Erect herb. Flowers pink.	Annual	Cracking clay, black loam. Edges of waterholes, plains.	54	Unlikely	Unlikely
Nicotiana umbratica	Erect, viscid herb, 0.3 m to 0.7 m high. Flowers white, April to June.	Annual or short-lived perennial	Shallow soils. Under rocky outcrops and overhangs where it is protected from much of the heat of the sun.	~100	Unlikely	Unlikely

Species	Habit and flowering information[1]	Life form[1]	Habitat[1]	Distance from survey area (km)	Likelihood of occurrence	
					Pre-survey	Post-survey
Oldenlandia sp. Hamersley Station (A.A. Mitchell PRP 1479)	Spreading herb, 0.05 m to 0.1 m high. Flowers blue, March.	Annual	Cracking clay, basalt. Gently undulating plain with large surface rocks, flat crabholed plain.	15	Potential	Potential - habitat present, poor seasonal conditions
Olearia mucronata	Densely branched, unpleasantly aromatic shrub, 0.6 m to 1 m high. Flowers white and yellow, August to December or January.	Perennial	Schistose hills, along drainage channels.	21	Unlikely	Unlikely
Pilbara trudgenii	Gnarled, aromatic shrub, to 1 m high. Flowers September.	Perennial	Skeletal, red stony soil over ironstone. Hill summits, steep slopes, screes, cliff faces.	5	Likely	Potential – habitat present, not all suitable habitat searched
Ptilotus subspinescens	Compact shrub, to 0.8 m high. Flowers February, July, September.	Perennial	Gentle rocky slopes, screes and the bases of screes, particularly on calcareous substrates.	~130	Unlikely	Unlikely
Rhagodia sp. Hamersley (M. Trudgen 17794)	Shrub, 2.5 m high. Leaves small lanceolate, not aromatic. Flowers yellow. Fruit small red drupelets.	Perennial	Mulga plains. Alluvial plains. Red brown clay to loamy clay. Occasionally on slopes.	0	Likely	Recorded
Rostellularia adscendens var. *latifolia*	Herb or shrub, 0.1 m to 0.3 m high. Flowers blue-purple-violet, April to May.	Perennial	Ironstone soils. Near creeks or watercourses, along shaded rocky ridges, often in dry gullies and gorges.	2	Potential	Potential – habitat present, not all suitable habitat searched, poor seasonal conditions
Sida sp. Barlee Range (S. van Leeuwen 1642)	Spreading shrub to 0.5m high. Flowers yellow, August.	Perennial	Skeletal red soils pockets. Scree slopes and rock piles in full sun to afternoon shade or in small chines and gullies.	3	Likely	Potential – habitat present, not all suitable habitat searched

Species	Habit and flowering information[1]	Life form[1]	Habitat[1]	Distance from survey area (km)	Likelihood of occurrence	
					Pre-survey	Post-survey
Sida sp. Hamersley Range (K. Newbey 10692)	Semi-prostrate to upright shrub to 2 m high. Flowers September to October.	Perennial	Gorges, base of cliffs, rocky breakaways. Sometimes found in flat areas between hills in shrubby grasslands.	24	Potential	Potential - habitat present, not all suitable habitat searched
Solanum kentrocaule	Shrub 0.5 m to 1.5 m high. Flowers mauve or purple.	Perennial	Hamersley ranges between 700 m to 1,250 m altitude. Hillsides and mountaintops, or occasionally creek beds, in skeletal red-brown soil over ironstone or on basalt scree.	3	Likely	Unlikely - suitable habitat searched
Stackhousia clementii	Dense broom-like aphyllous shrub or herb, to 0.45 m high. Flowers green/yellow/brown.	Perennial	Sand to cracking clay, gibber plains and gilgai, often associated with limestone flats and ridges. Skeletal soils, sandstone hills.	36	Unlikely	Unlikely
Stylidium weeliwolli	Herb, 0.1 m to 0.25 m high. Flowers pink- red, August to September.	Annual	Gritty sand soil, sandy clay. Often in wet root masses of *Melaleuca leucadendra* at the edge of permanent pools or in gorges.	1	Likely	Unlikely – no suitable habitat
Swainsona thompsoniana	Prostrate herb to 0.1 m. Flowers mauve-cream-yellow, August to September.	Annual	Open flood plains on heavy clay soils. From gibber plains, crabhole plains and gilgai, usually at some elevation and in association with tussock grasses.	22	Potential	Potential - habitat present, poor seasonal conditions
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	Tussocky grass, 0.9 m to 1.8 m high. Flowers late in the season after rains.	Perennial	Drainage lines, clay flats, crabhole flats and dark, self-mulching clays.	1	Likely	Potential - habitat present, poor seasonal conditions
Triodia sp. Mt Ella (M.E. Trudgen 12739)	Grass-like or herb, 0.4 m high.	Perennial	Light orange-brown, pebbly loam. Amongst rocks and outcrops, gully slopes.	0	Likely	Recorded

Species	Habit and flowering information[1]	Life form[1]	Habitat[1]	Distance from survey area (km)	Likelihood of occurrence	
					Pre-survey	Post-survey
Xerochrysum boreale	Erect shrub, 1.5 m high. Flowers yellow.	Perennial	Mulga on stony surfaced red-brown, clay-loam.	25	Unlikely	Unlikely
Priority 4						
Acacia bromilowiana	Tree or shrub, to 12 m high. Flowers yellow/pink, July to August.	Perennial	Red skeletal stony loam, orange-brown pebbly, gravel loam, laterite, banded ironstone, basalt. Rocky hills, breakaways, scree slopes, gorges, creek beds.	0	Likely	Recorded
Eremophila magnifica subsp. *magnifica*	Shrub, 0.5 m to 1.5 m high. Flowers blue, August to November.	Perennial	Skeletal soils on the slopes and summits of ironstone hills in the Hamersley Range area.	0	Likely	Recorded
Eremophila youngii subsp. *lepidota*	Dense, spreading shrub, (0.2-) 1-3 m high. Flowers purple-red-pink, January, March, June or August to September.	Perennial	Mulga woodlands/shrublands often associated with Chenopodiaceous shrubs. Drainage lines subject to periodic flooding, floodplains or on the margins of clay depressions, on red-brown soils or occasionally on stony flats.	1	Likely	Potential – habitat present, not all suitable habitat searched
Goodenia nuda	Erect to ascending herb, to 0.5 m high. Flowers yellow, April to August.	Annual or short-lived perennial	Alluvial soils over ironstone, floodplains, valleys, watercourses, floodplains and in orange-brown alluvial sand over ironstone.	9	Likely	Potential – habitat present, poor seasonal conditions
Lepidium catapycnon	Open, woody herb or shrub, 0.2 m to 0.3 m high, stems zigzag. Flowers white, October.	Perennial	Occurs on hillsides in skeletal soils, shale, ironstone.	0	Likely	Recorded
Ptilotus mollis	Compact shrub, to 0.5 m high, soft grey foliage. Flowers white/pink, May or September.	Perennial	Stony hills, steep rocky sites and screes. Usually in full sun on massive ironstone formations.	0	Likely	Recorded

Species	Habit and flowering information[1]	Life form[1]	Habitat[1]	Distance from survey area (km)	Likelihood of occurrence	
					Pre-survey	Post-survey
Rhynchosia bungarensis	Compact, prostrate shrub, to 0.5 m high. Flowers yellow.	Perennial	Rock piles, gorges, river beds and alluvial soils in shrubland or gallery woodland.	22	Unlikely	Unlikely

[1] – Florabase (Western Australian Herbarium 1998-2019).

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Appendix F: Vegetation Classification and Condition Scales

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Table F.1: Vegetation Classification System Specht (1970) as modified by Aplin (1979).

Stratum	70-100% cover	30-70% cover	10-30% cover	2-10% cover	<2% cover
Trees > 30 m	Tall closed forest	Tall open Forest	Tall woodland	Tall open woodland	Scattered tall trees
Trees 10-30 m	Closed forest	Open forest	Woodland	Open woodland	Scattered trees
Trees < 10 m	Low closed forest	Low open forest	Low woodland	Low open woodland	Scattered low trees
Shrubs > 2 m	Tall closed scrub	Tall open scrub	Tall shrubland	Tall open shrubland	Scattered tall shrubs
Shrubs 1-2 m	Closed heath	Open heath	Shrubland	Open shrubland	Scattered shrubs
Shrubs < 1 m	Low closed heath	Low open heath	Low shrubland	Low open shrubland	Scattered low shrubs
Hummock grasses	Closed hummock grassland	Hummock grassland	Open hummock grassland	Very open hummock grassland	Scattered hummock grasses
Grasses, sedges, herbs	Closed tussock grassland/ sedgeland/ herbland	Tussock grassland/ sedgeland/ herbland	Open tussock grassland/ sedgeland/ herbland	Very open tussock grassland/ sedgeland/ herbland	Scattered tussock grasses/ sedges/ herbs

Table F.2: Vegetation condition scale as adapted from Trudgen (1988).

Vegetation condition	Condition description
Excellent	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

Table F.3: Rating scale for local significance of vegetation, developed by Rio Tinto.

Local significance	Description
High	Supports threatened flora; supports priority 1 flora; associated with listed TECs or PECs; or associated with major drainage systems supporting riparian vegetation.
Moderate	Supports priority 2 flora, or high densities of priority 3 flora and associated habitat; associated with local drainage systems supporting riparian vegetation; or has limited local representation.
Low	Supports scattered records of priority 3 flora, or locally common priority 4 flora; associated with minor local drainage systems supporting riparian vegetation.
Negligible	Supports priority 4 flora that are regionally common; or associated with vegetation common across the Pilbara region.

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Appendix G: Fire Mapping

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690000 700000 710000 720000

7460000

7450000

7440000

Survey Area

Fire Detected (Year) ***Darwin Centre for Bushfire Research, Charles Darwin University***

2017

2016

2015

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure G.1: Historical fire mapping

Scale: 1:100,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Appendix H: Vegetation Unit Mapping and Site Locations

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695000 700000 705000 710000 715000 720000

7460000 7455000 7450000 7445000

Map Extent
Survey Area

Sampling Site
Quadrat
Relevé
Vegetation Mapping Note

Vegetation Unit

D1	D5	H3	H8	P1
D2	D7	H4	H9	P2
D3	D8	H5	H10	P3
D4	H1	H6	H11	P4
	H2	H7	H12	Cleared

H.1 H.2 H.3 H.4 H.5 H.6 H.7 H.8 H.9 H.10 H.11 H.12 H.13 H.14 H.15 H.16 H.17 H.18 H.19 H.20 H.21 H.22 H.23 H.24 H.25 H.26

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Figure H: Vegetation unit mapping and site locations - Overview

Scale: 1:80,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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694000 695000 696000 697000

7447000

7446000

7445000

H.20 H.21 H.17 H.22 H.10 H.15 H.18 H.23 H.25 H.6 H.11 H.16 H.19 H.24 H.26 H.3 H.7 H.12 H.1 H.4 H.8 H.13 H.2 H.5 H.9 H.14

GHMNBE004 HD29 HD31 HD51 MNLV13 MNLV12

P3 D8 D1 P2 H8 D4

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure H.1: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 07-11-2019 Figure Ref: 14292A-19-BIDR-3RevB_191107_VegType_FigH

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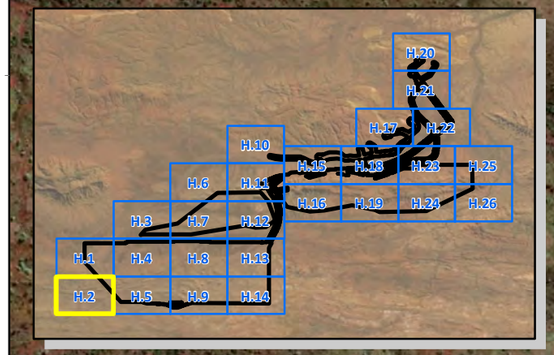
7444000

7443000



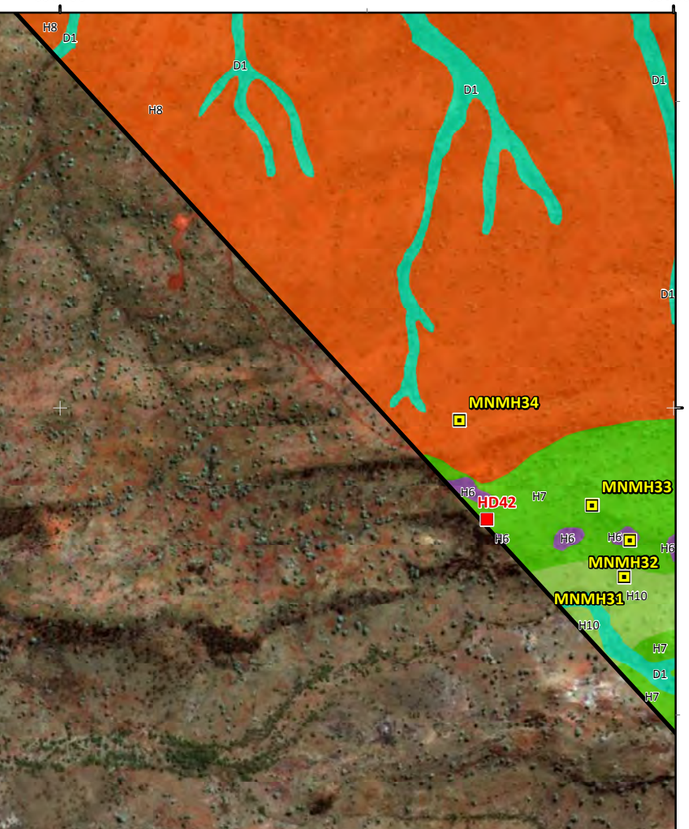


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Figure H.2: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

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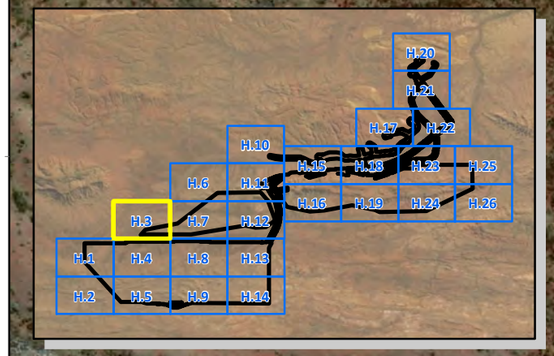

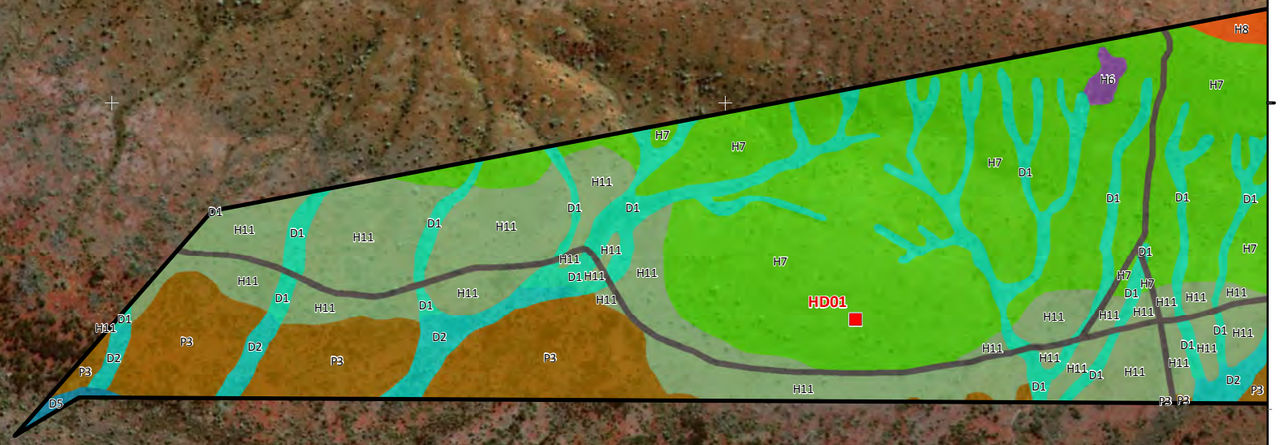

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Figure H.3: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

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Figure H.4: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

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697000 698000 699000 700000

7444000

7443000

MNMH37 MNMH35 MNMH36 HD44 HD21 MNMH18 MNMH19 HDR18 HDR13

H.20 H.21 H.17 H.22 H.10 H.15 H.18 H.23 H.25 H.6 H.11 H.16 H.19 H.24 H.26 H.3 H.7 H.12 H.1 H.4 H.8 H.13 H.2 H.5 H.9 H.14

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Figure H.5: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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703000
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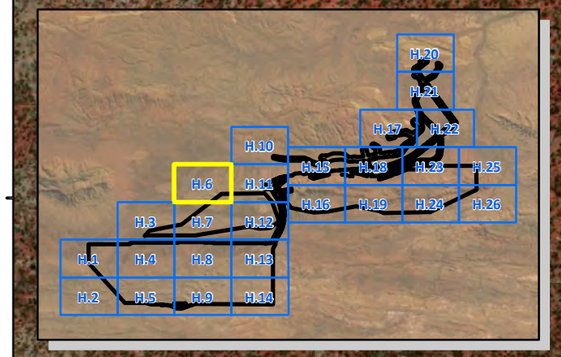

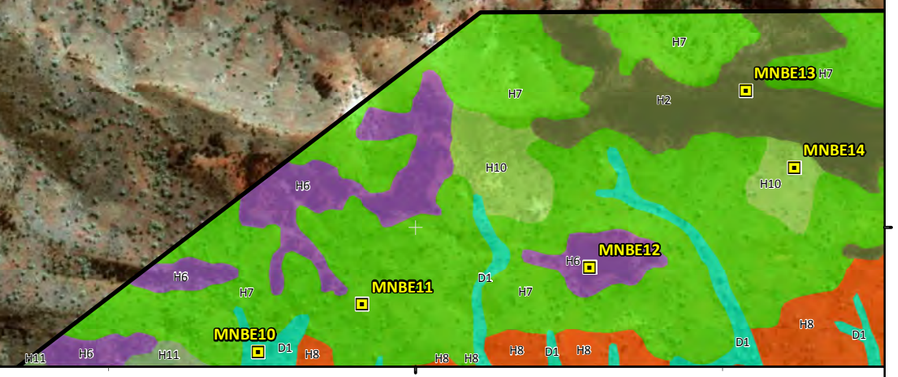

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Figure H.6: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

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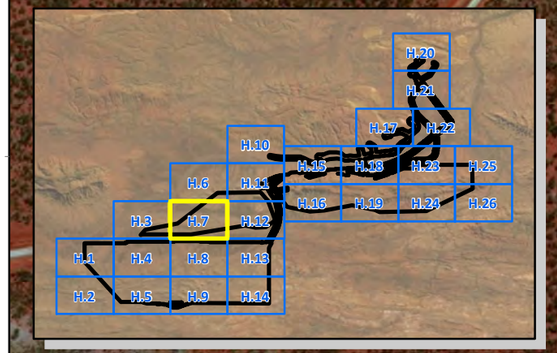

HD49

GHR10

GHMNBE005

GHMNBE008

GHMNBE007

GHR28

GH27

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Figure H.7: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 07-11-2019 Figure Ref: 14292A-19-BIDR-3RevB_191107_VegType_FigH

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GH09 HD28 HDR19 HD08 HD22 MNMH28 HD16 MNBE02 HDR03

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Figure H.8: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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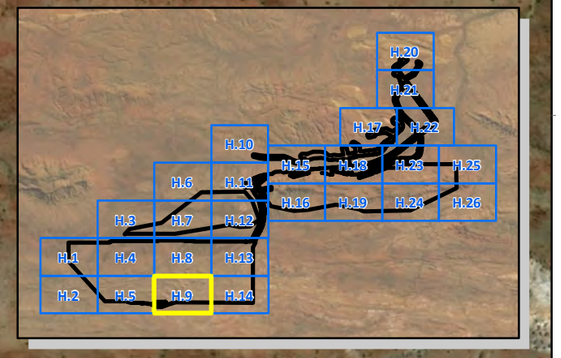

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Hope Downs 2 Proposal – Flora and Vegetation Survey

Figure H.9: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 07-11-2019 | Figure Ref: 14292A-19-BIDR-3RevB_191107_VegType_FigH

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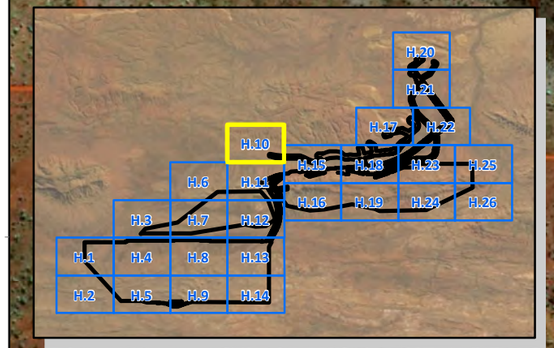

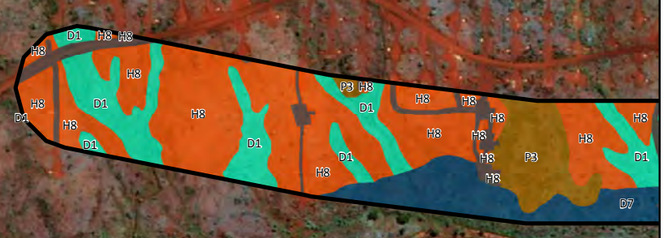

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Figure H.10: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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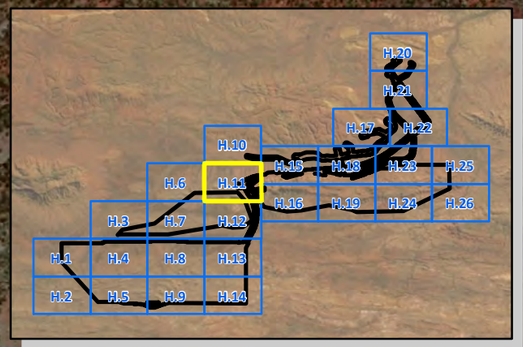

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GHR30

GH11

HD53

HD48

HD52

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Figure H.11: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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705000 706000 707000 708000

7449000

7448000

MNBE15 MNBE09 HD55 HD54 HD02 GH03 GH02 GH12 GHMNKM05 GH13 GH15

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Figure H.12: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

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705000 706000 707000 708000

7447000 7446000 7445000

GH07 GH08 HD12 HD10 HD09 HD11 HD14 HD30 HD18 HDR07 HDR05 MNLV01 MNMH01 MNMH27 MNLV02 MNMH07 MNMH02 MNMH06 MNMH03 MNMH05 MNMH04

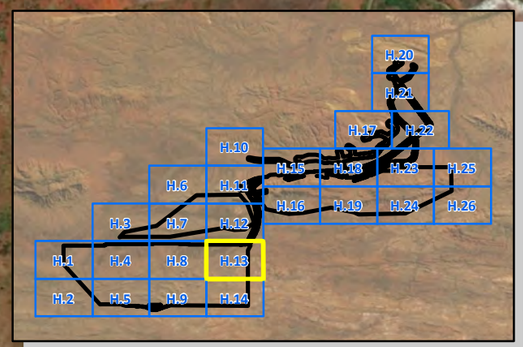

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Figure H.13: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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705000 706000 707000 708000

7444000

7443000

MNLV05 MNLV04 MNMH16 MNMH17 HD33 MNMH15 MNMH10 HD19 MNMH09 MNMH14 HD17 MNMH11 MNMH12 HD47 MNMH13

H.20 H.21 H.17 H.22 H.10 H.15 H.18 H.23 H.25 H.6 H.11 H.16 H.19 H.24 H.26 H.3 H.7 H.12 H.1 H.4 H.8 H.13 H.2 H.5 H.9 H.14

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Figure H.14: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 07-11-2019 Figure Ref: 14292A-19-BIDR-3RevB_191107_VegType_FigH

709000 710000 711000 712000

7453000 7452000 7451000

H.1 H.2 H.3 H.4 H.5 H.6 H.7 H.8 H.9 H.10 H.11 H.12 H.13 H.14 H.15 H.16 H.17 H.18 H.19 H.20 H.21 H.22 H.23 H.24 H.25 H.26

GHR16

HDR10

HD26

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Figure H.15: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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709000 710000 711000 712000

7450000

7449000

MNBE07 HD03 HD24 HD46 MNMH23 MNMH22 MNMH24 MNMH21 HD40 HD39 MNMH25 MNLV09 MNMH26 MNLV08 HD41 MNMH20 HD35 HDR02

H.1 H.2 H.3 H.4 H.5 H.6 H.7 H.8 H.9 H.10 H.11 H.12 H.13 H.14 H.15 H.16 H.17 H.18 H.19 H.20 H.21 H.22 H.23 H.24 H.25 H.26

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Figure H.16: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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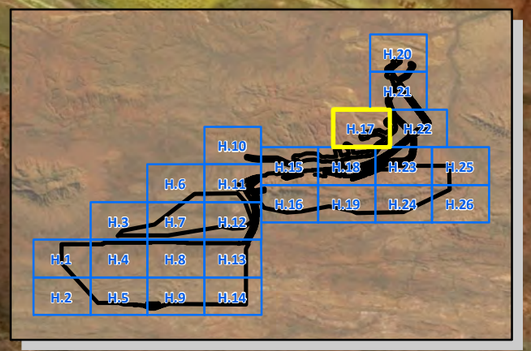
Author: B. Eckermann Drawn: C. Dyde Date: 07-11-2019 Figure Ref: 14292A-19-BIDR-3RevB_191107_VegType_FigH

714000 715000 716000 717000

7456000 7455000 7454000



BHD05-AR

GHMNKM13

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure H.17: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

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Author: B. Eckermann | Drawn: C. Dyde | Date: 07-11-2019 | Figure Ref: 14292A-19-BIDR-3RevB_191107_VegType_FigH

713000 714000 715000 716000

7453000 7452000 7451000

H.20 H.21 H.17 H.22 H.10 H.15 H.18 H.23 H.25 H.6 H.11 H.16 H.19 H.24 H.26 H.3 H.7 H.12 H.1 H.4 H.8 H.13 H.2 H.5 H.9 H.14

GH24 GH17 HD06

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Figure H.18: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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713000 714000 715000 716000

7450000

7449000

MNBE03 HD04 HD07 HD05 MNMH08 HDR11 MNLV03 HDR01

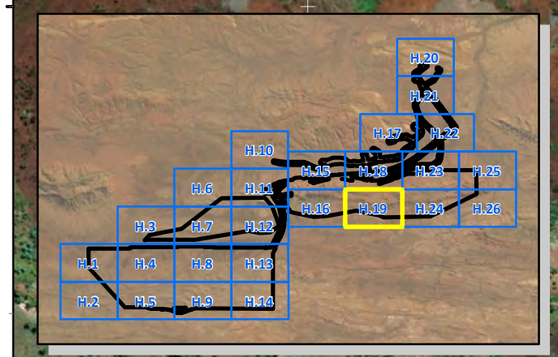

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Figure H.19: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

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Figure H.20: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

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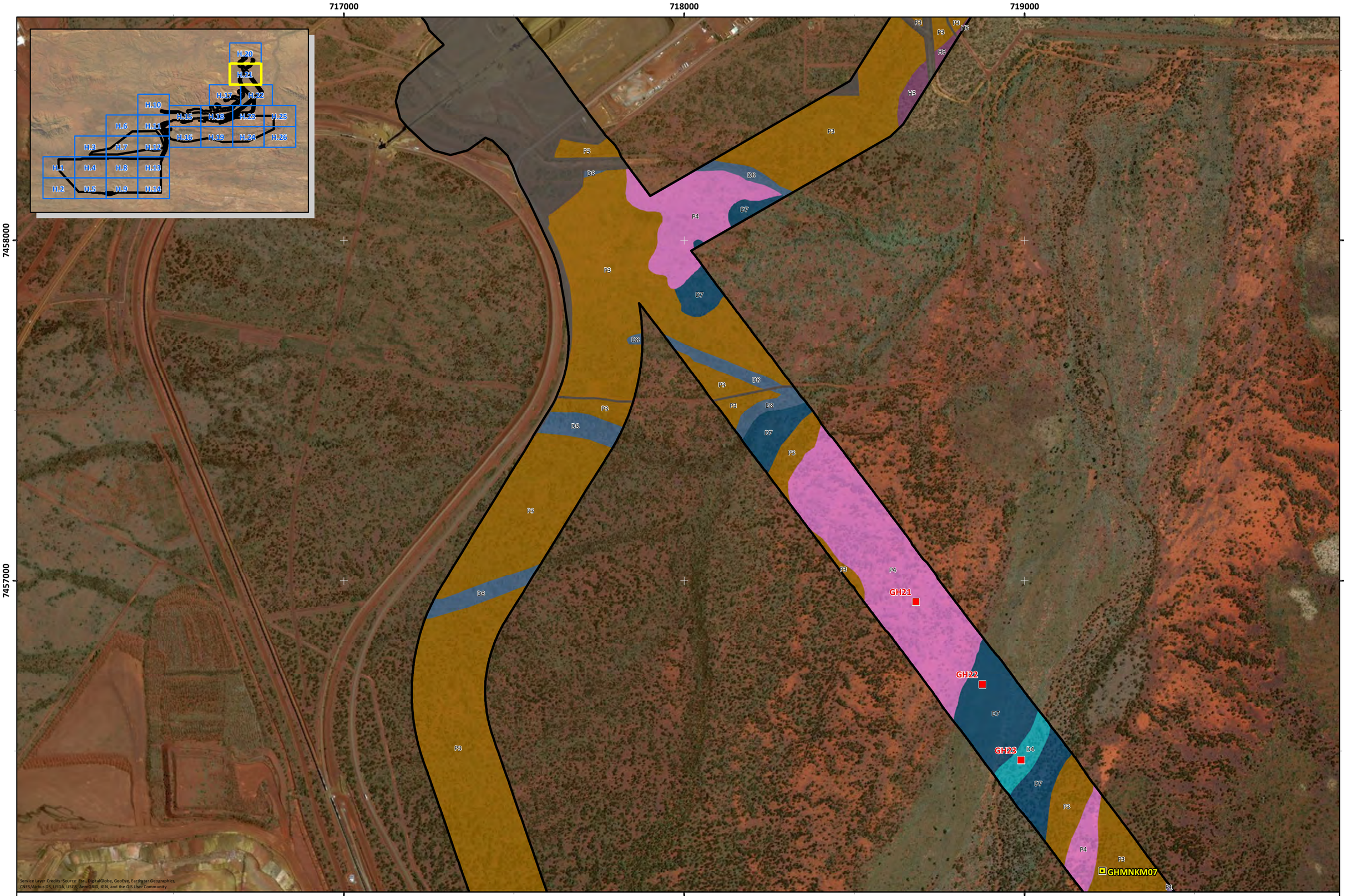

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Figure H.21: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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718000 719000 720000 721000

7456000 7455000 7454000

GHMNKM08 GHMNKM09 GHMNKM10 GHMNKM11 GHMNKM12

GH26 GH25 GH20

GHMNDR02 GHMNBE010 GHMNDR01

H.1 H.2 H.3 H.4 H.5 H.6 H.7 H.8 H.9 H.10 H.11 H.12 H.13 H.14 H.15 H.16 H.17 H.18 H.19 H.20 H.21 H.22 H.23 H.24 H.25 H.26

P1 P3 P4 D1 D2 D4 D7 D8 H5 H11

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Figure H.22: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 07-11-2019 Figure Ref: 14292A-19-BIDR-3RevB_191107_VegType_FigH

717000 718000 719000 720000

7453000 7452000 7451000

GH19 HD43 HD37 MNBE05

H.1 H.2 H.3 H.4 H.5 H.6 H.7 H.8 H.9 H.10 H.11 H.12 H.13 H.14 H.15 H.16 H.17 H.18 H.19 H.20 H.21 H.22 H.23 H.24 H.25 H.26

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Figure H.23: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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717000 718000 719000 720000

7450000

7449000

HDR08 HD15 HD13 HDR04

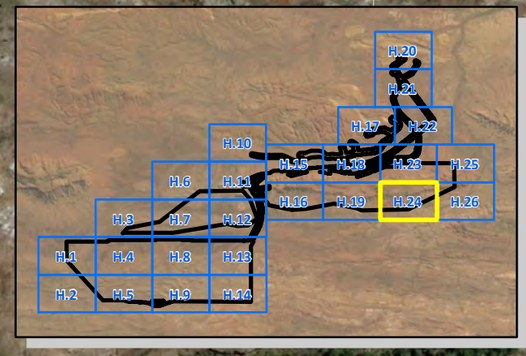

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Figure H.24: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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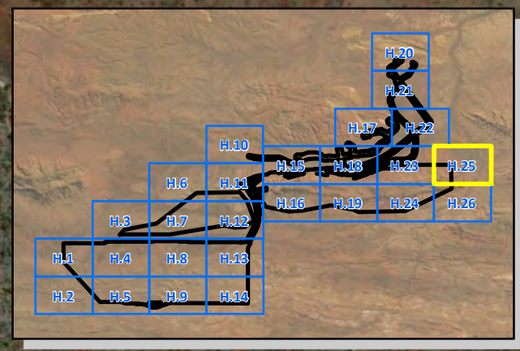
721000 722000 723000 724000

7453000 7452000 7451000



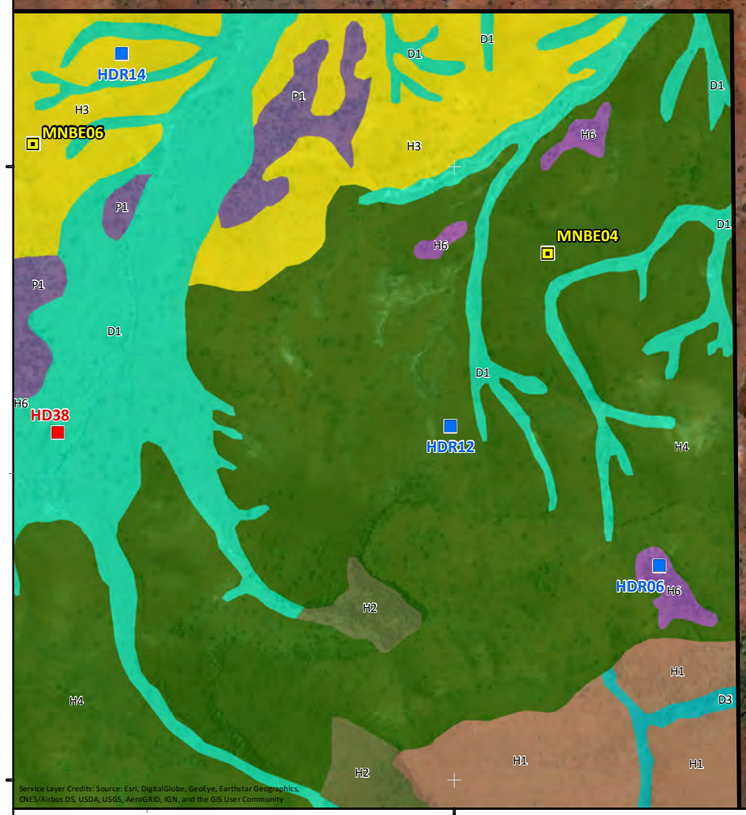


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Figure H.25: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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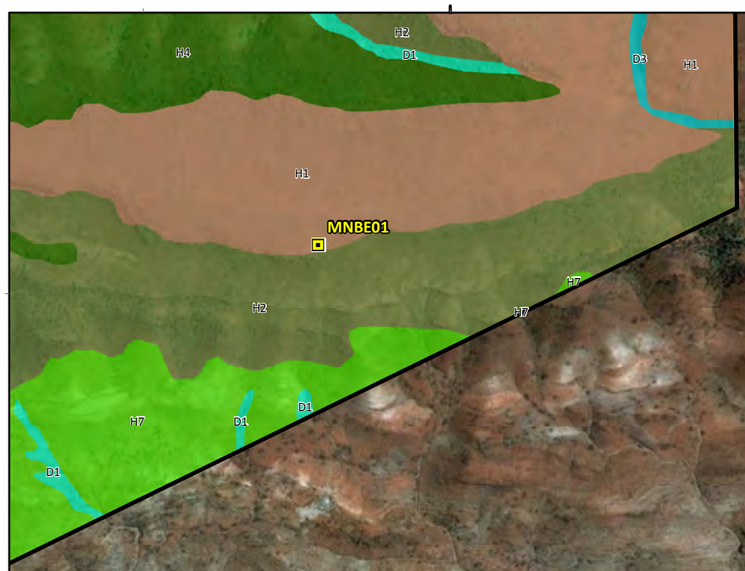
Author: B. Eckermann | Drawn: C. Dyde | Date: 07-11-2019 | Figure Ref: 14292A-19-BIDR-3RevB_191107_VegType_FigH

721000 722000 723000 724000

7450000

7449000



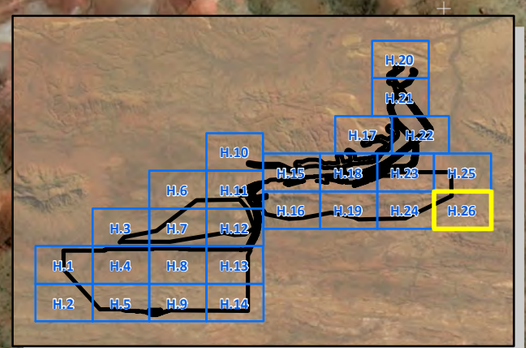


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Figure H.26: Vegetation unit mapping and site locations

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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Vegetation of Drainage Lines

D1 *Corymbia hamersleyana* sens. lat., *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees to low open woodland over *Petalostylis labicheoides*, *Acacia monticola, A. maitlandii* scattered tall shrubs to tall shrubland over *Dodonaea lanceolata* var. *lanceolata, Androcalva luteiflora* scattered shrubs to open shrubland over *Triodia pungens* very open hummock grassland to open hummock grassland with *Themeda triandra*, *Eriachne mucronata* very open tussock grassland to open tussock grassland

D2 *Acacia aptaneura, A. catenulata* subsp. *occidentalis*, *A. pruinocarpa* tall shrubland to tall open scrub over *Petalostylis labicheoides* scattered shrubs to open shrubland over *Triodia pungens* very open hummock grassland with *Chrysopogon fallax* scattered tussock grasses

D3 *Corymbia ferriticola*, *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Petalostylis labicheoides*, *Acacia hamersleyensis, Dodonaea viscosa* subsp. *spatulata* tall open shrubland over *Triodia pungens* very open hummock grassland with *Eriachne mucronata*, *Themeda* sp. Mt Barricade (M.E. Trudgen 2471), *Cymbopogon ambiguus* very open tussock grassland to tussock grassland

D5 *Eucalyptus xerothermica* scattered low trees to low open woodland over *Petalostylis labicheoides, Acacia maitlandii*, *A. pyrifolia* tall open shrubland to tall shrubland over *Androcalva luteiflora* scattered shrubs over *Triodia longiceps* very open hummock grassland to open hummock grassland with *Themeda triandra*, *Eulalia aurea* open tussock grassland to tussock grassland and **Bidens bipinnata* scattered herbs

D4 *Eucalyptus victrix*, (*E. camaldulensis* subsp. *obtusa*) low open woodland to open woodland over *Acacia citrinoviridis*, *Petalostylis labicheoides* scattered tall shrubs to tall shrubland over *Androcalva luteiflora*, *Gossypium sturtianum* var. *sturtianum* scattered shrubs to open shrubland over *Triodia longiceps* scattered hummock grasses to very open hummock grassland with *Themeda triandra*, *Eulalia aurea*, (**Cenchrus ciliaris*) very open tussock grassland to tussock grassland and **Bidens bipinnata* scattered herbs

D7 *Acacia citrinoviridis, A. aptaneura, A. pruinocarpa* scattered tall shrubs to tall shrubland over *Senna artemisioides* subsp. *oligophylla* scattered low shrubs over *Triodia longiceps* open hummock grassland to hummock grassland

D8 *Eucalyptus xerothermica* scattered low trees to low open woodland over *Acacia aptaneura, A. catenulata* subsp. *occidentalis* tall open shrubland to tall open scrub over *Triodia pungens* scattered hummock grasses to very open hummock grassland with *Themeda triandra* very open tussock grassland to open tussock grassland

Vegetation of Plains

P1 *Acacia aptaneura*, *A. catenulata* subsp. *occidentalis*, (*A. pruinocarpa*) tall shrubland to tall open scrub over *Eremophila forrestii* subsp. *forrestii* open shrubland to shrubland over *Triodia pungens*, (*T. vanleeuwenii*) scattered hummock grasses to very open hummock grassland

P2 *Acacia aptaneura*, *A. pruinocarpa, A. tetragonophylla* scattered tall shrubs to tall open shrubland over *Eremophila forrestii* subsp. *forrestii, A. synchronicia* scattered shrubs over *Ptilotus obovatus, Sida fibulifera* scattered low shrubs over *Aristida latifolia*, *Astrebla elymoides*, *Eragrostis xerophila* open tussock grassland to tussock grassland

P3 *Acacia aptaneura*, *A. catenulata* subsp. *occidentalis*, *A. pruinocarpa* tall open shrubland to tall shrubland over *Eremophila forrestii* subsp. *forrestii* scattered shrubs to open shrubland over *Triodia pungens* open hummock grassland to hummock grassland

P4 *Acacia pruinocarpa, A. aptaneura*, *A. catenulata* subsp. *occidentalis* tall open shrubland to tall shrubland over *Rhagodia eremaea* scattered shrubs

Vegetation of Hills and Slopes

H1 *Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia hamersleyana* sens. lat. scattered low trees to low open woodland over *Petalostylis labicheoides, Senna glutinosa* subsp. *glutinosa* scattered tall shrubs over *Gompholobium oreophilum*, *Acacia hilliana, A. spondylophylla* low open shrubland to low shrubland over *Triodia vanleeuwenii*, *T. wiseana*, *T. pungens* open hummock grassland with *Amphipogon sericeus* scattered tussock grasses

H2 *Eucalyptus repullulans* scattered low mallees over *Acacia catenulata* subsp. *occidentalis*, *A. aptaneura*, (*Grevillea saxicola*) tall shrubland to tall open scrub over *Scaevola acacioides, Dodonaea pachyneura, Eremophila latrobei* subsp. *filiformis* scattered shrubs to open shrubland over *Triodia pungens* scattered hummock grasses to very open hummock grassland with *Eriachne mucronata* scattered tussock grasses to very open tussock grassland

H3 *Corymbia deserticola* subsp. *deserticola* scattered low trees over *Acacia inaequilatera*, *Hakea chordophylla* scattered tall shrubs to tall open shrubland over *Senna glutinosa* subsp. *pruinosa* scattered shrubs over *Triodia vanleeuwenii* open hummock grassland with *Amphipogon sericeus* scattered tussock grasses to very open tussock grassland

H4 *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Senna glutinosa* subsp. *glutinosa*, *S. glutinosa* subsp. *pruinosa* scattered shrubs over *Triodia vanleeuwenii* and/or *T. wiseana* open hummock grassland to hummock grassland

H5 *Eucalyptus socialis* subsp. *eucentrica* scattered low mallees to low open mallee woodland over *Acacia bivenosa* scattered tall shrubs to tall open shrubland over *Senna glutinosa* subsp. × *luerssenii* scattered shrubs over *Ptilotus obovatus* scattered low shrubs over *Triodia wiseana* very open hummock grassland to open hummock grassland

H6 *Acacia aptaneura*, *A. catenulata* subsp. *occidentalis* tall open shrubland to tall shrubland over *Eremophila forrestii* subsp. *forrestii*, *Senna stricta* scattered shrubs to open shrubland over *Triodia pungens* and/or *T. vanleeuwenii* and/or *T. wiseana* scattered hummock grasses to very open hummock grassland with *Eriachne mucronata* scattered tussock grasses

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Legend: Vegetation Unit Mapping

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Vegetation of Hills and Slopes (cont'd)

H7 *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees to low open woodland over *Senna glutinosa* subsp. *glutinosa, Acacia maitlandii* scattered shrubs over *Triodia wiseana* and/or *T. vanleeuwenii* and/or *T. pungens* open hummock grassland to hummock grassland

H8 *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees to low open woodland over *Acacia pruinocarpa*, *Hakea chordophylla* scattered tall shrubs to tall open shrubland over *Triodia vanleeuwenii*, (*T. pungens*) open hummock grassland to hummock grassland with *Amphipogon sericeus* scattered tussock grasses

H9 *Acacia arida, Grevillea wickhamii* subsp. *hispidula* open shrubland over *Triodia wiseana* open hummock grassland with *Themeda* sp. Mt Barricade (M.E. Trudgen 2471) very open tussock grassland

Cleared

H10 *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees with *E. repullulans* and/or *E. socialis* subsp. *eucentrica* and/or *E. pilbarensis* scattered low mallees to low open mallee woodland over *Acacia bivenosa* scattered shrubs over *Triodia wiseana, (T. angusta)* open hummock grassland to hummock grassland

H11 *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees with *E. gamophylla* low open mallee woodland over *Acacia ancistrocarpa* scattered tall shrubs to tall open shrubland over *A. hilliana* scattered low shrubs to low open shrubland over *Triodia vanleeuwenii*, (*T. pungens*) open hummock grassland to hummock grassland

H12 *Corymbia hamersleyana* sens. lat. scattered low trees over *Acacia inaequilatera*, *Hakea chordophylla*, *A. bivenosa* scattered tall shrubs to tall open shrubland over *Senna artemisioides* subsp. *oligophylla* scattered low shrubs over *Triodia wiseana* open hummock grassland to hummock grassland with *Themeda* sp. Mt Barricade (M.E. Trudgen 2471), *Cymbopogon ambiguus* scattered tussock grasses and *Heliotropium ovalifolium, Corchorus lasiocarpus* subsp. *parvus* scattered herbs

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Legend: Vegetation Unit Mapping

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Appendix I: Vegetation Sample Site Data

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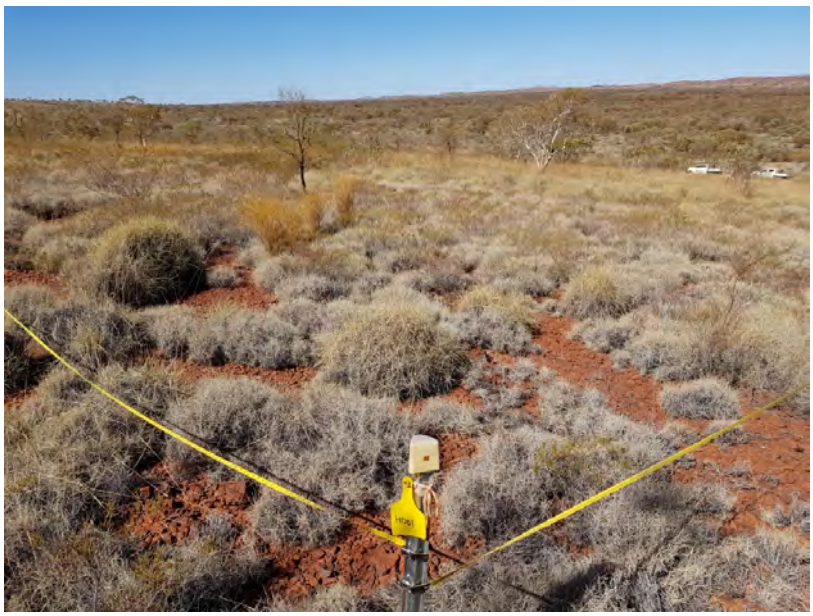
Site: HD01
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 2/11/2017 **Phase 3 Date:** 21/05/2019 **Described by:** LV
MGA Zone: 50 **Easting:** 700213 **Northing:** 7447647
Habitat: Hillslope
Soil: Dark reddish brown clay loam
Rock type: Ironstone
Vegetation code: H7
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia maitlandii* scattered shrubs over *Acacia hilliana* scattered low shrubs over *Triodia vanleeuwenii* and *Triodia wiseana* hummock grassland
Vegetation Condition: Excellent
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Acacia adoxa var. *adoxa*	0.1	0.4
Acacia adsurgens	0.1	1.1
Acacia hilliana	1	0.6
Acacia maitlandii	1	1.3
Acacia pachyacra	0.1	0.4
Acacia pruinocarpa	0.1	2.2
Acacia pyrifolia	0.1	2.1
Eriachne mucronata	0.1	0.2
Eucalyptus leucophloia subsp. *leucophloia*	1	6
Gompholobium oreophilum	0.1	0.8
Hakea chordophylla	0.1	2.5
Halgania gustafsenii var. *gustafsenii*	0.1	0.3
Jasminum didymum subsp. *lineare*	0.1	0.8
Mirbelia viminalis	0.1	0.1
Ptilotus rotundifolius	0.1	0.7

Name	Cover (%)	Height (m)
Scaevola browniana subsp. *browniana*	0.1	0.3
Senna ferraria	0.1	2
Senna glutinosa subsp. *glutinosa*	0.1	1.7
Solanum lasiophyllum	0.1	0.5
Themeda triandra	0.1	0.4
Triodia vanleeuwenii	35	0.2
Triodia wiseana	15	0.5

Site: HD02
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 2/11/2017 **Phase 2 Date:** 24/05/2018 **Described by:** LV
MGA Zone: 50 **Easting:** 706655 **Northing:** 7448969
Habitat: Plain
Soil: Red brown clay loam
Rock type: Ironstone
Vegetation code: P1
Vegetation: *Acacia aptanuera*, (*A. catenulata* subsp. *occidentalis*) tall shrubland over *Eremophila forrestii* subsp. *forrestii* shrubland over *Maireana tomentosa* subsp. *tomentosa* scattered low shrubs over *Triodia pungens* very open hummock grassland with **Bidens bipinnata* scattered herbs
Vegetation Condition: Very Good
Fire Age: 5-10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	22	6.0
Acacia catenulata subsp. *occidentalis*	2	5.0
Aristida contorta	0.1	0.25
Aristida inaequiglumis	0.1	0.4
Aristida obscura	0.1	0.4
**Bidens bipinnata*	0.5	0.2
Boerhavia coccinea	0.1	0.1
Bulbostylis barbata	0.1	0.1
Cheilanthes sieberi subsp. *sieberi*	0.1	0.1
Chrysopogon fallax	0.1	0.4
Cynodon convergens	0.1	0.1
Duperreya commixta	0.1	twiner
Dysphania plantaginella	0.1	0.1
Enneapogon caerulescens	0.1	0.15
Enneapogon lindleyanus	0.1	0.25

Name	Cover (%)	Height (m)
Enneapogon polyphyllus	0.1	0.35
Eragrostis cumingii	0.1	0.1
Eremophila forrestii subsp. *forrestii*	15	1.7
Eremophila latrobei	0.1	0.5
Eriachne pulchella	0.1	0.1
Euphorbia sp.	0.1	0.02
Evolvulus alsinoides var. *villosicalyx*	0.1	0.3
Hibiscus burtonii	0.1	0.4
Hibiscus leptocladus	0.1	0.4
Iseilema vaginiflorum	0.1	0.2
Maireana tomentosa subsp. *tomentosa*	0.5	0.2
Panicum decompositum	0.1	0.35
Paspalidium clementii	0.1	0.2
Perotis rara	0.1	0.2
Polycarpaea corymbosa var. *corymbosa*	0.1	0.2
Polycarpaea holtzei	0.1	0.1
Polycarpaea longiflora	0.1	0.15
Psydrax suaveolens	0.1	0.3
Pterocaulon sphacelatum	0.1	0.25
Ptilotus astrolasius	0.1	0.5
Ptilotus exaltatus	0.1	0.2
Ptilotus obovatus	0.1	0.25
Sida sp.	0.1	0.2
Sida sp. dark green fruits (S. van Leeuwen 2260)	0.1	0.4
Sporobolus australasicus	0.1	0.1
Triodia pungens	4	0.4
Wahlenbergia tumidifructa	0.1	0.2

* denotes weed species

Site: HD03
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 3/11/2017 **Phase 2 Date:** 25/05/2018 **Described by:** LV
MGA Zone: 50 **Easting:** 710941 **Northing:** 7450542
Habitat: Hillslope
Soil: Reddish brown sandy loam
Rock type: Ironstone
Vegetation code: H3
Vegetation: *Eucalyptus repullulans* scattered low mallees over *Acacia aptaneura*, *A. catenulata* subsp. *occidentalis*, (*A. ayersiana*, *Grevillea saxicola*, *A. mulganeura*) tall open scrub over *Eremophila latrobei* subsp. *filiformis* scattered shrubs over *Ptilotus obovatus* scattered low shrubs over *Triodia pungens* scattered hummock grasses with *Eriachne mucronata* very open tussock grassland
Vegetation Condition: Very Good
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	25	5.0
Acacia ayersiana	6	5.3
Acacia catenulata subsp. *occidentalis*	10	5.0
Acacia mulganeura	1	5.4
Acacia pruinocarpa	0.1	5.0
Aristida contorta	0.1	0.1
Aristida sp.	0.1	0.15
**Bidens bipinnata*	0.1	0.15
Cheilanthes lasiophylla	0.1	0.2
Cymbopogon ambiguus	0.1	0.4
Dodonaea lanceolata var. *lanceolata*	0.1	1.3
Duperreya commixta	0.1	twiner
Dysphania rhadinostachya subsp. *rhadinostachya*	0.1	0.1
Enneapogon lindleyanus	0.1	0.5
Enneapogon polyphyllus	0.1	0.1

Name	Cover (%)	Height (m)
Eremophila latrobei subsp. *filiformis*	0.5	1.8
Eremophila sp. Hamersley Range (K. Walker KW 136) P3	1	2.3
Eriachne mucronata	3	0.3
Eriachne pulchella	0.1	0.1
Eucalyptus repullulans	1	3.0
Euphorbia sp.	0.1	0.08
Grevillea saxicola P3	3	5.5
Nicotiana sp.	0.1	0.1
Paraneurachne muelleri	0.1	0.1
Paspalidium clementii	0.1	0.2
Psydrax suaveolens	0.1	0.4
Ptilotus exaltatus	0.1	0.3
Ptilotus obovatus	0.5	0.4
Rhagodia eremaea	0.1	0.2
Scaevola acacioides	1	2.4
Schizachyrium fragile	0.1	0.5
Solanum lasiophyllum	0.1	0.3
Triodia pungens	1	0.4
Triodia vanleeuwenii	0.1	0.4
Triodia wiseana	0.1	0.5

* denotes weed species

Site: HD04
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 3/11/2017 **Phase 2 Date:** 22/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 713294 **Northing:** 7450657
Habitat: Hillslope
Soil: Dark reddish brown sandy loam
Rock type: Ironstone
Vegetation code: H1
Vegetation: *Corymbia hamersleyana* sens. lat., *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia hamersleyensis*, *Senna glutinosa* subsp. *glutinosa*, *A. catenulata* subsp. *occidentalis* tall open shrubland over *Triodia wiseana*, *T. pungens*, *T. vanleeuwenii* hummock grassland
Vegetation Condition: Excellent
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	0.1	2.2
Acacia catenulata subsp. *occidentalis*	0.5	3.5
Acacia hamersleyensis	1	3.2
Acacia pruinocarpa	0.1	2.5
Acacia pyrifolia	0.1	3.2
Amyema miquelii	0.1	mistletoe
Bulbostylis barbata	0.1	0.05
Clerodendrum floribundum var. *angustifolium*	0.1	1.5
Corchorus lasiocarpus subsp. *parvus*	0.1	0.5
Corymbia hamersleyana sens. lat.	4	4.5
Cymbopogon ambiguus	0.1	0.1
Duperreya commixta	0.1	twiner
Eriachne lanata	0.1	0.4
Eucalyptus leucophloia subsp. *leucophloia*	2.5	4.5
Goodenia stobbsiana	0.1	0.3

Name	Cover (%)	Height (m)
Hakea chordophylla	0.1	3.0
Mirbelia viminalis	0.1	0.6
Petalostylis labicheoides	0.1	2.5
Polycarpaea corymbosa var. *corymbosa*	0.1	0.05
Polycarpaea holtzei	0.1	0.02
Ptilotus calostachyus	0.1	0.5
Scaevola browniana	0.1	0.3
Senna glaucifolia	0.1	2.2
Senna glutinosa subsp. *glutinosa*	1	2.2
Sida echinocarpa	0.1	0.5
Sida sp. Excedentifolia (J.L. Egan 1925)	0.1	0.2
Sida sp. Shovelanna Hill (S. van Leeuwen 3842)	0.1	0.5
Triodia pungens	10	0.5
Triodia vanleeuwenii	10	0.4
Triodia wiseana	20	0.6

Site: HD05
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 4/11/2017 **Phase 2 Date:** 22/05/2018 **Described by:** LD
MGA Zone: 50 **Easting:** 714854 **Northing:** 7450939
Habitat: Footslope
Soil: Reddish brown sandy loam
Rock type: Ironstone
Vegetation code: H3
Vegetation: *Corymbia deserticola* subsp. *deserticola* scattered low trees over *Acacia inaequilatera* scattered tall shrubs over *Triodia vanleeuwenii* open hummock grassland with *Amphipogon sericeus* very open tussock grassland
Vegetation Condition: Excellent
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Acacia adsurgens	0.1	2.5
Acacia aptaneura	0.1	2.0
Acacia inaequilatera	0.5	3.0
Amphipogon sericeus	3	0.2
Bonamia pilbarensis	0.1	0.1
Bulbostylis barbata	0.1	0.1
Codonocarpus cotinifolius	0.1	0.5
Corchorus lasiocarpus subsp. *parvus*	0.1	0.4
Corymbia deserticola subsp. *deserticola*	0.5	5.0
Cymbopogon ambiguus	0.1	0.6
Dampiera candicans	0.1	0.2
Dysphania rhadinostachya subsp. *rhadinostachya*	0.1	0.1
Eriachne pulchella subsp. *pulchella*	0.1	0.1
Fimbristylis simulans	0.1	0.1
Gompholobium oreophilum	0.1	0.3

Name	Cover (%)	Height (m)
Goodenia stobbsiana	0.1	0.2
Hakea chordophylla	0.1	2.0
Hibiscus sturtii var. *campylochlamys*	0.1	0.1
Indigofera monophylla	0.1	0.2
Jasminum didymum subsp. *lineare*	0.1	twiner
Maireana tomentosa subsp. *tomentosa*	0.1	0.2
Polycarpaea corymbosa var. *corymbosa*	0.1	0.1
Polycarpaea holtzei	0.1	0.05
Ptilotus calostachyus	0.1	0.6
Ptilotus exaltatus	0.1	0.3
Scaevola parvifolia subsp. *pilbarae*	0.1	0.2
Schizachyrium fragile	0.1	0.2
Senna artemisioides subsp. *oligophylla*	0.1	0.6
Senna glutinosa subsp. x *luerssenii*	0.1	1.7
Solanum lasiophyllum	0.1	0.7
Sporobolus australasicus	0.1	0.1
Triodia pungens	0.1	0.4
Triodia vanleeuwenii	27	0.3

Site: HD06
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 4/11/2017 **Phase 2 Date:** 23/05/2018 **Described by:** LD
MGA Zone: 50 **Easting:** 715969 **Northing:** 7451699
Habitat: Plain
Soil: Reddish brown sandy loam
Rock type: Ironstone
Vegetation code: P1
Vegetation: *Acacia catenulata* subsp. *occidentalis*, *A. aptaneura*, (*A. pruinocarpa*) tall shrubland over *Eremophila forrestii* subsp. *forrestii* open shrubland over *Triodia vanleeuwenii*, (*T. pungens*) open hummock grassland with *Amphipogon sericeus* very open tussock grassland
Vegetation Condition: Very Good
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Abutilon lepidum	0.1	0.4
Abutilon ?lepidum	0.1	0.3
Abutilon macrum	0.1	0.4
Abutilon otocarpum	0.1	0.5
Acacia aptaneura	4	5.0
Acacia ayersiana	0.1	4.5
Acacia bivenosa	0.1	0.4
Acacia catenulata subsp. *occidentalis*	10	5.0
Acacia maitlandii	0.1	0.6
Acacia monticola	0.1	1.5
Acacia pruinocarpa	1	5.0
Acacia tenuissima	0.1	0.6
Amphipogon sericeus	5	0.2
Androcalva luteiflora	0.1	1.6
Aristida contorta	0.1	0.2

Name	Cover (%)	Height (m)
Aristida inaequiglumis	0.1	0.6
**Bidens bipinnata*	0.1	0.2
Cheilanthes sieberi subsp. *sieberi*	0.1	0.1
Cleome viscosa	0.1	0.3
Codonocarpus cotinifolius	0.1	0.4
Corchorus lasiocarpus subsp. *parvus*	0.1	0.7
Cucumis variabilis	0.1	twiner
Digitaria brownii	0.1	0.4
Dysphania rhadinostachya subsp. *rhadinostachya*	0.1	0.2
Enchylaena tomentosa var. *tomentosa*	0.1	0.3
Enneapogon lindleyanus	0.1	0.4
Enneapogon polyphyllus	0.1	0.3
Eremophila forrestii subsp. *forrestii*	3	1.8
Eriachne pulchella	0.1	0.1
Euphorbia australis var. *subtomentosa*	0.1	0.1
Euphorbia sp.	0.1	0.05
Evolvulus alsinoides var. *villosicalyx*	0.1	0.2
Gomphrena cunninghamii	0.1	0.1
Goodenia stobbsiana	0.1	0.2
Gossypium robinsonii	0.1	2.0
Hibiscus burtonii	0.1	0.3
Hibiscus coatesii	0.1	1.5
Hibiscus sturtii var. *campylochlamys*	0.1	0.4
Indigofera monophylla	0.1	0.4
Iseilema vaginiflorum	0.1	0.1
Paraneurachne muelleri	0.1	0.3
Paspalidium clementii	0.1	0.1
Perotis rara	0.1	0.1
Polycarpaea corymbosa var. *corymbosa*	0.1	0.1
Polycarpaea holtzei	0.1	0.1
Pterocaulon sphacelatum	0.1	0.5
Ptilotus astrolasius	0.1	0.3
Ptilotus calostachyus	0.1	0.6
Ptilotus exaltatus	0.1	0.5
Ptilotus fusiformis	0.1	0.3
Ptilotus helipteroides	0.1	0.2
Rhagodia eremaea	0.1	0.5
Schizachyrium fragile	0.1	0.1
Senna artemisioides subsp. *helmsii*	0.1	0.5
Senna glutinosa subsp. x *luerssenii*	0.1	2.1
Senna notabilis	0.1	0.2

Name	Cover (%)	Height (m)
Sida fibulifera	0.1	0.1
Sida sp. dark green fruits (S. van Leeuwen 2260)	0.1	0.6
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.1	0.3
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	2.1
Solanum lasiophyllum	0.1	0.3
Solanum phlomoides	0.1	0.3
Sporobolus australasicus	0.1	0.1
Streptoglossa decurrens	0.1	0.4
Teucrium teucriiflorum	0.1	1.3
Tribulus suberosus	0.1	0.5
Trichodesma zeylanicum var. *zeylanicum*	0.1	0.6
Triodia pungens	5	0.4
Triodia vanleeuwenii	10	0.3
Waltheria indica	0.1	0.3

* denotes weed species
? denotes unconfirmed ID

Site: HD07
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 4/11/2017 **Phase 2 Date:** 22/05/2018 **Described by:** LD
MGA Zone: 50 **Easting:** 713558 **Northing:** 7450156
Habitat: Hillslope
Soil: Reddish brown sandy loam
Rock type: Ironstone
Vegetation code: H2
Vegetation: *Eucalyptus repullulans* scattered low mallees over *Acacia catenulata* subsp. *occidentalis*, *A. aptaneura*, (*A. incurvaneura*, *A. mulganeura*, *Grevillea saxicola*) tall open scrub over *Senna stricta*, (*Eremophila latrobei* subsp. *filiformis*, *S. artemisioides* subsp. *helmsii*) open shrubland over *Triodia pungens* very open hummock grassland
Vegetation Condition: Excellent
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	10	5.0
Acacia catenulata subsp. *occidentalis*	20	4.5
Acacia hamersleyensis	0.1	5.0
Acacia incurvaneura	2	5.0
Acacia mulganeura	1	5.0
Aristida contorta	0.1	0.1
Asteraceae sp.	0.1	0.2
Cheilanthes lasiophylla	0.1	0.2
Dodonaea pachyneura	0.1	2.0
Dysphania rhadinostachya subsp. *rhadinostachya*	0.1	0.1
Enchylaena tomentosa var. *tomentosa*	0.1	0.3
Enneapogon polyphyllus	0.1	0.4
Eremophila latrobei subsp. *filiformis*	0.5	1.8
Eremophila platycalyx subsp. *pardalota*	0.1	3.0
Eriachne mucronata	0.1	0.3

Name	Cover (%)	Height (m)
Eriachne pulchella	0.1	0.1
Eucalyptus repullulans	1	2.5
Grevillea saxicola P3	1	5.0
Lobelia heterophylla subsp. *pilbarensis*	0.1	0.1
Nicotiana sp.	0.1	0.1
Paspalidium clementii	0.1	0.1
Psydrax suaveolens	0.1	0.7
Ptilotus exaltatus	0.1	0.4
Ptilotus obovatus	0.1	0.3
Santalum lanceolatum	0.1	2.4
Scaevola acacioides	0.5	2.5
Senna artemisioides subsp. *helmsii*	0.5	1.8
Senna glaucifolia	0.1	2.1
Senna glutinosa subsp. x *luerssenii*	0.1	1.3
Senna stricta	2	1.2
Solanum lasiophyllum	0.1	0.4
Triodia pungens	5	0.4
Triodia vanleeuwenii	0.1	0.2

Site: HD08
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 5/11/2017 **Phase 2 Date:** 21/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 703384 **Northing:** 7446220
Habitat: Minor creek
Soil: Reddish brown sandy loam
Rock type: Ironstone
Vegetation code: D2
Vegetation: *Corymbia hamersleyana* sens. lat. scattered low trees over *Acacia catenulata* subsp. *occidentalis*, (*A. pruinocarpa, A. aptaneura*, *Petalostylis labicheoides*, *A. citrinoviridis*) tall shrubland over *Triodia pungens* very open hummock grassland with *Eriachne mucronata*, (*Themeda triandra*) very open tussock grassland
Vegetation Condition: Very Good
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	4	4.2
Acacia ayersiana	0.1	2.8
Acacia catenulata subsp. *occidentalis*	15	5.5
Acacia citrinoviridis	2	5.0
Acacia pruinocarpa	4	5.2
Aristida contorta	0.1	0.3
Capparis lasiantha	0.1	2.5
Corymbia hamersleyana sens. lat.	1	5.0
Cymbopogon ambiguus	0.1	0.5
Dodonaea petiolaris	2	3.0
Duperreya commixta	0.1	twiner
Eremophila platycalyx subsp. *pardalota*	0.1	1.1
Eriachne mucronata	5	0.3
Eucalyptus gamophylla	0.1	1.7
Eucalyptus leucophloia subsp. *leucophloia*	0.1	5.0

Name	Cover (%)	Height (m)
Jasminum didymum subsp. *lineare*	0.1	twiner
Petalostylis labicheoides	4	2.5
Psydrax latifolia	0.1	0.5
Senna artemisioides subsp. *oligophylla*	0.1	0.7
Sida sp.	0.1	0.1
Themeda triandra	0.5	0.4
Triodia pungens	3	0.4

Site: HD09
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 5/11/2017 **Phase 2 Date:** 19/05/2018 **Described by:** BE
MGA Zone: 50 **Easting:** 706457 **Northing:** 7446593
Habitat: Floodplain
Soil: Dark reddish brown sandy clay
Rock type: Ironstone
Vegetation code: P2
Vegetation: *Acacia pruinocarpa*, (*A. aptaneura*) tall open shrubland over *Eremophila forrestii* subsp. *forrestii* open shrubland over *Aristida latifolia*, (*Astrebla* sp.) tussock grassland
Vegetation Condition: Very Good
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Abutilon otocarpum	0.1	0.1
Acacia aptaneura	1	2.2
Acacia pachyacra	0.1	0.9
Acacia pruinocarpa	5	4
Acacia sp.	0.1	2.4
Acacia synchronicia	0.1	3.8
Acacia tetragonophylla	0.1	2.2
Alternanthera nana	0.1	0.1
Anthobolus leptomerioides	0.1	1
Aristida contorta	0.1	0.3
Aristida latifolia	35	0.7
Asteraceae sp.	0.1	0.2
Astrebla sp.	5	0.6
Bidens bipinnata	0.1	0.2
Boerhavia coccinea	0.1	0.2
Bulbostylis barbata	0.1	0.1

Name	Cover (%)	Height (m)
Chrysopogon fallax	0.1	0.4
Cleome viscosa	0.1	0.3
Crotalaria medicaginea var. *neglecta*	0.1	0.2
Cymbopogon ambiguus	0.1	0.7
Cynodon convergens	0.1	0.1
Dactyloctenium ?radulans	0.1	0.1
Dichanthium sericeum subsp. *humilius*	0.1	0.3
Enchylaena tomentosa var. *tomentosa*	0.1	0.9
Enneapogon caerulescens	0.1	0.1
Enneapogon polyphyllus	0.1	0.2
Eragrostis setifolia	0.1	0.4
Eragrostis tenellula	0.1	0.2
Eragrostis xerophila	0.1	0.4
Eremophila forrestii subsp. *forrestii*	2	1.7
Eremophila longifolia	0.1	0.7
Eriachne ?benthamii	0.1	0.3
Eriachne obtusa	0.1	0.4
Euphorbia sp.	0.1	0.1
Evolvulus alsinoides var. *villosicalyx*	0.1	0.2
Fimbristylis dichotoma	0.1	0.1
Indigofera linifolia	0.1	0.1
Iseilema eremaeum	0.1	0.1
Maireana villosa	0.1	0.2
Malvastrum americanum	0.1	0.3
Panicum decompositum	0.1	0.3
Paraneurachne muelleri	0.1	0.5
Pterocaulon sphacelatum	0.1	0.2
Ptilotus aervoides	0.1	0.1
Ptilotus exaltatus	0.1	0.4
Ptilotus helipteroides	0.1	0.1
Ptilotus obovatus	0.1	0.6
Rhagodia eremaea	0.1	1
Rhagodia sp. Hamersley (M. Trudgen 17794)	0.1	1.6
Rhynchosia minima	0.1	twiner
Salsola australis	0.1	0.4
Sclerolaena cornishiana	0.1	0.3
Senna artemisioides subsp. *oligophylla*	0.1	1.3
Senna artemisioides subsp. x *artemisioides*	0.1	0.3
Sida fibulifera	0.1	0.2
Solanum lasiophyllum	0.1	0.3
Sporobolus australasicus	0.1	0.1

Name	Cover (%)	Height (m)
Streptoglossa bubakii	0.1	0.4
Tragus australianus	0.1	0.1
Triodia wiseana	0.1	0.4

? denotes unconfirmed ID

Site: HD10
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 5/11/2017 **Phase 2 Date:** 19/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 705856 **Northing:** 7446600
Habitat: Plain
Soil: Dark reddish brown sandy loam
Rock type: Ironstone
Vegetation code: P1
Vegetation: *Acacia aptaneura*, (*A. catenulata* subsp. *occidentalis*, *A. ayersiana, A. aptaneura* x, *A. incurvaneura*) tall shrubland over *Eremophila forrestii* subsp. *forrestii* open shrubland over *Triodia pungens* very open hummock grassland
Vegetation Condition: Very Good
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Abutilon otocarpum	0.1	0.3
Acacia aptaneura	15	4.3
Acacia aptaneura x	1	4.0
Acacia ayersiana	2	3.8
Acacia catenulata subsp. *occidentalis*	6	4.3
Acacia incurvaneura	0.5	4.0
Acacia tetragonophylla	0.1	2.3
Aristida contorta	0.1	0.1
Aristida obscura	0.1	0.1
**Bidens bipinnata*	0.1	0.2
Cheilanthes sieberi subsp. *sieberi*	0.1	0.1
Chrysopogon fallax	0.1	1.1
Corymbia deserticola subsp. *deserticola*	0.1	4.0
Dichanthium sp.	0.1	0.2
Enchylaena tomentosa var. *tomentosa*	0.1	0.3

Name	Cover (%)	Height (m)
Enneapogon caerulescens	0.1	0.1
Enneapogon polyphyllus	0.1	0.1
Eremophila forrestii subsp. *forrestii*	4	1.0
Eremophila latrobei subsp. *filiformis*	0.1	1.7
Eriachne pulchella	0.1	0.1
Evolvulus alsinoides var. *decumbens*	0.1	0.2
Glycine canescens	0.1	twiner
Hibiscus burtonii	0.1	0.6
Iseilema vaginiflorum	0.1	0.2
Maireana tomentosa subsp. *tomentosa*	0.1	0.2
Paspalidium clementii	0.1	0.1
Perotis rara	0.1	0.1
Psydrax suaveolens	0.1	1.5
Sida ?ectogama	0.1	0.5
Sida fibulifera	0.1	0.1
Sida sp.	0.1	0.5
Sida sp. dark green fruits (S. van Leeuwen 2260)	0.1	0.4
Sporobolus australasicus	0.1	0.2
Triodia pungens	7	0.5
Triodia vanleeuwenii	0.1	0.2

* denotes weed species
? denotes unconfirmed ID

Site: HD11
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 5/11/2017 **Phase 2 Date:** 19/05/2018 **Described by:** LV
MGA Zone: 50 **Easting:** 706727 **Northing:** 7446383
Habitat: Footslope
Soil: Dark reddish brown sandy clay loam
Rock type: Ironstone
Vegetation code: H11
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees with *E. gamophylla* low open mallee woodland over *Acacia ancistrocarpa* scattered tall shrubs over *Senna ferraria* scattered shrubs over *A. hilliana* low open shrubland over *Triodia vanleeuwenii*, (*T. pungens*) hummock grassland
Vegetation Condition: Excellent
Fire Age: No fire evident



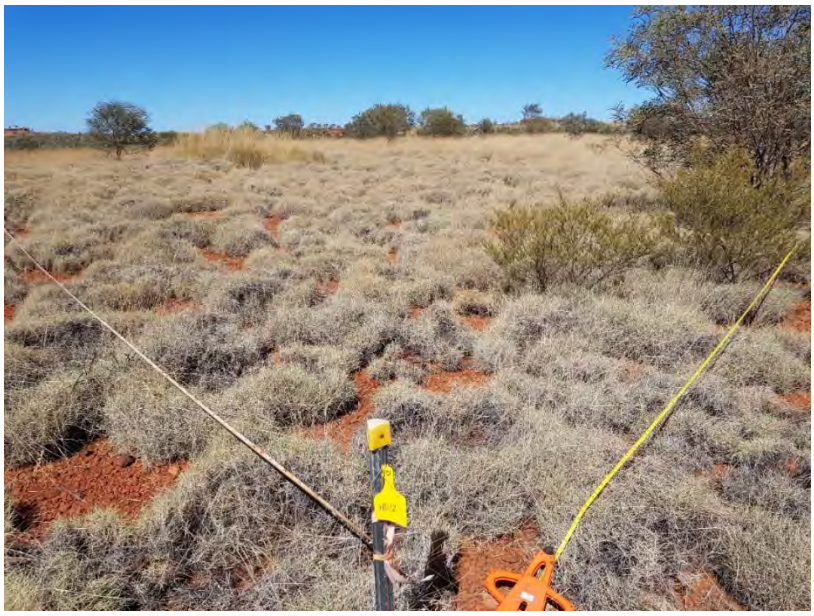
Species List:

Name	Cover (%)	Height (m)
Acacia ancistrocarpa	1	2.9
Acacia aptaneura	0.1	3.0
Acacia hilliana	4	0.5
Acacia maitlandii	0.1	1.8
Acacia pachyacra	0.1	0.5
Acacia pruinocarpa	0.1	2.1
Acacia tenuissima	0.1	1.7
Amphipogon sericeus	0.1	0.8
Anthobolus leptomerioides	0.1	1.8
Aristida contorta	0.1	0.3
Aristida holathera var. *holathera*	0.1	0.4
Aristida inaequiglumis	0.1	0.6
Capparis lasiantha	0.1	0.1
Corchorus lasiocarpus subsp. *parvus*	0.1	0.4
Cymbopogon ambiguus	0.1	0.5

Name	Cover (%)	Height (m)
Cymbopogon obtectus	0.1	0.4
Digitaria ammophila	0.1	0.2
Digitaria brownii	0.1	0.4
Duperreya commixta	0.1	twiner
Enneapogon caerulescens	0.1	0.2
Enneapogon polyphyllus	0.1	0.3
Eremophila forrestii subsp. *forrestii*	0.1	0.7
Eremophila longifolia	0.1	2.5
Eriachne ?benthamii	0.1	0.1
Eriachne mucronata	0.1	0.2
Eriachne pulchella subsp. *pulchella*	0.1	0.1
Eucalyptus gamophylla	4	5.0
Eucalyptus leucophloia subsp. *leucophloia*	1	5.5
Gompholobium oreophilum	0.1	0.4
Goodenia stobbsiana	0.1	0.3
Hakea chordophylla	0.1	3.3
Indigofera monophylla	0.1	0.3
Jasminum didymum subsp. *lineare*	0.1	twiner
Paraneurachne muelleri	0.1	0.3
Pterocaulon sphacelatum	0.1	0.2
Ptilotus astrolasius	0.1	0.3
Ptilotus calostachyus	0.1	0.1
Ptilotus exaltatus	0.1	0.2
Ptilotus rotundifolius	0.1	1.1
Scaevola parvifolia subsp. *pilbarae*	0.1	0.2
Schizachyrium fragile	0.1	0.2
Senna artemisioides subsp. *oligophylla*	0.1	0.7
Senna ferraria	1	1.5
Senna glutinosa subsp. *glutinosa*	0.1	1.5
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	0.4
Solanum lasiophyllum	0.1	1.0
Trichodesma zeylanicum var. *zeylanicum*	0.1	0.05
Triodia pungens	12	0.5
Triodia vanleeuwenii	45	0.5
Triodia wiseana	0.1	0.4

? denotes unconfirmed ID

Site: HD12
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 5/11/2017 **Phase 2 Date:** 19/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 705230 **Northing:** 7446638
Habitat: Hillcrest
Soil: Dark reddish brown sandy loam
Rock type: Ironstone
Vegetation code: H8
Vegetation: *Acacia pruinocarpa* tall open shrubland over *Triodia vanleeuwenii*, (*T. pungens*) hummock grassland
Vegetation Condition: Excellent
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	0.1	1.3
Acacia ayersiana	0.1	1.1
Acacia pruinocarpa	5	2.7
Goodenia sp.	0.1	0.2
Jasminum didymum subsp. *lineare*	0.1	twiner
Psydrax latifolia	0.1	0.8
Ptilotus calostachyus	0.1	0.4
Solanum horridum	0.1	0.2
Solanum lasiophyllum	0.1	0.3
Triodia pungens	1	0.5
Triodia vanleeuwenii	45	0.3

Site: HD13
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 6/11/2017 **Phase 2 Date:** 24/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 718945 **Northing:** 7450427
Habitat: Hillcrest
Soil: Red brown sandy clay loam
Rock type: Ironstone
Vegetation code: H1
Vegetation: *Corymbia hamersleyana* sens. lat., *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees with *E. gamophylla* low open mallee woodland over *Hakea chordophylla*, *Petalostylis labicheoides* scattered tall shrubs over *Acacia spondylophylla*, *Gompholobium oreophilum*, *A. hilliana* low shrubland over *Triodia vanleeuwenii*, (*T. pungens, T. wiseana*) open hummock grassland
Vegetation Condition: Excellent
Fire Age: 5-10 years



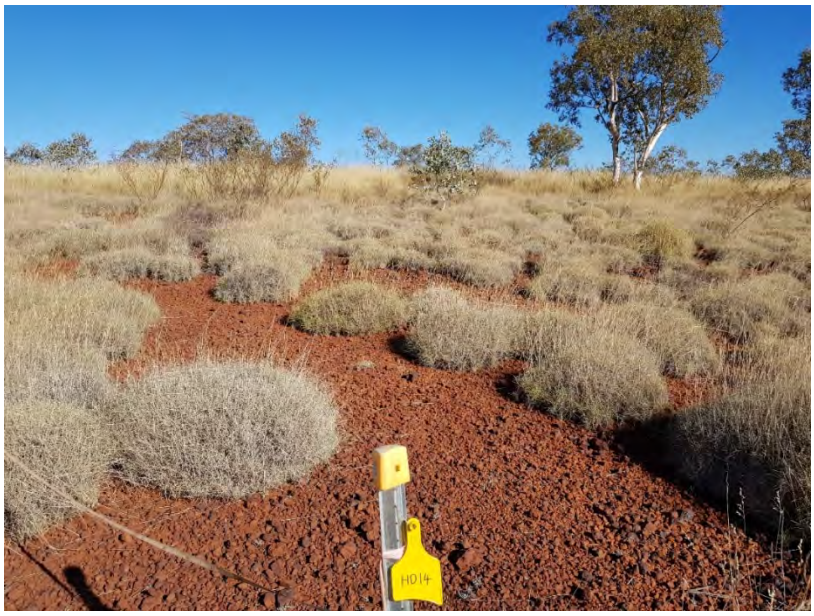
Species List:

Name	Cover (%)	Height (m)
Acacia hilliana	4	0.5
Acacia pyrifolia	0.1	0.6
Acacia spondylophylla	5	0.5
Amphipogon sericeus	0.1	0.3
Aristida inaequiglumis	0.1	0.9
Codonocarpus cotinifolius	0.1	0.5
Corchorus lasiocarpus subsp. *parvus*	0.1	0.3
Corymbia hamersleyana sens. lat.	0.5	5.0
Cymbopogon ambiguus	0.1	0.4
Duperreya commixta	0.1	twiner
Eriachne pulchella subsp. *dominii*	0.1	0.05
Eucalyptus gamophylla	4	3.5
Eucalyptus leucophloia subsp. *leucophloia*	0.5	4.0
Gompholobium oreophilum	5	0.4
Goodenia triodiophila	0.1	0.4

Name	Cover (%)	Height (m)
Grevillea wickhamii subsp. *hispidula*	0.1	0.7
Hakea chordophylla	1	3.0
Hibiscus ?coatesii	0.1	0.35
Petalostylis labicheoides	0.5	2.4
Ptilotus calostachyus	0.1	0.7
Santalum lanceolatum	0.1	0.6
Scaevola browniana	0.1	0.4
Senna glutinosa subsp. *glutinosa*	0.1	0.9
Triodia pungens	1	0.7
Triodia vanleeuwenii	17	0.5
Triodia wiseana	1	0.5

? denotes unconfirmed ID

Site: HD14
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 7/11/2017 **Phase 2 Date:** 19/05/2018 **Described by:** LD
MGA Zone: 50 **Easting:** 704939 **Northing:** 7445738
Habitat: Hillcrest
Soil: Dark reddish brown sandy loam
Rock type: Ironstone
Vegetation code: H7
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia maitlandii* scattered tall shrubs over *Triodia pungens*, *T. vanleeuwenii* hummock grassland
Vegetation Condition: Excellent
Fire Age: No fire evident

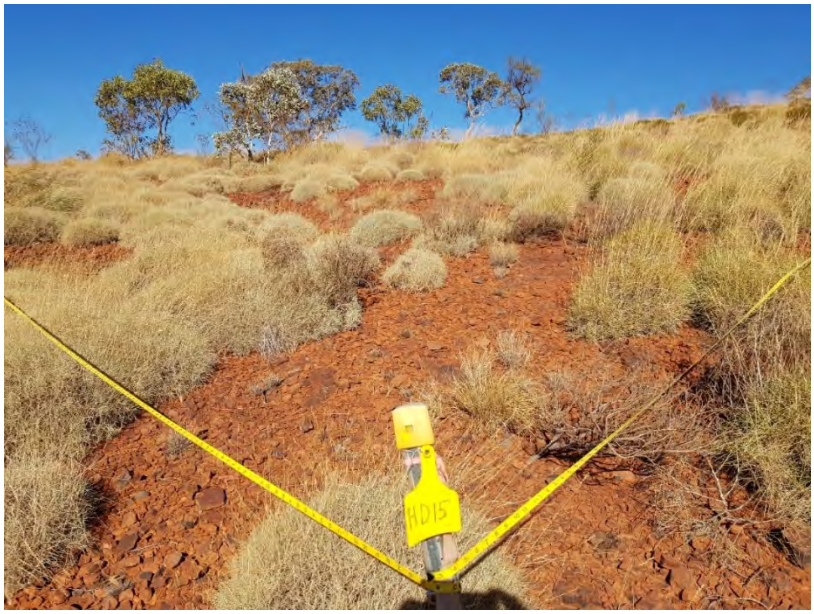


Species List:

Name	Cover (%)	Height (m)
Abutilon lepidum	0.1	0.3
Acacia adoxa var. *adoxa*	0.1	0.4
Acacia maitlandii	1	3.0
Acacia pachyacra	0.1	2.1
Acacia pruinocarpa	0.1	2.5
Acacia pteraneura x *aptaneura*	0.1	0.5
Aristida contorta	0.1	0.2
Aristida holathera var. *holathera*	0.1	0.3
Bonamia pilbarensis	0.1	0.1
Bulbostylis barbata	0.1	0.1
Capparis lasiantha	0.1	0.4
Corymbia deserticola subsp. *deserticola*	0.1	0.6
Cymbopogon ambiguus	0.1	0.4
Enneapogon caerulescens	0.1	0.1
Enneapogon polyphyllus	0.1	0.1
Eremophila fraseri subsp. *fraseri*	0.1	0.3

Name	Cover (%)	Height (m)
Eremophila latrobei subsp. *glabra*	0.1	1.1
Eriachne mucronata	0.1	0.2
Eriachne pulchella	0.1	0.1
Eucalyptus leucophloia subsp. *leucophloia*	8	7.5
Euphorbia australis var. *subtomentosa*	0.1	0.1
Goodenia stobbsiana	0.1	0.3
Goodenia tenuiloba	0.1	0.2
Indigofera monophylla	0.1	0.2
Lepidium pedicellosum	0.1	0.3
Maireana triptera	0.1	0.2
Paraneurachne muelleri	0.1	0.2
Paspalidium clementii	0.1	0.1
Polycarpaea corymbosa var. *corymbosa*	0.1	0.1
Ptilotus astrolasius	0.1	0.3
Ptilotus exaltatus	0.1	0.2
Ptilotus obovatus	0.1	0.4
Salsola australis	0.1	0.1
Schizachyrium fragile	0.1	0.1
Senna glutinosa subsp. *glutinosa*	0.1	1.6
Senna glutinosa subsp. *pruinosa*	0.1	1.6
Senna glutinosa subsp. x *luerssenii*	0.1	2.1
Sida sp. Excedentifolia (J.L. Egan 1925)	0.1	0.2
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.1	0.2
Solanum lasiophyllum	0.1	0.3
Sporobolus australasicus	0.1	0.1
Themeda triandra	0.1	0.5
Triodia pungens	25	0.5
Triodia vanleeuwenii	15	0.3

Site: HD15
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 6/11/2017 **Phase 2 Date:** 23/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 717618 **Northing:** 7450313
Habitat: Hillcrest
Soil: Red brown sandy clay loam
Rock type: Ironstone
Vegetation code: H1
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia hamersleyana* sens. lat. low open woodland over *Gompholobium oreophilum*, *Acacia hilliana* low open shrubland over *Triodia vanleeuwenii*, (*T. wiseana*, *T. pungens*) open hummock grassland
Vegetation Condition: Excellent
Fire Age: 5-10 years



Species List:

Name	Cover (%)	Height (m)
Acacia hilliana	2	0.4
Acacia spondylophylla	0.1	0.4
Amphipogon sericeus	0.1	0.3
Aristida holathera var. *holathera*	0.1	0.3
Cheilanthes sieberi subsp. *sieberi*	0.1	0.2
Codonocarpus cotinifolius	0.1	1.8
Corymbia hamersleyana sens. lat.	1	4.0
Dysphania rhadinostachya subsp. *rhadinostachya*	0.1	0.15
Eremophila jucunda subsp. *pulcherrima*	0.1	0.8
Eriachne aristidea	0.1	0.25
Eriachne mucronata	0.1	0.3
Eucalyptus leucophloia subsp. *leucophloia*	3	5.0
Fimbristylis sp.	0.1	0.2
Gompholobium oreophilum	2	0.6
Goodenia stobbsiana	0.1	0.35

Name	Cover (%)	Height (m)
Goodenia triodiophila	0.1	0.3
Hakea chordophylla	0.1	3.5
Iseilema sp.	0.1	0.1
Jasminum didymum subsp. *lineare*	0.1	twiner
Paraneurachne muelleri	0.1	0.2
Petalostylis labicheoides	0.1	2.2
Ptilotus calostachyus	0.1	0.7
Ptilotus fusiformis	0.1	0.35
Scaevola browniana	0.1	0.3
Schizachyrium fragile	0.1	0.1
Senna glaucifolia	0.1	1.5
Senna glutinosa subsp. *glutinosa*	0.1	2.5
Sida arenicola	0.1	0.3
Sida sp. Excedentifolia (J.L. Egan 1925)	0.1	0.2
Solanum lasiophyllum	0.1	0.4
Triodia pungens	0.5	0.4
Triodia vanleeuwenii	15	0.4
Triodia wiseana	5	0.4

Site: HD16
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 7/11/2017 **Phase 2 Date:** 20/05/2018 **Described by:** LD
MGA Zone: 50 **Easting:** 703984 **Northing:** 7445042
Habitat: Hillcrest
Soil: Dark reddish brown sandy loam
Rock type: Dolerite
Vegetation code: H9
Vegetation: *Acacia arida*, *Grevillea wickhamii* subsp. *hispidula*, *Androcalva luteiflora* open shrubland over *Triodia wiseana* open hummock grassland with *Themeda* sp. Mt Barricade (M.E. Trudgen 2471) very open tussock grassland
Vegetation Condition: Excellent
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Acacia arida	3	1.4
Acacia arida x	0.1	1.1
Acacia inaequilatera	0.1	0.7
Androcalva luteiflora	1	1.8
Aristida holathera var. *holathera*	0.1	0.3
Cheilanthes lasiophylla	0.1	0.1
Corymbia hamersleyana sens. lat.	0.1	3.2
Cymbopogon ambiguus	0.1	0.6
Eremophila fraseri subsp. *fraseri*	0.1	0.4
Eriachne mucronata	0.1	0.5
Gossypium australe	0.1	0.2
Grevillea wickhamii subsp. *hispidula*	1.5	1.9
Senna glutinosa subsp. *glutinosa*	0.1	1.1
Themeda sp. Mt Barricade (M.E. Trudgen 2471)	7	0.5
Triodia wiseana	25	0.5

Site: HD17
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 7/11/2017 **Phase 2 Date:** 20/05/2018 **Described by:** LV
MGA Zone: 50 **Easting:** 706292 **Northing:** 7443062
Habitat: Drainage depression
Soil: Brown sand
Rock type: Dolerite
Vegetation code: D4
Vegetation: *Eucalyptus victrix* low open woodland over *Melaleuca glomerata*, *Acacia citrinoviridis* tall open shrubland over *Gossypium sturtianum* var. *sturtianum, Androcalva luteiflora*, *Acacia bivenosa* open shrubland over *Themeda triandra*, (**Cenchrus setiger*, *Eulalia aurea, *C. ciliaris*) open tussock grassland with **Bidens bipinnata* scattered herbs
Vegetation Condition: Good
Fire Age: 5-10 years



Species List:

Name	Cover (%)	Height (m)
Acacia bivenosa	1	1.5
Acacia citrinoviridis	2	8.0
Acacia maitlandii	0.1	1.3
Acacia pyrifolia	0.1	1.6
Androcalva luteiflora	1.5	1.7
**Bidens bipinnata*	1	0.2
Bothriochloa ewartiana	0.1	1.0
Cassytha sp.	0.1	twiner
**Cenchrus ciliaris*	1	0.5
**Cenchrus setiger*	4	0.7
Cleome viscosa	0.1	0.2
Clerodendrum floribundum var. *angustifolium*	0.1	0.35
Corchorus lasiocarpus subsp. *parvus*	0.1	0.35
Cucumis variabilis	0.1	twiner
Cymbopogon ambiguus	0.1	0.3

Name	Cover (%)	Height (m)
Cyperus vaginatus	0.1	0.6
Eremophila canaliculata	0.1	0.15
Eremophila longifolia	0.1	1.5
Eucalyptus camaldulensis subsp. *obtusa*	0.1	2.0
Eucalyptus victrix	2.0	10
Eulalia aurea	1.5	0.9
Euphorbia biconvexa	0.1	0.2
**Flaveria trinervia*	0.1	0.4
Glycine canescens	0.1	twiner
Gossypium australe	0.1	0.4
Gossypium robinsonii	0.1	2.3
Gossypium sturtianum var. *sturtianum*	1.5	1.8
Jasminum didymum subsp. *lineare*	0.1	twiner
Marsdenia sp.	0.1	twiner
Melaleuca glomerata	3.0	4.0
Peripleura arida	0.1	0.25
Petalostylis labicheoides	0.1	1.9
Phyllanthus maderaspatensis	0.1	0.2
Pluchea dentex	0.1	0.3
Pluchea rubelliflora	0.1	0.3
Pluchea sp.	0.1	0.5
Pterocaulon sphacelatum	0.1	0.2
Rhynchosia minima	0.1	twiner
Scaevola amblyanthera var. *centralis*	0.1	0.15
Scaevola browniana	0.1	0.1
**Sigesbeckia orientalis*	0.1	0.4
Solanum lasiophyllum	0.1	0.3
Stemodia grossa	0.1	0.3
Themeda triandra	12	0.7
Trichodesma zeylanicum var. *zeylanicum*	0.1	1.2
Tricoryne sp. Hamersley Range (S. van Leeuwen 915)	0.1	0.3
Triodia longiceps	0.1	0.5

* denotes weed species

Site: HD18
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 7/11/2017 **Phase 2 Date:** 19/05/2018 **Described by:** LV
MGA Zone: 50 **Easting:** 707275 **Northing:** 7445867
Habitat: Major creek
Soil: Reddish brown sandy loam
Rock type: Ironstone
Vegetation code: D4
Vegetation: *Eucalyptus camaldulensis* subsp. *obtusa*, (*E. victrix*) open woodland with *E. xerothermica* low open woodland over *Petalostylis labicheoides*, (*Melaleuca bracteata*) tall open shrubland over *Androcalva luteiflora* scattered shrubs over over *Gossypium sturtianum* var. *sturtianum* scattered low shrubs over *Triodia longiceps* very open hummock grassland with *Themeda triandra*, *Eulalia aurea*, **Cenchrus ciliaris*, (*Enteropogon ramosus*, *Dichanthium sericeum* subsp. *humilius*) open tussock grassland
Vegetation Condition: Good
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Abutilon amplum	0.1	1.7
Abutilon otocarpum	0.1	0.2
Acacia bivenosa	0.1	2.0
Acacia citrinoviridis	0.1	0.5
Acacia dictyophleba	0.1	0.5
Acacia maitlandii	0.1	0.3
Androcalva luteiflora	1.0	1.8
Aristida contorta	0.1	0.25
Aristida holathera var. *holathera*	0.5	0.4
Aristida lazaridis P2	0.1	0.3
**Bidens bipinnata*	0.1	0.1
Bonamia pilbarensis	0.1	0.1
Bothriochloa ewartiana	0.1	0.7
**Cenchrus ciliaris*	3.0	0.6

Name	Cover (%)	Height (m)
**Cenchrus setiger*	0.1	0.4
Chrysopogon fallax	0.1	1.0
Convolvulus clementii	0.1	twiner
**Conyza bonariensis*	0.1	0.2
Corchorus lasiocarpus subsp. *parvus*	0.1	0.4
Crotalaria medicaginea var. *neglecta*	0.1	0.3
Cucumis variabilis	0.1	twiner
Cymbopogon ambiguus	0.1	0.4
Cyperus vaginatus	0.1	0.4
Dichanthium sericeum subsp. *humilius*	1	0.6
Duperreya commixta	0.1	twiner
Enneapogon lindleyanus	0.1	0.4
Enteropogon ramosus	2	0.6
Eragrostis eriopoda	0.1	0.3
Eragrostis tenellula	0.1	0.1
Eremophila longifolia	0.1	0.4
Eriachne mucronata	0.1	0.2
Eucalyptus camaldulensis subsp. *obtusa*	8	12
Eucalyptus leucophloia subsp. *leucophloia*	0.1	2.1
Eucalyptus victrix	1.5	15
Eucalyptus xerothermica	2	6.5
Eulalia aurea	6	0.6
Euphorbia boophthona	0.1	0.3
Evolvulus alsinoides var. *villosicalyx*	0.1	0.3
**Flaveria trinervia*	0.1	0.2
Glycine canescens	0.1	twiner
Goodenia lamprosperma	0.1	0.2
Gossypium robinsonii	0.1	2.0
Gossypium sturtianum var. *sturtianum*	1.0	0.8
Hakea lorea subsp. *lorea*	0.1	1.7
Hibiscus sturtii var. *campylochlamys*	0.1	0.3
Indigofera monophylla	0.1	0.3
Jasminum didymum subsp. *lineare*	0.1	twiner
**Malvastrum americanum*	0.1	0.3
Melaleuca bracteata	2.0	3.7
Melhania oblongifolia	0.1	0.2
Paraneurachne muelleri	0.1	0.4
Paspalidium rarum	0.1	0.2
Petalostylis labicheoides	7.0	2.2
Pluchea rubelliflora	0.1	0.2
Polycarpaea corymbosa var. *corymbosthaa*	0.1	0.2

Name	Cover (%)	Height (m)
Polygala isingii	0.1	0.1
Pterocaulon sphacelatum	0.1	0.2
Ptilotus astrolasius	0.1	0.35
Ptilotus exaltatus	0.1	0.45
Ptilotus obovatus	0.1	0.2
Rhynchosia minima	0.1	twiner
Salsola australis	0.1	0.2
Santalum lanceolatum	0.1	1.7
Scaevola amblyanthera var. *centralis*	0.1	0.1
Senna artemisioides subsp. *x artemisioides*	0.1	0.5
Senna pleurocarpa var. *angustifolia*	0.1	0.6
Setaria dielsii	0.1	0.3
Sida echinocarpa	0.1	0.4
Sida fibulifera	0.1	0.15
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	0.3
Solanum phlomoides	0.1	0.2
Sporobolus australasicus	0.1	0.1
Themeda triandra	8.0	0.6
Trichodesma zeylanicum var. *zeylanicum*	0.1	1.5
Tricoryne sp. Hamersley Range (S. van Leeuwen 915)	0.1	0.4
Triodia longiceps	3.0	0.4
Triodia wiseana	0.1	0.5
**Vachellia farnesiana*	0.1	1.8
Wahlenbergia tumidifructa	0.1	0.3

* denotes weed species

Site: HD19
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 7/11/2017 **Phase 2 Date:** 20/05/2018 **Described by:** BE
MGA Zone: 50 **Easting:** 705911 **Northing:** 7443247
Habitat: Hillslope
Soil: Dark reddish brown sandy clay loam
Rock type: Dolerite
Vegetation code: H12
Vegetation: *Hakea chordophylla*, *Acacia pyrifolia* scattered shrubs over *Triodia wiseana* hummock grassland with *Themeda* sp. Mt Barricade (M.E. Trudgen 2471) scattered tussock grasses and *Tricoryne* sp. Hamersley Range (S. van Leeuwen 915) scattered herbs
Vegetation Condition: Excellent
Fire Age: No fire evident
Notes: Parts of the east and north have been burnt in the last two years

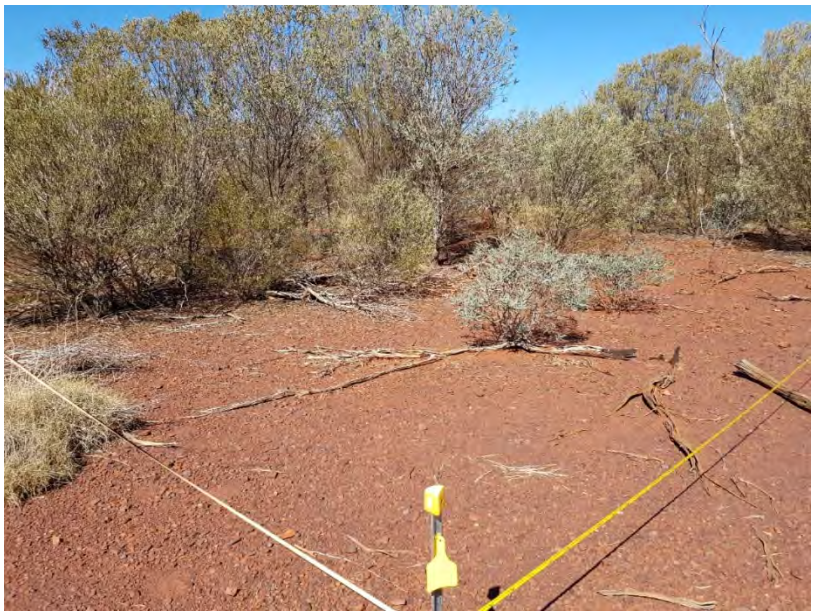


Species List:

Name	Cover (%)	Height (m)
Acacia arida	0.1	0.8
Acacia bivenosa	0.1	1.1
Acacia dictyophleba	0.1	0.8
Acacia kempeana	0.1	0.8
Acacia pyrifolia	0.5	1.7
Acacia sibirica	0.1	0.5
Aristida contorta	0.1	0.1
Aristida holathera var. *holathera*	0.1	0.3
Cheilanthes lasiophylla	0.1	0.1
Cymbopogon ambiguus	0.1	0.8
Dodonaea coriacea	0.1	0.5
Eriachne mucronata	0.1	0.2
Euphorbia careyi	0.1	0.1
Goodenia cusackiana	0.1	0.2
Goodenia prostrata	0.1	0.1

Name	Cover (%)	Height (m)
Hakea chordophylla	0.5	1.8
Heliotropium ovalifolium	0.1	0.2
Mirbelia viminalis	0.1	0.8
Poaceae sp.	0.1	0.1
Polygala isingii	0.1	0.1
Senna artemisioides subsp. *oligophylla*	0.1	0.5
Senna glutinosa subsp. *pruinosa*	0.1	1.3
Swainsona maccullochiana	0.1	0.2
Themeda sp. Mt Barricade (M.E. Trudgen 2471)	0.5	0.8
Trachymene oleracea subsp. *oleracea*	0.1	0.5
Trichodesma zeylanicum var. *zeylanicum*	0.1	0.7
Tricoryne sp. Hamersley Range (S. van Leeuwen 915)	0.5	0.5
Triodia wiseana	40	0.7

Site: HD20
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 8/11/2017 **Phase 2 Date:** 21/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 699216 **Northing:** 7446699
Habitat: Plain
Soil: Dark reddish brown sandy loam
Rock type: Ironstone
Vegetation code: P3
Vegetation: *Acacia aptaneura*, (*A. pruinocarpa*, *A. catenulata* subsp. *occidentalis*) tall shrubland over *Triodia pungens* open hummock grassland
Vegetation Condition: Excellent
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	20	4.5
Acacia ayersiana x	0.1	3.0
Acacia catenulata subsp. *occidentalis*	2.0	4.5
Acacia pachyacra	0.1	3.5
Acacia pruinocarpa	5.0	4.0
Aristida contorta	0.1	0.2
Aristida inaequiglumis	0.1	0.4
Chrysopogon fallax	0.1	0.3
Digitaria brownii	0.1	0.2
Duperreya commixta	0.1	twiner
Enneapogon polyphyllus	0.1	0.2
Eragrostis cumingii	0.1	0.3
Eremophila fraseri subsp. *fraseri*	0.1	1.0
Eriachne pulchella	0.1	0.1
Hibiscus burtonii	0.1	0.5
Iseilema vaginiflorum	0.1	0.2

Name	Cover (%)	Height (m)
Maireana tomentosa subsp. *tomentosa*	0.1	0.3
Maireana villosa	0.1	0.2
Paspalidium jubiflorum	0.1	0.1
Psydrax suaveolens	0.1	1.6
Ptilotus astrolasius	0.1	0.3
Ptilotus exaltatus	0.1	0.1
Ptilotus obovatus	0.1	0.6
Rhagodia sp. Hamersley (M. Trudgen 17794) P3	0.1	0.4
Senna artemisioides subsp. *helmsii*	0.1	1.5
Sida ?sp. dark green fruits (S. van Leeuwen 2260)	0.1	0.2
Triodia pungens	12	0.5

? denotes unconfirmed ID

Site: HD21
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 7/11/2017 **Phase 2 Date:** 21/05/2018 **Described by:** LD
MGA Zone: 50 **Easting:** 699950 **Northing:** 7444300
Habitat: Footslope
Soil: Dark reddish brown sandy clay loam
Rock type: Ironstone
Vegetation code: H10
Vegetation: *Eucalyptus socialis* subsp. *eucentrica*, (*E. pilbarensis*) low open mallee woodland over *Triodia wiseana*, *T. angusta*, (*T. vanleeuwenii*) hummock grassland
Vegetation Condition: Excellent
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Abutilon lepidum	0.1	0.4
Acacia bivenosa	0.1	2.0
Acacia synchronicia	0.1	0.4
Aristida contorta	0.1	0.2
Aristida holathera var. *holathera*	0.1	0.3
Aristida inaequiglumis	0.1	0.7
Capparis lasiantha	0.1	0.8
Codonocarpus cotinifolius	0.1	1.2
Cucumis variabilis	0.1	twiner
Cymbopogon obtectus	0.1	0.3
Duperreya commixta	0.1	twiner
Enneapogon polyphyllus	0.1	0.1
Eriachne pulchella	0.1	0.1
Eucalyptus pilbarensis	1.0	4.0
Eucalyptus socialis subsp. *eucentrica*	4.0	4.0
Goodenia muelleriana	0.1	0.2

Name	Cover (%)	Height (m)
Hakea chordophylla	0.1	4.0
Jasminum didymum subsp. *lineare*	0.1	twiner
Maireana georgei	0.1	0.2
Paraneurachne muelleri	0.1	0.3
Ptilotus astrolasius	0.1	0.3
Ptilotus exaltatus	0.1	0.2
Salsola australis	0.1	0.1
Senna glutinosa subsp. *glutinosa*	0.1	0.6
Senna glutinosa subsp. *pruinosa*	0.1	0.4
Senna glutinosa subsp. x *luerssenii*	0.1	1.1
Senna sp. Meekatharra (E. Bailey 1-26)	0.1	0.2
Sida sp. Excedentifolia (J.L. Egan 1925)	0.1	0.5
Solanum lasiophyllum	0.1	0.3
Templetonia egena	0.1	0.6
Triodia angusta	10	0.5
Triodia vanleeuwenii	1.0	0.2
Triodia wiseana	25	0.7

Site: HD22
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 8/11/2017 **Phase 2 Date:** 21/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 701608 **Northing:** 7445751
Habitat: Major creek
Soil: Dark reddish brown sandy clay loam
Rock type: Ironstone
Vegetation code: D5
Vegetation: *Eucalyptus xerothermica* low open woodland over *Acacia maitlandii*, *Petalostylis labicheoides*, *A. pyrifolia*, (*A. dictyophleba*, *Santalum lanceolatum*) tall shrubland over *Androcalva luteiflora* scattered shrubs over *Triodia longiceps* open hummock grassland with *Eulalia aurea*, *Themeda triandra* open tussock grassland and **Bidens bipinnata* scattered herbs
Vegetation Condition: Good
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Abutilon otocarpum	0.1	0.3
Acacia aptaneura	0.1	4.2
Acacia bivenosa	0.1	0.6
Acacia dictyophleba	1.0	3.0
Acacia maitlandii	4.0	3.0
Acacia pyrifolia	3.0	2.2
Acacia sibirica	0.1	3.5
Alternanthera nana	0.1	0.1
Androcalva luteiflora	1.0	1.2
Aristida contorta	0.1	0.2
Aristida holathera var. *holathera*	0.1	0.2
Aristida ingrata	0.1	1.1
**Bidens bipinnata*	1.0	0.4
Boerhavia coccinea	0.1	0.2
**Cenchrus ciliaris*	0.1	0.4

Name	Cover (%)	Height (m)
Cheilanthes sieberi subsp. *sieberi*	0.1	0.1
Chrysocephalum apiculatum subsp. *pilbarense*	0.1	0.3
Chrysopogon fallax	0.1	0.4
Cleome viscosa	0.1	0.1
Crotalaria medicaginea var. *neglecta*	0.1	0.2
Cucumis variabilis	0.1	twiner
Cymbopogon ambiguus	0.1	0.4
Cynodon convergens	0.1	0.3
Dichanthium sericeum subsp. *humilius*	0.1	0.6
Digitaria brownii	0.1	0.5
Duperreya commixta	0.1	twiner
Dysphania kalpari	0.1	0.1
Enneapogon lindleyanus	0.1	0.3
Enneapogon polyphyllus	0.1	0.1
Eragrostis cumingii	0.1	0.2
Eragrostis tenellula	0.1	0.2
Eriachne mucronata	0.1	0.2
Eriachne pulchella	0.1	0.1
Eucalyptus leucophloia subsp. *leucophloia*	0.1	1.7
Eucalyptus xerothermica	3.0	8.0
Eulalia aurea	6.0	0.3
Euphorbia australis var. *subtomentosa*	0.1	0.2
Euphorbia biconvexa	0.1	0.1
Euphorbia trigonosperma	0.1	0.1
Evolvulus alsinoides var. *villosicalyx*	0.1	0.1
**Flaveria trinervia*	0.1	0.3
Glycine canescens	0.1	twiner
Gossypium sturtianum var. *sturtianum*	0.1	0.3
Hakea chordophylla	0.1	0.7
Haloragis gossei	0.1	0.2
Indigofera georgei	0.1	0.4
Indigofera monophylla	0.1	0.3
Iseilema vaginiflorum	0.1	0.2
Jasminum didymum subsp. *lineare*	0.1	twiner
**Malvastrum americanum*	0.1	0.3
Melhania oblongifolia	0.1	0.3
Panicum effusum	0.1	0.4
Paraneurachne muelleri	0.1	0.2
Peripleura arida	0.1	0.3
Perotis rara	0.1	0.2
Petalostylis labicheoides	4.0	2.1

Name	Cover (%)	Height (m)
Phyllanthus erwinii	0.1	0.1
Pluchea dentex	0.1	0.1
Polycarpaea corymbosa var. *corymbosa*	0.1	0.1
Pterocaulon sphacelatum	0.1	0.3
Ptilotus exaltatus	0.1	0.4
Ptilotus helipteroides	0.1	0.2
Ptilotus obovatus	0.1	0.4
Rhynchosia minima	0.1	twiner
Santalum lanceolatum	1.0	2.1
Scaevola amblyanthera var. *centralis*	0.1	0.1
Scaevola parvifolia subsp. *pilbarae*	0.5	0.2
Schizachyrium fragile	0.1	0.1
Senna artemisioides subsp. *oligophylla*	0.1	0.8
Senna artemisioides subsp. *x artemisioides*	0.1	0.4
Sida fibulifera	0.1	0.2
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	1.2
Solanum lasiophyllum	0.1	1.5
**Sonchus oleraceus*	0.1	0.2
Sporobolus australasicus	0.1	0.4
Stemodia grossa	0.1	0.2
Themeda triandra	5.0	0.5
Triodia longiceps	12	0.7
Triodia pungens	0.1	0.4
Wahlenbergia tumidifructa	0.1	0.4

* denotes weed species

Site: HD23
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 7/11/2017 **Phase 2 Date:** 21/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 701062 **Northing:** 7443836
Habitat: Hillslope
Soil: Brown sandy clay loam
Rock type: Ironstone
Vegetation code: H6
Vegetation: *Acacia aptaneura*, (*A. catenulata* subsp. *occidentalis*) tall open scrub over *Eremophila forrestii* subsp. *forrestii*, (*Senna stricta*) shrubland over *Maireana melanocoma* scattered low shrubs over *Triodia wiseana* scattered hummock grasses
Vegetation Condition: Excellent
Fire Age: 5-10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	35	4.5
Acacia catenulata subsp. *occidentalis*	2.0	2.7
Acacia tetragonophylla	0.1	1.7
Aristida contorta	0.1	0.2
Aristida sp.	0.1	1.2
Duperreya commixta	0.1	twiner
Enneapogon caerulescens	0.1	0.25
Enneapogon lindleyanus	0.1	0.3
Eragrostis tenellula	0.1	0.2
Eremophila forrestii subsp. *forrestii*	20	1.2
Eremophila platycalyx subsp. *pardalota*	0.1	0.6
Eriachne mucronata	0.1	0.4
Eriachne pulchella	0.1	0.2
Eucalyptus leucophloia subsp. *leucophloia*	0.1	4.0
Euphorbia biconvexa/coghlanii/trigonosperma	0.1	0.1

Name	Cover (%)	Height (m)
Grevillea berryana	0.1	4.0
Maireana melanocoma	0.5	0.4
Psydrax suaveolens	0.1	0.4
Ptilotus obovatus	0.1	0.4
Scaevola acacioides	0.1	1.8
Senna glutinosa subsp. x *luerssenii*	0.1	1.8
Senna stricta	1.0	1.4
Triodia pungens	0.1	0.7
Triodia wiseana	1.0	0.4

Site: HD24
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 9/11/2017 **Phase 2 Date:** 22/05/2018 **Described by:** LD
MGA Zone: 50 **Easting:** 712488 **Northing:** 7450677
Habitat: Gully
Soil: Dark reddish brown sandy loam
Rock type: Ironstone
Vegetation code: D3
Vegetation: *Corymbia ferriticola*, (*Corymbia* sp.) low open woodland over *Petalostylis labicheoides*, *Dodonaea petiolaris*, *Acacia catenulata* subsp. occidentalis tall open shrubland over *Triodia pungens* very open hummock grassland with *Themeda* sp. Mt Barricade (M.E. Trudgen 2471), (*Cymbopogon ambiguus*) very open tussock grassland
Vegetation Condition: Excellent
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Abutilon sp.	0.1	0.1
Acacia aptaneura	0.1	3.0
Acacia catenulata subsp. *occidentalis*	1.0	5.0
Acacia hamersleyensis	0.1	4.0
Acacia pruinocarpa	0.1	4.0
Aristida burbidgeae	0.1	0.5
Capparis spinosa subsp. *nummularia*	0.1	0.3
Cheilanthes sieberi subsp. *sieberi*	0.1	0.1
Clerodendrum tomentosum var. *lanceolatum*	0.1	0.6
Corymbia ferriticola	8.0	7.5
Corymbia sp.	0.5	8.0
Cucumis variabilis	0.1	twiner
Cymbopogon ambiguus	1.0	0.4
Cyperus cunninghamii subsp. *cunninghamii*	0.1	0.2
Dodonaea petiolaris	2.0	2.5

Name	Cover (%)	Height (m)
Duperreya commixta	0.1	twiner
Dysphania rhadinostachya subsp. *rhadinostachya*	0.1	0.1
Eremophila jucunda subsp. *pulcherrima*	0.1	1.6
Eriachne mucronata	0.1	0.2
Euphorbia biconvexa/coghlanii/trigonosperma	0.1	0.2
Euphorbia coghlanii	0.1	0.4
Ficus brachypoda	0.1	1.6
Gomphrena cunninghamii	0.1	0.1
Goodenia sp.	0.1	0.1
Goodenia stobbsiana	0.1	0.3
Grevillea wickhamii subsp. *hispidula*	0.1	1.2
Hibiscus coatesii	0.1	1.2
Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2	0.1	1.9
Indigofera fractiflexa subsp. *fractiflexa*	0.1	0.2
Jasminum didymum subsp. *lineare*	0.1	twiner
Maireana tomentosa subsp. *tomentosa*	0.1	0.4
Newcastelia sp. Hamersley Range (S. van Leeuwen 4264)	0.1	0.2
Paspalidium clementii	0.1	0.2
Petalostylis labicheoides	2.0	3.0
Psydrax latifolia	0.1	3.2
Psydrax suaveolens	0.1	0.3
Pterocaulon sphacelatum	0.1	0.4
Ptilotus exaltatus	0.1	0.2
Ptilotus obovatus	0.1	0.3
Rhodanthe margarethae	0.1	0.3
Senna glutinosa subsp. *glutinosa*	0.1	2.1
Senna notabilis	0.1	0.3
Senna stricta	0.1	1.7
Sida sp. Shovelanna Hill (S. van Leeuwen 3842)	0.1	0.4
Solanum horridum	0.1	0.1
Stemodia grossa	0.1	0.2
Streptoglossa sp.	0.1	0.3
Themeda sp. Mt Barricade (M.E. Trudgen 2471)	8.0	0.4
Trichodesma zeylanicum var. *zeylanicum*	0.1	0.6
Triodia pungens	2.0	0.1

Site: HD25
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 8/11/2017 **Phase 2 Date:** 20/05/2018 **Described by:** LV
MGA Zone: 50 **Easting:** 697803 **Northing:** 7445532
Habitat: Drainage depression
Soil: Dark reddish brown sandy clay
Rock type: Ironstone
Vegetation code: D1
Vegetation: *Corymbia hamersleyana* sens. lat. low open woodland over *Petalostylis labicheoides*, (*Androcalva luteiflora*, *Acacia monticola*, *Dodonaea lanceolata* var. *lanceolata*) tall open scrub over *Santalum lanceolatum* scattered shrubs with *Duperreya commixta* scattered vines over *Triodia pungens* very open hummock grassland with *Themeda triandra*, (*Eriachne mucronata*) open tussock grassland
Vegetation Condition: Excellent
Fire Age: 2-5 years



Species List:

Name	Cover (%)	Height (m)
Abutilon otocarpum	0.1	0.1
Acacia ancistrocarpa	0.1	2.5
Acacia aptaneura	0.1	1.5
Acacia maitlandii	0.1	3.0
Acacia monticola	6.0	3.0
Acacia pruinocarpa	0.1	3.0
Acacia sibirica	0.1	3.0
Androcalva luteiflora	8.0	3.0
Anthobolus leptomerioides	0.1	1.5
Aristida contorta	0.1	0.3
Aristida holathera var. *holathera*	0.1	0.3
Aristida inaequiglumis	0.1	0.6
Capparis lasiantha	0.1	0.8
Corchorus lasiocarpus subsp. *parvus*	0.1	0.3
Corymbia hamersleyana sens. lat.	6.0	5.0

Name	Cover (%)	Height (m)
Cymbopogon ambiguus	0.1	0.8
Cymbopogon obtectus	0.1	0.8
Dodonaea lanceolata var. *lanceolata*	1.0	2.5
Duperreya commixta	0.5	twiner
Enneapogon polyphyllus	0.1	0.4
Enneapogon robustissimus	0.1	0.6
Eremophila longifolia	0.1	1.2
Eriachne benthamii	0.1	0.4
Eriachne mucronata	0.5	0.3
Eriachne pulchella subsp. *pulchella*	0.1	0.1
Eucalyptus gamophylla	0.1	4.5
Eucalyptus leucophloia subsp. *leucophloia*	0.1	2.0
Euphorbia sp.	0.1	0.1
Gompholobium oreophilum	0.1	0.6
Gossypium robinsonii	0.1	1.5
Gossypium sturtianum var. *sturtianum*	0.1	0.6
Hakea chordophylla	0.1	4.5
Hybanthus aurantiacus	0.1	0.3
Jasminum didymum subsp. *lineare*	0.1	twiner
Panicum effusum	0.1	0.2
Paraneurachne muelleri	0.1	0.3
Peripleura virgata	0.1	0.3
Petalostylis labicheoides	15	3.5
Pterocaulon serrulatum var. *velutinum*	0.1	0.2
Pterocaulon sphacelatum	0.1	0.3
Ptilotus calostachyus	0.1	0.6
Ptilotus exaltatus	0.1	0.3
Ptilotus obovatus	0.1	0.3
Santalum lanceolatum	0.5	1.7
Scaevola parvifolia subsp. *pilbarae*	0.1	0.3
Schizachyrium fragile	0.1	0.1
Senna artemisioides subsp. *oligophylla x helmsii*	0.1	0.2
Senna glutinosa subsp. *glutinosa*	0.1	1.6
Senna glutinosa subsp. *pruinosa*	0.1	0.8
Seringia elliptica	0.1	0.4
Sida cardiophylla	0.1	0.3
Sida sp.	0.1	0.5
Solanum cleistogamum	0.1	0.2
Solanum horridum	0.1	0.1
Solanum lasiophyllum	0.1	0.2
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	0.1	0.2

Name	Cover (%)	Height (m)
Themeda triandra	15	0.7
Trianthema glossostigmum	0.1	0.1
Triodia pungens	9.0	0.7
Triodia vanleeuwenii	0.1	0.3

Site: HD26
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 9/11/2017 **Phase 2 Date:** 23/05/2018 **Described by:** LD
MGA Zone: 50 **Easting:** 711093 **Northing:** 7451039
Habitat: Gully
Soil: Dark reddish brown sandy loam
Rock type: Ironstone
Vegetation code: D3
Vegetation: *Corymbia ferriticola*, *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia catenulata* subsp. *occidentalis*, *Petalostylis labicheoides*, *A. pruinocarpa*, *Eremophila* sp. Hamersley Range (K. Walker KW 136) tall open shrubland over *Dodonaea petiolaris* scattered shrubs over *Ptilotus incanus* scattered low shrubs over *Triodia pungens* very open hummock grassland with *Eriachne mucronata*, *Cymbopogon ambiguus*, *Aristida* sp. very open tussock grassland
Vegetation Condition: Excellent
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Abutilon lepidum	0.1	0.5
Acacia aptaneura	0.1	8.0
Acacia bromilowiana P4	0.1	3.5
Acacia catenulata subsp. *occidentalis*	3	5.0
Acacia mulganeura	0.1	3.5
Acacia pruinocarpa	2	5.0
Acacia pyrifolia	0.1	0.7
Aristida sp.	0.5	0.1
Astrotricha hamptonii	0.1	3.0
Bulbostylis barbata	0.1	0.1
Capparis lasiantha	0.1	0.5
Cleome viscosa	0.1	0.3
Clerodendrum tomentosum var. *lanceolatum*	0.1	0.5
Corymbia ferriticola	2	5.0

Name	Cover (%)	Height (m)
Corymbia hamersleyana sens. lat.	0.1	2.0
Cucumis variabilis	0.1	twiner
Cymbopogon ambiguus	1	0.4
Cynanchum floribundum	0.1	twiner
Dodonaea petiolaris	0.5	1.8
Dodonaea viscosa subsp. *spatulata*	0.1	1.5
Duperreya commixta	0.1	twiner
Dysphania rhadinostachya subsp. *rhadinostachya*	0.1	0.1
Enchylaena tomentosa var. *tomentosa*	0.1	0.3
Enneapogon caerulescens	0.1	0.1
Enneapogon lindleyanus	0.1	0.4
Enneapogon polyphyllus	0.1	0.1
Eremophila jucunda subsp. *pulcherrima*	0.1	0.9
Eremophila sp. Hamersley Range (K. Walker KW 136) P3	1	3.5
Eriachne mucronata	2	0.3
Eucalyptus leucophloia subsp. *leucophloia*	2	4.0
Euphorbia biconvexa	0.1	0.3
Euphorbia biconvexa/coghlanii/trigonosperma	0.1	0.2
Ficus brachypoda	0.1	0.5
Gomphrena cunninghamii	0.1	0.1
Hibiscus coatesii	0.1	1.2
Indigofera fractiflexa subsp. *fractiflexa*	0.1	0.4
Paspalidium clementii	0.1	0.2
Peripleura virgata	0.1	0.2
Petalostylis labicheoides	3	3.0
Psydrax latifolia	0.1	1.0
Pterocaulon sphacelatum	0.1	0.4
Ptilotus calostachyus	0.1	0.5
Ptilotus exaltatus	0.1	0.3
Ptilotus incanus	1	0.3
Ptilotus obovatus	0.1	0.3
Rhagodia eremaea	0.1	0.4
Salsola australis	0.1	0.2
Senna glutinosa subsp. *glutinosa*	0.1	1.2
Senna stricta	0.1	1.7
Senna venusta	0.1	1.2
Sida sp.	0.1	0.1
Sida sp. Shovelanna Hill (S. van Leeuwen 3842)	0.1	0.3
Solanum ferocissimum	0.1	0.2
Solanum gabrielae	0.1	0.4
Solanum horridum	0.1	0.2

Name	Cover (%)	Height (m)
Sporobolus australasicus	0.1	0.1
Streptoglossa sp.	0.1	0.2
Tinospora smilacina	0.1	twiner
Trichodesma zeylanicum var. *zeylanicum*	0.1	1.2
Triodia pungens	3	0.4

Site: HD27
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 8/11/2017 **Phase 2 Date:** 21/05/2018 **Described by:** LV
MGA Zone: 50 **Easting:** 697731 **Northing:** 7446197
Habitat: Plain
Soil: Red brown sandy clay loam
Rock type: Ironstone
Vegetation code: P1
Vegetation: *Acacia catenulata* subsp. *occidentalis*, (*Eremophila fraseri* subsp. *fraseri*, *A. pruinocarpa*) tall shrubland over *Corchorus lasiocarpus* subsp. *parvus* open shrubland over *Triodia pungens* very open hummock grassland
Vegetation Condition: Excellent
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	0.1	2.8
Acacia catenulata subsp. *occidentalis*	25	8.0
Acacia pruinocarpa	1	6.5
Anthobolus leptomerioides	0.1	1.6
Cheilanthes sieberi subsp. *sieberi*	0.1	0.2
Corchorus lasiocarpus subsp. *parvus*	2	1.2
Enneapogon lindleyanus	0.1	0.25
Eragrostis eriopoda	0.1	0.35
Eragrostis xerophila	0.1	0.25
Eremophila fraseri subsp. *fraseri*	5	2.5
Eriachne pulchella subsp. *pulchella*	0.1	0.08
Maireana tomentosa subsp. *tomentosa*	0.1	0.25
Paspalidium clementii	0.1	0.2
Perotis rara	0.1	0.1
Ptilotus rotundifolius	0.1	0.6

Name	Cover (%)	Height (m)
Ptilotus schwartzii var. *schwartzii*	0.1	0.3
Senna artemisioides subsp. *helmsii*	0.1	1.7
Sida ?ectogama	0.1	1.5
Sporobolus australasicus	0.1	0.1
Triodia pungens	9	0.4

? denotes unconfirmed ID

Site: HD28
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 10/11/2017 **Phase 2 Date:** 19/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 704640 **Northing:** 7446462
Habitat: Plain
Soil: Red brown sandy clay loam
Rock type: Ironstone
Vegetation code: P3
Vegetation: *Acacia aptaneura*, *A. catenulata* subsp. *occidentalis*, (*A. pruinocarpa*, *A. ayersiana*) tall shrubland over *Triodia pungens*, *T. vanleeuwenii* open hummock grassland
Vegetation Condition: Excellent
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	15	6.0
Acacia ayersiana	0.5	3.0
Acacia catenulata subsp. *occidentalis*	10	4.0
Acacia pruinocarpa	2	3.0
Acacia tetragonophylla	0.1	2.5
Aristida contorta	0.1	0.15
Aristida obscura	0.1	0.2
Cheilanthes sieberi subsp. *sieberi*	0.1	0.1
Codonocarpus cotinifolius	0.1	1.5
Eremophila latrobei subsp. *filiformis*	0.1	2.0
Eriachne obtusa	0.1	0.3
Eriachne pulchella	0.1	0.1
Petalostylis labicheoides	0.1	1.5
Polycarpaea corymbosa var. *corymbosa*	0.1	0.05
Psydrax latifolia	0.1	0.6
Senna ferraria	0.1	1.6

Name	Cover (%)	Height (m)
Triodia pungens	8	0.4
Triodia vanleeuwenii	6	0.4

Site: HD29
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 8/11/2017 **Phase 2 Date:** 21/05/2018 **Described by:** LV
MGA Zone: 50 **Easting:** 695980 **Northing:** 7446338
Habitat: Clay plain
Soil: Red brown clay loam
Rock type: Ironstone
Vegetation code: P2
Vegetation: *Acacia aptaneura,* (*A. pruinocarpa, Eremophila longifolia, A. pteraneura*) tall shrubland over *E. forrestii* subsp. *forrestii scattered* shrubs over *Ptilotus astrolasicus, E. lanceolata, P. obovatus* low open shrubland over *Chrysopogon fallax, Aristida* sp., *(Aristida latifolia, Eriachne benthamii, Themeda triandra)* tussock grassland
Vegetation Condition: Excellent
Fire Age: 5-10 years



Species List:

Name	Cover (%)	Height (m)
Abutilon cryptopetalum	0.1	0.09
Abutilon otocarpum	0.1	0.2
Acacia aptaneura	18	7
Acacia pruinocarpa	1	2.6
Acacia pteraneura	0.5	2.1
Alternanthera nana	0.1	0.15
Amaranthus sp.	0.1	0.2
Aristida contorta	0.1	0.2
Aristida latifolia	2	0.4
Aristida obscura	0.1	0.4
Aristida sp.	20	0.4
Astrebla sp.	0.1	0.45
Bidens bipinnata	0.1	0.2
Capparis lasiantha	0.1	2.5
Cheilanthes sieberi subsp. *sieberi*	0.1	0.2

Name	Cover (%)	Height (m)
Chloris virgata	0.1	0.3
Chrysocephalum gilesii	0.1	0.2
Chrysopogon fallax	20	0.4
Cleome viscosa	0.1	0.15
Cuscuta victoriana	0.1	twiner
Dactyloctenium radulans	0.1	0.2
Enneapogon lindleyanus	0.1	0.2
Enneapogon polyphyllus	0.1	0.3
Eragrostis xerophila	0.1	0.3
Eremophila forrestii subsp. *forrestii*	0.5	1.4
Eremophila lanceolata	1.5	0.35
Eremophila longifolia	0.5	2.3
Eriachne benthamii	0.5	0.4
Eriachne obtusa	0.5	0.35
Evolvulus alsinoides var. *villosicalyx*	0.1	0.25
Fimbristylis dichotoma	0.1	0.15
Hakea chordophylla	0.1	1.4
Iseilema vaginiflorum	0.1	0.15
Maireana tomentosa subsp. *tomentosa*	0.1	0.15
Panicum decompositum	0.1	0.2
Perotis rara	0.1	0.06
Pterocaulon sphacelatum	0.1	1.1
Ptilotus aervoides	0.1	0.02
Ptilotus astrolasius	2	0.6
Ptilotus helipteroides	0.1	0.2
Ptilotus obovatus	0.5	0.35
Ptilotus sp.	0.1	0.2
Rhagodia eremaea	0.1	1.3
Rhynchosia minima	0.1	twiner
Salsola australis	0.1	0.35
Sida echinocarpa	0.1	0.02
Sida fibulifera	0.1	0.15
Sida platycalyx	0.1	0.2
Solanum cleistogamum	0.1	0.2
Solanum lasiophyllum	0.1	0.5
Sporobolus australasicus	0.1	0.15
Themeda triandra	0.5	0.4
Tragus australianus	0.1	0.1

* denotes weed species

Site: HD30
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 10/11/2017 **Phase 2 Date:** 20/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 705973 **Northing:** 7445811
Habitat: Floodplain
Soil: Dark reddish brown sandy clay loam
Rock type: Ironstone
Vegetation code: P2
Vegetation: *Acacia tetragonophylla, A. synchronicia* open shrubland over *Aristida latifolia, Astrebla* sp., *Eragrostis xerophila,* (*Eriachne obtusa*) tussock grassland
Vegetation Condition: Very Good
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	0.1	1
Acacia synchronicia	1	1.6
Acacia tetragonophylla	1	1.8
Alternanthera nana	0.1	0.2
Aristida contorta	0.1	0.3
Aristida latifolia	30	0.7
Aristida sp.	10	0.4
Asteraceae sp.	0.1	0.2
Astrebla sp.	10	0.4
Centipeda minima subsp. *macrocephala*	0.1	0.1
Cleome viscosa	0.1	0.3
Crotalaria medicaginea var. *neglecta*	0.1	0.3
Cynodon convergens	0.1	0.2
Dichanthium sericeum subsp. *humilius*	0.1	0.1
Dipteracanthus australasicus subsp. *australasicus*	0.1	0.4
Enchylaena tomentosa var. *tomentosa*	0.1	0.3

Name	Cover (%)	Height (m)
Enneapogon caerulescens	0.1	0.2
Enneapogon polyphyllus	0.1	0.2
Eragrostis setifolia	10	0.3
Eragrostis tenellula	0.1	0.2
Eragrostis xerophila	10	0.3
Eremophila forrestii subsp. *forrestii*	0.1	0.7
Eremophila jucunda subsp. *pulcherrima*	0.1	0.7
Eremophila longifolia	0.1	0.7
Eriachne obtusa	1	0.4
Eriachne pulchella subsp. *dominii*	0.1	0.1
Euphorbia sp.	0.1	0.1
Evolvulus alsinoides var. *villosicalyx*	0.1	0.2
Fimbristylis dichotoma	0.1	0.1
Hibiscus leptocladus	0.1	0.3
Indigofera linifolia	0.1	0.2
Iseilema vaginiflorum	0.1	0.2
Malvastrum americanum	0.1	0.2
Panicum decompositum	0.1	0.6
Panicum effusum	0.1	0.3
Ptilotus exaltatus	0.1	0.4
Ptilotus obovatus	0.1	0.4
Rhagodia eremaea	0.1	0.8
Rhynchosia minima	0.1	twiner
Schenkia australis	0.1	0.2
Sclerolaena cornishiana	0.1	0.3
Sclerolaena densiflora	0.1	0.1
Senna artemisioides subsp. x *artemisioides*	0.1	1.5
Senna glutinosa subsp. x *luerssenii*	0.1	0.6
Setaria verticillata	0.1	0.3
Sida fibulifera	0.1	0.2
Solanum cleistogamum	0.1	0.2
Solanum lasiophyllum	0.1	0.3
Sporobolus australasicus	0.1	0.1
Streptoglossa bubakii	0.1	0.4
Themeda triandra	0.1	1
Tragus australianus	0.1	0.05
Triodia longiceps	0.1	1.2
Vittadinia eremaea	0.1	0.3

? denotes unconfirmed ID

Site: HD31
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 8/11/2017 **Phase 2 Date:** 21/05/2018 **Described by:** BE
MGA Zone: 50 **Easting:** 696425 **Northing:** 7445990
Habitat: Major creek
Soil: Dark reddish brown sandy clay
Rock type: Ironstone
Vegetation code: D4
Vegetation: *Eucalyptus victrix* open woodland over *E. xerothermica* low open woodland over *Petalostylis labicheoides*, *Acacia dictyophleba*, (*A. pyrifolia*, *Androcalva luteiflora*) tall shrubland over *Senna artemisioides* subsp. ×*artemisioides* scattered shrubs over *Triodia longiceps* very open hummock grassland with *Themeda triandra*, *Eulalia aurea*, *Enteropogon ramosus*, (**Chloris virgata*, *Aristida lazaridis*) tussock grassland and **Bidens bipinnata*, (*Chrysocephalum apiculatum* subsp. *pilbarense*) very open herbland
Vegetation Condition: Poor
Fire Age: 5-10 years



Species List:

Name	Cover (%)	Height (m)
Acacia dictyophleba	8	4.0
Acacia maitlandii	0.1	1.8
Acacia pyrifolia	4	3.0
Acacia sibirica	0.1	0.9
Acrachne racemosa	0.1	0.7
Alternanthera denticulata	0.1	0.2
Alternanthera nana	0.1	0.05
Androcalva luteiflora	0.5	2.5
Aristida contorta	0.1	0.1
Aristida holathera var. *holathera*	0.1	0.2
Aristida inaequiglumis	0.1	1.0
Aristida lazaridis P2	0.5	0.7
**Bidens bipinnata*	3	0.4
Boerhavia ?coccinea	0.1	0.2

Name	Cover (%)	Height (m)
Centipeda minima subsp. *macrocephala*	0.1	0.1
**Chloris virgata*	0.5	1.2
Chrysocephalum apiculatum subsp. *pilbarense*	0.5	0.3
Chrysopogon fallax	0.1	0.9
Cleome viscosa	0.1	0.3
Crotalaria medicaginea var. *neglecta*	0.1	0.2
Cucumis melo	0.1	twiner
Cymbopogon ambiguus	0.1	1.2
Cyperus difformis	0.1	0.2
Cyperus vaginatus	0.1	0.7
Dichanthium sericeum subsp. *humilius*	0.1	0.5
Duperreya commixta	0.1	twiner
Enneapogon polyphyllus	0.1	0.2
Enneapogon robustissimus	0.5	0.7
Enteropogon ramosus	10	0.8
Eragrostis cumingii	0.1	0.1
Eragrostis tenellula	0.1	0.3
Eremophila longifolia	0.1	2.5
Eriachne benthamii	0.1	0.4
Eriachne mucronata	0.1	0.4
Eriachne pulchella subsp. *pulchella*	0.1	0.1
Eucalyptus victrix	7	12
Eucalyptus xerothermica	4	9.0
Eulalia aurea	15	0.7
Euphorbia coghlanii	0.1	0.3
Euphorbia sp.	0.1	0.1
Glycine canescens	0.1	twiner
Gossypium robinsonii	0.1	1.2
Gossypium sturtianum var. *sturtianum*	0.1	0.3
Heliotropium tenuifolium	0.1	0.3
Hibiscus coatesii	0.1	0.4
Iseilema membranaceum	0.1	0.1
Isotropis sp. Arid zone (G. Byrne 2775)	0.1	0.6
Jasminum didymum subsp. *lineare*	0.1	twiner
**Malvastrum americanum*	0.1	0.4
Panicum decompositum	0.1	1.2
Paraneurachne muelleri	0.1	0.3
Petalostylis labicheoides	15	3.2
Phyllanthus maderaspatensis	0.1	0.2
Pterocaulon sphacelatum	0.1	0.5
Ptilotus obovatus	0.1	0.5

Name	Cover (%)	Height (m)
Salsola australis	0.1	0.3
Santalum lanceolatum	0.1	2.2
Senna artemisioides subsp. *x artemisioides*	0.5	1.5
Setaria dielsii	0.1	0.6
**Setaria verticillata*	0.1	0.4
Sida fibulifera	0.1	0.2
Solanum cleistogamum	0.1	0.15
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	0.1	0.3
Themeda triandra	30	0.8
Triodia longiceps	8	0.8
Triodia pungens	0.1	0.5
Triodia wiseana	0.1	0.6
Triraphis mollis	0.1	0.1
**Vachellia farnesiana*	0.1	2.5

* denotes weed species
? denotes unconfirmed ID

Site: HD32
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 10/11/2017 **Phase 2 Date:** 21/05/2018 **Described by:** BE
MGA Zone: 50 **Easting:** 698038 **Northing:** 7445534
Habitat: Plain
Soil: Red brown sandy clay loam
Rock type: Ironstone
Vegetation code: P3
Vegetation: *Corymbia deserticola* subsp. *deserticola* scattered low trees over *Acacia catenulata* subsp. *occidentalis*, (*A. pruinocarpa*) tall shrubland over *A. ayersiana*, *Eremophila forrestii* subsp. *forrestii* open shrubland over *Triodia pungens* open hummock grassland with *Aristida inaequiglumis*, *Eragrostis eriopoda* scattered tussock grasses
Vegetation Condition: Excellent
Fire Age: 5-10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	0.1	2.2
Acacia ayersiana	2	1.7
Acacia catenulata subsp. *occidentalis*	11	5
Acacia incurvaneura	0.1	0.6
Acacia pruinocarpa	3	3.5
Aristida contorta	0.1	0.2
Aristida holathera var. *holathera*	0.1	0.25
Aristida inaequiglumis	0.5	0.8
Aristida latifolia	0.1	0.35
Aristida obscura	0.1	0.2
Aristida sp.	0.1	0.2
Codonocarpus cotinifolius	0.1	0.9
Corymbia deserticola subsp. *deserticola*	1	4
Cymbopogon ambiguus	0.1	0.4
Enneapogon polyphyllus	0.1	0.35

Name	Cover (%)	Height (m)
Eragrostis eriopoda	0.5	0.35
Eremophila forrestii subsp. *forrestii*	1	1.3
Eriachne mucronata	0.1	0.4
Eucalyptus gamophylla	0.1	3.7
Hibiscus burtonii	0.1	0.4
Indigofera monophylla	0.1	0.4
Maireana tomentosa subsp. *tomentosa*	0.1	0.2
Panicum effusum	0.1	0.3
Paraneurachne muelleri	0.1	0.4
Psydrax suaveolens	0.1	1.6
Ptilotus calostachyus	0.1	0.8
Ptilotus obovatus	0.1	1.1
Salsola australis	0.1	0.3
Schizachyrium fragile	0.1	0.25
Senna glaucifolia	0.1	1.2
Sida sp. Golden calyces glabrous (H.N. Foote 32)	0.1	0.3
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.1	0.3
Solanum lasiophyllum	0.1	0.5
Triodia pungens	20	1.2

Site: HD33
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 8/11/2017 **Phase 2 Date:** 20/05/2018 **Described by:** LV
MGA Zone: 50 **Easting:** 706525 **Northing:** 7443697
Habitat: Footslope
Soil: Dark reddish grey sandy clay loam
Rock type: Dolerite
Vegetation code: H12
Vegetation: *Corymbia hamersleyana* sens. lat. scattered low trees over *Acacia inaequilatera* tall open shrubland over *Corchorus lasiocarpus* subsp. *parvus*, *Indigofera monophylla* scattered low shrubs over *Triodia wiseana* hummock grassland with *Heliotropium ovalifolium* scattered herbs
Vegetation Condition: Very Good
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Acacia adsurgens	0.1	1.5
Acacia bivenosa	0.1	2.2
Acacia dictyophleba	0.1	1.5
Acacia hamersleyensis	0.1	2.5
Acacia inaequilatera	3	2.6
Acacia pachyacra	0.1	1.7
Aristida contorta	0.1	0.3
Aristida holathera var. *holathera*	0.1	0.25
Boerhavia coccinea	0.1	0.1
Bonamia pilbarensis	0.1	0.1
Corchorus lasiocarpus subsp. *parvus*	0.5	0.5
Corymbia hamersleyana sens. lat.	0.5	4.5
Cymbopogon ambiguus	0.1	0.5
Enneapogon caerulescens	0.1	0.15
Eremophila longifolia	0.1	0.5

Name	Cover (%)	Height (m)
Eulalia aurea	0.1	0.5
Euphorbia australis var. *subtomentosa*	0.1	0.06
Goodenia sp.	0.1	0.1
Gossypium australe	0.1	0.5
Hakea chordophylla	0.1	2.5
Heliotropium ovalifolium	0.5	0.2
Heliotropium tenuifolium	0.1	0.1
Hibiscus sturtii var. *campylochlamys*	0.1	0.2
Indigofera monophylla	0.5	0.4
Jasminum didymum subsp. *lineare*	0.1	twiner
Paraneurachne muelleri	0.1	0.3
Paspalidium clementii	0.1	0.2
Polycarpaea corymbosa var. *corymbosa*	0.1	0.1
Polymeria ambigua	0.1	0.1
Ptilotus astrolasius	0.1	0.35
Ptilotus obovatus	0.1	0.4
Scaevola amblyanthera var. *centralis*	0.1	0.2
Schizachyrium fragile	0.1	0.1
Senna artemisioides subsp. *filifolia*	0.1	0.4
Senna artemisioides subsp. *oligophylla*	0.1	0.5
Senna pleurocarpa var. *angustifolia*	0.1	0.4
Sida echinocarpa	0.1	0.2
Swainsona maccullochiana	0.1	0.3
Triodia wiseana	60	0.4

Site: HD34
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 10/11/2017 **Phase 2 Date:** 21/05/2018 **Described by:** LD
MGA Zone: 50 **Easting:** 699399 **Northing:** 7445532
Habitat: Drainage depression
Soil: Dark reddish brown sandy clay loam
Rock type: Ironstone
Vegetation code: D1
Vegetation: *Corymbia hamersleyana* sens. lat. low open woodland with *Eucalyptus repullulans*, *E. gamophylla* low open mallee woodland over *Petalostylis labicheoides*, (*Acacia monticola*, *Dodonaea petiolaris*) tall shrubland over *Androcalva luteiflora* scattered shrubs over *Triodia pungens* very open hummock grassland with *Themeda triandra*, (*Aristida holathera* var. *holathera*) open tussock grassland
Vegetation Condition: Very Good
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	0.1	3.0
Acacia bivenosa	0.1	1.6
Acacia hamersleyensis	0.1	3.5
Acacia maitlandii	0.1	2.1
Acacia monticola	2	3.0
Acacia pruinocarpa	0.1	2.0
Acacia steedmanii subsp. *borealis*	0.1	2.1
Acacia tumida var. *pilbarensis*	0.1	2.1
Androcalva luteiflora	1	1.6
Aristida contorta	0.1	0.1
Aristida holathera var. *holathera*	1	0.3
Capparis lasiantha	0.1	0.8
Corchorus lasiocarpus subsp. *parvus*	0.1	0.6
Corymbia hamersleyana sens. lat.	6	4.5
Dodonaea petiolaris	1	2.1

Name	Cover (%)	Height (m)
Eriachne mucronata	0.1	0.3
Eucalyptus gamophylla	1	4.2
Eucalyptus repullulans	3	3.5
Gompholobium oreophilum	0.1	0.4
Gossypium robinsonii	0.1	2.2
Indigofera monophylla	0.1	0.2
Jasminum didymum subsp. *lineare*	0.1	twiner
Peripleura obovata	0.1	0.2
Petalostylis labicheoides	13	2.2
Ptilotus calostachyus	0.1	0.5
Santalum lanceolatum	0.1	1.6
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	0.7
Themeda triandra	20	0.5
Triodia pungens	8	0.4
Triodia vanleeuwenii	0.1	0.2

Site: HD35
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 9/11/2017 **Phase 2 Date:** 22/05/2018 **Described by:** BE
MGA Zone: 50 **Easting:** 711138 **Northing:** 7449553
Habitat: Minor creek
Soil: Red brown sandy clay loam
Rock type: Ironstone
Vegetation code: D1
Vegetation: *Corymbia hamersleyana* sens. lat.low open woodland with *Eucalyptus gamophylla* low open mallee woodland over *Dodonea lanceolata* var. *lanceolata*, *Petalostylis labicheoides*, (*Acacia maitlandii*) tall open scrub over *Triodia pungens* open hummock grassland with *Eriachne mucronata*, (*Themeda triandra*) very open tussock grassland
Vegetation Condition: Excellent
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Acacia bivenosa	0.1	3.0
Acacia catenulata subsp. *occidentalis*	0.1	3.2
Acacia hilliana	0.1	0.5
Acacia maitlandii	2	3.0
Acacia pyrifolia	0.1	1.5
Acacia tenuissima	0.1	4.0
Amphipogon sericeus	0.1	0.3
Androcalva luteiflora	0.1	2.3
Aristida contorta	0.1	0.2
Aristida holathera var. *holathera*	0.1	0.3
Capparis lasiantha	0.1	1.1
Clerodendrum floribundum var. *angustifolium*	0.1	0.4
Corchorus lasiocarpus subsp. *parvus*	0.1	0.3
Corymbia hamersleyana sens. lat.	4	9.0
Cymbopogon ambiguus	0.1	0.9

Name	Cover (%)	Height (m)
Dodonaea lanceolata var. *lanceolata*	35	2.5
Duperreya commixta	0.1	twiner
Enneapogon lindleyanus	0.1	0.5
Eriachne mucronata	3	0.4
Eucalyptus gamophylla	8	6.0
Eucalyptus leucophloia subsp. *leucophloia*	0.1	2.4
Eucalyptus socialis subsp. *eucentrica*	0.1	4.0
Eulalia aurea	0.1	0.5
Gompholobium oreophilum	0.1	0.4
Gossypium sturtianum var. *sturtianum*	0.1	1.2
Hakea chordophylla	0.1	3.8
Hibiscus coatesii	0.1	0.45
Jasminum didymum subsp. *lineare*	0.1	twiner
Marsdenia australis	0.1	twiner
Paraneurachne muelleri	0.1	0.3
Petalostylis labicheoides	15	2.5
Pterocaulon sphacelatum	0.1	0.2
Ptilotus obovatus	0.1	0.5
Santalum lanceolatum	0.1	2.8
Scaevola parvifolia subsp. *pilbarae*	0.1	0.25
Senna artemisioides subsp. *oligophylla*	0.1	1.2
Senna ferraria	0.1	2.0
Senna glutinosa subsp. *glutinosa*	0.1	1.0
Seringia elliptica	0.1	0.6
Themeda triandra	0.5	0.8
Triodia pungens	15	0.6
Triodia vanleeuwenii	0.1	0.3

Site: HD37
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 9/11/2017 **Phase 2 Date:** 23/05/2018 **Described by:** LV
MGA Zone: 50 **Easting:** 716614 **Northing:** 7451366
Habitat: Plain
Soil: Red brown sandy clay loam
Rock type: Ironstone
Vegetation code: P1
Vegetation: *Acacia aptaneura*, (*A. catenulata* subsp. *occidentalis*, *Grevillea berryana*) tall shrubland over *Eremophila forrestii* subsp. *forrestii*, (*A. pteraneura*, *Senna stricta*) shrubland over *Triodia vanleeuwenii* open hummock grassland
Vegetation Condition: Excellent
Fire Age: 5-10 years



Species List:

Name	Cover (%)	Height (m)
Abutilon otocarpum	0.1	0.1
Acacia aptaneura	15	4.0
Acacia bivenosa	0.1	2.0
Acacia catenulata subsp. *occidentalis*	5	5.0
Acacia maitlandii	0.1	0.2
Acacia pruinocarpa	0.1	4.0
Acacia pteraneura	0.5	1.5
Acacia synchronicia	0.1	2.5
Amphipogon sericeus	0.1	0.3
Aristida contorta	0.1	0.3
Corchorus lasiocarpus subsp. *parvus*	0.1	0.45
Cymbopogon ambiguus	0.1	0.45
Enneapogon caerulescens	0.1	0.2
Enneapogon polyphyllus	0.1	0.2
Eremophila forrestii subsp. *forrestii*	11	1.7

Name	Cover (%)	Height (m)
Eremophila platycalyx subsp. *pardalota*	0.1	1.6
Eriachne pulchella subsp. *pulchella*	0.1	0.35
Eucalyptus leucophloia subsp. *leucophloia*	0.1	1.9
Goodenia stobbsiana	0.1	0.3
Gossypium robinsonii	0.1	1.8
Grevillea berryana	1	4.0
Hakea chordophylla	0.1	0.6
Hibiscus burtonii	0.1	0.3
Hibiscus coatesii	0.1	0.4
Hybanthus aurantiacus	0.1	0.4
Paspalidium clementii	0.1	0.15
Ptilotus calostachyus	0.1	0.35
Ptilotus exaltatus	0.1	0.2
Scaevola spinescens	0.1	1.1
Schizachyrium fragile	0.1	0.1
Senna artemisioides subsp. *helmsii*	0.1	1.0
Senna glutinosa subsp. x *luerssenii*	0.1	1.6
Senna notabilis	0.1	0.25
Senna sp. Meekatharra (E. Bailey 1-26) ×	0.1	0.1
Senna stricta	0.5	1.4
Seringia elliptica	0.1	0.3
Sida arenicola	0.1	1.6
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.1	0.4
Solanum cleistogamum	0.1	0.2
Solanum phlomoides	0.1	0.4
Sporobolus australasicus	0.1	0.1
Triodia pungens	0.1	0.35
Triodia vanleeuwenii	20	0.4
Triodia wiseana	0.1	0.35

Site: HD38
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 10/11/2017 **Phase 2 Date:** 23/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 720355 **Northing:** 7451567
Habitat: Minor creek
Soil: Dark reddish brown silty loam
Rock type: Ironstone
Vegetation code: D1
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Gossypium robinsonii* scattered tall shrubs over *Dodonaea viscosa* subsp. *spatulata*, *Stylobasium spathulatum* open shrubland over *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186), *Corchorus lasiocarpus* subsp. *parvus* low open shrubland over *Triodia pungens* very open hummock grassland with *Themeda* sp. Mt Barricade (M.E. Trudgen 2471), (*Eriachne mucronata*, *Enneapogon lindleyanus*) open tussock grassland
Vegetation Condition: Very Good
Fire Age: 2-5 years



Species List:

Name	Cover (%)	Height (m)
Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)	0.1	1.2
Acacia aptaneura	0.1	4.0
Acacia bivenosa	0.1	0.6
Acacia coriacea subsp. *pendens*	0.1	5.0
Acacia pruinocarpa	0.1	2.2
Acacia pyrifolia	0.1	1.0
Acacia sibirica	0.1	1.5
Acacia spondylophylla	0.1	0.3
**Bidens bipinnata*	0.1	0.4
Boerhavia coccinea	0.1	0.2
Capparis lasiantha	0.1	3.0
Cleome viscosa	0.1	0.4
Corchorus crozophorifolius	0.1	0.5
Corchorus lasiocarpus subsp. *parvus*	1.5	0.4

Name	Cover (%)	Height (m)
Crotalaria medicaginea var. *neglecta*	0.1	0.3
Cucumis variabilis	0.1	twiner
Cymbopogon ambiguus	0.1	0.4
Dampiera candicans	0.1	0.4
Dichanthium sericeum subsp. *humilius*	0.1	0.6
Dodonaea viscosa subsp. *spatulata*	2	1.9
Duperreya commixta	0.1	twiner
Dysphania plantaginella	0.1	0.1
Dysphania rhadinostachya subsp. *rhadinostachya*	0.1	0.2
Enchylaena tomentosa var. *tomentosa*	0.1	1.3
Enneapogon lindleyanus	0.5	0.5
Enneapogon polyphyllus	0.1	0.4
Enneapogon sp.	0.1	0.6
Eragrostis cumingii	0.1	0.2
Eragrostis tenellula	0.1	0.3
Eremophila latrobei subsp. *glabra*	0.1	0.6
Eriachne mucronata	6	0.4
Eucalyptus gamophylla	0.1	0.25
Eucalyptus leucophloia subsp. *leucophloia*	1.5	8.0
Euphorbia biconvexa/coghlanii/trigonosperma	0.1	0.3
Euphorbia boophthona	0.1	0.3
Euphorbia sp.	0.1	0.1
Evolvulus alsinoides var. *villosicalyx*	0.1	0.1
**Flaveria trinervia*	0.1	0.2
Gomphrena cunninghamii	0.1	0.3
Goodenia muelleriana	0.1	0.1
Goodenia sp.	0.1	0.4
Goodenia stobbsiana	0.1	0.3
Goodenia tenuiloba	0.1	0.3
Gossypium robinsonii	1	2.5
Grevillea saxicola P3	0.1	5.0
Grevillea wickhamii subsp. *hispidula*	0.1	2.3
Hibiscus sturtii var. *campylochlamys*	0.1	0.3
Hibiscus sturtii var. *platychlamys*	0.1	0.3
Hybanthus aurantiacus	0.1	0.4
Indigofera monophylla	0.1	0.2
Jasminum didymum subsp. *lineare*	0.1	twiner
Lepidium catapycnon P4	0.1	0.2
Paraneurachne muelleri	0.1	0.4
Paspalidium clementii	0.1	0.3
Petalostylis labicheoides	0.1	3.0

Name	Cover (%)	Height (m)
Polycarpaea longiflora	0.1	0.3
Pterocaulon sphacelatum	0.1	0.2
Ptilotus calostachyus	0.1	0.4
Ptilotus clementii	0.1	0.3
Ptilotus exaltatus	0.1	0.5
Ptilotus obovatus	0.1	0.3
Rhagodia eremaea	0.1	1.6
Salsola australis	0.1	0.2
Santalum lanceolatum	0.1	0.8
Senna artemisioides subsp. *oligophylla*	0.1	0.8
Senna glutinosa subsp. *glutinosa*	0.1	1.5
Senna glutinosa subsp. x *luerssenii*	0.1	0.6
Senna notabilis	0.1	0.6
Senna sp. Meekatharra (E. Bailey 1-26)	0.1	0.4
**Setaria verticillata*	0.1	0.4
Sida fibulifera	0.1	0.2
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.1	0.3
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	2.5
Solanum lasiophyllum	0.1	0.3
Solanum phlomoides	0.1	0.3
Sporobolus australasicus	0.1	0.1
Stemodia grossa	0.1	0.3
Streptoglossa sp.	0.1	0.1
Stylobasium spathulatum	2	1.9
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	2	0.7
Themeda sp. Mt Barricade (M.E. Trudgen 2471)	12	0.5
Trachymene oleracea subsp. *oleracea*	0.1	0.2
Trichodesma zeylanicum var. *zeylanicum*	0.1	0.3
Triodia pungens	4	0.4
Triodia wiseana	0.1	0.3

* denotes weed species

Site: HD39
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 9/11/2017 **Phase 2 Date:** 22/05/2018 **Described by:** LV
MGA Zone: 50 **Easting:** 709274 **Northing:** 7449696
Habitat: Footslope
Soil: Dark reddish brown sandy clay loam
Rock type: Ironstone
Vegetation code: H8
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia hamersleyana* sens. lat. scattered low trees over *Hakea chordophylla*, *Acacia aptaneura* scattered tall shrubs over *Triodia vanleeuwenii* hummock grassland with *Amphipogon sericeus* very open tussock grassland
Vegetation Condition: Excellent
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Acacia adoxa var. *adoxa*	0.1	0.3
Acacia aptaneura	0.5	2.6
Acacia maitlandii	0.1	0.4
Acacia pruinocarpa	0.1	1.7
Acacia pteraneura	0.1	0.4
Amphipogon sericeus	2	0.3
Bulbostylis barbata	0.1	0.1
Corymbia hamersleyana	0.5	3.5
Cymbopogon ambiguus	0.1	0.5
Dodonaea coriacea	0.1	1.2
Duperreya commixta	0.1	twiner
Dysphania rhadinostachya subsp. *rhadinostachya*	0.1	0.1
Eremophila latrobei subsp. *latrobei*	0.1	1.3
Eriachne pulchella subsp. *dominii*	0.1	0.1
Eucalyptus leucophloia subsp. *leucophloia*	0.5	4.2

Name	Cover (%)	Height (m)
Fimbristylis simulans	0.1	0.1
Goodenia stobbsiana	0.1	0.35
Goodenia triodiophila	0.1	0.35
Hakea chordophylla	0.5	3.0
Hibiscus sturtii var. *campylochlamys*	0.1	0.35
Hybanthus aurantiacus	0.1	0.2
Indigofera monophylla	0.1	0.3
Paraneurachne muelleri	0.1	0.2
Polycarpaea corymbosa var. *corymbosa*	0.1	0.1
Polycarpaea holtzei	0.1	0.1
Pterocaulon sphacelatum	0.1	0.35
Ptilotus calostachyus	0.1	1.2
Ptilotus rotundifolius	0.1	1.4
Schizachyrium fragile	0.1	0.1
Senna ferraria	0.1	3.7
Senna glutinosa subsp. *glutinosa*	0.1	1.7
Sida arenicola	0.1	0.4
Stackhousia muricata subsp. annual (W.R. Barker 2172)	0.1	0.3
Triodia vanleeuwenii	40	0.5

Site: HD40
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 10/11/2017 **Phase 2 Date:** 22/05/2018 **Described by:** LV
MGA Zone: 50 **Easting:** 709045 **Northing:** 7449688
Habitat: Hillslope
Soil: Dark reddish brown sandy loam
Rock type: Ironstone
Vegetation code: H6
Vegetation: *Acacia catenulata* subsp. *occidentalis*, (*A. aptaneura*, *Grevillea saxicola*, *A. pruinocarpa*) tall shrubland over *Eremophila forrestii* subsp. *forrestii* shrubland over *Triodia vanleeuwenii*, *T. pungens* very open hummock grassland
Vegetation Condition: Excellent
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	5	4.5
Acacia aptaneura x	0.1	1.8
Acacia catenulata subsp. *occidentalis*	18	5.0
Acacia pruinocarpa	2	4.0
Aristida contorta	0.1	0.35
Aristida inaequiglumis	0.1	0.35
**Bidens bipinnata*	0.1	0.1
Bulbostylis barbata	0.1	0.1
Capparis lasiantha	0.1	0.3
Cheilanthes lasiophylla	0.1	0.1
Cheilanthes sieberi subsp. *sieberi*	0.1	0.1
Chrysopogon fallax	0.1	0.3
Cucumis variabilis	0.1	twiner
Cymbopogon ambiguus	0.1	0.4
Duperreya commixta	0.1	twiner

Name	Cover (%)	Height (m)
Dysphania rhadinostachya subsp. *rhadinostachya*	0.1	0.2
Enneapogon caerulescens	0.1	0.1
Enneapogon polyphyllus	0.1	0.2
Enneapogon sp.	0.1	0.6
Eragrostis eriopoda	0.1	0.2
Eremophila forrestii subsp. *forrestii*	11	1.9
Eremophila latrobei subsp. *glabra*	0.1	0.5
Eriachne mucronata	0.1	0.35
Eriachne obtusa	0.1	0.35
Eriachne pulchella	0.1	0.1
Eucalyptus leucophloia subsp. *leucophloia*	0.1	5.5
Goodenia stobbsiana	0.1	0.25
Grevillea berryana	0.1	1.8
Grevillea saxicola P3	3	4.0
Hibiscus burtonii	0.1	0.25
Iseilema vaginiflorum	0.1	0.1
Paspalidium clementii	0.1	0.15
Polycarpaea holtzei	0.1	0.05
Psydrax latifolia	0.1	2.0
Psydrax suaveolens	0.1	2.0
Pterocaulon sphacelatum	0.1	0.2
Schizachyrium fragile	0.1	0.1
Senna artemisioides subsp. *oligophylla*	0.1	1.2
Senna glaucifolia	0.1	1.5
Sida sp. Excedentifolia (J.L. Egan 1925)	0.1	0.25
Solanum lasiophyllum	0.1	0.3
Triodia pungens	3	0.3
Triodia vanleeuwenii	5	0.3

* denotes weed species

Site: HD41
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 9/11/2017 **Phase 2 Date:** 22/05/2018 **Described by:** BE
MGA Zone: 50 **Easting:** 710463 **Northing:** 7449277
Habitat: Footslope
Soil: Dark reddish brown sandy clay loam
Rock type: Ironstone
Vegetation code: H8
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Triodia vanleeuwenii* hummock grassland with *Amphipogon sericeus* very open tussock grassland
Vegetation Condition: Excellent
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Acacia bivenosa	0.1	0.9
Acacia incurvaneura	0.1	0.5
Amphipogon sericeus	3	0.3
Codonocarpus cotinifolius	0.1	2.8
Corymbia hamersleyana sens. lat.	0.1	1.0
Cymbopogon ambiguus	0.1	0.8
Eriachne pulchella subsp. *dominii*	0.1	0.1
Eucalyptus leucophloia subsp. *leucophloia*	1.5	4.5
Eulalia aurea	0.1	0.5
Goodenia stobbsiana	0.1	0.3
Goodenia triodiophila	0.1	0.1
Hakea chordophylla	0.1	3.8
Paraneurachne muelleri	0.1	0.4
Ptilotus calostachyus	0.1	0.7
Senna artemisioides subsp. *oligophylla*	0.1	0.5
Senna glutinosa subsp. *glutinosa*	0.1	2.3

Name	Cover (%)	Height (m)
Senna glutinosa subsp. *pruinosa*	0.1	1.8
Senna glutinosa subsp. x *luerssenii*	0.1	2.0
Seringia elliptica	0.1	0.2
Seringia nephrosperma	0.1	0.6
Sida arenicola	0.1	0.3
Solanum lasiophyllum	0.1	0.4
Tephrosia oxalidea	0.1	0.1
Triodia vanleeuwenii	35	0.5

Site: HD42
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 11/11/2017 **Phase 2 Date:** 25/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 696679 **Northing:** 7443808
Habitat: Hillslope
Soil: Dark reddish brown sandy clay loam
Rock type: Ironstone
Vegetation code: H6
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia sibirica*, *A. incurvaneura*, *A. catenulata* subsp. *occidentalis* tall shrubland over *Senna stricta* open shrubland over *Triodia vanleeuwenii*, (*T. pungens*, *T. angusta*) open hummock grassland
Vegetation Condition: Excellent
Fire Age: No fire evident

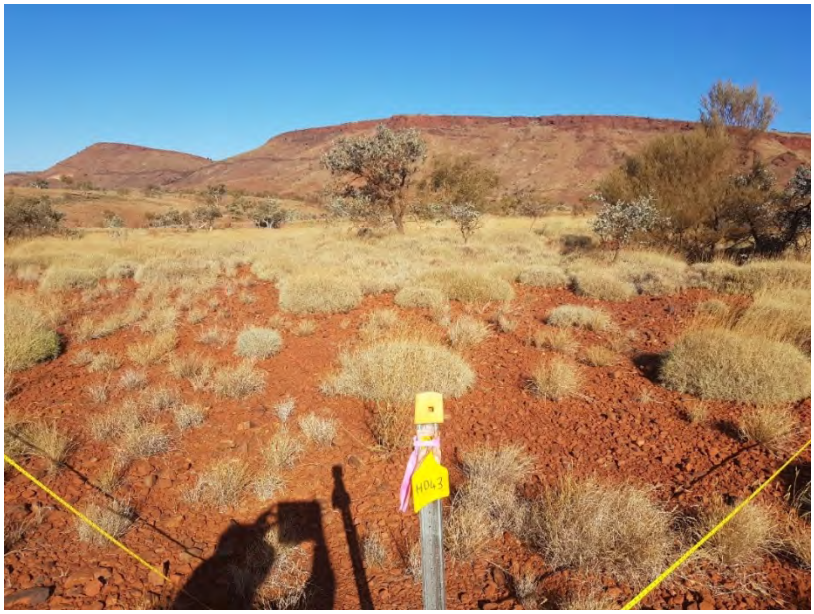


Species List:

Name	Cover (%)	Height (m)
Acacia adsurgens	0.1	0.7
Acacia aptaneura	0.1	2.4
Acacia catenulata subsp. *occidentalis*	2	5.5
Acacia incurvaneura	4	3.0
Acacia macraneura	0.1	3.0
Acacia pruinocarpa	0.1	1.8
Acacia sibirica	4	5.0
Acacia sp.	0.1	0.5
Acacia tetragonophylla	0.1	1.5
Aristida contorta	0.1	0.2
Aristida holathera var. *holathera*	0.1	0.2
Aristida inaequiglumis	0.1	0.7
Cheilanthes lasiophylla	0.1	0.1
Cheilanthes sieberi subsp. *sieberi*	0.1	0.1
Cucumis variabilis	0.1	twiner

Name	Cover (%)	Height (m)
Cymbopogon ambiguus	0.1	0.4
Dysphania rhadinostachya subsp. *rhadinostachya*	0.1	0.1
Enneapogon lindleyanus	0.1	0.2
Enneapogon polyphyllus	0.1	0.2
Eremophila latrobei subsp. *latrobei*	0.1	1.8
Eriachne mucronata	0.1	0.4
Eriachne pulchella subsp. *dominii*	0.1	0.1
Eriachne pulchella subsp. *pulchella*	0.1	0.1
Eucalyptus leucophloia subsp. *leucophloia*	0.5	4.0
Jasminum didymum subsp. *lineare*	0.1	twiner
Lepidium pedicellosum	0.1	0.4
Maireana georgei	0.1	0.6
Paraneurachne muelleri	0.1	0.3
Paspalidium clementii	0.1	0.2
Ptilotus exaltatus	0.1	0.2
Ptilotus obovatus	0.1	0.4
Salsola australis	0.1	0.2
Scaevola acacioides	0.1	0.7
Senna glutinosa subsp. *glutinosa*	0.1	1.1
Senna stricta	2	1.5
Seringia sp.	0.1	0.9
Solanum cleistogamum	0.1	0.2
Solanum lasiophyllum	0.1	0.4
Sporobolus australasicus	0.1	0.1
Templetonia egena	0.1	0.6
Triodia angusta	3	0.4
Triodia pungens	5	0.9
Triodia vanleeuwenii	20	0.5

Site: HD43
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 9/11/2017 **Phase 2 Date:** 23/05/2018 **Described by:** LD
MGA Zone: 50 **Easting:** 717459 **Northing:** 7452031
Habitat: Footslope
Soil: Dark reddish brown sandy clay loam
Rock type: Ironstone
Vegetation code: H3
Vegetation: *Corymbia deserticola* subsp. *deserticola* scattered low trees over *Acacia inaequilatera* tall open shrubland over *Triodia vanleeuwenii* open hummock grassland with *Amphipogon sericeus* very open tussock grassland
Vegetation Condition: Excellent
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Acacia ancistrocarpa	0.1	1.2
Acacia inaequilatera	4	2.5
Acacia incurvaneura	0.1	3.0
Acacia marramamba	0.1	2.1
Amphipogon sericeus	5	0.4
Aristida inaequiglumis	0.1	0.6
Codonocarpus cotinifolius	0.1	1.6
Corchorus lasiocarpus subsp. *parvus*	0.1	0.4
Corymbia deserticola subsp. *deserticola*	1	4.0
Cymbopogon obtectus	0.1	0.6
Duperreya commixta	0.1	twiner
Enneapogon polyphyllus	0.1	0.2
Eremophila longifolia	0.1	1.2
Fimbristylis simulans	0.1	0.1
Goodenia stobbsiana	0.1	0.3

Name	Cover (%)	Height (m)
Goodenia triodiophila	0.1	0.2
Hibiscus sturtii var. *campylochlamys*	0.1	0.3
Indigofera monophylla	0.1	0.4
Paraneurachne muelleri	0.1	0.3
Paspalidium clementii	0.1	0.1
Polycarpaea corymbosa var. *corymbosa*	0.1	0.1
Polycarpaea holtzei	0.1	0.1
Ptilotus astrolasius	0.1	0.4
Ptilotus calostachyus	0.1	0.7
Ptilotus exaltatus	0.1	0.1
Ptilotus rotundifolius	0.1	0.8
Schizachyrium fragile	0.1	0.1
Senna glaucifolia	0.1	1.5
Senna glutinosa subsp. *glutinosa*	0.1	1.8
Senna glutinosa subsp. *pruinosa*	0.1	1.8
Senna glutinosa subsp. x *luerssenii*	0.1	2.2
Sida arenicola	0.1	0.5
Solanum lasiophyllum	0.1	0.4
Tephrosia oxalidea	0.1	0.2
Triodia vanleeuwenii	25	0.6

Site: HD44
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 11/11/2017 **Phase 2 Date:** 27/05/2018 **Described by:** BE
MGA Zone: 50 **Easting:** 697914 **Northing:** 7443587
Habitat: Footslope
Soil: Light reddish brown sandy clay loam
Rock type: Ironstone, Quartz
Vegetation code: H10
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees with *E. repullulans*, (*E. socialis* subsp. *eucentrica*) low open mallee woodland over *Acacia synchronicia* scattered shrubs over *Maireana georgei*, *M. eriosphaera* low open shrubland over *Triodia wiseana*, *T. brizoides* hummock grassland
Vegetation Condition: Excellent
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	0.1	1.0
Acacia bivenosa	0.1	1.5
Acacia pachyacra	0.1	1.6
Acacia pruinocarpa	0.1	1.0
Acacia sibirica	0.1	0.6
Acacia synchronicia	1	1.8
Aristida contorta	0.1	0.2
Capparis lasiantha	0.1	1.0
Cymbopogon ambiguus	0.1	0.8
Cynodon prostratus	0.1	0.02
Enneapogon caerulescens	0.1	0.1
Eremophila latrobei subsp. *latrobei*	0.1	1.0
Eremophila platycalyx subsp. *pardalota*	0.1	1.0
Eucalyptus leucophloia subsp. *leucophloia*	1.5	7.0
Eucalyptus repullulans	5	3.5

Name	Cover (%)	Height (m)
Eucalyptus socialis subsp. *eucentrica*	0.5	4.0
Euphorbia sp.	0.1	0.1
Lepidium pedicellosum	0.1	0.3
Maireana carnosa	0.1	0.2
Maireana eriosphaera	1	0.2
Maireana georgei	2	0.3
Maireana melanocoma	0.1	0.2
Maireana triptera	0.1	0.3
Ptilotus exaltatus	0.1	0.2
Ptilotus obovatus	0.1	0.6
Salsola australis	0.1	0.1
Sclerolaena cuneata	0.1	0.2
Sclerolaena densiflora	0.1	0.2
Sclerolaena ?gardneri	0.1	0.1
Senna glutinosa subsp. *glutinosa*	0.1	1.0
Senna glutinosa subsp. x *luerssenii*	0.1	1.0
Senna stricta	0.1	1.2
Sida fibulifera	0.1	0.2
Solanum horridum	0.1	0.1
Solanum lasiophyllum	0.1	0.3
Sporobolus australasicus	0.1	0.1
Triodia brizoides	15	0.7
Triodia wiseana	20	0.8

? denotes unconfirmed ID

Site: HD46
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 11/11/2017 **Phase 2 Date:** 22/05/2018 **Described by:** LV
MGA Zone: 50 **Easting:** 708917 **Northing:** 7450014
Habitat: Hillslope
Soil: Dark reddish brown sandy loam
Rock type: Ironstone
Vegetation code: H7
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia pruinocarpa*, *A. catenulata* subsp. *occidentalis* tall open shrubland over *A. tenuissima*, *Senna glutinosa* subsp. *glutinosa*, *Codonocarpus cotinifolius*, *Scaevola acacioides* open shrubland over *Triodia pungens*, (*T. vanleeuwenii*) hummock grassland
Vegetation Condition: Excellent
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	0.1	2.2
Acacia bivenosa	0.1	1.7
Acacia catenulata subsp. *occidentalis*	1	5.0
Acacia dictyophleba	0.1	1.8
Acacia maitlandii	0.1	1.3
Acacia pruinocarpa	2	2.5
Acacia pyrifolia	0.1	4.2
Acacia tenuissima	0.5	1.8
Amphipogon sericeus	0.1	0.3
Capparis lasiantha	0.1	0.5
Codonocarpus cotinifolius	0.5	1.5
Cymbopogon ambiguus	0.1	0.7
Cymbopogon obtectus	0.1	0.6
Dodonaea coriacea	0.1	0.5
Duperreya commixta	0.1	twiner

Name	Cover (%)	Height (m)
Eremophila latrobei subsp. *glabra*	0.1	1.3
Eremophila latrobei subsp. *latrobei*	0.1	1.3
Eriachne lanata	0.1	0.4
Eriachne mucronata	0.1	0.3
Eriachne pulchella	0.1	0.15
Eriachne pulchella subsp. *pulchella*	0.1	0.1
Eucalyptus gamophylla	0.1	4.2
Eucalyptus leucophloia subsp. *leucophloia*	5	4.6
Gompholobium oreophilum	0.1	0.5
Goodenia stobbsiana	0.1	0.2
Goodenia triodiophila	0.1	0.3
Hakea chordophylla	0.1	0.4
Jasminum didymum subsp. *lineare*	0.1	twiner
Paraneurachne muelleri	0.1	0.3
Ptilotus calostachyus	0.1	1.1
Scaevola acacioides	0.5	1.2
Schizachyrium fragile	0.1	0.1
Senna glaucifolia	0.1	1.6
Senna glutinosa subsp. *glutinosa*	0.5	1.8
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.1	0.3
Solanum lasiophyllum	0.1	0.8
Triodia pungens	45	0.7
Triodia vanleeuwenii	6	0.5

Site: HD47
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 11/11/2017 **Phase 2 Date:** 27/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 707179 **Northing:** 7443005
Habitat: Hillslope
Soil: Dark reddish brown sandy clay loam
Rock type: Dolerite
Vegetation code: H12
Vegetation: *Acacia inaequilatera*, *Hakea chordophylla* tall open shrubland over *Senna artemisioides* subsp. *oligophylla* scattered low shrubs over *Triodia wiseana* hummock grassland with *Cymbopogon ambiguus*, *Themeda* sp. Mt Barricade (M.E. Trudgen 2471) scattered tussock grasses
Vegetation Condition: Excellent
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Acacia arida	0.1	1.7
Acacia inaequilatera	3	2.6
Acacia pyrifolia	0.1	2.3
Aristida contorta	0.1	0.2
Aristida holathera var. *holathera*	0.1	0.2
Bonamia pilbarensis	0.1	0.2
Cassytha capillaris	0.1	twiner
Cheilanthes lasiophylla	0.1	0.1
Corchorus lasiocarpus subsp. *parvus*	0.1	0.3
Cymbopogon ambiguus	1	0.6
Dodonaea coriacea	0.1	0.1
Enneapogon caerulescens	0.1	0.2
Eriachne mucronata	0.1	0.3
Goodenia muelleriana	0.1	0.3
Goodenia prostrata	0.1	0.2

Name	Cover (%)	Height (m)
Goodenia stobbsiana	0.1	0.2
Goodenia triodiophila	0.1	0.3
Hakea chordophylla	1.5	3.0
Heliotropium ovalifolium	0.1	0.2
Indigofera monophylla	0.1	0.2
Jasminum didymum subsp. *lineare*	0.1	twiner
Oldenlandia crouchiana	0.1	0.1
Paraneurachne muelleri	0.1	0.2
Polycarpaea corymbosa var. *corymbosa*	0.1	0.1
Polycarpaea holtzei	0.1	0.1
Pterocaulon sphacelatum	0.1	0.3
Ptilotus astrolasius	0.1	0.3
Ptilotus calostachyus	0.1	0.3
Schizachyrium fragile	0.1	0.1
Senna artemisioides subsp. *oligophylla*	0.5	1.0
Senna glutinosa subsp. *glutinosa*	0.1	1.7
Sida echinocarpa	0.1	0.5
Solanum phlomoides	0.1	0.5
Stackhousia muricata subsp. annual (W.R. Barker 2172)	0.1	0.2
Swainsona maccullochiana	0.1	0.3
Themeda sp. Mt Barricade (M.E. Trudgen 2471)	0.5	0.7
Trichodesma zeylanicum var. *zeylanicum*	0.1	0.5
Tricoryne sp. Hamersley Range (S. van Leeuwen 915)	0.1	0.5
Triodia wiseana	30	0.7

Site: HD48
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 12/11/2017 **Phase 2 Date:** 24/05/2018 **Described by:** LV
MGA Zone: 50 **Easting:** 707007 **Northing:** 7450110
Habitat: Hillslope
Soil: Dark reddish brown sandy clay loam
Rock type: Ironstone
Vegetation code: H4
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia pruinocarpa*, *A. aptaneura*, *Senna glutinosa* subsp. *glutinosa* open shrubland over *Triodia vanleeuwenii* hummock grassland with *Eriachne pulchella* subsp. *pulchella* scattered tussock grasses
Vegetation Condition: Excellent
Fire Age: 5-10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	1	1.8
Acacia pruinocarpa	1	1.9
Cymbopogon obtectus	0.1	0.3
Enneapogon caerulescens	0.1	0.2
Eremophila latrobei subsp. *latrobei*	0.1	1.0
Eriachne pulchella subsp. *pulchella*	1	0.06
Eucalyptus leucophloia subsp. *leucophloia*	1.5	5.6
Iseilema membranaceum	0.1	0.1
Maireana georgei	0.1	0.35
Paspalidium clementii	0.1	0.1
Pterocaulon sphacelatum	0.1	0.3
Ptilotus incanus	0.1	0.6
Ptilotus obovatus	0.1	0.5
Ptilotus rotundifolius	0.1	0.6
Scaevola acacioides	0.1	0.5

Name	Cover (%)	Height (m)
Senna glutinosa subsp. *glutinosa*	0.5	1.7
Senna glutinosa subsp. *pruinosa*	0.1	2.1
Senna glutinosa subsp. x *luerssenii*	0.1	0.8
Senna stricta	0.1	0.5
Sida arenicola	0.1	0.4
Sida sp.	0.1	0.4
Sida sp. Shovelanna Hill (S. van Leeuwen 3842)	0.1	0.4
Sporobolus australasicus	0.1	0.06
Tribulus suberosus	0.1	0.6
Trichodesma zeylanicum var. *zeylanicum*	0.1	0.2
Triodia vanleeuwenii	65	0.35

Site: HD49
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 12/11/2017 **Phase 2 Date:** 24/05/2018 **Described by:** LV
MGA Zone: 50 **Easting:** 702774 **Northing:** 7449267
Habitat: Minor creek
Soil: Dark reddish brown sandy clay loam
Rock type: Ironstone
Vegetation code: D2
Vegetation: *Acacia catenulata* subsp. *occidentalis*, (*A. aptaneura*, *Petalostylis labicheoides*, *A. pruinocarpa*) tall shrubland over *Triodia pungens* very open hummock grassland with *Chrysopogon fallax* scattered tussock grasses
Vegetation Condition: Very Good
Fire Age: 5-10 years



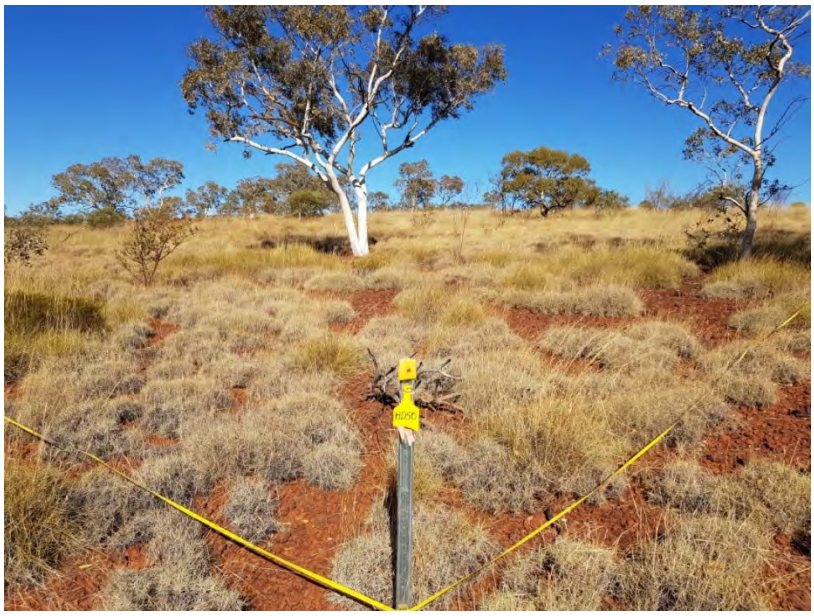
Species List:

Name	Cover (%)	Height (m)
Abutilon sp.	0.1	0.3
Acacia aptaneura	5	5.0
Acacia aptaneura x	0.1	3.0
Acacia catenulata subsp. *occidentalis*	12	6.0
Acacia dictyophleba	0.1	0.5
Acacia maitlandii	0.1	3.5
Acacia pruinocarpa	0.5	4.0
Acacia tenuissima	0.1	1.4
Amyema fitzgeraldii	0.1	mistletoe
Aristida contorta	0.1	0.25
Aristida obscura	0.1	0.3
Aristida sp.	0.1	0.35
Asteraceae sp.	0.1	0.1
**Bidens bipinnata*	0.1	0.3
Capparis lasiantha	0.1	0.6

Name	Cover (%)	Height (m)
Chrysopogon fallax	1	0.8
Cleome viscosa	0.1	0.3
Duperreya commixta	0.1	twiner
Enchylaena tomentosa var. *tomentosa*	0.1	0.6
Enneapogon caerulescens	0.1	0.3
Enneapogon polyphyllus	0.1	0.25
Eremophila forrestii subsp. *forrestii*	0.1	1.6
Eriachne mucronata	0.1	0.4
Eriachne obtusa	0.1	0.35
Eriachne pulchella	0.1	0.2
Eucalyptus leucophloia subsp. *leucophloia*	0.1	3.5
Eucalyptus xerothermica	0.1	5.6
Eulalia aurea	0.1	0.4
Euphorbia biconvexa/coghlanii/trigonosperma	0.1	0.2
Evolvulus alsinoides var. *villosicalyx*	0.1	0.15
Iseilema vaginiflorum	0.1	0.15
Panicum effusum	0.1	0.4
Paraneurachne muelleri	0.1	0.1
Paspalidium clementii	0.1	0.3
Petalostylis labicheoides	3	3.5
Polycarpaea corymbosa var. *corymbosa*	0.1	0.2
Psydrax latifolia	0.1	2.9
Pterocaulon sphacelatum	0.1	0.4
Ptilotus astrolasius	0.1	0.5
Ptilotus obovatus	0.1	0.6
Rhagodia eremaea	0.1	1.6
Salsola australis	0.1	0.3
Senna artemisioides subsp. *oligophylla*	0.1	0.6
Senna artemisioides subsp. x *artemisioides*	0.1	1.6
Senna stricta	0.1	1.0
Seringia sp.	0.1	2.3
Sida sp. dark green fruits (S. van Leeuwen 2260)	0.1	0.3
Solanum lasiophyllum	0.1	0.5
Sporobolus australasicus	0.1	0.1
Themeda triandra	0.1	0.8
Triodia pungens	8	0.6
Triodia vanleeuwenii	0.1	0.4

* denotes weed species

Site: HD50
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 11/11/2017 **Phase 2 Date:** 21/05/2018 **Described by:** LV
MGA Zone: 50 **Easting:** 697330 **Northing:** 7444649
Habitat: Hillslope
Soil: Red brown sandy clay loam
Rock type: Ironstone
Vegetation code: H8
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* low woodland over *Acacia pruinocarpa* scattered tall shubs over *A. rhodophloia* scattered shrubs over *Triodia vanleeuwenii*, *T. pungens* hummock grassland
Vegetation Condition: Excellent
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Acacia dictyophleba	0.1	2.2
Acacia hilliana	0.1	0.5
Acacia pruinocarpa	1	2.1
Acacia pyrifolia	0.1	1.5
Acacia rhodophloia	0.5	1.8
Aristida holathera var. *holathera*	0.1	0.3
Corchorus lasiocarpus subsp. *parvus*	0.1	0.5
Cymbopogon ambiguus	0.1	0.5
Eriachne pulchella	0.1	0.1
Eucalyptus leucophloia subsp. *leucophloia*	11	7.0
Goodenia stobbsiana	0.1	0.3
Grevillea wickhamii subsp. *hispidula*	0.1	1.8
Hakea chordophylla	0.1	3.0
Jasminum didymum subsp. *lineare*	0.1	twiner
Pterocaulon sphacelatum	0.1	0.3
Ptilotus obovatus	0.1	0.3

Name	Cover (%)	Height (m)
Ptilotus rotundifolius	0.1	0.5
Scaevola browniana	0.1	0.35
Senna glutinosa subsp. *glutinosa*	0.1	1.6
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.1	1.0
Solanum cleistogamum	0.1	0.3
Triodia pungens	12	0.5
Triodia vanleeuwenii	20	0.3

Site: HD51
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 11/11/2017 **Phase 2 Date:** 21/05/2018 **Described by:** BE
MGA Zone: 50 **Easting:** 695931 **Northing:** 7445220
Habitat: Minor creek
Soil: Dark reddish brown sandy loam
Rock type: Ironstone
Vegetation code: D1
Vegetation: *Corymbia hamersleyana* sens. lat.scattered low trees over *Petalostylis labicheiodes*, (*Acacia monticola*, *A. maitlandii*) tall shrubland over *Dodonaea lanceolata* var. *lanceolata*, *Androcalva luteiflora* scattered shrubs over *Triodia pungens* very open hummock grassland with *Eriachne mucronata*, *Themeda triandra* open tussock grassland
Vegetation Condition: Excellent
Fire Age: 5-10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	0.1	2.8
Acacia bivenosa	0.1	1.5
Acacia hamersleyensis	0.1	2.7
Acacia maitlandii	1	2.5
Acacia monticola	6	4.2
Acacia pruinocarpa	0.1	1.9
Androcalva luteiflora	0.5	1.7
Aristida contorta	0.1	0.3
Aristida inaequiglumis	0.1	0.35
Capparis umbonata	0.1	2.3
Corchorus lasiocarpus subsp. *parvus*	0.1	0.3
Corymbia hamersleyana sens. lat.	0.5	8.0
Cymbopogon ambiguus	0.1	0.8
Dodonaea lanceolata var. *lanceolata*	0.5	1.9
Duperreya commixta	0.1	twiner

Name	Cover (%)	Height (m)
Dysphania plantaginella	0.1	0.1
Enneapogon robustissimus	0.1	0.4
Eriachne mucronata	7	0.4
Eucalyptus leucophloia subsp. *leucophloia*	0.1	3.0
Evolvulus alsinoides var. *villosicalyx*	0.1	0.1
Gossypium robinsonii	0.1	1.6
Grevillea wickhamii subsp. *hispidula*	0.1	3.2
Jasminum didymum subsp. *lineare*	0.1	twiner
Marsdenia australis	0.1	twiner
Petalostylis labicheoides	13	3.0
Pterocaulon sphacelatum	0.1	0.3
Santalum lanceolatum	0.1	2.5
Schizachyrium fragile	0.1	0.1
Senna ferraria	0.1	1.2
Senna glutinosa subsp. *glutinosa*	0.1	1.8
Seringia elliptica	0.1	0.5
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	1.5
Themeda triandra	5	1.1
Triodia pungens	4	0.6

Site: HD52
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 11/11/2017 **Phase 2 Date:** 24/05/2018 **Described by:** LD
MGA Zone: 50 **Easting:** 707034 **Northing:** 7449992
Habitat: Hillslope
Soil: Dark reddish brown sandy clay loam
Rock type: Ironstone
Vegetation code: H2
Vegetation: *Eucalyptus repullulans* scattered low mallees over *Acacia catenulata* subsp. *occidentalis*, (*A. aptaneura*, *Grevillea saxicola*, *Scaevola acacioides*, *A. pruinocarpa*) tall open scrub over *Triodia pungens*, *T. vanleeuwenii* very open hummock grassland
Vegetation Condition: Excellent
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	10	5.0
Acacia catenulata subsp. *occidentalis*	40	5.0
Acacia pruinocarpa	1	5.0
Aristida obscura	0.1	0.3
Cheilanthes lasiophylla	0.1	0.1
Dodonaea pachyneura	0.1	1.8
Dysphania rhadinostachya subsp. *rhadinostachya*	0.1	0.1
Enneapogon lindleyanus	0.1	0.3
Enneapogon polyphyllus	0.1	0.1
Eremophila latrobei subsp. *latrobei*	0.1	1.5
Eriachne mucronata	0.1	0.4
Eriachne pulchella subsp. *pulchella*	0.1	0.1
Eucalyptus leucophloia subsp. *leucophloia*	0.1	4.0
Eucalyptus repullulans	1	3.9
Grevillea saxicola P3	2	5.0

Name	Cover (%)	Height (m)
Hakea lorea subsp. *lorea*	0.1	2.0
Iseilema membranaceum	0.1	0.1
Paspalidium clementii	0.1	0.2
Perotis rara	0.1	0.1
Psydrax suaveolens	0.1	1.2
Ptilotus astrolasius	0.1	0.4
Ptilotus exaltatus	0.1	0.2
Scaevola acacioides	2	2.8
Senna glutinosa subsp. *glutinosa*	0.1	1.6
Solanum lasiophyllum	0.1	0.1
Triodia pungens	2	0.5
Triodia vanleeuwenii	0.5	0.5
Wahlenbergia sp.	0.1	0.2

Site: HD53
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 12/11/2017 **Phase 2 Date:** 24/05/2018 **Described by:** LD
MGA Zone: 50 **Easting:** 706347 **Northing:** 7450159
Habitat: Plain
Soil: Red brown sandy clay loam
Rock type: Ironstone, Dolerite
Vegetation code: H8
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland with *E. gamophylla* scattered low mallees over *Hakea chordophylla* scattered tall shrubs over *Acacia pruinocarpa* scattered shrubs over *Triodia vanleeuwenii*, (*T. pungens*) hummock grassland
Vegetation Condition: Excellent
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Acacia adoxa var. *adoxa*	0.1	0.4
Acacia bivenosa	0.1	1.6
Acacia pruinocarpa	0.5	1.6
Acacia tenuissima	0.1	1.5
Acacia tumida var. *pilbarensis*	0.1	0.3
Cymbopogon ambiguus	0.1	0.5
Duperreya commixta	0.1	twiner
Eremophila latrobei subsp. *latrobei*	0.1	1.6
Eriachne lanata	0.1	0.3
Eucalyptus gamophylla	1	5.5
Eucalyptus leucophloia subsp. *leucophloia*	5	6.0
Goodenia triodiophila	0.1	0.2
Hakea chordophylla	1	3.0
Indigofera monophylla	0.1	0.4
Jasminum didymum subsp. *lineare*	0.1	twiner

Name	Cover (%)	Height (m)
Pterocaulon sphacelatum	0.1	0.2
Ptilotus calostachyus	0.1	0.6
Scaevola browniana	0.1	0.3
Senna artemisioides subsp. *helmsii*	0.1	0.7
Senna ferraria	0.1	1.6
Senna glutinosa subsp. *glutinosa*	0.1	1.3
Senna glutinosa subsp. *pruinosa*	0.1	0.8
Senna glutinosa subsp. x *luerssenii*	0.1	1.3
Triodia pungens	10	0.4
Triodia vanleeuwenii	40	0.35
Triodia wiseana	0.1	0.35

Site: HD54
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 12/11/2017 **Phase 2 Date:** 24/05/2018 **Described by:** LD
MGA Zone: 50 **Easting:** 706428 **Northing:** 7449405
Habitat: Plain
Soil: Red brown sandy clay loam
Rock type: Ironstone
Vegetation code: H11
Vegetation: *Eucalyptus gamophylla* low mallee woodland over *Acacia ancistrocarpa*, *A. tenuissima* tall open shrubland over *A. bivenosa* scattered shrubs over *Triodia vanleeuwenii* hummock grassland
Vegetation Condition: Excellent
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Acacia ancistrocarpa	2	2.5
Acacia aptaneura	0.1	1.0
Acacia bivenosa	1	1.7
Acacia pruinocarpa	0.1	1.5
Acacia tenuissima	0.5	2.2
Amphipogon sericeus	0.1	0.35
Aristida holathera var. *holathera*	0.1	0.35
Aristida obscura	0.1	0.2
Cymbopogon ambiguus	0.1	0.4
Duperreya commixta	0.1	twiner
Eucalyptus gamophylla	15	5.0
Hakea chordophylla	0.1	2.2
Indigofera monophylla	0.1	0.3
Paraneurachne muelleri	0.1	0.3
Pterocaulon sphacelatum	0.1	0.2
Ptilotus calostachyus	0.1	0.5

Name	Cover (%)	Height (m)
Ptilotus rotundifolius	0.1	0.5
Scaevola parvifolia subsp. *pilbarae*	0.1	0.3
Themeda triandra	0.1	0.45
Triodia pungens	0.1	0.4
Triodia vanleeuwenii	50	0.4

Site: HD55
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 1 Date: 11/11/2017 **Phase 2 Date:** 24/05/2018 **Described by:** LD
MGA Zone: 50 **Easting:** 705103 **Northing:** 7449190
Habitat: Plain
Soil: Dark reddish brown sandy clay loam
Rock type: Ironstone
Vegetation code: P3
Vegetation: *Acacia aptaneura*, (*A. pruinocarpa*, *A. catenulata* subsp. *occidentalis*) tall shrubland over *Triodia pungens* hummock grassland
Vegetation Condition: Excellent
Fire Age: 5-10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	11	4.0
Acacia ayersiana	0.1	3.0
Acacia bivenosa	0.1	1.6
Acacia catenulata subsp. *occidentalis*	2	4.5
Acacia dictyophleba	0.1	15
Acacia maitlandii	0.1	0.9
Acacia pachyacra	0.1	2.0
Acacia pruinocarpa	4	3.5
Acacia sibirica	0.1	3.2
Cymbopogon ambiguus	0.1	0.4
Eremophila latrobei subsp. *latrobei*	0.1	1.5
Eremophila longifolia	0.1	1.6
Eriachne pulchella subsp. *pulchella*	0.1	0.1
Eucalyptus leucophloia subsp. *leucophloia*	0.1	4.0
Eucalyptus socialis subsp. ?*eucentrica*	0.1	3.5
Petalostylis labicheoides	0.1	3.0

Name	Cover (%)	Height (m)
Psydrax suaveolens	0.1	1.2
Seringia elliptica	0.1	0.4
Sida sp.	0.1	0.2
Triodia pungens	65	0.7

? denotes unconfirmed ID

Site: HDR01
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 1 Date: 4/11/2017 **Phase 2 Date:** 29/05/2018 **Described by:** BE
MGA Zone: 50 **Easting:** 712667 **Northing:** 7449624
Habitat: Hillcrest
Soil: Brown sandy loam
Rock type: Calcrete
Vegetation code: H10
Vegetation: *Eucalyptus repullulans* low open mallee woodland over *Acacia bivenosa*, *Corchorus lasiocarpus* subsp. *parvus* scattered low shrubs over *Triodia wiseana* open hummock grassland with *Paraneurachne muelleri* scattered tussock grasses
Vegetation Condition: Excellent
Fire Age: 0-2 years



Species List:

Name	Cover (%)	Height (m)
Acacia bivenosa	0.5	0.7
Acacia pyrifolia	0.1	1.7
Amphipogon sericeus	0.1	0.3
Capparis lasiantha	0.1	0.6
Codonocarpus cotinifolius	0.1	1.4
Corchorus lasiocarpus subsp. *parvus*	0.5	0.3
Dampiera candicans	0.1	0.3
Eucalyptus gamophylla	0.1	1.7
Eucalyptus leucophloia subsp. *leucophloia*	0.1	2.2
Eucalyptus repullulans	5	1.8
Goodenia stobbsiana	0.1	0.3
Hibiscus sturtii var. *platychlamys*	0.1	0.6
Indigofera monophylla	0.1	0.2
Paraneurachne muelleri	0.5	0.4
Ptilotus calostachyus	0.1	1.2

Name	Cover (%)	Height (m)
Ptilotus exaltatus	0.1	0.4
Senna artemisioides subsp. *oligophylla*	0.1	0.5
Senna ferraria	0.1	1.2
Senna glutinosa subsp. *glutinosa*	0.1	1.6
Solanum phlomoides	0.1	0.8
Triodia wiseana	22	0.5

Site: HDR02
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 1 Date: 4/11/2017 **Phase 2 Date:** 22/05/2018 **Described by:** BE
MGA Zone: 50 **Easting:** 711579 **Northing:** 7449411
Habitat: Hillcrest
Soil: Dark reddish brown sandy loam
Rock type: Ironstone
Vegetation code: H8
Vegetation: *Hakea chordophylla* scattered tall shrubs over *Triodia vanleeuwenii* hummock grassland with *Amphipogon sericeus* scattered tussock grasses
Vegetation Condition: Excellent
Fire Age: 5-10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	0.1	2.3
Acacia bivenosa	0.1	1.6
Acacia dictyophleba	0.1	1.3
Acacia hilliana	0.1	0.5
Amphipogon sericeus	0.5	0.4
Codonocarpus cotinifolius	0.1	0.8
Eriachne mucronata	0.1	0.3
Eucalyptus gamophylla	0.1	3.2
Eucalyptus leucophloia subsp. *leucophloia*	0.1	3.5
Goodenia stobbsiana	0.1	0.2
Hakea chordophylla	0.5	3.5
Maireana tomentosa subsp. *tomentosa*	0.1	0.2
Polycarpaea holtzei	0.1	0.02
Polycarpaea longiflora	0.1	0.1
Pterocaulon sphacelatum	0.1	0.05
Ptilotus calostachyus	0.1	1.2

Name	Cover (%)	Height (m)
Senna artemisioides subsp. *oligophylla*	0.1	0.6
Senna glutinosa subsp. *glutinosa*	0.1	1.4
Seringia elliptica	0.1	0.2
Sida echinocarpa	0.1	0.2
Solanum lasiophyllum	0.1	0.5
Stackhousia muricata subsp. annual (W.R. Barker 2172)	0.1	0.3
Triodia vanleeuwenii	40	0.4

Site: HDR03
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 1 Date: 5/11/2017 **Phase 2 Date:** 20/05/2018 **Described by:** LD
MGA Zone: 50 **Easting:** 703055 **Northing:** 7444913
Habitat: Hillslope
Soil: Dark reddish brown sandy loam
Rock type: Ironstone
Vegetation code: H6
Vegetation: *Acacia aptaneura* tall shrubland over *Eremophila jucunda* subsp. *pulcherrima* scattered shrubs over *Senna stricta* low open shrubland over *Triodia wiseana* very open hummock grassland with *Eriachne pulchella* scattered tussock grasses
Vegetation Condition: Excellent
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	13	4.5
Acacia catenulata subsp. *occidentalis*	0.1	2.3
Acacia incurvaneura	0.1	4.0
Aristida contorta	0.1	0.2
Aristida inaequiglumis	0.1	0.5
Aristida obscura	0.1	0.3
Capparis lasiantha	0.1	0.4
Cymbopogon ambiguus	0.1	0.4
Dichanthium sericeum subsp. *humilius*	0.1	0.6
Dodonaea pachyneura	0.1	0.8
Duperreya commixta	0.1	twiner
Enneapogon caerulescens	0.1	0.1
Enneapogon lindleyanus	0.1	0.4
Enneapogon polyphyllus	0.1	0.1
Eremophila jucunda subsp. *pulcherrima*	0.5	1.2

Name	Cover (%)	Height (m)
Eremophila phyllopoda subsp. *obliqua*	0.1	1.6
Eremophila platycalyx subsp. *pardalota*	0.1	1.6
Eriachne mucronata	0.1	0.3
Eriachne pulchella	1	0.2
Eucalyptus leucophloia subsp. *leucophloia*	0.1	5.0
Euphorbia biconvexa/coghlanii/trigonosperma	0.1	0.2
Hibiscus sturtii var. *campylochlamys*	0.1	0.4
Iseilema eremaeum	0.1	0.1
Maireana georgei	0.1	0.2
Paspalidium clementii	0.1	0.1
Perotis rara	0.1	0.1
Ptilotus obovatus	0.1	0.5
Scaevola acacioides	0.1	0.4
Schizachyrium fragile	0.1	0.1
Senna stricta	3	0.7
Sida fibulifera	0.1	0.3
Solanum horridum	0.1	0.1
Sporobolus australasicus	0.1	0.1
Triodia pungens	0.1	0.4
Triodia vanleeuwenii	0.1	0.3
Triodia wiseana	7	0.4

Site: HDR04
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 1 Date: 6/11/2017 **Phase 2 Date:** 24/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 719839 **Northing:** 7450422
Habitat: Hillcrest
Soil: Dark reddish brown sandy loam
Rock type: Ironstone
Vegetation code: H4
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Triodia vanleeuwenii*, *T. pungens* open hummock grassland
Vegetation Condition: Excellent
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Acacia bivenosa	0.1	2.5
Acacia pruinocarpa	0.1	1.2
Duperreya commixta	0.1	twiner
Dysphania rhadinostachya subsp. *rhadinostachya*	0.1	0.1
Enchylaena tomentosa var. *tomentosa*	0.1	0.6
Eremophila latrobei subsp. *glabra*	0.1	1.8
Eriachne mucronata	0.1	0.2
Eucalyptus leucophloia subsp. *leucophloia*	8	5.5
Goodenia stobbsiana	0.1	0.3
Ptilotus calostachyus	0.1	0.5
Ptilotus exaltatus	0.1	0.2
Ptilotus obovatus	0.1	0.4
Scaevola acacioides	0.1	1.6
Senna glutinosa subsp. *glutinosa*	0.1	0.9
Senna glutinosa subsp. *pruinosa*	0.1	2.2
Senna sp. Meekatharra (E. Bailey 1-26)	0.1	0.5

Name	Cover (%)	Height (m)
Senna stricta	0.1	0.4
Sida echinocarpa	0.1	0.2
Sida sp. Excedentifolia (J.L. Egan 1925)	0.1	0.2
Solanum lasiophyllum	0.1	0.5
Tribulus suberosus	0.1	0.3
Triodia pungens	10	0.4
Triodia vanleeuwenii	15	0.3

Site: HDR05
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 1 Date: 5/11/2017 **Phase 2 Date:** 20/05/2018 **Described by:** LV
MGA Zone: 50 **Easting:** 706635 **Northing:** 7445519
Habitat: Hillslope
Soil: Reddish brown sandy clay
Rock type: Ironstone
Vegetation code: H7
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Ptilotus obovatus* scattered low shrubs over *Triodia wiseana*, *T. pungens* open hummock grassland with *Eriachne mucronata*, (*Cymbopogon ambiguus*) very open tussock grassland
Vegetation Condition: Excellent
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Acacia bivenosa	0.1	0.7
Acacia tenuissima	0.1	0.8
Aristida contorta	0.1	0.1
Cheilanthes lasiophylla	0.1	0.15
Cleome viscosa	0.1	0.2
Cucumis variabilis	0.1	twiner
Cymbopogon ambiguus	2	0.6
Duperreya commixta	0.1	twiner
Enchylaena tomentosa var. *tomentosa*	0.1	0.7
Enneapogon caerulescens	0.1	0.3
Enneapogon polyphyllus	0.1	0.2
Enneapogon robustissimus	0.1	0.4
Eremophila platycalyx subsp. *pardalota*	0.1	0.6
Eriachne mucronata	6	0.4
Eucalyptus leucophloia subsp. *leucophloia*	5	5.0

Name	Cover (%)	Height (m)
Hibiscus sturtii var. *campylochlamys*	0.1	0.2
Indigofera monophylla	0.1	0.2
Lepidium phlebopetalum	0.1	0.5
Maireana tomentosa subsp. *tomentosa*	0.1	0.1
Paraneurachne muelleri	0.1	0.2
Paspalidium clementii	0.1	0.1
Polycarpaea longiflora	0.1	0.1
Ptilotus obovatus	1	0.6
Rhagodia eremaea	0.1	0.7
Salsola australis	0.1	0.4
Schizachyrium fragile	0.1	0.1
Senna glutinosa subsp. *glutinosa*	0.1	1.3
Senna glutinosa subsp. x *luerssenii*	0.1	1.5
Senna stricta	0.1	0.4
Sida echinocarpa	0.1	0.4
Sida sp. Excedentifolia (J.L. Egan 1925)	0.1	0.15
Solanum lasiophyllum	0.1	0.4
Themeda sp. Mt Barricade (M.E. Trudgen 2471)	0.1	0.4
Triodia pungens	10	0.5
Triodia wiseana	10	0.6

Site: HDR06
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 1 Date: 6/11/2017 **Phase 2 Date:** 23/05/2018 **Described by:** BE
MGA Zone: 50 **Easting:** 721335 **Northing:** 7451349
Habitat: Hillcrest
Soil: Dark reddish brown sandy loam
Rock type: Ironstone
Vegetation code: H6
Vegetation: *Acacia catenulata* subsp. *occidentalis*, (*A. aptaneura, A. mulganeura*) tall shrubland over *Eremophila latrobei* subsp. *glabra* scattered shrubs over *Triodia vanleeuwenii*, *T. pungens, T. wiseana* very open hummock grassland with *Eriachne mucronata* scattered tussock grasses
Vegetation Condition: Excellent
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	4	5.0
Acacia ayersiana	0.1	4.0
Acacia catenulata subsp. *occidentalis*	10	4.0
Acacia mulganeura	4	4.5
Amphipogon sericeus	0.1	0.3
Bulbostylis barbata	0.1	0.05
Codonocarpus cotinifolius	0.1	1.3
Cymbopogon ambiguus	0.1	0.8
Dysphania rhadinostachya subsp. *rhadinostachya*	0.1	0.1
Enneapogon polyphyllus	0.1	0.2
Eremophila latrobei subsp. *glabra*	1	1.5
Eriachne mucronata	1	0.4
Eriachne pulchella	0.1	0.05
Eucalyptus leucophloia subsp. *leucophloia*	0.1	4.0
Grevillea berryana	0.1	4.0

Name	Cover (%)	Height (m)
Maireana georgei	0.1	0.2
Paspalidium clementii	0.1	0.1
Ptilotus calostachyus	0.1	1.1
Ptilotus exaltatus	0.1	0.3
Scaevola acacioides	0.1	0.9
Schizachyrium fragile	0.1	0.1
Senna glutinosa subsp. *glutinosa*	0.1	1.2
Senna glutinosa subsp. x *luerssenii*	0.1	1.2
Sida sp. Excedentifolia (J.L. Egan 1925)	0.1	0.3
Solanum horridum	0.1	0.2
Solanum phlomoides	0.1	0.5
Tribulus suberosus	0.1	0.8
Triodia pungens	2	0.4
Triodia vanleeuwenii	3	0.3
Triodia wiseana	1	0.4

Site: HDR07
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 1 Date: 5/11/2017 **Phase 2 Date:** 20/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 705797 **Northing:** 7445560
Habitat: Hillcrest
Soil: Brown sandy loam
Rock type: Ironstone, Dolerite
Vegetation code: H10
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia inaequilatera*, *A. synchronicia* open shrubland over *Eremophila jucunda* subsp. *pulcherrima*, *Senna artemisioides* subsp. *oligophylla* scattered low shrubs over *Triodia wiseana* hummock grassland with *Cymbopogon ambiguus*, *Eulalia aurea* very open tussock grassland
Vegetation Condition: Very Good
Fire Age: 5-10 years



Species List:

Name	Cover (%)	Height (m)
Acacia ?ancistrocarpa	0.1	1.7
Acacia aptaneura	0.1	2.2
Acacia bivenosa	0.1	0.4
Acacia ?catenulata	0.1	3.0
Acacia inaequilatera	1	1.9
Acacia synchronicia	1	1.7
Acacia tetragonophylla	0.1	1.6
Aristida contorta	0.1	0.15
Boerhavia coccinea	0.1	0.2
Capparis lasiantha	0.1	0.4
Corchorus lasiocarpus subsp. *parvus*	0.1	0.5
Cymbopogon ambiguus	1	0.5
Dipteracanthus australasicus subsp. *australasicus*	0.1	0.1
Enneapogon caerulescens	0.1	0.15
Enneapogon polyphyllus	0.1	0.2

Name	Cover (%)	Height (m)
Eremophila forrestii subsp. *forrestii*	0.1	0.4
Eremophila jucunda subsp. *pulcherrima*	0.5	1.0
Eriachne benthamii	0.1	0.4
Eucalyptus leucophloia subsp. *leucophloia*	0.5	3.0
Eucalyptus repullulans	0.1	3.0
Eulalia aurea	1	0.3
Euphorbia australis var. *subtomentosa*	0.1	0.05
Euphorbia sp.	0.1	0.2
Evolvulus alsinoides var. *villosicalyx*	0.1	0.1
Goodenia prostrata	0.1	0.2
Hakea lorea subsp. *lorea*	0.1	0.5
Hibiscus coatesii	0.1	0.4
Jasminum didymum subsp. *lineare*	0.1	twiner
Paraneurachne muelleri	0.1	0.15
Portulaca oleracea	0.1	0.1
Pterocaulon sp.	0.1	0.1
Ptilotus astrolasius	0.1	0.4
Ptilotus exaltatus	0.1	0.1
Ptilotus obovatus	0.1	0.35
Rhagodia eremaea	0.1	1.2
Rhynchosia minima	0.1	twiner
Salsola australis	0.1	0.2
Santalum lanceolatum	0.1	2.5
Senna artemisioides subsp. *oligophylla*	0.5	0.5
Senna glutinosa subsp. *glutinosa*	0.1	2.5
Sida fibulifera	0.1	0.2
Sida sp. Articulation below (A.A. Mitchell PRP 1605)	0.1	0.7
Solanum cleistogamum	0.1	0.25
Solanum lasiophyllum	0.1	0.4
Sporobolus australasicus	0.1	0.1
Stackhousia muricata subsp. annual (W.R. Barker 2172)	0.1	0.35
Streptoglossa bubakii	0.1	0.2
Swainsona maccullochiana	0.1	0.4
Themeda triandra	1	0.6
Triodia wiseana	30	0.4
**Vachellia farnesiana*	0.1	1.3

* denotes weed species
? denotes unconfirmed ID

Site: HDR08
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 1 Date: 6/11/2017 **Phase 2 Date:** 23/05/2018 **Described by:** BE
MGA Zone: 50 **Easting:** 718185 **Northing:** 7450490
Habitat: Gully
Soil: Dark reddish brown sandy loam
Rock type: Ironstone
Vegetation code: D3
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia ferriticola*, *C. opaca* low open woodland over *Grevillea wickhamii* subsp. *hispidula*, *Dodonaea viscosa* subsp. *spatulata*, *Acacia hamersleyensis* tall open shrubland over *Triodia pungens* very open hummock grassland with *Themeda* sp. Mt Barricade (M.E. Trudgen 2471), (*Eriachne mucronata*) open tussock grassland
Vegetation Condition: Excellent
Fire Age: No fire evident



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	0.1	2.6
Acacia bivenosa	0.1	1.3
Acacia hamersleyensis	2	3.2
Acacia pruinocarpa	0.1	0.6
Acacia pyrifolia	0.1	1.5
Acacia sibirica x	0.1	1.1
Androcalva luteiflora	0.1	1.4
Bulbostylis barbata	0.1	0.25
Cassytha capillaris	0.1	twiner
Clerodendrum tomentosum var. *lanceolatum*	0.1	0.3
Corchorus lasiocarpus subsp. *parvus*	0.1	0.2
Corymbia ferriticola	1	8.0
Corymbia hamersleyana sens. lat.	1	8.0
Cymbopogon ambiguus	0.1	0.7
Dodonaea pachyneura	0.1	1.5

Name	Cover (%)	Height (m)
Dodonaea viscosa subsp. *spatulata*	3	2.5
Duperreya commixta	0.1	twiner
Eremophila jucunda subsp. *pulcherrima*	0.1	0.5
Eriachne mucronata	1	0.4
Eucalyptus leucophloia subsp. *leucophloia*	1.5	5.0
Euphorbia coghlanii	0.1	0.2
Ficus brachypoda	0.1	2.2
Gompholobium oreophilum	0.1	0.8
Gossypium robinsonii	0.1	1.5
Grevillea wickhamii subsp. *hispidula*	4	2.5
Jasminum didymum subsp. *lineare*	0.1	twiner
Marsdenia australis	0.1	twiner
Maytenus sp. Mt Windell (S. van Leeuwen 846)	0.1	1.5
Pandorea pandorana	0.1	twiner
Petalostylis labicheoides	0.1	2.5
Psydrax latifolia	0.1	1.1
Ptilotus exaltatus	0.1	0.2
Santalum lanceolatum	0.1	2.1
Senna artemisioides subsp. *oligophylla*	0.1	0.3
Senna ferraria	0.1	1.3
Senna glutinosa subsp. *glutinosa*	0.1	1.2
Sida sp. Excedentifolia (J.L. Egan 1925)	0.1	0.2
Stylobasium spathulatum	0.1	3.0
Themeda sp. Mt Barricade (M.E. Trudgen 2471)	20	0.7
Triodia pungens	5	0.6

Site: HDR09
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 1 Date: 7/11/2017 **Phase 2 Date:** 28/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 704557 **Northing:** 7444346
Habitat: Hillslope
Soil: Brown sandy clay loam
Rock type: Ironstone, Mudstone
Vegetation code: H7
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia catenulata* subsp. *occidentalis* scattered tall shrubs over *Grevillea berryana*, *Scaevola acacioides* scattered shrubs *over Maireana georgei* scattered low shrubs over *Triodia wiseana*, *T. vanleeuwenii* open hummock grassland with *Goodenia stobbsiana* scattered herbs
Vegetation Condition: Excellent
Fire Age: 5-10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	0.1	3.0
Acacia arida	0.1	0.7
Acacia catenulata subsp. *occidentalis*	0.5	4.0
Acacia incurvaneura	0.1	2.5
Acacia kempeana	0.1	1.4
Acacia maitlandii	0.1	1.8
Acacia pteraneura	0.1	2.0
Acacia sibirica	0.1	0.6
Acacia tenuissima	0.1	0.6
Acacia tetragonophylla	0.1	2.1
Aristida sp.	0.1	0.2
Capparis lasiantha	0.1	0.8
Codonocarpus cotinifolius	0.1	2.5
Eriachne pulchella subsp. *pulchella*	0.1	0.2
Eucalyptus leucophloia subsp. *leucophloia*	2	7.0

Name	Cover (%)	Height (m)
Goodenia stobbsiana	1	0.3
Grevillea berryana	0.5	1.5
Hibiscus coatesii	0.1	0.4
Maireana georgei	0.5	0.4
Ptilotus calostachyus	0.1	0.3
Scaevola acacioides	0.5	1.1
Senna glutinosa subsp. *glutinosa*	0.1	1.5
Senna glutinosa subsp. x *luerssenii*	0.1	1.9
Triodia vanleeuwenii	10	0.45
Triodia wiseana	10	0.5

Site: HDR10
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 1 Date: 9/11/2017 **Phase 2 Date:** 22/05/2018 **Described by:** LD
MGA Zone: 50 **Easting:** 710598 **Northing:** 7451383
Habitat: Hillslope
Soil: Dark reddish brown sandy loam
Rock type: Ironstone
Vegetation code: H4
Vegetation: *Senna sericea*, *Sida* sp. Excedentifolia (J.L. Egan 1925) low open shrubland over *Triodia wiseana* open hummock grassland
Vegetation Condition: Excellent
Fire Age: 0-2 years



Species List:

Name	Cover (%)	Height (m)
Aristida holathera var. *holathera*	0.1	0.2
Cymbopogon obtectus	0.1	0.4
Enneapogon polyphyllus	0.1	0.1
Eriachne aristidea	0.1	0.2
Eriachne pulchella	0.1	0.1
Eucalyptus leucophloia subsp. *leucophloia*	0.1	0.6
Gomphrena cunninghamii	0.1	0.1
Goodenia microptera	0.1	0.2
Goodenia stobbsiana	0.1	0.2
Lepidium pholidogynum	0.1	0.2
Maireana georgei	0.1	0.2
Oldenlandia crouchiana	0.1	0.1
Paraneurachne muelleri	0.1	0.4
Paspalidium clementii	0.1	0.1
Peripleura virgata	0.1	0.2
Pterocaulon sphacelatum	0.1	0.2

Name	Cover (%)	Height (m)
Ptilotus astrolasius	0.1	0.3
Ptilotus calostachyus	0.1	0.5
Ptilotus exaltatus	0.1	0.3
Schizachyrium fragile	0.1	0.1
Senna glutinosa subsp. *glutinosa*	0.1	1.2
Senna glutinosa subsp. *pruinosa*	0.1	0.7
Senna sericea	1	0.8
Sida sp. Excedentifolia (J.L. Egan 1925)	1	0.2
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.1	0.3
Tephrosia oxalidea	0.1	0.1
Triodia wiseana	18	0.8

Site: HDR11
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 1 Date: 6/11/2017 **Phase 2 Date:** 28/05/2018 **Described by:** LD
MGA Zone: 50 **Easting:** 716314 **Northing:** 7450887
Habitat: Hillslope
Soil: Dark reddish brown sandy clay loam
Rock type: Ironstone
Vegetation code: H4
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Lepidium catapycnon* scattered low shrubs over *Triodia wiseana* very open hummock grassland
Vegetation Condition: Excellent
Fire Age: 0-2 years



Species List:

Name	Cover (%)	Height (m)
Acacia bivenosa	0.1	0.3
Acacia pruinocarpa	0.1	0.5
Acacia synchronicia	0.1	0.2
Amphipogon sericeus	0.1	0.2
Aristida contorta	0.1	0.1
Cymbopogon ambiguus	0.1	0.5
Dampiera candicans	0.1	0.3
Dodonaea coriacea	0.1	0.3
Enneapogon caerulescens	0.1	0.1
Enneapogon polyphyllus	0.1	0.1
Eriachne pulchella subsp. *pulchella*	0.1	0.1
Eucalyptus leucophloia subsp. *leucophloia*	0.5	1.2
Gomphrena cunninghamii	0.1	0.1
Goodenia stobbsiana	0.1	0.2
Lepidium catapycnon P4	0.5	0.5
Paraneurachne muelleri	0.1	0.3

Name	Cover (%)	Height (m)
Paspalidium clementii	0.1	0.1
Ptilotus astrolasius	0.1	0.3
Ptilotus calostachyus	0.1	0.4
Ptilotus exaltatus	0.1	0.3
Ptilotus mollis P4	0.1	0.5
Salsola australis	0.1	0.3
Schizachyrium fragile	0.1	0.1
Senna artemisioides subsp. *oligophylla*	0.1	0.5
Senna glutinosa subsp. *glutinosa*	0.1	0.7
Senna glutinosa subsp. *pruinosa*	0.1	0.4
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.1	0.3
Solanum cleistogamum	0.1	0.1
Tephrosia oxalidea	0.1	0.1
Triodia wiseana	8	0.1
Triumfetta chaetocarpa	0.1	0.2

Site: HDR12
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 1 Date: 10/11/2017 **Phase 2 Date:** 23/05/2018 **Described by:** BE
MGA Zone: 50 **Easting:** 720995 **Northing:** 7451577
Habitat: Hillslope
Soil: Dark reddish brown sandy loam
Rock type: Ironstone
Vegetation code: H4
Vegetation: *Senna glutinosa* subsp. *pruinosa* scattered shrubs over *Sida* sp. Pilbara (A.A. Mitchell PRP 1543) low open shrubland over *Triodia wiseana* open hummock grassland with *Amphipogon sericeus* scattered tussock grasses
Vegetation Condition: Excellent
Fire Age: 0-2 years



Species List:

Name	Cover (%)	Height (m)
Acacia bivenosa	0.1	0.6
Amphipogon sericeus	0.5	0.3
Cymbopogon ambiguus	0.1	0.7
Enneapogon caerulescens	0.1	0.1
Eriachne pulchella subsp. *dominii*	0.1	0.3
Eucalyptus leucophloia subsp. *leucophloia*	0.1	1.2
Gomphrena cunninghamii	0.1	0.1
Goodenia stobbsiana	0.1	0.3
Grevillea wickhamii subsp. *hispidula*	0.1	0.7
Lepidium catapycnon P4	0.1	0.2
Maireana georgei	0.1	0.2
Oldenlandia crouchiana	0.1	0.2
Paraneurachne muelleri	0.1	0.4
Paspalidium clementii	0.1	0.1
Peripleura virgata	0.1	0.2

Name	Cover (%)	Height (m)
Pluchea dentex	0.1	0.25
Pterocaulon sphacelatum	0.1	0.2
Ptilotus calostachyus	0.1	0.6
Ptilotus clementii	0.1	0.2
Ptilotus exaltatus	0.1	0.4
Schizachyrium fragile	0.1	0.1
Sclerolaena densiflora	0.1	0.1
Senna glutinosa subsp. *glutinosa*	0.1	1.2
Senna glutinosa subsp. *pruinosa*	1	1.2
Senna glutinosa subsp. x *luerssenii*	0.1	1.2
Sida sp. Excedentifolia (J.L. Egan 1925)	0.1	0.6
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	2	0.5
Solanum horridum	0.1	0.3
Solanum phlomoides	0.1	0.3
Streptoglossa sp.	0.1	0.1
Triodia vanleeuwenii	0.1	0.2
Triodia wiseana	15	0.3

Site: HDR13
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 1 Date: 7/11/2017 **Phase 2 Date:** 28/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 699687 **Northing:** 7443423
Habitat: Hillcrest
Soil: Dark reddish brown sandy clay loam
Rock type: Ironstone
Vegetation code: H7
Vegetation: *Corymbia deserticola* subsp. *deserticola* scattered low trees with *Eucalyptus gamophylla* low open mallee woodland over *Acacia ancistrocarpa* tall open shrubland over *Gompholobium oreophilum* scattered low shrubs over *Triodia vanleeuwenii* open hummock grassland
Vegetation Condition: Excellent
Fire Age: 0-2 years



Species List:

Name	Cover (%)	Height (m)
Acacia ancistrocarpa	4	2.2
Acacia bivenosa	0.1	1.2
Amphipogon sericeus	0.1	0.2
Aristida holathera var. *holathera*	0.1	0.2
Calytrix carinata	0.1	0.4
Corchorus lasiocarpus subsp. *parvus*	0.1	0.2
Corymbia deserticola subsp. *deserticola*	1	4.0
Cucumis variabilis	0.1	twiner
Eucalyptus gamophylla	2	4.0
Eucalyptus leucophloia subsp. *leucophloia*	0.1	4.0
Gompholobium oreophilum	0.5	0.3
Goodenia stobbsiana	0.1	0.3
Goodenia triodiophila	0.1	0.2
Hakea chordophylla	0.1	2.5
Hibiscus coatesii	0.1	0.4

Name	Cover (%)	Height (m)
Indigofera monophylla	0.1	0.3
Jasminum didymum subsp. *lineare*	0.1	twiner
Ptilotus astrolasius	0.1	0.3
Ptilotus calostachyus	0.1	0.5
Scaevola acacioides	0.1	0.5
Scaevola parvifolia subsp. *pilbarae*	0.1	0.3
Senna glaucifolia	0.1	1.5
Senna notabilis	0.1	0.2
Seringia sp.	0.1	0.2
Solanum lasiophyllum	0.1	0.4
Solanum phlomoides	0.1	0.4
Triodia vanleeuwenii	20	0.5

Site: HDR14
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 1 Date: 10/11/2017 **Phase 2 Date:** 23/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 720459 **Northing:** 7452184
Habitat: Hillslope
Soil: Dark reddish brown sandy loam
Rock type: Ironstone
Vegetation code: H3
Vegetation: *Acacia inaequilatera*, *Hakea chordophylla* tall open shrubland over *Gompholobium oreophilum*, *Dampiera candicans* low open shrubland over *Triodia vanleeuwenii* open hummock grassland with *Amphipogon sericeus* scattered tussock grasses
Vegetation Condition: Excellent
Fire Age: 0-2 years



Species List:

Name	Cover (%)	Height (m)
Acacia inaequilatera	2	3.0
Acacia marramamba	0.1	0.5
Acacia monticola	0.1	0.3
Acacia spondylophylla	0.1	0.3
Acacia tenuissima	0.1	0.5
Amphipogon sericeus	1	0.3
Bulbostylis barbata	0.1	0.1
Clerodendrum floribundum var. *angustifolium*	0.1	2.5
Corchorus lasiocarpus subsp. *parvus*	0.1	0.4
Cymbopogon obtectus	0.1	0.5
Dampiera candicans	1	0.3
Gompholobium oreophilum	2	0.3
Goodenia stobbsiana	0.1	0.3
Goodenia triodiophila	0.1	0.3
Grevillea wickhamii subsp. *hispidula*	0.1	1.2

Name	Cover (%)	Height (m)
Hakea chordophylla	1	3.2
Indigofera monophylla	0.1	0.2
Ptilotus calostachyus	0.1	0.4
Ptilotus rotundifolius	0.1	0.4
Senna glutinosa subsp. *glutinosa*	0.1	0.9
Senna glutinosa subsp. *pruinosa*	0.1	0.5
Senna notabilis	0.1	0.3
Sida arenicola	0.1	1.6
Solanum horridum	0.1	0.2
Solanum phlomoides	0.1	0.8
Triodia vanleeuwenii	12	0.2

Site: HDR16
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 1 Date: 11/11/2017 **Phase 2 Date:** 29/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 708501 **Northing:** 7451135
Habitat: Hillslope
Soil: Dark reddish brown sandy loam
Rock type: Ironstone
Vegetation code: H3
Vegetation: *Acacia inaequilatera* scattered tall shrubs over *Senna glutinosa* subsp. *pruinosa* scattered shrubs over *A. bivenosa* scattered low shrubs over *Triodia vanleeuwenii* open hummock grassland with *Amphipogon sericeus*, *Themeda* sp. Mt Barricade (M.E. Trudgen 2471) very open tussock grassland
Vegetation Condition: Excellent
Fire Age: 0-2 years



Species List:

Name	Cover (%)	Height (m)
Acacia bivenosa	0.5	0.7
Acacia inaequilatera	1	2.1
Adriana tomentosa var. *tomentosa*	0.1	0.4
Amphipogon sericeus	2	0.4
Androcalva luteiflora	0.1	0.6
Cymbopogon obtectus	0.1	0.5
Enneapogon lindleyanus	0.1	0.4
Eucalyptus leucophloia subsp. *leucophloia*	0.1	3.0
Fimbristylis dichotoma	0.1	0.3
Goodenia sp.	0.1	0.3
Goodenia stobbsiana	0.1	0.3
Gossypium robinsonii	0.1	1.2
Hakea chordophylla	0.1	0.8
Heliotropium inexplicitum	0.1	0.05
Hibiscus sturtii var. *campylochlamys*	0.1	0.4

Name	Cover (%)	Height (m)
Hibiscus sturtii var. *platychlamys*	0.1	0.5
Indigofera monophylla	0.1	0.3
Paraneurachne muelleri	0.1	0.3
Paspalidium clementii	0.1	0.2
Polycarpaea holtzei	0.1	0.05
Ptilotus astrolasius	0.1	0.8
Ptilotus calostachyus	0.1	1.2
Ptilotus exaltatus	0.1	0.3
Ptilotus obovatus	0.1	0.5
Ptilotus rotundifolius	0.1	0.7
Senna artemisioides subsp. *oligophylla*	0.1	1.4
Senna glutinosa subsp. *glutinosa*	0.1	0.9
Senna glutinosa subsp. *pruinosa*	0.5	1.5
Senna notabilis	0.1	0.2
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	0.6
Solanum lasiophyllum	0.1	0.5
Themeda sp. Mt Barricade (M.E. Trudgen 2471)	0.5	0.6
Triodia vanleeuwenii	25	0.2
Triodia wiseana	0.1	0.3

Site: HDR18
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 2 Date: 28/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 700267 **Northing:** 7444557
Habitat: Channel
Soil: Reddish brown sandy clay loam
Rock type: Ironstone
Vegetation code: D5
Vegetation: *Eucalyptus xerothermica*, (*E. camaldulensis* subsp. *obtusa*) low open woodland over *Dodonaea petiolaris* scattered low shrubs over *Themeda triandra*, (*Eulalia aurea*) tussock grassland
Vegetation Condition: Excellent
Fire Age: 5-10 years



Species List:

Name	Cover (%)	Height (m)
Abutilon otocarpum	0.1	0.6
Acacia bivenosa	0.1	1.0
Acacia dictyophleba	0.1	1.2
Acacia maitlandii	0.1	0.2
Androcalva luteiflora	0.1	0.7
Aristida contorta	0.1	0.3
Corchorus lasiocarpus subsp. *parvus*	0.1	0.2
Crotalaria medicaginea var. *neglecta*	0.1	0.5
Cymbopogon obtectus	0.1	0.6
Dodonaea petiolaris	1	0.7
Enneapogon lindleyanus	0.1	0.4
Eucalyptus camaldulensis subsp. *obtusa*	1	2.5
Eucalyptus xerothermica	6	8.0
Eulalia aurea	10	0.6
Euphorbia biconvexa/coghlanii/trigonosperma	0.1	0.3
Gossypium robinsonii	0.1	1.5

Name	Cover (%)	Height (m)
Gossypium sturtianum var. *sturtianum*	0.1	0.5
Indigofera monophylla	0.1	0.3
Jasminum didymum subsp. *lineare*	0.1	twiner
Petalostylis labicheoides	0.1	1.9
Pterocaulon sp.	0.1	0.4
Rhynchosia minima	0.1	twiner
Senna artemisioides subsp. x *artemisioides*	0.1	0.5
Stemodia grossa	0.1	0.2
Themeda triandra	35	0.8
Triodia longiceps	0.1	0.3

Site: HDR19
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 2 Date: 28/05/2018 **Described by:** DL
MGA Zone: 50 **Easting:** 702535 **Northing:** 7446647
Habitat: Drainage depression
Soil: Red brown silty clay
Rock type: Ironstone
Vegetation code: D2
Vegetation: *Acacia pruinocarpa*, (*A. catenulata* subsp. *occidentalis*, *A. aptaneura*) tall shrubland over *Psydrax latifolia* scattered low shrubs over *Triodia pungens* open hummock grassland
Vegetation Condition: Excellent
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	3	3.0
Acacia ayersiana	0.1	3.0
Acacia catenulata subsp. *occidentalis*	3	4.0
Acacia citrinoviridis	0.1	1.9
Acacia incurvaneura	0.1	3.0
Acacia pruinocarpa	7.5	4.0
Acacia tenuissima	0.1	1.8
Aristida contorta	0.1	0.3
Aristida holathera var. *holathera*	0.1	0.2
Aristida inaequiglumis	0.1	0.6
**Bidens bipinnata*	0.1	0.2
Cymbopogon obtectus	0.1	0.3
Cymbopogon sp.	0.1	0.2
Duperreya commixta	0.1	twiner
Enchylaena tomentosa var. *tomentosa*	0.1	0.3
Enneapogon lindleyanus	0.1	0.5

Name	Cover (%)	Height (m)
Eriachne pulchella	0.1	0.2
Maireana tomentosa subsp. *tomentosa*	0.1	0.2
Paraneurachne muelleri	0.1	0.2
Petalostylis labicheoides	0.1	4.0
Psydrax latifolia	0.5	0.7
Ptilotus exaltatus	0.1	0.2
Ptilotus obovatus	0.1	0.4
Salsola australis	0.1	0.3
Santalum lanceolatum	0.1	2.0
Sida fibulifera	0.1	0.3
Solanum lasiophyllum	0.1	0.7
Sporobolus australasicus	0.1	0.3
Triodia pungens	25	0.7

* denotes weed species

Site: BHD05-AR
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 27/05/2019 **Described by:** KMc
MGA Zone: 50 **Easting:** 714531 **Northing:** 7453713
Habitat: Hillslope
Soil: Dark reddish brown Sandy clay loam
Rock type: Ironstone
Vegetation code: H7
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* sens. lat. low open woodland over *Petalostylis labicheoides* and *Grevillea wickhamii* subsp. *hispidula* tall shrubland over *Mirbelia viminalis* low open shrubland over *Triodia wiseana* and *Triodia vanleeuwenii* very open hummock grassland
Vegetation Condition: Good
Fire Age: 2-5 years



Species List:

Name	Cover (%)	Height (m)
Acacia hamersleyensis	0.1	0.8
Acacia hilliana	0.1	0.3
Acacia maitlandii	0.1	0.8
Acacia monticola	0.1	1.9
Amphipogon sericeus	0.1	0.3
Corchorus lasiocarpus subsp. *lasiocarpus*	0.1	0.3
Corymbia hamersleyana sens lat.	1	5
Dampiera candicans	0.1	0.3
Dodonaea coriacea	0.1	0.7
Eriachne mucronata	0.1	0.2
Eucalyptus leucophloia subsp. *leucophloia*	1	5
Goodenia stobbsiana	0.1	0.1
Grevillea wickhamii subsp. *hispidula*	2	2.5
Mirbelia viminalis	6	0.5

Name	Cover (%)	Height (m)
Petalostylis labicheoides	9	3.5
Ptilotus calostachyus	0.1	0.5
Ptilotus exaltatus	0.1	0.5
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.1	0.3
Solanum lasiophyllum	0.1	0.6
Triodia vanleeuwenii	1	0.15
Triodia wiseana	5	0.2

Site: BHD10-AR
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 25/05/2019 **Described by:** KMc
MGA Zone: 50 **Easting:** 708769 **Northing:** 7452817
Habitat: Hillslope
Soil: Dark reddish brown Silty clay loam
Rock type: Ironstone
Vegetation code: H8
Vegetation: *Eucalyptus gamophylla* scattered low trees over *Acacia inaequilatera* tall open shrubland over *Triodia vanleeuwenii* and *Triodia pungens* open hummock grassland
Vegetation Condition: Poor
Fire Age: Very long unburnt



Species List:

Name	Cover (%)	Height (m)
Acacia adsurgens	0.1	1.1
Acacia bivenosa	0.1	1.8
Acacia inaequilatera	3	4
Acacia pruinocarpa	0.5	2.3
Amphipogon sericeus	0.1	0.2
Aristida contorta	0.1	0.4
Aristida holathera var. *holathera*	0.1	0.3
Codonocarpus cotinifolius	0.1	3
Corymbia deserticola subsp. *deserticola*	0.5	4
Cymbopogon obtectus	0.1	0.2
Duperreya commixta	0.1	0.3
Enneapogon caerulescens	0.1	0.2
Enneapogon lindleyanus	0.1	0.3
Eriachne mucronata	0.1	0.2
Eucalyptus gamophylla	1	3.8

Name	Cover (%)	Height (m)
Goodenia stobbsiana	0.1	0.3
Hakea chordophylla	0.1	2.7
Heliotropium sp.	0.1	0.2
Hybanthus aurantiacus	0.1	0.1
Indigofera monophylla	0.1	0.2
Ptilotus astrolasius	0.1	0.4
Ptilotus calostachyus	0.1	0.6
Ptilotus exaltatus	0.1	0.05
Ptilotus obovatus	0.1	0.5
Ptilotus rotundifolius	0.1	1.1
Rhagodia eremaea	0.1	0.6
Senna artemisioides subsp. *helmsii*	0.1	0.5
Senna artemisioides subsp. *oligophylla*	0.1	0.3
Senna glutinosa subsp. *× luerssenii*	0.1	1.9
Senna glutinosa subsp. *glutinosa*	0.1	2.6
Senna glutinosa subsp. *pruinosa*	0.1	1.2
Senna sp. Meekatharra (E. Bailey 1-26) × *glaucifolia*	0.1	1.4
Themeda triandra	0.1	0.2
Triodia pungens	4	0.4
Triodia vanleeuwenii	25	0.4

Site: GH01
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 21/05/2019 **Described by:** LD
MGA Zone: 50 **Easting:** 700354 **Northing:** 7446915
Habitat: Minor creek
Soil: Dark reddish brown Clay loam
Rock type: Ironstone
Vegetation code: D5
Vegetation: *Eucalyptus xerothermica* scattered low trees over *Acacia pyrifolia* var. *pyrifolia*, *Petalostylis labicheoides* and *Acacia maitlandii* tall open shrubland over **Bidens bipinnata* scattered low shrubs over *Triodia longiceps* very open hummock grassland with *Themeda triandra* and *Chrysopogon fallax* open tussock grassland
Vegetation Condition: Very Good
Fire Age: 5-10 years



Species List:

Name	Cover (%)	Height (m)
Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)	0.1	0.2
Acacia aptaneura	0.1	4
Acacia maitlandii	1	3
Acacia pruinocarpa	0.1	2.2
Acacia pyrifolia	4	2.2
Alternanthera nana	0.1	0.2
Androcalva luteiflora	0.1	1.1
**Bidens bipinnata*	1	0.2
Boerhavia coccinea	0.1	0
Bulbostylis turbinata	0.1	0.1
Chrysocephalum apiculatum subsp. *pilbarense*	0.1	0.1
Chrysopogon fallax	2	0.8
Cleome viscosa	0.1	0.2
Corchorus tridens	0.1	0.1

Name	Cover (%)	Height (m)
Crotalaria medicaginea var. *neglecta*	0.1	0.2
**Cynodon dactylon*	0.1	0.2
**Datura leichhardtii* subsp. *leichhardtii*	0.1	0.1
Dichanthium sericeum subsp. *humilius*	0.1	0.2
Duperreya commixta	0.1	0
Dysphania rhadinostachya subsp. *rhadinostachya*	0.1	0.1
Enneapogon polyphyllus	0.1	0.3
Eragrostis cumingii	0.1	0.1
Eragrostis tenellula	0.1	0.1
Eremophila longifolia	0.1	1.4
Eriachne pulchella subsp. *dominii*	0.1	0.1
Eucalyptus xerothermica	1	7
Eulalia aurea	0.1	0.8
Euphorbia biconvexa	0.1	0.1
Evolvulus alsinoides var. *decumbens*	0.1	0.1
Evolvulus alsinoides var. *villosicalyx*	0.1	0.1
**Flaveria trinervia*	0.1	0.2
Goodenia stellata	0.1	0.1
Haloragis odontocarpa	0.1	0.3
Indigofera georgei	0.1	0.4
Iseilema eremaeum	0.1	0.1
Isotropis sp. Arid zone (G. Byrne 2775)	0.1	0.4
Jasminum didymum subsp. *lineare*	0.1	0
**Malvastrum americanum*	0.1	0.2
Nicotiana sp.	0.1	0.2
Paraneurachne muelleri	0.1	0.2
Paspalidium clementii	0.1	0.1
Paspalidium rarum	0.1	0.1
Petalostylis labicheoides	2	3
Pluchea rubelliflora	0.1	0.2
Pterocaulon serrulatum var. *velutinum*	0.1	0.1
Pterocaulon sphacelatum	0.1	0.2
Ptilotus obovatus	0.1	0.1
Rhagodia sp. Hamersley (M. Trudgen 17794) P3	0.1	1.8
Rhynchosia minima	0.1	0
Scaevola amblyanthera var. *centralis*	0.1	0.2
Senna stricta	0.1	2.2
Sida fibulifera	0.1	0.2
Themeda triandra	12	0.8

Name	Cover (%)	Height (m)
Trigastrotheca molluginea	0.1	0.1
Triodia longiceps	7	1.1
Triodia pungens	0.1	0.3
Vigna lanceolata var. *lanceolata*	0.1	0

* denotes weed species

Site: GH02
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 21/05/2019 **Described by:** DR
MGA Zone: 50 **Easting:** 705808 **Northing:** 7448628
Habitat: Stony clay plain
Soil: Red brown Clay loam
Rock type: Ironstone
Vegetation code: P3
Vegetation: *Acacia aptaneura*, *Acacia catenulata* subsp. *occidentalis* and *Acacia pruinocarpa* tall shrubland over *Eremophila forrestii* subsp. *forrestii* open shrubland over *Triodia pungens* and *Triodia vanleeuwenii* open hummock grassland
Vegetation Condition: Excellent
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	14	6.5
Acacia ayersiana	0.5	2
Acacia catenulata subsp. *occidentalis*	5	6.5
Acacia pachyacra	0.1	0.9
Acacia pruinocarpa	1.5	2.8
Corymbia deserticola subsp. *deserticola*	0.1	4
Eremophila forrestii subsp. *forrestii*	9	1.8
Jasminum didymum subsp. *lineare*	0.1	1
Sida fibulifera	0.1	0.1
Sida sp. dark green fruits (S. van Leeuwen 2260)	0.1	0.2
Triodia pungens	12	0.4
Triodia vanleeuwenii	1	0.2

Site: GH03
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 21/05/2019 **Described by:** LD
MGA Zone: 50 **Easting:** 706346 **Northing:** 7448780
Habitat: *Minor* drainage
Soil: Reddish brown Sandy clay
Rock type: Ironstone
Vegetation code: D2
Vegetation: *Eucalyptus xerothermica* x *Eucalyptus tephrodes* open woodland over *Acacia aptaneura* and *Acacia pruinocarpa* tall shrubland over *Triodia pungens* very open hummock grassland
Vegetation Condition: Very Good
Fire Age: 5-10 years



Species List:

Name	Cover (%)	Height (m)
Abutilon fraseri subsp. *fraseri*	0.1	0.1
Acacia aptaneura	26	9
Acacia pruinocarpa	2	3.2
Aristida sp.	0.1	0.2
**Bidens bipinnata*	0.1	0.2
Cheilanthes sieberi subsp. *sieberi*	0.1	0.2
Chrysopogon fallax	0.1	0.4
Duperreya commixta	0.1	0
Enchylaena tomentosa var. *tomentosa*	0.1	0.4
Enneapogon polyphyllus	0.1	0.1
Eragrostis setifolia	0.1	0.3
Eremophila lanceolata	0.1	0.2
Eucalyptus xerothermica x *Eucalyptus tephrodes*	3	11
Maireana villosa	0.5	0.3
Petalostylis labicheoides	0.1	2

Name	Cover (%)	Height (m)
Psydrax suaveolens	0.1	2.1
Ptilotus obovatus	0.1	0.4
Sclerolaena cornishiana	0.1	0.2
Sida fibulifera	0.1	0.1
Solanum lasiophyllum	0.1	0.5
Triodia pungens	6	0.5

* denotes weed species

Site: GH04
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 22/05/2019 **Described by:** KMc
MGA Zone: 50 **Easting:** 702240 **Northing:** 7442818
Habitat: *Minor* creek
Soil: Orange brown Clay loam
Rock type: Dolerite, Ironstone
Vegetation code: D4
Vegetation: *Corymbia hamersleyana* sens. lat. and *Eucalyptus victrix* low open woodland over *Petalostylis labicheoides* scattered tall shrubs over *Gossypium sturtianum* var. *sturtianum* and *Androcalva luteiflora* open shrubland over *Eulalia aurea*, *Themeda triandra* and **Cenchrus ciliaris* tussock grassland
Vegetation Condition: Good
Fire Age: 5-10 years



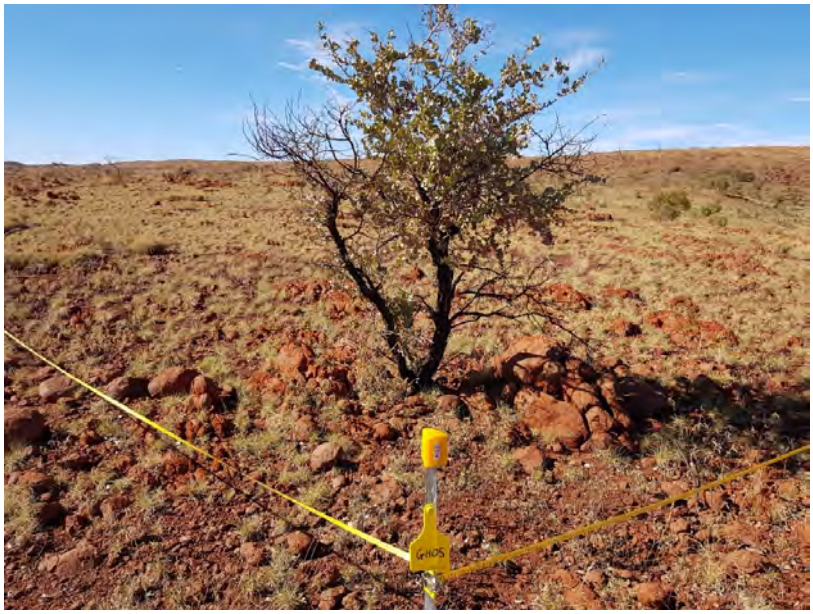
Species List:

Name	Cover (%)	Height (m)
Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)	0.1	1.6
Acacia bivenosa	0.1	2.3
Acacia dictyophleba	0.1	0.3
Acacia maitlandii	0.1	0.2
Acacia pyrifolia	0.1	1.4
Androcalva luteiflora	1	1.3
**Bidens bipinnata*	0.1	0.2
**Cenchrus ciliaris*	4	0.7
Cleome viscosa	0.1	0.1
Corchorus crozophorifolius	0.1	0.2
Corchorus tridens	0.1	0.05
Corymbia hamersleyana sens lat.	3	5
Cymbopogon ambiguus	1	0.8
Dodonaea lanceolata var. *lanceolata*	0.1	1.1

Name	Cover (%)	Height (m)
Duperreya commixta	0.1	0.4
Enneapogon caerulescens	0.1	0.3
Enneapogon polyphyllus	0.1	0.4
Eragrostis tenellula	0.1	0.1
Eremophila longifolia	0.1	1.6
Eriachne mucronata	0.1	0.4
Eucalyptus victrix	1	4
Eulalia aurea	25	0.8
Evolvulus alsinoides var. *decumbens*	0.1	0.1
**Flaveria trinervia*	0.1	0.1
Gossypium australe	0.1	0.4
Gossypium robinsonii	0.1	2.3
Gossypium sturtianum var. *sturtianum*	6	1.6
Grevillea wickhamii subsp. *hispidula*	0.1	1.8
Jasminum didymum subsp. *lineare*	0.1	0.6
Maytenus sp. Mt Windell (S. van Leeuwen 846)	0.1	1.1
Paraneurachne muelleri	0.1	0.3
Petalostylis labicheoides	1	2.3
Pluchea rubelliflora	0.1	0.2
Pterocaulon sphacelatum	0.1	0.3
Ptilotus obovatus	0.1	0.6
Rhynchosia minima	0.1	0.3
Santalum lanceolatum	0.1	1.3
Scaevola amblyanthera var. *centralis*	0.1	0.3
Senna glutinosa subsp. *glutinosa*	0.1	1.5
Sida sp. Articulation below (A.A. Mitchell PRP 1605)	0.4	0.3
Stemodia grossa	0.1	0.6
Themeda triandra	8	0.7
Triodia longiceps	0.1	0.4
Triodia wiseana	0.1	0.2

* denotes weed species

Site: GH05
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 22/05/2019 **Described by:** LD
MGA Zone: 50 **Easting:** 701982 **Northing:** 7442782
Habitat: Hillcrest
Soil: Reddish brown Silty clay loam
Rock type: Dolerite
Vegetation code: H12
Vegetation: *Acacia inaequilatera* scattered tall shrubs over *Corchorus lasiocarpus* subsp. *parvus* scattered low shrubs over *Triodia wiseana* open hummock grassland with *Cymbopogon ambiguus* scattered tussock grasses
Vegetation Condition: Excellent
Fire Age: 2-5 years



Species List:

Name	Cover (%)	Height (m)
Acacia bivenosa	0.1	1.1
Acacia dictyophleba	0.1	1.5
Acacia inaequilatera	0.5	2.5
Acacia maitlandii	0.1	0.6
Acacia marramamba	0.1	0.6
Acacia pyrifolia	0.1	1.2
Aristida contorta	0.1	0.2
Aristida holathera var. *holathera*	0.1	0.3
Bonamia pilbarensis	0.1	0.1
Cheilanthes lasiophylla	0.1	0.1
Corchorus lasiocarpus subsp. *parvus*	0.5	0.3
Cymbopogon ambiguus	0.5	0.5
Enneapogon caerulescens	0.1	0.1
Eriachne mucronata	0.1	0.3
Eucalyptus leucophloia subsp. *leucophloia*	0.1	0.8
Eulalia aurea	0.1	0.3

Name	Cover (%)	Height (m)
Euphorbia careyi	0.1	0.2
Goodenia stobbsiana	0.1	0.2
Hakea chordophylla	0.1	1
Heliotropium ovalifolium	0.1	0.2
Hibiscus sturtii var. *campylochlamys*	0.1	0.4
Pterocaulon sphacelatum	0.1	0.3
Ptilotus astrolasius	0.1	0.3
Ptilotus calostachyus	0.1	0.3
Senna artemisioides subsp. *oligophylla*	0.1	0.3
Senna glutinosa subsp. *glutinosa*	0.1	0.5
Senna glutinosa subsp. *pruinosa*	0.1	0.2
Solanum lasiophyllum	0.1	0.5
Themeda sp. Mt Barricade (M.E. Trudgen 2471)	0.1	0.3
Trichodesma zeylanicum var. *zeylanicum*	0.1	0.6
Tricoryne sp. Hamersley Range (S. van Leeuwen 915)	0.1	0.4
Triodia wiseana	20	0.1

Site: GH06
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 22/05/2019 **Described by:** DR
MGA Zone: 50 **Easting:** 701614 **Northing:** 7442789
Habitat: Hillslope
Soil: Brown Sandy loam
Rock type: Ironstone, Siltstone
Vegetation code: H10
Vegetation: *Eucalyptus socialis* subsp. *eucentrica* and *Eucalyptus repullulans* low open woodland over *Triodia wiseana* open hummock grassland
Vegetation Condition: Excellent
Fire Age: 2-5 years
Notes: Mallee resprouted from fire ca 3 years ago. Cover values lower than at climax community



Species List:

Name	Cover (%)	Height (m)
Acacia bivenosa	0.5	3.3
Cymbopogon ambiguus	0.1	0.5
Eucalyptus repullulans	2	3.5
Eucalyptus socialis subsp. *eucentrica*	4	3.5
Halgania cyanea	0.1	0.6
Hibiscus sp.	0.1	0.2
Paraneurachne muelleri	0.1	0.2
Ptilotus calostachyus	0.1	0.3
Ptilotus clementii	0.1	0.3
Ptilotus exaltatus	0.1	0.2
Senna artemisioides subsp. *oligophylla*	0.1	0.4
Triodia wiseana	20	0.4

Site: GH07
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 23/05/2019 **Described by:** KMc
MGA Zone: 50 **Easting:** 705303 **Northing:** 7446952
Habitat: Clay plain
Soil: Reddish brown Sandy clay
Rock type: Ironstone
Vegetation code: P3
Vegetation: *Acacia aptaneura*, *Acacia pruinocarpa* and *Acacia catenulata* subsp. *occidentalis* tall open scrub over *Triodia pungens* very open hummock grassland
Vegetation Condition: Very Good
Fire Age: >10 years



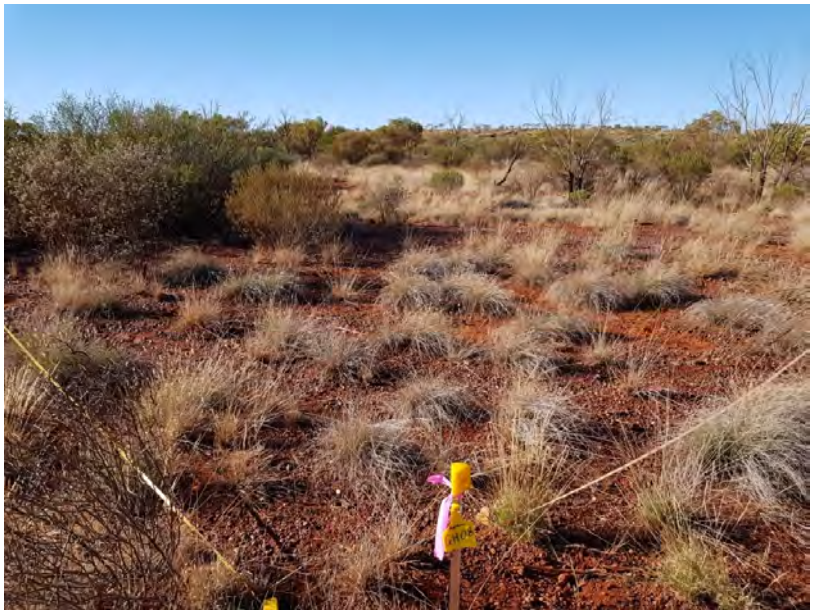
Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	1	2.9
Acacia ayersiana	0.1	2
Acacia catenulata subsp. *occidentalis*	5	5.5
Acacia pruinocarpa	8	6
Amyema hilliana	0.1	4
Aristida sp.	0.1	0.3
**Bidens bipinnata*	0.1	0.2
Cheilanthes sieberi subsp. *sieberi*	0.1	0.1
Eremophila aff. *clarkei*	0.1	1.7
Eremophila forrestii subsp. *forrestii*	0.1	0.5
Eremophila latrobei subsp. *filiformis*	0.1	1.6
Maireana villosa	0.1	0.3
Psydrax suaveolens	0.1	1.1
Ptilotus obovatus	0.1	0.5
Sida sp. dark green fruits (S. van Leeuwen 2260)	0.1	0.4
Solanum lasiophyllum	0.1	0.3

Name	Cover (%)	Height (m)
Triodia pungens	7	0.4

* denotes weed species

Site: GH08
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 23/05/2019 **Described by:** DR
MGA Zone: 50 **Easting:** 706745 **Northing:** 7446812
Habitat: Plain
Soil: Red brown Light clay
Rock type: Ironstone, Quartz
Vegetation code: P2
Vegetation: *Acacia tetragonophylla* and *Acacia aptaneura* tall open shrubland over *Eremophila forrestii* subsp. *forrestii* and *Senna artemisioides* subsp. x *artemisioides* open shrubland over *Aristida latifolia*, *Eragrostis xerophila* and *Eriachne obtusa* open tussock grassland
Vegetation Condition: Very Good
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Abutilon malvifolium	0.1	0.05
Acacia aptaneura	1	3
Acacia pruinocarpa	0.1	4
Acacia synchronicia	0.1	0.3
Acacia tetragonophylla	2.5	2.8
Anthobolus leptomerioides	0.1	1.2
Aristida contorta	0.1	0.1
Aristida latifolia	15	0.5
Astrebla elymoides	0.1	0.5
Corchorus tridens	0.1	0.05
Crotalaria medicaginea var. *neglecta*	0.1	0.1
Cynodon convergens	0.1	0.01
**Datura leichhardtii* subsp. *leichhardtii*	0.1	0.1
Enchylaena tomentosa var. *tomentosa*	0.1	0.2
Enneapogon caerulescens	0.1	0.1

Name	Cover (%)	Height (m)
Enneapogon polyphyllus	0.1	0.1
Eragrostis xerophila	7	0.3
Eremophila forrestii subsp. *forrestii*	2	1.9
Eremophila latrobei subsp. *glabra*	0.1	0.5
Eriachne obtusa	5	0.4
Eucalyptus socialis subsp. *eucentrica*	0.1	3.2
Euphorbia biconvexa	0.1	0.01
Goodenia sp. (of interest)	0.1	0.01
Haloragis sp.	0.1	0.05
Hibiscus verdcourtii	0.1	0.1
Neptunia dimorphantha	0.1	0.1
Polymeria aff. *longifolia*	0.1	0.01
Ptilotus exaltatus	0.1	0.05
Ptilotus obovatus	0.1	0.2
Rhynchosia minima	0.1	0.1
Sclerolaena cornishiana	0.1	0.2
Senna artemisioides subsp. *× artemisioides*	2	1.9
Senna artemisioides subsp. *oligophylla*	0.1	0.3
Sida fibulifera	0.1	0.1
Solanum lasiophyllum	0.1	0.3
Sporobolus australasicus	0.1	0.1
Streptoglossa bubakii	0.1	0.3
Themeda triandra	0.1	0.7
Triodia wiseana	0.1	0.2
Vigna lanceolata var. *lanceolata*	0.1	0.1

* denotes weed species

Site: GH09
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 23/05/2019 **Described by:** KMc
MGA Zone: 50 **Easting:** 704696 **Northing:** 7446946
Habitat: Drainage depression
Soil: Reddish brown Clay loam
Rock type: Ironstone
Vegetation code: D2
Vegetation: *Eucalyptus xerothermica* scattered low trees over *Acacia aptaneura*, *Petalostylis labicheoides* and *Acacia catenulata* subsp. *occidentalis* tall open scrub over *Psydrax latifolia* scattered shrubs over *Triodia pungens* very open hummock grassland
Vegetation Condition: Very Good
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	60	4
Acacia catenulata subsp. *occidentalis*	3	2.8
Aristida contorta	0.1	0.3
**Bidens bipinnata*	0.1	0.2
Cheilanthes sieberi subsp. *sieberi*	0.1	0.1
Chrysopogon fallax	0.1	0.2
Duperreya commixta	0.1	0.5
Eremophila aff. *clarkei*	0.1	0.5
Eucalyptus xerothermica	1	7
Maireana villosa	0.1	0.2
Petalostylis labicheoides	4	2.7
Psydrax latifolia	1	1.1
Psydrax suaveolens	0.1	0.5
Ptilotus obovatus	0.1	0.4
Senna artemisioides subsp. *filifolia*	0.1	1.7

Name	Cover (%)	Height (m)
Solanum ferocissimum	0.1	0.2
Teucrium teucriiflorum	0.1	0.3
Triodia pungens	4	0.4

* denotes weed species

Site: GH11
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 23/05/2019 **Described by:** KMc
MGA Zone: 50 **Easting:** 707864 **Northing:** 7450439
Habitat: Hillslope
Soil: Light reddish brown Silty clay
Rock type: Ironstone
Vegetation code: H2
Vegetation: *Acacia aptaneura* and *Acacia catenulata* subsp. *occidentalis* tall shrubland over *Dodonaea pachyneura* and *Senna stricta* open shrubland over *Triodia pungens* and *Triodia wiseana* very open hummock grassland with *Eriachne mucronata* and *Paraneurachne muelleri* very open tussock grassland
Vegetation Condition: Excellent
Fire Age: Very long unburnt



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	15	5
Acacia catenulata subsp. *occidentalis*	10	6.8
Acacia mulganeura	0.1	7
Acacia rhodophloia	0.1	5
**Bidens bipinnata*	0.1	0.1
Capparis lasiantha	0.1	0.8
Cheilanthes lasiophylla	0.1	0.5
Dodonaea pachyneura	1.5	1.8
Duperreya commixta	0.1	0
Enchylaena tomentosa var. *tomentosa*	0.1	0.3
Eremophila forrestii subsp. *forrestii*	0.1	0.8
Eremophila latrobei subsp. *filiformis*	0.1	1.6
Eremophila platycalyx subsp. *pardalota*	0.1	0.9
Eriachne mucronata	1	0.2
Eucalyptus leucophloia subsp. *leucophloia*	0.1	1.1

Name	Cover (%)	Height (m)
Grevillea saxicola P3	0.5	3.5
Hibiscus burtonii	0.1	0.4
Paraneurachne muelleri	1	0.2
Psydrax suaveolens	0.1	1.1
Ptilotus obovatus	0.1	0.9
Rhagodia sp. Hamersley (M. Trudgen 17794) P3	0.1	1.8
Santalum lanceolatum	0.1	2.1
Scaevola acacioides	0.1	2.1
Senna glutinosa subsp. *× luerssenii*	0.1	1.7
Senna stricta	1.5	1.9
Solanum lasiophyllum	0.1	0.2
Tribulus suberosus	0.1	1.2
Triodia pungens	2.5	0.4
Triodia wiseana	2.5	0.4

* denotes weed species

Site: GH12
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 23/05/2019 **Described by:** DR
MGA Zone: 50 **Easting:** 705873 **Northing:** 7448322
Habitat: Hillslope
Soil: Reddish brown Clay loam
Rock type: Ironstone
Vegetation code: H11
Vegetation: *Eucalyptus gamophylla* and *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia sibirica* tall open shrubland over *Triodia vanleeuwenii* open hummock grassland
Vegetation Condition: Excellent
Fire Age: Very long unburnt



Species List:

Name	Cover (%)	Height (m)
Acacia adoxa var. *adoxa*	0.1	0.3
Acacia aptaneura	0.1	2.3
Acacia bivenosa	0.1	0.6
Acacia hilliana	0.1	0.5
Acacia inaequilatera	0.1	2.7
Acacia maitlandii	0.5	2.5
Acacia marramamba	0.1	2.4
Acacia pruinocarpa	0.1	4.5
Acacia sibirica	1	2.3
Acacia tenuissima	0.1	1.4
Amphipogon sericeus	0.5	0.2
Anthobolus leptomerioides	0.1	0.3
Aristida holathera var. *holathera*	0.1	0.2
Aristida inaequiglumis	0.1	0.3
Corymbia deserticola subsp. *deserticola*	0.1	4.5
Cymbopogon ambiguus	0.1	0.1

Name	Cover (%)	Height (m)
Duperreya commixta	0.1	0.1
Enneapogon polyphyllus	0.1	0.2
Eragrostis eriopoda	0.1	0.2
Eremophila latrobei subsp. *latrobei*	0.1	0.5
Eucalyptus gamophylla	4	5
Eucalyptus leucophloia subsp. *leucophloia*	1.5	6
Fimbristylis sp.	0.1	0.1
Goodenia stobbsiana	0.1	0.3
Goodenia triodiophila	0.1	0.1
Hakea chordophylla	0.1	0.8
Halgania gustafsenii var. *gustafsenii*	0.1	0.5
Indigofera monophylla	0.1	0.4
Jasminum didymum subsp. *lineare*	0.1	0.3
Paraneurachne muelleri	0.1	0.4
Poaceae sp.	0.1	0.1
Polycarpaea longiflora	0.1	0.2
Psydrax suaveolens	0.1	2.1
Ptilotus calostachyus	0.1	0.4
Ptilotus rotundifolius	0.1	0.5
Senna glaucifolia	0.1	1.6
Senna glutinosa subsp. *× luerssenii*	0.1	0.1
Senna glutinosa subsp. *glutinosa*	0.1	1.6
Sida arenicola	0.1	0.3
Solanum lasiophyllum	0.1	1.6
Triodia pungens	0.5	0.6
Triodia vanleeuwenii	18	0.3

Site: GH13
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 24/05/2019 **Described by:** DR
MGA Zone: 50 **Easting:** 708216 **Northing:** 7448362
Habitat: Minor drainage
Soil: Brown Clay loam
Rock type: Ironstone
Vegetation code: D8
Vegetation: *Eucalyptus xerothermica* low open woodland over *Acacia aptaneura* tall open shrubland over *Themeda triandra* open tussock grassland
Vegetation Condition: Very Good
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Abutilon fraseri subsp. *fraseri*	0.1	0.1
Acacia aptaneura	3	3.5
Alternanthera nana	0.1	0.1
**Bidens bipinnata*	0.1	0.05
Capparis lasiantha	0.1	0.2
Chrysopogon fallax	0.1	0.2
Cleome viscosa	0.1	0.1
Dipteracanthus australasicus subsp. *australasicus*	0.1	0.3
Duperreya commixta	0.1	0.3
Enneapogon caerulescens	0.1	0.1
Eucalyptus xerothermica	8	8.5
Euphorbia biconvexa	0.1	0.1
Evolvulus alsinoides var. *villosicalyx*	0.1	0.1
Goodenia stellata	0.1	0.01
Hakea lorea subsp. *lorea*	0.1	3.8
Indigofera linifolia	0.1	0.05

Name	Cover (%)	Height (m)
Maireana tomentosa subsp. *tomentosa*	0.1	0.1
**Malvastrum americanum*	0.1	0.1
Ptilotus obovatus	0.5	0.3
Sida aff. *fibulifera*	0.1	0.1
Solanum lasiophyllum	0.1	0.2
Themeda triandra	20	0.5
Triodia basedowii	0.1	0.05
Triraphis mollis	0.1	0.1
Yakirra australiensis var. *australiensis*	0.1	0.1

* denotes weed species

Site: GH15
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 24/05/2019 **Described by:** DR
MGA Zone: 50 **Easting:** 708078 **Northing:** 7448129
Habitat: Plain
Soil: Red brown Clay loam
Rock type: Ironstone
Vegetation code: P1
Vegetation: *Acacia aptaneura* and *Acacia pruinocarpa* tall open scrub over *Triodia pungens* very open hummock grassland
Vegetation Condition: Very Good
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	33	6
Acacia pruinocarpa	2	3.7
Aristida sp.	0.1	0.2
**Bidens bipinnata*	0.1	0.1
Chrysopogon fallax	0.1	0.4
Commelina ensifolia	0.1	0.2
Eremophila aff. *clarkei*	0.1	0.8
Eriachne mucronata	0.1	0.2
Maireana tomentosa subsp. *tomentosa*	0.1	0.3
Psydrax suaveolens	0.1	1.5
Ptilotus obovatus	0.1	0.4
Sida sp.	0.1	0.1
Sida sp. dark green fruits (S. van Leeuwen 2260)	0.1	0.7
Solanum lasiophyllum	0.1	0.4
Themeda triandra	0.1	0.4
Triodia basedowii	0.1	0.3

Name	Cover (%)	Height (m)
Triodia pungens	6	0.5

* denotes weed species

Site: GH17
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 25/05/2019 **Described by:** KMc
MGA Zone: 50 **Easting:** 714668 **Northing:** 7452099
Habitat: *Minor* drainage
Soil: Reddish brown Clay loam
Rock type: Ironstone
Vegetation code: D8
Vegetation: *Eucalyptus xerothermica* scattered low trees over *Acacia catenulata* subsp. *occidentalis*, *Acacia aptaneura* and *Acacia pruinocarpa* tall open scrub over *Triodia pungens* very open hummock grassland with *Themeda triandra* very open tussock grassland
Vegetation Condition: Very Good
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Abutilon sp.	0.1	0.4
Acacia aptaneura	20	5
Acacia catenulata subsp. *occidentalis*	25	8
Acacia dictyophleba	0.1	3.8
Acacia macraneura	0.1	2.2
Acacia pruinocarpa	1	2.7
Acacia pyrifolia	0.1	0.5
Alternanthera sp.	0.1	0.2
Androcalva luteiflora	0.1	1.5
**Bidens bipinnata*	0.1	0.4
Capparis lasiantha	0.1	2.7
Chrysopogon fallax	0.1	0.3
Cleome viscosa	0.1	0.4
Cymbopogon ambiguus	0.1	0.2
Dipteracanthus australasicus subsp. *australasicus*	0.1	0.3

Name	Cover (%)	Height (m)
Duperreya commixta	0.1	2
Enchylaena tomentosa var. *tomentosa*	0.1	0.8
Enneapogon lindleyanus	0.1	0.2
Eremophila forrestii subsp. *forrestii*	0.1	0.9
Eriachne mucronata	0.1	0.2
Eucalyptus leucophloia subsp. *leucophloia*	0.1	5
Eucalyptus xerothermica	1	6
Isotropis sp. Arid zone (G. Byrne 2775)	0.1	0.4
Maireana tomentosa subsp. *tomentosa*	0.1	0.2
**Malvastrum americanum*	0.1	0.3
Paraneurachne muelleri	0.1	0.1
Psydrax suaveolens	0.1	0.4
Pterocaulon sphaeranthoides	0.1	0.4
Ptilotus obovatus	0.1	0.9
Ptilotus sp.	0.1	0.3
Rhagodia eremaea	0.5	1.8
Senna artemisioides subsp. *helmsii*	0.1	1.1
Senna glutinosa subsp. *× luerssenii*	0.1	1.4
Sida aff. *fibulifera*	0.1	0.3
Themeda triandra	3	0.4
Triodia pungens	5	0.4

* denotes weed species

Site: GH19
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 25/05/2019 **Described by:** KMc
MGA Zone: 50 **Easting:** 717596 **Northing:** 7452467
Habitat: Footslope
Soil: Red brown Sandy clay loam
Rock type: Ironstone
Vegetation code: H3
Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia inaequilatera* tall open shrubland over *Triodia vanleeuwenii* open hummock grassland with *Amphipogon sericeus* scattered tussock grasses
Vegetation Condition: Excellent
Fire Age: 2-5 years



Species List:

Name	Cover (%)	Height (m)
Acacia adsurgens	0.1	0.4
Acacia bivenosa	0.1	0.3
Acacia inaequilatera	3	2.2
Amphipogon sericeus	1.5	0.3
Aristida contorta	0.1	0.2
Aristida sp.	0.1	0.5
Corchorus lasiocarpus subsp. *lasiocarpus*	0.5	0.5
Cymbopogon ambiguus	0.1	0.3
Duperreya commixta	0.1	0
Eremophila forrestii subsp. *forrestii*	0.5	1.8
Eucalyptus gamophylla	0.5	2.1
Eucalyptus leucophloia subsp. *leucophloia*	1	6
Goodenia sp.	0.1	0.1
Gossypium robinsonii	0.1	1.5
Hibiscus sturtii var. *platychlamys*	0.1	0.4

Name	Cover (%)	Height (m)
Indigofera monophylla	0.1	0.2
Paraneurachne muelleri	0.1	0.2
Ptilotus astrolasius	0.1	0.4
Ptilotus calostachyus	0.1	1.2
Ptilotus exaltatus	0.1	0.4
Ptilotus rotundifolius	0.1	1.1
Sclerolaena cornishiana	0.1	0.1
Senna artemisioides subsp. *helmsii*	0.1	0.4
Senna glutinosa subsp. *× luerssenii*	0.1	1.5
Senna glutinosa subsp. *pruinosa*	0.1	1.5
Seringia sp.	0.1	0.6
Sida arenicola	0.1	0.8
Solanum lasiophyllum	0.1	0.7
Themeda sp.	0.1	0.3
Triodia pungens	0.1	0.3
Triodia vanleeuwenii	15	0.2

Site: GH20
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 25/05/2019 **Described by:** LD
MGA Zone: 50 **Easting:** 719336 **Northing:** 7454644
Habitat: Plain
Soil: Red brown Sandy loam
Rock type: Ironstone
Vegetation code: P1
Vegetation: *Acacia pruinocarpa* open woodland over *Acacia catenulata* subsp. *occidentalis*, *Acacia aneura* and *Grevillea berryana* tall shrubland over *Sida calyxhymenia* scattered low shrubs over *Triodia wiseana* and *Triodia pungens* very open hummock grassland
Vegetation Condition: Very Good
Fire Age: Very long unburnt



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	0.5	3.5
Acacia aptaneura sens. lat.	3	6
Acacia ayersiana	0.5	5
Acacia catenulata subsp. *occidentalis*	13	7
Acacia pruinocarpa	6	11
Aristida obscura	0.1	0.3
**Bidens bipinnata*	0.1	0.1
Cheilanthes sieberi subsp. *sieberi*	0.1	0.1
Duperreya commixta	0.1	0.1
Eremophila latrobei subsp. *filiformis*	0.1	1.5
Grevillea berryana	2	6
Hibiscus burtonii	0.1	0.4
Maireana tomentosa subsp. *tomentosa*	0.1	0.1
Sida calyxhymenia	1.5	0.6
Triodia pungens	1	0.5

Name	Cover (%)	Height (m)
Triodia wiseana	5	0.6

* denotes weed species

Site: GH21
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 26/05/2019 **Described by:** DR
MGA Zone: 50 **Easting:** 718726 **Northing:** 7456934
Habitat: Clay plain
Soil: Red brown Silty clay
Rock type: Ironstone, Quartz
Vegetation code: P4
Vegetation: *Acacia pruinocarpa*, *Acacia aptaneura* and *Acacia catenulata* subsp. *occidentalis* tall shrubland
Vegetation Condition: Very Good
Fire Age: Very long unburnt
Notes: More low shrub, herb and tussock grass cover is likely in better season



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	3	5
Acacia catenulata subsp. *occidentalis*	3	6
Acacia citrinoviridis	0.1	3.8
Acacia pruinocarpa	7	5
Alternanthera sp.	0.1	0.1
Anthobolus leptomerioides	0.1	1.3
Aristida burbidgeae	0.1	0.3
Aristida obscura	0.1	0.1
**Bidens bipinnata*	0.1	0.1
Cheilanthes sieberi subsp. *sieberi*	0.1	0.1
Duperreya commixta	0.1	1
Eremophila forrestii subsp. *forrestii*	0.1	1.5
Eremophila latrobei subsp. *filiformis*	0.1	2
Grevillea berryana	2	5.5
Hakea lorea subsp. *lorea*	0.1	3.8
Hibiscus sturtii	0.1	0.2

Name	Cover (%)	Height (m)
Maireana tomentosa subsp. *tomentosa*	0.1	0.1
Ptilotus astrolasius	0.1	0.3
Ptilotus obovatus	0.1	0.3
Rhagodia eremaea	0.1	1.5
Sclerolaena cornishiana	0.1	0.1
Sida fibulifera	0.1	0.2
Sida platycalyx	0.1	0.01
Sida sp. Shovelanna Hill (S. van Leeuwen 3842)	0.1	1
Solanum lasiophyllum	0.1	0.5

* denotes weed species

Site: GH22
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 26/05/2019 **Described by:** DR
MGA Zone: 50 **Easting:** 718932 **Northing:** 7456688
Habitat: Floodplain
Soil: Reddish brown Silty clay
Rock type: Ironstone
Vegetation code: D7
Vegetation: *Acacia aptaneura* scattered tall shrubs over *Triodia longiceps* and *Triodia pungens* hummock grassland
Vegetation Condition: Very Good
Fire Age: Very long unburnt



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	1	3.8
Acacia pruinocarpa	0.5	3.5
Acacia pyrifolia	0.5	1.4
Androcalva luteiflora	0.1	1.9
Aristida obscura	0.1	0.1
**Bidens bipinnata*	0.1	0.4
Cleome viscosa	0.1	0.4
Corchorus lasiocarpus subsp. *parvus*	0.1	0.2
Cucumis variabilis	0.1	0.5
Duperreya commixta	0.1	0.8
Eremophila longifolia	0.1	1.4
Eriachne mucronata	0.1	0.2
Eulalia aurea	0.1	0.8
Euphorbia australis var. *subtomentosa*	0.1	0.05
Heliotropium tanythrix	0.1	0.1
Hibiscus sturtii	0.1	0.1

Name	Cover (%)	Height (m)
Indigofera georgei	0.1	0.3
**Malvastrum americanum*	0.1	0.4
Phyllanthus maderaspatensis	0.1	0.1
Poaceae sp.	0.1	0.05
Psydrax suaveolens	0.1	0.4
Pterocaulon sp.	0.1	0.4
Ptilotus astrolasius	0.1	0.3
Ptilotus obovatus	0.1	0.5
Rhagodia eremaea	0.1	0.5
Sclerolaena cornishiana	0.1	0.3
Senna artemisioides subsp. *oligophylla*	0.5	1.1
Sida fibulifera	0.1	0.2
Solanum lasiophyllum	0.1	0.4
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	0.1	0.5
Triodia longiceps	51	1.1
Triodia pungens	9	0.6

* denotes weed species

Site: GH23
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 26/05/2019 **Described by:** DR
MGA Zone: 50 **Easting:** 719018 **Northing:** 7456448
Habitat: Minor creek
Soil: Reddish brown Silty clay loam
Rock type: Ironstone, Quartz
Vegetation code: D4
Vegetation: *Acacia citrinoviridis* tall shrubland over *Corchorus lasiocarpus* subsp. *lasiocarpus* open shrubland over *Triodia longiceps* and *Triodia pungens* very open hummock grassland
Vegetation Condition: Very Good
Fire Age: Very long unburnt



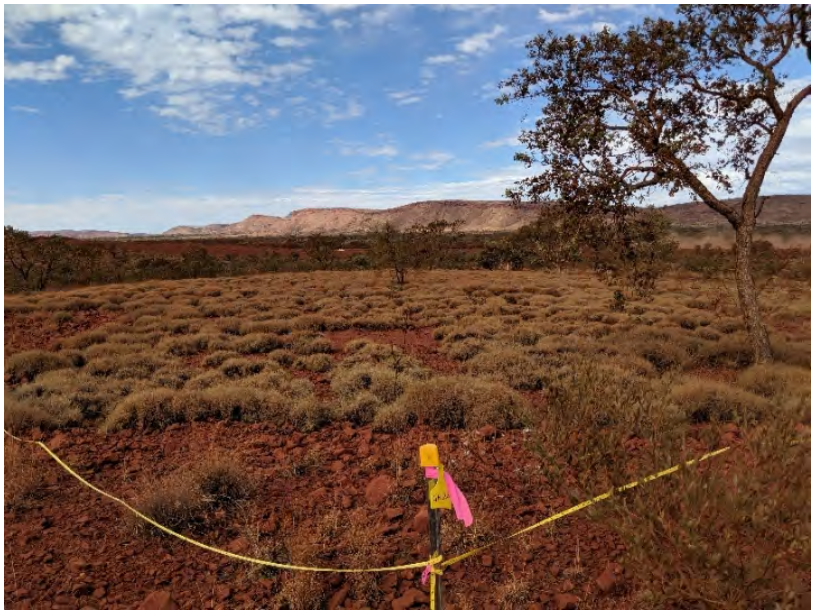
Species List:

Name	Cover (%)	Height (m)
Acacia citrinoviridis	27	7
Acacia pruinocarpa	0.1	6
Acacia pyrifolia	0.1	0.5
Acacia sp.	0.1	0.1
Alternanthera nana	0.1	0.1
Atalaya hemiglauca	0.5	3.8
**Bidens bipinnata*	0.1	0.6
Cleome viscosa	0.1	0.4
Corchorus lasiocarpus subsp. *lasiocarpus*	3	1.3
Cymbopogon ambiguus	0.1	0.3
Dicladanthera forrestii	0.1	0.1
Duperreya commixta	0.1	0.5
Enneapogon lindleyanus	0.1	0.2
Eriachne pulchella subsp. *dominii*	0.1	0.05
Eriachne tenuiculmis	0.1	0.2
Eucalyptus victrix	0.5	11

Name	Cover (%)	Height (m)
Eulalia aurea	0.1	0.3
Goodenia sp.	0.1	0.1
Heliotropium tanythrix	0.1	0.1
Hybanthus aurantiacus	0.1	0.1
Isotropis sp. Arid zone (G. Byrne 2775)	0.1	0.8
Lepidium sp.	0.1	0.1
**Malvastrum americanum*	0.1	0.1
Phyllanthus maderaspatensis	0.1	0.1
Polycarpaea corymbosa var. *corymbosa*	0.1	0.2
Ptilotus astrolasius	0.1	0.4
Rhagodia eremaea	0.1	1.7
Rhynchosia minima	0.1	0.2
Santalum spicatum	0.1	3
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	0.1	0.5
Themeda triandra	0.1	0.3
Triodia longiceps	3	0.9
Triodia pungens	2	0.3
Waltheria indica	0.1	0.2

* denotes weed species

Site: GH24
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 27/05/2019 **Described by:** KMc
MGA Zone: 50 **Easting:** 713803 **Northing:** 7452985
Habitat: Footslope
Soil: Reddish brown Silty clay loam
Rock type: Ironstone
Vegetation code: H8
Vegetation: *Corymbia deserticola* subsp. *deserticola* and *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Triodia vanleeuwenii* and *Triodia pungens* hummock grassland
Vegetation Condition: Good
Fire Age: Very long unburnt



Species List:

Name	Cover (%)	Height (m)
Acacia adsurgens	0.1	0.8
Acacia bivenosa	0.1	1.1
Acacia inaequilatera	0.5	3
Acacia tenuissima	0.1	1.6
Acacia tumida var. *pilbarensis*	0.1	1.9
Amphipogon sericeus	0.1	0.4
Aristida sp.	0.1	0.4
Corymbia deserticola subsp. *deserticola*	1.5	5.5
Cymbopogon ambiguus	0.1	0.3
Duperreya commixta	0.1	1.8
Eriachne mucronata	0.1	0.3
Eucalyptus gamophylla	0.1	3
Eucalyptus leucophloia subsp. *leucophloia*	1	6.5
Fimbristylis sp.	0.1	0.05
Goodenia stobbsiana	0.1	0.2
Goodenia triodiophila	0.1	0.4

Name	Cover (%)	Height (m)
Hakea chordophylla	0.1	3
Indigofera monophylla	0.1	0.6
Peripleura obovata	0.1	0.5
Ptilotus calostachyus	0.1	0.5
Ptilotus rotundifolius	0.1	0.5
Senna artemisioides subsp. *oligophylla*	0.1	1.2
Senna glutinosa subsp. *× luerssenii*	0.1	1.2
Themeda sp. Mt Barricade (M.E. Trudgen 2471)	0.1	0.5
Triodia pungens	1	0.8
Triodia vanleeuwenii	38	0.3

Site: GH25
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 28/05/2019 **Described by:** KMc
MGA Zone: 50 **Easting:** 718388 **Northing:** 7455089
Habitat: Floodplain
Soil: Dark reddish brown Clay loam
Rock type: Ironstone
Vegetation code: D7
Vegetation: *Eucalyptus xerothermica* low open woodland over *Acacia citrinoviridis*, *Acacia pruinocarpa* and *Acacia aptaneura* tall shrubland over *Triodia longiceps* hummock grassland
Vegetation Condition: Very Good
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	2	3
Acacia bivenosa	0.1	1.9
Acacia citrinoviridis	8	3.5
Acacia pruinocarpa	3	3.2
Acacia pyrifolia	0.1	1.2
Acacia tetragonophylla	0.1	3
Androcalva luteiflora	0.1	1
Aristida contorta	0.1	0.1
Capparis lasiantha	0.1	0.8
Cleome viscosa	0.1	0.3
Duperreya commixta	0.1	1
Enchylaena tomentosa var. *tomentosa*	0.1	0.9
Eremophila longifolia	0.1	1.8
Eucalyptus xerothermica	3	8
Hakea lorea subsp. *lorea*	0.1	3.5
Hibiscus sturtii	0.1	0.05

Name	Cover (%)	Height (m)
Indigofera georgei	0.1	0.5
Maireana tomentosa subsp. *tomentosa*	0.1	0.3
**Malvastrum americanum*	0.1	0.4
Paraneurachne muelleri	0.1	0.3
Ptilotus obovatus	0.1	0.8
Rhagodia eremaea	0.1	1.1
Salsola australis	0.1	0.2
Senna artemisioides subsp. *helmsii*	0.1	1.5
Senna artemisioides subsp. *oligophylla*	0.1	0.9
Sida fibulifera	0.1	0.2
Solanum lasiophyllum	0.1	0.7
Themeda triandra	0.1	0.7
Triodia longiceps	40	1

* denotes weed species

Site: GH26
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 28/05/2019 **Described by:** KMc
MGA Zone: 50 **Easting:** 718084 **Northing:** 7455393
Habitat: Plain
Soil: Reddish brown Silty clay loam
Rock type: Ironstone
Vegetation code: P4
Vegetation: *Eucalyptus xerothermica* scattered low trees over *Eremophila longifolia*, *Acacia pruinocarpa* and *Acacia catenulata* subsp. *occidentalis* tall closed scrub
Vegetation Condition: Very Good
Fire Age: >10 years

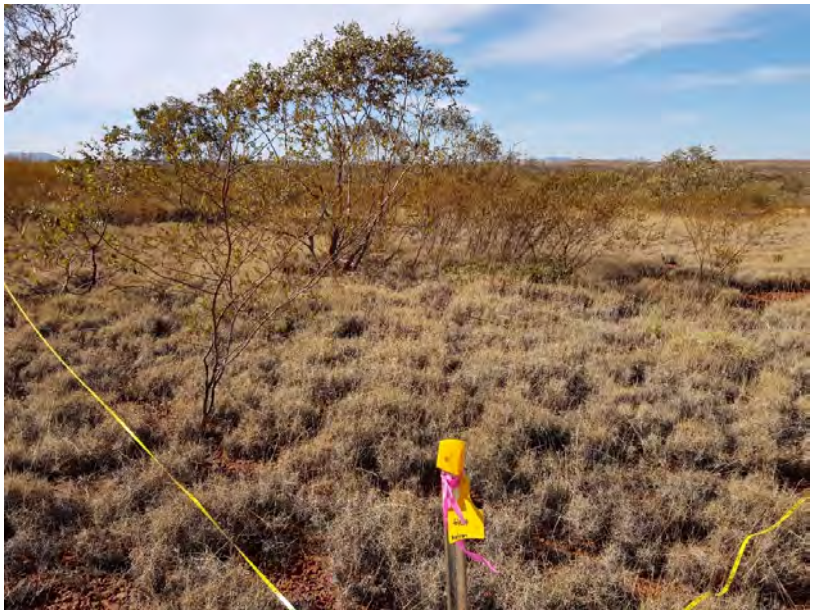


Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	0.5	4
Acacia aptaneura sens. lat.	0.1	2
Acacia catenulata subsp. *occidentalis*	1	5
Acacia macraneura	0.1	1
Acacia pruinocarpa	3	4
Anthobolus leptomerioides	0.1	0.5
Aristida contorta	0.1	0.1
Aristida ingrata	0.1	1
Cheilanthes sieberi subsp. *sieberi*	0.1	0.2
Cleome viscosa	0.1	0.3
Cymbopogon ambiguus	0.1	0.2
Duperreya commixta	0.1	0.6
Enchylaena tomentosa var. *tomentosa*	0.1	0.4
Enneapogon lindleyanus	0.1	0.5
Eremophila forrestii subsp. *forrestii*	0.1	0.6
Eremophila longifolia	0.1	2.1

Name	Cover (%)	Height (m)
Eucalyptus xerothermica	1	6
Evolvulus alsinoides var. *villosicalyx*	0.1	0.2
Glycine canescens	0.1	0.05
Hibiscus sturtii	0.1	0.2
Maireana tomentosa subsp. *tomentosa*	0.1	0.2
Paraneurachne muelleri	0.1	0.3
Ptilotus obovatus	0.1	0.4
Rhagodia eremaea	0.5	1.1
Salsola australis	0.1	0.2
Sclerolaena cornishiana	0.1	0.1
Sida calyxhymenia	0.1	1.3
Sida fibulifera	0.1	0.1
Sida platycalyx	0.1	0.05
Solanum lasiophyllum	0.1	0.2
Themeda triandra	0.1	0.4

Site: GH27
Location: HD2 Detailed Survey Area **Type:** Quadrat
Phase 3 Date: 29/05/2019 **Described by:** DR
MGA Zone: 50 **Easting:** 702178 **Northing:** 7447593
Habitat: Riseslope
Soil: Red brown Silty clay loam
Rock type: Ironstone
Vegetation code: H11
Vegetation: *Eucalyptus gamophylla* and *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia pachyacra* scattered tall shrubs over *Acacia hilliana* scattered low shrubs over *Triodia vanleeuwenii* and *Triodia wiseana* hummock grassland
Vegetation Condition: Excellent
Fire Age: Very long unburnt



Species List:

Name	Cover (%)	Height (m)
Acacia adoxa var. *adoxa*	0.5	0.5
Acacia adsurgens	0.1	2
Acacia bivenosa	0.1	1.5
Acacia hamersleyensis	0.1	1.9
Acacia hilliana	1	0.7
Acacia maitlandii	0.5	2.2
Acacia pachyacra	1	2.1
Capparis lasiantha	0.1	1
Dodonaea lanceolata var. *lanceolata*	0.1	1.8
Eucalyptus gamophylla	5	5
Eucalyptus leucophloia subsp. *leucophloia*	1	6
Gompholobium oreophilum	0.1	0.5
Hakea chordophylla	0.1	4
Halgania gustafsenii var. *gustafsenii*	0.1	0.4
Indigofera monophylla	0.1	0.3

Name	Cover (%)	Height (m)
Themeda triandra	0.1	0.6
Triodia vanleeuwenii	49	0.4
Triodia wiseana	6	0.5

Site: GHR10
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 3 Date: 23/05/2019 **Described by:** DR
MGA Zone: 50 **Easting:** 702598 **Northing:** 7448426
Habitat: Gorge
Soil: Reddish brown Sandy loam
Rock type: Ironstone
Vegetation code: D3
Vegetation: *Corymbia ferriticola* low open woodland over *Dodonaea pachyneura* tall open shrubland over *Triodia pungens* very open hummock grassland with *Eriachne mucronata* scattered tussock grasses
Vegetation Condition: Excellent
Fire Age: >10 years
Notes: 15x166 m



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	0.1	1
Acacia hamersleyensis	0.5	5.5
Acacia monticola	0.1	3
Acacia mulganeura	0.5	5.5
Aristida burbidgeae	0.1	0.4
Bulbostylis barbata	0.1	0.3
Capparis lasiantha	0.1	0.6
Clerodendrum tomentosum var. *lanceolatum*	0.1	0.1
Corymbia ferriticola	9	7
Cymbopogon ambiguus	0.5	0.5
Dodonaea pachyneura	4	2.2
Dodonaea viscosa subsp. *spatulata*	0.1	2.2
Duperreya commixta	0.1	0.2
Eremophila jucunda subsp. *pulcherrima*	0.1	1.2
Eriachne mucronata	1.5	0.3

Name	Cover (%)	Height (m)
Eucalyptus leucophloia subsp. *leucophloia*	0.5	6
Ficus brachypoda	0.1	1.8
Gossypium robinsonii	0.1	2
Grevillea wickhamii subsp. *hispidula*	0.1	2.8
Indigofera fractiflexa subsp. *fractiflexa*	0.1	0.2
Indigofera georgei	0.1	0.1
Jasminum didymum subsp. *lineare*	0.1	0.8
Petalostylis labicheoides	0.1	3.6
Psydrax latifolia	0.1	0.3
Pterocaulon sp.	0.1	0.2
Sida sp. Shovelanna Hill (S. van Leeuwen 3842)	0.1	0.3
Solanum cleistogamum	0.1	0.05
Themeda triandra	0.1	0.4
Triodia pungens	9	0.3
Vigna lanceolata var. *lanceolata*	0.1	0.1

Site: GHR16
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 3 Date: 24/05/2019 **Described by:** DR
MGA Zone: 50 **Easting:** 709786 **Northing:** 7451537
Habitat: Breakaway
Soil: Red brown Silty clay loam
Rock type: Ironstone
Vegetation code: H6
Vegetation: *Acacia catenulata* subsp. *occidentalis*, *Grevillea saxicola* P3 and *Grevillea berryana* tall shrubland over *Triodia pungens* very open hummock grassland with *Amphipogon sericeus* scattered tussock grasses
Vegetation Condition: Excellent
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Acacia catenulata subsp. *occidentalis*	8	5.5
Acacia pruinocarpa	0.1	3.7
Amphipogon sericeus	1	0.5
Amyema sp.	0.1	0
Capparis lasiantha	0.1	1.2
Corymbia hamersleyana sens lat.	0.1	4.5
Eremophila forrestii subsp. *forrestii*	0.1	0.5
Eremophila latrobei subsp. *filiformis*	0.1	1.9
Eriachne lanata	0.1	0.2
Eriachne mucronata	0.5	0.2
Eucalyptus leucophloia subsp. *leucophloia*	0.1	5.8
Grevillea berryana	1	2.2
Grevillea saxicola P3	3	8
Psydrax suaveolens	0.1	3
Rhagodia eremaea	0.1	1
Triodia pungens	4	0.4

Name	Cover (%)	Height (m)
Triodia vanleeuwenii	0.1	0.3

Site: GHR28
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 3 Date: 29/05/2019 **Described by:** DR
MGA Zone: 50 **Easting:** 702014 **Northing:** 7447685
Habitat: Minor drainage
Soil: Red brown Silty clay loam
Rock type: Ironstone
Vegetation code: D1
Vegetation: *Corymbia hamersleyana* sens. lat. and *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia monticola*, *Acacia maitlandii* and *Santalum lanceolatum* tall shrubland over *Triodia pungens* and *Triodia wiseana* very open hummock grassland with *Themeda triandra* very open tussock grassland
Vegetation Condition: Excellent
Fire Age: Very long unburnt



Species List:

Name	Cover (%)	Height (m)
Acacia adoxa var. *adoxa*	0.1	0.7
Acacia hamersleyensis	0.1	2.1
Acacia maitlandii	5	2.8
Acacia monticola	15	3.5
Acacia pachyacra	0.1	0.5
Acacia pyrifolia	0.1	0.4
Androcalva luteiflora	0.5	1.7
Capparis lasiantha	0.1	1
Cassytha capillaris	0.1	0.2
Corymbia hamersleyana sens lat.	4	6.5
Cymbopogon ambiguus	0.1	0.8
Dipteracanthus australasicus subsp. *australasicus*	0.1	0.3
Dodonaea lanceolata var. *lanceolata*	0.1	1.6
Dodonaea pachyneura	0.1	0.7
Duperreya commixta	0.1	1

Name	Cover (%)	Height (m)
Eremophila jucunda subsp. *pulcherrima*	0.1	0.6
Eremophila latrobei subsp. *filiformis*	0.1	0.7
Eriachne tenuiculmis	0.1	0.5
Eucalyptus leucophloia subsp. *leucophloia*	2	6
Gossypium robinsonii	0.1	2.8
Indigofera fractiflexa subsp. *fractiflexa*	0.1	1
Jasminum didymum subsp. *lineare*	0.1	0.8
Paraneurachne muelleri	0.1	0.3
Petalostylis labicheoides	0.1	1.6
Santalum lanceolatum	2	2.1
Senna glutinosa subsp. *glutinosa*	0.1	0.8
Sida sp. Articulation below (A.A. Mitchell PRP 1605)	0.1	0.5
Sida sp. Excedentifolia (J.L. Egan 1925)	0.1	0.2
Themeda triandra	3	0.7
Triodia pungens	6	0.3
Triodia wiseana	3	0.4

Site: GHR30
Location: HD2 Detailed Survey Area **Type:** Relevé
Phase 3 Date: 29/05/2019 **Described by:** KMc
MGA Zone: 50 **Easting:** 707880 **Northing:** 7450520
Habitat: Hillslope
Soil: Reddish brown Silty clay loam
Rock type: Ironstone
Vegetation code: H4
Vegetation: *Triodia wiseana* closed hummock grassland
Vegetation Condition: Excellent
Fire Age: Very long unburnt



Species List:

Name	Cover (%)	Height (m)
Acacia pachyacra	0.1	0.9
Acacia pruinocarpa	0.1	0.7
Amphipogon sericeus	0.1	0.2
Cymbopogon ambiguus	0.1	0.3
Enneapogon lindleyanus	0.1	0.5
Eremophila latrobei subsp. *filiformis*	0.1	1.2
Eriachne mucronata	0.1	0.2
Eucalyptus leucophloia subsp. *leucophloia*	0.1	1.4
Lepidium sp.	0.1	0.3
Maireana georgei	0.1	0.4
Maireana tomentosa subsp. *tomentosa*	0.1	0.3
Ptilotus obovatus	0.1	0.9
Ptilotus rotundifolius	0.1	0.8
Scaevola acacioides	0.1	1.1
Senna artemisioides subsp. *oligophylla*	0.1	0.9
Senna glaucifolia	0.1	1.2
Senna glutinosa subsp. *× luerssenii*	0.1	1.5

Name	Cover (%)	Height (m)
Senna glutinosa subsp. *glutinosa*	0.1	1.4
Senna glutinosa subsp. *pruinosa*	0.1	1.6
Senna stricta	0.1	0.8
Tribulus suberosus	0.1	0.6
Triodia wiseana	71	0.5

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Appendix J: Vegetation Condition Mapping

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695000 700000 705000 710000 715000 720000

7460000 7455000 7450000 7445000

Map Extent
Survey Area

Vegetation Condition

Excellent
Very Good
Good
Completely Degraded

J.1 J.2 J.3 J.4 J.5 J.6 J.7 J.8 J.9 J.10 J.11 J.12 J.13 J.14 J.15 J.16 J.17 J.18 J.19 J.20 J.21 J.22 J.23 J.24 J.25 J.26

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Hope Downs 2 Proposal – Flora and Vegetation Survey

Figure J: Vegetation condition mapping - Overview

Scale: 1:80,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 07-10-2019 | Figure Ref: 14292A-19-BIDR-3RevB_191107_VegCond_FigJ_Overview

694000 695000 696000 697000

7447000

7446000

7445000

J.20 J.21 J.17 J.22 J.10 J.15 J.18 J.23 J.25 J.6 J.11 J.16 J.19 J.24 J.26 J.3 J.7 J.12 J.1 J.4 J.8 J.13 J.2 J.5 J.9 J.14

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Figure J.1: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

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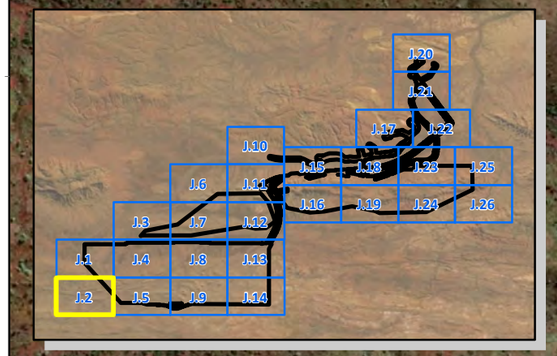
694000
695000
696000
697000
7444000
7443000



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure J.2: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 07-11-2019 | Figure Ref: 14292A-19-BIDR-3RevB_191107_VegCond_FigJ

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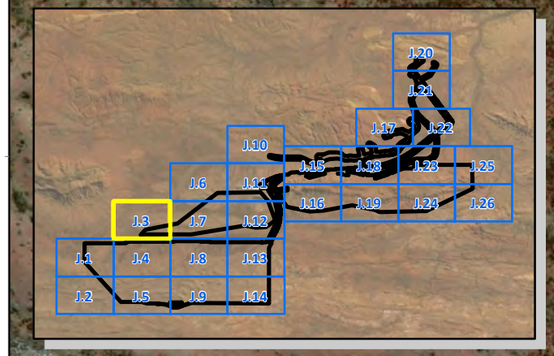

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure J.3: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 07-11-2019 Figure Ref: 14292A-19-BIDR-3RevB_191107_VegCond_FigJ

697000 698000 699000 700000

7447000

7446000

7445000

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, EarthStar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 2 Proposal – Flora and Vegetation Survey

Figure J.4: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

Metres

0 100 200 300 400 500

N

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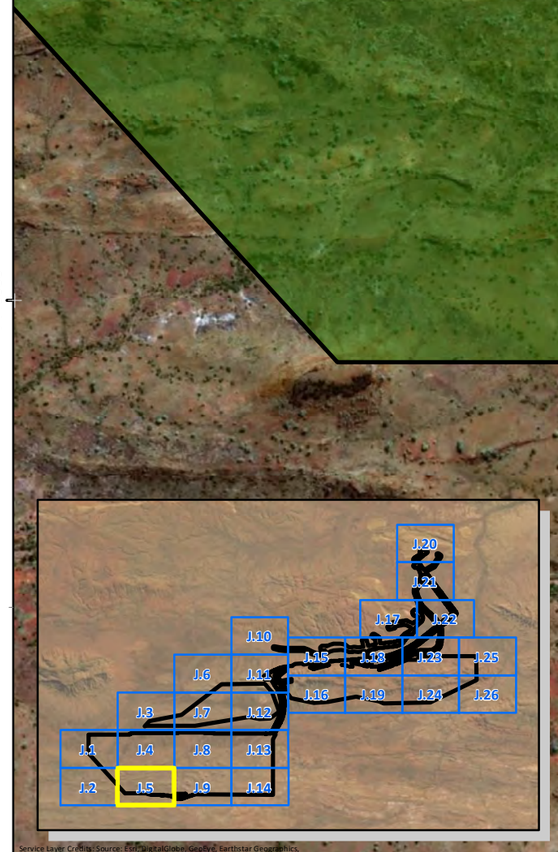
Author: B. Eckermann | Drawn: C. Dyde | Date: 07-11-2019 | Figure Ref: 14292A-19-BIDR-3RevB_191107_VegCond_FigJ

697000 698000 699000 700000

7444000

7443000



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure J.5: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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7451000
7450000

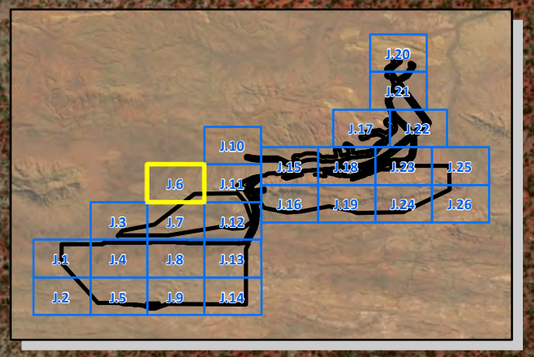

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Figure J.6: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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701000 702000 703000 704000

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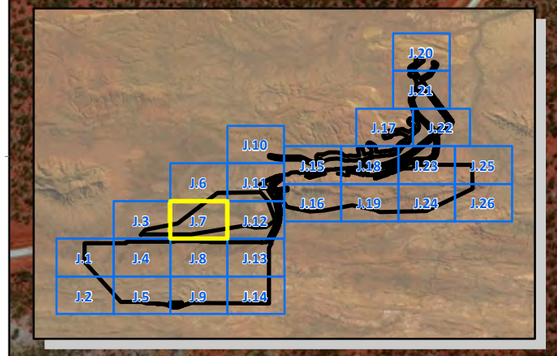

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Figure J.7: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

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Figure J.8: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

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Figure J.9: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

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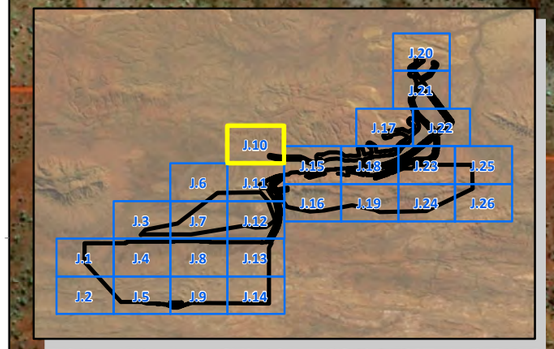

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Figure J.10: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

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Figure J.11: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

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Figure J.12: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

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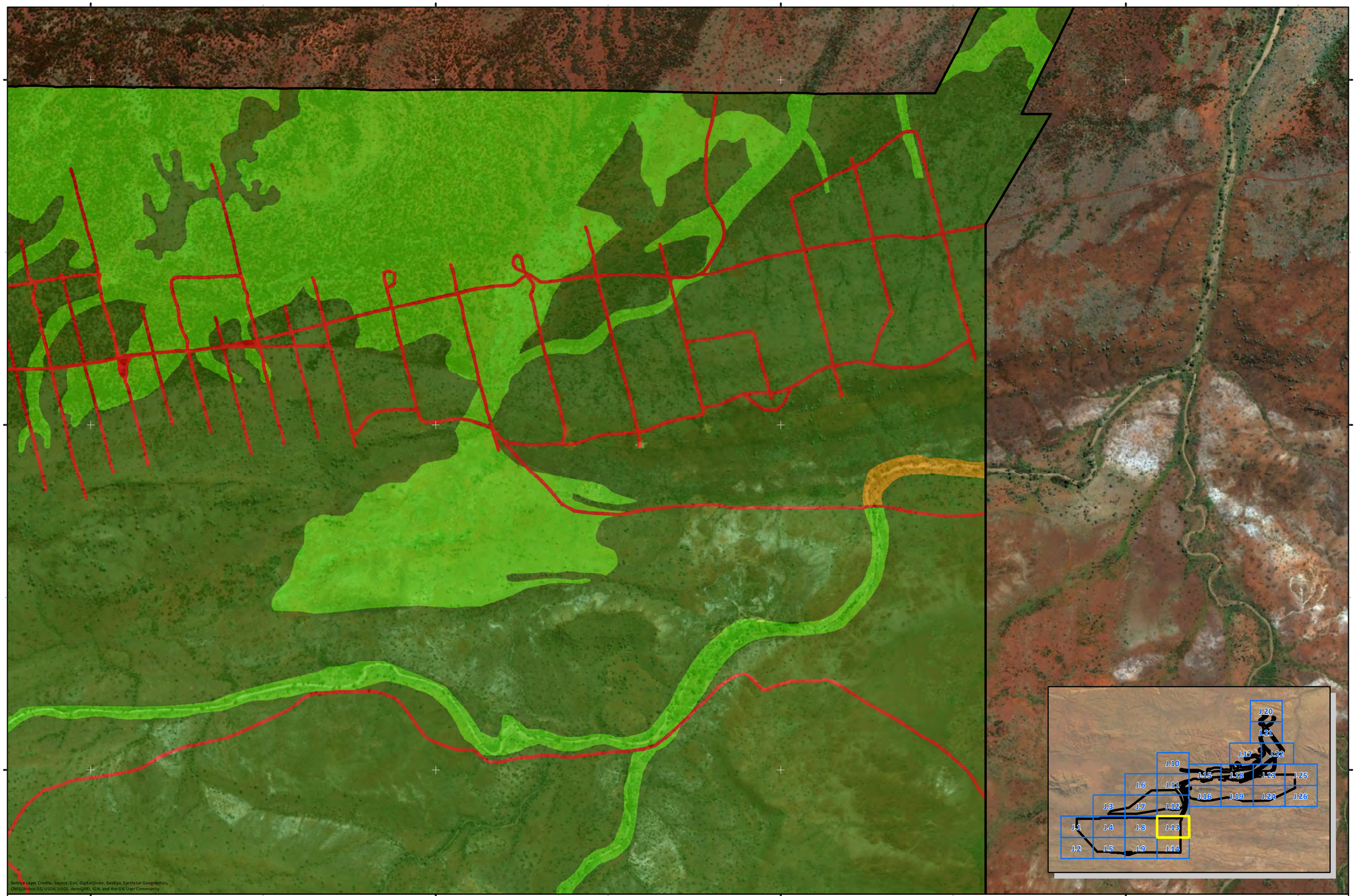

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Figure J.13: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

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Figure J.14: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

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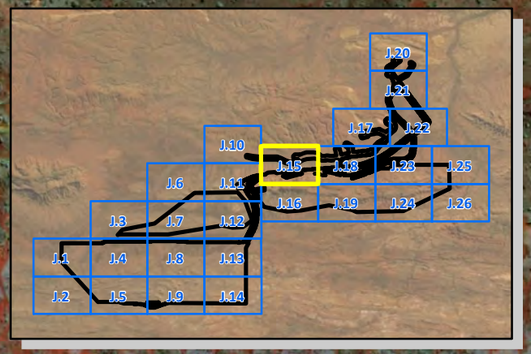

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Figure J.15: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

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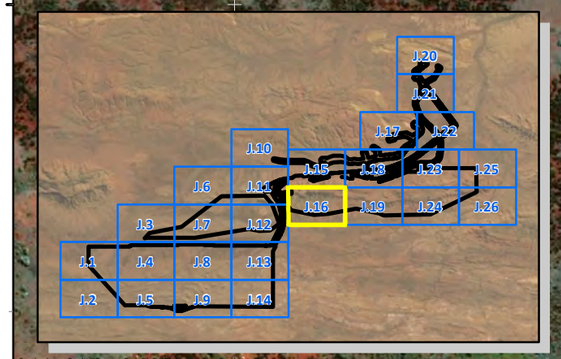

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Figure J.16: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

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Figure J.17: Vegetation condition mapping
Scale: 1:10,000 at A3
Coordinate System: GDA 1994 MGA Zone 50
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Author: B. Eckermann
Drawn: C. Dyde
Date: 07-11-2019
Figure Ref: 14292A-19-BIDR-3RevB_191107_VegCond_FigJ

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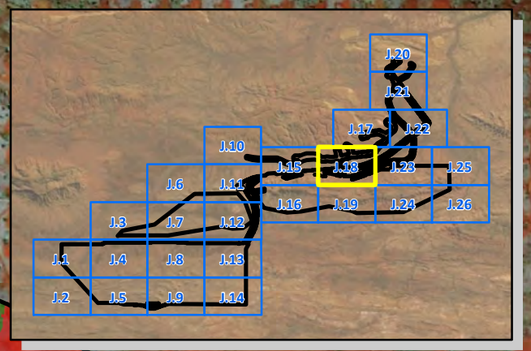

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Figure J.18: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

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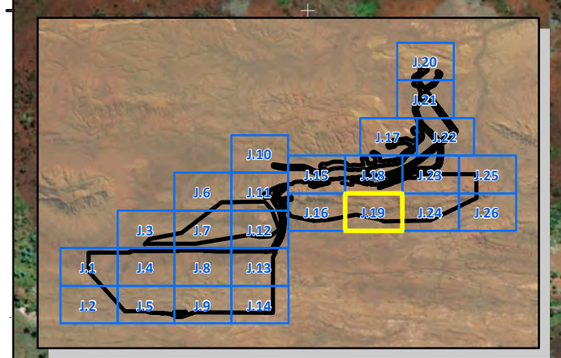

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Figure J.19: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

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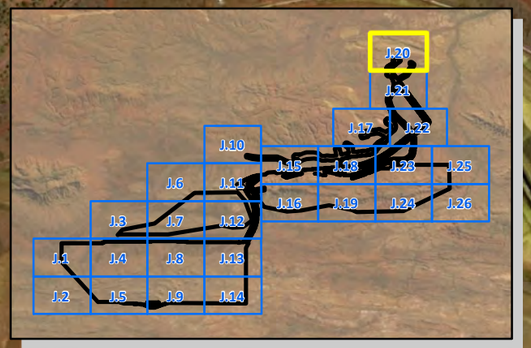

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure J.20: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

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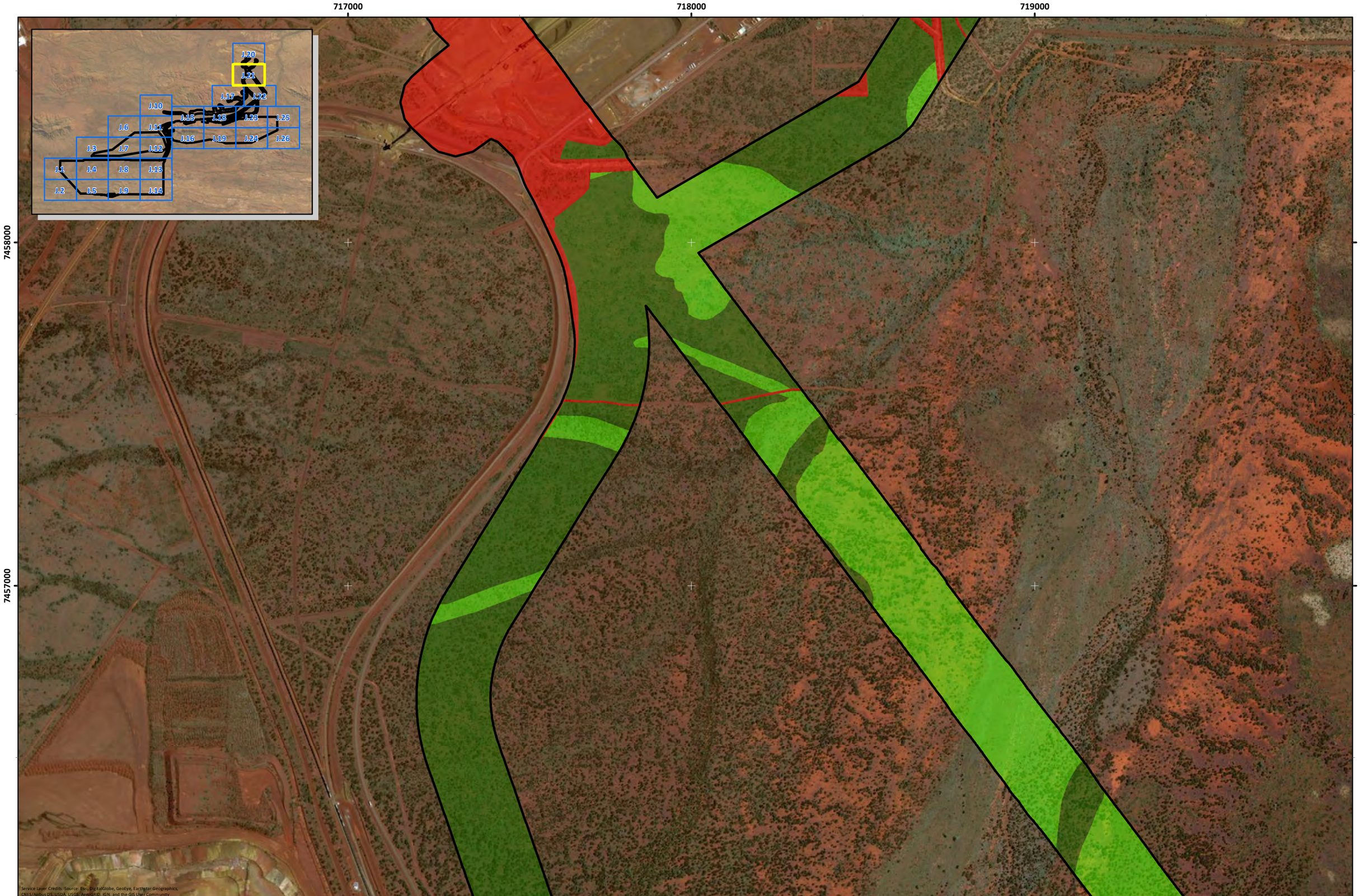

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Figure J.21: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

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Figure J.22: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

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Author: B. Eckermann Drawn: C. Dyde Date: 07-11-2019 Figure Ref: 14292A-19-BIDR-3RevB_191107_VegCond_FigJ

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Figure J.23: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

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Author: B. Eckermann | Drawn: C. Dyde | Date: 07-11-2019 | Figure Ref: 14292A-19-BIDR-3RevB_191107_VegCond_FigJ

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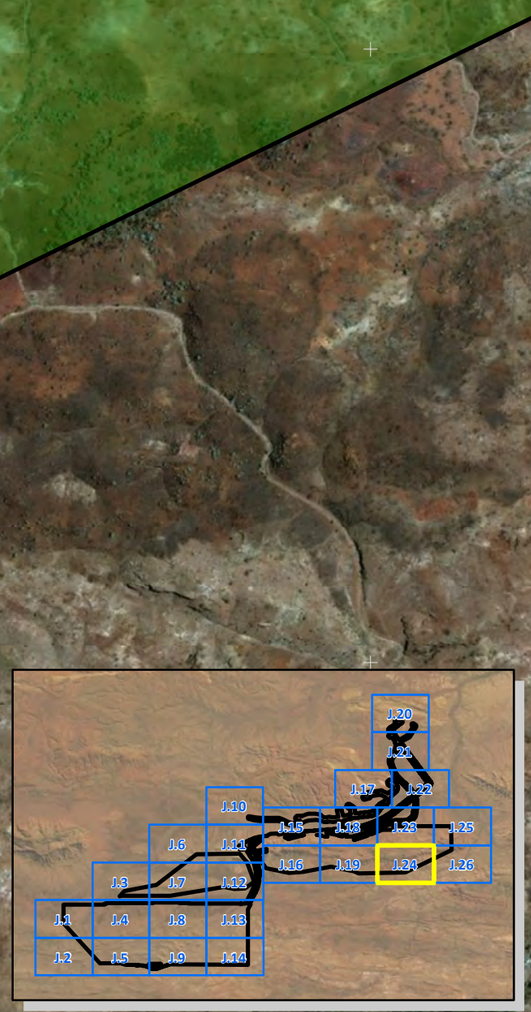

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Figure J.24: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

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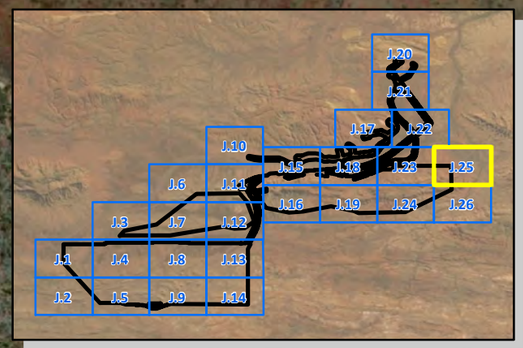



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Figure J.25: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

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Figure J.26: Vegetation condition mapping

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

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Appendix K: Floristic Analysis

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1 Floristic Analysis

1.1 Sampling Effort

Sampling effort was assessed using a species accumulation curve and modelled estimates of the total species pool. Species accumulation curves are created by randomly sampling an incremental number of samples, and plotting the mean number of species sampled at each sample size. Species estimators are particular statistical models of species accumulation which are used to estimate the total species pool available. Four different species estimators were compared: Chao 2, Jackknife 1, Jackknife 2, and Bootstrap (Colwell and Coddington 1994). All analysis was performed in R 3.6.0 (R Development Core Team 2015) using the package 'Vegan'.

1.2 Vegetation Classification

Similarity amongst vegetation sites was assessed using a dendrogram which was based on Sorensen's index of Similarity (equivalent to Bray-Curtis similarity when applied to presence-absence data). The dendrogram was constructed using the UPGMA (Unweighted Pair Group Method with Arithmetic Mean) method (or 'group average' method), within Primer. Significant clusters of samples were identified using the Simprof test (Clarke, Somerfield, and Gorley 2008). In order to understand the current survey in regional context, a separate analysis was carried out with permanent sites from five previous surveys in the locality (Biota Environmental Sciences 2006; Mattiske Consulting 2008, 2009, 2010; Ecologia Environment 2013).

1.3 Floristic Community Groups

1.3.1 Sampling Effort

A total of 397 taxa from the Astron surveys were included in the floristic analysis. Quadrat and relevé data from the Phase 1, Phase 2 and Phase 3 surveys were included (opportunistic records were excluded), names not confirmed to species level and hybrids were removed from the analysis. The species accumulation curve indicates that the total number of species has reached an asymptote, and that sampling has been near-exhaustive (Figure K.1). This is highlighted by the fact that the final 10% increase in sampling effort only led to a 3% increase in species sampled.

The species estimators suggest that there were between 438 and 520 species available in the pool at the time of the surveys. This suggests that between 76% and 90% of the total species pool has been sampled from quadrats and relevés (Table K.1). Including opportunistic observations, 435 confirmed species were recorded within the survey area, indicating that between 84% and 99% of the potential total species pool available at the time of the surveys were recorded.

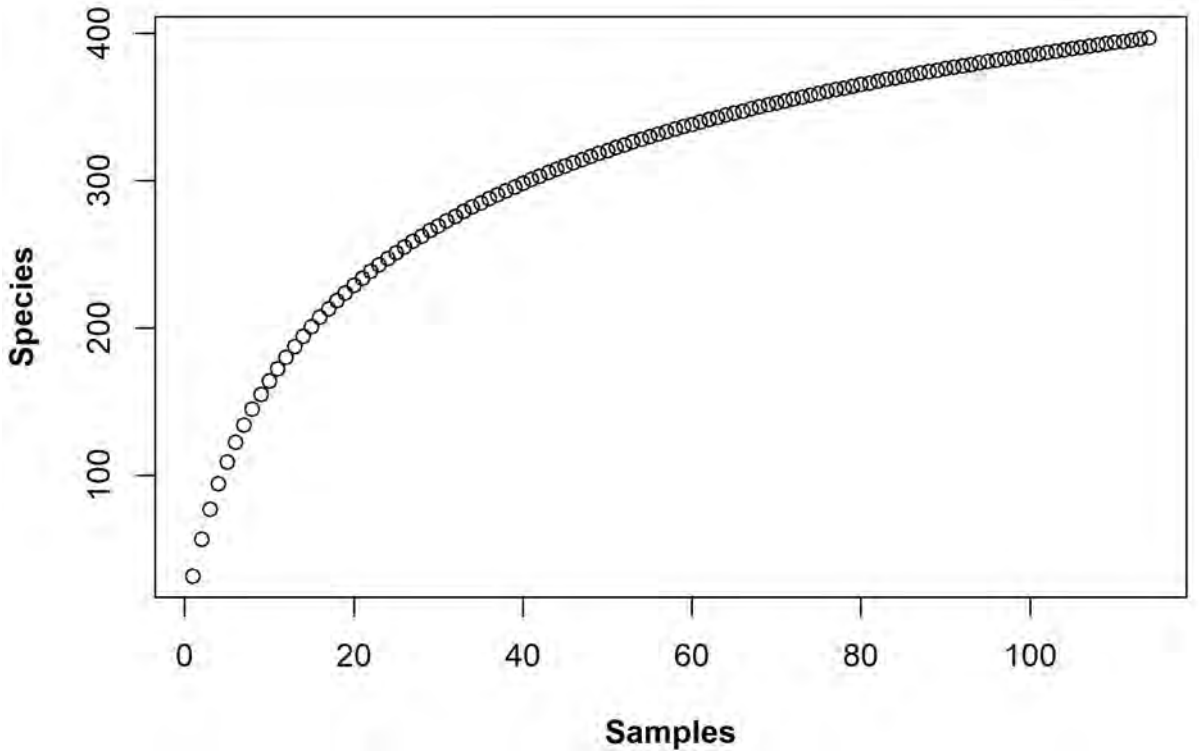

Figure K.1: Species accumulation curve for all Astron quadrats and relevés surveyed.

Table K.1: Total number of taxa sampled in comparison to estimates of the total species pool based on several models.

	Observed	Chao2	Jackknife 1	Jackknife 2	Bootstrap
Number of species	397	472	483	520	438
Estimated % of total flora sampled	-	84	82	76	90

1.3.2 Vegetation Classification

Prior to analysis, the species lists from all projects used in the analyses were reconciled to provide consistency in nomenclature. For instance, changes were made for current taxonomic revision; all mulga taxa were grouped as *Acacia aneura* sens. lat. and where multiple variants or subspecies were recorded within a species, these were reduced to the species level. Where possible, names were corrected for previous identification errors and any taxa not confirmed to species level were removed from the analyses (Table K.2). Singletons (species recorded from only one site) were retained. Some of the datasets (Mattiske Consulting 2008, 2009, 2010; Ecologia Environment 2013) listed a number of taxa which had questionable identification. Any obvious nomenclature errors were corrected where possible (Table K.2), however where there were doubts as to a correct identification, vetting of species data involved removing the taxon from the analysis dataset or assigning it a likely new name (Mattiske Consulting 2008, 2009, 2010; Ecologia Environment 2013).

1.3.2.1 Detailed survey area

Dendrogram production was combined with the Simprof statistical test using two separate datasets, the square-root transformed percentage foliar cover (PFC) data of perennial native taxa and the presence/absence of perennial native taxa from 99 quadrats and relevés occurring in the survey area. This led to the identification of 23 significant clusters for the PFC data (Figure K.2), with eight being formed by individual sites: BHD05-AR, GH13, HD16, HD29, HD42, HD44, HDR07 and HDR14. The presence/absence dataset presented 21 significant clusters (Figure K.3), with eight being formed by individual sites: GH06, GH13, GH23, HD16, HD21, HD29, HD33, and HDR07. Clusters generally showed some pattern of grouping according to the structural vegetation units described within the survey area and related to similar landforms.

The presence/absence data of perennial native taxa within the 99 quadrats and relevés from the current survey were combined with a further 757 permanent sites from a selection of projects from the surrounding area to provide a broader regional context (Biota Environmental Sciences 2006; Mattiske Consulting 2008, 2009, 2010; Ecologia Environment 2013; Biota Environmental Sciences 2014). Multivariate floristic analysis of this combined dataset led to identification of 118 significant clusters of sites (Figure K.4a). Twelve of the significant clusters were made up exclusively from sites within the current survey. Of these clusters, five were formed by an individual site: GH23, GH34, GH36, GH37, HD29; three were formed by two sites: GH33 and GH38, HD06 and HD37, GH03 and GH32; two were formed by three sites: GH08, HD09 and HD30; and HD19, HD47 and GH05.

Table K.2: Changes made to species names within the broader regional dataset prior to use in the floristic analysis.

Species name as reported	Species name used in analysis	Removed for analysis	Astron (2018)	Astron (2019)	Biota (2006)	Biota (2014)	Mattiske (2008)	Mattiske (2009)	Mattiske (2010)	Ecologia (2013)
Abutilon aff. sp. Dioicum (A.A. Mitchell PRP 1618)	N/A	Y				X				
Abutilon ?*cunninghamii*	N/A	Y								X
Abutilon ?*dioicum*	N/A	Y								X
Abutilon dioicum	*Abutilon* sp. Dioicum (A.A. Mitchell PRP 1618)						X			X
Abutilon ?*fraseri*	N/A	Y								X
Abutilon fraseri subsp. *fraseri*	*Abutilon fraseri*			X						X
Abutilon ?*lepidum*	N/A	Y	X							X
Abutilon sp.	N/A	Y		X			X			
Abutilon sp. (indet.)	N/A	Y								X
Abutilon trudgenii	*Abutilon* sp. Pilbara (W.R. Barker 2025)									X
Acacia aff. *aneura*	*Acacia aneura* sens. lat.					X				
Acacia aff. *aneura* (grey flat recurved tips; MET 15,828)	*Acacia aneura* sens. lat.				X					
Acacia aff. *aneura* (long, flat, recurved; FMR 35.3)	*Acacia aneura* sens. lat.				X					
Acacia aff. *aneura* (narrow fine veined; site 1259)	*Acacia aneura* sens. lat.				X					
Acacia aff. *aneura* (scythe-shaped; MET 15,743)	*Acacia aneura* sens. lat.				X					
Acacia aff. *aneura* (subterete long; site 1245)	*Acacia aneura* sens. lat.				X					

Species name as reported	Species name used in analysis	Removed for analysis	Astron (2018)	Astron (2019)	Biota (2006)	Biota (2014)	Mattiske (2008)	Mattiske (2009)	Mattiske (2010)	Ecologia (2013)
Acacia aff. *ayersiana* (narrow form; MET 15,786)	*Acacia aneura* sens. lat.				X					
Acacia ?*ancistrocarpa*	N/A	Y	X							
Acacia aneura	*Acacia aneura* sens. lat.		X	X						
Acacia aneura (flat curved; MET 15 548)	*Acacia aneura* sens. lat.				X					
Acacia aneura var. (green flat; MET 15 946)	*Acacia aneura* sens. lat.				X					
Acacia aneura var. aff. *longicarpa* (MET 16,050)	*Acacia aneura* sens. lat.				X					
Acacia aneura var. *aneura*	*Acacia aneura* sens. lat.						X	X	X	
Acacia aneura var. *conifera*	*Acacia aneura* sens. lat.						X	X	X	
Acacia aneura var. *intermedia*	*Acacia aneura* sens. lat.						X	X	X	
Acacia aneura var. *longicarpa*	*Acacia aneura* sens. lat.				X					
Acacia aptaneura	*Acacia aneura* sens. lat.		X	X		X				X
Acacia aptaneura x	*Acacia aneura* sens. lat.		X			X				
Acacia aptaneura x *aneura*	*Acacia aneura* sens. lat.					X				
Acacia arida X	N/A	Y	X							
Acacia arrecta	*Acacia hilliana*								X	
Acacia ?*ayersiana*	N/A	Y								X
Acacia ayersiana X	N/A	Y	X							
Acacia bivenosa (narrow)	*Acacia bivenosa*								X	
Acacia bivenosa (wispy/weeping form)	*Acacia bivenosa*				X	X				
Acacia ?*catenulata*	N/A	Y	X							X

Species name as reported	Species name used in analysis	Removed for analysis	Astron (2018)	Astron (2019)	Biota (2006)	Biota (2014)	Mattiske (2008)	Mattiske (2009)	Mattiske (2010)	Ecologia (2013)
Acacia cuthbertsonii subsp. *cuthbertsonii*	N/A	Y						X		
Acacia ?*hamersleyensis*	N/A	Y								X
Acacia hamersleyensis sens. lat.	N/A	Y	X							
Acacia ? *hilliana* x *hamersleyensis*	N/A	Y				X				
Acacia holosericea	N/A	Y						X		
Acacia incurvaneura	*Acacia aneura* sens. lat.		X	X						X
Acacia macraneura	*Acacia aneura* sens. lat.		X	X						X
Acacia mulganeura	*Acacia aneura* sens. lat.		X	X						
Acacia paraneura	*Acacia aneura* sens. lat.					X				
Acacia pteraneura	*Acacia aneura* sens. lat.		X	X						X
Acacia pyrifolia var. *pyrifolia*	*Acacia pyrifolia*			X		X				X
Acacia ?*sibirica*	N/A	Y								X
Acacia sibirica x	N/A	Y	X							
Acacia sibirica x (? *rhodophloia*)	N/A	Y			X					
Acacia sp.	N/A	Y	X	X			X	X	X	
Acacia ?*tenuissima*	N/A	Y	X							
Acacia trachycarpa x *tumida* var.*pilbarensis*	N/A	Y						X		
Acacia tumida var. *pilbarensis*	*Acacia tumida*		X							
Acacia validinervia	N/A	Y								X
Adriana urticoides var. *urticoides*	*Adriana tomentosa* var. *tomentosa*							X		
Alternanthera sp.	N/A	Y		X						
Amaranthus sp.	N/A	Y	X							

Species name as reported	Species name used in analysis	Removed for analysis	Astron (2018)	Astron (2019)	Biota (2006)	Biota (2014)	Mattiske (2008)	Mattiske (2009)	Mattiske (2010)	Ecologia (2013)
Amyema sp.	N/A	Y		X						
Aristida ?jerichoensis var. *subspinulifera*	N/A	Y								X
Aristida sp.	N/A	Y	X	X			X			
Asteraceae sp.	N/A	Y	X	X			X	X		
Atriplex vesicaria	N/A	Y						X		
Austrostipa sp.	N/A	Y					X			
Boerhavia ?coccinea	N/A	Y	X							
Boerhavia sp.	N/A	Y				X				
Capparis spinosa	*Capparis spinosa* subsp. *nummularia*						X	X	X	
Cassytha sp.	N/A	Y	X							
Cheilanthes austrotenuifolia	*Cheilanthes sieberi*						X	X	X	
Cheilanthes sieberi subsp. *pseudovellea*	*Cheilanthes sieberi*					X				
Cheilanthes sieberi subsp. *sieberi*	*Cheilanthes sieberi*		X	X	X		X	X		X
Chrysocephalum apiculatum	*Chrysocephalum apiculatum* subsp. *pilbarense*				X		X	X		X
Chrysocephalum ?eremaeum	N/A	Y								X
Convolvulus ?clementii	N/A	Y								X
Corchorus lasiocarpus subsp. *lasiocarpus*	*Corchorus lasiocarpus*			X		X	X	X	X	
Corchorus lasiocarpus subsp. *parvus*	*Corchorus lasiocarpus*		X	X		X	X			X
Corchorus parviflorus	*Corchorus lasiocarpus*						X			
Corchorus walcottii	*Corchorus crozophorifolius*						X	X	X	

Species name as reported	Species name used in analysis	Removed for analysis	Astron (2018)	Astron (2019)	Biota (2006)	Biota (2014)	Mattiske (2008)	Mattiske (2009)	Mattiske (2010)	Ecologia (2013)
Corymbia candida subsp. *candida*	*Corymbia candida*			X						
Corymbia ?*deserticola*	N/A	Y	X							
Corymbia hamersleyana	*Corymbia hamersleyana* sens. lat.		X	X	X	X	X	X	X	X
Corymbia opaca	*Corymbia hamersleyana* sens. lat.		X				X			
Corymbia sp.	N/A	Y	X							
Corymbia zygophylla	N/A	Y								
Corynotheca micrantha	*Tricoryne* sp. Hamersley Range (S. van Leeuwen 915)									X
Crotalaria novae-hollandiae subsp. *novae-hollandiae*	*Crotalaria novae-hollandiae*			X						X
Cymbopogon ?*ambiguus*	N/A	Y								X
Cymbopogon ?*obtectus*	N/A	Y								X
Cymbopogon ? *procerus*	*Cymbopogon obtectus*					X				
Cymbopogon procerus	*Cymbopogon obtectus*					X	X		X	X
Cymbopogon sp.	N/A	Y	X							
Cyperus cunninghamii	*Cyperus cunninghamii* subsp. *cunninghamii*						X			
Cyperus sp.	N/A	Y					X			
Denhamia cunninghamii	*Maytenus* sp. Mt Windell (S. van Leeuwen 846)									X
Dodonaea ?*coriacea*	N/A	Y								X
Dodonaea ?*pachyneura*	N/A	Y								X
Dodonaea viscosa subsp. *mucronata*	*Dodonaea viscosa*				X	X				X

Species name as reported	Species name used in analysis	Removed for analysis	Astron (2018)	Astron (2019)	Biota (2006)	Biota (2014)	Mattiske (2008)	Mattiske (2009)	Mattiske (2010)	Ecologia (2013)
Dodonaea viscosa subsp. *spatulata*	*Dodonaea viscosa*		X	X						X
Enchylaena tomentosa	*Enchylaena tomentosa* var. *tomentosa*						X	X	X	
Enneapogon sp.	N/A	Y	X	X						
Eragrostis sp.	N/A	Y		X			X			
Eremophila aff. *clarkei*	N/A	Y		X						
Eremophila ?*forrestii*	N/A	Y								X
Eremophila forrestii	*Eremophila forrestii* subsp. *forrestii*						X			
Eremophila fraseri	*Eremophila fraseri* subsp. *fraseri*						X	X	X	
Eremophila jucunda subsp. *jucunda*	*Eremophila jucunda*						X	X	X	
Eremophila jucunda subsp. *pulcherrima*	*Eremophila jucunda*		X	X		X				X
Eremophila latrobei subsp. *filiformis*	*Eremophila latrobei*		X	X	X		X	X	X	X
Eremophila latrobei subsp. *glabra*	*Eremophila latrobei*		X	X	X		X			
Eremophila latrobei subsp. *latrobei*	*Eremophila latrobei*		X	X			X	X		X
Eremophila sp.	N/A	Y	X				X			X
Eremophila ?*tietkensii*	N/A	Y								X
Eremophila youngii	*Eremophila youngii* subsp. *lepidota*							X		
Eriachne ?*benthamii*	N/A	Y	X							

Species name as reported	Species name used in analysis	Removed for analysis	Astron (2018)	Astron (2019)	Biota (2006)	Biota (2014)	Mattiske (2008)	Mattiske (2009)	Mattiske (2010)	Ecologia (2013)
Eriachne mucronata (arid form) (MET 12 736)	*Eriachne mucronata*				X					
Eriachne mucronata (typical form)	*Eriachne mucronata*					X				
Eriachne sp.	N/A	Y	X				X			
Eucalyptus camaldulensis subsp. *obtusa*	*Eucalyptus camaldulensis*		X	X						
Eucalyptus leucophloia	*Eucalyptus leucophloia* subsp. *leucophloia*						X	X	X	X
Eucalyptus ?sheathiana	*Eucalyptus trivalva*						X	X		
Eucalyptus socialis	*Eucalyptus socialis* subsp. *eucentrica*						X	X	X	
Eucalyptus socialis subsp. *?eucentrica*	N/A	Y	X							
Eucalyptus sp.	N/A	Y					X			
Eucalyptus ?trivalva	N/A	Y								X
Eucalyptus ?victrix	N/A	Y								X
Eucalyptus ?xerothermica	N/A	Y								X
Eucalyptus xerothermica x *Eucalyptus tephrodes*	N/A	Y								X
?Eulalia aurea	N/A	Y								X
Evolvulus alsinoides var. *decumbens*	*Evolvulus alsinoides*		X	X		X				X
Evolvulus alsinoides var. *villosicalyx*	*Evolvulus alsinoides*		X	X	X	X	X			X
Exocarpos aphyllus	*Exocarpus sparteus*						X	X		
Fimbristylis sp.	N/A	Y	X	X						

Species name as reported	Species name used in analysis	Removed for analysis	Astron (2018)	Astron (2019)	Biota (2006)	Biota (2014)	Mattiske (2008)	Mattiske (2009)	Mattiske (2010)	Ecologia (2013)
Frankenia ?magnifica	N/A	Y						X		
Gompholobium polyzygum	*Gompholobium oreophilum*						X	X	X	
Goodenia ?nuda	N/A	Y								X
Goodenia sp.	N/A	Y	X	X			X	X		
Goodenia sp. (of interest)	N/A	Y		X						
Goodenia ?triodiophila	N/A	Y								X
Gossypium australe (Burrup Peninsula form)	*Gossypium australe*				X					
Gossypium sturtianum	*Gossypium sturtianum* var. *sturtianum*						X			
Grevillea wickhamii subsp. *aprica*	*Grevillea wickhamii*						X		X	
Grevillea wickhamii subsp. *hispidula*	*Grevillea wickhamii*		X	X						X
Halgania gustafsenii var. Mid West (G. Perry 370)	*Halgania gustafsenii*				X					
Halgania solanacea var. Mt. Doreen (G.M. Chippendale 4206)	*Halgania solanacea*						X			
Heliotropium sp.	N/A	Y		X			X			
Hibiscus ?coatesii	N/A	Y	X							
Hibiscus gardneri	*Hibiscus* sp. Gardneri (A.L. Payne PRP 1435)									X
Hibiscus sp.	N/A	Y		X						
Hibiscus sturtii var. aff. *campylochlamys* (site 1398)	*Hibiscus sturtii*				X					

Species name as reported	Species name used in analysis	Removed for analysis	Astron (2018)	Astron (2019)	Biota (2006)	Biota (2014)	Mattiske (2008)	Mattiske (2009)	Mattiske (2010)	Ecologia (2013)
Hibiscus sturtii var. aff. *grandiflorus*	*Hibiscus sturtii*				X					
Hibiscus sturtii var. *campylochlamys*	*Hibiscus sturtii*		X	X	X	X	X	X		X
Hibiscus sturtii var. *platychlamys*	*Hibiscus sturtii*		X	X	X	X	X			X
Hibiscus sturtii var. *truncatus*	*Hibiscus sturtii*						X			
Hibiscus trionum	*Hibiscus verdcourtii*									X
Indigofera fractiflexa	*Indigofera fractiflexa* subsp. *fractiflexa*						X		X	X
Indigofera gilesii subsp. *gilesii*	*Indigofera gilesii*									X
Indigofera monophylla (small leaflet form)	*Indigofera monophylla*				X					
Indigofera sp. *Fractiflexa* (S. van Leeuwen 3773) PN	*Indigofera fractiflexa subsp. fractiflexa*					X				
Isotropis cuneifolia	*Isotropis* sp. Arid zone (G. Byrne 2775)							X		
Isotropis forrestii	*Isotropis* sp. Arid zone (G. Byrne 2775)				X	X		X	X	
Keraudrenia nephrosperma	*Seringia nephrosperma*				X		X	X	X	
Keraudrenia ?velutina	N/A	Y								X
Keraudrenia velutina	*Seringia elliptica*									X
Keraudrenia velutina subsp. *elliptica*	*Seringia elliptica*				X	X	X	X		
Lepidium sp.	N/A	Y		X						
Maireana planifolia x *villosa*	N/A	Y			X					
Maireana sp.	N/A	Y			X		X		X	

Species name as reported	Species name used in analysis	Removed for analysis	Astron (2018)	Astron (2019)	Biota (2006)	Biota (2014)	Mattiske (2008)	Mattiske (2009)	Mattiske (2010)	Ecologia (2013)
Maireana tomentosa	*Maireana tomentosa* subsp. *tomentosa*						X	X	X	X
Malvaceae sp.	N/A	Y		X						
Marsdenia sp.	N/A	Y	X							
Melaleuca lasiandra	*Melaleuca glomerata*						X	X	X	
?*Melhania oblongifolia*	N/A	Y								X
Panicum ?*decompositum*	N/A	Y	X							
Papilionaceae sp. (juvenile)	N/A	Y						X		
Phyllanthus sp.	N/A	Y	X							
Pluchea sp.	N/A	Y	X							
Poaceae sp.	N/A	Y	X	X			X		X	
Polycarpaea corymbosa	*Polycarpaea corymbosa* var. *corymbosa*									X
Polymeria aff. *longifolia*	N/A	Y		X						
Pterocaulon serrulatum var. *velutinum*	*Pterocaulon serrulatum*		X							
Pterocaulon sp.	N/A	Y	X	X	X					
Ptilotus astrolasius var. *astrolasius*	*Ptilotus astrolasius*						X	X	X	
?*Ptilotus calostachyus*	N/A	Y								X
Ptilotus calostachyus var. *calostachyus*	*Ptilotus calostachyus*						X	X		
?*Ptilotus clementii*	N/A	Y								X
Ptilotus ?*fusiformis*	N/A	Y								X
Ptilotus obovatus var. *obovatus*	*Ptilotus obovatus*						X	X	X	

Species name as reported	Species name used in analysis	Removed for analysis	Astron (2018)	Astron (2019)	Biota (2006)	Biota (2014)	Mattiske (2008)	Mattiske (2009)	Mattiske (2010)	Ecologia (2013)
Ptilotus schwartzii	*Ptilotus schwartzii* var. *schwartzii*							X		
Ptilotus sp.	N/A	Y	X	X				X	X	
Rhyncharrhena linearis	*Vincetoxicum lineare*									X
Rulingia loxophylla	*Androcalva loxophylla*						X			
Rulingia luteiflora	*Androcalva luteiflora*						X	X	X	
Sarcostemma viminale subsp. *australe*	*Cynanchum viminale* subsp. *australe*				X		X		X	X
Scaevola amblyanthera var. *centralis*	*Scaevola amblyanthera*		X	X	X					
Scaevola browniana subsp. *browniana*	*Scaevola browniana*			X			X	X	X	X
Scaevola parvifolia	*Scaevola parvifolia* subsp. *pilbarae*									X
?*Scaevola spinescens*	N/A	Y						X		
Sclerolaena ?*gardneri*	N/A	Y	X							
Senna artemisioides subsp. *oligophylla* x *helmsii*	N/A	Y	X				X	X	X	
Senna artemisioides subsp. *oligophylla* x subsp. *helmsii*	N/A	Y			X	X				
Senna artemisioides subsp. x *sturtii* x	*Senna artemisioides* subsp. x *sturtii*					X				
Senna charlesiana	N/A	Y						X		
Senna glaucifolia x ? (site 626)	N/A	Y			X					
Senna glaucifolia x *S. artemisioides* subsp. *oligophylla*	N/A	Y			X					

Species name as reported	Species name used in analysis	Removed for analysis	Astron (2018)	Astron (2019)	Biota (2006)	Biota (2014)	Mattiske (2008)	Mattiske (2009)	Mattiske (2010)	Ecologia (2013)
Senna glaucifolia x *S. glutinosa* subsp. *glutinosa*	N/A	Y			X					
Senna glaucifolia x *S. glutinosa* subsp. x *luerssenii*	N/A	Y			X					
Senna glutinosa subsp. *glutinosa* x subsp. x *luerssenii*	N/A	Y			X					
Senna glutinosa subsp. x *luerssenii* x *S. stricta*	N/A	Y			X					
Senna sp.	N/A	Y					X	X		
Senna sp. Meekatharra (E. Bailey 1-26) ×	N/A	Y			X					
Senna sp. Meekatharra (E. Bailey 1-26) × *glaucifolia*	N/A	Y		X						
Senna ?*stricta*	N/A	Y								X
Seringia sp.	N/A	Y	X	X						
Sida aff. *fibulifera*	N/A	Y		X						
Sida aff. *fibulifera*	*Sida fibulifera*				X					
Sida aff. *fibulifera* (grey; MET 15 783)	*Sida fibulifera*				X					
Sida aff. *fibulifera* (oblong; MET 15 220)	*Sida fibulifera*				X					
Sida aff. *fibulifera* (site 1394)	*Sida fibulifera*				X					
Sida ?*ammophila*	N/A	Y					X			
Sida ?*arsiniata*	N/A	Y								X
Sida ?*echinocarpa*	N/A	Y								X
Sida ?*ectogama*	N/A	Y	X							X

Species name as reported	Species name used in analysis	Removed for analysis	Astron (2018)	Astron (2019)	Biota (2006)	Biota (2014)	Mattiske (2008)	Mattiske (2009)	Mattiske (2010)	Ecologia (2013)
Sida excedentifolia ms	*Sida* sp. Excedentifolia (J.L. Egan 1925)						X			
Sida sp.	N/A	Y	X	X			X		X	X
Sida sp. 3	N/A	Y					X			
Sida ?sp. B Kimberley Flora (A.A. Mitchell 2745)	N/A	Y					X			
Sida ?sp. dark green fruits (S. van Leeuwen 2260)	N/A	Y	X							
Sida sp. excedentifolia (J.L. Egan 1925)	Sida sp. Excedentifolia (J.L. Egan 1925)						X	X	X	
Sida ?sp. Golden calyces glabrous (H.N. Foote 32)	N/A	Y								X
Sida sp. (MET 16,086)	N/A	Y			X					
Sida ?sp. Shovelanna Hill (S. van Leeuwen 3842)	N/A	Y								X
Sida ?sp. spiciform panicles (E. Leyland s.n. 14/8/1990 PN	N/A	Y								X
Sida ?sp. verrucose glands (F.H. Mollemans 2423)	N/A	Y								X
Sida ?trichopoda	N/A	Y								X
Solanum ellipticum	*Solanum cleistogamum*						X			
Solanum ?horridum	N/A	Y								X
Solanum ?lasiophyllum	N/A	Y								X
Solanum ?phlomoides	N/A	Y								X
Solanum sp.	N/A	Y					X			
Spartothamnella teucriiflora	*Teucrium teucriiflorum*									X
Stemodia sp.	N/A	Y		X						

Species name as reported	Species name used in analysis	Removed for analysis	Astron (2018)	Astron (2019)	Biota (2006)	Biota (2014)	Mattiske (2008)	Mattiske (2009)	Mattiske (2010)	Ecologia (2013)
Streptoglossa ?bubakii	N/A	Y								X
Streptoglossa sp.	N/A	Y	X							
Stylidium sp.	N/A	Y					X			
Tephrosia densa	*Tephrosia* sp. Fortescue (A.A. Mitchell 606)									X
Tephrosia rosea var. *clementii*	*Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186)						X	X	X	
Tephrosia rosea var. *glabrior*	*Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186)									X
Themeda sp.	N/A	Y		X						
Trianthema glossostigma	*Trianthema glossostigmum*						X	X		X
Triodia aff. *wiseana* (JDMM-35)	N/A	Y			X					
Triodia ?basedowii	N/A	Y								X
Triodia epactia	*Triodia pungens*						X	X	X	
Triodia ?pungens	N/A	Y								X
Triodia sp.	N/A	Y					X			
Triodia sp. Shovelanna Hill (S. van Leeuwen 3835)	*Triodia vanleeuwenii*				X	X				
Triumfetta sp.	N/A	Y					X		X	
Tylophora flexuosa	*Vincetoxicum flexuosum*					X				
Vigna lanceolata var. *lanceolata*	*Vigna lanceolata*			X						

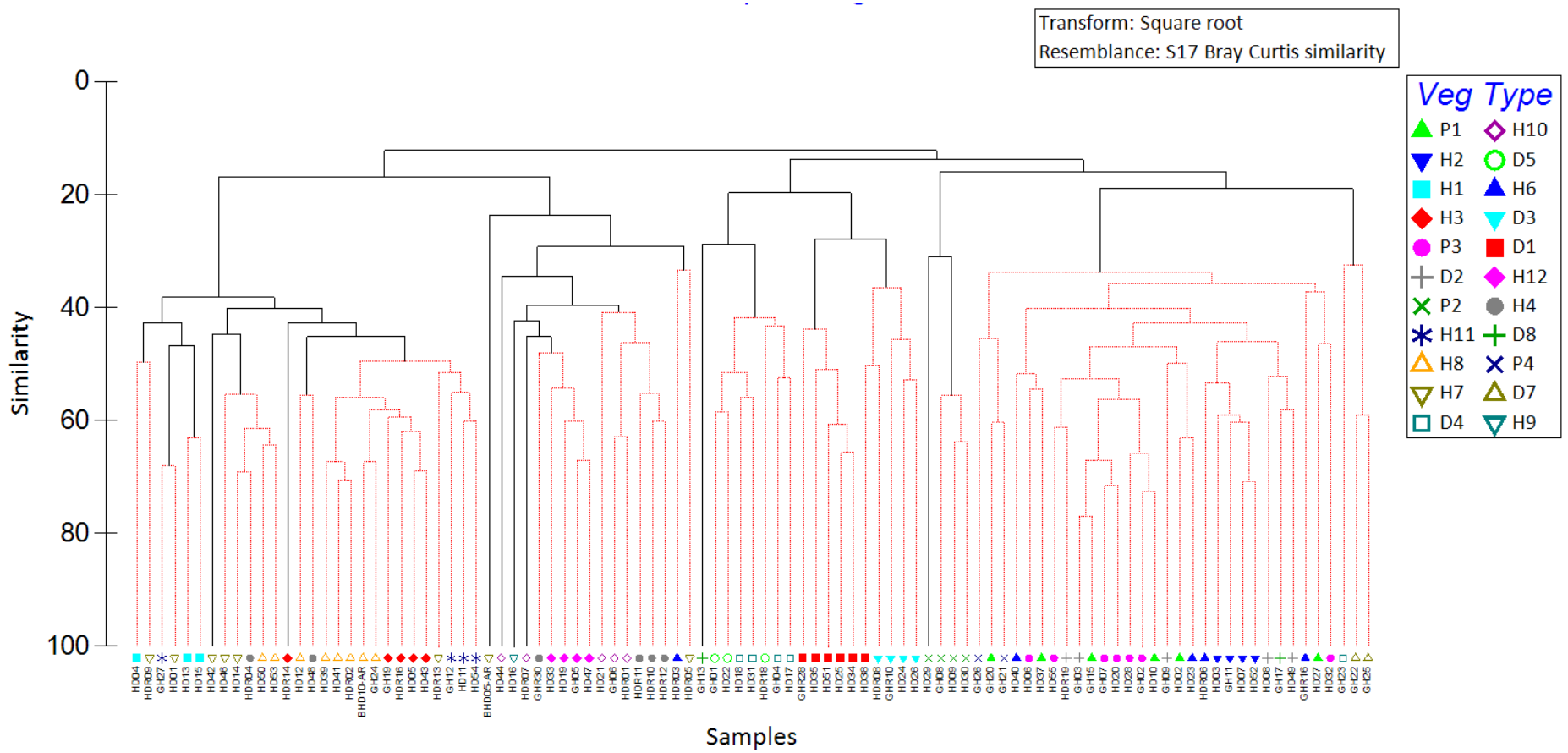

Figure K.2: Detailed survey area dendrogram showing relationship between Astron quadrats and relevés according to the degree of shared species (Sorensen's Index based on square root percentage foliar cover data). Significant clusters are separated by solid black lines.

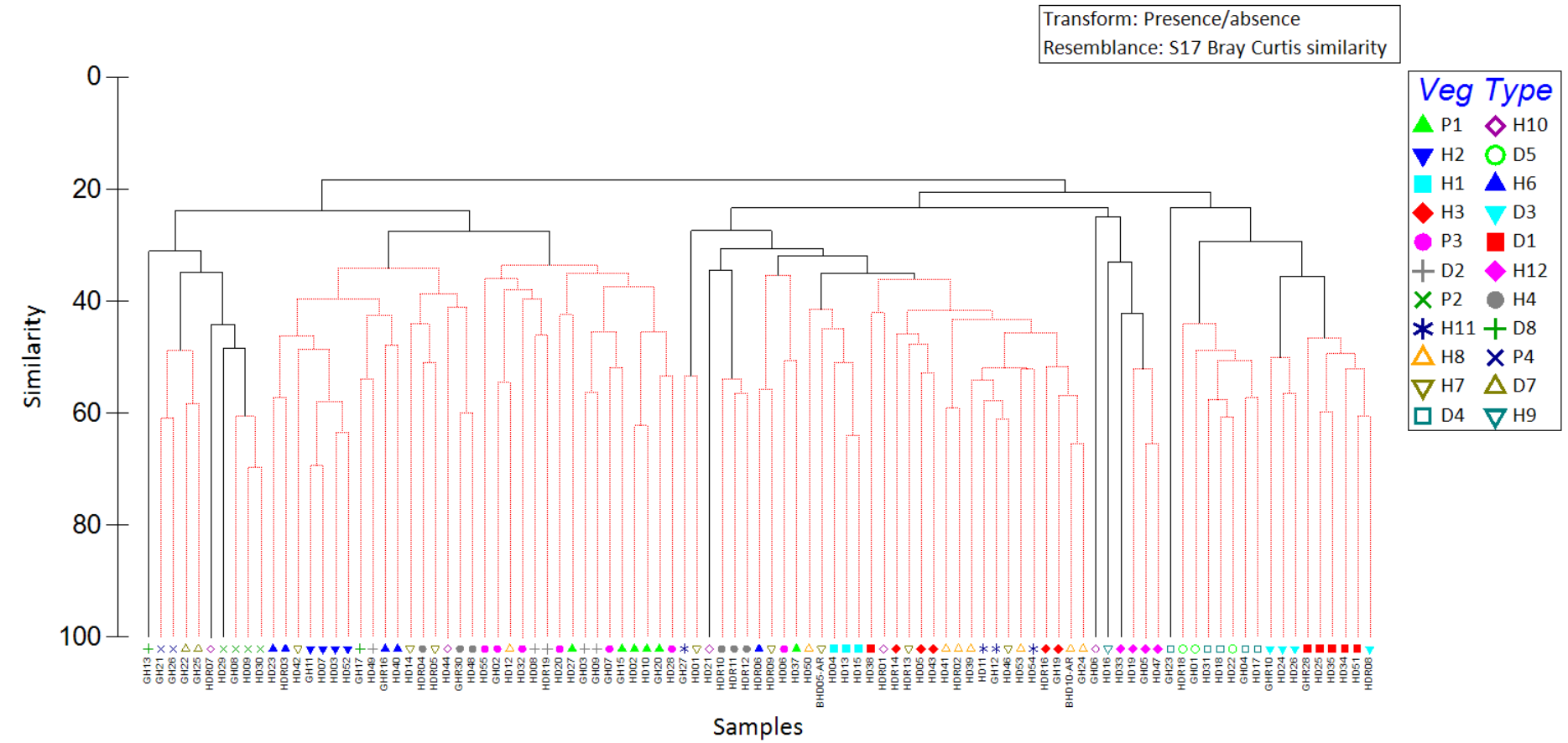

Figure K.3: Dendrogram showing relationship between Astron quadrats and relevés according to the degree of shared species. (Sorensen's Index based on presence-absence data). Significant clusters are separated by solid black lines.



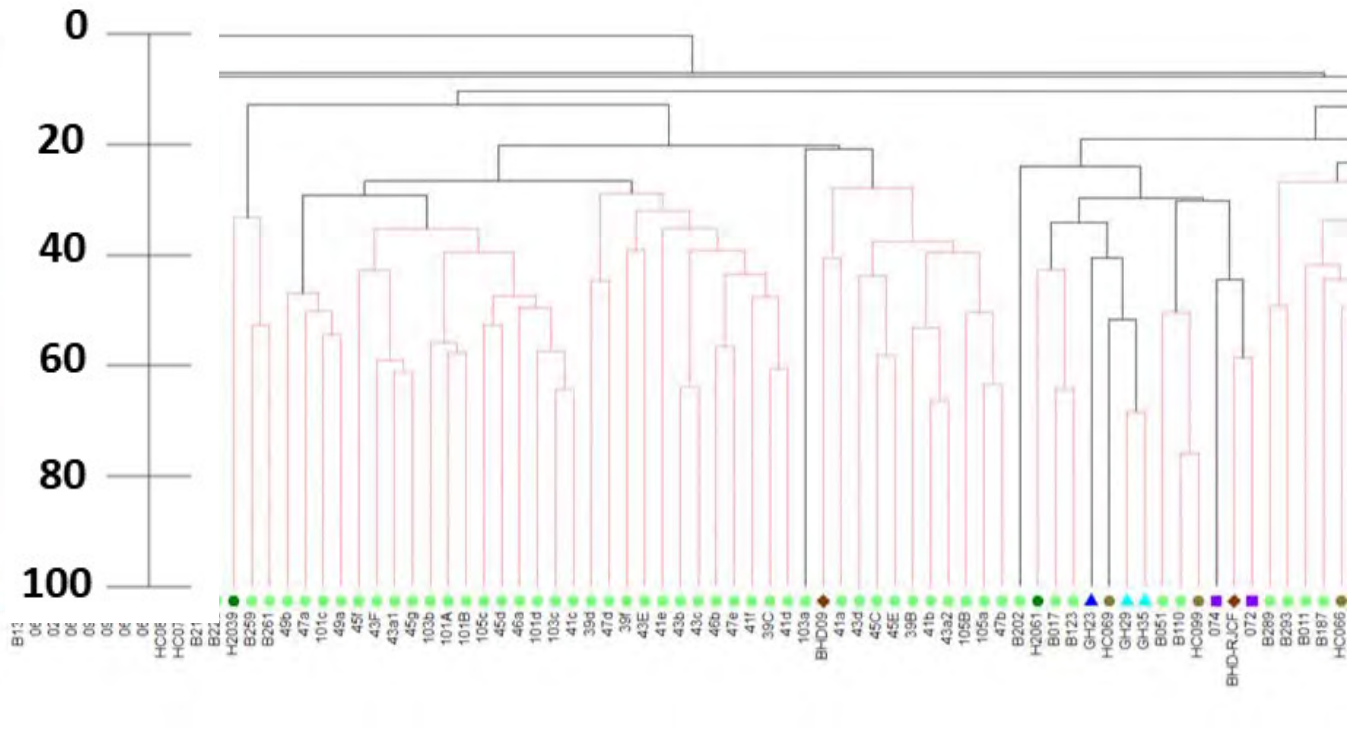

Figure K.4a: Dendrogram showing broader regional dataset according to the degree of shared species (Sorensen's Index based on presence-absence data). Significant clusters are separated by solid black lines.

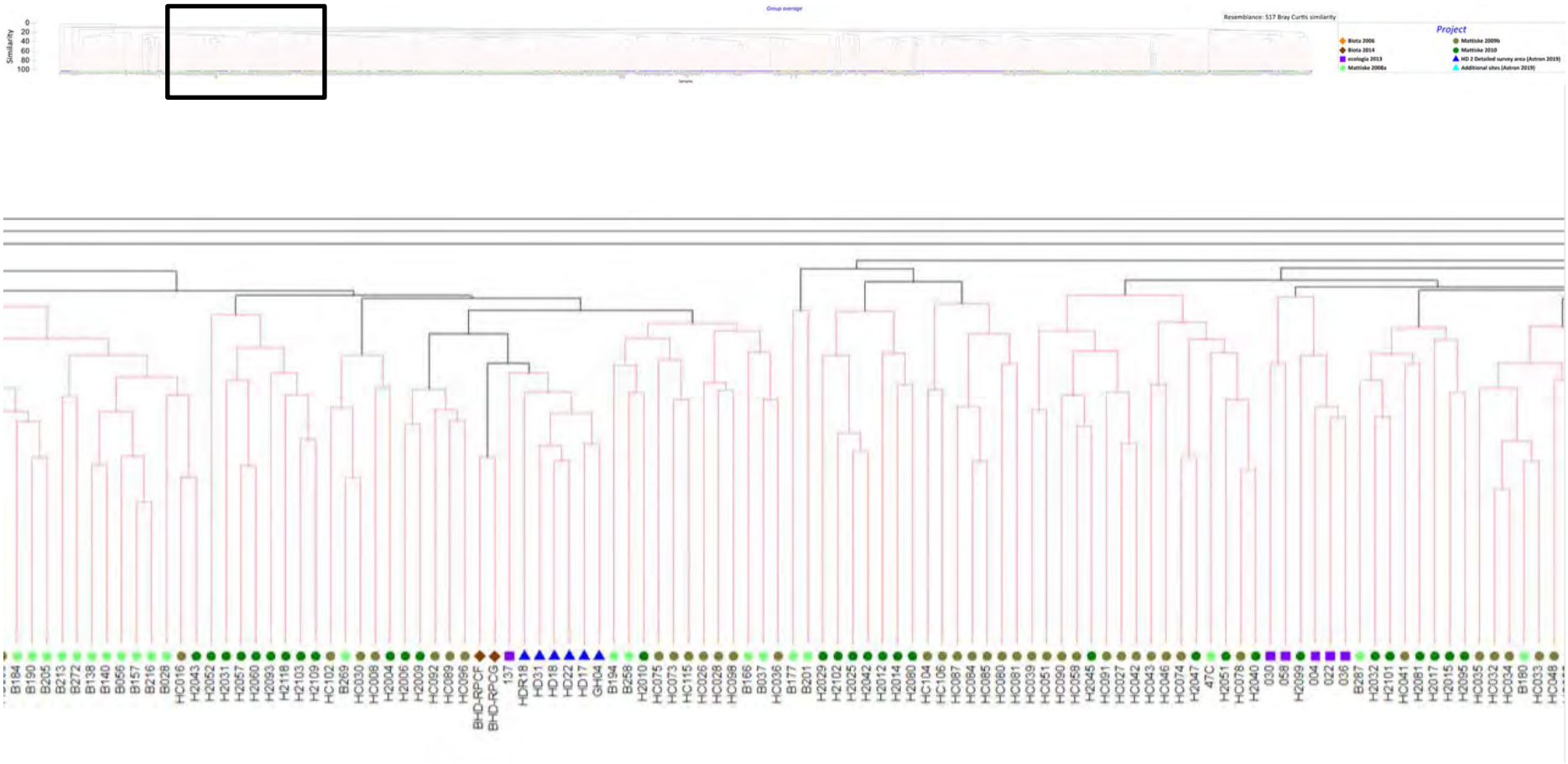

Figure K.4b: Dendrogram showing broader regional dataset according to the degree of shared species (Sorensen's Index based on presence-absence data). Significant clusters are separated by solid black lines.

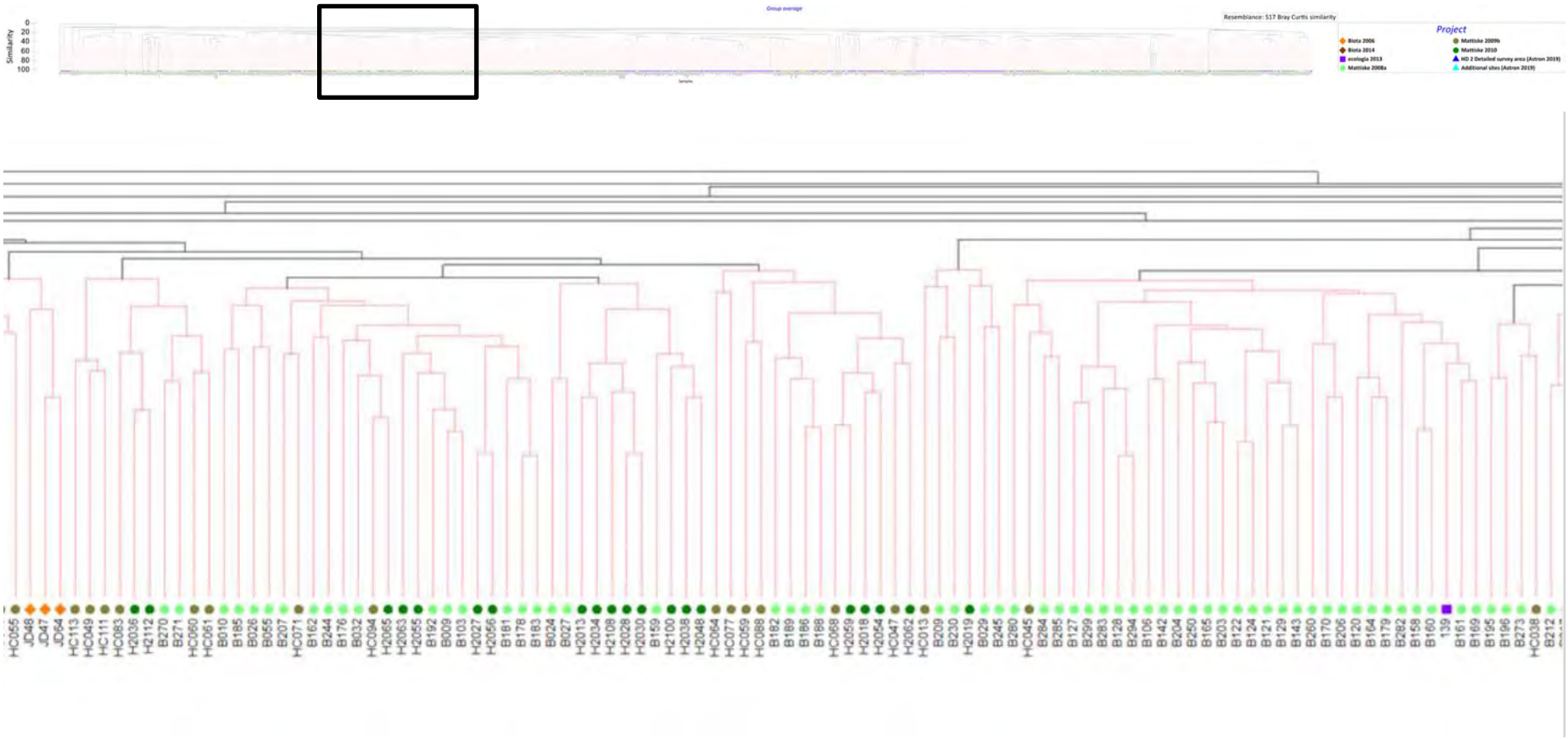

Figure K.4c: Dendrogram showing broader regional dataset according to the degree of shared species (Sorensen's Index based on presence-absence data). Significant clusters are separated by solid black lines.

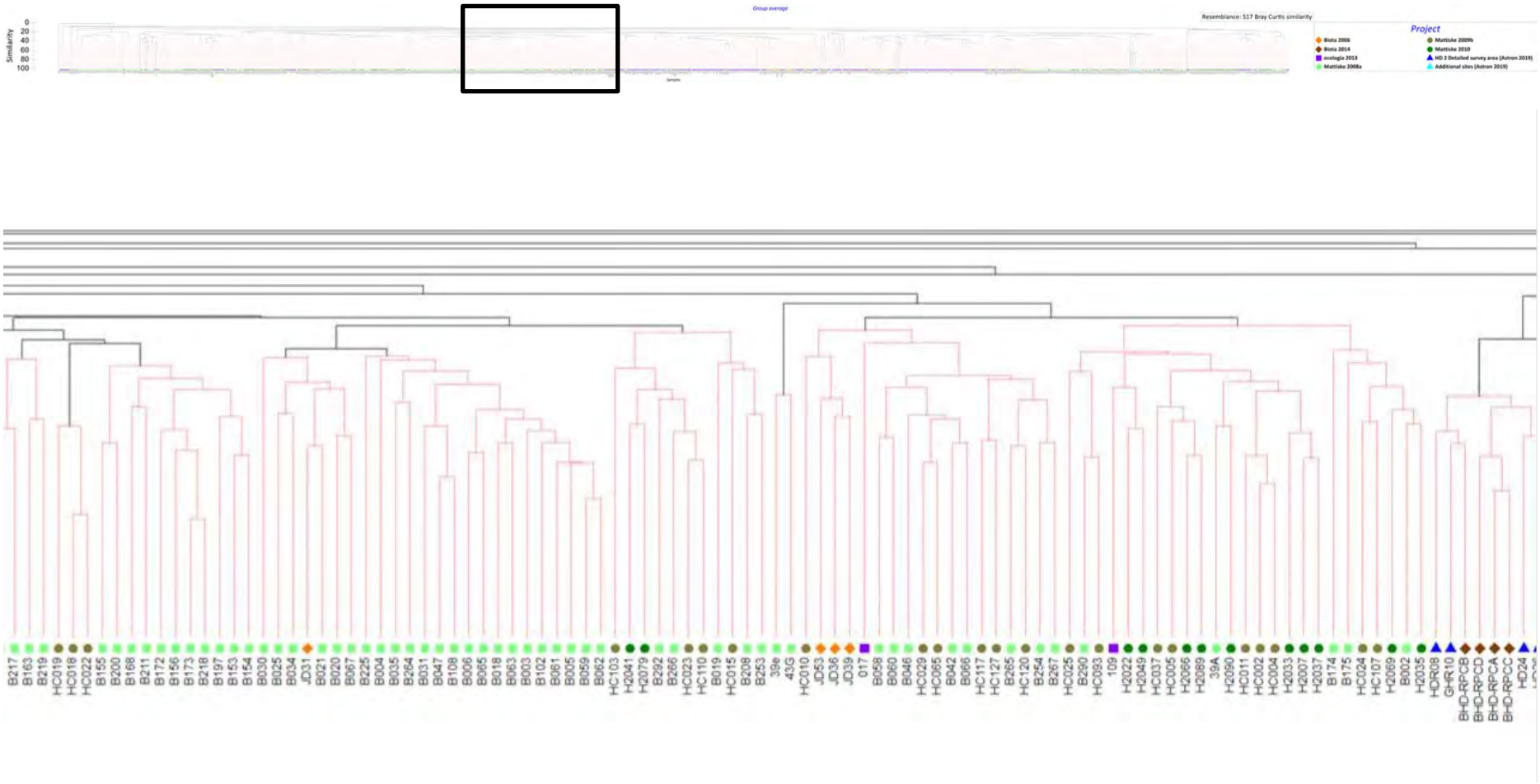

Figure K.4d: Dendrogram showing broader regional dataset according to the degree of shared species (Sorensen's Index based on presence-absence data). Significant clusters are separated by solid black lines.

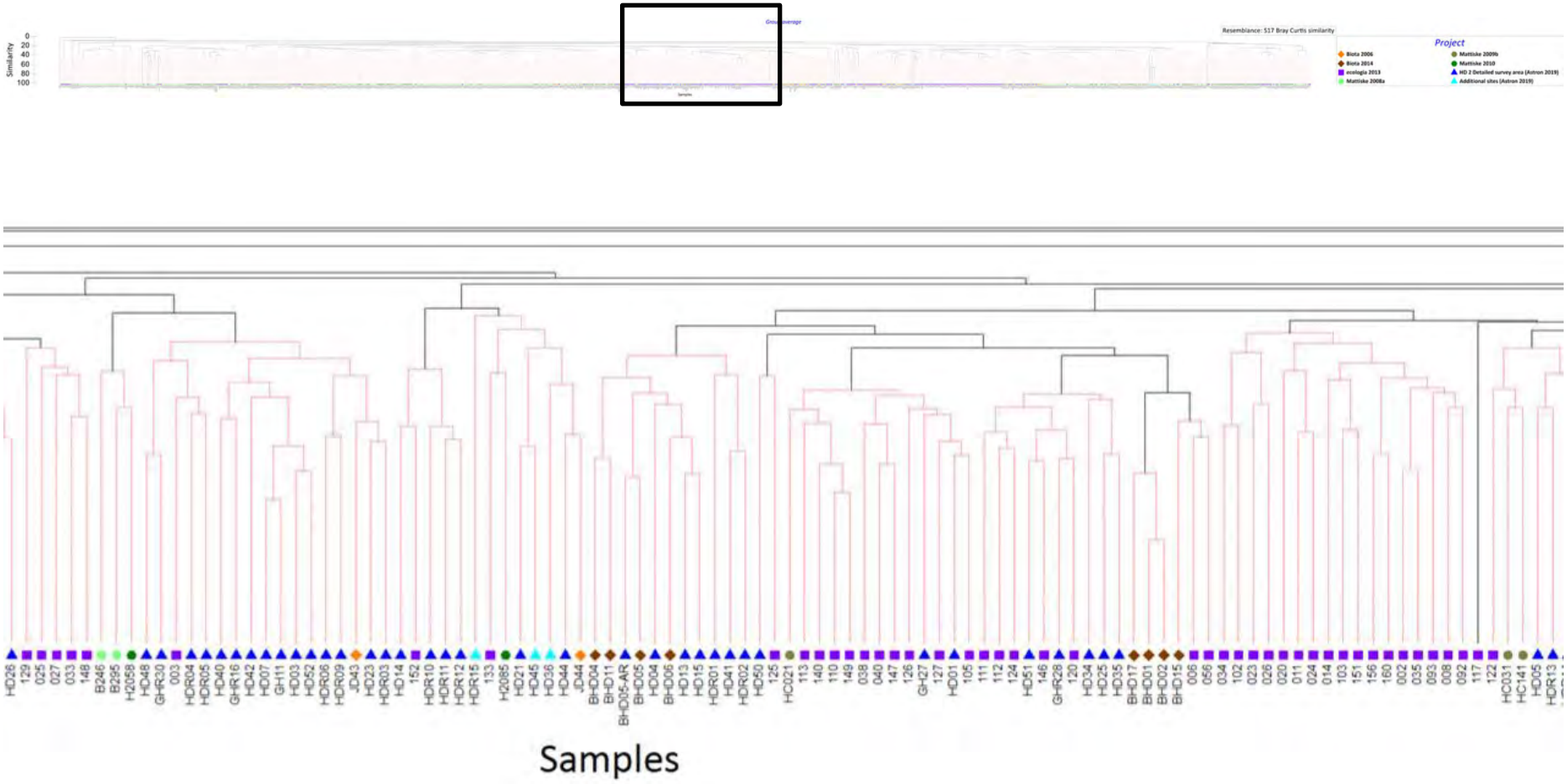

Figure K.4e: Dendrogram showing broader regional dataset according to the degree of shared species (Sorensen's Index based on presence-absence data). Significant clusters are separated by solid black lines.

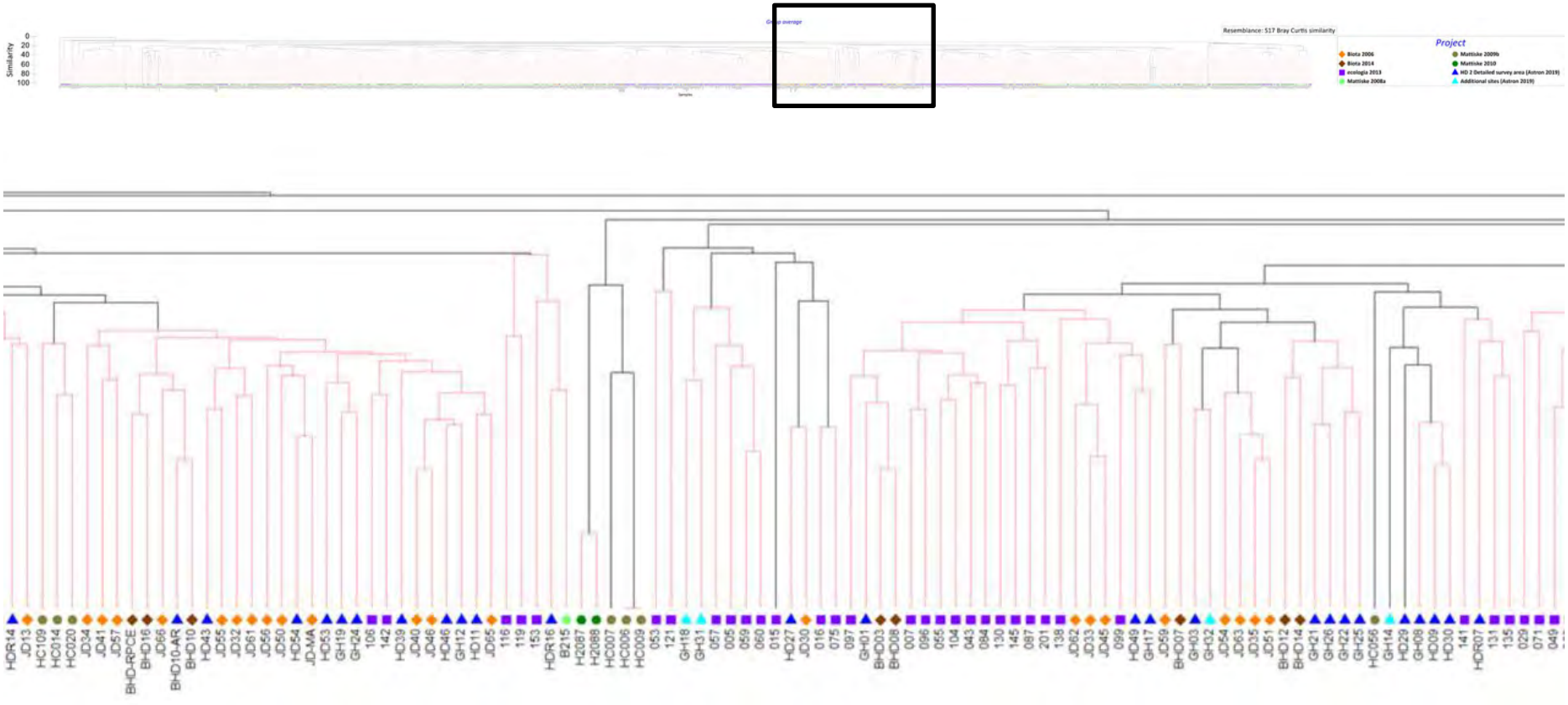

Figure K.4f: Dendrogram showing broader regional dataset according to the degree of shared species (Sorensen's Index based on presence-absence data). Significant clusters are separated by solid black lines.

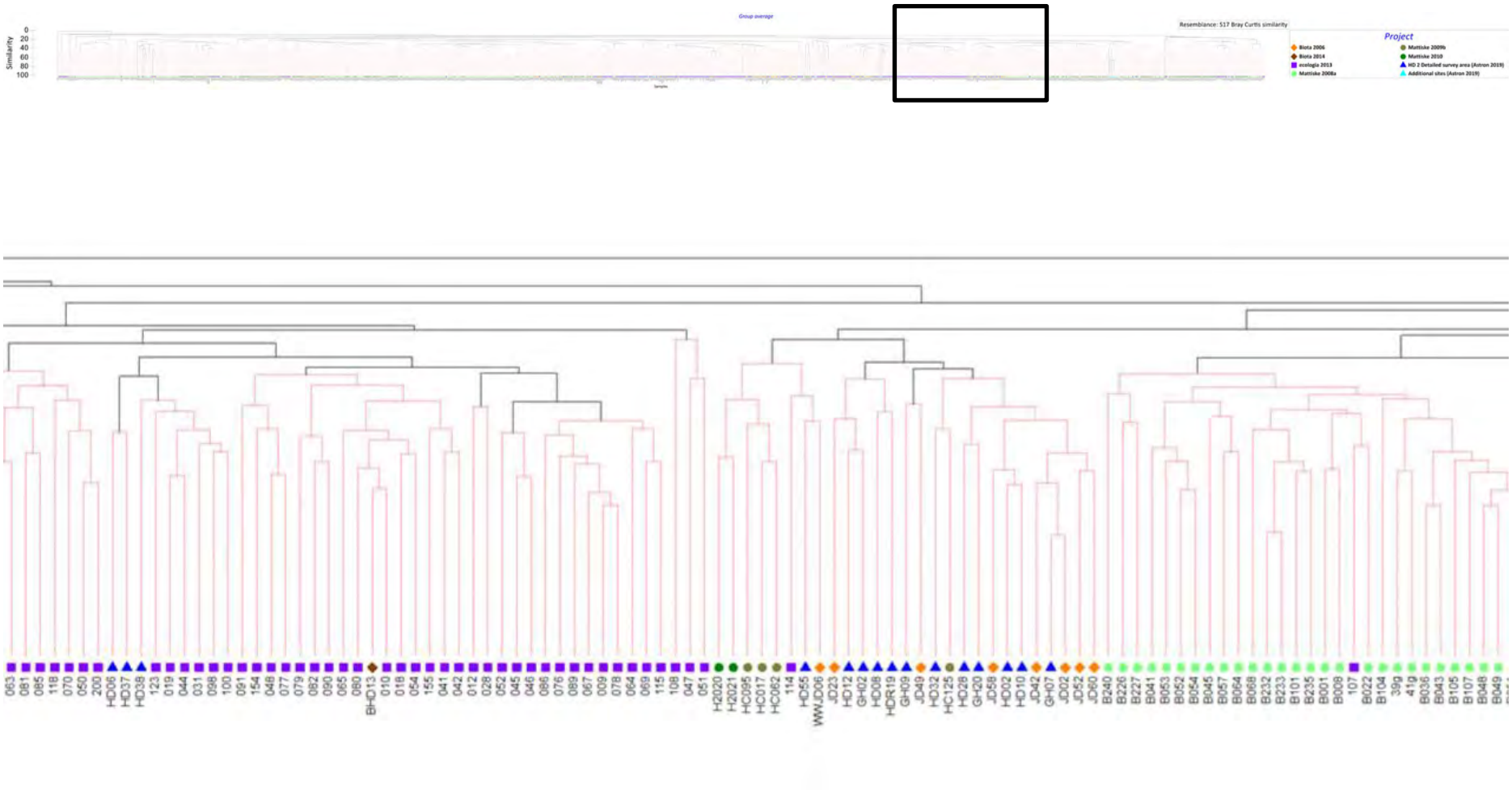

Figure K.4g: Dendrogram showing broader regional dataset according to the degree of shared species (Sorensen's Index based on presence-absence data). Significant clusters are separated by solid black lines.

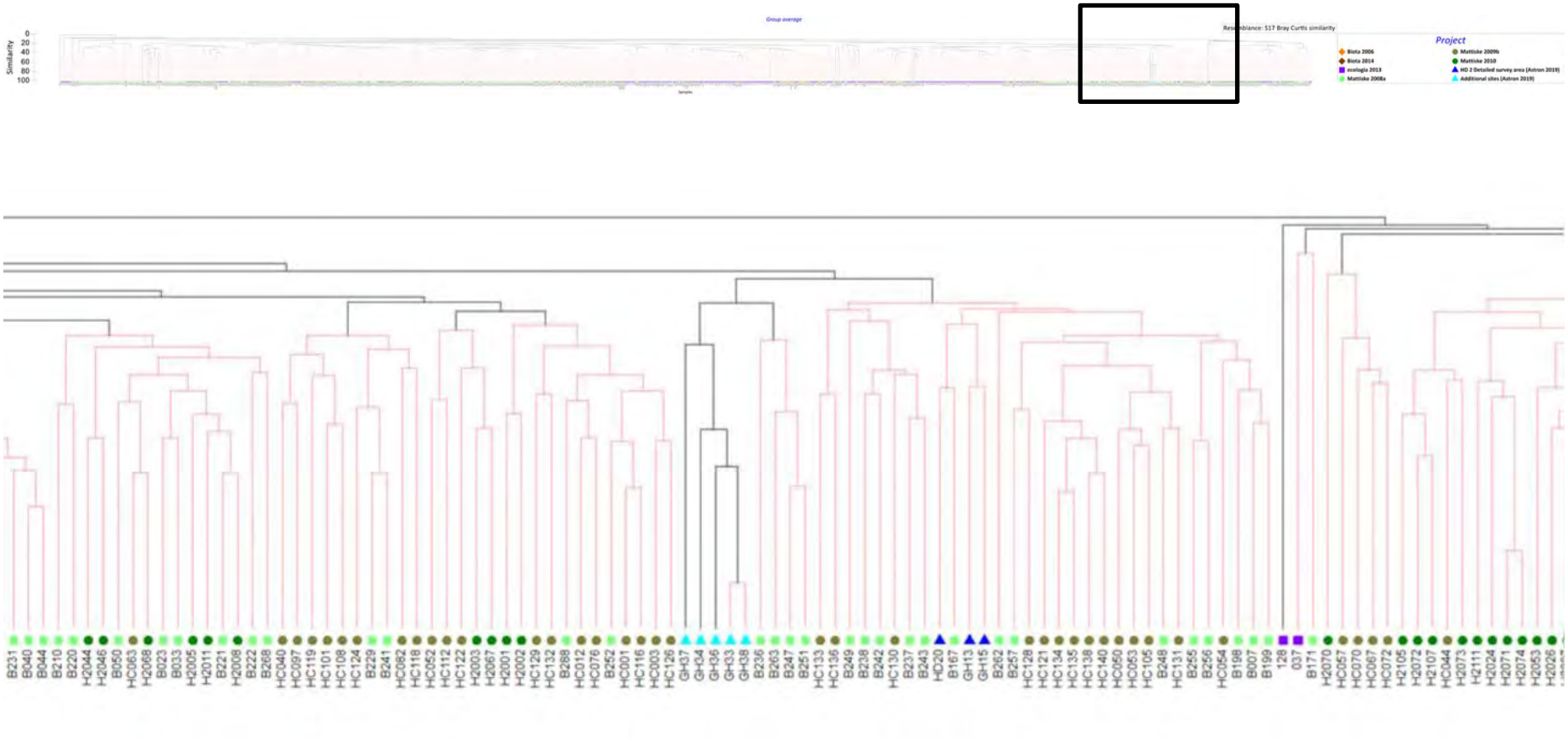

Figure K.4h: Dendrogram showing broader regional dataset according to the degree of shared species (Sorensen's Index based on presence-absence data). Significant clusters are separated by solid black lines.



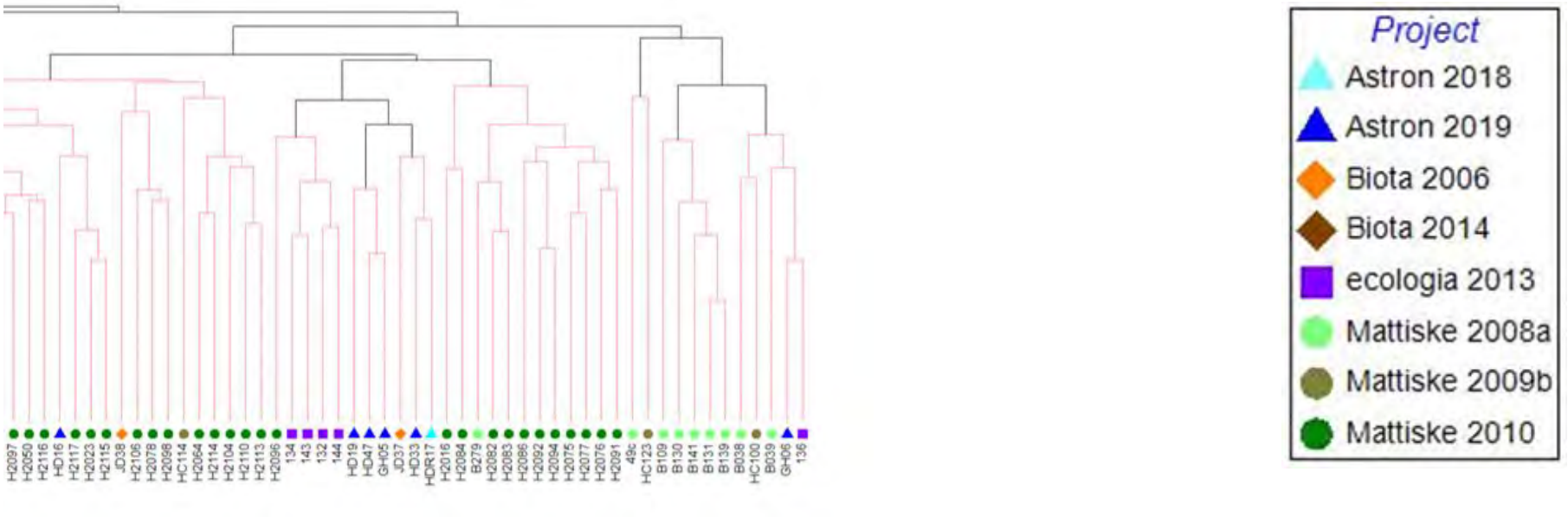

Figure K.4i: Dendrogram showing broader regional dataset according to the degree of shared species (Sorensen's Index based on presence-absence data). Significant clusters are separated by solid black lines.

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Appendix L: Vascular Flora Species List, Project by Species Matrix and Site by Species Matrix

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Table L.1: Vascular flora species recorded in the survey area.

Family	Species name	Conservation status	Weed
Acanthaceae	*Dicladanthera forrestii*		
	Dipteracanthus australasicus subsp. *australasicus*		
	Rostellularia adscendens var. *latifolia*	P3	
Aizoaceae	*Trianthema glossostigmum*		
Amaranthaceae	*Alternanthera denticulata*		
	Alternanthera nana		
	Alternanthera sp.		
	Amaranthus sp.		
	Gomphrena cunninghamii		
	Ptilotus aervoides		
	Ptilotus astrolasius		
	Ptilotus auriculifolius		
	Ptilotus calostachyus		
	Ptilotus clementii		
	Ptilotus exaltatus		
	Ptilotus fusiformis		
	Ptilotus helipteroides		
	Ptilotus incanus		
	Ptilotus mollis	P4	
	Ptilotus obovatus		
	Ptilotus polystachyus		
	Ptilotus rotundifolius		
	Ptilotus schwartzii var. *schwartzii*		
	Ptilotus sp.		
Apocynaceae	*Cynanchum floribundum*		
	Cynanchum viminale		
	Marsdenia australis		
	Marsdenia sp.		
Araliaceae	*Astrotricha hamptonii*		
	Trachymene oleracea subsp. *oleracea*		
Asteraceae	**Bidens bipinnata*		*
	Centipeda minima subsp. *macrocephala*		
	Chrysocephalum apiculatum subsp. *pilbarense*		
	Chrysocephalum gilesii		
	**Conyza bonariensis*		*
	**Flaveria trinervia*		*
	Peripleura arida		
	Peripleura obovata		

Family	Species name	Conservation status	Weed
Asteraceae	*Peripleura virgata*		
	Pluchea dentex		
	Pluchea rubelliflora		
	Pluchea sp.		
	Pterocaulon serrulatum var. *velutinum*		
	Pterocaulon sp.		
	Pterocaulon sphacelatum		
	Pterocaulon sphaeranthoides		
	Rhodanthe margarethae		
	**Sigesbeckia orientalis*		*
	**Sonchus oleraceus*		*
	Streptoglossa bubakii		
	Streptoglossa decurrens		
	Streptoglossa sp.		
	**Tridax procumbens*		*
	Vittadinia eremaea		
Bignoniaceae	*Pandorea pandorana*		
Boraginaceae	*Halgania cyanea*		
	Halgania gustafsenii var. *gustafsenii*		
	Heliotropium inexplicitum		
	Heliotropium ovalifolium		
	Heliotropium pachyphyllum		
	Heliotropium sp.		
	Heliotropium tanythrix		
	Heliotropium tenuifolium		
	Trichodesma zeylanicum var. *zeylanicum*		
Brassicaceae	*Lepidium catapycnon*	P4	
	Lepidium pedicellosum		
	Lepidium phlebopetalum		
	Lepidium pholidogynum		
	Lepidium sp.		
Campanulaceae	*Lobelia heterophylla* subsp. *pilbarensis*		
	Wahlenbergia sp.		
	Wahlenbergia tumidifructa		
Capparaceae	*Capparis lasiantha*		
	Capparis spinosa subsp. *nummularia*		
	Capparis umbonata		
Caryophyllaceae	*Polycarpaea corymbosa* var. *corymbosa*		
	Polycarpaea holtzei		

Family	Species name	Conservation status	Weed
Caryophyllaceae	*Polycarpaea longiflora*		
Celastraceae	*Maytenus* sp. Mt Windell (S. van Leeuwen 846)		
	Stackhousia muricata subsp. annual (W.R. Barker 2172)		
Chenopodiaceae	*Dysphania kalpari*		
	Dysphania plantaginella		
	Dysphania rhadinostachya subsp. *rhadinostachya*		
	Enchylaena tomentosa var. *tomentosa*		
	Maireana carnosa		
	Maireana eriosphaera		
	Maireana georgei		
	Maireana melanocoma		
	Maireana tomentosa subsp. *tomentosa*		
	Maireana triptera		
	Maireana villosa		
	Rhagodia eremaea		
	Rhagodia sp. Hamersley (M. Trudgen 17794)	P3	
	Salsola australis		
	Sclerolaena cornishiana		
	Sclerolaena cuneata		
	Sclerolaena densiflora		
	Sclerolaena ?gardneri		
Cleomaceae	*Cleome viscosa*		
Commelinaceae	*Commelina ensifolia*		
Convolvulaceae	*Bonamia pilbarensis*		
	Convolvulus clementii		
	Cuscuta victoriana		
	Duperreya commixta		
	Evolvulus alsinoides var. *decumbens*		
	Evolvulus alsinoides var. *villosicalyx*		
	Polymeria aff. *longifolia*		
	Polymeria ambigua		
Cucurbitaceae	*Cucumis melo*		
	Cucumis variabilis		
Cyperaceae	*Bulbostylis barbata*		
	Bulbostylis turbinata		
	Cyperus cunninghamii subsp. *cunninghamii*		
	Cyperus difformis		
	Cyperus vaginatus		
	Fimbristylis dichotoma		

Family	Species name	Conservation status	Weed
Cyperaceae	*Fimbristylis simulans*		
	Fimbristylis sp.		
Euphorbiaceae	*Adriana tomentosa* var. *tomentosa*		
	Euphorbia australis var. *subtomentosa*		
	Euphorbia biconvexa		
	Euphorbia biconvexa/coghlanii/trigonosperma		
	Euphorbia boophthona		
	Euphorbia careyi		
	Euphorbia coghlanii		
	Euphorbia sp.		
	Euphorbia trigonosperma		
Fabaceae	*Acacia adoxa* var. *adoxa*		
	Acacia adsurgens		
	Acacia ancistrocarpa		
	Acacia ?ancistrocarpa		
	Acacia aptaneura		
	Acacia aptaneura sens. lat.		
	Acacia aptaneura x		
	Acacia arida		
	Acacia arida x		
	Acacia ayersiana		
	Acacia ayersiana x		
	Acacia bivenosa		
	Acacia bromilowiana	P4	
	Acacia ?catenulata		
	Acacia catenulata subsp. *occidentalis*		
	Acacia citrinoviridis		
	Acacia colei		
	Acacia coriacea subsp. *pendens*		
	Acacia dictyophleba		
	Acacia hamersleyensis		
	Acacia hilliana		
	Acacia inaequilatera		
	Acacia incurvaneura		
	Acacia kempeana		
	Acacia macraneura		
	Acacia maitlandii		
	Acacia marramamba		
	Acacia minyura		

Family	Species name	Conservation status	Weed
Fabaceae	*Acacia monticola*		
	Acacia mulganeura		
	Acacia pachyacra		
	Acacia pruinocarpa		
	Acacia pteraneura		
	Acacia pteraneura x aptaneura		
	Acacia pyrifolia		
	Acacia rhodophloia		
	Acacia sibirica		
	Acacia sibirica x		
	Acacia sp.		
	Acacia spondylophylla		
	Acacia steedmanii subsp. borealis		
	Acacia subtiliformis	P3	
	Acacia synchronicia		
	Acacia tenuissima		
	Acacia tetragonophylla		
	Acacia tumida var. *pilbarensis*		
	Crotalaria medicaginea var. *neglecta*		
	Cullen leucochaites		
	Glycine canescens		
	Gompholobium oreophilum		
	Indigofera fractiflexa subsp. *fractiflexa*		
	Indigofera georgei		
	Indigofera linifolia		
	Indigofera monophylla		
	Indigofera rugosa		
	Isotropis sp. Arid zone (G. Byrne 2775)		
	Mirbelia viminalis		
	Neptunia dimorphantha		
	Petalostylis labicheoides		
	Rhynchosia minima		
	Senna artemisioides subsp. × *artemisioides*		
	Senna artemisioides subsp. *filifolia*		
	Senna artemisioides subsp. *helmsii*		
	Senna artemisioides subsp. *oligophylla*		
	Senna artemisioides subsp. *oligophylla* x *helmsii*		
	Senna artemisioides subsp. x *artemisioides*		
	Senna ferraria		

Family	Species name	Conservation status	Weed
Fabaceae	*Senna glaucifolia*		
	Senna glutinosa		
	Senna glutinosa subsp. *× luerssenii*		
	Senna glutinosa subsp. *glutinosa*		
	Senna glutinosa subsp. *pruinosa*		
	Senna notabilis		
	Senna pleurocarpa var. *angustifolia*		
	Senna sericea		
	Senna sp. Meekatharra (E. Bailey 1-26)		
	Senna sp. Meekatharra (E. Bailey 1-26) ×		
	Senna stricta		
	Senna venusta		
	Swainsona maccullochiana		
	Templetonia egena		
	Tephrosia oxalidea		
	Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)		
	Tephrosia sp. Fortescue (A.A. Mitchell 606)		
	**Vachellia farnesiana*		*
	Vigna lanceolata var. *lanceolata*		
Gentianaceae	*Schenkia australis*		
Goodeniaceae	*Dampiera candicans*		
	Goodenia cusackiana		
	Goodenia lamprosperma		
	Goodenia microptera		
	Goodenia muelleriana		
	Goodenia prostrata		
	Goodenia sp.		
	Goodenia sp. (of interest)		
	Goodenia stellata		
	Goodenia stobbsiana		
	Goodenia tenuiloba		
	Goodenia triodiophila		
	Scaevola acacioides		
	Scaevola amblyanthera var. *centralis*		
	Scaevola browniana		
	Scaevola parvifolia subsp. *pilbarae*		
	Scaevola spinescens		
	Velleia connata		
Gyrostemonaceae	*Codonocarpus cotinifolius*		

Family	Species name	Conservation status	Weed
Haloragaceae	*Haloragis gossei*		
	Haloragis odontocarpa		
	Haloragis sp.		
Hemerocallidaceae	*Tricoryne* sp. Hamersley Range (S. van Leeuwen 915)		
Lamiaceae	*Clerodendrum floribundum* var. *angustifolium*		
	Clerodendrum tomentosum var. *lanceolatum*		
	Newcastelia sp. Hamersley Range (S. van Leeuwen 4264)		
	Teucrium teucriiflorum		
Lauraceae	*Cassytha capillaris*		
	Cassytha filiformis		
	Cassytha sp.		
Loranthaceae	*Amyema fitzgeraldii*		
	Amyema hilliana		
	Amyema miquelii		
	Amyema sp.		
Malvaceae	*Abutilon amplum*		
	Abutilon cryptopetalum		
	Abutilon fraseri subsp. *fraseri*		
	Abutilon lepidum		
	Abutilon ?lepidum		
	Abutilon macrum		
	Abutilon malvifolium		
	Abutilon otocarpum		
	Abutilon sp.		
	Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)		
	Androcalva luteiflora		
	Brachychiton acuminatus		
	Corchorus crozophorifolius		
	Corchorus lasiocarpus subsp. *lasiocarpus*		
	Corchorus lasiocarpus subsp. *parvus*		
	Corchorus tridens		
	Gossypium australe		
	Gossypium robinsonii		
	Gossypium sturtianum var. *sturtianum*		
	Hibiscus burtonii		
	Hibiscus coatesii		
	Hibiscus ?coatesii		
	Hibiscus leptocladus		
	Hibiscus sp.		

Family	Species name	Conservation status	Weed
Malvaceae	*Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708)	P2	
	Hibiscus sturtii		
	Hibiscus sturtii var. *campylochlamys*		
	Hibiscus sturtii var. *platychlamys*		
	Hibiscus verdcourtii		
	**Malvastrum americanum*		*
	Melhania oblongifolia		
	Seringia elliptica		
	Seringia nephrosperma		
	Seringia sp.		
	Sida arenicola		
	Sida calyxhymenia		
	Sida cardiophylla		
	Sida echinocarpa		
	Sida ?ectogama		
	Sida fibulifera		
	Sida platycalyx		
	Sida sp.		
	Sida sp. Articulation below (A.A. Mitchell PRP 1605)		
	Sida sp. dark green fruits (S. van Leeuwen 2260)		
	Sida ?sp. dark green fruits (S. van Leeuwen 2260)		
	Sida sp. *Excedentifolia (J.L. Egan 1925)*		
	Sida sp. Golden calyces glabrous (H.N. Foote 32)		
	Sida sp. Pilbara (A.A. Mitchell PRP 1543)		
	Sida sp. Shovelanna Hill (S. van Leeuwen 3842)		
	Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)		
	Triumfetta chaetocarpa		
	Waltheria indica		
Menispermaceae	*Tinospora smilacina*		
Molluginaceae	*Trigastrotheca molluginea*		
Moraceae	*Ficus brachypoda*		
Myrtaceae	*Calytrix carinata*		
	Corymbia deserticola		
	Corymbia deserticola subsp. *deserticola*		
	Corymbia ferriticola		
	Corymbia hamersleyana		
	Corymbia hamersleyana sens lat.		
	Corymbia opaca		
	Corymbia sp.		

Family	Species name	Conservation status	Weed
Myrtaceae	*Eucalyptus camaldulensis* subsp. *obtusa*		
	Eucalyptus gamophylla		
	Eucalyptus kingsmillii		
	Eucalyptus leucophloia subsp. *leucophloia*		
	Eucalyptus pilbarensis		
	Eucalyptus repullulans		
	Eucalyptus socialis subsp. *eucentrica*		
	Eucalyptus socialis subsp. *?eucentrica*		
	Eucalyptus victrix		
	Eucalyptus xerothermica		
	Eucalyptus xerothermica x *Eucalyptus tephrodes*		
	Melaleuca bracteata		
	Melaleuca eleuterostachya		
	Melaleuca glomerata		
Nyctaginaceae	*Boerhavia coccinea*		
	Boerhavia ?coccinea		
Oleaceae	*Jasminum didymum* subsp. *lineare*		
Phyllanthaceae	*Phyllanthus erwinii*		
	Phyllanthus maderaspatensis		
Plantaginaceae	*Stemodia grossa*		
Poaceae	*Acrachne racemosa*		
	Amphipogon sericeus		
	Aristida burbidgeae		
	Aristida contorta		
	Aristida holathera var. *holathera*		
	Aristida inaequiglumis		
	Aristida ?inaequiglumis		
	Aristida ingrata		
	Aristida latifolia		
	Aristida lazaridis	P2	
	Aristida obscura		
	Aristida sp.		
	Astrebla elymoides		
	Astrebla sp.		
	Bothriochloa ewartiana		
	**Cenchrus ciliaris*		*
	**Cenchrus setiger*		*
	**Chloris virgata*		*
	Chrysopogon fallax		

Family	Species name	Conservation status	Weed
Poaceae	*Cymbopogon ambiguus*		
	Cymbopogon obtectus		
	Cymbopogon sp.		
	Cynodon convergens		
	**Cynodon dactylon*		*
	Cynodon prostratus		
	Dactyloctenium radulans		
	Dactyloctenium ?radulans		
	Dichanthium sericeum subsp. *humilius*		
	Dichanthium sp.		
	Digitaria ammophila		
	Digitaria brownii		
	**Echinochloa colona*		*
	Enneapogon caerulescens		
	Enneapogon lindleyanus		
	Enneapogon polyphyllus		
	Enneapogon robustissimus		
	Enneapogon sp.		
	Enteropogon ramosus		
	Eragrostis cumingii		
	Eragrostis eriopoda		
	Eragrostis setifolia		
	Eragrostis tenellula		
	Eragrostis xerophila		
	Eriachne aristidea		
	Eriachne benthamii		
	Eriachne ?benthamii		
	Eriachne lanata		
	Eriachne mucronata		
	Eriachne obtusa		
	Eriachne pulchella		
	Eriachne pulchella subsp. *dominii*		
	Eriachne pulchella subsp. *pulchella*		
	Eriachne tenuiculmis		
	Eulalia aurea		
	Iseilema eremaeum		
	Iseilema membranaceum		
	Iseilema sp.		
	Iseilema vaginiflorum		

Family	Species name	Conservation status	Weed
Poaceae	*Panicum decompositum*		
	Panicum effusum		
	Paraneurachne muelleri		
	Paspalidium clementii		
	Paspalidium jubiflorum		
	Paspalidium rarum		
	Perotis rara		
	Schizachyrium fragile		
	Setaria dielsii		
	**Setaria verticillata*		*
	Sporobolus australasicus		
	Themeda avenacea		
	Themeda sp.		
	Themeda sp. Mt Barricade (M.E. Trudgen 2471)		
	Themeda triandra		
	Tragus australianus		
	Triodia angusta		
	Triodia ?angusta		
	Triodia basedowii		
	Triodia brizoides		
	Triodia longiceps		
	Triodia pungens		
	Triodia sp. Mt Ella (M.E. Trudgen 12739)	P3	
	Triodia vanleeuwenii		
	Triodia ?vanleeuwenii		
	Triodia wiseana		
	Triraphis mollis		
	Urochloa ?occidentalis		
	Yakirra australiensis var. *australiensis*		
Polygalaceae	*Polygala isingii*		
Portulacaceae	*Portulaca oleracea*		
Proteaceae	*Grevillea berryana*		
	Grevillea saxicola	P3	
	Grevillea wickhamii subsp. *hispidula*		
	Hakea chordophylla		
	Hakea lorea subsp. *lorea*		
Pteridaceae	*Cheilanthes lasiophylla*		
Pteridaceae	*Cheilanthes sieberi* subsp. *sieberi*		
Rhamnaceae	*Cryptandra monticola*		

Family	Species name	Conservation status	Weed
Rubiaceae	*Oldenlandia crouchiana*		
	Psydrax latifolia		
	Psydrax suaveolens		
Santalaceae	*Anthobolus leptomerioides*		
	Santalum lanceolatum		
	Santalum spicatum		
Sapindaceae	*Atalaya hemiglauca*		
	Dodonaea coriacea		
	Dodonaea lanceolata var. *lanceolata*		
	Dodonaea pachyneura		
	Dodonaea petiolaris		
	Dodonaea viscosa subsp. *spatulata*		
Scrophulariaceae	*Eremophila* aff. *clarkei*		
	Eremophila canaliculata		
	Eremophila forrestii subsp. *forrestii*		
	Eremophila fraseri		
	Eremophila fraseri subsp. *fraseri*		
	Eremophila jucunda subsp. *pulcherrima*		
	Eremophila lanceolata		
	Eremophila latrobei		
	Eremophila latrobei subsp. *filiformis*		
	Eremophila latrobei subsp. *glabra*		
	Eremophila latrobei subsp. *latrobei*		
	Eremophila longifolia		
	Eremophila magnifica subsp. *magnifica*	P4	
	Eremophila phyllopoda subsp. *obliqua*		
	Eremophila platycalyx subsp. *pardalota*		
	Eremophila sp. Hamersley Range (K. Walker KW 136)	P3	
	Eremophila sp. West Angelas (S. van Leeuwen 4068)	P1	
Solanaceae	**Datura leichhardtii*		*
	**Datura leichhardtii* subsp. *leichhardtii*		*
	Nicotiana benthamiana		
	Nicotiana sp.		
	Solanum cleistogamum		
	Solanum ferocissimum		
	Solanum gabrielae		
	Solanum horridum		
	Solanum lasiophyllum		
	Solanum phlomoides		

Family	Species name	Conservation status	Weed
Solanaceae	*Solanum* sp.		
Surianaceae	*Stylobasium spathulatum*		
Violaceae	*Hybanthus aurantiacus*		
Zygophyllaceae	*Tribulus platypterus*		
	Tribulus suberosus		

Table M.2: Vascular flora species list from previous projects in the vicinity of the survey area.

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Abutilon amplum		X		X		X		X
Abutilon cryptopetalum		X	X	X		X		X
Abutilon cunninghamii	X	X		X		X		
Abutilon fraseri	X		X					X
Abutilon fraseri subsp. *fraseri*						X		
Abutilon ?lepidum								X
Abutilon lepidum	X		X	X		X	X	X
Abutilon leucopetalum		X				X		X
Abutilon macrum	X					X	X	X
Abutilon malvifolium								X
Abutilon otocarpum	X	X	X	X		X	X	X
Abutilon oxycarpum		X		X	X	X		
Abutilon sp.		X	X					X
Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)		X		X		X	X	X
Abutilon sp. Pilbara (W.R. Barker 2025)						X		
Acacia acradenia		X		X	X			
Acacia adoxa var. *adoxa*	X	X	X	X		X	X	X
Acacia adsurgens	X	X	X	X		X	X	X
Acacia aff. *aneura* (grey flat recurved tips; MET 15,828)	X							
Acacia aff. *aneura* (long, flat, recurved; FMR 35.3)	X							
Acacia aff. *aneura* (narrow fine veined; site 1259)	X							
Acacia aff. *aneura* (scythe-shaped; MET 15,743)	X							
Acacia aff. *aneura* (subterete long; site 1245)	X							
Acacia aff. *ayersiana* (narrow form; MET 15,786)	X							
Acacia aff. *subtiliformis*						X		
Acacia ampliceps		X	X		X			X

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Acacia ?ancistrocarpa								X
Acacia ancistrocarpa	X	X	X	X	X	X		X
Acacia ancistrocarpa x trachycarpa				X				
Acacia aneura	X	X	X	X	X			
Acacia aneura sens lat.		X	X	X	X		X	X
Acacia aneura var. aff. *longicarpa* (MET 16,050)	X							
Acacia aneura var. *longicarpa*	X							
Acacia aptaneura						X		X
Acacia aptaneura x								X
Acacia arida	X	X		X	X			X
Acacia arida x								X
Acacia arrecta		X			X			
Acacia atkinsiana		X		X		X		
Acacia ayersiana	X	X		X	X	X		X
Acacia ayersiana x								X
Acacia bivenosa	X	X	X	X	X	X	X	X
Acacia bromilowiana P4								X
Acacia ?catenulata								X
Acacia catenulata	X							
Acacia catenulata subsp. *occidentalis*		X		X		X	X	X
Acacia citrinoviridis		X	X	X	X	X	X	X
Acacia colei				X				X
Acacia colei var. *colei*						X		
Acacia coriacea subsp. *pendens*		X	X	X				X
Acacia cowleana	X	X		X	X	X		
Acacia cuthbertsonii subsp. *cuthbertsonii*		X		X				
Acacia dictyophleba	X	X	X	X	X	X		X
Acacia distans		X	X	X				
Acacia elachantha		X		X			X	
Acacia eriopoda						X		
Acacia hamersleyensis		X	X	X		X	X	X

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Acacia hilliana	X	X	X	X	X		X	X
Acacia holosericea		X		X				
Acacia inaequilatera	X	X	X	X	X	X	X	X
Acacia incurvaneura						X		X
Acacia kempeana	X	X						X
Acacia ligulata				X				
Acacia macraneura						X		X
Acacia maitlandii	X	X	X	X	X	X	X	X
Acacia marramamba		X		X		X		X
Acacia minyura						X		X
Acacia monticola	X	X	X	X	X	X	X	X
Acacia mulganeura								X
Acacia orthocarpa				X				
Acacia pachyacra	X	X		X		X	X	X
Acacia paraneura	X							
Acacia pruinocarpa	X	X	X	X	X	X	X	X
Acacia pteraneura		X	X	X	X	X		X
Acacia pteraneura x aptaneura								X
Acacia pyrifolia	X	X	X	X	X	X	X	X
Acacia pyrifolia var. *pyrifolia*						X		
Acacia rhodophloia		X		X		X	X	X
Acacia sclerosperma subsp. *sclerosperma*		X		X	X			
Acacia sericophylla		X		X				
Acacia sibirica		X		X	X	X	X	X
Acacia sibirica x								X
Acacia sp.		X		X	X			X
Acacia spondylophylla		X	X				X	X
Acacia steedmanii	X							
Acacia steedmanii subsp. *borealis*								X
Acacia synchronicia	X	X		X	X	X		X
Acacia tenuissima	X	X	X	X	X	X	X	X

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Acacia tetragonophylla	X	X		X	X	X	X	X
Acacia trachycarpa x tumida var. *pilbarensis*		X						
Acacia tumida		X	X	X				X
Acacia tumida var. *pilbarensis*								X
Acacia validinervia						X		
Acacia victoriae		X		X	X			
Achyranthes aspera						X		
Acrachne racemosa				X		X	X	X
Adriana tomentosa var. *tomentosa*		X	X	X		X		X
**Aerva javanica*		X	X					
Alternanthera denticulata								X
Alternanthera nana	X	X		X		X	X	X
Alternanthera nodiflora		X	X	X			X	
**Alternanthera pungens*		X						
Amaranthus cuspidifolius						X		
Amaranthus mitchellii		X	X	X		X		
Amaranthus sp.								X
Amaranthus undulatus			X	X				X
Amphipogon caricinus		X						
Amphipogon caricinus var. *caricinus*		X						
Amphipogon sericeus	X	X		X		X	X	X
Amyema fitzgeraldii				X				X
Amyema hilliana		X				X		X
Amyema miquelii		X	X	X		X		X
Amyema sanguinea		X						
Amyema sanguinea var. *pulchra*		X						
Androcalva loxophylla		X		X				
Androcalva luteiflora	X	X	X	X	X	X	X	X
Anthobolus leptomerioides	X	X	X	X	X		X	X
**Argemone ochroleuca*		X	X					
Aristida burbidgeae						X	X	X

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Aristida contorta	X	X	X	X	X	X	X	X
Aristida holathera		X						
Aristida holathera var. *holathera*	X	X	X	X	X	X	X	X
Aristida ?inaequiglumis								X
Aristida inaequiglumis	X	X		X			X	X
Aristida ingrata						X	X	X
Aristida jerichoensis var. *subspinulifera* P3						X		
Aristida latifolia		X	X	X		X		X
Aristida lazaridis P2						X		X
Aristida obscura	X	X				X		X
Aristida pruinosa	X	X		X				
Aristida sp.		X		X				X
Asteraceae sp.		X	X	X				
Astrebla elymoides								X
Astrebla pectinata						X		
Astrebla sp.								X
Astrotricha hamptonii		X		X	X	X	X	X
Atalaya hemiglauca		X	X	X				X
Atriplex vesicaria		X						
Austrostipa sp.		X						
Bergia pedicellaris		X						
**Bidens bipinnata*	X	X	X	X	X	X	X	X
Blumea tenella		X						
Boerhavia burbidgeana		X		X				
Boerhavia ?coccinea								X
Boerhavia coccinea		X		X		X		X
Boerhavia gardneri		X		X				
Boerhavia paludosa						X		
Boerhavia sp.		X	X	X				
Bonamia erecta		X						
Bonamia media	X	X						

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Bonamia pilbarensis								X
Bonamia rosea	X	X		X				
Bothriochloa ewartiana	X					X	X	X
Brachyachne ciliaris						X		
Brachychiton acuminatus								X
Brachyscome iberidifolia		X		X				
Brunonia australis	X	X			X			
Brunonia sp. Long hairs (D.E. Symon 2440)						X		
Bulbostylis barbata		X		X		X	X	X
Bulbostylis turbinata		X		X				X
Cajanus marmoratus				X				
Calandrinia ?eremaea		X						
Calandrinia ptychosperma	X							
Calandrinia quadrivalvis		X						
Calandrinia sp. The Pink Hills (F. Obbens FO 19/06)						X		
Calocephalus knappii	X					X		
Calotis hispidula	X							
Calotis multicaulis						X		
Calotis plumulifera	X							
Calotis porphyroglossa						X		
Calytrix carinata		X		X		X		X
Capparis lasiantha	X	X	X	X	X	X	X	X
Capparis mitchellii						X		
Capparis spinosa		X	X	X	X			
Capparis spinosa subsp. *nummularia*						X	X	X
Capparis umbonata		X	X	X	X			X
Cassytha capillaris		X		X		X	X	X
Cassytha filiformis								X
Cassytha sp.			X	X				X
**Cenchrus ciliaris*	X	X	X	X		X		X
**Cenchrus setiger*				X				X

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Centipeda minima subsp. *macrocephala*		X					X	X
Cheilanthes austrotenuifolia		X		X	X			
Cheilanthes lasiophylla						X		X
Cheilanthes sieberi							X	X
Cheilanthes sieberi subsp. *sieberi*	X	X		X		X		X
Chloris pectinata						X		
**Chloris virgata*		X		X			X	X
Chrysocephalum apiculatum	X	X	X	X		X		
Chrysocephalum apiculatum subsp. *pilbarensis*								X
Chrysocephalum eremaeum			X			X		
Chrysocephalum gilesii	X	X		X		X		X
Chrysocephalum pterochaetum	X	X			X	X		
Chrysopogon fallax	X	X		X	X	X	X	X
Cleome oxalidea		X		X				
Cleome viscosa	X	X	X	X	X	X	X	X
Clerodendrum floribundum						X		
Clerodendrum floribundum var. *angustifolium*		X	X	X	X	X	X	X
Clerodendrum ?tomentosum			X					
Clerodendrum tomentosum var. *lanceolatum*								X
Codonocarpus cotinifolius	X	X	X	X	X	X	X	X
Commelina ensifolia		X		X				X
Convolvulaceae sp.			X					
Convolvulus angustissimus subsp. *angustissimus*	X							
Convolvulus clementii						X		X
**Conyza bonariensis*								X
Corchorus crozophorifolius						X	X	X
Corchorus lasiocarpus	X	X	X	X		X	X	X
Corchorus lasiocarpus subsp. *lasiocarpus*		X		X	X			
Corchorus lasiocarpus subsp. *parvus*		X				X		X
Corchorus parviflorus		X						
Corchorus sidoides subsp. *sidoides*						X		

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Corchorus sp.				X				
Corchorus sp. 1		X						
Corchorus sp. B		X						
Corchorus tridens				X		X		X
Corchorus walcottii		X	X	X	X			
Corymbia aspera		X		X				
Corymbia candida						X		X
Corymbia deserticola	X	X						X
Corymbia deserticola subsp. *deserticola*		X	X	X	X	X	X	X
Corymbia ferriticola		X	X				X	X
Corymbia hamersleyana	X	X	X	X	X	X		X
Corymbia hamersleyana sens. lat.							X	X
Corymbia opaca		X						X
Corymbia sp.								X
Corymbia sp. (seedlings)				X				
Corymbia zygophylla		X				X		
Corynotheca micrantha						X		
Crotalaria cunninghamii		X		X				
Crotalaria medicaginea		X	X	X				
Crotalaria medicaginea var. *neglecta*						X		X
Crotalaria novae-hollandiae		X			X			X
Crotalaria novae-hollandiae subsp. *novae-hollandiae*						X		
Cryptandra monticola		X				X		X
Cucumis argenteus	X	X	X	X	X			
Cucumis melo								X
Cucumis variabilis						X	X	X
Cullen lachnostachys		X	X		X			
Cullen leucanthum		X		X				
Cullen leucochaites				X		X	X	X
Cullen martinii		X			X			
Cullen pogonocarpum		X		X	X			

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Cuscuta victoriana								X
Cymbopogon ambiguus	X	X	X	X	X	X	X	X
Cymbopogon bombycinus		X						
Cymbopogon obtectus	X	X		X		X	X	X
Cymbopogon procerus		X		X	X	X		
Cymbopogon sp.		X						X
Cynanchum floribundum						X	X	X
Cynanchum viminale								X
Cynanchum viminale subsp. *australe*	X	X			X	X		
Cynodon convergens		X	X	X		X	X	X
**Cynodon dactylon*								X
Cynodon prostratus								X
Cyperus cunninghamii		X						
Cyperus cunninghamii subsp. *cunninghamii*						X	X	X
Cyperus difformis								X
Cyperus iria			X					
Cyperus sp.		X						
Cyperus vaginatus		X	X	X	X			X
Dactyloctenium ?radulans								X
Dactyloctenium radulans	X	X		X				X
Dampiera candicans		X	X	X	X	X		X
**Datura leichhardtii*		X	X	X				X
**Datura leichhardtii* subsp. *leichhardtii*								X
Dichanthium sericeum		X		X	X	X		X
Dichanthium sericeum subsp. *humilius*								X
Dichanthium sp.								X
Dicladanthera forrestii		X				X	X	X
Dicrastylis cordifolia		X		X				
Digitaria ammophila	X	X	X	X	X			X
Digitaria brownii	X	X		X		X	X	X
Digitaria ctenantha		X		X		X	X	X

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Diplopeltis stuartii var. *stuartii*		X						
Dipteracanthus australasicus subsp. *australasicus*	X	X				X	X	X
Dissocarpus paradoxus						X		
Dodonaea coriacea	X	X		X	X	X		X
Dodonaea lanceolata var. *lanceolata*	X	X	X	X		X		X
Dodonaea pachyneura		X	X	X		X		X
Dodonaea petiolaris		X		X				X
Dodonaea sp.				X				
Dodonaea viscosa		X	X				X	X
Dodonaea viscosa subsp. *mucronata*	X		X			X		
Dodonaea viscosa subsp. *spatulata*						X		X
Duperreya commixta	X	X	X	X	X	X	X	X
Dysphania glomulifera						X		
Dysphania glomulifera subsp. *eremaea*						X		
Dysphania kalpari	X	X		X		X		X
Dysphania melanocarpa	X							X
Dysphania plantaginella								X
Dysphania rhadinostachya		X					X	X
Dysphania rhadinostachya subsp. *rhadinostachya*	X	X	X	X	X	X		X
**Echinochloa colona*								X
Ehretia saligna				X				
Enchylaena tomentosa		X	X	X	X			
Enchylaena tomentosa var. *tomentosa*	X					X	X	X
Enneapogon avenaceus						X		
Enneapogon caerulescens	X	X	X	X	X	X	X	X
Enneapogon intermedius						X		
Enneapogon lindleyanus	X	X		X		X	X	X
Enneapogon pallidus						X		
Enneapogon polyphyllus	X	X		X	X	X	X	X
Enneapogon purpurascens			X	X				

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Enneapogon robustissimus						X	X	X
Enneapogon sp.								X
Enteropogon ramosus		X		X	X		X	X
Eragrostis cumingii		X	X	X	X	X	X	X
Eragrostis desertorum						X		
Eragrostis dielsii		X		X		X		
Eragrostis eriopoda	X	X		X	X	X		X
Eragrostis falcata		X		X		X		
Eragrostis leptocarpa		X		X				
Eragrostis pergracilis		X		X		X		
Eragrostis setifolia		X			X	X	X	X
Eragrostis sp.		X		X				
Eragrostis tenellula		X			X	X	X	X
Eragrostis xerophila						X		X
Eremophila aff. *clarkei*								X
Eremophila caespitosa						X		
Eremophila canaliculata								X
Eremophila clarkei						X		
Eremophila cuneifolia		X		X		X		
Eremophila exilifolia		X		X		X		
Eremophila forrestii	X	X						
Eremophila forrestii subsp. *forrestii*	X	X	X	X	X	X	X	X
Eremophila ?forrestii subsp. *viridis*		X						
Eremophila forrestii subsp. *viridis* P3		X						
Eremophila fraseri		X			X			X
Eremophila fraseri subsp. *fraseri*	X	X				X	X	X
Eremophila galeata		X	X	X		X		
Eremophila jucunda							X	X
Eremophila jucunda subsp. *jucunda*		X		X	X			
Eremophila jucunda subsp. *pulcherrima*						X		X
Eremophila lanceolata	X	X		X		X		X

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Eremophila latrobei		X	X	X	X	X		X
Eremophila latrobei subsp. aff. *filiformis*	X							
Eremophila ?latrobei subsp. *filiformis*		X						
Eremophila latrobei subsp. *filiformis*	X	X		X	X	X		X
Eremophila latrobei subsp. *glabra*	X	X						X
Eremophila latrobei subsp. *latrobei*		X		X		X		X
Eremophila longifolia	X	X	X	X	X	X	X	X
Eremophila maculata		X		X				
Eremophila magnifica subsp. *magnifica* P4							X	
Eremophila magnifica subsp. *velutina* P3			X				X	
Eremophila phyllopoda subsp. *obliqua*						X		X
Eremophila platycalyx subsp. *pardalota*	X					X		X
Eremophila pusilliflora P2						X		
Eremophila sp.		X		X				
Eremophila sp. Hamersley Range (K. Walker KW 136) P3							X	X
Eremophila sp. West Angelas (S. van Leeuwen 4068) P1								X
Eremophila tietkensii						X	X	
Eremophila youngii		X		X				
Eremophila youngii subsp. *lepidota* P4		X		X				
Eriachne aristidea	X	X		X				X
Eriachne ?benthamii								X
Eriachne benthamii								X
Eriachne ciliata		X						
Eriachne flaccida			X					
Eriachne helmsii						X		
Eriachne lanata		X	X	X		X	X	X
Eriachne melicacea		X						
Eriachne mucronata	X	X	X	X	X	X	X	X
Eriachne obtusa		X		X	X			X
Eriachne ovata		X						

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Eriachne pulchella		X	X	X	X		X	X
Eriachne pulchella subsp. *dominii*	X		X			X		X
Eriachne pulchella subsp. *pulchella*						X		X
Eriachne sp.		X		X				
Eriachne tenuiculmis	X	X					X	X
Eucalyptus camaldulensis		X	X	X				X
Eucalyptus camaldulensis subsp. *obtusa*								X
Eucalyptus gamophylla	X	X	X	X	X	X	X	X
Eucalyptus kingsmillii		X						X
Eucalyptus leucophloia		X	X	X	X	X		
Eucalyptus leucophloia subsp. *leucophloia*	X	X				X	X	X
Eucalyptus pilbarensis						X		X
Eucalyptus repullulans								X
Eucalyptus ?sheathiana		X		X				
Eucalyptus socialis		X		X	X			
Eucalyptus socialis subsp. *?eucentrica*		X						X
Eucalyptus socialis subsp. *eucentrica*						X		X
Eucalyptus sp.		X	X	X				
Eucalyptus striaticalyx		X		X				
Eucalyptus trivalva	X	X		X	X	X		
Eucalyptus victrix		X	X	X	X	X	X	X
Eucalyptus xerothermica	X	X	X	X	X	X	X	X
Eucalyptus xerothermica x Eucalyptus tephrodes								X
Eulalia ?aurea								X
Eulalia aurea	X	X	X	X	X	X	X	X
Euphorbia aff. coghlanii (HD186-18)	X							
Euphorbia alsiniflora						X		
Euphorbia australis	X	X	X	X	X	X	X	X
Euphorbia australis var. *subtomentosa*								X
Euphorbia biconvexa		X			X	X		X
Euphorbia biconvexa/coghlanii/trigonosperma								X

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Euphorbia boophthona	X	X	X	X	X	X	X	X
Euphorbia careyi	X							X
Euphorbia coghlanii		X	X	X	X			X
Euphorbia drummondii		X	X	X		X		
Euphorbia myrtoides		X		X				
Euphorbia schultzii		X			X	X		
Euphorbia sp.								X
Euphorbia sp. (site 1089)	X							
Euphorbia tannensis subsp. *eremophila*	X		X	X				
Euphorbia trigonosperma							X	X
Evolvulus alsinoides		X	X	X	X	X	X	X
Evolvulus alsinoides var. *decumbens*						X		X
Evolvulus alsinoides var. *villosicalyx*	X	X				X		X
Exocarpos aphyllus		X		X				
Exocarpos sparteus		X				X		
Ficus brachypoda		X		X		X	X	X
Fimbristylis dichotoma		X	X	X		X	X	X
Fimbristylis simulans		X		X		X		X
Fimbristylis sp.		X						X
**Flaveria trinervia*	X	X	X	X	X	X	X	X
Frankenia ?magnifica		X		X				
Frankenia setosa		X						
Gastrolobium grandiflorum		X				X		
Glycine canescens		X		X		X	X	X
Gnephosis arachnoidea	X							
Gompholobium karijini P2	X	X		X	X			
Gompholobium oreophilum						X		X
Gompholobium polyzygum		X	X	X	X			
Gomphrena affinis subsp. *pilbarensis*						X		
Gomphrena canescens		X				X		
Gomphrena canescens subsp. *canescens*		X		X				

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Gomphrena cunninghamii		X		X	X	X	X	X
Gomphrena kanisii						X		
Goodenia ? prostrata		X						
Goodenia cusackiana		X		X	X			X
Goodenia ?krauseana			X					
Goodenia lamprosperma		X		X				X
Goodenia microptera	X	X	X	X	X	X	X	X
Goodenia muelleriana		X	X	X	X	X	X	X
Goodenia nuda P4						X		
Goodenia ?prostrata				X				
Goodenia prostrata	X	X						X
Goodenia purpurascens P3		X						
Goodenia scaevolina						X		
Goodenia sp.		X	X	X				X
Goodenia sp. (of interest)								X
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727) P3		X		X				
Goodenia stellata	X	X				X		X
Goodenia stobbsiana	X	X	X	X	X	X	X	X
Goodenia tenuiloba						X		X
Goodenia triodiophila	X	X		X	X	X	X	X
Gossypium australe	X	X	X	X	X	X	X	X
Gossypium robinsonii		X	X	X	X	X	X	X
Gossypium sturtianum		X						
Gossypium sturtianum var. *sturtianum*								X
Grevillea berryana	X	X		X		X		X
Grevillea pyramidalis		X		X				
Grevillea saxicola P3								X
Grevillea stenobotrya		X		X		X		
Grevillea striata		X						
Grevillea wickhamii	X	X	X	X	X	X	X	X
Grevillea wickhamii subsp. *aprica*		X			X			

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Grevillea wickhamii subsp. *hispidula*						X		X
Gymnanthera cunninghamii P3		X						
Hakea chordophylla	X	X	X	X	X	X	X	X
Hakea lorea subsp. *lorea*	X	X		X	X	X	X	X
Halgania cyanea								X
Halgania cyanea var. Allambi Stn (B.W. Strong 676)		X						
Halgania erecta		X						
Halgania gustafsenii	X					X		X
Halgania gustafsenii var. *gustafsenii*								X
Halgania gustafsenii var. *Mid West (G. Perry 370)*		X						
Halgania solanacea		X		X				
Halgania solanacea var. Mt Doreen (G.M. Chippendale 4206)		X						
Haloragis gossei	X	X				X		X
Haloragis gossei var. *gossei*						X		
Haloragis gossei var. *inflata*						X		
Haloragis odontocarpa								X
Haloragis sp.								X
Harnieria kempeana subsp. *muelleri*						X		
Heliotropium chrysocarpum	X					X		
Heliotropium cunninghamii		X	X	X	X	X	X	
Heliotropium heteranthum	X	X	X	X	X	X	X	
Heliotropium inexplicitum	X	X		X		X	X	X
Heliotropium ovalifolium		X		X	X			X
Heliotropium pachyphyllum		X				X		X
Heliotropium sp.		X						
Heliotropium tanythrix								X
Heliotropium tenuifolium			X			X	X	X
Heteropogon contortus		X						
Hibiscus aff. *coatesii*	X							

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Hibiscus burtonii	X	X	X	X	X	X	X	X
Hibiscus ?coatesii								X
Hibiscus coatesii		X		X	X	X	X	X
Hibiscus leptocladus		X		X				X
Hibiscus sp.		X						
Hibiscus sp. Gardneri (A.L. Payne PRP 1435)						X		
Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2							X	X
Hibiscus sp. Mt Robinson (G. Byrne 3537)							X	
Hibiscus sturtii						X	X	X
Hibiscus sturtii var *?sturtii*		X						
Hibiscus sturtii var. aff. *grandiflorus*	X							
Hibiscus sturtii var. *campylochlamys*	X	X		X		X		X
Hibiscus sturtii var. *platychlamys*	X	X				X		X
Hibiscus sturtii var. *truncatus*		X						
**Hibiscus tridactylites*						X		
Hibiscus verdcourtii								X
Hybanthus aurantiacus		X	X	X		X	X	X
Indigofera brevidens	X	X		X	X			
Indigofera colutea		X	X	X				
Indigofera fractiflexa		X		X	X	X		
Indigofera fractiflexa subsp. *fractiflexa*							X	X
Indigofera georgei	X	X		X		X	X	X
Indigofera gilesii P3						X		
Indigofera linifolia		X		X				X
Indigofera monophylla	X	X	X	X	X	X	X	X
Indigofera rugosa						X		X
Indigofera trita				X				
Ipomoea coptica		X		X				
Ipomoea muelleri		X	X	X		X		
Ipomoea polymorpha						X		
Ischaemum albovillosum						X		

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Iseilema dolichotrichum		X		X				
Iseilema eremaeum						X		X
Iseilema membranaceum		X		X		X	X	X
Iseilema sp.								X
Iseilema vaginiflorum				X		X		X
Isotoma petraea						X		
Isotropis cuneifolia		X		X				
Isotropis forrestii P1	X	X		X	X	X		
Isotropis sp. Arid zone (G. Byrne 2775)							X	X
Ixiochlamys cuneifolia			X					
Jacksonia aculeata		X						
Jasminum didymum subsp. *lineare*	X	X	X	X	X	X	X	X
Josephinia eugeniae								X
**Lactuca serriola*			X					X
Lamarchea sulcata		X						
Lepidium catapycnon P4		X		X		X		X
Lepidium echinatum		X						
Lepidium muelleri-ferdinandii	X							
Lepidium pedicellosum		X	X	X	X	X		X
Lepidium phlebopetalum	X					X		X
Lepidium pholidogynum						X		X
Lepidium platypetalum						X		
Lepidium sp.								X
Lobelia arnhemiaca			X					X
Lobelia heterophylla		X			X	X		
Lobelia heterophylla subsp. *pilbarensis*							X	X
Lotus cruentus	X							
Lysiana casuarinae		X		X				
Maireana aphylla		X						
Maireana carnosa		X		X				X
Maireana eriosphaera								X

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Maireana georgei	X	X		X	X	X		X
Maireana lanosa						X		
Maireana melanocoma	X	X				X		X
Maireana planifolia	X	X		X		X	X	
Maireana planifolia x villosa	X							
Maireana sp.	X	X		X	X			
Maireana thesioides	X	X		X				
Maireana tomentosa		X	X	X	X	X		
Maireana tomentosa subsp. *tomentosa*								X
Maireana triptera	X	X		X		X		X
Maireana villosa	X	X	X	X		X	X	X
Malvaceae sp.		X	X	X				
**Malvastrum americanum*	X		X	X		X	X	X
Marsdenia australis		X				X		X
Marsdenia sp.								X
Marsilea hirsuta				X		X		
Maytenus sp. Mt Windell (S. van Leeuwen 846)						X		X
Melaleuca argentea		X	X	X				X
Melaleuca bracteata		X			X			X
Melaleuca eleuterostachya		X		X	X	X		X
Melaleuca glomerata		X			X			X
Melaleuca lasiandra		X		X	X			
Melhania oblongifolia		X		X		X	X	X
**Melinis repens*								X
Menkea villosula	X							
Mirbelia viminalis	X	X	X	X		X	X	X
Monachather paradoxus			X					
Myoporum montanum		X						
Neobassia astrocarpa		X						
Neptunia dimorphantha								X

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Newcastelia sp. Hamersley Range (S. van Leeuwen 4264)						X	X	X
Nicotiana benthamiana		X		X	X	X		X
Nicotiana occidentalis		X		X		X		
Nicotiana occidentalis subsp. *obliqua*		X						
Nicotiana rosulata subsp. *ingulba*			X					
Nicotiana rosulata subsp. *rosulata*	X	X		X				
Nicotiana simulans						X		
Nicotiana sp.								X
Notoleptopus decaisnei						X		
Notoleptopus decaisnei var. Orbicularis (A.B. Craig 428)								X
Oldenlandia crouchiana		X	X	X		X	X	X
Olearia fluvialis		X	X	X				
Olearia stuartii	X							
Olearia xerophila	X							
Operculina aequisepala						X		
Oxalis aff. *corniculata* (site 654)	X							
Pandorea pandorana								X
Panicum decompositum		X			X	X		X
Panicum effusum		X		X		X		X
Panicum laevinode						X		
Papilionaceae sp. (juvenile)		X		X				
Paraneurachne muelleri	X	X	X	X	X	X	X	X
Paspalidium basicladum	X		X			X		
Paspalidium clementii						X	X	X
Paspalidium constrictum						X		
Paspalidium jubiflorum								X
Paspalidium rarum						X		X
Paspalidium sp.		X		X				
Peripleura arida						X		X
Peripleura hispidula var. *setosa*						X		

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Peripleura obovata						X		X
Peripleura virgata		X			X			X
Perotis rara		X	X	X		X		X
Petalostylis labicheoides	X	X	X	X	X	X	X	X
**Phoenix dactylifera*			X					
Phyllanthus erwinii	X					X	X	X
Phyllanthus maderaspatensis		X		X		X	X	X
Pittosporum angustifolium		X		X	X	X		
Pluchea dentex		X	X	X	X	X	X	X
Pluchea dunlopii		X				X		
Pluchea rubelliflora		X						X
Pluchea sp.								X
Poaceae sp.		X	X		X			
Polycarpaea corymbosa						X		
Polycarpaea corymbosa var. *corymbosa*		X					X	X
Polycarpaea holtzei						X	X	X
Polycarpaea longiflora	X	X	X	X		X	X	X
Polygala isingii						X		X
Polymeria aff. *longifolia*								X
Polymeria ambigua	X	X	X	X		X	X	X
Portulaca oleracea		X		X		X		X
**Portulaca pilosa*		X		X				
Prostanthera albiflora							X	
Pseudognaphalium luteoalbum		X	X					
Psydrax latifolia	X	X	X	X	X	X	X	X
Psydrax rigidula		X						
Psydrax suaveolens	X	X		X	X	X	X	X
Pterocaulon serrulatum		X	X	X	X	X		X
Pterocaulon serrulatum var. *velutinum*								X
Pterocaulon sp.	X		X					X
Pterocaulon sphacelatum		X		X	X	X	X	X

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Pterocaulon sphaeranthoides	X	X		X				X
Ptilotus ? incanus var. *incanus*		X						
Ptilotus aervoides	X	X		X		X		X
Ptilotus astrolasius	X	X	X	X	X	X	X	X
Ptilotus auriculifolius		X		X	X	X		X
Ptilotus calostachyus	X	X	X	X	X	X	X	X
Ptilotus carinatus		X		X		X		
Ptilotus clementii		X		X		X		X
Ptilotus drummondii		X						
Ptilotus exaltatus	X	X	X	X	X		X	X
Ptilotus fusiformis		X		X		X		X
Ptilotus gaudichaudii	X	X		X				
Ptilotus gomphrenoides		X				X		
Ptilotus helipteroides	X	X	X	X	X	X	X	X
Ptilotus incanus				X				X
Ptilotus macrocephalus	X							
Ptilotus mollis P4								X
Ptilotus nobilis						X		
Ptilotus obovatus		X				X	X	X
Ptilotus obovatus var. *obovatus*	X	X	X	X	X			
Ptilotus polystachyus	X	X		X	X	X		
Ptilotus roei		X		X		X		X
Ptilotus rotundifolius	X	X	X	X	X	X	X	X
Ptilotus schwartzii		X						
Ptilotus schwartzii var. *schwartzii*				X		X		X
Ptilotus sp.		X		X	X			X
Rhagodia eremaea	X	X	X	X	X	X	X	X
Rhagodia sp. Hamersley (M. Trudgen 17794) P3	X	X		X		X		X
Rhagodia sp.1		X						
Rhagodia sp.2		X						
Rhodanthe charsleyae	X							

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Rhodanthe citrina						X		
Rhodanthe floribunda	X	X			X	X		
Rhodanthe humboldtiana	X							
Rhodanthe margarethae	X					X	X	X
Rhodanthe propinqua	X							
Rhodanthe sp.	X	X						
Rhynchosia minima		X	X	X	X	X	X	X
Roebuckiella ciliocarpa	X	X		X				
Roebuckiella similis						X		
Roepera eichleri						X		
Roepera iodocarpum	X	X			X	X		
Rostellularia adscendens			X					
Rostellularia adscendens var. *clementii*								X
Rostellularia adscendens var. *pogonanthera*		X						
Rutidosis helichrysoides subsp. *helichrysoides*		X		X	X		X	
Salsola australis	X	X		X	X	X	X	X
Santalum acuminatum		X						
Santalum lanceolatum	X	X		X		X	X	X
Santalum spicatum		X				X	X	X
Scaevola acacioides	X	X		X				X
Scaevola amblyanthera		X		X	X			X
Scaevola amblyanthera var. *centralis*	X							X
Scaevola browniana								X
Scaevola browniana subsp. *browniana*		X		X	X	X		
Scaevola parvifolia				X		X		
Scaevola parvifolia subsp. *pilbarae*	X	X	X	X	X	X	X	X
?Scaevola spinescens		X		X				
Scaevola spinescens		X		X		X		X
Schenkia australis								X
Schizachyrium fragile			X				X	X
Sclerolaena convexula		X		X		X		

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Sclerolaena cornishiana	X	X		X		X	X	X
Sclerolaena costata	X							
Sclerolaena cuneata		X		X				X
Sclerolaena densiflora	X							X
Sclerolaena deserticola		X		X				
Sclerolaena eriacantha	X	X		X		X		
Sclerolaena ?gardneri								X
Sclerolaena tetragona						X		
Senna artemisioides	X							
Senna artemisioides subsp. *filifolia*		X		X		X		X
Senna artemisioides subsp. *helmsii*	X	X		X	X	X	X	X
Senna artemisioides subsp. *helmsii x oligophylla*		X						
Senna artemisioides subsp. *oligophylla*		X	X	X	X	X	X	X
Senna artemisioides subsp. *oligophylla x helmsii*		X	X	X	X			X
Senna artemisioides subsp. *x artemisioides*		X		X	X	X		X
Senna artemisioides subsp. *x sturtii*		X		X	X		X	
Senna charlesiana	X	X		X				
Senna ferraria		X			X	X	X	X
Senna glaucifolia	X	X		X	X			X
Senna glaucifolia x ? (site 626)	X							
Senna glaucifolia x glutinosa	X							
Senna glaucifolia x helmsii	X							
Senna glaucifolia x luerssenii	X							
Senna glaucifolia x oligophylla	X							
Senna glutinosa	X	X						X
Senna glutinosa subsp. *chatelainiana*		X			X			
Senna glutinosa subsp. *glutinosa*		X	X	X	X	X	X	X
Senna glutinosa subsp. *pruinosa*		X	X	X	X	X	X	X
Senna glutinosa subsp. *x luerssenii*	X	X		X	X	X	X	X
Senna glutinosa x luerssenii	X							

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Senna hamersleyensis		X				X		
Senna luerssenii x 'stricta'	X							
Senna notabilis	X	X	X	X	X	X	X	X
Senna oligophylla x helmsii	X							
Senna pleurocarpa var. *angustifolia*		X		X		X		X
Senna sericea		X		X	X	X		X
Senna sp.		X		X				
Senna sp. Meekatharra (E. Bailey 1-26)	X					X		X
Senna sp. Meekatharra (E. Bailey 1-26) ×								X
Senna stricta	X	X		X		X		X
Senna symonii		X		X		X		
Senna venusta		X		X	X		X	X
Seringia elliptica	X	X		X			X	X
Seringia nephrosperma	X	X		X	X			X
Seringia sp.								X
Seringia velutina		X				X		
Sesbania cannabina		X	X					X
Setaria dielsii	X	X				X	X	X
Setaria surgens						X		
**Setaria verticillata*								X
Sida ? sp. Dark Green Fruits(S. van Leeuwen 2260)			X					
Sida aff. cardiophylla (site 1215)	X							
Sida aff. *fibulifera*	X							
Sida ?ammophila		X						
Sida arenicola	X	X		X	X	X	X	X
Sida arsiniata						X		
Sida calyxhymenia		X	X					X
Sida cardiophylla	X	X	X	X	X			X
Sida clementii			X					
Sida echinocarpa	X	X	X			X	X	X
Sida ?ectogama								X

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Sida ectogama	X	X				X		
Sida fibulifera		X	X	X		X	X	X
Sida platycalyx	X	X	X	X	X		X	X
Sida rohlenae		X	X	X	X			
Sida sp.		X	X	X	X			X
Sida sp. (DM194)		X						
Sida sp. (MET 16,086)	X							
Sida sp. (SC078)		X						
Sida sp. (SC092)		X						
Sida sp. 1		X						
Sida sp. 3		X						
Sida sp. 4		X						
Sida sp. Articulation below (A.A. Mitchell PRP 1605)								X
*Sida ?*sp. B Kimberley Flora (A.A. Mitchell 2745)		X						
Sida sp. Barlee Range (S. van Leeuwen 1642) P3						X		
*Sida ?*sp. dark green fruits (S. van Leeuwen 2260)								X
Sida sp. dark green fruits (S. van Leeuwen 2260)	X	X		X		X		X
Sida sp. Excedentifolia (J.L. Egan 1925)		X	X	X	X		X	X
Sida sp. Golden calyces glabrous (H.N. Foote 32)						X		X
Sida sp. L (A.M. Ashby 4202)						X		
Sida sp. Pilbara (A.A. Mitchell PRP 1543)		X				X	X	X
*Sida ?*sp. Pilbara (A.A.Mitchell PRP1543)				X				
Sida sp. Shovelanna Hill (S. van Leeuwen 3842)						X	X	X
*Sida ?*sp. spiciform panicles (E. Leyland s.n. 14/8/90)		X						

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	X	X				X	X	X
Sida sp. Supplejack Station (T.S. Henshall 2345)						X		
Sida sp.2		X						
Sida spinosa						X		
Sida trichopoda						X		
**Sigesbeckia orientalis*		X				X	X	X
Solanum centrale	X	X	X	X	X	X		
Solanum cleistogamum								X
Solanum ellipticum		X						
Solanum esuriale		X		X				
Solanum ferocissimum	X							X
Solanum gabrielae		X	X				X	X
Solanum horridum	X	X			X	X	X	X
Solanum lasiophyllum	X	X	X	X	X	X	X	X
**Solanum nigrum*								X
Solanum phlomoides		X		X	X	X		X
Solanum sp.		X						X
Solanum sturtianum		X			X	X		
**Sonchus oleraceus*		X		X	X			X
Sonchus sp.		X	X					
Sorghum plumosum		X	X	X				
Spermacoce brachystema		X				X		
Sporobolus actinocladus		X						
Sporobolus australasicus		X	X	X	X	X	X	X
Stackhousia intermedia	X	X	X	X		X		
Stackhousia muricata subsp. annual (W.R. Barker 2172)								X
Stemodia grossa	X	X	X	X	X		X	X
Stemodia sp.		X						
Stemodia viscosa		X						

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Stenopetalum anfractum	X							
Stenopetalum decipiens							X	
Stenopetalum nutans	X							
Stenopetalum velutinum	X							
?Streptoglossa bubakii				X				
Streptoglossa ?bubakii			X					
Streptoglossa bubakii	X	X		X	X	X		X
Streptoglossa decurrens		X	X		X	X	X	X
Streptoglossa liatroides		X	X	X	X	X		
Streptoglossa odora		X				X		
Streptoglossa sp.		X						X
Streptoglossa tenuiflora		X		X		X		
Stylidium sp.		X						
Stylidium weeliwolli P3		X	X					
Stylobasium spathulatum		X	X	X	X	X	X	X
Swainsona kingii	X					X		
Swainsona maccullochiana		X		X	X	X		X
Swainsona sp.			X					
Templetonia egena	X	X				X		X
Tephrosia clementii		X				X		
Tephrosia densa						X		X
Tephrosia oxalidea	X						X	X
Tephrosia rosea		X		X				
Tephrosia rosea var. *clementii*		X	X	X	X			
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	X	X				X	X	X
Tephrosia rosea var. *rosea*			X					
Tephrosia sp. Bungaroo Creek (M.E. Trudgen 11601)		X						
Tephrosia ?supina			X					
Tephrosia supina		X				X		
Termites		X						

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Teucrium teucriiflorum		X				X		X
Themeda avenacea								X
Themeda sp.								X
Themeda sp. ?Hamersley Station (M.E. Trudgen 11431) (P3)		X						
Themeda sp. Hamersley Station (M.E. Trudgen 11431) P3						X		
Themeda sp. Mt Barricade (M.E. Trudgen 2471)		X	X	X				X
Themeda triandra	X	X	X	X	X	X	X	X
Tinospora smilacina							X	X
Trachymene bialata		X						
Trachymene oleracea		X	X	X	X			
Trachymene oleracea subsp. *oleracea*	X	X		X		X	X	X
Trachymene pilbarensis						X		
Tragus australianus	X					X		X
Trianthema glossostigmum		X		X		X		X
Trianthema pilosum				X				
Trianthema triquetrum				X				
Tribulus astrocarpus		X		X	X	X		
Tribulus cistoides		X		X				
Tribulus hirsutus		X		X	X	X		
Tribulus macrocarpus						X		
Tribulus occidentalis			X	X		X		
Tribulus platypterus		X			X			X
Tribulus suberosus	X	X		X	X	X		X
**Tribulus terrestris*		X		X				
Trichodesma zeylanicum		X				X		
Trichodesma zeylanicum var. *zeylanicum*	X	X	X	X	X	X	X	X
Tricoryne sp. Hamersley Range (S. van Leeuwen 915)	X	X	X		X			X
**Tridax procumbens*								X

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Trigastrotheca molluginea			X	X				X
Triodia aff. *basedowii*	X							
Triodia aff. *wiseana*	X	X						
Triodia ?angusta								X
Triodia angusta		X	X	X	X			X
Triodia basedowii		X	X	X	X	X		X
Triodia brizoides	X	X		X		X		X
Triodia epactia		X	X	X	X			
Triodia lanigera		X		X				
Triodia longiceps	X	X	X	X		X	X	X
Triodia melvillei	X	X		X		X		X
Triodia pungens	X	X	X	X	X	X	X	X
Triodia sp.		X						
Triodia sp. Mt Ella (M.E. Trudgen 12739) P3						X		X
Triodia ?vanleeuwenii								X
Triodia vanleeuwenii							X	X
Triodia wiseana	X	X	X	X	X	X	X	X
Tripogonella loliiformis		X				X		
Triraphis mollis						X		X
Triumfetta chaetocarpa		X		X				X
Triumfetta clementii		X			X			
Triumfetta leptacantha						X	X	
Triumfetta maconochieana				X			X	
Triumfetta propinqua		X						
Triumfetta ramosa		X	X	X				
Triumfetta sp.		X	X		X			
Typha domingensis		X	X	X	X			X
Urochloa ?occidentalis								X
Urochloa occidentalis var. *occidentalis*						X		
Urochloa piligera		X		X				
**Vachellia farnesiana*		X	X	X	X	X		X

Species	Biota (2006)	Mattiske (2008)	Mattiske (2009a)	Mattiske (2009b)	Mattiske (2010)	Ecologia (2013)	Biota (2014)	Survey area
Velleia connata	X	X			X		X	X
Ventilago viminalis						X		
Vigna lanceolata		X	X	X	X			X
Vigna lanceolata var. *lanceolata*								X
Vigna sp. Hamersley Clay (A.A. Mitchell PRP 113)						X		
Vincetoxicum flexuosum							X	
Vincetoxicum lineare			X			X		
Vittadinia eremaea						X		X
Wahlenbergia sp.								X
Wahlenbergia tumidifructa	X	X		X		X		X
Waltheria indica		X	X	X	X	X	X	X
Xerochrysum bracteatum	X	X		X				
Yakirra australiensis						X		
Yakirra australiensis var. *australiensis*						X		X

[1] - also presented 4 sites from (Halpern Glick Maunsell 2000)

[2]- expanding work presented in Mattiske Consulting (2005)

[3]- expanding work presented in Mattiske Consulting (1995, 2005, 2008b, 2008c, 2009c)

[4]- expanding work presented in Mattiske Consulting (2005, 2008b, 2008c)

[5]- expanding work presented in Mattiske Consulting 1995, 2005, 2008b, 2008c, 2009a, 2009c)

* denotes weed species

Table M.3: Species by site matrix for vascular flora species for the survey area.

Taxa	BHD05.AR	BHD10.AR	GH01	GH02	GH03	GH04	GH05	GH06	GH07	GH08	GH09	GH11	GH12	GH13	GH15	GH17	GH19	GH20	GH21	GH22	GH23	GH24	GH25	GH26	GH27	GHR10	GHR16	GHR28	GHR30
Abutilon amplum																													
Abutilon cryptopetalum																													
Abutilon fraseri subsp. *fraseri*					X									X															
Abutilon ?lepidum																													
Abutilon lepidum																													
Abutilon leucopetalum																													
Abutilon macrum																													
Abutilon malvifolium										X																			
Abutilon otocarpum																													
Abutilon sp.																X													
Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)			X			X																							
Acacia adoxa var. *adoxa*													X												X			X	
Acacia adsurgens		X															X					X			X				
Acacia ampliceps																													
Acacia ?ancistrocarpa																													
Acacia ancistrocarpa																													
Acacia aptaneura			X	X	X				X	X	X	X	X	X	X	X		X	X	X			X	X		X			
Acacia aptaneura sens. lat.																		X						X					
Acacia aptaneura x																													
Acacia arida																													
Acacia arida x																													
Acacia ayersiana				X					X									X											
Acacia ayersiana x																													
Acacia bivenosa		X				X	X	X					X				X					X	X		X				
Acacia bromilowiana P4																													
Acacia ?catenulata																													
Acacia catenulata subsp. *occidentalis*				X					X		X	X				X		X	X					X			X		
Acacia citrinoviridis																			X		X		X						
Acacia colei																													
Acacia coriacea subsp. *pendens*																													
Acacia dictyophleba						X	X									X													
Acacia hamersleyensis	X																								X	X		X	
Acacia hilliana	X												X												X				
Acacia inaequilatera		X					X						X				X					X							
Acacia incurvaneura																													
Acacia kempeana																													
Acacia macraneura																X								X					
Acacia maitlandii	X		X			X	X						X												X			X	
Acacia marramamba							X						X																
Acacia minyura																													
Acacia monticola	X																									X		X	
Acacia mulganeura												X														X			
Acacia pachyacra				X																					X			X	X
Acacia pruinocarpa		X	X	X	X				X	X			X		X	X		X	X	X	X		X	X			X		X
Acacia pteraneura																													
Acacia pteraneura x aptaneura																													
Acacia pyrifolia			X			X	X									X				X	X		X					X	
Acacia rhodophloia												X																	
Acacia sibirica													X																
Acacia sibirica x																													
Acacia sp.																					X								
Acacia spondylophylla																													
Acacia steedmanii subsp. *borealis*																													

Taxa	BHD05.AR	BHD10.AR	GH01	GH02	GH03	GH04	GH05	GH06	GH07	GH08	GH09	GH11	GH12	GH13	GH15	GH17	GH19	GH20	GH21	GH22	GH23	GH24	GH25	GH26	GH27	GHR10	GHR16	GHR28	GHR30
Acacia subtiliformis P3																													
Acacia synchronicia										X																			
Acacia tenuissima													X									X							
Acacia tetragonophylla										X													X						
Acacia tumida var. *pilbarensis*																						X							
Acrachne racemosa																													
Adriana tomentosa var. *tomentosa*																													
Alternanthera denticulata																													
Alternanthera nana			X											X							X								
Alternanthera sp.																X			X										
Amaranthus mitchellii																													
Amaranthus sp.																													
Amaranthus undulatus																													
Amphipogon sericeus	X	X											X				X					X					X		X
Amyema fitzgeraldii																													
Amyema hilliana									X																				
Amyema miquelii																													
Amyema sp.																											X		
Androcalva luteiflora			X			X										X				X			X					X	
Anthobolus leptomerioides										X			X						X						X				
Aristida burbidgeae																			X							X			
Aristida contorta		X					X			X	X						X						X	X					
Aristida holathera var. *holathera*		X					X						X																
Aristida inaequiglumis													X																
Aristida ingrata																								X					
Aristida latifolia										X																			
Aristida lazaridis P2																													
Aristida obscura																		X	X	X									
Aristida sp.					X				X						X		X					X							
Asteraceae sp.																													
Astrebla elymoides										X																			
Astrebla sp.																													
Astrotricha hamptonii																													
Atalaya hemiglauca																					X								
**Bidens bipinnata*			X		X	X			X		X	X		X	X	X		X	X	X	X								
Boerhavia ?coccinea																													
Boerhavia coccinea			X																										
Boerhavia schomburgkiana																													
Bonamia pilbarensis							X																						
Bothriochloa ewartiana																													
Brachychiton acuminatus																													
Bulbostylis barbata																										X			
Bulbostylis turbinata			X																										
Calytrix carinata																													
Capparis lasiantha												X		X		X							X		X	X	X	X	
Capparis spinosa subsp. *nummularia*																													
Capparis umbonata																													
Cassytha capillaris																												X	
Cassytha filiformis																													
Cassytha sp.																													
**Cenchrus ciliaris*						X																							
**Cenchrus setiger*																													
Centipeda minima subsp. *macrocephala*																													
Cheilanthes lasiophylla							X					X																	
Cheilanthes sieberi subsp. *sieberi*					X				X		X							X	X					X					

Taxa	BHD05.AR	BHD10.AR	GH01	GH02	GH03	GH04	GH05	GH06	GH07	GH08	GH09	GH11	GH12	GH13	GH15	GH17	GH19	GH20	GH21	GH22	GH23	GH24	GH25	GH26	GH27	GHR10	GHR16	GHR28	GHR30
**Chloris virgata*																													
Chrysocephalum apiculatum subsp. *pilbarense*			X																										
Chrysocephalum gilesii																													
Chrysopogon fallax			X		X						X			X	X	X													
Cleome viscosa			X			X								X		X				X	X		X	X					
Clerodendrum floribundum var. *angustifolium*																													
Clerodendrum tomentosum var. *lanceolatum*																										X			
Codonocarpus cotinifolius		X																											
Commelina ensifolia															X														
Convolvulus clementii																													
**Conyza bonariensis*																													
Corchorus crozophorifolius						X																							
Corchorus lasiocarpus subsp. *lasiocarpus*	X																X				X								
Corchorus lasiocarpus subsp. *parvus*							X													X									
Corchorus tridens			X			X				X																			
Corymbia candida																													
Corymbia deserticola																													
Corymbia deserticola subsp. *deserticola*		X		X									X									X							
Corymbia ferriticola																										X			
Corymbia hamersleyana																													
Corymbia hamersleyana sens. lat.	X					X																					X	X	
Corymbia opaca																													
Corymbia sp.																													
Crotalaria medicaginea var. *neglecta*			X							X																			
Crotalaria novae-hollandiae subsp. *novae-hollandiae*																													
Cryptandra monticola																													
Cucumis melo																													
Cucumis variabilis																				X									
Cullen leucochaites																													
Cuscuta victoriana																													
Cymbopogon ambiguus						X	X	X					X			X	X				X	X		X		X		X	X
Cymbopogon obtectus		X																											
Cymbopogon sp.																													
Cynanchum floribundum																													
Cynanchum viminale																													
Cynodon convergens										X																			
**Cynodon dactylon*			X																										
Cynodon prostratus																													
Cyperus cunninghamii subsp. *cunninghamii*																													
Cyperus difformis																													
Cyperus vaginatus																													
Dactyloctenium ?radulans																													
Dactyloctenium radulans																													
Dampiera candicans	X																												
**Datura leichhardtii*																													
**Datura leichhardtii* subsp. *leichhardtii*			X							X																			
Dichanthium sericeum subsp. *humilius*			X																										
Dichanthium sp.																													
Dicladanthera forrestii																					X								
Digitaria ammophila																													
Digitaria brownii																													
Digitaria ctenantha																													
Dipteracanthus australasicus subsp. *australasicus*														X		X												X	
Dodonaea coriacea	X																												
Dodonaea lanceolata var. *lanceolata*						X																			X			X	

Taxa	BHD05.AR	BHD10.AR	GH01	GH02	GH03	GH04	GH05	GH06	GH07	GH08	GH09	GH11	GH12	GH13	GH15	GH17	GH19	GH20	GH21	GH22	GH23	GH24	GH25	GH26	GH27	GHR10	GHR16	GHR28	GHR30
Dodonaea pachyneura												X														X		X	
Dodonaea petiolaris																													
Dodonaea viscosa subsp. *spatulata*																										X			
Duperreya commixta		X	X		X	X					X	X	X	X		X	X	X	X	X	X	X	X	X		X		X	
Dysphania kalpari																													
Dysphania melanocarpa forma *melanocarpa*																													
Dysphania plantaginella																													
Dysphania rhadinostachya subsp. *rhadinostachya*			X																										
**Echinochloa colona*																													
Enchylaena tomentosa var. *tomentosa*					X					X		X				X							X	X					
Enneapogon caerulescens		X				X	X			X				X															
Enneapogon lindleyanus		X														X					X			X					X
Enneapogon polyphyllus			X		X	X				X			X																
Enneapogon robustissimus																													
Enneapogon sp.																													
Enteropogon ramosus																													
Eragrostis cumingii			X																										
Eragrostis eriopoda													X																
Eragrostis setifolia					X																								
Eragrostis sp.																													
Eragrostis tenellula			X			X																							
Eragrostis xerophila										X																			
Eremophila aff. *clarkei*									X		X				X														
Eremophila canaliculata																													
Eremophila forrestii subsp. *forrestii*				X					X	X		X				X	X		X					X			X		
Eremophila fraseri																													
Eremophila fraseri subsp. *fraseri*																													
Eremophila jucunda subsp. *pulcherrima*																										X		X	
Eremophila lanceolata					X																								
Eremophila latrobei																													
Eremophila latrobei subsp. *filiformis*									X			X						X	X								X	X	X
Eremophila latrobei subsp. *glabra*										X																			
Eremophila latrobei subsp. *latrobei*													X																
Eremophila longifolia			X			X														X			X	X					
Eremophila magnifica subsp. *magnifica* P4																													
Eremophila phyllopoda subsp. *obliqua*																													
Eremophila platycalyx subsp. *pardalota*												X																	
Eremophila sp. Hamersley Range (K. Walker KW 136) P3																													
Eremophila sp. West Angelas (S. van Leeuwen 4068) P1																													
Eriachne aristidea																													
Eriachne ?benthamii																													
Eriachne benthamii																													
Eriachne lanata																											X		
Eriachne mucronata	X	X				X	X					X			X	X				X		X				X	X		X
Eriachne obtusa										X																			
Eriachne pulchella																													
Eriachne pulchella subsp. *dominii*			X																		X								
Eriachne pulchella subsp. *pulchella*																													
Eriachne tenuiculmis																					X							X	
Eucalyptus camaldulensis subsp. *obtusa*																													
Eucalyptus gamophylla		X											X				X					X			X				
Eucalyptus kingsmillii																													
Eucalyptus leucophloia subsp. *leucophloia*	X						X					X	X			X	X					X			X	X	X	X	X
Eucalyptus pilbarensis																													
Eucalyptus repullulans								X																					

Taxa	BHD05.AR	BHD10.AR	GH01	GH02	GH03	GH04	GH05	GH06	GH07	GH08	GH09	GH11	GH12	GH13	GH15	GH17	GH19	GH20	GH21	GH22	GH23	GH24	GH25	GH26	GH27	GHR10	GHR16	GHR28	GHR30
Eucalyptus socialis subsp. *?eucentrica*								X		X																			
Eucalyptus socialis subsp. *eucentrica*						X															X								
Eucalyptus victrix			X								X			X		X							X	X					
Eucalyptus xerothermica					X																								
Eucalyptus xerothermica x *Eucalyptus tephrodes*			X			X	X													X	X								
Eulalia aurea			X																	X									
Euphorbia australis var. *subtomentosa*										X				X															
Euphorbia biconvexa			X																										
Euphorbia biconvexa/coghlanii/trigonosperma																													
Euphorbia boophthona																													
Euphorbia careyi							X																						
Euphorbia coghlanii																													
Euphorbia sp.																													
Euphorbia trigonosperma																													
Evolvulus alsinoides var. *decumbens*			X			X																							
Evolvulus alsinoides var. *villosicalyx*			X											X										X					
Ficus brachypoda																										X			
Fimbristylis dichotoma																													
Fimbristylis simulans																													
Fimbristylis sp.													X									X							
**Flaveria trinervia*			X			X																							
Glycine canescens																								X					
Gompholobium oreophilum																									X				
Gomphrena cunninghamii																													
Gomphrena sp.																													
Goodenia cusackiana																													
Goodenia lamprosperma																													
Goodenia microptera																													
Goodenia muelleriana																													
Goodenia prostrata																													
Goodenia sp.																	X				X								
Goodenia sp. (of interest)										X																			
Goodenia stellata			X											X															
Goodenia stobbsiana	X	X					X						X									X							
Goodenia tenuiloba																													
Goodenia triodiophila													X									X							
Gossypium australe						X																							
Gossypium robinsonii						X										X									X		X		
Gossypium sturtianum var. *sturtianum*						X																							
Grevillea berryana																	X	X									X		
Grevillea saxicola P3												X															X		
Grevillea wickhamii subsp. *hispidula*	X					X																				X			
Hakea chordophylla		X					X						X									X			X				
Hakea lorea subsp. *lorea*														X					X				X						
Halgania cyanea								X																					
Halgania gustafsenii var. *gustafsenii*													X												X				
Haloragis gossei																													
Haloragis odontocarpa			X																										
Haloragis sp.										X																			
Heliotropium inexplicitum																													
Heliotropium ovalifolium							X																						
Heliotropium pachyphyllum																													
Heliotropium sp.		X																											
Heliotropium tanythrix																				X	X								
Heliotropium tenuifolium																													

Taxa	BHD05.AR	BHD10.AR	GH01	GH02	GH03	GH04	GH05	GH06	GH07	GH08	GH09	GH11	GH12	GH13	GH15	GH17	GH19	GH20	GH21	GH22	GH23	GH24	GH25	GH26	GH27	GHR10	GHR16	GHR28	GHR30
Hibiscus burtonii												X						X											
Hibiscus ?coatesii																													
Hibiscus coatesii																													
Hibiscus leptocladus																													
Hibiscus sp.								X																					
Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2																													
Hibiscus sturtii																			X	X			X	X					
Hibiscus sturtii var. *campylochlamys*							X																						
Hibiscus sturtii var. *platychlamys*																	X												
Hibiscus verdcourtii										X																			
Hybanthus aurantiacus		X																			X								
Indigofera fractiflexa subsp. *fractiflexa*																										X		X	
Indigofera georgei			X																	X			X			X			
Indigofera linifolia														X															
Indigofera monophylla		X											X				X					X			X				
Indigofera rugosa																													
Iseilema eremaeum			X																										
Iseilema membranaceum																													
Iseilema sp.																													
Iseilema vaginiflorum																													
Isotropis sp. Arid zone (G. Byrne 2775)			X													X					X								
Jasminum didymum subsp. *lineare*			X	X		X							X													X		X	
Josephinia eugeniae																													
**Lactuca serriola*																													
Lepidium catapycnon P4																													
Lepidium pedicellosum																													
Lepidium phlebopetalum																													
Lepidium pholidogynum																													
Lepidium sp.																					X								X
Lobelia arnhemiaca																													
Lobelia heterophylla subsp. *pilbarensis*																													
Maireana carnosa																													
Maireana eriosphaera																													
Maireana georgei																													X
Maireana melanocoma																													
Maireana tomentosa subsp. *tomentosa*														X	X	X		X	X				X	X					X
Maireana triptera																													
Maireana villosa					X				X		X																		
Malvaceae sp.																													
**Malvastrum americanum*			X											X		X				X	X		X						
Marsdenia australis																													
Marsdenia sp.																													
Maytenus sp. Mt Windell (S. van Leeuwen 846)						X																							
Melaleuca argentea																													
Melaleuca bracteata																													
Melaleuca eleuterostachya																													
Melaleuca glomerata																													
Melhania oblongifolia																													
**Melinis repens*																													
Mirbelia viminalis	X																												
Neptunia dimorphantha										X																			
Newcastelia sp. Hamersley Range (S. van Leeuwen 4264)																													
Nicotiana benthamiana																													
Nicotiana sp.			X																										
Notoleptopus decaisnei var. Orbicularis (A.B. Craig 428)																													

Taxa	BHD05.AR	BHD10.AR	GH01	GH02	GH03	GH04	GH05	GH06	GH07	GH08	GH09	GH11	GH12	GH13	GH15	GH17	GH19	GH20	GH21	GH22	GH23	GH24	GH25	GH26	GH27	GHR10	GHR16	GHR28	GHR30
Oldenlandia crouchiana																													
Pandorea pandorana																													
Panicum decompositum																													
Panicum effusum																													
Paraneurachne muelleri			X			X		X				X	X			X	X						X	X				X	
Paspalidium clementii			X																										
Paspalidium jubiflorum																													
Paspalidium rarum			X																										
Peripleura arida																													
Peripleura obovata																						X							
Peripleura virgata																													
Perotis rara																													
Petalostylis labicheoides	X		X		X	X					X															X		X	
Phyllanthus erwinii																													
Phyllanthus maderaspatensis																				X	X								
Pluchea dentex																													
Pluchea rubelliflora			X			X																							
Pluchea sp.																													
Poaceae sp.													X							X									
Polycarpaea corymbosa var. *corymbosa*																					X								
Polycarpaea holtzei																													
Polycarpaea longiflora													X																
Polygala isingii																													
Polymeria aff. *longifolia*										X																			
Polymeria ambigua																													
Portulaca oleracea																													
Psydrax latifolia											X															X			
Psydrax suaveolens					X				X		X	X	X		X	X				X							X		
Pterocaulon serrulatum var. *velutinum*			X																										
Pterocaulon sp.																				X						X			
Pterocaulon sphacelatum			X			X	X																						
Pterocaulon sphaeranthoides																X													
Ptilotus aervoides																													
Ptilotus astrolasius		X					X										X		X	X	X								
Ptilotus calostachyus	X	X					X	X					X				X					X							
Ptilotus clementii								X																					
Ptilotus exaltatus	X	X						X		X							X												
Ptilotus fusiformis																													
Ptilotus helipteroides																													
Ptilotus incanus																													
Ptilotus mollis P4																													
Ptilotus obovatus		X	X		X	X			X	X	X	X		X	X	X			X	X			X	X					X
Ptilotus polystachyus																													
Ptilotus roei																													
Ptilotus rotundifolius		X											X				X					X							X
Ptilotus schwartzii var. *schwartzii*																													
Ptilotus sp.																X													
Rhagodia eremaea		X														X			X	X	X		X	X			X		
Rhagodia sp. Hamersley (M. Trudgen 17794) P3			X									X																	
Rhodanthe margarethae																													
Rhynchosia minima			X			X				X										X									
Rostellularia adscendens var. *clementii*																													
Rostellularia adscendens var. *latifolia* P3																													
Salsola australis																							X	X					
Santalum lanceolatum						X						X																X	

Taxa	BHD05.AR	BHD10.AR	GH01	GH02	GH03	GH04	GH05	GH06	GH07	GH08	GH09	GH11	GH12	GH13	GH15	GH17	GH19	GH20	GH21	GH22	GH23	GH24	GH25	GH26	GH27	GHR10	GHR16	GHR28	GHR30
Santalum spicatum																					X								
Scaevola acacioides												X																	X
Scaevola amblyanthera var. *centralis*			X			X																							
Scaevola browniana																													
Scaevola browniana subsp. *browniana*																													
Scaevola parvifolia subsp. *pilbarae*																													
Scaevola spinescens																													
Schenkia australis																													
Schizachyrium fragile																													
Sclerolaena cornishiana					X					X							X		X	X				X					
Sclerolaena cuneata																													
Sclerolaena densiflora																													
Sclerolaena ?gardneri																													
Senna artemisioides subsp. × *artemisioides*										X																			
Senna artemisioides subsp. *filifolia*											X																		
Senna artemisioides subsp. *helmsii*		X														X	X						X						
Senna artemisioides subsp. *oligophylla*		X					X	X		X										X		X	X						X
Senna artemisioides subsp. *oligophylla x helmsii*																													
Senna ferraria																													
Senna glaucifolia													X																X
Senna glutinosa subsp. *glutinosa*		X				X	X						X															X	X
Senna glutinosa subsp. ×*luerssenii*		X										X	X			X	X					X							X
Senna glutinosa subsp. *pruinosa*		X					X										X												X
Senna notabilis																													
Senna pleurocarpa var. angustifolia																													
Senna sericea																													
Senna sp. Meekatharra (E. Bailey 1-26)																													
Senna sp. Meekatharra (E. Bailey 1-26) ×																													
Senna sp. Meekatharra (E. Bailey 1-26) × *glaucifolia*		X																											
Senna stricta			X									X																	X
Senna venusta																													
Seringia elliptica																													
Seringia nephrosperma																													
Seringia sp.																	X												
Sesbania cannabina																													
Setaria dielsii																													
**Setaria verticillata*																													
Sida aff. *fibulifera*														X		X													
Sida arenicola													X				X												
Sida calyxhymenia																		X						X					
Sida cardiophylla																													
Sida echinocarpa																													
Sida ?ectogama																													
Sida fibulifera			X	X	X					X									X	X			X	X					
Sida platycalyx																			X					X					
Sida sp.															X														
Sida sp. Articulation below (A.A. Mitchell PRP 1605)						X																						X	
Sida ?sp. dark green fruits (S. van Leeuwen 2260)																													
Sida sp. dark green fruits (S. van Leeuwen 2260)				X					X						X														
Sida sp. Excedentifolia (J.L. Egan 1925)																												X	
Sida sp. Golden calyces glabrous (H.N. Foote 32)																													
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	X																												
Sida sp. Shovelanna Hill (S. van Leeuwen 3842)																			X							X			
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)																													
**Sigesbeckia orientalis*																													

Taxa	BHD05.AR	BHD10.AR	GH01	GH02	GH03	GH04	GH05	GH06	GH07	GH08	GH09	GH11	GH12	GH13	GH15	GH17	GH19	GH20	GH21	GH22	GH23	GH24	GH25	GH26	GH27	GHR10	GHR16	GHR28	GHR30
Solanum cleistogamum																										X			
Solanum ferocissimum											X																		
Solanum gabrielae																													
Solanum horridum																													
Solanum lasiophyllum	X				X		X		X	X		X	X	X	X		X		X	X			X	X					
**Solanum nigrum*																													
Solanum phlomoides																													
**Sonchus oleraceus*																													
sp. indet																													
Sporobolus australasicus										X																			
Stackhousia muricata subsp. annual (W.R. Barker 2172)																													
Stemodia grossa						X																							
Stemodia sp.																													
Streptoglossa bubakii										X																			
Streptoglossa decurrens																													
Streptoglossa sp.																													
Stylobasium spathulatum																													
Swainsona maccullochiana																													
Templetonia egena																													
Tephrosia oxalidea																													
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)																				X	X								
Teucrium teucriiflorum											X																		
Themeda avenacea																													
Themeda sp.																	X												
Themeda sp. Mt Barricade (M.E. Trudgen 2471)							X															X							
Themeda triandra		X	X			X				X				X	X	X					X		X	X	X	X		X	
Tinospora smilacina																													
Trachymene oleracea subsp. *oleracea*																													
Tragus australianus																													
Trianthema glossostigmum																													
Tribulus platypterus																													
Tribulus suberosus												X																	X
Trichodesma zeylanicum var. *zeylanicum*							X																						
Tricoryne sp. Hamersley Range (S. van Leeuwen 915)							X																						
**Tridax procumbens*																													
Trigastrotheca molluginea			X																										
Triodia ?angusta																													
Triodia angusta																													
Triodia basedowii														X	X														
Triodia brizoides																													
Triodia longiceps			X			X														X	X		X						
Triodia melvillei																													
Triodia pungens		X	X	X	X				X		X	X	X		X	X	X	X		X	X	X				X	X	X	
Triodia sp. Mt Ella (M.E. Trudgen 12739) P3																													
Triodia vanleeuwenii	X	X		X									X				X					X			X		X		
Triodia wiseana	X					X	X	X		X		X						X							X			X	X
Triraphis mollis														X															
Triumfetta chaetocarpa																													
Typha domingensis																													
Urochloa ?occidentalis																													
**Vachellia farnesiana*																													
Velleia connata																													
Vigna lanceolata var. *lanceolata*			X							X																X			
Vittadinia eremaea																													
Wahlenbergia sp.																													

Taxa	BHD05.AR	BHD10.AR	GH01	GH02	GH03	GH04	GH05	GH06	GH07	GH08	GH09	GH11	GH12	GH13	GH15	GH17	GH19	GH20	GH21	GH22	GH23	GH24	GH25	GH26	GH27	GHR10	GHR16	GHR28	GHR30
Wahlenbergia tumidifructa																													
Waltheria indica																					X								
Yakirra australiensis var. *australiensis*														X															

*Denotes weed species

Taxa	HD01	HD02	HD03	HD04	HD05	HD06	HD07	HD08	HD09	HD10	HD11	HD12	HD13	HD14	HD15	HD16	HD17	HD18	HD19	HD20	HD21	HD22	HD23	HD24	HD25	HD26	HD27	HD28	HD29	HD30	HD31	HD32	HD33	HD34	HD35	HD37	HD38	HD39	HD40	HD41
Abutilon amplum																		X																						
Abutilon cryptopetalum																													X											
Abutilon fraseri subsp. *fraseri*																																								
Abutilon ?lepidum						X																																		
Abutilon lepidum						X								X							X					X														
Abutilon leucopetalum																																								
Abutilon macrum						X																																		
Abutilon malvifolium																																								
Abutilon otocarpum						X			X	X								X				X			X				X							X				
Abutilon sp.																								X																
Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)																																					X			
Acacia adoxa var. *adoxa*	X													X																								X		
Acacia adsurgens	X				X																												X							
Acacia ampliceps																																								
Acacia ?ancistrocarpa																																								
Acacia ancistrocarpa											X														X															
Acacia aptaneura		X	X	X	X	X	X	X	X	X	X	X								X		X	X	X	X	X	X	X	X	X		X		X		X	X	X	X	
Acacia aptaneura sens. lat.																																								
Acacia aptaneura x										X																													X	
Acacia arida																X			X																				
Acacia arida x																X																								
Acacia ayersiana			X			X		X		X		X																X				X								
Acacia ayersiana x																				X																				
Acacia bivenosa	X					X											X	X	X		X	X											X	X	X	X	X			X
Acacia bromilowiana P4																										X														
Acacia ?catenulata																																								
Acacia catenulata subsp. *occidentalis*		X	X	X		X	X	X		X										X		X	X			X	X	X				X			X	X			X	
Acacia citrinoviridis								X									X	X																						
Acacia colei																																								
Acacia coriacea subsp. *pendens*																																					X			
Acacia dictyophleba																		X	X			X										X		X						
Acacia hamersleyensis				X			X																	X									X	X						
Acacia hilliana	X										X		X		X																				X						
Acacia inaequilatera					X											X																	X							
Acacia incurvaneura							X			X																						X								X
Acacia kempeana																			X																					
Acacia macraneura																																								
Acacia maitlandii	X					X					X			X			X	X				X			X							X			X	X	X		X		
Acacia marramamba																																								
Acacia minyura																																								
Acacia monticola						X																			X											X				
Acacia mulganeura			X				X																			X														
Acacia pachyacra	X								X		X			X						X													X							
Acacia pruinocarpa	X		X	X		X		X	X		X	X		X						X				X	X	X	X	X			X		X		X	X	X	X	
Acacia pteraneura																													X							X		X		
Acacia pteraneura x aptaneura														X																										
Acacia pyrifolia	X			X									X				X		X			X				X					X				X		X			
Acacia rhodophloia																																								
Acacia sibirica																			X			X			X						X						X			
Acacia sibirica x																																								
Acacia sp.									X																															
Acacia spondylophylla													X		X																						X			
Acacia steedmanii subsp. *borealis*																																		X						
Acacia subtiliformis P3																																								
Acacia synchronicia									X												X								X							X				

Taxa	HD01	HD02	HD03	HD04	HD05	HD06	HD07	HD08	HD09	HD10	HD11	HD12	HD13	HD14	HD15	HD16	HD17	HD18	HD19	HD20	HD21	HD22	HD23	HD24	HD25	HD26	HD27	HD28	HD29	HD30	HD31	HD32	HD33	HD34	HD35	HD37	HD38	HD39	HD40	HD41
Acacia tenuissima						X					X																								X					
Acacia tetragonophylla									X	X													X					X		X									
Acacia tumida var. *pilbarensis*																																		X					
Acrachne racemosa																															X								
Adriana tomentosa var. *tomentosa*																																							
Alternanthera denticulata																															X								
Alternanthera nana									X													X							X	X	X								
Alternanthera sp.																																							
Amaranthus mitchellii																																							
Amaranthus sp.																													X										
Amaranthus undulatus																																							
Amphipogon sericeus					X	X					X		X		X																				X	X		X		X
Amyema fitzgeraldii																																							
Amyema hilliana																																							
Amyema miquelii				X																																			
Amyema sp.																																							
Androcalva luteiflora						X										X	X	X				X			X						X			X	X				
Anthobolus leptomerioides									X		X														X		X												
Aristida burbidgeae																								X																
Aristida contorta		X	X			X	X	X	X	X	X			X				X	X	X	X	X	X		X			X	X	X	X	X	X	X	X	X			X	
Aristida holathera var. *holathera*											X			X	X	X		X	X		X	X			X						X	X	X	X	X				
Aristida inaequiglumis		X				X					X		X							X	X				X						X	X						X	
Aristida ingrata																						X																	
Aristida latifolia									X																				X	X		X							
Aristida lazaridis P2																		X													X								
Aristida obscura		X								X																		X	X			X							
Aristida sp.			X																				X			X			X	X		X							
Asteraceae sp.							X		X																					X										
Astrebla elymoides																																							
Astrebla sp.									X																				X	X									
Astrotricha hamptonii																										X													
Atalaya hemiglauca																																							
**Bidens bipinnata*		X	X			X			X	X								X	X			X							X		X				X		X	
Boerhavia ?coccinea																															X								
Boerhavia coccinea		X							X													X										X			X				
Boerhavia schomburgkiana																																							
Bonamia pilbarensis					X									X				X														X							
Bothriochloa ewartiana																	X	X																					
Brachychiton acuminatus																																							
Bulbostylis barbata		X		X	X				X					X												X											X	X	
Bulbostylis turbinata																																							
Calytrix carinata																																							
Capparis lasiantha								X			X			X							X				X	X			X					X	X		X		X	
Capparis spinosa subsp. *nummularia*																								X																
Capparis umbonata																																							
Cassytha capillaris																																							
Cassytha filiformis																																							
Cassytha sp.																	X																						
**Cenchrus ciliaris*																	X	X				X																	
**Cenchrus setiger*																	X	X																					
Centipeda minima subsp. *macrocephala*																														X	X								
Cheilanthes lasiophylla			X				X									X			X																			X	
Cheilanthes sieberi subsp. *sieberi*		X				X				X					X							X		X			X	X	X									X	
**Chloris virgata*																													X		X								
Chrysocephalum apiculatum subsp. *pilbarense*																						X									X								

Taxa	HD01	HD02	HD03	HD04	HD05	HD06	HD07	HD08	HD09	HD10	HD11	HD12	HD13	HD14	HD15	HD16	HD17	HD18	HD19	HD20	HD21	HD22	HD23	HD24	HD25	HD26	HD27	HD28	HD29	HD30	HD31	HD32	HD33	HD34	HD35	HD37	HD38	HD39	HD40	HD41
Chrysocephalum gilesii																													X											
Chrysopogon fallax		X							X	X								X		X		X							X		X							X	
Cleome viscosa						X			X								X					X				X			X	X	X					X			
Clerodendrum floribundum var. *angustifolium*	X			X													X																		X		X			
Clerodendrum tomentosum var. *lanceolatum*																								X		X														
Codonocarpus cotinifolius					X	X							X		X						X							X				X							X
Commelina ensifolia																																								
Convolvulus clementii																		X																						
**Conyza bonariensis*																		X																						
Corchorus crozophorifolius																																					X			
Corchorus lasiocarpus subsp. *lasiocarpus*																																								
Corchorus lasiocarpus subsp. *parvus*				X	X	X					X		X				X	X							X		X						X	X	X	X	X			
Corchorus tridens																																								
Corymbia candida																																								
Corymbia deserticola																																								
Corymbia deserticola subsp. *deserticola*					X					X				X																			X							
Corymbia ferriticola																								X		X														
Corymbia hamersleyana				X				X					X			X										X							X	X			X			
Corymbia hamersleyana sens. lat.																																								
Corymbia opaca															X										X										X					X
Corymbia sp.																								X																
Crotalaria medicaginea var. *neglecta*									X									X				X								X	X						X			
Crotalaria novae-hollandiae subsp. *novae-hollandiae*																																								
Cryptandra monticola																																								
Cucumis melo																															X									
Cucumis variabilis						X											X	X			X	X		X		X											X		X	
Cullen leucochaites																																								
Cuscuta victoriana																													X											
Cymbopogon ambiguus			X	X	X			X	X		X		X	X		X	X	X	X			X		X	X	X					X	X	X		X	X	X	X	X	X
Cymbopogon obtectus											X										X				X															
Cymbopogon sp.																																								
Cynanchum floribundum																										X														
Cynanchum viminale																																								
Cynodon convergens		X							X													X							X										
**Cynodon dactylon*																																								
Cynodon prostratus																																								
Cyperus cunninghamii subsp. *cunninghamii*																								X																
Cyperus difformis																															X									
Cyperus vaginatus																	X	X													X									
Dactyloctenium ?radulans									X																															
Dactyloctenium radulans																													X											
Dampiera candicans					X																																X			
**Datura leichhardtii*																																								
**Datura leichhardtii* subsp. *leichhardtii*																																								
Dichanthium sericeum subsp. *humilius*									X									X				X								X	X						X			
Dichanthium sp.										X																														
Dicladanthera forrestii																																								
Digitaria ammophila											X																													
Digitaria brownii						X					X									X		X																		
Digitaria ctenantha																																								
Dipteracanthus australasicus subsp. *australasicus*																														X										
Dodonaea coriacea																			X																			X		
Dodonaea lanceolata var. *lanceolata*			X																						X										X					
Dodonaea pachyneura							X																																	
Dodonaea petiolaris								X																X		X									X					

Taxa	HD01	HD02	HD03	HD04	HD05	HD06	HD07	HD08	HD09	HD10	HD11	HD12	HD13	HD14	HD15	HD16	HD17	HD18	HD19	HD20	HD21	HD22	HD23	HD24	HD25	HD26	HD27	HD28	HD29	HD30	HD31	HD32	HD33	HD34	HD35	HD37	HD38	HD39	HD40	HD41
Dodonaea viscosa subsp. *spatulata*																										X											X				
Duperreya commixta		X	X	X				X			X		X					X		X	X	X	X	X	X	X					X			X		X	X	X	
Dysphania kalpari																						X																		
Dysphania melanocarpa forma *melanocarpa*																																								
Dysphania plantaginella		X																																			X			
Dysphania rhadinostachya subsp. *rhadinostachya*			X		X	X	X								X									X		X											X	X	X	
**Echinochloa colona*																																								
Enchylaena tomentosa var. *tomentosa*						X	X		X	X																X				X							X			
Enneapogon caerulescens		X							X	X	X			X									X			X				X			X			X		X	
Enneapogon lindleyanus		X	X			X												X				X	X			X	X		X						X		X		
Enneapogon polyphyllus		X	X			X	X		X	X	X			X						X	X	X			X	X			X	X	X	X				X	X		
Enneapogon robustissimus																									X						X								
Enneapogon sp.																																					X		X	
Enteropogon ramosus																		X													X								
Eragrostis cumingii		X																		X		X									X						X		
Eragrostis eriopoda																		X									X					X						X		
Eragrostis setifolia									X																					X										
Eragrostis sp.																																								
Eragrostis tenellula									X									X				X	X							X	X						X			
Eragrostis xerophila									X																		X		X	X										
Eremophila aff. *clarkei*																																								
Eremophila canaliculata																	X																							
Eremophila forrestii subsp. *forrestii*		X				X			X	X	X												X						X	X		X				X		X	
Eremophila fraseri																																								
Eremophila fraseri subsp. *fraseri*														X		X				X							X													
Eremophila jucunda subsp. *pulcherrima*															X									X		X				X										
Eremophila lanceolata																													X											
Eremophila latrobei		X																																						
Eremophila latrobei subsp. *filiformis*			X				X			X																	X													
Eremophila latrobei subsp. *glabra*	X													X																							X		X	
Eremophila latrobei subsp. *latrobei*																																						X		
Eremophila longifolia									X		X						X	X							X				X	X	X		X						
Eremophila magnifica subsp. *magnifica* P4																																								
Eremophila phyllopoda subsp. *obliqua*																																								
Eremophila platycalyx subsp. *pardalota*							X	X															X													X			
Eremophila sp. Hamersley Range (K. Walker KW 136) P3			X																							X													
Eremophila sp. West Angelas (S. van Leeuwen 4068) P1																																								
Eriachne aristidea															X																									
Eriachne ?benthamii									X		X																													
Eriachne benthamii																									X				X		X									
Eriachne lanata				X																																				
Eriachne mucronata	X		X				X	X			X			X	X	X		X	X			X	X	X	X	X					X	X		X	X		X		X	
Eriachne obtusa									X																			X	X	X									X	
Eriachne pulchella	X	X	X			X	X			X				X							X	X	X	X				X										X	
Eriachne pulchella subsp. *dominii*													X																	X							X		X
Eriachne pulchella subsp. *pulchella*					X						X														X		X				X				X				
Eriachne tenuiculmis																																								
Eucalyptus camaldulensis subsp. *obtusa*																	X	X																						
Eucalyptus gamophylla								X			X		X												X							X		X	X		X			
Eucalyptus kingsmillii																																								
Eucalyptus leucophloia subsp. *leucophloia*	X			X				X			X		X	X	X			X				X	X		X	X									X	X	X	X	X	X
Eucalyptus pilbarensis																					X																			
Eucalyptus repullulans			X				X																												X					
Eucalyptus socialis subsp. *?eucentrica*																																								
Eucalyptus socialis subsp. *eucentrica*																					X															X				

Taxa	HD01	HD02	HD03	HD04	HD05	HD06	HD07	HD08	HD09	HD10	HD11	HD12	HD13	HD14	HD15	HD16	HD17	HD18	HD19	HD20	HD21	HD22	HD23	HD24	HD25	HD26	HD27	HD28	HD29	HD30	HD31	HD32	HD33	HD34	HD35	HD37	HD38	HD39	HD40	HD41
Eucalyptus victrix																	X	X													X									
Eucalyptus xerothermica																		X				X									X									
Eucalyptus xerothermica x *Eucalyptus tephrodes*																																								
Eulalia aurea																	X	X				X									X		X		X					X
Euphorbia australis var. *subtomentosa*						X								X								X											X							
Euphorbia biconvexa																	X					X				X														
Euphorbia biconvexa/coghlanii/trigonosperma																							X	X		X											X			
Euphorbia boophthona																		X																			X			
Euphorbia careyi																			X																					
Euphorbia coghlanii																								X							X									
Euphorbia sp.		X	X			X			X																X					X	X						X			
Euphorbia trigonosperma										X												X																		
Evolvulus alsinoides var. *decumbens*																																								
Evolvulus alsinoides var. *villosicalyx*		X				X			X									X				X							X	X						X			
Ficus brachypoda																								X		X														
Fimbristylis dichotoma									X																				X	X									
Fimbristylis simulans					X																																X			
Fimbristylis sp.															X																									
**Flaveria trinervia*																	X	X				X															X			
Glycine canescens										X							X	X				X									X									
Gompholobium oreophilum	X				X						X		X		X										X									X	X					
Gomphrena cunninghamii						X																		X		X											X			
Gomphrena sp.																																								
Goodenia cusackiana																			X																					
Goodenia lamprosperma																		X																						
Goodenia microptera																																								
Goodenia muelleriana																					X																X			
Goodenia prostrata																			X																		X			
Goodenia sp.												X												X													X			
Goodenia sp. (of interest)																																								
Goodenia stellata																																								
Goodenia stobbsiana				X	X	X					X			X	X									X												X	X	X	X	X
Goodenia tenuiloba														X																							X			
Goodenia triodiophila													X		X																							X		X
Gossypium australe																X	X																X							
Gossypium robinsonii						X											X	X							X						X			X		X	X			
Gossypium sturtianum var. *sturtianum*																	X	X				X			X						X				X					
Grevillea berryana																							X													X			X	
Grevillea saxicola P3			X				X						X											X												X		X	
Grevillea wickhamii subsp. *hispidula*													X			X								X												X			
Hakea chordophylla	X			X	X						X		X		X				X		X	X			X				X				X		X	X		X		X
Hakea lorea subsp. *lorea*																		X																						
Halgania cyanea																																								
Halgania gustafsenii var. *gustafsenii*	X																																							
Haloragis gossei																						X																		
Haloragis odontocarpa																																								
Haloragis sp.																																								
Heliotropium inexplicitum																																								
Heliotropium ovalifolium																			X																					
Heliotropium pachyphyllum																																								
Heliotropium sp.																																								
Heliotropium tanythrix																																								
Heliotropium tenuifolium																															X		X							
Hibiscus burtonii		X				X				X										X												X				X		X	
Hibiscus ?coatesii													X																											

Taxa	HD01	HD02	HD03	HD04	HD05	HD06	HD07	HD08	HD09	HD10	HD11	HD12	HD13	HD14	HD15	HD16	HD17	HD18	HD19	HD20	HD21	HD22	HD23	HD24	HD25	HD26	HD27	HD28	HD29	HD30	HD31	HD32	HD33	HD34	HD35	HD37	HD38	HD39	HD40	HD41
Hibiscus coatesii						X																		X		X					X				X	X				
Hibiscus leptocladus		X																											X										
Hibiscus sp.																																								
Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2																								X																
Hibiscus sturtii																																								
Hibiscus sturtii var. *campylochlamys*					X	X												X														X				X	X			
Hibiscus sturtii var. *platychlamys*																																				X				
Hibiscus verdcourtii																																								
Hybanthus aurantiacus																									X											X	X	X		
Indigofera fractiflexa subsp. *fractiflexa*																								X		X														
Indigofera georgei																						X																		
Indigofera linifolia									X																					X										
Indigofera monophylla					X	X					X			X				X				X										X	X	X			X	X		
Indigofera rugosa																																								
Iseilema eremaeum									X																															
Iseilema membranaceum																															X									
Iseilema sp.															X																									
Iseilema vaginiflorum		X				X				X										X		X							X	X								X	
Isotropis sp. Arid zone (G. Byrne 2775)																															X									
Jasminum didymum subsp. *lineare*	X				X			X			X	X			X		X	X			X	X		X	X						X		X	X	X		X			
Josephinia eugeniae																																								
**Lactuca serriola*																																								
Lepidium catapycnon P4																																					X			
Lepidium pedicellosum														X																										
Lepidium phlebopetalum																																								
Lepidium pholidogynum																																								
Lepidium sp.																																								
Lobelia arnhemiaca																																								
Lobelia heterophylla subsp. *pilbarensis*							X																																	
Maireana carnosa																																								
Maireana eriosphaera																																								
Maireana georgei																					X																			
Maireana melanocoma																							X																	
Maireana tomentosa subsp. *tomentosa*		X			X					X										X				X			X		X			X							
Maireana triptera														X																										
Maireana villosa									X											X																				
Malvaceae sp.																																								
**Malvastrum americanum*									X									X				X								X	X								
Marsdenia australis																																			X					
Marsdenia sp.																	X																							
Maytenus sp. Mt Windell (S. van Leeuwen 846)																																								
Melaleuca argentea																																								
Melaleuca bracteata																		X																						
Melaleuca eleuterostachya																																								
Melaleuca glomerata																	X																							
Melhania oblongifolia																		X				X																		
**Melinis repens*																																								
Mirbelia viminalis	X			X															X																					
Neptunia dimorphantha																																								
Newcastelia sp. Hamersley Range (S. van Leeuwen 4264)																								X																
Nicotiana benthamiana																																								
Nicotiana sp.			X				X																																	
Notoleptopus decaisnei var. Orbicularis (A.B. Craig 428)																																								
Oldenlandia crouchiana																																								
Pandorea pandorana																																								

Taxa	HD01	HD02	HD03	HD04	HD05	HD06	HD07	HD08	HD09	HD10	HD11	HD12	HD13	HD14	HD15	HD16	HD17	HD18	HD19	HD20	HD21	HD22	HD23	HD24	HD25	HD26	HD27	HD28	HD29	HD30	HD31	HD32	HD33	HD34	HD35	HD37	HD38	HD39	HD40	HD41
Panicum decompositum		X							X													X							X	X	X									
Panicum effusum																						X			X					X		X								
Paraneurachne muelleri			X			X			X		X			X	X			X			X	X			X						X	X	X		X		X	X		X
Paspalidium clementii		X	X			X	X			X				X										X		X	X						X			X	X			
Paspalidium jubiflorum																				X																	X			
Paspalidium rarum																		X																						
Peripleura arida																	X					X																		
Peripleura obovata																																		X						
Peripleura virgata																									X	X														
Perotis rara		X				X				X												X					X		X											
Petalostylis labicheoides				X				X					X		X		X	X				X		X	X	X		X			X			X	X		X			
Phyllanthus erwinii																						X																		
Phyllanthus maderaspatensis																	X														X									
Pluchea dentex																	X					X																		
Pluchea rubelliflora																	X	X																						
Pluchea sp.																	X																							
Poaceae sp.																			X																					
Polycarpaea corymbosa var. *corymbosa*		X		X	X	X								X				X				X						X					X					X		
Polycarpaea holtzei		X		X	X	X																																X	X	
Polycarpaea longiflora		X																																			X			
Polygala isingii																		X	X																					
Polymeria aff. *longifolia*																																								
Polymeria ambigua																																	X							
Portulaca oleracea																																								
Psydrax latifolia								X				X												X		X		X											X	
Psydrax suaveolens		X	X				X			X										X			X	X								X						X	
Pterocaulon serrulatum var. *velutinum*																									X															
Pterocaulon sp.																																								
Pterocaulon sphacelatum		X				X			X		X						X	X				X		X	X	X			X		X				X		X	X	X	
Pterocaulon sphaeranthoides																																								
Ptilotus aervoides									X																				X											
Ptilotus astrolasius		X				X					X			X				X		X	X								X				X						
Ptilotus calostachyus				X	X	X					X	X	X		X										X	X						X		X		X	X	X		X
Ptilotus clementii																																					X			
Ptilotus exaltatus		X	X		X	X	X		X		X			X				X		X	X	X		X	X	X				X					X	X			
Ptilotus fusiformis						X									X																									
Ptilotus helipteroides						X			X													X							X											
Ptilotus incanus																										X														
Ptilotus mollis P4																																								
Ptilotus obovatus		X	X				X		X					X				X		X		X	X	X	X	X			X	X	X	X	X		X		X			
Ptilotus polystachyus																																								
Ptilotus roei																																								
Ptilotus rotundifolius	X										X																X											X		
Ptilotus schwartzii var. *schwartzii*																											X													
Ptilotus sp.																													X											
Rhagodia eremaea			X			X			X																	X			X	X							X			
Rhagodia sp. Hamersley (M. Trudgen 17794) P3									X											X																				
Rhodanthe margarethae																								X																
Rhynchosia minima									X								X	X				X							X	X										
Rostellularia adscendens var. *clementii*																																								
Rostellularia adscendens var. *latifolia* P3																																								
Salsola australis									X					X				X			X					X			X		X	X					X		
Santalum lanceolatum							X						X					X				X			X						X			X	X		X			
Santalum spicatum																																								
Scaevola acacioides			X				X																X																	

Taxa	HD01	HD02	HD03	HD04	HD05	HD06	HD07	HD08	HD09	HD10	HD11	HD12	HD13	HD14	HD15	HD16	HD17	HD18	HD19	HD20	HD21	HD22	HD23	HD24	HD25	HD26	HD27	HD28	HD29	HD30	HD31	HD32	HD33	HD34	HD35	HD37	HD38	HD39	HD40	HD41
Scaevola amblyanthera var. *centralis*																	X	X				X											X							
Scaevola browniana				X									X		X		X																							
Scaevola browniana subsp. *browniana*	X																																							
Scaevola parvifolia subsp. *pilbarae*					X						X											X			X										X					
Scaevola spinescens																																				X				
Schenkia australis																														X										
Schizachyrium fragile			X		X	X					X			X	X							X			X							X	X			X		X	X	
Sclerolaena cornishiana									X																					X										
Sclerolaena cuneata																																								
Sclerolaena densiflora																														X										
Sclerolaena ?gardneri																																								
Senna artemisioides subsp. × *artemisioides*									X									X				X								X	X									
Senna artemisioides subsp. *filifolia*																																	X							
Senna artemisioides subsp. *helmsii*						X	X													X						X									X				
Senna artemisioides subsp. *oligophylla*	X				X			X	X		X								X			X										X		X		X		X	X	
Senna artemisioides subsp. *oligophylla x helmsii*																									X															
Senna ferraria	X										X																	X							X		X		
Senna glaucifolia				X			X								X																	X						X	
Senna glutinosa subsp. *glutinosa*	X			X							X		X	X	X	X					X			X	X	X								X		X	X		X	
Senna glutinosa subsp. ×*luerssenii*					X	X	X							X							X		X						X					X	X			X	
Senna glutinosa subsp. *pruinosa*														X					X		X				X														X	
Senna notabilis						X																		X											X	X				
Senna pleurocarpa var. angustifolia																		X															X							
Senna sericea																																								
Senna sp. Meekatharra (E. Bailey 1-26)																					X																			
Senna sp. Meekatharra (E. Bailey 1-26) ×																																				X				
Senna sp. Meekatharra (E. Bailey 1-26) × *glaucifolia*																																								
Senna stricta							X																X	X		X										X				
Senna venusta																									X	X														
Seringia elliptica																									X										X	X				X
Seringia nephrosperma																																								X
Seringia sp.																																								
Sesbania cannabina																																								
Setaria dielsii																		X													X									
**Setaria verticillata*																														X	X					X				
Sida aff. *fibulifera*																																								
Sida arenicola															X																					X		X		X
Sida calyxhymenia																																								
Sida cardiophylla																									X															
Sida echinocarpa				X														X												X				X					
Sida ?ectogama										X																	X													
Sida fibulifera						X			X	X								X				X								X	X	X					X			
Sida platycalyx																														X										
Sida sp.		X						X		X															X	X														
Sida sp. Articulation below (A.A. Mitchell PRP 1605)																																								
Sida ?sp. dark green fruits (S. van Leeuwen 2260)																				X																				
Sida sp. dark green fruits (S. van Leeuwen 2260)		X				X				X																														
Sida sp. Excedentifolia (J.L. Egan 1925)				X										X	X						X																	X	
Sida sp. Golden calyces glabrous (H.N. Foote 32)																																X								
Sida sp. Pilbara (A.A. Mitchell PRP 1543)						X								X																		X				X	X			
Sida sp. Shovelanna Hill (S. van Leeuwen 3842)				X																				X		X														
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)						X					X							X				X												X			X			
**Sigesbeckia orientalis*																	X																							
Solanum cleistogamum																									X					X	X	X				X				
Solanum ferocissimum																										X															

Taxa	HD01	HD02	HD03	HD04	HD05	HD06	HD07	HD08	HD09	HD10	HD11	HD12	HD13	HD14	HD15	HD16	HD17	HD18	HD19	HD20	HD21	HD22	HD23	HD24	HD25	HD26	HD27	HD28	HD29	HD30	HD31	HD32	HD33	HD34	HD35	HD37	HD38	HD39	HD40	HD41
Solanum gabrielae																										X														
Solanum horridum												X												X	X	X														
Solanum lasiophyllum	X		X		X	X	X		X		X	X		X	X		X				X	X			X				X	X		X				X		X	X
**Solanum nigrum*																																								
Solanum phlomoides						X												X																		X	X			
**Sonchus oleraceus*																						X																		
sp. indet																																								
Sporobolus australasicus		X			X	X			X	X				X				X				X				X	X		X	X					X	X			
Stackhousia muricata subsp. annual (W.R. Barker 2172)																																						X		
Stemodia grossa																	X					X		X													X			
Stemodia sp.																																								
Streptoglossa bubakii									X																					X										
Streptoglossa decurrens						X																																		
Streptoglossa sp.																								X		X											X			
Stylobasium spathulatum																																					X			
Swainsona maccullochiana																			X														X							
Templetonia egena																					X																			
Tephrosia oxalidea																																								X
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)																									X						X					X			
Teucrium teucriiflorum						X																																		
Themeda avenacea																																								
Themeda sp.																																								
Themeda sp. Mt Barricade (M.E. Trudgen 2471)																X			X					X													X			
Themeda triandra	X							X						X			X	X				X			X				X	X	X			X	X				
Tinospora smilacina																										X														
Trachymene oleracea subsp. *oleracea*																			X																		X			
Tragus australianus									X																				X	X										
Trianthema glossostigmum																									X															
Tribulus platypterus																																								
Tribulus suberosus						X																																		
Trichodesma zeylanicum var. *zeylanicum*						X					X						X	X	X					X		X											X			
Tricoryne sp. Hamersley Range (S. van Leeuwen 915)																	X	X	X																					
**Tridax procumbens*																																								
Trigastrotheca molluginea																																								
Triodia ?angusta																																								
Triodia angusta																					X																			
Triodia basedowii																																								
Triodia brizoides																																								
Triodia longiceps																	X	X				X								X	X								
Triodia melvillei																																								
Triodia pungens		X	X	X	X	X	X	X		X	X	X	X	X	X					X		X	X	X	X	X	X	X			X	X		X	X	X	X		X	
Triodia sp. Mt Ella (M.E. Trudgen 12739) P3																																								
Triodia vanleeuwenii	X		X	X	X	X	X			X	X	X	X	X	X						X				X			X					X	X	X		X	X	X
Triodia wiseana	X		X	X					X		X		X		X	X		X	X		X		X								X		X			X	X			
Triraphis mollis																															X									
Triumfetta chaetocarpa																																								
Typha domingensis																																								
Urochloa ?occidentalis																																								
**Vachellia farnesiana*																		X													X									
Velleia connata																																								
Vigna lanceolata var. *lanceolata*																																								
Vittadinia eremaea																														X										
Wahlenbergia sp.																																								
Wahlenbergia tumidifructa		X																X				X																	
Waltheria indica						X																																		

Taxa	HD01	HD02	HD03	HD04	HD05	HD06	HD07	HD08	HD09	HD10	HD11	HD12	HD13	HD14	HD15	HD16	HD17	HD18	HD19	HD20	HD21	HD22	HD23	HD24	HD25	HD26	HD27	HD28	HD29	HD30	HD31	HD32	HD33	HD34	HD35	HD37	HD38	HD39	HD40	HD41
Yakirra australiensis var. *australiensis*																																								

*Denotes weed species

Taxa	HD42	HD43	HD44	HD46	HD47	HD48	HD49	HD50	HD51	HD52	HD53	HD54	HD55	HDR01	HDR02	HDR03	HDR04	HDR05	HDR06	HDR07	HDR08	HDR09	HDR10	HDR11	HDR12	HDR13	HDR14	HDR16	HDR18	HDR19	OPPS
Abutilon amplum																															
Abutilon cryptopetalum																															
Abutilon fraseri subsp. *fraseri*																															
Abutilon ?lepidum																															X
Abutilon lepidum																															
Abutilon leucopetalum																															
Abutilon macrum																															
Abutilon malvifolium																															
Abutilon otocarpum																												X			
Abutilon sp.							X																								
Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)																															X
Acacia adoxa var. *adoxa*											X																				
Acacia adsurgens	X																														X
Acacia ampliceps																															
Acacia ?ancistrocarpa																				X											
Acacia ancistrocarpa		X										X														X					
Acacia aptaneura	X		X	X		X	X		X	X		X	X		X	X			X	X	X	X								X	
Acacia aptaneura sens. lat.																															
Acacia aptaneura x							X																								
Acacia arida					X																	X									
Acacia arida x																															
Acacia ayersiana													X						X											X	
Acacia ayersiana x																															
Acacia bivenosa			X	X					X		X	X	X	X	X		X	X		X	X			X	X	X		X	X		
Acacia bromilowiana P4																															X
Acacia ?catenulata																				X											
Acacia catenulata subsp. *occidentalis*	X			X			X			X			X			X			X			X							X	X
Acacia citrinoviridis																														X	
Acacia colei																															X
Acacia coriacea subsp. *pendens*																															
Acacia dictyophleba				X			X	X					X		X														X		X
Acacia hamersleyensis									X												X										X
Acacia hilliana								X							X																
Acacia inaequilatera		X			X															X							X	X			
Acacia incurvaneura	X	X														X						X								X	
Acacia kempeana																						X									
Acacia macraneura	X																														
Acacia maitlandii				X			X		X				X									X							X		
Acacia marramamba		X																									X				X
Acacia minyura																															X
Acacia monticola									X																		X				

Taxa	HD42	HD43	HD44	HD46	HD47	HD48	HD49	HD50	HD51	HD52	HD53	HD54	HD55	HDR01	HDR02	HDR03	HDR04	HDR05	HDR06	HDR07	HDR08	HDR09	HDR10	HDR11	HDR12	HDR13	HDR14	HDR16	HDR18	HDR19	OPPS
Acacia mulganeura																			X												
Acacia pachyacra			X										X																		X
Acacia pruinocarpa	X		X	X		X	X	X	X	X	X	X	X				X				X			X						X	
Acacia pteraneura																						X									X
Acacia pteraneura x aptaneura																															
Acacia pyrifolia				X	X			X						X							X										
Acacia rhodophloia								X																							X
Acacia sibirica	X		X										X									X									X
Acacia sibirica x																					X										
Acacia sp.	X																														
Acacia spondylophylla																											X				X
Acacia steedmanii subsp. *borealis*																															X
Acacia subtiliformis P3																															X
Acacia synchronicia			X																	X				X							X
Acacia tenuissima				X			X				X	X						X				X					X			X	
Acacia tetragonophylla	X																			X		X									
Acacia tumida var. *pilbarensis*											X																				
Acrachne racemosa																															
Adriana tomentosa var. *tomentosa*																												X			
Alternanthera denticulata																															
Alternanthera nana																															
Alternanthera sp.																															
Amaranthus mitchellii																															
Amaranthus sp.																															
Amaranthus undulatus																															
Amphipogon sericeus		X		X								X		X	X				X					X	X	X	X	X			
Amyema fitzgeraldii							X																								
Amyema hilliana																															
Amyema miquelii																															X
Amyema sp.																															
Androcalva luteiflora									X												X							X	X		
Anthobolus leptomerioides																															
Aristida burbidgeae																															
Aristida contorta	X		X		X		X		X							X		X		X				X					X	X	
Aristida holathera var. *holathera*	X				X			X				X											X			X				X	
Aristida inaequiglumis	X	X							X							X														X	
Aristida ingrata																															
Aristida latifolia																															
Aristida lazaridis P2																															X
Aristida obscura							X			X		X				X															X
Aristida sp.							X															X									

Taxa	HD42	HD43	HD44	HD46	HD47	HD48	HD49	HD50	HD51	HD52	HD53	HD54	HD55	HDR01	HDR02	HDR03	HDR04	HDR05	HDR06	HDR07	HDR08	HDR09	HDR10	HDR11	HDR12	HDR13	HDR14	HDR16	HDR18	HDR19	OPPS
Asteraceae sp.							X																								
Astrebla elymoides																															
Astrebla sp.																															
Astrotricha hamptonii																															X
Atalaya hemiglauca																															X
**Bidens bipinnata*							X																							X	X
Boerhavia ?coccinea																															
Boerhavia coccinea																				X											
Boerhavia schomburgkiana																															
Bonamia pilbarensis					X																										
Bothriochloa ewartiana																															
Brachychiton acuminatus																															X
Bulbostylis barbata																			X		X						X				
Bulbostylis turbinata																															
Calytrix carinata																										X					X
Capparis lasiantha			X	X			X							X		X				X		X									X
Capparis spinosa subsp. *nummularia*																															
Capparis umbonata									X																						
Cassytha capillaris					X																X										
Cassytha filiformis																					X										
Cassytha sp.																															
**Cenchrus ciliaris*																															X
**Cenchrus setiger*																															X
Centipeda minima subsp. *macrocephala*																															
Cheilanthes lasiophylla	X				X					X								X													
Cheilanthes sieberi subsp. *sieberi*	X																														
**Chloris virgata*																															
Chrysocephalum apiculatum subsp. *pilbarense*																															X
Chrysocephalum gilesii																															
Chrysopogon fallax							X																								
Cleome viscosa							X											X													X
Clerodendrum floribundum var. *angustifolium*																											X				
Clerodendrum tomentosum var. *lanceolatum*																					X										
Codonocarpus cotinifolius		X		X										X	X				X			X									
Commelina ensifolia																															X
Convolvulus clementii																															
**Conyza bonariensis*																															
Corchorus crozophorifolius																															
Corchorus lasiocarpus subsp. *lasiocarpus*																															
Corchorus lasiocarpus subsp. *parvus*		X			X			X	X					X						X	X					X	X		X		
Corchorus tridens																															

Taxa	HD42	HD43	HD44	HD46	HD47	HD48	HD49	HD50	HD51	HD52	HD53	HD54	HD55	HDR01	HDR02	HDR03	HDR04	HDR05	HDR06	HDR07	HDR08	HDR09	HDR10	HDR11	HDR12	HDR13	HDR14	HDR16	HDR18	HDR19	OPPS
Corymbia candida																															
Corymbia deserticola																															X
Corymbia deserticola subsp. *deserticola*		X																								X					
Corymbia ferriticola																					X										
Corymbia hamersleyana																															X
Corymbia hamersleyana sens. lat.																															
Corymbia opaca									X												X										X
Corymbia sp.																															X
Crotalaria medicaginea var. *neglecta*																													X		
Crotalaria novae-hollandiae subsp. *novae-hollandiae*																															
Cryptandra monticola																															X
Cucumis melo																															
Cucumis variabilis	X																	X								X					
Cullen leucochaites																															X
Cuscuta victoriana																															
Cymbopogon ambiguus	X		X	X	X			X	X		X	X	X			X		X	X	X	X			X	X						
Cymbopogon obtectus		X		X		X																	X				X	X	X	X	
Cymbopogon sp.																														X	
Cynanchum floribundum																															
Cynanchum viminale																															X
Cynodon convergens																															
**Cynodon dactylon*																															
Cynodon prostratus			X																												
Cyperus cunninghamii subsp. *cunninghamii*																															
Cyperus difformis																															
Cyperus vaginatus																															
Dactyloctenium ?radulans																															
Dactyloctenium radulans																															
Dampiera candicans														X										X			X				
**Datura leichhardtii*																															X
**Datura leichhardtii* subsp. *leichhardtii*																															
Dichanthium sericeum subsp. *humilius*																X															
Dichanthium sericeum subsp. *humilius*																															
Dichanthium sp.																															
Dicladanthera forrestii																															
Digitaria ammophila																															
Digitaria brownii																															
Digitaria ctenantha																															
Dipteracanthus australasicus subsp. *australasicus*																					X										
Dodonaea coriacea				X	X																			X							X
Dodonaea lanceolata var. *lanceolata*									X																						

Taxa	HD42	HD43	HD44	HD46	HD47	HD48	HD49	HD50	HD51	HD52	HD53	HD54	HD55	HDR01	HDR02	HDR03	HDR04	HDR05	HDR06	HDR07	HDR08	HDR09	HDR10	HDR11	HDR12	HDR13	HDR14	HDR16	HDR18	HDR19	OPP5
Dodonaea pachyneura										X						X					X										X
Dodonaea petiolaris																													X		
Dodonaea viscosa subsp. *spatulata*																					X										X
Duperreya commixta		X		X			X		X		X	X				X	X	X			X									X	
Dysphania kalpari																															
Dysphania melanocarpa forma *melanocarpa*																															
Dysphania plantaginella									X																						
Dysphania rhadinostachya subsp. *rhadinostachya*	X									X							X		X												
**Echinochloa colona*																															X
Enchylaena tomentosa var. *tomentosa*							X										X	X												X	
Enneapogon caerulescens			X		X	X	X									X		X		X				X	X						
Enneapogon lindleyanus	X									X						X												X	X	X	
Enneapogon polyphyllus	X	X					X			X						X		X	X	X			X	X							
Enneapogon robustissimus									X									X													
Enneapogon sp.																															
Enteropogon ramosus																															
Eragrostis cumingii																															
Eragrostis eriopoda																															
Eragrostis setifolia																															
Eragrostis sp.																															
Eragrostis tenellula																															
Eragrostis xerophila																															
Eremophila aff. *clarkei*																															
Eremophila canaliculata																															
Eremophila forrestii subsp. *forrestii*							X														X										
Eremophila fraseri																															X
Eremophila fraseri subsp. *fraseri*																															X
Eremophila jucunda subsp. *pulcherrima*																X				X	X										
Eremophila lanceolata																															
Eremophila latrobei																															
Eremophila latrobei subsp. *filiformis*																															X
Eremophila latrobei subsp. *glabra*				X													X		X												
Eremophila latrobei subsp. *latrobei*	X		X	X		X				X	X		X																		
Eremophila longifolia		X											X																		
Eremophila magnifica subsp. *magnifica* P4																															X
Eremophila phyllopoda subsp. *obliqua*																X															
Eremophila platycalyx subsp. *pardalota*			X													X		X													
Eremophila sp. Hamersley Range (K. Walker KW 136) P3																															X
Eremophila sp. West Angelas (S. van Leeuwen 4068) P1																															X
Eriachne aristidea																							X								
Eriachne ?benthamii																															

Taxa	HD42	HD43	HD44	HD46	HD47	HD48	HD49	HD50	HD51	HD52	HD53	HD54	HD55	HDR01	HDR02	HDR03	HDR04	HDR05	HDR06	HDR07	HDR08	HDR09	HDR10	HDR11	HDR12	HDR13	HDR14	HDR16	HDR18	HDR19	OPPS
Eriachne benthamii																				X											X
Eriachne lanata				X							X																				
Eriachne mucronata	X			X	X		X		X	X					X	X	X	X	X		X										
Eriachne obtusa							X																								
Eriachne pulchella				X			X	X								X			X				X							X	
Eriachne pulchella subsp. *dominii*	X																								X						
Eriachne pulchella subsp. *pulchella*	X			X		X				X			X									X		X							
Eriachne tenuiculmis																															
Eucalyptus camaldulensis subsp. *obtusa*																													X		
Eucalyptus gamophylla				X							X	X		X	X											X					
Eucalyptus kingsmillii																															X
Eucalyptus leucophloia subsp. *leucophloia*	X		X	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X			
Eucalyptus pilbarensis																															
Eucalyptus repullulans			X							X				X						X											X
Eucalyptus socialis subsp. ?*eucentrica*													X																		X
Eucalyptus socialis subsp. *eucentrica*			X																												X
Eucalyptus victrix																															
Eucalyptus xerothermica							X																						X		
Eucalyptus xerothermica x *Eucalyptus tephrodes*																															
Eulalia aurea							X													X								X		
Euphorbia australis var. *subtomentosa*																				X											
Euphorbia biconvexa																															
Euphorbia biconvexa/coghlanii/trigonosperma							X									X													X		X
Euphorbia boophthona																															X
Euphorbia careyi																															X
Euphorbia coghlanii																					X										
Euphorbia sp.			X																	X											
Euphorbia trigonosperma																															
Evolvulus alsinoides var. *decumbens*																															
Evolvulus alsinoides var. *villosicalyx*							X		X											X											
Ficus brachypoda																					X										X
Fimbristylis dichotoma																												X			
Fimbristylis simulans		X																													
Fimbristylis sp.																															
**Flaveria trinervia*																															X
Glycine canescens																															
Gompholobium oreophilum				X																	X					X	X				
Gomphrena cunninghamii																							X	X	X						X
Gomphrena sp.																															
Goodenia cusackiana																															X
Goodenia lamprosperma																															

Taxa	HD42	HD43	HD44	HD46	HD47	HD48	HD49	HD50	HD51	HD52	HD53	HD54	HD55	HDR01	HDR02	HDR03	HDR04	HDR05	HDR06	HDR07	HDR08	HDR09	HDR10	HDR11	HDR12	HDR13	HDR14	HDR16	HDR18	HDR19	OPP5
Goodenia microptera																							X								
Goodenia muelleriana					X																										
Goodenia prostrata					X															X											X
Goodenia sp.																												X			
Goodenia sp. (of interest)																															X
Goodenia stellata																															
Goodenia stobbsiana		X		X	X			X						X	X		X					X	X	X	X	X	X	X			
Goodenia tenuiloba																															
Goodenia triodiophila		X		X	X						X															X	X				X
Gossypium australe																															X
Gossypium robinsonii									X												X							X	X		
Gossypium sturtianum var. *sturtianum*																													X		X
Grevillea berryana																			X			X									X
Grevillea saxicola P3										X																					X
Grevillea wickhamii subsp. *hispidula*								X	X												X				X		X			
Hakea chordophylla				X	X			X			X	X			X											X	X	X			
Hakea lorea subsp. *lorea*										X										X											
Halgania cyanea																															
Halgania gustafsenii var. *gustafsenii*																															
Haloragis gossei																															X
Haloragis odontocarpa																															
Haloragis sp.																															
Heliotropium inexplicitum																												X			
Heliotropium ovalifolium					X																										
Heliotropium pachyphyllum																															X
Heliotropium sp.																															
Heliotropium tanythrix																															
Heliotropium tenuifolium																															
Hibiscus burtonii																															
Hibiscus ?coatesii																															
Hibiscus coatesii																				X		X				X					
Hibiscus leptocladus																															
Hibiscus sp.																															
Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2																															X
Hibiscus sturtii																															
Hibiscus sturtii var. *campylochlamys*		X														X		X										X			
Hibiscus sturtii var. *platychlamys*														X														X			
Hibiscus verdcourtii																															
Hybanthus aurantiacus																															
Indigofera fractiflexa subsp. *fractiflexa*																															X
Indigofera georgei																															X

Taxa	HD42	HD43	HD44	HD46	HD47	HD48	HD49	HD50	HD51	HD52	HD53	HD54	HD55	HDR01	HDR02	HDR03	HDR04	HDR05	HDR06	HDR07	HDR08	HDR09	HDR10	HDR11	HDR12	HDR13	HDR14	HDR16	HDR18	HDR19	OPPS
Indigofera linifolia																															
Indigofera monophylla		X			X						X	X		X				X								X	X	X	X		
Indigofera rugosa																															X
Iseilema eremaeum																X															
Iseilema membranaceum						X				X																					
Iseilema sp.																															
Iseilema vaginiflorum							X																								
Isotropis sp. Arid zone (G. Byrne 2775)																															
Jasminum didymum subsp. *lineare*	X			X	X			X	X		X									X	X					X			X		
Josephinia eugeniae																															
**Lactuca serriola*																															
Lepidium catapycnon P4																								X	X						X
Lepidium pedicellosum	X		X																												X
Lepidium phlebopetalum																		X													
Lepidium pholidogynum																							X								
Lepidium sp.																															
Lobelia arnhemiaca																															
Lobelia heterophylla subsp. *pilbarensis*																															
Maireana carnosa			X																												X
Maireana eriosphaera			X																												
Maireana georgei	X		X			X										X			X			X	X		X						X
Maireana melanocoma			X																												X
Maireana tomentosa subsp. *tomentosa*															X			X												X	
Maireana triptera			X																												X
Maireana villosa																															
Malvaceae sp.																															
**Malvastrum americanum*																															X
Marsdenia australis									X												X										
Marsdenia sp.																															
Maytenus sp. Mt Windell (S. van Leeuwen 846)																					X										
Melaleuca argentea																															
Melaleuca bracteata																															
Melaleuca eleuterostachya																															X
Melaleuca glomerata																															
Melhania oblongifolia																															
**Melinis repens*																															
Mirbelia viminalis																															
Neptunia dimorphantha																															
Newcastelia sp. Hamersley Range (S. van Leeuwen 4264)																															X
Nicotiana benthamiana																															X
Nicotiana sp.																															

Taxa	HD42	HD43	HD44	HD46	HD47	HD48	HD49	HD50	HD51	HD52	HD53	HD54	HD55	HDR01	HDR02	HDR03	HDR04	HDR05	HDR06	HDR07	HDR08	HDR09	HDR10	HDR11	HDR12	HDR13	HDR14	HDR16	HDR18	HDR19	OPPS
Notoleptopus decaisnei var. Orbicularis (A.B. Craig 428)																															
Oldenlandia crouchiana					X																		X		X						X
Pandorea pandorana																					X										
Panicum decompositum																															
Panicum effusum							X																								
Paraneurachne muelleri	X	X		X	X		X					X		X				X		X			X	X	X			X		X	
Paspalidium clementii	X	X				X	X			X						X		X	X				X	X	X			X			
Paspalidium jubiflorum																															
Paspalidium rarum																															
Peripleura arida																															
Peripleura obovata																															
Peripleura virgata																							X		X						X
Perotis rara										X						X															
Petalostylis labicheoides							X		X				X								X								X	X	
Phyllanthus erwinii																															
Phyllanthus maderaspatensis																															
Pluchea dentex																									X						
Pluchea rubelliflora																															
Pluchea sp.																															
Poaceae sp.																															
Polycarpaea corymbosa var. *corymbosa*		X			X		X																								
Polycarpaea holtzei		X			X										X													X			
Polycarpaea longiflora															X			X													
Polygala isingii																															
Polymeria aff. *longifolia*																															
Polymeria ambigua																															
Portulaca oleracea																				X											
Psydrax latifolia							X														X								X	X	
Psydrax suaveolens										X			X																		
Pterocaulon serrulatum var. *velutinum*																															
Pterocaulon sp.																				X									X		
Pterocaulon sphacelatum					X	X	X	X	X		X	X			X								X		X						
Pterocaulon sphaeranthoides																															
Ptilotus aervoides																															
Ptilotus astrolasius		X			X		X			X										X			X	X		X		X			X
Ptilotus calostachyus		X		X	X						X	X		X	X		X		X			X	X	X	X	X	X	X			
Ptilotus clementii																									X						X
Ptilotus exaltatus	X	X	X							X				X			X		X	X	X		X	X	X			X		X	
Ptilotus fusiformis																															X
Ptilotus helipteroides																															X
Ptilotus incanus						X																									

Taxa	HD42	HD43	HD44	HD46	HD47	HD48	HD49	HD50	HD51	HD52	HD53	HD54	HD55	HDR01	HDR02	HDR03	HDR04	HDR05	HDR06	HDR07	HDR08	HDR09	HDR10	HDR11	HDR12	HDR13	HDR14	HDR16	HDR18	HDR19	OPP5
Ptilotus mollis P4																								X							X
Ptilotus obovatus	X		X			X	X	X								X	X	X		X								X		X	X
Ptilotus polystachyus																															X
Ptilotus roei																															
Ptilotus rotundifolius		X				X		X				X															X	X			
Ptilotus schwartzii var. *schwartzii*																															
Ptilotus sp.																															
Rhagodia eremaea							X											X		X											X
Rhagodia sp. Hamersley (M. Trudgen 17794) P3																															X
Rhodanthe margarethae																															
Rhynchosia minima																				X									X		
Rostellularia adscendens var. *clementii*																															
Rostellularia adscendens var. *latifolia P3*																															X
Salsola australis	X		X				X											X		X				X						X	
Santalum lanceolatum									X											X	X									X	X
Santalum spicatum																															
Scaevola acacioides	X			X		X				X						X	X		X			X				X					
Scaevola amblyanthera var. *centralis*																															X
Scaevola browniana								X			X																				X
Scaevola browniana subsp. *browniana*																															
Scaevola parvifolia subsp. *pilbarae*												X														X					
Scaevola spinescens																															
Schenkia australis																															
Schizachyrium fragile		X		X	X				X							X		X	X				X	X	X					
Sclerolaena cornishiana																															
Sclerolaena cuneata			X																												
Sclerolaena densiflora			X																						X						X
Sclerolaena ?gardneri			X																												
Senna artemisioides subsp. × *artemisioides*							X																						X		
Senna artemisioides subsp. *filifolia*																															
Senna artemisioides subsp. *helmsii*											X																				
Senna artemisioides subsp. *oligophylla*					X		X							X	X					X	X			X				X			
Senna artemisioides subsp. *oligophylla x helmsii*																															
Senna ferraria									X		X			X							X										
Senna glaucifolia		X		X																						X					
Senna glutinosa subsp. *glutinosa*	X	X	X	X	X	X		X	X	X	X			X	X		X	X	X	X	X	X	X	X	X		X	X			
Senna glutinosa subsp. ×*luerssenii*		X	X			X					X							X	X			X			X						X
Senna glutinosa subsp. *pruinosa*		X				X					X						X						X	X	X		X	X			X
Senna notabilis																										X	X	X			
Senna pleurocarpa var. angustifolia																															
Senna sericea																							X								

Taxa	HD42	HD43	HD44	HD46	HD47	HD48	HD49	HD50	HD51	HD52	HD53	HD54	HD55	HDR01	HDR02	HDR03	HDR04	HDR05	HDR06	HDR07	HDR08	HDR09	HDR10	HDR11	HDR12	HDR13	HDR14	HDR16	HDR18	HDR19	OPPS
Senna sp. Meekatharra (E. Bailey 1-26)																	X														
Senna sp. Meekatharra (E. Bailey 1-26) ×																															
Senna sp. Meekatharra (E. Bailey 1-26) × *glaucifolia*																															
Senna stricta	X		X			X	X									X	X	X													
Senna venusta																															
Seringia elliptica									X				X		X																
Seringia nephrosperma																															
Seringia sp.	X						X																			X					
Sesbania cannabina																															
Setaria dielsii																															
**Setaria verticillata*																															X
Sida aff. *fibulifera*																															
Sida arenicola		X				X																					X				X
Sida calyxhymenia																															
Sida cardiophylla																															
Sida echinocarpa					X										X		X	X													
Sida ?ectogama																															
Sida fibulifera			X													X				X										X	
Sida platycalyx																															
Sida sp.						X							X																		
Sida sp. Articulation below (A.A. Mitchell PRP 1605)																				X											
Sida ?sp. dark green fruits (S. van Leeuwen 2260)																															
Sida sp. dark green fruits (S. van Leeuwen 2260)							X																								
Sida sp. Excedentifolia (J.L. Egan 1925)																	X	X	X		X		X		X						X
Sida sp. Golden calyces glabrous (H.N. Foote 32)																															
Sida sp. Pilbara (A.A. Mitchell PRP 1543)				X				X															X	X	X						X
Sida sp. Shovelanna Hill (S. van Leeuwen 3842)						X																									X
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)									X																		X				
**Sigesbeckia orientalis*																															
Solanum cleistogamum	X							X												X				X							
Solanum ferocissimum																															
Solanum gabrielae																															
Solanum horridum			X													X			X						X		X				
Solanum lasiophyllum	X	X	X	X			X			X					X		X	X		X							X		X		X	
**Solanum nigrum*																															
Solanum phlomoides					X									X					X						X	X	X				X
**Sonchus oleraceus*																															X
sp. indet																															
Sporobolus australasicus	X		X			X	X									X				X										X	
Stackhousia muricata subsp. annual (W.R. Barker 2172)					X										X					X											
Stemodia grossa																												X			

Taxa	HD42	HD43	HD44	HD46	HD47	HD48	HD49	HD50	HD51	HD52	HD53	HD54	HD55	HDR01	HDR02	HDR03	HDR04	HDR05	HDR06	HDR07	HDR08	HDR09	HDR10	HDR11	HDR12	HDR13	HDR14	HDR16	HDR18	HDR19	OPPS
Stemodia sp.																															
Streptoglossa bubakii																				X											
Streptoglossa decurrens																															
Streptoglossa sp.																									X						
Stylobasium spathulatum																					X										
Swainsona maccullochiana					X															X											X
Templetonia egena	X																														X
Tephrosia oxalidea		X																					X	X							
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)																															
Teucrium teucriiflorum																															
Themeda avenacea																															X
Themeda sp.																															
Themeda sp. Mt Barricade (M.E. Trudgen 2471)					X													X			X							X			X
Themeda triandra							X		X			X								X									X		
Tinospora smilacina																															
Trachymene oleracea subsp. *oleracea*																															X
Tragus australianus																															
Trianthema glossostigmum																															
Tribulus platypterus																															X
Tribulus suberosus						X											X		X												X
Trichodesma zeylanicum var. *zeylanicum*					X	X																									
Tricoryne sp. Hamersley Range (S. van Leeuwen 915)					X																										X
**Tridax procumbens*																															X
Trigastrotheca molluginea																															
Triodia ?angusta																															X
Triodia angusta	X																														
Triodia basedowii																															
Triodia brizoides			X																												
Triodia longiceps																													X		X
Triodia melvillei																															
Triodia pungens	X			X			X	X	X	X	X	X	X			X	X	X	X		X									X	
Triodia sp. Mt Ella (M.E. Trudgen 12739) P3																															X
Triodia vanleeuwenii	X	X		X		X	X	X		X	X	X			X	X	X		X			X			X	X	X	X			
Triodia wiseana			X		X						X			X		X		X	X	X		X	X	X	X			X			
Triraphis mollis																															
Triumfetta chaetocarpa																								X							
Typha domingensis																															
Urochloa ?occidentalis																															X
**Vachellia farnesiana*																				X											X
Velleia connata																															X
Vigna lanceolata var. *lanceolata*																															

Taxa	HD42	HD43	HD44	HD46	HD47	HD48	HD49	HD50	HD51	HD52	HD53	HD54	HD55	HDR01	HDR02	HDR03	HDR04	HDR05	HDR06	HDR07	HDR08	HDR09	HDR10	HDR11	HDR12	HDR13	HDR14	HDR16	HDR18	HDR19	OPPS
Vittadinia eremaea																															
Wahlenbergia sp.										X																					
Wahlenbergia tumidifructa																															
Waltheria indica																															
Yakirra australiensis var. *australiensis*																															

*Denotes weed species

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Appendix M: Survey Effort

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695000 700000 705000

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7445000

N.2

N.1

MNBE13 MNBE14 MNBE11 MNBE12 MNBE10 MNBE15 MNBE08 HDR16 MNBE07 MNBE09

HD53 HD48 HD52 HD46 HD40 HD39 HD54 HD55 HD49 HD02 GH03 GH02 GH12 GH11 GHR30

GHR10 GHMNBE005 GHMNBE008 GHMNKM05 GH13 GH15

GHMNBE007 HD01 GH27 GHR28

GHMNBE004 GHMNBE006 GH01 HD20 HDR19 GH09 GH07 GH08 HD12 HD10 HD09 HD11 HD28 HD08

HD29 HD31 HD27 HD22 HD14 MNMH01 MNMH27 HD18 HD30 MNMH07

HD32 HD25 HD34 MNMH28 MNLV02 HDR07 HDR05 HD51 MNLV13 MNLV12 MNMH03 MNMH02 MNMH06 HD16 MNMH05

HD50 HDR03 MNBE02 MNMH04

HD21 HDR18 MNLV05 HDR09

MNMH34 MNMH37 MNMH19 MNMH18 MNLV04

MNMH33 HD23 MNLV06 MNMH17 MNMH16

HD42 HD33 MNMH15

MNMH32 MNMH35 HD44 MNMH10 MNMH14

MNMH36 HDR13 MNMH09 HD19 HD17 MNMH11 HD47

MNLV07 MNMH12 MNMH13

GH06 GH05 GH04

GHMNBE003

Survey Area

Sampling Site

- Quadrat
- Relevé
- Vegetation Mapping Note

GPS Tracklogs

- FV 3 - 2019
- FV 2 - 2018
- FV 1 - 2017

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 2 Proposal – Flora and Vegetation Survey

Figure M.1: Survey effort

Scale: 1:41,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 500 1,000 1,500 2,000 2,500 3,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 07-11-2019 | Figure Ref: 14292A-19-BIDR-3RevB_191107_SurveyEff_FigM

710000 715000 720000

7455000

7450000

N.2

N.1

Survey Area

Sampling Site

Quadrat

Relevé

Vegetation Mapping Note

GPS Tracklogs

FV 3 - 2019

FV 2 - 2018

FV 1 - 2017

GH21 GH22 GH23 GHMNKM07 GHMNKM08 GH26 GHMNKM10 GHMNKM09 GHMNKM11 GHMNDR02 GH25 GHMNKM12 GHMNBE010 GHMNDR01 GH20 BHD05-AR GHMNKM13 GH24 GH19 GH17 HD43 MNBE06 HDR14 MNBE04 HD06 MNBE05 HD38 HD37 HDR12 HDR06 GHR16 HDR10 HD26 MNBE08 HDR16 MNBE07 MNBE03 HD24 HD04 HD05 MNMH08 MNLV03 HDR11 MNBE01 GH11 GHR30 HD03 HD07 HD15 HDR08 HD13 HDR04 HD48 HD52 HD45 MNMH23 MNMH24 MNMH22 MNMH21 HD40 HD39 MNBE09 MNMH25 MNMH20 HD35 HDR01 MNMH26 MNLV09 HD41 MNLV08 HDR02

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Rio Tinto

Hope Downs 2 Proposal – Flora and Vegetation Survey

Figure M.2: Survey effort

Scale: 1:41,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 500 1,000 1,500 2,000 2,500 3,000 Metres

N

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Appendix N: Conservation Significant Flora Locations and Descriptions

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714000 716000 718000 720000

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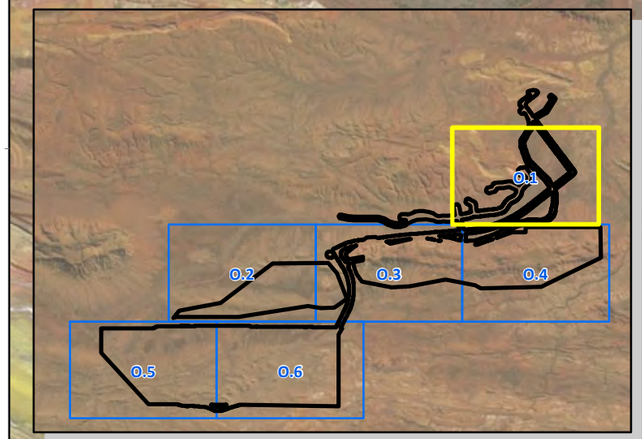

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Survey Area

Priority Flora - Recorded by Astron

Eremophila magnifica subsp. *magnifica* P4

Priority Flora - Previously Recorded

Eremophila magnifica subsp. *magnifica* P4

Goodenia lyrata P3

Rio Tinto

Hope Downs 2 Proposal – Flora and Vegetation Survey

Figure N.1: Conservation significant flora locations

Scale: 1:20,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

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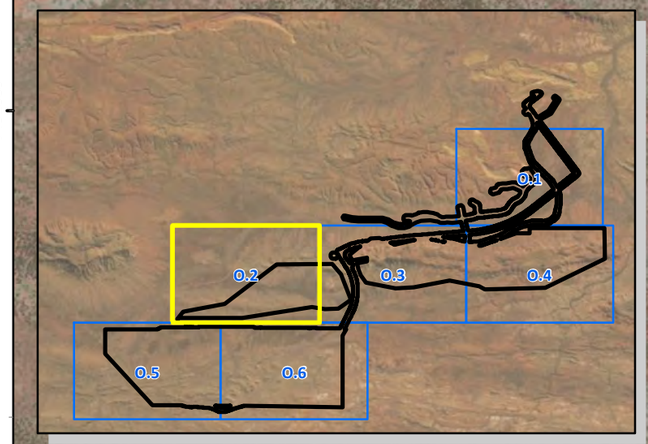
702000
704000
706000
7452000
7450000
7448000



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Survey Area

Priority Flora - Recorded by Astron

■ *Grevillea saxicola* P3

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Hope Downs 2 Proposal – Flora and Vegetation Survey

Figure N.2: Conservation significant flora locations

Scale: 1:20,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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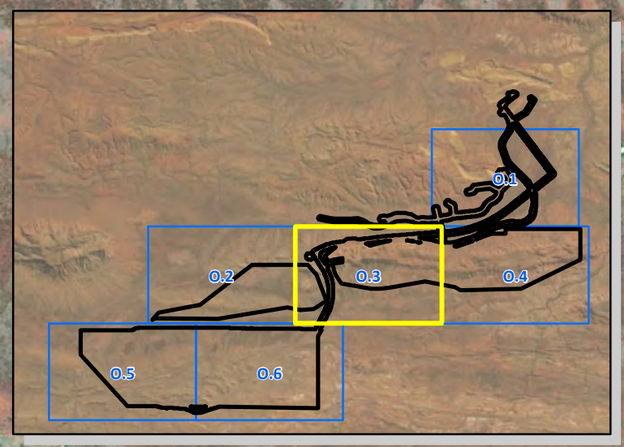
708000 710000 712000 714000

7452000

7450000

7448000

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Survey Area

Priority Flora - Recorded by Astron

- *Acacia bromilowiana* P4
- *Eremophila* sp. Hamersley Range (K. Walker KW 136) P1
- *Eremophila* sp. West Angelas (S. van Leeuwen 4068) P1
- *Grevillea saxicola* P3
- *Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2
- *Lepidium catapycnon* P4
- *Ptilotus mollis* P4
- *Rhagodia* sp. Hamersley (M. Trudgen 17794) P3

Priority Flora - Previously Recorded

- *Acacia bromilowiana* P4
- *Eremophila* sp. Hamersley Range (K. Walker KW 136) P1
- *Eremophila* sp. West Angelas (S. van Leeuwen 4068) P1
- *Grevillea saxicola* P3
- *Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2
- *Lepidium catapycnon* P4
- *Ptilotus mollis* P4

Priority Flora - WA Herbarium and TPFL

- *Grevillea saxicola* P3

Rio Tinto

Hope Downs 2 Proposal – Flora and Vegetation Survey

Figure N.3: Conservation significant flora locations

Scale: 1:20,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

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Author: B. Eckermann | Drawn: C. Dyde | Date: 07-11-2019 | Figure Ref: 14292A-19-BIDR-3RevB_191107_PriFlora_FigN

716000

718000

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7452000

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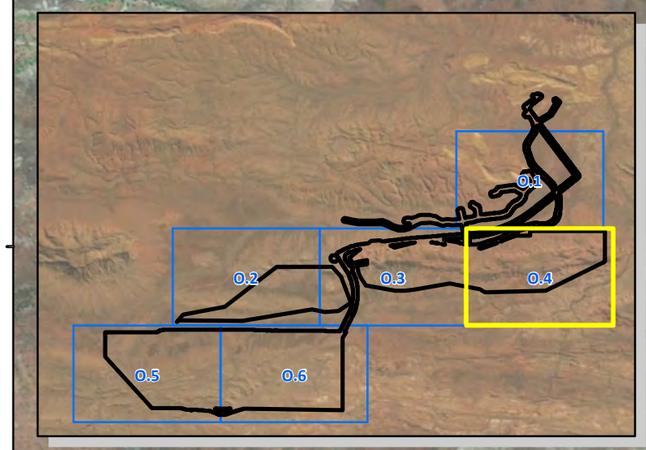

Survey Area

Priority Flora - Recorded by Astron

- *Acacia bromilowiana* P4
- *Eremophila* sp. West Angelas (S. van Leeuwen 4068) P1
- *Grevillea saxicola* P3
- *Lepidium catapycnon* P4
- *Ptilotus mollis* P4
- *Triodia* sp. Mt Ella (M.E. Trudgen 12739) P3

Priority Flora - Previously Recorded

- *Acacia bromilowiana* P4
- *Acacia subtiliformis* P3
- *Eremophila* sp. Hamersley Range (K. Walker KW 136) P1
- *Eremophila* sp. West Angelas (S. van Leeuwen 4068) P1
- *Grevillea saxicola* P3
- *Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2
- *Lepidium catapycnon* P4
- *Ptilotus mollis* P4
- *Triodia* sp. Mt Ella (M.E. Trudgen 12739) P3

Priority Flora - WA Herbarium and TPFL

- *Acacia subtiliformis* P3
- *Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2
- *Lepidium catapycnon* P4
- *Triodia* sp. Mt Ella (M.E. Trudgen 12739) P3

Rio Tinto

Hope Downs 2 Proposal – Flora and Vegetation Survey

Figure N.4: Conservation significant flora locations

Scale: 1:20,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

Metres

0 200 400 600 800 1,000

N

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694000 696000 698000 700000

7446000

7444000

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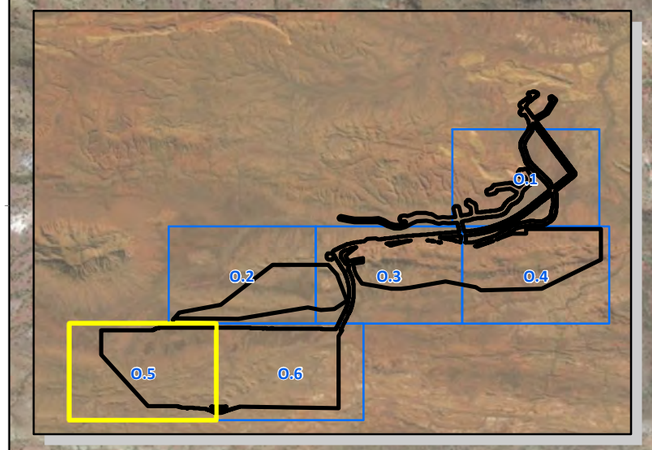
Survey Area

Priority Flora - Recorded by Astron

- *Aristida lazaridis* P2
- *Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2
- *Rhagodia* sp. Hamersley (M. Trudgen 17794) P3



Rio Tinto

Hope Downs 2 Proposal – Flora and Vegetation Survey

Figure N.5: Conservation significant flora locations

Scale: 1:20,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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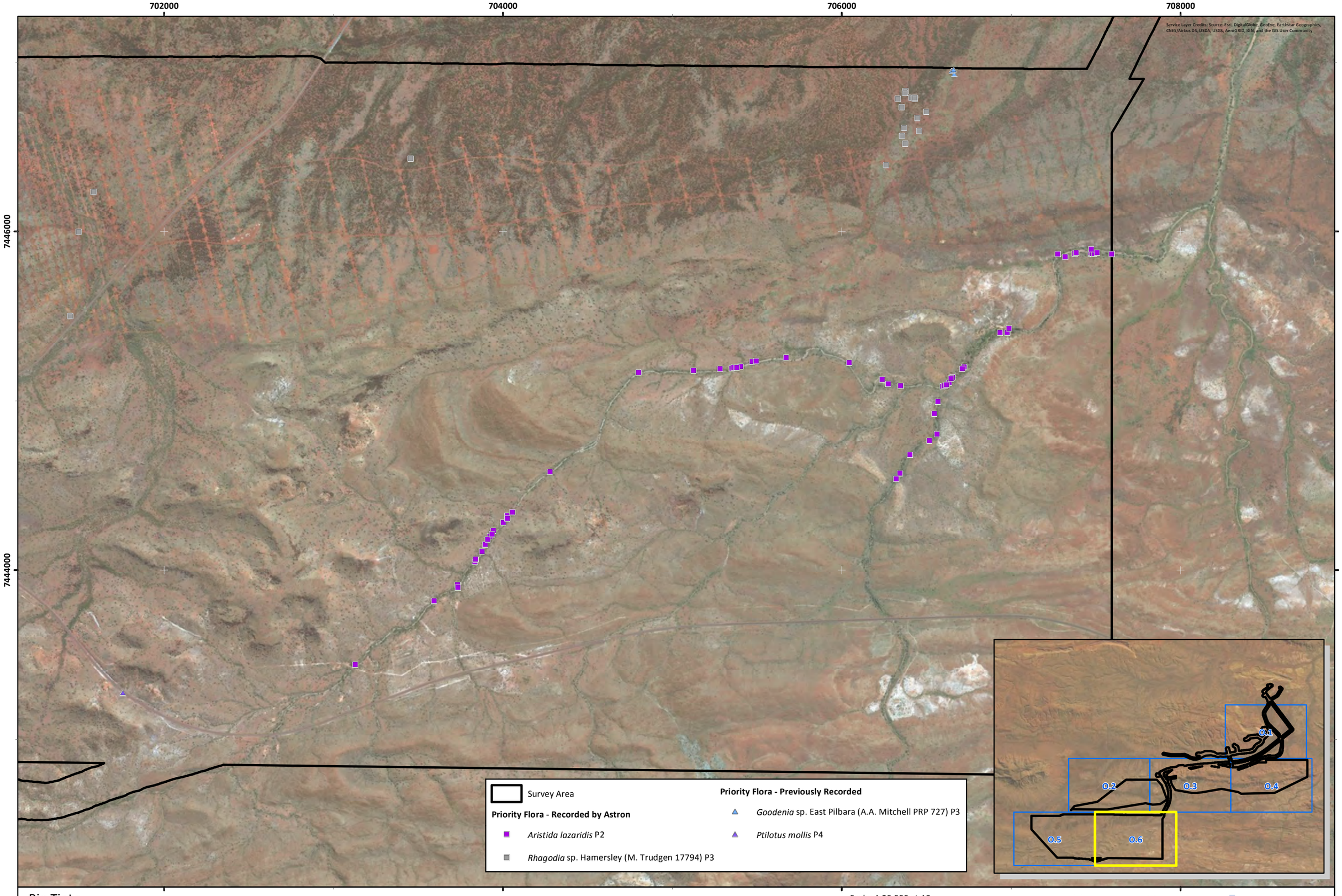

Rio Tinto

Hope Downs 2 Proposal – Flora and Vegetation Survey

Figure N.6: Conservation significant flora locations

Scale: 1:20,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Table N.1: Conservation significant flora recorded in the survey area.

Species	Description[1]	Habitat[1]
Eremophila sp. West Angelas (S. van Leeuwen 4068) P1 	Erect-branched spindly whip shrub with narrow leaves to 3 m high. Flower purple with corolla medial lobe of lower lip completely closes the throat.	Rocky hills or ridges and mulga bands in clay soil between rocky ridges. Very steep hillslope of brown silty loam. Breakaways, skeletal red gritty soil over massive banded iron.
Aristida lazaridis P2 	Densely clumped grass with clumps to 1.4 m high. Leaf-blade surface scaberulous. Flowers April.	Sand, loam, clayey soils. Plains, ironstone hills in *Triodia* spp. hummock grassland with sparse overstorey of *Eucalyptus leucophloia*. Mulga Shrublands
Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2 	Spindly upright shrub to 3 m high. Flowers May to July.	Near summit of hill, high in landscape, skeletal red-brown stony soil over massive ironstone of the Brockman Iron Formation. Sheltered or rocky drainage lines below associated cliff lines or rocky ridges.

Species	Description[1]	Habitat[1]
Acacia subtiliformis P3 	Spindly, slender, erect shrub, to 3.5 m high, new growth slightly viscid, resinous, aromatic. Flowers yellow, June.	Low, undulating country on calcareous rises adjacent to drainage lines.
Eremophila sp. Hamersley Range (K. Walker KW 136) P3 	Erect shrub. Flowers white-cream-yellow-pink-purple, August to September.	High in the landscape, cliff tops, gorge tops, steep rocky slopes, gullies and rock faces associated with large hills and cliffs. Skeletal red-brown soils.
Goodenia lyrata P3[2] 	Prostrate herb, with lyrate leaves. Flowers yellow, August.	Red sandy loam. Near claypan. In sand and clay on poorly drained flats often occurring with various *Calandrinia* spp. and *Eucalyptus victrix.*

Species	Description[1]	Habitat[1]
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727) P3[2] 	Small rosetted herb (with spathulata leaves), to 0.2 m high. Flowers yellow, March to September.	Red-brown clay soil, calcrete pebbles. Low undulating plain, swampy plains, stony plains, hill slopes.
Grevillea saxicola P3 	Erect shrub to 2.5 m high. Flowers February, April, November.	Low rocky hill, red-brown sandy loam with ironstone pebble cover, steep scree slopes often associated with banded iron formation. Mulga woodlands.
Rhagodia sp. Hamersley (M. Trudgen 17794) P3 	Shrub, 2.5 m high. Leaves small lanceolate, not aromatic. Flowers yellow. Fruit small red drupelets.	Mulga plains. Alluvial plains. Red brown clay to loamy clay. Occasionally on slopes.

Species	Description[1]	Habitat[1]
Triodia sp. Mt Ella (M.E. Trudgen 12739) P3 	Grass-like or herb, 0.4 m high.	Light orange-brown, pebbly loam. Amongst rocks and outcrops, gully slopes.
Acacia bromilowiana P4 	Tree or shrub, to 12 m high. Flowers yellow/pink, July to August.	Red skeletal stony loam, orange-brown pebbly, gravel loam, laterite, banded ironstone, basalt. Rocky hills, breakaways, scree slopes, gorges, creek beds.
Eremophila magnifica subsp. *magnifica* P4 	Shrub, 0.5 m to 1.5 m high. Flowers blue, August to November.	Skeletal soils on the slopes and summits of ironstone hills in the Hamersley Range area.

Species	Description[1]	Habitat[1]
Lepidium catapycnon P4 	Open, woody herb or shrub, 0.2 m to 0.3 m high, stems zigzag. Flowers white, October.	Occurs on hillsides in skeletal soils, shale, ironstone.
Ptilotus mollis P4 	Compact shrub, to 0.5 m high, soft grey foliage. Flowers white/pink, May or September.	Stony hills, steep rocky sites and screes. Usually in full sun on massive ironstone formations.

[1] – Florabase (Western Australian Herbarium 1998-2019).
[2] – Species not observed in current survey, but previously recorded within survey area. For project presence see Table N.2.

Table N.2: Conservation significant flora recorded in HD2 Detailed Survey Area (GDA94, Zone 50).

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Acacia bromilowiana P4	A	0.1	1	711093	7451039
		0.1	1	711160	7450834
		0.1	7	711149	7450896
		0.1	15	711157	7450865
		0.5	1	711232	7450605
		0.5	2	712732	7450829
		0.5	5	712294	7450505
		0.5	5	712431	7450522
		0.5	5	712540	7450565
		0.5	5	713675	7450561
		0.5	5	718147	7450395
		0.5	5	718157	7450409
		0.5	5	718178	7450430
		0.5	5	718184	7450442
		0.5	5	718185	7450336
		0.5	5	718185	7450337
		0.5	5	718188	7450457
		0.5	10	712356	7450513
		0.5	10	712490	7450663
		0.5	10	713652	7450547
		1	20	710953	7450902
	D	-	10	714676	7450002
		-	14	714675	7450020
	E	-	1	713995	7450670
		-	3	714190	7450728
		-	4	714005	7450658
		-	6	714068	7450750
		-	11	713782	7450811
		-	11	714023	7450734
		-	15	714047	7450744
		-	28	713836	7450802
		-	40	714040	7450649
	H	-	1	711133	7451044
		-	1	717889	7450991
		-	10	711099	7450984
		-	25	711203	7450770
		-	50	710959	7450876
Acacia subtiliformis P3	C	-	1	715227	7449939
	D	-	1	715227	7449939

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		-	5	696277	7445914
		-	6	696296	7445922
		-	10	695879	7445560
		-	10	695897	7445559
		-	10	695913	7445787
		-	10	696001	7445751
		-	10	696146	7445827
		-	15	696114	7445840
		-	15	696557	7445946
		-	20	695910	7445760
		-	20	695972	7445757
		-	25	696546	7445948
		-	40	696203	7445876
		-	40	696236	7445888
		-	100	696260	7445903
		0.1	1	696621	7446050
		0.1	1	704026	7444305
		0.1	1	704057	7444342
		0.1	1	706322	7444540
		0.1	1	707470	7445869
Aristida lazaridis P2	A	0.1	1	707471	7445873
		0.1	1	707473	7445896
		0.1	2	695495	7445213
		0.1	2	695510	7445229
		0.1	2	695670	7445366
		0.1	2	696682	7446140
		0.1	2	696792	7446151
		0.1	2	696851	7446461
		0.1	2	696861	7446598
		0.1	2	696883	7446651
		0.1	2	696884	7446710
		0.1	2	696894	7446731
		0.1	2	696903	7446731
		0.1	2	696979	7446814
		0.1	2	697069	7446747
		0.1	2	697122	7446742
		0.1	2	697132	7446724
		0.1	2	697171	7446721
		0.1	2	697177	7446722
		0.1	2	697181	7446854
		0.1	2	697190	7446865

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		0.1	2	697230	7446863
		0.1	2	697232	7446869
		0.1	2	697238	7446872
		0.1	2	705125	7445179
		0.1	2	705380	7445196
		0.1	2	706274	7445100
		0.1	2	706518	7444764
		0.1	2	706547	7444924
		0.1	2	707319	7445850
		0.1	2	707383	7445873
		0.1	2	707480	7445870
		0.1	2	707507	7445876
		0.1	3	695561	7445259
		0.1	3	695614	7445317
		0.1	3	695738	7445408
		0.1	3	695818	7445426
		0.1	3	696334	7445971
		0.1	3	696340	7445967
		0.1	3	696512	7445971
		0.1	3	696572	7445981
Aristida lazaridis P2	A	0.1	3	696579	7445976
		0.1	3	696603	7445978
		0.1	3	696729	7446148
		0.1	3	696758	7446156
		0.1	3	696802	7446369
		0.1	3	704802	7445168
		0.1	3	706711	7445189
		0.1	3	707376	7445869
		0.1	4	696482	7445964
		0.1	4	705672	7445256
		0.1	4	706044	7445225
		0.1	4	706567	7444995
		0.1	4	706935	7445402
		0.1	4	707472	7445874
		0.1	4	707593	7445867
		0.1	5	695578	7445287
		0.1	5	696608	7445991
		0.1	5	696837	7446408
		0.1	5	696842	7446413
		0.1	5	696844	7446427
		0.1	5	696907	7446733

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		0.1	5	703733	7443913
		0.1	5	703735	7443897
		0.1	5	706723	7445199
		0.1	5	707491	7445868
		0.1	6	695640	7445336
		0.1	6	696763	7446192
		0.1	6	706344	7444571
		0.1	6	706562	7444803
		0.1	6	706646	7445132
		0.1	8	695613	7445318
		0.1	8	695641	7445341
		0.1	8	696792	7446172
		0.1	8	696856	7446581
		0.1	8	696943	7446704
		0.1	8	704026	7444323
		0.1	8	705403	7445203
		0.1	8	706619	7445095
		0.1	8	706634	7445107
		0.1	8	706977	7445402
		0.1	8	706988	7445428
Aristida lazaridis P2	A	0.1	9	703876	7444110
		0.1	9	705363	7445198
		0.1	10	695444	7445199
		0.1	10	695588	7445300
		0.1	10	695639	7445339
		0.1	10	703594	7443817
		0.1	10	705283	7445187
		0.1	10	706239	7445126
		0.1	10	706607	7445087
		0.1	12	696723	7446179
		0.1	12	696824	7446424
		0.1	12	704278	7444580
		0.1	12	705495	7445235
		0.1	13	706403	7444681
		0.1	15	696749	7446204
		0.1	15	696819	7446228
		0.1	15	703936	7444213
		0.1	15	706348	7445088
		0.1	18	696711	7446134
		0.1	20	696819	7446308
		0.1	20	697122	7446813

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		0.1	20	697183	7446794
		0.1	20	704002	7444282
		0.1	20	705352	7445192
		0.1	20	706596	7445086
		0.1	20	707275	7445867
		0.1	24	696932	7446737
		0.1	25	696822	7446455
		0.1	25	696899	7446713
		0.1	25	696969	7446764
		0.1	25	696984	7446788
		0.1	25	703840	7444063
		0.1	30	696781	7446203
		0.1	30	696981	7446726
		0.1	30	697100	7446801
		0.1	30	703835	7444048
		0.1	30	703945	7444232
		0.1	35	697231	7446841
		0.1	35	705472	7445231
		0.1	35	706654	7445138
		0.1	40	696998	7446746
Aristida lazaridis P2	A	0.1	40	697275	7446899
		0.1	50	696906	7446668
		0.5	10	695446	7445221
		0.5	20	696428	7445960
		0.5	40	703911	7444182
		1	2	695767	7445374
		1	2	695776	7445377
		1	2	703129	7443442
		1	5	696723	7446147
		1	5	696737	7446142
		1	5	696748	7446140
		1	5	696755	7446145
		1	5	696758	7446148
		1	5	696836	7446364
		1	5	696844	7446366
		1	5	696858	7446440
		1	5	696919	7446744
		1	5	696930	7446748
		1	5	696931	7446741
		1	5	696936	7446760
		1	5	696940	7446772

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		1	5	696947	7446789
		1	5	696948	7446696
		1	5	696962	7446796
		1	5	697132	7446723
		1	5	697265	7446849
		1	5	697266	7446873
		1	5	697271	7446859
		1	6	696559	7445946
		1	6	696576	7445944
		1	6	696646	7446072
		1	6	696675	7446096
		1	8	695765	7445373
		1	10	695736	7445370
		1	10	695827	7445421
		1	10	695984	7445453
		1	12	695714	7445378
		1	20	695674	7445366
		1	25	695467	7445222
		1	60	703895	7444151
		1	60	703925	7444201
Aristida lazaridis P2	A	10	35	695621	7445355
		15	40	696693	7446106
		15	40	696702	7446128
		15	50	696526	7445982
		2	10	696334	7445965
		2	10	696335	7445971
		2	10	696346	7445973
		2	10	696355	7445976
		2	10	696363	7445978
		2	10	696371	7445976
		2	10	696372	7445973
		2	10	696428	7445960
		2	10	696982	7446709
		2	10	696990	7446731
		2	10	696998	7446731
		2	10	697008	7446731
		2	10	697014	7446726
		2	20	695507	7445242
		2	20	695580	7445319
		2	20	695848	7445460
		2	20	696715	7446146

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Aristida lazaridis P2	A	3	25	695596	7445333
		40	100	695743	7445401
		40	150	695650	7445384
		5	20	696651	7446081
		5	20	696662	7446086
		5	20	696687	7446110
		5	20	697235	7446881
		5	20	697240	7446889
		5	50	695517	7445268
Eremophila magnifica subsp. *magnifica* P4	A	0.1	1	714576	7453661
		0.1	2	714770	7453603
	F	-	19	714765	7453592
Eremophila sp. Hamersley Range (K. Walker KW 136) P1	A	0.1	1	711128	7451062
		0.1	2	711612	7450384
		0.1	11	710874	7450417
		0.1	11	711144	7451009
		0.2	4	711423	7450384
		0.2	5	711405	7450389
		0.5	1	710738	7450523
		0.5	1	710819	7450499
		0.5	1	710951	7450528
		0.5	1	710959	7450528
		0.5	1	710972	7450503
		0.5	1	711012	7450523
		0.5	1	711026	7450526
		0.5	1	711053	7450527
		0.5	1	711071	7450527
		0.5	1	711074	7450529
		0.5	1	711099	7450540
		0.5	1	711112	7450472
		0.5	1	711131	7450470
		0.5	1	711135	7450501
		0.5	1	711139	7450500
		0.5	1	711140	7450429
		0.5	1	711141	7450501
		0.5	1	711160	7450426
		0.5	1	711166	7450489
		0.5	1	711169	7450453
		0.5	1	711193	7450480
		0.5	1	711205	7450479
		0.5	1	711206	7450484

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Eremophila sp. Hamersley Range (K. Walker KW 136) P1	A	0.5	1	711210	7450444
		0.5	1	711230	7450429
		0.5	1	711242	7450422
		0.5	1	711259	7450423
		0.5	2	710953	7450505
		0.5	2	710955	7450511
		0.5	2	710956	7450506
		0.5	2	710956	7450522
		0.5	2	710975	7450502
		0.5	2	710998	7450510
		0.5	2	710999	7450514
		0.5	2	711038	7450461
		0.5	2	711067	7450530
		0.5	2	711120	7450500
		0.5	2	711131	7450502
		0.5	2	711172	7450452
		0.5	2	711173	7450484
		0.5	2	711249	7450417
		0.5	2	711292	7450446
		0.5	2	711297	7450425
		0.5	2	711311	7450440
		0.5	2	712518	7450592
		0.5	2	712559	7450660
		0.5	3	710953	7450502
		0.5	3	710953	7450514
		0.5	3	710968	7450509
		0.5	3	711034	7450501
		0.5	3	711036	7450497
		0.5	3	711080	7450535
		0.5	3	711082	7450513
		0.5	3	711083	7450490
		0.5	3	711091	7450486
		0.5	3	711108	7450480
		0.5	3	711125	7450500
		0.5	3	711186	7450453
		0.5	3	711197	7450483
		0.5	3	711226	7450434
		0.5	3	711264	7450431
		0.5	3	711307	7450441
		0.5	3	711507	7450302
		0.5	3	712533	7450631

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Eremophila sp. Hamersley Range (K. Walker KW 136) P1	A	0.5	4	711004	7450485
		0.5	4	711042	7450524
		0.5	4	711047	7450396
		0.5	4	711127	7450503
		0.5	4	711189	7450447
		0.5	4	711199	7450473
		0.5	4	711204	7450467
		0.5	4	711207	7450468
		0.5	4	711208	7450482
		0.5	5	708890	7450168
		0.5	5	710985	7450515
		0.5	5	710997	7450516
		0.5	5	711009	7450522
		0.5	5	711061	7450530
		0.5	5	711069	7450407
		0.5	5	711071	7450491
		0.5	5	711072	7450444
		0.5	5	711083	7450506
		0.5	5	711087	7450507
		0.5	5	711090	7450506
		0.5	5	711095	7450513
		0.5	5	711095	7451038
		0.5	5	711102	7450484
		0.5	5	711104	7450505
		0.5	5	711181	7450453
		0.5	5	711199	7450437
		0.5	5	711206	7450473
		0.5	5	711227	7450468
		0.5	5	711231	7450462
		0.5	5	711238	7450459
		0.5	5	711245	7450458
		0.5	5	711250	7450456
		0.5	5	711256	7450456
		0.5	5	711264	7450453
		0.5	5	711278	7450454
		0.5	5	711279	7450454
		0.5	5	711283	7450452
		0.5	5	711286	7450430
		0.5	5	711296	7450444
		0.5	5	711301	7450443
		0.5	5	711572	7450367

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Eremophila sp. Hamersley Range (K. Walker KW 136) P1	A	0.5	5	711593	7450341
		0.5	5	712606	7450699
		0.5	6	710997	7450522
		0.5	6	711033	7450493
		0.5	6	711056	7450529
		0.5	6	711067	7450517
		0.5	6	711125	7450465
		0.5	6	711193	7450326
		0.5	6	711216	7450440
		0.5	6	711652	7450393
		0.5	7	710759	7450406
		0.5	7	711077	7450514
		0.5	7	711114	7450504
		0.5	8	710990	7450527
		0.5	8	711071	7450518
		0.5	8	711204	7450472
		0.5	9	710804	7450412
		0.5	9	710828	7450428
		0.5	9	710964	7450504
		0.5	10	708751	7450383
		0.5	10	708757	7450386
		0.5	10	708895	7450161
		0.5	10	710801	7450439
		0.5	10	711017	7450492
		0.5	10	711029	7450490
		0.5	10	711033	7450483
		0.5	10	711041	7450486
		0.5	10	711047	7450489
		0.5	10	711052	7450525
		0.5	10	711065	7450492
		0.5	10	711073	7450487
		0.5	10	711079	7450484
		0.5	10	711082	7450483
		0.5	10	711084	7450507
		0.5	10	711094	7450504
		0.5	10	711098	7450506
		0.5	10	711099	7450512
		0.5	10	711121	7450971
		0.5	10	711212	7450471
		0.5	10	711215	7450471
		0.5	10	711218	7450434

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Eremophila sp. Hamersley Range (K. Walker KW 136) P1	A	0.5	10	711219	7450468
		0.5	10	711222	7450436
		0.5	10	711224	7450464
		0.5	10	711247	7450420
		0.5	12	711292	7450327
		0.5	12	711307	7450314
		0.5	12	711612	7450335
		0.5	12	711643	7450364
		0.5	15	710876	7450401
		0.5	15	710878	7450436
		0.5	15	711089	7450385
		0.5	15	711096	7450376
		0.5	20	711344	7450315
		0.5	22	711466	7450329
		0.5	24	711255	7450318
		0.5	24	711411	7450351
		0.5	25	711073	7450400
		0.5	30	708765	7450408
		0.5	32	711434	7450345
		0.5	50	711143	7450381
		0.5	55	711138	7450365
		0.5	55	711168	7450341
		1	1	710941	7450542
		1	1	711093	7451039
		1	5	711285	7450355
		1	5	711304	7450357
		1	9	711122	7450431
		1	11	711509	7450353
		1	12	710895	7450411
		1	15	711313	7450335
		1	20	711229	7450341
		2	20	711204	7450385
		4	6	711507	7450354
		6	55	711528	7450355
Eremophila sp. Hamersley Range (K. Walker KW 136) P1	E	-	1	716597	7450185
		-	1	716625	7449983
		-	1	716638	7449976
		-	2	716576	7450103
		-	2	716576	7450141
		-	2	716579	7450075
		-	2	716589	7450060

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Eremophila sp. Hamersley Range (K. Walker KW 136) P1	E	-	2	716620	7450003
		-	3	716589	7450053
		-	3	716614	7450015
		-	3	716620	7449996
		-	3	716621	7450009
		-	4	716596	7450032
		-	4	716725	7450481
		-	6	716575	7449976
		-	6	716585	7450063
		-	6	716587	7450089
		-	6	716606	7450024
		-	7	716695	7450483
		-	10	716560	7449994
		-	10	716569	7449950
		-	10	716662	7450443
		-	12	716585	7450145
		-	14	716547	7450036
		-	15	716561	7450092
		-	18	716665	7450473
		-	21	716560	7450038
		-	25	716561	7450066
		-	25	716570	7450033
		-	25	716644	7450470
		-	27	716584	7450158
		-	33	716588	7450041
Eremophila sp. Hamersley Range (K. Walker KW 136) P1	H	-	1	710400	7450964
		-	1	711211	7451234
		-	1	711215	7451230
		-	1	711243	7451185
		-	1	711619	7451017
		-	1	711996	7450714
		-	1	712012	7450684
		-	2	711114	7451148
		-	2	711123	7451072
		-	2	712595	7450380
		-	3	712515	7450610
		-	5	711078	7451132
		-	5	711133	7451229
		-	5	711288	7451113
		-	6	710340	7451030
		-	6	711345	7451051

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Eremophila sp. Hamersley Range (K. Walker KW 136) P1	H	-	6	712725	7450470
		-	7	711660	7450974
		-	8	711083	7451126
		-	8	711442	7451014
		-	10	711167	7451253
		-	12	710484	7451075
		-	15	710426	7451070
		-	20	711108	7450021
		-	20	711415	7451015
		-	20	712540	7450663
		-	50	711115	7450985
Eremophila sp. West Angelas (S. van Leeuwen 4068) P1	A	0.1	1	710070	7450580
		0.1	1	719527	7450347
		0.1	1	719872	7450384
		0.1	1	720532	7450448
		0.1	1	720630	7450489
		0.1	1	720647	7450455
		0.1	1	720794	7450561
		0.1	1	720805	7450428
		0.1	2	710064	7450581
		0.1	2	710107	7450457
		0.1	2	710250	7450519
		0.1	2	710422	7450564
		0.1	2	711430	7450340
		0.1	2	719457	7450395
		0.1	2	719462	7450380
		0.1	2	719563	7450341
		0.1	2	720489	7450483
		0.1	2	720529	7450446
		0.1	2	720556	7450490
		0.1	2	720557	7450455
		0.1	2	720582	7450458
		0.1	2	720601	7450484
		0.1	2	720606	7450491
		0.1	2	720658	7450480
		0.1	2	720915	7450594
		0.1	2	721244	7450658
		0.1	2	721254	7450619
		0.1	2	721266	7450677
		0.1	3	710066	7450578
		0.1	3	710071	7450549

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Eremophila sp. West Angelas (S. van Leeuwen 4068) P1	A	0.1	3	710127	7450574
		0.1	3	710445	7450559
		0.1	3	720545	7450580
		0.1	3	720588	7450446
		0.1	3	720599	7450441
		0.1	3	720615	7450488
		0.1	3	720633	7450482
		0.1	3	720664	7450447
		0.1	3	720688	7450576
		0.1	3	720733	7450566
		0.1	3	720842	7450575
		0.1	3	720965	7450515
		0.1	4	710056	7450577
		0.1	4	710069	7450557
		0.1	4	710357	7450534
		0.1	4	710382	7450540
		0.1	4	720827	7450579
		0.1	4	721117	7450633
		0.1	5	710064	7450575
		0.1	5	710079	7450557
		0.1	5	710090	7450562
		0.1	5	710231	7450512
		0.1	5	710284	7450540
		0.1	5	710370	7450539
		0.1	5	720645	7450479
		0.1	6	710140	7450562
		0.1	6	710326	7450533
		0.1	6	710353	7450538
		0.1	6	720577	7450574
		0.1	6	720778	7450560
		0.1	7	710107	7450565
		0.1	7	720665	7450556
		0.1	8	710119	7450457
		0.1	8	710233	7450535
		0.1	8	710396	7450548
		0.1	9	710396	7450477
		0.1	9	710421	7450479
		0.1	9	710443	7450486
		0.1	10	710188	7450538
		0.1	12	710155	7450555
		0.1	12	710497	7450473

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Eremophila sp. West Angelas (S. van Leeuwen 4068) P1	A	0.1	15	710082	7450550
		0.1	15	710473	7450482
		0.1	15	710484	7450473
		0.1	15	721138	7450617
		0.1	16	710196	7450542
		0.1	18	710152	7450560
		0.1	19	710098	7450560
		0.1	20	709998	7450505
		0.1	20	710140	7450468
		0.1	20	710311	7450421
		0.1	22	710303	7450433
		0.1	26	710274	7450431
		0.5	1	711157	7450426
		0.5	2	711044	7450570
		0.5	2	711074	7450554
		0.5	2	711224	7450506
		0.5	3	711143	7450520
		0.5	4	711089	7450551
		0.5	4	711237	7450404
		0.5	5	720239	7450683
		1	5	720588	7450488
		1	5	720613	7450488
Eremophila sp. West Angelas (S. van Leeuwen 4068) P1	H	-	5	710430	7450566
		-	10	710054	7450570
		-	10	710368	7450552
		-	10	710475	7450575
		-	10	710553	7450570
		-	10	711234	7450494
		-	10	711551	7450476
		-	10	711651	7450491
		-	10	719272	7450805
		-	10	719324	7450801
		-	20	710189	7450557
		-	20	711077	7450545
		-	20	711431	7450507
		-	20	711469	7450496
		-	20	719400	7450784
		-	20	719481	7450763
		-	30	719356	7450802
Goodenia lyrata P3	F	0.1	1	715444	7452887

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727) P3	C	-	10	706660	7446956
		-	20	706664	7446928
		-	50	706648	7446948
Grevillea saxicola P3	A	0.1	1	704284	7449935
		0.1	1	704539	7450222
		0.1	1	706995	7449945
		0.1	1	707050	7450013
		0.1	1	708186	7450952
		0.1	1	709515	7450289
		0.1	1	709540	7450249
		0.1	1	709591	7450249
		0.1	1	709604	7450223
		0.1	1	709690	7450274
		0.1	1	709723	7450254
		0.1	1	709777	7450405
		0.1	1	709778	7450301
		0.1	1	709780	7450421
		0.1	1	709790	7450423
		0.1	1	709794	7450331
		0.1	1	709810	7450297
		0.1	1	709810	7450423
		0.1	1	709812	7450304
		0.1	1	711771	7450210
		0.1	1	712152	7450234
		0.1	1	712396	7450189
		0.1	1	712654	7450339
		0.1	1	712926	7450187
		0.1	1	718857	7450184
		0.1	1	718890	7450186
		0.1	1	719567	7450337
		0.1	1	720006	7450398
		0.1	1	720115	7450411
		0.1	1	720203	7450416
		0.1	1	720343	7450501
		0.1	1	720355	7451567
		0.1	1	720514	7450459
		0.1	2	706987	7449932
		0.1	2	706994	7449974
		0.1	2	707017	7449982
		0.1	2	707830	7450509

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		0.1	2	709641	7450234
		0.1	2	709770	7451436
		0.1	2	709789	7450380
		0.1	2	709813	7450363
		0.1	2	709842	7450534
		0.1	2	709866	7450546
		0.1	2	709903	7450562
		0.1	2	710002	7450572
		0.1	2	710004	7450588
		0.1	2	710011	7451142
		0.1	2	710046	7450567
		0.1	2	710370	7450431
		0.1	2	710863	7450415
		0.1	2	712215	7450238
		0.1	2	712596	7450323
		0.1	3	706949	7449861
		0.1	3	707011	7449944
		0.1	3	709839	7450562
		0.1	3	709859	7450520
		0.1	3	709870	7450508
Grevillea saxicola P3	A	0.1	3	710382	7450445
		0.1	3	711824	7450212
		0.1	3	712560	7450168
		0.1	3	712608	7450188
		0.1	3	712686	7450188
		0.1	3	712847	7450188
		0.1	3	716900	7450027
		0.1	4	707752	7450580
		0.1	4	707834	7450564
		0.1	4	708915	7450009
		0.1	4	709728	7451430
		0.1	4	709842	7450541
		0.1	4	709895	7450561
		0.1	4	710441	7450455
		0.1	4	711046	7450398
		0.1	4	712022	7450286
		0.1	4	712446	7450219
		0.1	4	712528	7450175
		0.1	4	712885	7450185
		0.1	4	717332	7449896
		0.1	5	709582	7450211

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		0.1	5	709849	7451552
		0.1	5	710139	7450564
		0.1	5	710269	7450404
		0.1	5	711167	7450339
		0.1	5	711222	7450313
		0.1	5	712120	7450242
		0.1	5	712528	7450187
		0.1	5	718090	7450146
		0.1	6	707735	7450503
		0.1	6	711517	7450311
		0.1	6	711585	7450346
		0.1	6	712064	7450288
		0.1	6	712372	7450238
		0.1	6	712651	7450187
		0.1	6	712813	7450190
		0.1	6	718102	7450062
		0.1	7	708748	7449918
		0.1	7	711675	7450381
		0.1	7	711751	7450288
		0.1	7	711814	7450247
Grevillea saxicola P3	A	0.1	7	712252	7450248
		0.1	7	712266	7450240
		0.1	8	707910	7450407
		0.1	8	708015	7450360
		0.1	8	709577	7450268
		0.1	8	710164	7450441
		0.1	8	710235	7450514
		0.1	8	710241	7450421
		0.1	8	710271	7450514
		0.1	8	710357	7450463
		0.1	8	710418	7450538
		0.1	8	710454	7450480
		0.1	8	710522	7450459
		0.1	8	710847	7450418
		0.1	8	711709	7450242
		0.1	8	711847	7450247
		0.1	8	712090	7450261
		0.1	8	712632	7450356
		0.1	9	711864	7450286
		0.1	10	707811	7450441
		0.1	10	709610	7450260

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		0.1	10	709626	7450215
		0.1	10	709653	7450266
		0.1	10	709891	7450469
		0.1	10	710574	7450416
		0.1	10	710621	7450457
		0.1	10	711240	7450314
		0.1	10	711322	7450308
		0.1	10	711437	7450341
		0.1	10	712625	7450385
		0.1	11	709998	7451230
		0.1	11	710802	7450430
		0.1	11	711106	7450371
		0.1	12	711599	7450346
		0.1	12	712296	7450262
		0.1	15	709730	7450297
		0.1	15	709766	7450303
		0.1	15	710041	7451204
		0.1	15	710700	7450450
		0.1	15	710752	7450446
		0.1	15	710760	7450436
Grevillea saxicola P3	A	0.1	15	712342	7450258
		0.1	16	711464	7450325
		0.1	20	709681	7450234
		0.1	20	709775	7450469
		0.1	20	709856	7450408
		0.1	20	710659	7450461
		0.1	22	718064	7450070
		0.1	40	709911	7450498
		0.5	1	709132	7449820
		0.5	1	710639	7450472
		0.5	1	710678	7450495
		0.5	1	710680	7450491
		0.5	1	710713	7450493
		0.5	1	710721	7450491
		0.5	1	710737	7450507
		0.5	1	710739	7450486
		0.5	1	710743	7450499
		0.5	1	710755	7450502
		0.5	1	710766	7450504
		0.5	1	710770	7450488
		0.5	1	710771	7450513

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		0.5	1	710809	7450515
		0.5	1	710811	7450499
		0.5	1	710814	7450502
		0.5	1	710828	7450490
		0.5	1	710834	7450507
		0.5	1	710837	7450506
		0.5	1	710842	7450502
		0.5	1	710852	7450507
		0.5	1	710854	7450511
		0.5	1	710864	7450473
		0.5	1	710866	7450516
		0.5	1	710881	7450504
		0.5	1	710886	7450469
		0.5	1	710944	7450479
		0.5	1	710950	7450477
		0.5	1	710953	7450475
		0.5	1	710962	7450505
		0.5	1	710965	7450481
		0.5	1	710972	7450483
		0.5	1	710973	7450498
Grevillea saxicola P3	A	0.5	1	710977	7450523
		0.5	1	710979	7450483
		0.5	1	710981	7450500
		0.5	1	710985	7450500
		0.5	1	710992	7450528
		0.5	1	710998	7450483
		0.5	1	711009	7450479
		0.5	1	711013	7450484
		0.5	1	711016	7450534
		0.5	1	711027	7450529
		0.5	1	711033	7450493
		0.5	1	711034	7450482
		0.5	1	711041	7450526
		0.5	1	711052	7450530
		0.5	1	711061	7450499
		0.5	1	711080	7450484
		0.5	1	711083	7450505
		0.5	1	711088	7450541
		0.5	1	711099	7450508
		0.5	1	711102	7450521
		0.5	1	711109	7450480

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		0.5	1	711115	7450503
		0.5	1	711116	7450526
		0.5	1	711124	7450463
		0.5	1	711139	7450500
		0.5	1	711144	7450504
		0.5	1	711177	7450484
		0.5	1	711188	7450481
		0.5	1	711191	7450443
		0.5	1	711199	7450483
		0.5	1	711200	7450484
		0.5	1	711215	7450402
		0.5	1	711221	7450466
		0.5	1	711235	7450459
		0.5	1	711240	7450428
		0.5	1	711256	7450456
		0.5	1	711264	7450431
		0.5	1	711265	7450452
		0.5	1	711292	7450447
		0.5	1	711308	7450434
		0.5	1	711816	7450179
Grevillea saxicola P3	A	0.5	1	711830	7450171
		0.5	2	708920	7450120
		0.5	2	710685	7450497
		0.5	2	710695	7450498
		0.5	2	710746	7450506
		0.5	2	710750	7450484
		0.5	2	710760	7450485
		0.5	2	710778	7450513
		0.5	2	710779	7450497
		0.5	2	710796	7450516
		0.5	2	710871	7450510
		0.5	2	710877	7450470
		0.5	2	710895	7450468
		0.5	2	710921	7450477
		0.5	2	710959	7450508
		0.5	2	710986	7450481
		0.5	2	710987	7450524
		0.5	2	711017	7450490
		0.5	2	711037	7450496
		0.5	2	711052	7450461
		0.5	2	711065	7450492

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		0.5	2	711069	7450516
		0.5	2	711081	7450516
		0.5	2	711155	7450461
		0.5	2	711202	7450469
		0.5	2	711209	7450514
		0.5	2	711215	7450436
		0.5	2	711231	7450429
		0.5	2	711236	7450425
		0.5	2	711242	7450422
		0.5	2	711277	7450430
		0.5	2	711286	7450430
		0.5	2	711291	7450448
		0.5	2	711297	7450425
		0.5	2	711305	7450426
		0.5	2	720053	7451635
		0.5	2	720205	7451639
		0.5	3	706718	7449924
		0.5	3	708197	7450962
		0.5	3	710703	7450421
		0.5	3	710735	7450480
Grevillea saxicola P3	A	0.5	3	710745	7450482
		0.5	3	710866	7450402
		0.5	3	710961	7450480
		0.5	3	710989	7450477
		0.5	3	711037	7450484
		0.5	3	711199	7450475
		0.5	3	711225	7450464
		0.5	3	711247	7450421
		0.5	3	711249	7450348
		0.5	3	711259	7450422
		0.5	4	710610	7450512
		0.5	4	710870	7450505
		0.5	4	711070	7450406
		0.5	4	711496	7450365
		0.5	4	716882	7449912
		0.5	5	704277	7449927
		0.5	5	707053	7449685
		0.5	5	707420	7449731
		0.5	5	708905	7450171
		0.5	5	710665	7450426
		0.5	5	710976	7450464

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		0.5	5	711073	7450490
		0.5	5	711103	7450505
		0.5	5	711213	7450354
		0.5	5	711391	7450379
		0.5	5	720936	7451241
		0.5	6	707818	7450448
		0.5	6	710723	7450418
		0.5	6	711316	7450337
		0.5	6	712441	7450200
		0.5	7	711787	7450143
		0.5	8	711460	7450393
		0.5	9	712271	7450229
		0.5	10	704444	7450230
		0.5	10	704567	7450194
		0.5	10	704606	7450183
		0.5	10	707289	7449915
		0.5	10	708189	7450940
		0.5	10	711170	7450369
		0.5	10	711233	7450350
		0.5	10	712465	7450511
Grevillea saxicola P3	A	0.5	13	708873	7450014
		0.5	13	711387	7450354
		0.5	20	704404	7450159
		0.5	20	704559	7450220
		0.5	20	710728	7450450
		1	1	709132	7449821
		1	1	712800	7450140
		1	1	713558	7450156
		1	1	719495	7450403
		1	1	719552	7450330
		1	2	709740	7450286
		1	2	709751	7450287
		1	2	709761	7450290
		1	2	709769	7450292
		1	2	709806	7450424
		1	2	709831	7450421
		1	2	709840	7450434
		1	2	709869	7450454
		1	2	709871	7450492
		1	2	709880	7450506
		1	2	709915	7450522

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		1	2	719368	7450379
		1	2	719388	7450386
		1	2	719519	7450369
		1	2	719524	7450383
		1	2	720266	7450457
		1	2	720476	7450450
		1	3	709603	7450247
		1	3	709615	7450253
		1	3	709645	7450246
		1	3	709655	7450252
		1	3	709658	7450235
		1	3	709850	7450441
		1	3	709860	7450469
		1	3	709860	7450482
		1	3	709862	7450456
		1	3	709922	7450528
		1	3	709933	7450530
		1	3	709976	7450525
		1	3	709995	7450532
		1	3	710019	7450529
Grevillea saxicola P3	A	1	3	710054	7450529
		1	3	710066	7450538
		1	3	719367	7450361
		1	3	719394	7450395
		1	3	719414	7450399
		1	3	719485	7450388
		1	4	710844	7450417
		1	4	719468	7450383
		1	5	711127	7450430
		1	5	711803	7450277
		1	5	712853	7450169
		1	6	706982	7449964
		1	6	711552	7450356
		1	6	711570	7450364
		1	6	712052	7450266
		1	6	712332	7450237
		1	7	706981	7449874
		1	7	710768	7450409
		1	7	711604	7450394
		1	8	710943	7450454
		1	8	712001	7450280

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Grevillea saxicola P3	A	1	9	712670	7450176
		1	11	712707	7450152
		2	1	707034	7449992
		2	2	719523	7450357
		2	3	720312	7450520
		2	3	720430	7450457
		2	3	720438	7450450
		2	4	711155	7450433
		2	8	709841	7450043
		2	10	710826	7450461
		2	10	710858	7450547
		2	11	711840	7450292
		2	11	711898	7450285
		3	1	709045	7449688
		3	1	709056	7449685
		3	1	710941	7450542
		3	3	719500	7450366
		3	3	719525	7450319
		3	3	720279	7450449
		3	3	720315	7450432
		3	5	719419	7450385
		3	10	710599	7450473
		3	14	709786	7451537
		4	3	720295	7450524
		5	8	719450	7450387
	C	-	1	707876	7450248
	E	-	1	713251	7450250
		-	1	713276	7450245
		-	1	713440	7450211
		-	1	713500	7450180
		-	1	713524	7450182
		-	1	713560	7450174
		-	1	713714	7450134
		-	1	713723	7450138
		-	1	713723	7450154
		-	1	713733	7450144
		-	1	713739	7450144
		-	1	713772	7450155
		-	1	713777	7450144
		-	1	713847	7450155
		-	1	713863	7450139

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Grevillea saxicola P3	E	-	1	713879	7450132
		-	1	713921	7450071
		-	1	713923	7450089
		-	1	713937	7450085
		-	1	713954	7449977
		-	1	714181	7450366
		-	1	716805	7449981
		-	1	716813	7449993
		-	1	716861	7450058
		-	1	716896	7450115
		-	1	716899	7450138
		-	1	717301	7449903
		-	1	717350	7449916
		-	2	713780	7450134
		-	2	713785	7450488
		-	2	713906	7450090
		-	2	713911	7450100
		-	2	714111	7449956
		-	2	716758	7449952
		-	2	716879	7450091
		-	3	713437	7450225
		-	3	713790	7450143
		-	3	713821	7450178
		-	3	713912	7450079
		-	3	714132	7449952
		-	3	716849	7450020
		-	3	716867	7450079
		-	3	716882	7450052
		-	4	716778	7449968
		-	4	716827	7450002
		-	4	716837	7450008
		-	5	713578	7450177
		-	5	714152	7449980
		-	7	714014	7449972
		-	7	716869	7450047
		-	8	713966	7449972
		-	9	713896	7450082
		-	10	714087	7449952
		-	19	714057	7449956
	H	-	1	710904	7450566
		-	1	711121	7451040

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Grevillea saxicola P3	H	-	1	711234	7450494
		-	1	711288	7451113
		-	1	712423	7450673
		-	1	712551	7450514
		-	1	712554	7450183
		-	1	712569	7450705
		-	1	712643	7450213
		-	1	712847	7450229
		-	1	717299	7449904
		-	1	717354	7449903
		-	1	718080	7450212
		-	1	718088	7450131
		-	1	718135	7450086
		-	1	718138	7449987
		-	1	718170	7450008
		-	1	719408	7450712
		-	1	719440	7450643
		-	2	711956	7450361
		-	2	712463	7450450
		-	2	712468	7451024
		-	2	712589	7450579
		-	2	712595	7450380
		-	2	717280	7449881
		-	2	718035	7449925
		-	2	718064	7449951
		-	3	712464	7450533
		-	3	712466	7451142
		-	3	712521	7450871
		-	3	712764	7450461
		-	4	711574	7451100
		-	4	712257	7450590
		-	5	710956	7450557
		-	5	717977	7449901
		-	5	718559	7451083
		-	10	712725	7450470
Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2	A	0.1	1	699261	7444531
		0.1	1	699972	7444780
		0.1	1	709677	7450288
		0.1	1	712488	7450677
		0.1	2	700020	7444806
		0.1	2	709660	7450261

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2	A	0.1	3	699256	7444523
		0.1	3	699270	7444529
		0.1	3	699950	7444776
		0.1	3	712005	7450792
		0.1	3	712047	7450702
		0.1	4	699280	7444534
		0.1	4	699986	7444785
		0.1	4	710131	7450460
		0.1	4	712079	7450674
		0.1	5	700113	7444797
		0.1	5	712218	7450633
		0.1	6	712067	7450676
		0.1	6	712839	7450677
		0.1	6	713113	7450559
		0.1	7	712124	7450666
		0.1	7	712530	7450711
		0.1	9	712052	7450674
		0.1	10	700086	7444796
		0.1	10	700233	7444837
		0.1	10	700393	7444895
		0.1	10	712915	7450629
		0.1	13	711984	7450805
		0.1	14	712545	7450701
		0.1	15	700307	7444839
		0.1	15	712953	7450589
		0.1	15	713076	7450557
		0.1	18	712008	7450762
		0.1	18	712023	7450757
		0.1	22	713056	7450564
		0.1	25	713027	7450587
		0.1	30	700840	7445124
		0.1	31	713095	7450575
		0.5	10	700066	7444859
		2	15	709682	7450274
		2	15	709684	7450273
	C	-	15	716581	7449974
	E	-	15	716581	7449974
	H	-	1	712545	7450684
		-	3	712438	7450673
		-	5	712154	7450654
		-	5	712341	7450641

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2	H	-	8	712095	7450677
		-	10	712272	7450647
		-	10	712631	7450733
		-	10	712891	7450628
		-	20	712958	7450600
Lepidium catapycnon P4	A	1	50	711042	7450545
		0.5	20	713413	7450293
		1	70	715517	7450688
		0.1	9	715800	7450997
		1	50	715834	7450952
		1	60	715855	7450952
		1	100	715857	7450952
		1	80	715886	7450947
		1	80	715907	7450945
		0.1	2	715909	7450997
		1	80	715939	7450941
		1	40	715961	7450940
		1	120	716026	7450944
		1	30	716049	7450997
		1	100	716058	7450948
		1	120	716080	7450951
		1	80	716103	7450955
		1	40	716123	7450951
		0.1	10	716142	7451067
		1	80	716147	7450948
		1	60	716166	7450944
		1	40	716196	7450960
		1	60	716261	7450926
		1	80	716281	7450920
		1	100	716301	7450906
		0.5	1	716314	7450888
		1	100	716314	7450886
		0.5	50	716352	7450884
		0.5	25	716362	7450934
		-	20	716362	7450871
		0.1	10	716447	7450878
		0.5	40	716455	7450940
		1	50	716490	7450882
		1	50	716523	7450883
		0.5	25	716571	7450895

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		1	50	716580	7450861
		0.5	2	719176	7450368
		0.5	50	719195	7450369
		0.1	5	719211	7450407
		0.1	5	719214	7450409
		0.5	20	719231	7450382
		0.5	20	719242	7450402
		0.1	5	719246	7450368
		0.1	5	719249	7450383
		0.5	5	719396	7450477
		0.5	20	719427	7450440
		0.5	20	719464	7450442
		0.1	1	719484	7450384
		0.5	30	719513	7450468
		0.5	20	719523	7450446
		0.5	10	719565	7450465
		0.1	10	719585	7450296
		0.1	10	719592	7450324
		0.1	10	719613	7450330
		0.5	20	719620	7450477
Lepidium catapycnon P4	A	0.1	10	719623	7450329
		0.1	25	719636	7450487
		0.5	5	719680	7450415
		0.1	4	719698	7450474
		3	20	719767	7450382
		3	20	719775	7450392
		0.1	5	719828	7450383
		0.1	5	719832	7450386
		0.5	5	719845	7450413
		0.1	4	719854	7450415
		0.1	5	719877	7450400
		0.1	5	719879	7450398
		0.5	5	719922	7450436
		0.1	5	719923	7450424
		0.5	5	719949	7450436
		0.5	5	719949	7450445
		0.5	40	719983	7450455
		1	10	719985	7450453
		1	10	720012	7450435
		0.1	2	720020	7450398
		1	10	720044	7450455

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		1	10	720088	7450448
		0.1	2	720096	7450418
		0.5	5	720114	7451848
		1	20	720116	7450455
		0.1	2	720130	7450405
		0.1	25	720130	7450526
		1	10	720148	7450403
		1	15	720151	7450401
		3	15	720171	7450404
		1	10	720175	7450411
		0.5	20	720201	7450890
		0.5	20	720212	7450836
		0.5	30	720221	7450859
		0.5	5	720225	7450525
		0.5	5	720226	7450527
		0.5	20	720227	7450607
		0.5	20	720238	7450799
		0.5	20	720251	7450688
		0.5	1	720253	7450549
		0.5	20	720253	7450630
Lepidium catapycnon P4	A	0.1	3	720285	7450563
		0.5	20	720309	7450583
		5	100	720340	7450406
		0.1	1	720355	7451567
		2	30	720361	7450413
		0.5	20	720376	7450557
		0.5	20	720379	7450647
		0.5	10	720387	7450563
		1	10	720392	7450415
		0.1	1	720393	7450560
		1	10	720422	7450437
		1	10	720423	7450441
		0.5	50	720429	7450562
		1	10	720432	7450460
		1	10	720448	7450441
		0.1	100	720452	7450612
		0.1	35	720456	7450548
		3	500	720464	7450570
		1	10	720473	7450457
		0.5	50	720480	7450556
		0.1	100	720495	7450560

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Lepidium catapycnon P4	A	0.5	100	720508	7450568
		2	20	720517	7450495
		0.1	15	720520	7450573
		0.1	5	720549	7450464
		0.1	5	720569	7450470
		0.5	100	720585	7451690
		2	20	720621	7450469
		2	20	720625	7450467
		0.1	30	720633	7450529
		2	20	720633	7450467
		1	10	720647	7450499
		0.5	30	720652	7450978
		0.1	30	720766	7450526
		1	10	720775	7450498
		0.1	50	720848	7450404
		3	50	720864	7450518
		0.1	30	720868	7450552
		0.1	50	720926	7450441
		0.5	5	720936	7451232
		1	10	720965	7450492
		0.1	1	720995	7451577
		0.1	50	721009	7450449
		0.1	2	721023	7450581
		1	10	721078	7450542
		0.5	100	721151	7451859
		0.5	100	721185	7451866
		1	10	721203	7450542
		1	10	721327	7450693
	B	-	40	715941	7451107
	B	-	40	716133	7451133
	D	-	4	715482	7450699
		-	1	715491	7450693
		-	5	715497	7450690
		-	12	715506	7450692
		-	4	715510	7450690
		-	1	715511	7450665
		-	7	715511	7450691
		-	6	715514	7450689
		-	1	715515	7450657
		-	91	715532	7450669
	E	-	7	715772	7450944

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		-	1	715798	7450874
		-	1	715826	7450892
		-	40	715826	7450916
		-	67	715827	7450932
		-	20	715829	7450932
		-	100	715831	7450899
		-	120	715831	7450921
		-	13	715832	7450757
		-	52	715832	7450926
		-	13	715834	7450934
		-	25	715835	7450940
		-	6	715838	7450934
		-	1	715839	7450896
		-	60	715842	7450919
		-	78	715842	7450953
		-	14	715846	7450893
		-	20	715846	7450901
		-	82	715846	7450908
		-	41	715847	7450920
		-	57	715847	7450938
Lepidium catapycnon P4	E	-	41	715849	7450956
		-	8	715854	7450904
		-	165	715854	7450939
		-	44	715855	7450922
		-	31	715856	7450953
		-	15	715860	7450903
		-	68	715860	7450909
		-	16	715861	7450946
		-	120	715861	7450926
		-	43	715863	7450935
		-	1	715866	7450959
		-	1	715867	7450905
		-	5	715869	7450893
		-	46	715869	7450913
		-	13	715873	7450879
		-	9	715874	7450898
		-	7	715878	7450918
		-	44	715878	7450883
		-	3	715880	7450872
		-	10	715883	7450936
		-	7	715886	7450950

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		-	120	715887	7450880
		-	18	715891	7450899
		-	7	715892	7450911
		-	5	715902	7450879
		-	100	715903	7450920
		-	4	715908	7450881
		-	18	715908	7450906
		-	16	715910	7450875
		-	50	715911	7450951
		-	6	715912	7450863
		-	45	715912	7450980
		-	10	715916	7450901
		-	52	715916	7450863
		-	100	715916	7450929
		-	19	715918	7450965
		-	67	715919	7450918
		-	5	715923	7450862
		-	4	715925	7450974
		-	57	715925	7450891
		-	45	715927	7450883
Lepidium catapycnon P4	E	-	6	715933	7450954
		-	116	715933	7450931
		-	31	715935	7450907
		-	85	715938	7450873
		-	24	715943	7450927
		-	40	715943	7450898
		-	22	715944	7450915
		-	7	715946	7450947
		-	24	715947	7450841
		-	35	715947	7450848
		-	22	715955	7450852
		-	37	715955	7450878
		-	3	715959	7450854
		-	27	715959	7450937
		-	8	715961	7450920
		-	1	715969	7450771
		-	1	715999	7450778
		-	1	716001	7450957
		-	24	716009	7450923
		-	5	716021	7450925
		-	35	716023	7450964

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		-	125	716025	7450908
		-	78	716031	7450938
		-	160	716044	7450900
		-	45	716046	7450970
		-	41	716049	7450880
		-	135	716053	7450920
		-	36	716057	7450942
		-	79	716072	7450880
		-	174	716078	7450957
		-	160	716079	7450931
		-	62	716089	7450972
		-	106	716090	7450951
		-	75	716093	7450932
		-	46	716101	7450919
		-	18	716112	7450914
		-	134	716120	7450958
		-	12	716124	7450914
		-	85	716124	7450962
		-	91	716141	7450917
		-	2	716146	7450866
Lepidium catapycnon P4	E	-	75	716147	7450960
		-	43	716149	7450950
		-	152	716161	7450910
		-	15	716165	7450950
		-	120	716166	7450944
		-	49	716176	7450931
		-	148	716184	7450901
		-	75	716188	7450939
		-	140	716191	7450924
		-	1	716205	7450957
		-	25	716209	7450904
		-	26	716220	7450845
		-	42	716291	7450899
		-	6	716336	7450869
		-	35	716455	7450840
		-	46	716497	7450879
		-	13	716509	7450880
		-	16	716557	7450885
		-	20	716560	7450877
		-	60	716562	7450967
		-	18	716571	7450886

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Lepidium catapycnon P4	E	-	254	716585	7450879
		-	7	716597	7450854
		-	96	716597	7450840
		-	15	716604	7450932
		-	6	716607	7450868
		-	21	716617	7450863
		-	8	716620	7450857
		-	11	716669	7450871
		-	203	716685	7450857
		-	6	716835	7450898
		-	3	716952	7450947
		-	16	716975	7450943
		-	10	716976	7450967
		-	23	716991	7450935
		-	1	716999	7450966
		-	53	717017	7450996
		-	32	717026	7451017
		-	4	717146	7451053
		-	44	717236	7451030
	H	-	10	712521	7450871
		-	1	718746	7450041
		-	1	718771	7450109
		-	1	718797	7450125
		-	1	718847	7450159
		-	5	718904	7450163
		-	1	719081	7450239
		-	1	719209	7450399
		-	3	719410	7450644
		-	10	719420	7450649
		-	5	719440	7450643
		-	10	719476	7450648
		-	5	719572	7450926
		-	10	719642	7450926
		-	5	719667	7450879
	J	-	1	715942	7451107
Ptilotus mollis P4	A	0.1	1	716314	7450888
		0.1	2	710026	7451202
		0.1	2	710028	7451216
		0.1	2	716348	7450850
		0.1	3	710030	7451195
		0.1	4	716365	7450840

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Ptilotus mollis P4	A	0.1	11	716350	7450888
		0.1	12	710014	7451155
		0.5	1	711060	7450500
		0.5	6	710665	7450611
		0.5	6	710690	7450612
	E	-	1	716685	7450857
		-	2	716527	7450856
		-	2	716585	7450879
		-	2	716848	7450763
		-	2	716952	7450947
		-	2	716955	7450854
		-	2	716955	7450929
		-	3	716617	7450863
		-	3	716880	7450831
		-	3	716990	7450918
		-	4	716916	7450844
		-	5	716989	7450872
		-	6	716709	7450802
		-	6	716961	7450911
		-	7	716719	7450766
		-	7	716747	7450735
		-	7	716991	7450944
		-	9	716597	7450854
		-	11	716884	7450892
		-	11	716985	7450898
		-	12	716835	7450898
		-	14	716597	7450840
		-	14	716789	7450735
		-	18	716818	7450751
		-	20	716975	7450943
		-	25	716999	7450966
		-	28	716869	7450857
	H	-	1	718161	7451081
		-	1	719093	7450517
		-	1	719420	7450649
		-	2	710714	7450635
		-	3	719124	7450494
		-	8	719410	7450644
		-	10	710674	7450606
		-	10	712187	7451180
		-	20	709954	7450630

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Ptilotus mollis P4	H	-	20	712465	7451142
		-	30	711539	7451107
	I	-	50	701756	7443276
Rhagodia sp. Hamersley (M. Trudgen 17794) P3	A	0.1	1	698882	7446756
		0.1	1	698918	7446755
		0.1	1	698933	7446767
		0.1	1	699050	7446218
		0.1	1	699079	7446169
		0.1	1	699142	7446754
		0.1	1	699187	7446156
		0.1	1	699216	7446699
		0.1	1	699280	7446221
		0.1	1	700255	7446956
		0.1	1	706354	7446733
		0.1	1	706367	7446611
		0.1	1	706373	7446819
		0.1	1	706374	7446518
		0.1	1	706447	7446669
		0.1	1	706457	7446593
		0.1	1	706499	7446707
		0.1	1	708140	7448403
		0.1	1	708175	7448431
		0.1	1	709549	7450286
		0.1	1	709667	7450268
		0.1	1	709681	7450240
		0.1	1	709683	7450274
		0.1	1	709694	7450283
		0.1	1	709730	7450251
		0.1	1	709749	7450309
		0.1	1	709771	7450399
		0.1	1	709863	7450571
		0.1	1	709871	7450491
		0.1	1	710005	7450579
		0.1	1	710666	7450528
		0.1	1	711160	7450347
		0.1	1	711315	7450332
		0.1	1	711343	7450314
		0.1	2	699134	7446228
		0.1	2	699230	7446210
		0.1	2	699269	7446260
		0.1	2	706355	7446565

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Rhagodia sp. Hamersley (M. Trudgen 17794) P3	A	0.1	2	706430	7446784
		0.1	2	706431	7446789
		0.1	2	709697	7450250
		0.1	3	699031	7446175
		0.1	3	699383	7446337
		0.1	3	706330	7446785
		0.1	3	706376	7446829
		0.1	3	706412	7446790
		0.1	3	707818	7450448
		0.1	3	708029	7450331
		0.1	3	711060	7450377
		0.1	4	699200	7446206
		0.5	1	699258	7446703
	G	0.5	1	701072	7446511
		0.5	1	701447	7445501
		0.5	1	701496	7445998
		0.5	1	701584	7446234
		0.5	1	706263	7446392
		0.5	2	703455	7446430
Triodia sp. Mt Ella (M.E. Trudgen 12739) P3	A	0.1	2	717464	7449882
		0.1	20	718161	7450162
		0.5	30	716998	7450255
		0.5	50	717487	7449880
		1	20	718203	7451112
		1	50	716891	7450100
		1	100	717049	7450268
		20	300	718093	7450092
		25	200	716984	7450220
		25	400	718085	7450116
		25	400	718093	7450193
		25	400	718114	7450216
		35	300	718148	7450267
		35	300	718168	7450238
		35	400	718089	7450122
		35	400	718101	7450173
		5	20	718980	7450183
		5	150	717529	7449873
	C	-	10	716946	7450138
	E	-	10	716946	7450138
	H	-	10	719036	7450892
		-	15	717661	7450706

Species	Project	Cover (%)	Abundance	Easting (mE)	Northing (mN)
Triodia sp. Mt Ella (M.E. Trudgen 12739) P3	H	-	20	717616	7450700
		-	20	718206	7451107
		-	20	719297	7450800
		-	20	719324	7450801
		-	40	718141	7450890
		-	50	717507	7450099
		-	100	717739	7449887
		-	100	717800	7449890
		-	100	718035	7449925
		-	100	718064	7449951
		-	100	718113	7450112
		-	100	719356	7450802
		-	100	719400	7450784

[1] - Project	Source
A	Greater Hope Downs – Flora and Vegetation survey (current survey)
B	Hope Downs proposed rail SO-06-01466 (Pilbara Iron 2006)
C	Hope Downs Rail Corridor (Juna Downs Section) Vegetation and Flora Survey (Biota Environmental Sciences 2006)
D	Rare Flora Survey for Dales Gorge Target Drilling (Rio Tinto 2012)
E	Flora and Vegetation Survey at Hope Downs 1 (Rio Tinto 2013)
F	Baby Hope Downs Flora and Vegetation Survey (Biota Environmental Sciences 2014)
G	Hope Downs 2 AR-13-11444 and Bakers East SO-13-11013 Biological Assessment (Astron Environmental Services 2014)
H	Systematic Flora Survey at Hope Downs 1 Bedded Hilltop Drilling AR-15-13090 (Rio Tinto 2015)
I	Rio Tinto flora database - Newman Highway (No Report Observation) (Rio Tinto Iron Ore 2018)
J	Threatened and Priority Flora Database (TPFL) (Department of Biodiversity, Conservation, and Attractions 2019a)
K	Western Australian Herbarium Database (Department of Biodiversity, Conservation, and Attractions 2019b)

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Astron Environmental Services 2014, *Hope Downs 2 AR-13-11444 and Bakers East SO-13-11013 Biological Assessment*, unpublished report to Rio Tinto Iron Ore.

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Rio Tinto 2013, *Flora and Vegetation Survey at Hope Downs 1*, Perth WA.

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Rio Tinto Iron Ore 2018, 'Flora Database Records', Digital dataset supplied by Rio Tinto.

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Appendix O: Introduced Flora Species (Weed) Locations and Descriptions

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7450000

Survey Area

Introduced Flora Species - Recorded by Astron

- **Aerva javanica*
- **Argemone ochroleuca*
- **Bidens bipinnata*
- **Cenchrus ciliaris*
- **Cenchrus setiger*
- **Chloris virgata*
- **Citrullus colocynthis*
- **Conyza bonariensis*
- **Cynodon dactylon*
- **Datura leichhardtii* subsp. *leichhardtii*
- **Euphorbia hirta*
- **Flaveria trinervia*
- **Lactuca serriola*
- **Malvastrum americanum*
- **Melinis repens*
- **Rumex vesicarius*
- **Setaria verticillata*
- **Sigesbeckia orientalis*
- **Sisymbrium orientale*
- **Solanum nigrum*
- **Sonchus oleraceus*
- **Tribulus terrestris*
- **Tridax procumbens*
- **Vachellia farnesiana*

Introduced Flora Species - Previous

- **Bidens bipinnata*
- **Brassica tournefortii*
- **Cenchrus ciliaris*
- **Cenchrus setiger*
- **Chloris virgata*
- **Datura leichhardtii* subsp. *leichhardtii*
- **Flaveria trinervia*
- **Malvastrum americanum*
- **Rumex vesicarius*
- **Setaria verticillata*
- **Sigesbeckia orientalis*
- **Sonchus oleraceus*
- **Vachellia farnesiana*

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Rio Tinto

Hope Downs 2 Proposal – Flora and Vegetation Survey

Figure O.1: Introduced flora species (weed) locations

Scale: 1:80,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

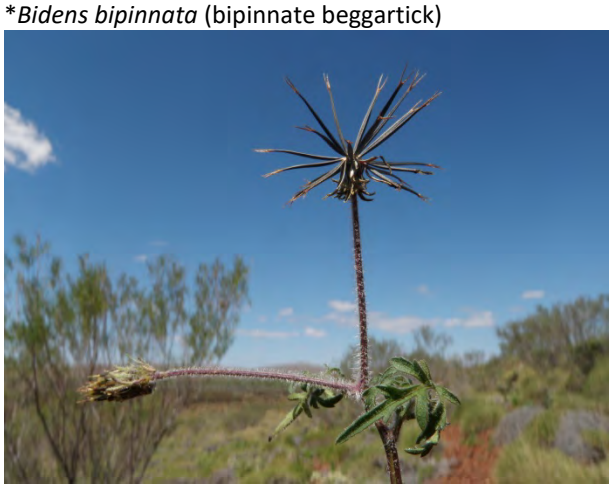
0 1 2 3 4 5 Kilometres

N

astron delivering environmental intelligence™

Author: B. Eckermann | Drawn: C. Dyde | Date: 07-11-2019 | Figure Ref: 14292A-19-BIDR-3RevB_191107_Weeds_FigO1

Table O.1: Weed species recorded in the survey area.

Species	Description[1]	Habitat[1]
**Bidens bipinnata* (bipinnate beggartick) 	Erect annual, herb, 0.1 m to 0.9(-1.5) m high. Flowers yellow, March to September.	Alluvium, clay, loam over sandstone, limestone. Along rivers and creeks, coastal areas, rocky hillsides.
**Brassica tournefortii* (Mediterranean turnip)[2] 	Annual, herb, 0.1 m to 0.6 m high. Flowers yellow-cream-white, June to November.	Sandy soils. Aggressive weed of disturbed ground, roadsides, cultivation and seaside.
**Cenchrus ciliaris* (buffel grass) 	Tufted or sometimes stoloniferous perennial, grass-like or herb, 0.2 m to 1.5 m high. Flowers purple, February to October.	White, red or brown sand, stony red loam, black cracking clay.

Species	Description[1]	Habitat[1]
**Cenchrus setiger* (birdwood grass) 	Erect, tussocky, stoloniferous perennial, herb or grass-like, to 0.5 m high. Flowers cream-purple, April to May.	Brown sands, red loam, pindan soils. Sand dunes, plains, rangelands, stony hillsides, floodplains.
**Chloris virgata* (feathertop rhodes grass) 	Annual, grass-like or herb, (0.15-)0.23-0.45(-0.95) m high. Flowers green-purple, April to May or September.	Clay, sand. Sand dunes.
**Conyza bonariensis* (flaxleaf fleabane) 	Erect annual, herb, 0.15 m to 1.5 m high. Flowers white, January to December.	Variety of soils. Weed of cultivation, waste places and roadsides.

Species	Description[1]	Habitat[1]
**Cynodon dactylon* (Couch) 	Rhizomatous (or stoloniferous), prostrate perennial, grass-like or herb, 0.05 m to 0.3 m high. Flower green-purple, June to November or February.	Sand, loam, clay.
**Datura leichhardtii* subsp. *leichhardtii* (Native Thornapple) 	Stout annual, herb, 0.2 m to 1 m high. Flowers white, January to October.	Alluvium. Along watercourses.
**Flaveria trinervia* (speedy weed) 	Erect annual shrub. Flowers yellow, May to July.	Sandy flat, along watercourses.

Species	Description[1]	Habitat[1]
**Lactuca serriola* (prickly lettuce) 	Erect annual or biennial, herb, 0.4 m to 2 m high. Flowers yellow, October to December or January to February.	Roadsides, gardens, cultivated fields, disturbed sites.
**Malvastrum americanum* (spiked malvastrum) 	Erect perennial, herb or shrub, 0.5 m to 1.3 m high. Flowers yellow-orange, April to July.	Orange/red/yellow sands, gritty alluvial sand, black/brown clay, alluvial cracking clays, limestone, calcrete. Stony ridges and hillsides, floodplains, along drainage lines.
**Rumex vesicarius* (ruby dock)[2] 	Erect, stout, fleshy, hollow-stemmed annual, herb, 0.2 m to 1 m high. Flowers red-pink, July to September.	Sandy alluvial soils, gravelly ironstone soils. Along roadsides, in disturbed areas.

Species	Description[1]	Habitat[1]
**Setaria verticillata* (whorled pigeon grass) 	Loosely tufted annual, grass-like or herb, 0.1 m to 1.3 m high. Flowers December or January to June.	Sand, clay, loam.
**Sigesbeckia orientalis* (Indian weed) 	Erect, slender annual, herb, 0.15 m to 1 m high. Flowers yellow, January to December.	Loamy soils over limestone or granite. Rocky gullies, limestone ranges, creek beds.
**Solanum nigrum* (black berry nightshade) 	Erect perennial, herb or shrub (short-lived), 0.3 m to 1 m high. Flowers white, January to December.	Dampland, along drainage line. Plain, hillslope, disturbed ground. Sand.

Species	Description[1]	Habitat[1]
**Sonchus oleraceus* (common sowthistle) 	Erect annual, herb, to 1.5 m high. Flowers yellow, January to December.	Variety of soils. Weed of waste places and disturbed ground.
**Vachellia farnesiana* (mimosa bush) 	Erect, spreading, thicket-forming, thorny tree or shrub, to 4 m high, bark dark grey, rough; leaves pinnate. Flowers yellow, June to August.	Stony sandy, clay or loam soils, gravel. Low-lying areas, river and creek banks, disturbed sites.

[1] – Florabase (Western Australian Herbarium 1998-2018).
[2] – Species not observed in current survey, but previously recorded within survey area. For project presence see Table O.2.

Table O.2: Locations of weed species recorded in the survey area (GDA94, Zone 50).

Species	Project[1]	Cover (%)	Abundance	Easting (mE)	Northing (mN)
**Bidens bipinnata*	A	-	5	696277	7445914
		-	30	696146	7445827
		-	40	696203	7445876
		-	40	706632	7446526
		-	100	695902	7445622
		-	100	696050	7445765
		-	100	696106	7445823
		-	100	696238	7445896
		-	100	696357	7445945
		-	200	695972	7445757
		-	500	695939	7445767
		0.1	1	697944	7446259
		0.1	1	702535	7446647
		0.1	1	707275	7445867
		0.1	1	708078	7448129
		0.1	3	719037	7456581
		0.1	5	705856	7446600
		0.1	6	714648	7452107
		0.1	6	718877	7456696
		0.1	10	695980	7446338
		0.1	10	702109	7442804
		0.1	10	706225	7446529
		0.1	10	709878	7450531
		0.1	10	709884	7450523
		0.1	10	710818	7450419
		0.1	10	718990	7456473
		0.1	10	720359	7450413
		0.1	15	706289	7443704
		0.1	15	718441	7454793
		0.1	20	702928	7449192
		0.1	20	706225	7446529
		0.1	20	709903	7450533
		0.1	20	710498	7450464
		0.1	20	710638	7450490
		0.1	25	718681	7456938
		0.1	30	710423	7450450
		0.1	30	711147	7450387
		0.1	30	719281	7454646

Species	Project[1]	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		0.1	40	702774	7449267
		0.1	50	706457	7446593
		0.1	50	708156	7448359
		0.1	50	710685	7450451
		0.1	70	715647	7452359
		0.1	80	705243	7446960
		0.1	80	710941	7450542
		0.1	80	715969	7451699
		0.1	100	695845	7445441
		0.1	100	701678	7445609
		0.1	200	705143	7448941
		0.1	200	706244	7448788
		0.1	200	706322	7446735
		0.1	200	706377	7446614
		0.1	200	709045	7449688
		0.1	200	711311	7450316
		0.1	200	720355	7451567
		0.1	500	695611	7445317
		0.1	500	695767	7445375
**Bidens bipinnata*	A	0.1	500	695836	7445469
		0.1	500	698423	7446984
		0.1	500	701397	7446256
		0.1	500	701475	7446130
		0.1	500	707974	7448449
		0.1	500	708028	7450324
		0.1	700	711417	7450351
		0.1	1000	695501	7445232
		0.1	1000	695777	7445423
		0.1	1000	695807	7445430
		0.1	1000	704680	7446950
		0.1	1500	707818	7450448
		0.1	2000	696750	7446185
		0.1	2000	710669	7450451
		0.5	1	706588	7450157
		0.5	10	701610	7445967
		0.5	10	701612	7445972
		0.5	10	701620	7445957
		0.5	20	701623	7445913
		0.5	20	701624	7445924

Species	Project[1]	Cover (%)	Abundance	Easting (mE)	Northing (mN)
**Bidens bipinnata*	A	0.5	20	702842	7449232
		0.5	20	702926	7449161
		0.5	20	702926	7449205
		0.5	20	702933	7449174
		0.5	20	702940	7449196
		0.5	20	704495	7449030
		0.5	20	704530	7449018
		0.5	25	703521	7448903
		0.5	35	706655	7448969
		0.5	50	703522	7448905
		0.5	50	703552	7448913
		0.5	100	716039	7451579
		0.5	120	706213	7446504
		0.5	250	699269	7446266
		0.5	250	716014	7451622
		0.5	500	695631	7445372
		0.5	500	701652	7445711
		1	40	706292	7443062
		1	300	710667	7450425
		1	500	695433	7445209
		1	2000	700255	7446956
		1	5000	695530	7445282
		1	5000	701608	7445751
		2	300	696381	7445980
		2	300	696539	7445989
		2	300	696568	7445945
		2	300	696607	7445979
		2	300	696620	7446049
		2	300	696659	7446022
		2	300	696671	7446097
		2	300	696675	7446135
		3	1000	696428	7445960
	B	-	1	698722	7445491
		-	1	698744	7445573
		-	1	698761	7446051
		-	1	698786	7446046
		-	1	698849	7445186
		-	1	698850	7445174
		-	1	706133	7444097

Species	Project[1]	Cover (%)	Abundance	Easting (mE)	Northing (mN)
**Bidens bipinnata*	B	-	1	706147	7443993
		-	1	706155	7443871
		-	1	706167	7444334
		-	1	706177	7444269
		-	1	706178	7444184
		-	1	706189	7444235
		-	1	706197	7449222
		-	1	706248	7449320
		-	1	706294	7449027
		-	1	707358	7443287
		-	1	717557	7455709
		-	1	717644	7455754
		-	1	717698	7455808
		-	1	717917	7455363
		-	1	717956	7455447
		-	50	717653	7455606
	C	-	1	698744	7445573
		-	1	706189	7444235
		-	1	707358	7443287
	D	0.5	4	705727	7446535
		0.5	6	700888	7446474
		0.5	10	701594	7446130
		0.5	10	705948	7446543
		0.5	10	706651	7446512
		0.5	15	705783	7446530
		0.5	15	705830	7446488
		0.5	20	706021	7446546
		0.5	20	706218	7446536
		0.5	50	701719	7445623
		0.5	50	705750	7446519
	E	-	1	717354	7449903
	H	-	1	716084	7453270
		-	800	717271	7454170
		0.1	100	715444	7452890
		2	3	715444	7452890
**Brassica tournefortii*	B	-	1	706177	7444269
		-	1	706557	7444961
**Cenchrus ciliaris*	A	0.1	1	706044	7445212
		0.1	2	701532	7445507

Species	Project[1]	Cover (%)	Abundance	Easting (mE)	Northing (mN)
		0.1	6	701608	7445751
		0.1	10	700010	7444534
		0.5	20	699998	7444557
		0.5	20	699999	7444577
		0.5	20	700018	7444600
		0.5	20	700035	7444642
		0.5	25	707048	7445427
		0.5	80	706738	7445287
		1	20	704027	7444307
		1	20	704044	7444321
		1	20	704055	7444338
		1	20	705695	7445252
		1	20	705713	7445292
		1	20	706292	7443062
		1	20	706325	7443186
		1	20	706348	7443251
		1	20	706356	7443204
		1	20	706361	7443223
		1	20	706364	7443232
**Cenchrus ciliaris*	A	1	100	701490	7443878
		1	200	706640	7445126
		1	250	706416	7444693
		15	750	706392	7443534
		18	1000	706206	7445142
		2	80	706934	7445418
		2	100	706330	7443227
		2	100	706343	7443189
		2	200	706802	7445327
		2	200	706860	7445394
		2	250	706763	7445254
		2	300	701536	7445502
		25	2000	706197	7443827
		3	50	707275	7445867
		35	250	707021	7445409
		4	300	702109	7442804
		5	100	707246	7445760
		5	200	706874	7445360
		5	300	702620	7443049
		5	300	702748	7443218

Species	Project[1]	Cover (%)	Abundance	Easting (mE)	Northing (mN)
**Cenchrus ciliaris*	A	5	300	703061	7443351
		5	300	703085	7443406
		5	600	701347	7443766
		5	600	702682	7443102
		5	600	703167	7443479
		8	80	703034	7443326
		8	200	697184	7446846
		8	200	702814	7443254
		8	300	703189	7443487
		8	1000	706556	7444767
	B	-	1	706147	7443993
		-	1	706155	7443871
		-	1	706167	7444334
		-	1	706177	7444242
		-	1	706178	7444184
		-	1	706557	7444978
	H	-	1	710267	7452510
		-	10	716180	7452550
**Cenchrus setiger*	A	0.1	1	707275	7445867
		0.1	3	701609	7445832
		0.1	5	695875	7445464
		0.1	15	701534	7445512
		0.1	15	702660	7443054
		0.1	20	702726	7443180
		0.5	15	706949	7445404
		1	5	702677	7443148
		1	50	706837	7445329
		10	200	706587	7445030
		2	75	706294	7443088
		2	100	707247	7445761
		3	50	706295	7443697
		3	150	706722	7445204
		5	50	706292	7443062
		6	150	706297	7443339
		8	250	706347	7443425
	B	-	1	706148	7443922
		-	1	706248	7444433
**Chloris virgata*	A	0.1	1	695980	7446338
		0.5	1	696428	7445960

Species	Project[1]	Cover (%)	Abundance	Easting (mE)	Northing (mN)
**Chloris virgata*	H	-	1	715444	7452890
**Conyza bonariensis*	A	0.1	1	707275	7445867
**Cynodon dactylon*	A	0.1	5	700255	7446956
**Datura leichhardtii* subsp. *leichhardtii*	A	0.1	1	700255	7446956
		0.1	1	706695	7446818
		0.1	20	701676	7445632
**Flaveria trinervia*	A	0.1	1	706292	7443062
		0.1	1	707275	7445867
		0.1	2	720355	7451567
		0.1	3	695617	7445362
		0.1	5	702109	7442804
		0.1	20	701676	7445642
		0.1	20	702787	7443238
		0.1	25	701608	7445751
		0.1	30	700255	7446956
		0.5	5	706390	7442961
**Lactuca serriola*	A	0.1	2	707099	7449419
	I	-	1	717740	7458320
		-	1	718512	7458435
**Malvastrum americanum*	A	0.1	1	695311	7446872
		0.1	1	706457	7446593
		0.1	2	696656	7446022
		0.1	2	718301	7455179
		0.1	2	718335	7455098
		0.1	2	718529	7454873
		0.1	3	701491	7445451
		0.1	3	715924	7452452
		0.1	4	705973	7445811
		0.1	4	707275	7445867
		0.1	5	696428	7445960
		0.1	5	701754	7445482
		0.1	5	706459	7446548
		0.1	5	714648	7452107
		0.1	8	700255	7446956
		0.1	8	701678	7445610
		0.1	10	718990	7456473
		0.1	12	718877	7456696
		0.1	15	701608	7445751
		0.1	15	708156	7448359

Species	Project[1]	Cover (%)	Abundance	Easting (mE)	Northing (mN)
**Malvastrum americanum*	A	0.1	30	701941	7444507
		0.1	100	696838	7446379
		0.5	1	696307	7445921
		0.5	1	696307	7445923
		0.5	5	701610	7445967
		0.5	5	701617	7445892
		0.5	10	696307	7445925
		0.5	50	701485	7446089
		1	60	705729	7445302
	D	0.5	1	703455	7446430
		0.5	2	701821	7445415
		0.5	8	701918	7445413
		0.5	8	706386	7446577
		0.5	10	706325	7446602
		0.5	15	701675	7445632
	H	-	10	716180	7452550
		-	50	714645	7452850
		0.1	100	715444	7452890
**Rumex vesicarius*	E	-	5	719408	7450712
	H	0.1	1	715444	7452890
	I	-	1	717557	7458342
		-	1	717605	7458489
		-	1	717717	7459236
		-	1	717904	7459380
		-	1	717945	7459461
		-	1	718036	7459461
		-	1	718066	7459477
		-	1	718067	7459429
		-	1	718076	7459447
		-	1	718094	7459415
		-	1	718762	7459204
**Setaria verticillata*	A	0.1	1	705973	7445811
		0.1	5	696428	7445960
		0.1	10	707293	7445637
		0.1	50	720355	7451567
	B	-	1	698722	7445491
**Sigesbeckia orientalis*	A	0.1	1	706292	7443062
	B	-	1	706167	7444334
	E	-	1	717354	7449903

Species	Project[1]	Cover (%)	Abundance	Easting (mE)	Northing (mN)
**Sigesbeckia orientalis*	E	-	5	718338	7450204
**Solanum nigrum*	G	1	3	706762	7449301
		1	5	706873	7449533
**Sonchus oleraceus*	A	0.1	1	701628	7445795
		0.1	2	695509	7445249
		0.1	12	695989	7445449
		0.1	15	701608	7445751
		0.1	30	695640	7445347
		0.5	1	701625	7445750
	B	-	1	697799	7445291
		-	1	706121	7444064
		-	1	706147	7443993
		-	1	706155	7443871
		-	1	706156	7444070
		-	1	706167	7444334
		-	1	706177	7444269
		-	1	706178	7444184
		-	1	706248	7444433
		-	1	706343	7444556
		-	1	706557	7444978
	C	-	1	703816	7444021
	F	1	10	707272	7448910
		1	15	707229	7448920
		1	15	707278	7448930
		1	20	707226	7448930
	J	-	1	703816	7444021
**Vachellia farnesiana*	A	-	3	696049	7445786
		-	3	696159	7445885
		-	10	695902	7445622
		-	10	696146	7445827
		-	10	696296	7445922
		-	20	695972	7445757
		-	30	696050	7445765
		-	40	696236	7445888
		0.1	1	696340	7445967
		0.1	1	696351	7445975
		0.1	1	696591	7445975
		0.1	1	696653	7446020
		0.1	1	705797	7445560

Species	Project[1]	Cover (%)	Abundance	Easting (mE)	Northing (mN)
**Vachellia farnesiana*	A	0.1	1	706951	7445404
		0.1	1	715700	7452385
		0.1	2	695749	7445407
		0.1	2	696614	7445999
		0.1	2	696671	7446095
		0.1	2	706145	7443976
		0.1	2	706161	7444287
		0.1	2	706428	7446730
		0.1	3	706317	7444514
		0.1	4	696655	7446104
		0.1	4	696681	7446139
		0.1	4	706638	7445087
		0.1	5	695776	7445370
		0.1	5	706721	7445221
		0.1	6	706783	7445278
		0.1	7	702727	7443183
		0.1	7	707275	7445867
		0.1	10	696428	7445960
		0.1	12	706206	7445142
		0.1	20	696773	7446200
		0.5	1	701676	7445632
		0.5	2	696306	7445953
		0.5	2	707247	7445758
		0.5	2	707288	7445857
		0.5	3	695818	7445471
		0.5	4	696309	7445930
		0.5	15	696304	7445920
		1	2	695587	7445348
		1	3	696616	7446068
		1	8	695875	7445478
		10	10	695682	7445394
		2	5	706397	7444685
	B	-	1	707283	7445745
	C	-	1	707283	7445745

[1] - Project	Source
A	Greater Hope Downs – Flora and Vegetation survey (current survey)
B	Hope Downs Rail Corridor (Juna Downs Section) Vegetation and Flora Survey (Biota Environmental Sciences 2006)
C	Flora and Vegetation of the Hope Downs 2 Area (Mattiske Consulting 2010)
D	Hope Downs 2 and Bakers East Flora & Fauna Assessment (Astron Environmental Services 2014)
E	Systematic Flora Survey at Hope Downs 1 Bedded Hilltop Drilling AR-15-13090 (Rio Tinto 2015)
F	Weed Control Program - Inland Operations, Hope Downs 1 - 2016 Annual Summary Report (Astron Environmental Services 2016)
G	Weed Control Program – Inland Operations, Hope Downs 1 – 2017 Annual Summary Report (Astron Environmental Services 2018)
H	Baby Hope Downs Flora and Vegetation Survey (Biota Environmental Sciences 2014)
I	Weed Control Program – Inland Operations – Brockman 2 and Hope Downs 1 (Astron Environmental Services 2015)
J	Flora and Vegetation of the Hope Downs 2 Area (Mattiske Consulting 2010)

References

Astron Environmental Services 2014, *Hope Downs 2 AR-13-11444 and Bakers East SO-13-11013 Biological Assessment*, unpublished report to Rio Tinto Iron Ore.

Astron Environmental Services 2015, *Weed Control Program – Inland Operations – Brockman 2 and Hope Downs 1, July 2015*, unpublished report to Rio Tinto Iron Ore.

Astron Environmental Services 2016, *Weed Control Program - Inland Operations, Hope Downs 1 - 2016 Annual Summary Report*, unpublished report to Rio Tinto Iron Ore.

Astron Environmental Services 2018, *Weed Control Program - Inland Operations, Hope Downs 1 - 2017 Annual Summary Report*, unpublished report prepared for Rio Tinto

Biota Environmental Sciences 2006, *Hope Downs Rail Corridor (Juna Downs Section) Vegetation and Flora Survey*, unpublished report for Pilbara Iron Company.

Biota Environmental Sciences 2014, *Baby Hope Downs Flora and Vegetation Survey*, unpublished report for Rio Tinto.

Mattiske Consulting 2010, *Flora and Vegetation of the Hope Downs 2 Area*, unpublished report for Pilbara Iron.

Rio Tinto 2015, *Systematic Flora Survey at Hope Downs 1 Bedded Hilltop Drilling AR-15-13090*, Perth WA.

Western Australian Herbarium 1998-2018, 'FloraBase – the Western Australian Flora', Department of Parks and Wildlife. http://florabase.dpaw.wa.gov.au.

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B.2: Hope Downs Development Envelope Consolidated Vegetation Mapping Report

22 May 2020

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Our Reference: 14292-19-BILR-1Rev2_200522

Michelle Doak
Senior Advisor - Environmental Approvals
Rio Tinto
Level 12 Central Park
152-158 St Georges Terrace
Perth WA 6000

Dear Michelle,

Re: Hope Downs Development Envelope - Vegetation Mapping

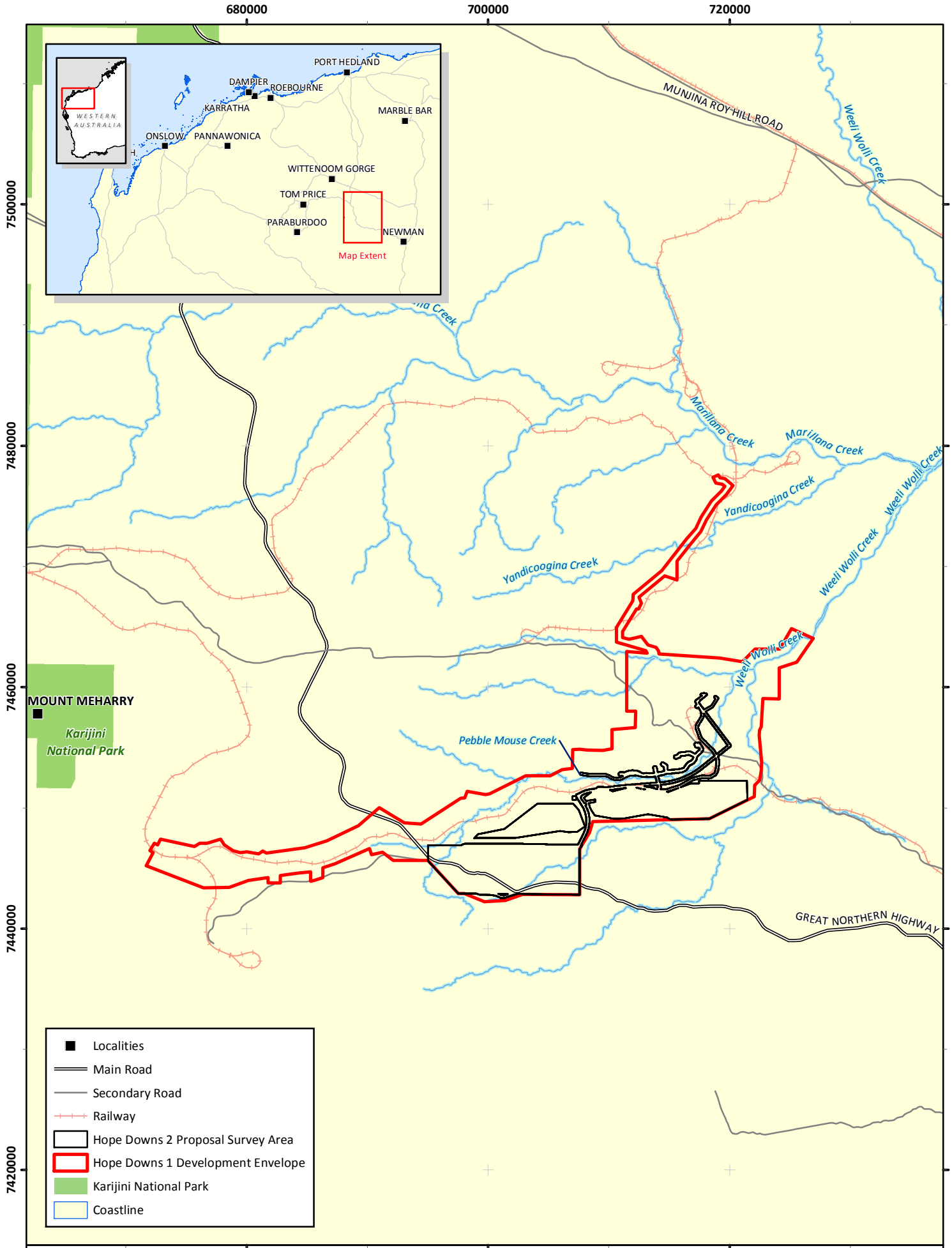
1 Introduction

Early in 2019 Rio Tinto commissioned a consolidation of all previous vegetation mapping across the Hope Downs 1 (HD1) Development Envelope. The proposed HD1 Development Envelope is approximately 36,944 ha and encompasses the Hope Downs 2 (HD2) Proposal area and the existing approved and operational Hope Downs 1 and Baby Hope mine sites, and corridors linking the West Angelas and Yandicoogina operations (Figure 1).

In 2017 to 2019 Astron conducted a Detailed flora and vegetation assessment within the HD2 Proposal area, the results of which are presented in Astron Environmental Services (2019). The results of the consolidated vegetation mapping and consolidated vegetation condition mapping as well as opportunistic conservation significant flora and weed locations for parts of the HD1 Development Envelope not captured in Astron Environmental Services (2019) are presented in this letter.

2 Methods

A combination of previous vegetation mapping within the HD1 Development Envelope and high resolution aerial imagery were used to produce a single desktop generated consolidated vegetation map using vegetation codes from Astron Environmental Services (2018). Vegetation units described in Astron Environmental Services (2018) were reviewed for typical vegetation structure, species composition and position in the landscape to assist with assigning codes to vegetation polygons observed on aerial imagery.



Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure 1: Survey area location

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Author: B. Eckermann	Date: 11-12-2019
Drawn: C. Dyde	Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_Fig01_Locn

Datum: GDA 1994 - Projection: MGA Zone 50

0 5 10 15 20 Km

N

A number of other flora and vegetation surveys have previously been carried out within the HD1 Development Envelope; these were also reviewed to provide vegetation unit and vegetation condition information. Vegetation unit boundaries from the following surveys were used to inform interpretation of vegetation units and condition in the HD1 Development Envelope:

- Hope Downs 2 Bedded Hilltop and Wonmunna Detailed Flora and Vegetation Survey (Astron Environmental Services 2018)
- Hope Downs Rail Corridor (Juna Downs Section) Vegetation and Flora Survey (Biota Environmental Sciences 2006)
- Baby Hope Downs Flora and Vegetation Survey (Biota Environmental Sciences 2014)
- Yandi Vegetation and Flora Integration Report (Biota Environmental Sciences 2015)
- Hope Downs Biological Survey (Ecologia Environment 1997)
- Flora and Vegetation, Northern Transport Corridor, Yandicoogina Junction Project Area (Mattiske 1995)
- Flora and Vegetation, Southern Transport Corridor, Yandicoogina Junction Project Area (Mattiske Consulting 1995)
- Flora and Vegetation of the Hope Downs 1 Area (Mattiske Consulting 2009a)
- Flora and Vegetation on the Hope Downs 4 Mine Pipeline Corridor to Opthalmia Dam (Mattiske Consulting 2009b)
- Flora and Vegetation of the Hope Downs 2 Area (Mattiske Consulting 2010)
- Flora and Vegetation Surveys of Orebody A and Orebody B in the West Angela Hill Area (Trudgen 1998).

Following the desktop assessment, a reconnaissance level field survey was undertaken to verify the accuracy of the desktop mapping and inform the mapping consolidation. The survey was conducted in May 2019 concurrently with the HD2 Proposal area Phase 3 survey, by Astron Senior Botanists Ben Eckermann (Flora Permit SL012522; DRF Permit 75-1819), Dr Kellie McMaster (Flora Permit SL012520; DRF Permit 56-1819), Daniel Roocke (Flora Permit SL012517) and Botanist Lucy Dadour (Flora Permit SL012524; DRF Permit 44-1819).

The survey involved ground-truthing of vegetation in areas able to be readily accessed by vehicle, and sampling of 11 quadrats (50 m x 50 m). Information collected from the quadrats included:

- Location – coordinates measured using a handheld global positioning system (GPS) unit (MGA50, GDA94) at each of the four corners of the site.
- Recorder and date –personnel involved in sampling that site and the survey date.
- Habitat – a broad description of the surrounding landscape based on landform, topography and soil.
- Soil – including colour and texture.
- Rock type and abundance – general description of surface geology and amount of ground covered by rocks.

- Vegetation description – vegetation described according to level V of the NVIS (Department of the Environment and Energy 2017) and classified according to the Aplin (1979) modification of the vegetation classification system of Specht (1970) (Appendix F).
- Vegetation condition – assessed according to the vegetation condition classification adapted from Trudgen (1988).
- Species list – percentage foliar cover and maximum height were recorded for each vascular plant taxon present within the site.
- Disturbances – records of any obvious disturbances such as fire, tracks or grazing.
- Photographs – a photograph was taken at the north-west and south-east corners of each quadrat.

Areas that could not be accessed on foot were viewed from a nearby vantage point to assist with vegetation mapping interpretation where possible. However, due to limited vehicle access and time constraints, not all of the HD1 Development Envelope was able to be ground-truthed.

Following the Phase 3 detailed survey of the HD2 Proposal area the description of some vegetation units was updated; as such the post-survey consolidated vegetation mapping was updated to reflect the vegetation units defined in Astron Environmental Services (2019).

In areas not visited during the field survey and where no vegetation mapping has previously been conducted, the boundaries of vegetation units were extrapolated using high resolution aerial imagery. Given that large areas of the HD1 Development Envelope were not able to be ground-truthed the vegetation mapping was given a confidence rating based on level of likely accuracy (Table 1).

Table 1: Criteria for confidence rating of consolidated vegetation unit mapping.

Confidence rating	Description
High	Recent, detailed vegetation mapping supported by traversing and/or quadrats in nearby area.
Medium	Previous detailed vegetation mapping conducted but is old (>5 years) or describes vegetation units similar to Astron Environmental Services (2019). If the area has been surveyed by Astron it has been conducted in a single poor season, or there is considerable distance to areas of high confidence.
Low	No vegetation mapping has been conducted, or previous detailed vegetation mapping is very old (>10 years) or presents vegetation units that Astron Environmental Services (2019) has not described.

Previous vegetation condition mapping within the HD1 Development Envelope, including Biota Environmental Sciences (2014) and Astron Environmental Services (2018), and the locations of introduced flora (weeds) and known disturbances within the HD1 Development Envelope were reviewed. This data informed the production of a single consolidated desktop vegetation condition map using the Trudgen (1988) scale. During the field survey, the desktop condition mapping was opportunistically verified where access and time allowed. Vegetation condition was mapped according to the vegetation unit polygons and overlaid with disturbance mapping provided by Rio Tinto.

Locations of conservation significant flora and weeds were recorded opportunistically from quadrats, and as the team traversed the HD1 Development Envelope.

3 Results

Twenty-seven vegetation units were mapped within the HD1 Development Envelope. Each vegetation unit is detailed in Table 2 and presented in Figure A (Attachment A). Twenty-three of the recorded and extrapolated vegetation units have been previously described in Astron Environmental Services (2019) and further detail on the vegetation units is presented in that report. Three plains units (P5, P6, and P7) and one drainage line unit (D6) have been described only from the HD1 Development Envelope. Data recorded from each quadrat is presented in Attachment B.

Table 2: Vegetation units described for the HD1 Development Envelope.

Vegetation unit code and description	HD1 Development Envelope Sites(s)[1]	HD2 Proposal Area Site(s)[2]	Vegetation condition	Mapped area (ha)
Vegetation of Hills and Slopes				
H1 – *Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia hamersleyana* sens. lat. scattered low trees to low open woodland over *Petalostylis labicheoides, Senna glutinosa* subsp. *glutinosa* scattered tall shrubs over *Gompholobium oreophilum*, *Acacia hilliana, A. spondylophylla* low open shrubland to low shrubland over *Triodia vanleeuwenii*, *T. wiseana*, *T. pungens* open hummock grassland with *Amphipogon sericeus* scattered tussock grasses	N/A	HD04, HD13, HD15	Excellent	1,628
H2 – *Eucalyptus repullulans* scattered low mallees over *Acacia catenulata* subsp. *occidentalis*, *A. aptaneura*, (*Grevillea saxicola*) tall shrubland to tall open scrub over *Scaevola acacioides, Dodonaea pachyneura, Eremophila latrobei* subsp. *filiformis* scattered shrubs to open shrubland over *Triodia pungens* scattered hummock grasses to very open hummock grassland with *Eriachne mucronata* scattered tussock grasses to very open tussock grassland	N/A	HD03, HD07, HD52, GH11	Very Good - Excellent	439
H3 – *Corymbia deserticola* subsp. *deserticola* scattered low trees over *Acacia inaequilatera*, *Hakea chordophylla* scattered tall shrubs to tall open shrubland over *Senna glutinosa* subsp. *pruinosa* scattered shrubs over *Triodia vanleeuwenii* open hummock grassland with *Amphipogon sericeus* scattered tussock grasses to very open tussock grassland	N/A	HD05, HD43, HDR14, HDR16, GH19	Excellent	917
H4 – *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Senna glutinosa* subsp. *glutinosa*, *S. glutinosa* subsp. *pruinosa* scattered shrubs over *Triodia vanleeuwenii* and/or *T. wiseana* open hummock grassland to hummock grassland	N/A	HD48, HDR04, HDR10, HDR11, HDR12, GHR30	Excellent	1,221

Vegetation unit code and description	HD1 Development Envelope Sites(s)[1]	HD2 Proposal Area Site(s) [2]	Vegetation condition	Mapped area (ha)
H5 – *Eucalyptus socialis* subsp. *eucentrica* scattered low mallees to low open mallee woodland over *Acacia bivenosa* scattered tall shrubs to tall open shrubland over *Senna glutinosa* subsp. × *luerssenii* scattered shrubs over *Ptilotus obovatus* scattered low shrubs over *Triodia wiseana* very open hummock grassland to open hummock grassland	GH18, GH31	N/A	Very Good - Excellent	1,118
H6 – *Acacia aptaneura*, *A. catenulata* subsp. *occidentalis* tall open shrubland to tall shrubland over *Eremophila forrestii* subsp. *forrestii*, *Senna stricta* scattered shrubs to open shrubland over *Triodia pungens* and/or *T. vanleeuwenii* and/or *T. wiseana* scattered hummock grasses to very open hummock grassland with *Eriachne mucronata* scattered tussock grasses	N/A	HD23, HD40, HD42, HDR03, HDR06, GHR16	Excellent	171
H7 – *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees to low open woodland over *Senna glutinosa* subsp. *glutinosa, Acacia maitlandii* scattered shrubs over *Triodia wiseana* and/or *T. vanleeuwenii* and/or *T. pungens* open hummock grassland to hummock grassland	N/A	HD01, HD14, HD46, HDR05, HDR09, HDR13, BHD05-AR	Good - Excellent	4,169
H8 – *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees to low open woodland over *Acacia pruinocarpa*, *Hakea chordophylla* scattered tall shrubs to tall open shrubland over *Triodia vanleeuwenii*, (*T. pungens*) open hummock grassland to hummock grassland with *Amphipogon sericeus* scattered tussock grasses	N/A	HD12, HD39, HD41, HD50, HD53, HDR02, BHD10-AR, GH24	Good - Excellent	3,749
H9 – *Acacia arida, Grevillea wickhamii* subsp. *hispidula* open shrubland over *Triodia wiseana* open hummock grassland with *Themeda* sp. Mt Barricade (M.E. Trudgen 2471) very open tussock grassland	N/A	HD16	Excellent	32
H10 – *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees with *E. repullulans* and/or *E. socialis* subsp. *eucentrica* and/or *E. pilbarensis* scattered low mallees to low open mallee woodland over *Acacia bivenosa* scattered shrubs over *Triodia wiseana, (T. angusta)* open hummock grassland to hummock grassland.	N/A	HD21, HD44, HDR01, HDR07, GH06	Very Good - Excellent	1,681

Vegetation unit code and description	HD1 Development Envelope Sites(s)[1]	HD2 Proposal Area Site(s) [2]	Vegetation condition	Mapped area (ha)
H11 – *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees with *E. gamophylla* low open mallee woodland over *Acacia ancistrocarpa* scattered tall shrubs to tall open shrubland over *A. hilliana* scattered low shrubs to low open shrubland over *Triodia vanleeuwenii*, (*T. pungens*) open hummock grassland to hummock grassland	N/A	HD11, HD54, GH12, GH27	Very Good - Excellent	1,681
H12 – *Corymbia hamersleyana* sens. lat. scattered low trees over *Acacia inaequilatera*, *Hakea chordophylla*, *A. bivenosa* scattered tall shrubs to tall open shrubland over *Senna artemisioides* subsp. *oligophylla* scattered low shrubs over *Triodia wiseana* open hummock grassland to hummock grassland with *Themeda* sp. Mt Barricade (M.E. Trudgen 2471), *Cymbopogon ambiguus* scattered tussock grasses and *Heliotropium ovalifolium, Corchorus lasiocarpus* subsp. *parvus* scattered herbs	N/A	HD19, HD33, HD47, GH05	Good - Excellent	691
Vegetation of Plains				
P1 – *Acacia aptaneura*, *A. catenulata* subsp. *occidentalis*, (*A. pruinocarpa*) tall shrubland to tall open scrub over *Eremophila forrestii* subsp. *forrestii* open shrubland to shrubland over *Triodia pungens*, (*T. vanleeuwenii*) scattered hummock grasses to very open hummock grassland	N/A	HD02, HD06, HD10, HD27, HD37, GH15, GH20	Very Good - Excellent	1,077
P2 – *Acacia aptaneura*, *A. pruinocarpa, A. tetragonophylla* scattered tall shrubs to tall open shrubland over *Eremophila forrestii* subsp. *forrestii, A. synchronicia* scattered shrubs over *Ptilotus obovatus, Sida fibulifera* scattered low shrubs over *Aristida latifolia*, *Astrebla elymoides*, *Eragrostis xerophila* open tussock grassland to tussock grassland	N/A	HD09, HD29, HD30, GH08	Very Good - Excellent	453
P3 – *Acacia aptaneura*, *A. catenulata* subsp. *occidentalis*, *A. pruinocarpa* tall open shrubland to tall shrubland over *Eremophila forrestii* subsp. *forrestii* scattered shrubs to open shrubland over *Triodia pungens* open hummock grassland to hummock grassland	N/A	HD20, HD28, HD32, HD55, GH02, GH07	Very Good - Excellent	5,520
P4 – *Acacia pruinocarpa, A. aptaneura, A. catenulata* subsp. *occidentalis* tall open shrubland to tall shrubland over *Rhagodia eremaea* scattered shrubs	GH14	GH21, GH26	Very Good	296
P5 – *Acacia aptaneura* tall shrubland over *Aristida obscura, Aristida ingrata, Themeda triandra* very open tussock grassland	GH32, GH36	N/A	Very Good - Excellent	353

Vegetation unit code and description	HD1 Development Envelope Sites(s)[1]	HD2 Proposal Area Site(s) [2]	Vegetation condition	Mapped area (ha)
P6 – *Acacia aptaneura* scattered tall shrubs to tall open shrubland over *Ptilotus schwartzii* var. *schwartzii* scattered low shrubs over Poaceae sp., *Aristida contorta* scattered tussock grasses to very open tussock grassland	GH34, GH37	N/A	Excellent	432
P7 – *Acacia aptaneura, A. catenulata* subsp. *occidentalis*, (*Grevillea berryana*) tall shrubland over *Ptilotus schwartzii* var. *schwartzii* scattered low shrubs over *Triodia melvillei* scattered hummock grasses to very open hummock grassland over *Aristida contorta* scattered tussock grasses	GH33, GH38	N/A	Excellent	495
Vegetation of Drainage Lines				
D1 – *Corymbia hamersleyana* sens. lat., *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees to low open woodland over *Petalostylis labicheoides*, *Acacia monticola, A. maitlandii* scattered tall shrubs to tall shrubland over *Dodonaea lanceolata* var. *lanceolata, Androcalva luteiflora* scattered shrubs to open shrubland over *Triodia pungens* very open hummock grassland to open hummock grassland with *Themeda triandra*, *Eriachne mucronata* very open tussock grassland to open tussock grassland	N/A	HD25, HD34, HD35, HD38, HD51, GHR28	Very Good - Excellent	2,546
D2 – *Acacia aptaneura, A. catenulata* subsp. *occidentalis*, *A. pruinocarpa* tall shrubland to tall open scrub over *Petalostylis labicheoides* scattered shrubs to open shrubland over *Triodia pungens* very open hummock grassland with *Chrysopogon fallax* scattered tussock grasses	N/A	HD08, HD49, HDR19, GH03, GH09	Very Good - Excellent	807
D3 – *Corymbia ferriticola*, *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Petalostylis labicheoides*, *Acacia hamersleyensis, Dodonaea viscosa* subsp. *spatulata* tall open shrubland over *Triodia pungens* very open hummock grassland with *Eriachne mucronata*, *Themeda* sp. Mt Barricade (M.E. Trudgen 2471), *Cymbopogon ambiguus* very open tussock grassland to tussock grassland	N/A	HD24, HD26, HDR08, GHR10	Good - Excellent	420

Vegetation unit code and description	HD1 Development Envelope Sites(s)[1]	HD2 Proposal Area Site(s) [2]	Vegetation condition	Mapped area (ha)
D4 – *Eucalyptus victrix*, (*E. camaldulensis* subsp. *obtusa*) low open woodland to open woodland over *Acacia citrinoviridis*, *Petalostylis labicheoides* scattered tall shrubs to tall shrubland over *Androcalva luteiflora*, *Gossypium sturtianum* var. *sturtianum* scattered shrubs to open shrubland over *Triodia longiceps* scattered hummock grasses to very open hummock grassland with *Themeda triandra*, *Eulalia aurea*, (**Cenchrus ciliaris*) very open tussock grassland to tussock grassland and **Bidens bipinnata* scattered herbs	N/A	HD17, HD18, HD31, GH04, GH23	Good – Very Good	440
D5 – *Eucalyptus xerothermica* scattered low trees to low open woodland over *Petalostylis labicheoides, Acacia maitlandii*, *A. pyrifolia* tall open shrubland to tall shrubland over *Androcalva luteiflora* scattered shrubs over *Triodia longiceps* very open hummock grassland to open hummock grassland with *Themeda triandra*, *Eulalia aurea* open tussock grassland to tussock grassland and **Bidens bipinnata* scattered herbs	N/A	HD22, HDR18, GH01	Good - Excellent	165
D6 – *Melaleuca argentea, Eucalyptus camaldulensis* subsp. *obtusa, (E. victrix*) open forest over *Acacia citrinoviridis, Atalaya hemiglauca* scattered tall shrubs over *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) scattered low shrubs over *Cyperus vaginatus, Typha domingensis* scattered sedges	GH29, GH35	N/A	Very Good	88
D7 – *Acacia citrinoviridis, A. aptaneura, A. pruinocarpa* scattered tall shrubs to tall shrubland over *Senna artemisioides* subsp. *oligophylla* scattered low shrubs over *Triodia longiceps* open hummock grassland to hummock grassland	N/A	GH22, GH25	Very Good - Excellent	1,293
D8 – *Eucalyptus xerothermica* scattered low trees to low open woodland over *Acacia aptaneura, A. catenulata* subsp. *occidentalis* tall open shrubland to tall open scrub over *Triodia pungens* scattered hummock grasses to very open hummock grassland with *Themeda triandra* very open tussock grassland to open tussock grassland	N/A	GH13, GH17	Very Good	162
Cleared	N/A	N/A	Completely Degraded	4,900

[1] Sites were sampled from within the HD1 Development Envelope and outside of the HD2 Proposal area.

[2] Sites were sampled from within the HD2 Proposal area and data presented in Astron Environmental Services (2019).

None of the vegetation recorded or extrapolated in the HD1 Development Envelope (outside of the areas previously reported for the HD2 Proposal area in Astron Environmental Services (2019)) are considered to represent a threatened ecological community under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the *Biodiversity Conservation Act 2016* (BC Act).

A Department of Biodiversity, Conservation and Attractions (DBCA) mapped location of the priority 1 priority ecological community (PEC) '*Weeli Wolli Spring Community*' occurs within the HD1 Development Envelope. The D6 vegetation unit is inferred to be associated with this PEC based on the presence of *Melaleuca argentea* (considered an obligate phreatophyte), *Eucalyptus camaldulensis* subsp. *obtusa* and *E. victrix* (considered facultative phreatophytes) and the assemblage of sedgeland and herbland understorey taxa.

Some areas of the DBCA mapped PEC are associated with vegetation units outside of the D6 boundary, however this is considered a result of the broader scale of mapping used to define the PEC. The majority of other vegetation units within the DBCA mapped PEC are small in area (<3 ha) and described from the surrounding hills and slopes, with the exception of D4 (75.6 ha within the DBCA mapped PEC) which is separated from D6 due to the absence of *Melaleuca argentea* and dominance of tussock and hummock grasses rather than sedges and herbs which are present in the D6 understorey taxa, and typical of the PEC.

Despite the dry seasonal conditions an average of 58 species were recorded from each D6 quadrat; it is likely that the number of grasses, sedges and herbs would likely be considerably higher following rainfall and the community would have the diverse sedgelands and herbfields typical of the PEC. The vegetation unit D6 does not occur within the HD2 Proposal area and no vegetation is considered to have affinity with the priority 1 PEC '*Weeli Wolli Spring Community*' within the HD2 Proposal area. Permanent water pools are likely to occur upstream (outside of the HD1 Development Envelope) along Weeli Wolli Creek, and may be associated with the priority 2 '*Riparian flora and plant communities of springs and river pools with high water permanence of the Pilbara Region*' PEC.

One further vegetation unit (P2) which occurred as a fine scale mosaic of shrublands and tussock grasslands on cracking-clays and alluvial plains is considered to share similarities with the priority 1 PEC '*West Angelas Cracking-Clays*', however is unlikely to represent the PEC. The degree to which P2 aligns with the PEC was difficult to determine given the poor seasonal conditions and therefore limited occurrence and/or poor condition of annual and short-lived perennial species which characterise the community, however the mosaic and small scale nature of the tussock grasslands is not consistent with mapped occurrences of the PEC (Astron Environmental Services 2019).

Vegetation condition within the HD1 Development Envelope ranges from 'Excellent' to 'Completely Degraded', with the majority of vegetation being in 'Excellent' condition (67% of total area) (Table 3 and Figure C – Attachment C). Approximately 4,900 ha of the HD1 Development Envelope has been previously cleared for tracks, roads, railways, mine site and other associated infrastructure; these areas have been mapped as 'Completely Degraded'.

Table 3: Desktop vegetation condition mapped for the HD1 Development Envelope.

Vegetation condition	Total mapped area within the HD1 Development Envelope (ha)	Proportion of HD1 Development Envelope (%)
Excellent	24,790	67
Very Good	6,846	19
Good	408	<1
Completely Degraded	4,900	13

The confidence of vegetation mapping ranged from 'low' to 'high'. There was 'high' confidence associated with 39% of the vegetation mapping within the HD1 Development Envelope; these areas were either ground-truthed during the field visit and had supporting quadrats and traverses or abutted other areas of 'high' confidence and able to have this rating applied. An estimated 37% of the vegetation mapping was considered 'low' confidence; these areas were not accessed during the field survey and had no previous, or outdated, vegetation mapping in the vicinity. Confidence ratings for desktop vegetation mapping are shown in Table 4 and Figure D (Attachment D).

Table 4: Confidence of vegetation mapping within the HD1 Development Envelope.

Confidence rating	Total mapped area within the HD1 Development Envelope (ha)	Proportion of HD1 Development Envelope (%)
High	14,236	39
Medium	4,045	11
Low	13,763	37
Disturbed	4,900	13

No flora listed as threatened under the EPBC Act or BC Act were recorded. There were seven conservation significant flora recorded within, and adjacent to, the HD1 Development Envelope during the survey: *Aristida lazaridis* P2, *Acacia subtiliformis* P3, *Grevillea saxicola* P3, *Rhagodia* sp. Hamersley (M. Trudgen 17794) P3, *Rostellularia adscendens* var. *latifolia* P3, *Eremophila magnifica* subsp. *magnifica* P4 and *Lepidium catapycnon* P4. Due to changes in the survey boundary, some conservation significant flora records are located outside of the HD1 Development Envelope. Location and abundance details for each conservation significant flora species recorded are presented in Table E.1 and locations are mapped in Figure E (Attachment E). Six of the seven species (excluding *R. adscendens* var. *latifolia* P3) have been previously recorded in the HD2 Proposal area. A further eight species: *Eremophila* sp. West Angelas (S. van Leeuwen 4068) P1, *Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2, *Eremophila* sp. Hamersley Range (K. Walker KW 136) P3, *Goodenia lyrata* P3, *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) P3, *Triodia* sp. Mt Ella (M.E. Trudgen 12739) P3, *Acacia bromilowiana* P4 and *Ptilotus mollis* P4 were recorded in the HD2 Proposal area only and are presented in Astron Environmental Services (2019).

Sixteen introduced (weed) species were recorded: **Bidens bipinnata, *Cenchrus ciliaris, *C. setiger, *Conyza bonariensis, *Cynodon dactylon, *Euphorbia hirta, *Flaveria trinervia, *Lactuca serriola, *Malvastrum americanum, *Melinis repens, *Setaria verticillata *Sigesbeckia orientalis, *Solanum nigrum, *Sonchus oleraceus, *Tridax procumbens* and **Vachellia farnesiana.* None of these species is a declared pest in Western Australia (Department of Primary Industries and Regional Development 2019) or a listed Weed of National Significance (Australian Weeds Committee 2012). The locations of weeds recorded are presented in Table F.2 and mapped in Figure F (Attachment F). All but three of the 15 weed species have been previously recorded in the HD2 Proposal area: **E. hirta, *M. repens* and **T. procumbens*, and a further five weed species: **Brassica tournefortii, *Chloris virgata*, **Datura leichhardtii* subsp. *leichhardtii, *Rumex vesicarius* and **Setaria verticillata* were recorded in the HD2 Proposal area only and are presented in Astron Environmental Services (2019).

4 Limitations

A number of limitations were encountered during the mapping consolidation; however, most of these were able to be overcome and therefore did not restrict the outcomes of the assessment. A summary of the limitations includes:

- The confidence of the consolidated vegetation mapping is limited by the consistency and quality of the previous adjacent surveys; the quality of previous survey effort is difficult to assess without ground-truthing. The development of confidence ratings assisted in indicating where there was uncertainty in the extrapolated mapping.
- Aerial imagery provided by Rio Tinto for the purposes of the vegetation mapping consolidation had been compiled from a number of separate images and the resolution was of low quality despite being quite recent. As such, imagery from other sources was used for the majority of the desktop mapping.
- There was low confidence in some previous vegetation mapping due to age or scale (Mattiske 1995, Mattiske Consulting 1995, 2009a, 2009b, 2010, Ecologia Environment 1997, Trudgen 1998)
- Some extensive areas had limited previous vegetation mapping, in particular the corridor connecting to the Yandicoogina project area. Vegetation extrapolation was limited to aerial imagery interpretation in these areas which led to low confidence in the vegetation mapping codes applied.
- The field survey was conducted during below mean seasonal conditions. Rainfall recorded in the 12 months prior to the survey in May 2019 was 110.1 mm, 210.2 mm less than the long-term mean. In the three months preceding the survey, 71.8 mm was recorded, 62.6 mm less than the long-term mean for the same period. This may have limited interpretation of some vegetation units and the opportunistic observation of some priority flora species with potential to occur.

5 Conclusions

The limitations outlined in this letter must be considered when interpreting the results; the majority of vegetation mapping and vegetation condition mapping has been extrapolated based on previous survey effort and aerial imagery, not all parts of the HD1 Development Envelope were accessed to verify the desktop mapping, and seasonal conditions were poor at the time of the ground-truthing. The confidence mapping assists in interpretation of the vegetation unit and vegetation condition mapping, however the conservation significant flora and weed locations presented and the interpretation of vegetation significance should not be considered comprehensive.

This letter was prepared by Principal Scientist Janelle Atkinson and reviewed by Senior Scientist Ben Eckermann. If you would like to discuss this further, please feel free to contact me on 9421 9600.

Yours sincerely
ASTRON ENVIRONMENTAL SERVICES



Dr Stuart Pearse
General Manager

Attachments

Attachment A: Vegetation Unit Maps

Attachment B: Quadrat Data

Attachment C: Vegetation Condition Maps

Attachment D: Confidence Mapping

Attachment E: Conservation Significant Flora Locations

Attachment F: Introduced Flora Locations

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Attachment A: Vegetation Unit Maps

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670000 680000 690000 700000 710000 720000

7480000 7470000 7460000 7450000 7440000

Map Extent
HD2 Proposal Survey Area
HD1 Development Envelope

HD2 Sampling Sites (Astron 2019)
Quadrat
Relevé
Vegetation Mapping Note

HD1 Sampling Sites
Quadrat
Relevé
Vegetation Mapping Note

Vegetation Unit

D1	H2	H12
D2	H3	P1
D3	H4	P2
D4	H5	P3
D5	H6	P4
D6	H7	P5
D7	H8	P6
D8	H9	P7
H1	H10	Cleared
	H11	

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A: Overview and legend for vegetation unit maps

Coordinate System: GDA 1994 MGA Zone 50

0 2 4 6 8 10 Kilometres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_VegUnitOverview_FigA

Vegetation of Drainage Lines

D1 *Corymbia hamersleyana* sens. lat., *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees to low open woodland over *Petalostylis labicheoides*, *Acacia monticola, A. maitlandii* scattered tall shrubs to tall shrubland over *Dodonaea lanceolata* var. *lanceolata, Androcalva luteiflora* scattered shrubs to open shrubland over *Triodia pungens* very open hummock grassland to open hummock grassland with *Themeda triandra*, *Eriachne mucronata* very open tussock grassland to open tussock grassland

D2 *Acacia aptaneura, A. catenulata* subsp. *occidentalis*, *A. pruinocarpa* tall shrubland to tall open scrub over *Petalostylis labicheoides* scattered shrubs to open shrubland over *Triodia pungens* very open hummock grassland with *Chrysopogon fallax* scattered tussock grasses

D3 *Corymbia ferriticola*, *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Petalostylis labicheoides*, *Acacia hamersleyensis, Dodonaea viscosa* subsp. *spatulata* tall open shrubland over *Triodia pungens* very open hummock grassland with *Eriachne mucronata*, *Themeda* sp. Mt Barricade (M.E. Trudgen 2471), *Cymbopogon ambiguus* very open tussock grassland to tussock grassland

D4 *Eucalyptus victrix*, (*E. camaldulensis* subsp. *obtusa*) low open woodland to open woodland over *Acacia citrinoviridis*, *Petalostylis labicheoides* scattered tall shrubs to tall shrubland over *Androcalva luteiflora*, *Gossypium sturtianum* var. *sturtianum* scattered shrubs to open shrubland over *Triodia longiceps* scattered hummock grasses to very open hummock grassland with *Themeda triandra*, *Eulalia aurea*, (**Cenchrus ciliaris*) very open tussock grassland to tussock grassland and **Bidens bipinnata* scattered herbs

D5 *Eucalyptus xerothermica* scattered low trees to low open woodland over *Petalostylis labicheoides, Acacia maitlandii*, *A. pyrifolia* tall open shrubland to tall shrubland over *Androcalva luteiflora* scattered shrubs over *Triodia longiceps* very open hummock grassland to open hummock grassland with *Themeda triandra*, *Eulalia aurea* open tussock grassland to tussock grassland and **Bidens bipinnata* scattered herbs

D6 *Melaleuca argentea, Eucalyptus camaldulensis* subsp. *obtusa, (E. victrix*) open forest over *Acacia citrinoviridis, Atalaya hemiglauca* scattered tall shrubs over *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) scattered low shrubs over *Cyperus vaginatus, Typha domingensis* scattered sedges

D7 *Acacia citrinoviridis, A. aptaneura, A. pruinocarpa* scattered tall shrubs to tall shrubland over *Senna artemisioides* subsp. *oligophylla* scattered low shrubs over *Triodia longiceps* open hummock grassland to hummock grassland

D8 *Eucalyptus xerothermica* scattered low trees to low open woodland over *Acacia aptaneura, A. catenulata* subsp. *occidentalis* tall open shrubland to tall open scrub over *Triodia pungens* scattered hummock grasses to very open hummock grassland with *Themeda triandra* very open tussock grassland to open tussock grassland

Vegetation of Plains

P1 *Acacia aptaneura*, *A. catenulata* subsp. *occidentalis*, (*A. pruinocarpa*) tall shrubland to tall open scrub over *Eremophila forrestii* subsp. *forrestii* open shrubland to shrubland over *Triodia pungens*, (*T. vanleeuwenii*) scattered hummock grasses to very open hummock grassland

P2 *Acacia aptaneura*, *A. pruinocarpa, A. tetragonophylla* scattered tall shrubs to tall open shrubland over *Eremophila forrestii* subsp. *forrestii, A. synchronicia* scattered shrubs over *Ptilotus obovatus, Sida fibulifera* scattered low shrubs over *Aristida latifolia*, *Astrebla elymoides*, *Eragrostis xerophila* open tussock grassland to tussock grassland

P3 *Acacia aptaneura*, *A. catenulata* subsp. *occidentalis*, *A. pruinocarpa* tall open shrubland to tall shrubland over *Eremophila forrestii* subsp. *forrestii* scattered shrubs to open shrubland over *Triodia pungens* open hummock grassland to hummock grassland

P4 *Acacia pruinocarpa, A. aptaneura*, *A. catenulata* subsp. *occidentalis* tall open shrubland to tall shrubland over *Rhagodia eremaea* scattered shrubs

P5 *Acacia aptaneura* tall shrubland over *Aristida obscura, Aristida ingrata, Themeda triandra* very open tussock grassland

P6 *Acacia aptaneura* scattered tall shrubs to tall open shrubland over *Ptilotus schwartzii* var. *schwartzii* scattered low shrubs over Poaceae sp., *Aristida contorta* scattered tussock grasses to very open tussock grassland

P7 *Acacia aptaneura, A. catenulata* subsp. *occidentalis*, (*Grevillea berryana*) tall shrubland over *Ptilotus schwartzii* var. *schwartzii* scattered low shrubs over *Triodia melvillei* scattered hummock grasses to very open hummock grassland over *Aristida contorta* scattered tussock grasses

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Hope Downs Development Envelope – Vegetation Mapping

Legend: Vegetation Unit Mapping

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Vegetation of Hills and Slopes

H1 *Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia hamersleyana* sens. lat. scattered low trees to low open woodland over *Petalostylis labicheoides, Senna glutinosa* subsp. *glutinosa* scattered tall shrubs over *Gompholobium oreophilum*, *Acacia hilliana, A. spondylophylla* low open shrubland to low shrubland over *Triodia vanleeuwenii*, *T. wiseana*, *T. pungens* open hummock grassland with *Amphipogon sericeus* scattered tussock grasses

H2 *Eucalyptus repullulans* scattered low mallees over *Acacia catenulata* subsp. *occidentalis*, *A. aptaneura*, (*Grevillea saxicola*) tall shrubland to tall open scrub over *Scaevola acacioides, Dodonaea pachyneura, Eremophila latrobei* subsp. *filiformis* scattered shrubs to open shrubland over *Triodia pungens* scattered hummock grasses to very open hummock grassland with *Eriachne mucronata* scattered tussock grasses to very open tussock grassland

H3 *Corymbia deserticola* subsp. *deserticola* scattered low trees over *Acacia inaequilatera*, *Hakea chordophylla* scattered tall shrubs to tall open shrubland over *Senna glutinosa* subsp. *pruinosa* scattered shrubs over *Triodia vanleeuwenii* open hummock grassland with *Amphipogon sericeus* scattered tussock grasses to very open tussock grassland

H4 *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Senna glutinosa* subsp. *glutinosa*, *S. glutinosa* subsp. *pruinosa* scattered shrubs over *Triodia vanleeuwenii* and/or *T. wiseana* open hummock grassland to hummock grassland

H5 *Eucalyptus socialis* subsp. *eucentrica* scattered low mallees to low open mallee woodland over *Acacia bivenosa* scattered tall shrubs to tall open shrubland over *Senna glutinosa* subsp. × *luerssenii* scattered shrubs over *Ptilotus obovatus* scattered low shrubs over *Triodia wiseana* very open hummock grassland to open hummock grassland

H6 *Acacia aptaneura*, *A. catenulata* subsp. *occidentalis* tall open shrubland to tall shrubland over *Eremophila forrestii* subsp. *forrestii*, *Senna stricta* scattered shrubs to open shrubland over *Triodia pungens* and/or *T. vanleeuwenii* and/or *T. wiseana* scattered hummock grasses to very open hummock grassland with *Eriachne mucronata* scattered tussock grasses

H7 *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees to low open woodland over *Senna glutinosa* subsp. *glutinosa, Acacia maitlandii* scattered shrubs over *Triodia wiseana* and/or *T. vanleeuwenii* and/or *T. pungens* open hummock grassland to hummock grassland

H8 *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees to low open woodland over *Acacia pruinocarpa*, *Hakea chordophylla* scattered tall shrubs to tall open shrubland over *Triodia vanleeuwenii*, (*T. pungens*) open hummock grassland to hummock grassland with *Amphipogon sericeus* scattered tussock grasses

H9 *Acacia arida, Grevillea wickhamii* subsp. *hispidula* open shrubland over *Triodia wiseana* open hummock grassland with *Themeda* sp. Mt Barricade (M.E. Trudgen 2471) very open tussock grassland

H10 *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees with *E. repullulans* and/or *E. socialis* subsp. *eucentrica* and/or *E. pilbarensis* scattered low mallees to low open mallee woodland over *Acacia bivenosa* scattered shrubs over *Triodia wiseana, (T. angusta)* open hummock grassland to hummock grassland

H11 *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees with *E. gamophylla* low open mallee woodland over *Acacia ancistrocarpa* scattered tall shrubs to tall open shrubland over *A. hilliana* scattered low shrubs to low open shrubland over *Triodia vanleeuwenii*, (*T. pungens*) open hummock grassland to hummock grassland

H12 *Corymbia hamersleyana* sens. lat. scattered low trees over *Acacia inaequilatera*, *Hakea chordophylla*, *A. bivenosa* scattered tall shrubs to tall open shrubland over *Senna artemisioides* subsp. *oligophylla* scattered low shrubs over *Triodia wiseana* open hummock grassland to hummock grassland with *Themeda* sp. Mt Barricade (M.E. Trudgen 2471), *Cymbopogon ambiguus* scattered tussock grasses and *Heliotropium ovalifolium, Corchorus lasiocarpus* subsp. *parvus* scattered herbs

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Hope Downs Development Envelope – Vegetation Mapping

Legend: Vegetation Unit Mapping

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672000

673000

7447000

7446000

7445000

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.1: Vegetation units

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Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

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674000 675000 676000 677000

7447000

7446000

Cleared

Cleared

GHMNKM18

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Figure A.2: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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674000 675000 676000 677000

7445000 7444000 7443000

GHMNKM17

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Figure A.3: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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678000 679000 680000 681000

7447000

7446000

GHMNKM20

GHMNKM23

Cleared

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Figure A.4: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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678000 679000 680000 681000

7445000 7444000 7443000

GH34 GH36 GH38 GH33 GHMNKM19

P1 P2 P3 P5 P6 P7 D2 Cleared

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Figure A.5: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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682000 683000 684000

7446000 7445000 7444000

H1 H2 H4 H8 D1 D2 P3 P5 P6 P7 P1 Cleared

GHMNKM21 GHMNKM22 GH37

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Figure A.6: Vegetation units

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Drawn: C. Dyde	Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_P_VegMap_FigA	Metres 0 100 200 300 400 500 N

685000 686000 687000 688000

7448000

7447000

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Figure A.7: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

685000
686000
687000
688000
7446000
7445000
7444000
H2
P3
D2
P6
P5
P1
Cleared
GH32
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Figure A.8: Vegetation units
Coordinate System: GDA 1994 MGA Zone 50
0 200 400 600 800 1,000 Metres
N
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Author: B. Eckermann
Drawn: C. Dyde
Date: 11-12-2019
Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

689000 690000 691000 692000

7450000

7449000

7448000

H11 D1 H11 D1 H11 D1

689000 690000 691000 692000

7447000

7446000

Cleared

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Figure A.10: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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693000 694000 695000 696000

7451000

7450000

7449000

H11 H7 H8 D1 D2 P3 Cleared

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Figure A.11: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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693000 694000 695000 696000

7448000

7447000

7446000

GHMNKM04
GHMNKM02
GHMNKM03
GHMNKM01
GHMNBE004
GHMNLD01
GHMNLD02
HD29

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Figure A.12: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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693000
694000
695000
696000
7445000
7444000
HDS1
Cleared
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Figure A.13: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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697000 698000 699000 700000

7451000

7450000

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Figure A.14: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Figure A.15: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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697000 698000 699000 700000

7446000

7445000

HD27 HD31 HD25 HD32 HD34 HD50 HD21 MNMH18 MNLV13 MNLV12

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Figure A.16: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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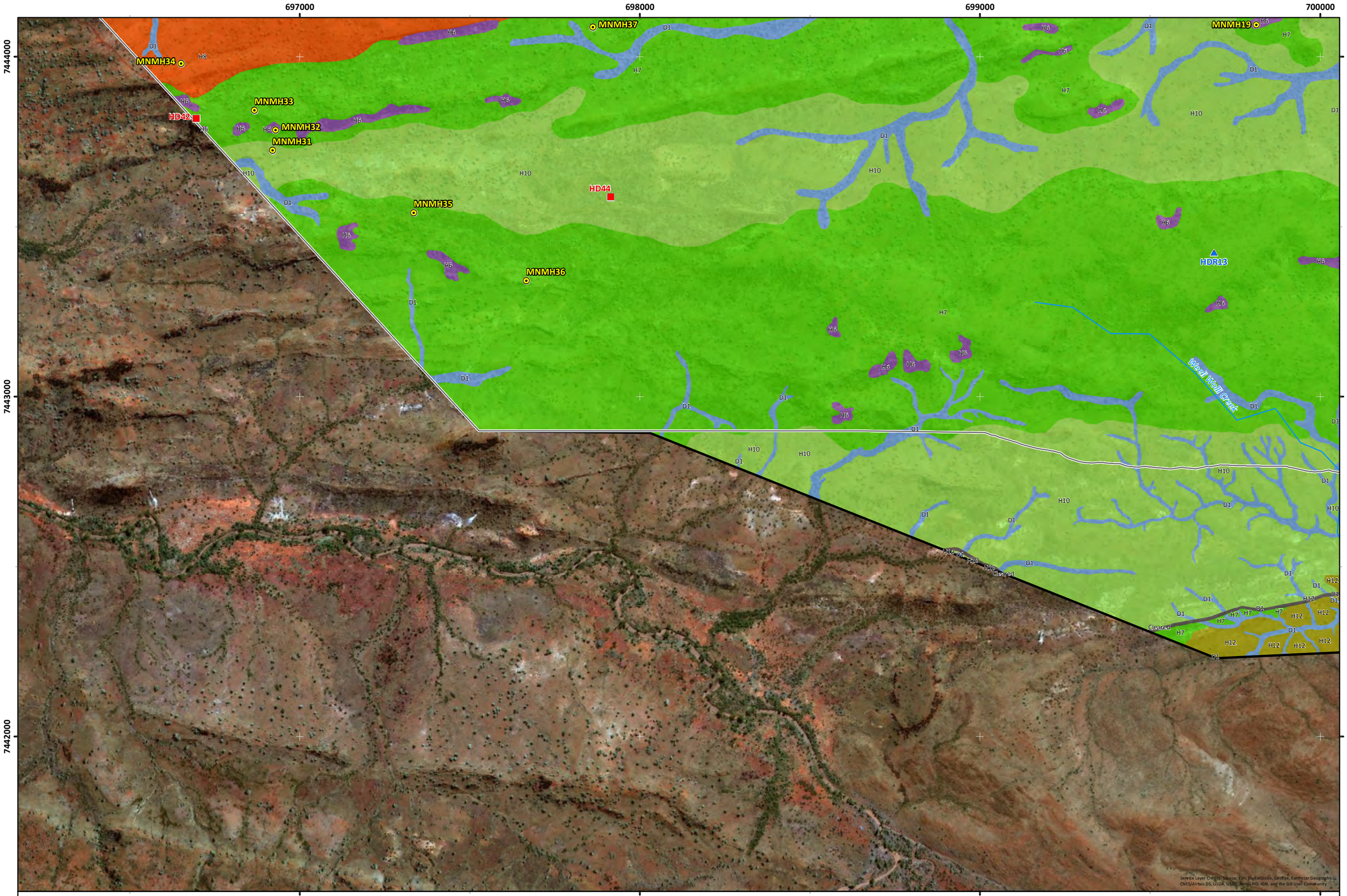

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.17: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

701000
702000
703000
7453000
7452000
D4
D7
P3
H8
D1
D2
P1
Cleared
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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.18: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

701000 702000 703000

7451000 7450000 7449000

Cleared

MNBE11

MNBE10

HD49

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.19: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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701000 702000 703000

7448000

7447000

GHR10
GHMNBE007
GHR28
GH27
HD01
GH01
HDR19

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Figure A.20: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 11-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

701000 702000 703000

7446000 7445000 7444000

HD08 HD22 HD23

MNMH28 MNBE02

HDR03 HDR18

Cleared

Weir Well Creek

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.21: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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701000 702000 703000

7443000 7442000

MNLV07

GH06 GH05 GH04

GHMNBE003

Cleared

Weeli Wolli Creek

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Figure A.22: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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704000 705000 706000 707000

7455000

7454000

7453000

Cleared

Cleared

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Figure A.23: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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704000 705000 706000 707000

7452000

7451000

7450000

Pebble Mouse Creek

Cleared

MNBE13

MNBE14

HD53

HD48

HD52

GH11

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.24: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

704000
705000
706000
707000
7449000
7448000
MNBE12
MNBE15
MNBE09
HD54
HD55
HD02
GH03
GH02
GH12
GHMNBE005
GHMNBE008
Cleared
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.25: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

astron delivering environmental intelligence™

Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

704000 705000 706000 707000

7447000 7446000 7445000

GH09 GH07 GH08 HD12 HD10 HD09 HD28 HD11 HD30 HD14 HD18 HD16 HDR07 HDR05 MNLV01 MNMH01 MNMH27 MNLV02 MNMH07 MNMH02 MNMH06 MNMH03 MNMH04 MNMH05

Weeli Wolli Creek

Cleared

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.26: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

astron delivering environmental intelligence™

Author: B. Eckermann Drawn: C. Dyde Date: 11-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

704000 705000 706000 707000

7444000

7443000

Weeli Wolli Creek

MNLV05 MNLV04 MNLV06 HDR09

MNMH16 MNMH17 HD33 MNMH15 MNMH10 MNMH14 MNMH09 HD19 HD17 MNMH11 MNMH12 HD47 MNMH13

Cleared

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.27: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

708000 709000 710000 711000

7456000

7455000

Cleared

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Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.28: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

708000 709000 710000 711000

7454000

7453000

7452000

BHD10-AR

Cleared

Cleared

Cleared

Pebble Mouse Creek

Pebble Mouse Creek

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.29: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

708000 709000 710000 711000

7451000

7450000

GHR16 HDR10 HDR16 MNBE08 MNBE07 HD26 HD03 GHR80 GH11 HD46 MNMH23 MNMH22 MNMH24 MNMH21 HD40 HD39 HD35 MNMH20 MNMH25 HDR02 MNLV09 MNMH26 MNLV08 HD41

Cleared

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.30: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 11-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

708000 709000 710000 711000

7449000

7448000

7447000

GHMNKM05

GH13

GH15

Weeli Wolli Creek

Weeli Wolli Creek

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.31: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

718000 719000 720000

7478000 7477000 7476000 7475000

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.32: Vegetation units

Author: B. Eckermann	Date: 11-12-2019	Coordinate System: GDA 1994 MGA Zone 50
Drawn: C. Dyde	Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_P_VegMap_FigA	0 100 200 300 400 500 Metres

N

astron
delivering environmental intelligence™

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

716000

717000

718000

7474000

7473000

7472000

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.33: Vegetation units

Author: B. Eckermann	Date: 11-12-2019	Coordinate System: GDA 1994 MGA Zone 50
Drawn: C. Dyde	Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_P_VegMap_FigA	Metres 0 100 200 300 400 500

N

astron delivering environmental intelligence™

714000 715000 716000

7471000 7470000 7469000

Cleared

H7 H8 H11 D1 D4

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Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.34: Vegetation units

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Author: B. Eckermann	Date: 11-12-2019	Coordinate System: GDA 1994 MGA Zone 50
Drawn: C. Dyde	Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_P_VegMap_FigA	0 100 200 300 400 500 Metres; N

711000 712000 713000

7468000 7467000 7466000

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.35: Vegetation units

Author: B. Eckermann	Date: 11-12-2019	Coordinate System: GDA 1994 MGA Zone 50
Drawn: C. Dyde	Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_P_VegMap_FigA	0 100 200 300 400 500 Metres

N

astron delivering environmental intelligence™

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

711000 712000 713000 714000

7465000 7464000 7463000

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.36: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 11-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

712000 713000 714000 715000

7462000

7461000

Cleared

Cleared

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.37: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

712000 713000 714000 715000

7460000

7459000

7458000

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.38: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

712000 713000 714000 715000

7457000

7456000

Cleared

Cleared

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.39: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 11-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

712000 713000 714000 715000

7455000 7454000 7453000

BHD05-AR
GHMNKM13
GHMNDR03
GH24
Cleared
Pebble Mouse Creek

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.40: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 11-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

712000 713000 714000 715000

7452000 7451000 7450000

GHMNKM16 Pebble Mouse Creek Pebble Mouse Creek GH17 HD05 MNBE03 HD24 HD04 HD07 Cleared

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.41: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 11-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

712000 713000 714000 715000

7449000

7448000

HDR01

Weeli Wolli Creek

Weeli Wolli Creek

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.42: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 11-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

716000 717000 718000 719000

7462000

7461000

Cleared

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.43: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 11-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

716000 717000 718000 719000

7460000 7459000 7458000

Cleared

GHMNKM14

GHMNKM15

Pebble Mouse Creek

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.44: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

astron delivering environmental intelligence™

Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

716000 717000 718000 719000

7457000

7456000

GH21
GH22
GH23
GH26
GHMNKM07
GHMNKM08
GHMNDR02
GHMNBE010
GH25
Pebble Mouse Creek
Cleared

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.45: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

716000
717000
718000
719000
7455000
7454000
7453000
GHMNDR01
GH20
Pebble Mouse Creek
Pebble Mouse Creek
Cleared
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.46: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

716000 717000 718000 719000

7452000

7451000

7450000

GHMNKM06 GH19 HD43 HD06 HD37 MNMH08 HDR11 MNLV03 HDR08 HD13 HD15

Pebble-Mouse Creek

Cleared

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.47: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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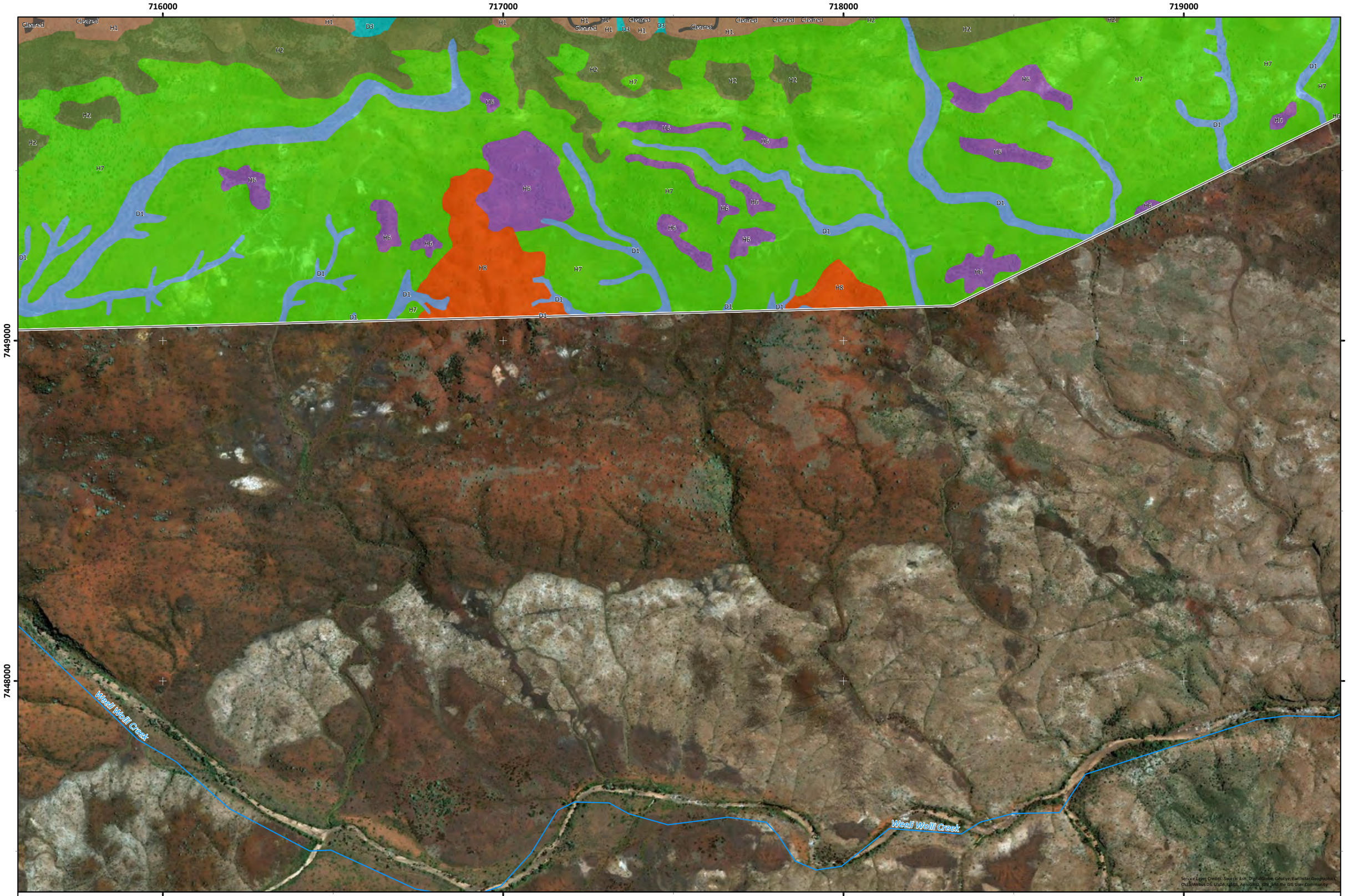
Author: B. Eckermann Drawn: C. Dyde Date: 11-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA



Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.48: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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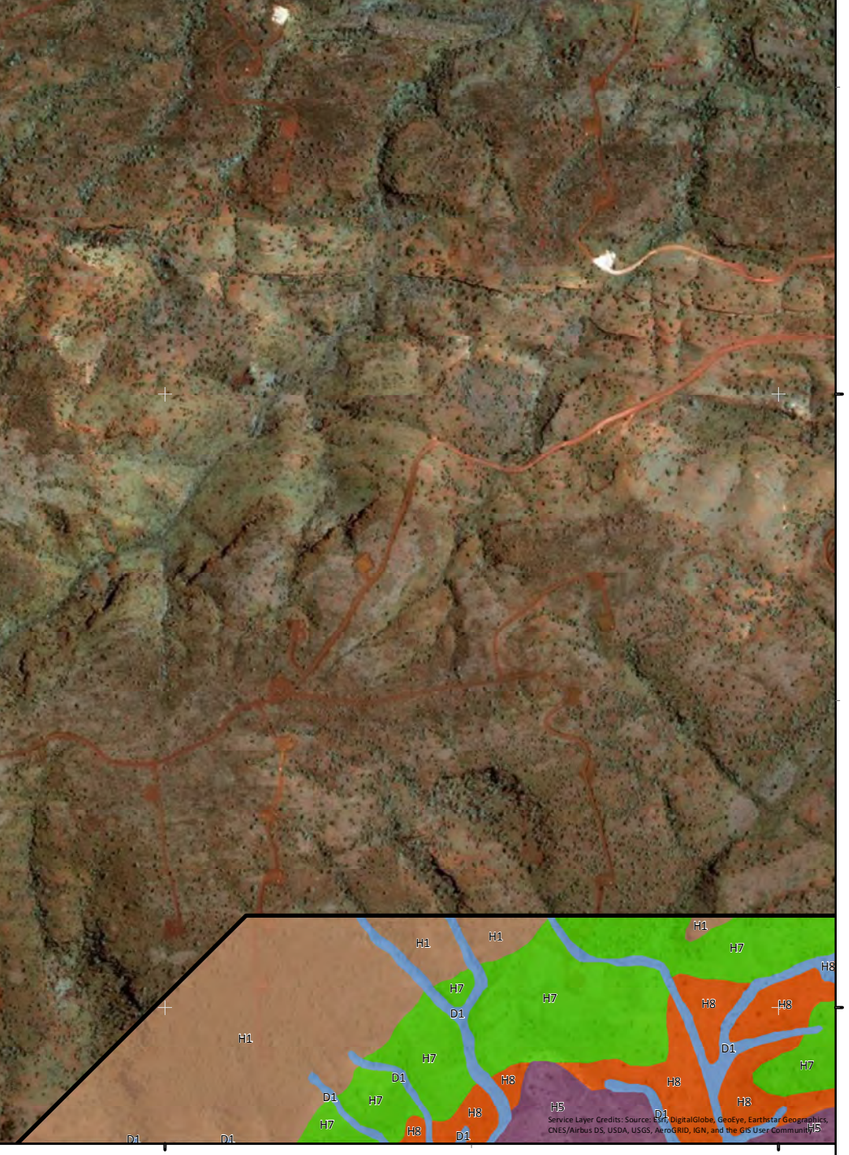
Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

720000 721000 722000 723000

7465000

7464000

7463000



Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.49: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

720000 721000 722000 723000

7462000

7461000

Weeli Wolli Creek

Pebble Mouse Creek

Cleared

Cleared

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.50: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

720000 721000 722000 723000

7460000 7459000 7458000

Pebble Mouse Creek

Weal Well Creek

GH31

Cleared

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.51: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 11-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

720000 721000 722000 723000

7457000

7456000

GHMNBE009

GHMNKM08

GHMNKM09

GHMNKM10

GHMNKM11

West Wolli Creek

Cleared

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.52: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 11-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

720000 721000 722000 723000

7455000 7454000 7453000

GHMNKM12 GH13 GH14

West Wolli Creek

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.53: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 11-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

720000 721000 722000 723000

7452000 7451000 7450000

HDR14 MNBE06 MNBE04 MNBE05 HD38 HDR12 HDR06 MNBE01 HDR04

Cleared

West Well Creek

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.54: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

720000
721000
722000
723000
7449000
7448000
D1
H6
H7
H8
H5
West Wolli Creek
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.55: Vegetation units

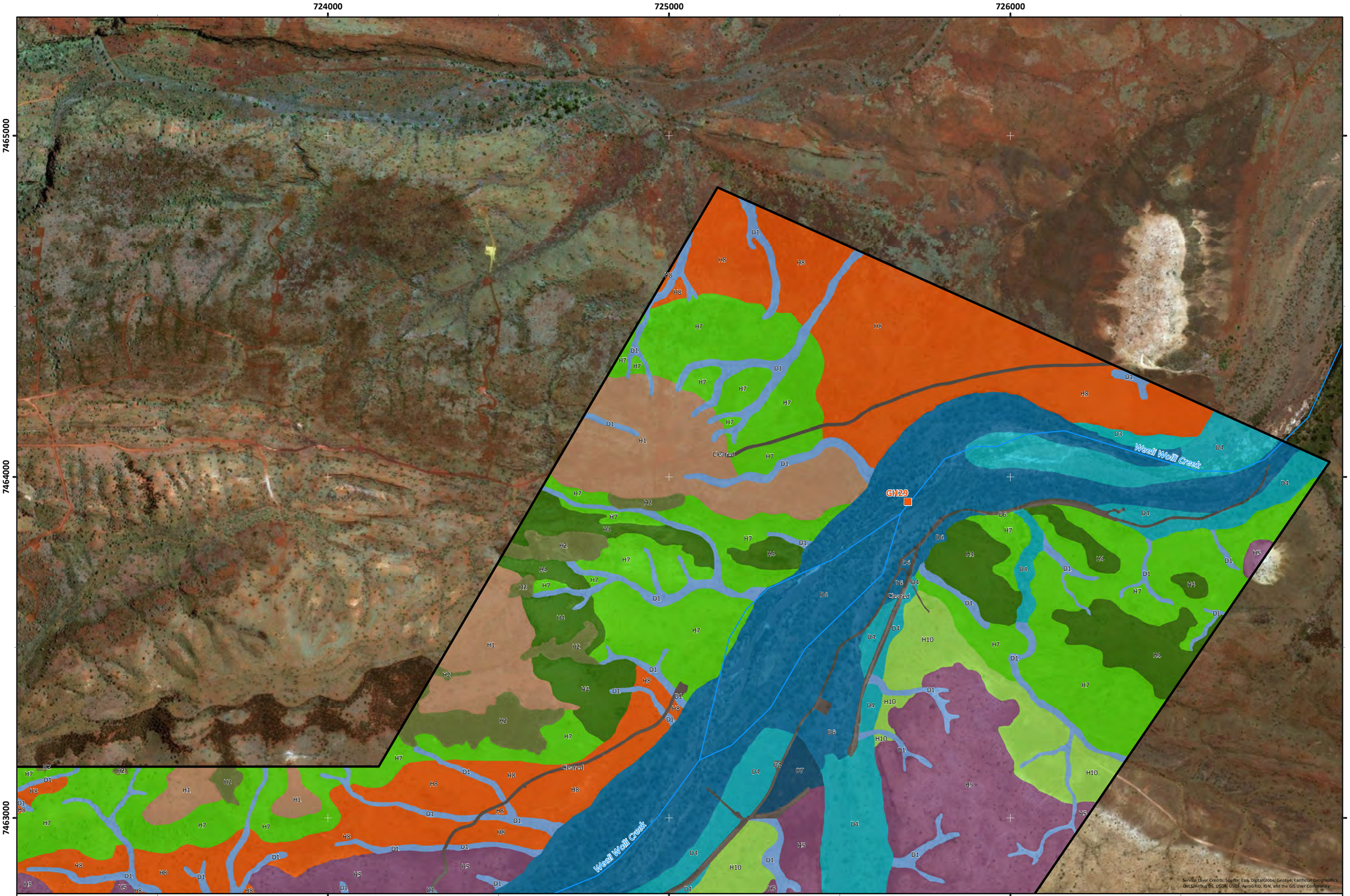
Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

astron
delivering environmental intelligence™

Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA



Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.56: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

724000 725000 726000

7462000

7461000

GH35

Weeli Wolli Creek

Cleared

H5 D1 H8 H10 D4

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.57: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 11-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

724000
725000
726000
7460000
7459000
7458000
H5
D1
H10
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure A.58: Vegetation units

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

astron delivering environmental intelligence™

Author: B. Eckermann | Drawn: C. Dyde | Date: 11-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191211_HD1_LS_VegMap_FigA

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Attachment B: Quadrat Data

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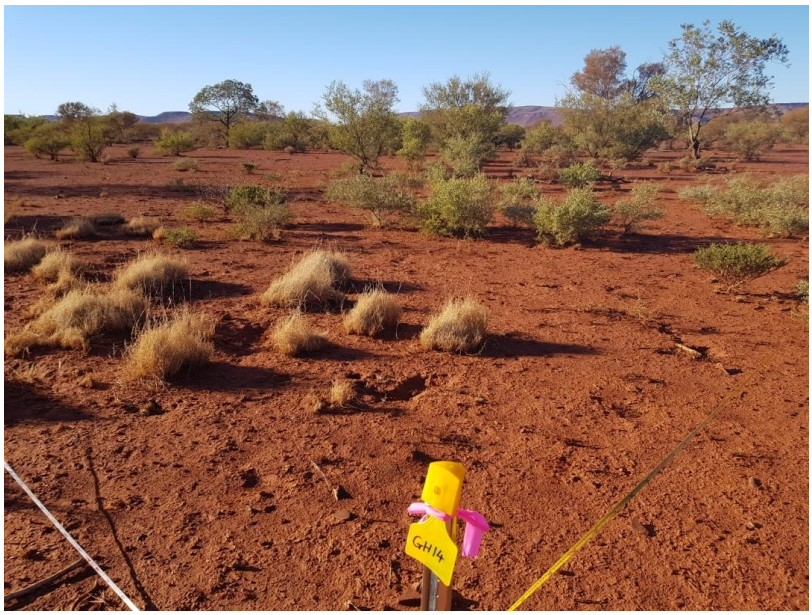
Site: GH14
Location: HD1 Development Envelope **Type:** Quadrat
Phase 3 Date: 25/05/2019 **Described by:** LD
MGA Zone: 50 **Easting:** 722186 **Northing:** 7453979
Habitat: Plain
Soil: Light reddish brown clay loam
Rock type: Ironstone
Veg code: P4
Vegetation: *Acacia synchronicia* and *Acacia macraneura* tall open shrubland over *Rhagodia eremaea* scattered shrubs
Veg Condition: Very Good
Fire Age: Very long unburnt



Species List:

Name	Cover (%)	Height (m)
Abutilon cryptopetalum	0.1	0.2
Abutilon leucopetalum	0.1	0.1
Abutilon otocarpum	0.1	0.2
Acacia aptaneura	0.1	0.3
Acacia bivenosa	0.1	0.6
Acacia inaequilatera	0.1	0.1
Acacia macraneura	1	6.5
Acacia pruinocarpa	0.5	5
Acacia sibirica	0.1	1.2
Acacia synchronicia	8	3.1
Aristida contorta	0.1	0.1
Aristida ingrata	0.1	1

Name	Cover (%)	Height (m)
Boerhavia schomburgkiana	0.1	0.1
Cynodon convergens	0.1	0.1
Dicladanthera forrestii	0.1	0.1
Duperreya commixta	0.1	0.1
Enchylaena tomentosa var. *tomentosa*	0.1	0.6
Enneapogon lindleyanus	0.1	0.5
Enneapogon polyphyllus	0.1	0.1
Eragrostis xerophila	0.5	0.4
Eremophila canaliculata	0.1	0.5
Eremophila forrestii subsp. *forrestii*	0.1	0.8
Eriachne obtusa	0.1	0.2
Evolvulus alsinoides var. *villosicalyx*	0.1	0.1
Maireana georgei	0.1	0.1
Maireana tomentosa subsp. *tomentosa*	0.1	0.1
**Malvastrum americanum*	0.1	0.2
Neptunia dimorphantha	0.1	0.2
Pterocaulon sphacelatum	0.1	0.3
Ptilotus exaltatus	0.1	0.1
Ptilotus obovatus	0.1	0.3
Rhagodia eremaea	1	1.1
Rhynchosia minima	0.1	0.1
Salsola australis	0.1	0.1
Sclerolaena cornishiana	0.1	0.2
Senna artemisioides subsp. *helmsii*	0.1	0.8
Senna sp. Meekatharra (E. Bailey 1-26)	0.1	0.5
Senna stricta	0.1	0.6
Sida fibulifera	0.1	0.1
Sida platycalyx	0.1	0.1
Solanum lasiophyllum	0.1	0.2
Sporobolus australasicus	0.1	0.1

* denotes weed species

Site: GH18
Location: HD1 Development Envelope **Type:** Quadrat
Phase 3 Date: 25/05/2019 **Described by:** LD
MGA Zone: 50 **Easting:** 720656 **Northing:** 7454891
Habitat: Hillslope
Soil: Brown Sandy clay loam
Rock type: Calcrete
Veg code: H5
Vegetation: *Eucalyptus socialis* subsp. *eucentrica* low open woodland over *Acacia bivenosa*, *Eremophila fraseri* subsp. *fraseri* and *Acacia sibirica* tall open shrubland over *Triodia wiseana* open hummock grassland
Veg Condition: Excellent
Fire Age: Very long unburnt



Species List:

Name	Cover (%)	Height (m)
Acacia bivenosa	3	2.4
Acacia sibirica	2	2.5
Androcalva luteiflora	0.1	0.4
Anthobolus leptomerioides	0.1	1.5
Corchorus lasiocarpus subsp. *parvus*	0.1	0.4
Enneapogon polyphyllus	0.1	0.1
Eremophila fraseri subsp. *fraseri*	2	2.1
Eucalyptus socialis subsp. *eucentrica*	8	4
Hibiscus sturtii var. *platychlamys*	0.1	0.3
Indigofera monophylla	0.1	0.1
Jasminum didymum subsp. *lineare*	0.1	0.1
Poaceae sp.	0.1	0.1

Name	Cover (%)	Height (m)
Ptilotus incanus	0.5	0.6
Ptilotus obovatus	0.1	0.4
Senna artemisioides subsp. *helmsii*	0.5	1.1
Senna artemisioides subsp. *oligophylla*	0.1	1.2
Senna glutinosa subsp. x *luerssenii*	0.1	1.2
Solanum lasiophyllum	0.1	0.6
Triodia wiseana	25	0.6

Site: GH29
Location: HD1 Development Envelope **Type:** Quadrat
Phase 3 Date: 28/05/2019 **Described by:** LD
MGA Zone: 50 **Easting:** 725750 **Northing:** 7463926
Habitat: Major creek
Soil: Light reddish brown sandy clay
Veg Code: D6
Vegetation: *Melaleuca argentea*, *Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* open forest over *Acacia citrinoviridis* scattered tall shrubs over *Typha domingensis* scattered shrubs
Veg Condition: Very Good
Fire Age: Very long unburnt



Species List:

Name	Cover (%)	Height (m)
Abutilon otocarpum	0.1	0.3
Acacia ampliceps	0.1	0.6
Acacia bivenosa	0.1	0.5
Acacia citrinoviridis	1	5
Acacia pyrifolia	0.1	0.3
Acacia tetragonophylla	0.1	0.8
Adriana tomentosa var. *tomentosa*	0.1	0.2
Amaranthus mitchellii	0.1	0.1
Amaranthus undulatus	0.1	0.3
Atalaya hemiglauca	0.1	4
**Bidens bipinnata*	0.1	0.1
Boerhavia schomburgkiana	0.1	0.1
Cassytha filiformis	0.1	8

Name	Cover (%)	Height (m)
**Cenchrus ciliaris*	0.1	0.3
Cleome viscosa	0.1	0.1
Clerodendrum tomentosum var. *lanceolatum*	0.1	0.6
**Conyza bonariensis*	0.1	0.2
Corchorus crozophorifolius	0.1	0.8
Crotalaria novae-hollandiae subsp. *novae-hollandiae*	0.1	0.1
Cucumis variabilis	0.1	1
Cymbopogon ambiguus	0.1	0.5
**Cynodon dactylon*	0.1	0.3
Cyperus vaginatus	0.5	0.6
Digitaria ctenantha	0.1	0.1
Dodonaea lanceolata var. *lanceolata*	0.1	0.6
Dysphania melanocarpa forma *melanocarpa*	0.1	0.1
Enneapogon caerulescens	0.1	0.3
Eucalyptus camaldulensis subsp. *obtusa*	18	22
Eucalyptus victrix	1	14
Eulalia aurea	0.1	0.3
Euphorbia biconvexa	0.1	0.1
**Euphorbia hirta*	0.1	0.1
Evolvulus alsinoides var. *decumbens*	0.1	0.1
Evolvulus alsinoides var. *villosicalyx*	0.1	0.1
**Flaveria trinervia*	0.1	0.2
Glycine canescens	0.1	0.1
Gomphrena cunninghamii	0.1	0.2
Gossypium robinsonii	0.1	0.3
Gossypium sturtianum var. *sturtianum*	0.1	0.3
**Lactuca serriola*	0.1	0.3
Lobelia arnhemiaca	0.1	0.1
**Malvastrum americanum*	0.1	0.3
Melaleuca argentea	30	12
Notoleptopus decaisnei var. Orbicularis (A.B. Craig 428)	0.1	0.2
Paspalidium rarum	0.1	0.2
Perotis rara	0.1	0.1
Phyllanthus maderaspatensis	0.1	0.1
Pluchea rubelliflora	0.1	0.1
Ptilotus exaltatus	0.1	0.1

Name	Cover (%)	Height (m)
Rhynchosia minima	0.1	0.1
Sesbania cannabina	0.1	0.2
**Setaria verticillata*	0.1	0.2
**Sigesbeckia orientalis*	0.1	0.3
**Solanum nigrum*	0.1	0.3
**Sonchus oleraceus*	0.1	0.1
Sp. indet	0.1	0.1
Sporobolus australasicus	0.1	0.1
Stemodia sp.	0.1	0.2
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	0.1	0.4
Themeda triandra	0.1	0.6
Triodia longiceps	0.1	0.2
Typha domingensis	1	1.4
**Vachellia farnesiana*	0.1	1.5
Vigna lanceolata var. *lanceolata*	0.1	0.1

* denotes weed species

Site: GH31
Location: HD1 Development Envelope **Type:** Quadrat
Phase 3 Date: 29/05/2019 **Described by:** DR
MGA Zone: 50 **Easting:** 721467 **Northing:** 7459243
Habitat: Rise slope
Soil: Brown Clay loam
Rock type: Calcrete, Ironstone, Quartz
Veg code: H5
Vegetation: *Eucalyptus socialis* subsp. *eucentrica* low open woodland over *Acacia bivenosa* open shrubland over *Triodia wiseana* open hummock grassland
Veg Condition: Excellent
Fire Age: Very long unburnt
Notes: Old disturbance in NE corner



Species List:

Name	Cover (%)	Height (m)
Acacia bivenosa	2	1.5
Acacia citrinoviridis	0.1	1
Acacia pruinocarpa	0.1	1.6
Androcalva luteiflora	0.1	1.6
Eucalyptus socialis subsp. *eucentrica*	6	3.3
Halgania gustafsenii var. *gustafsenii*	0.1	0.2
Heliotropium ovalifolium	0.1	0.2
Petalostylis labicheoides	0.1	3.5
Ptilotus obovatus	0.1	0.5
Senna artemisioides subsp. *oligophylla*	0.1	0.8
Senna glaucifolia	0.1	1.2
Senna glutinosa subsp. x *luerssenii*	0.1	1.2

Name	Cover (%)	Height (m)
Solanum lasiophyllum	0.1	0.7
Triodia wiseana	28	0.4

Site: GH32
Location: HD1 Development Envelope **Type:** Quadrat
Phase 3 Date: 30/05/2019 **Described by:** DR
MGA Zone: 50 **Easting:** 686019 **Northing:** 7445227
Habitat: Clay plain
Soil: Red brown Silty clay
Rock type: Ironstone, Quartz
Veg code: P5
Vegetation: *Corymbia deserticola* subsp. *deserticola* scattered low trees over *Acacia aptaneura* tall shrubland over *Sida calyxhymenia* scattered shrubs over *Triodia pungens* scattered hummock grasses with *Aristida obscura* and *Themeda triandra* very open tussock grassland
Veg Condition: Excellent
Fire Age: >10 years



Species List:

Name	Cover (%)	Height (m)
Abutilon fraseri subsp. *fraseri*	0.1	0.1
Acacia aptaneura	15	7
Anthobolus leptomerioides	0.1	0.8
Aristida contorta	0.1	0.2
Aristida ingrata	0.5	0.8
Aristida obscura	1	0.4
Cheilanthes sieberi subsp. *sieberi*	0.1	0.1
Chrysopogon fallax	0.1	0.1
Codonocarpus cotinifolius	0.1	3
Corymbia deserticola subsp. *deserticola*	1	3
Cymbopogon obtectus	0.1	0.3
Digitaria ammophila	0.1	0.5

Name	Cover (%)	Height (m)
Duperreya commixta	0.1	2
Enchylaena tomentosa var. *tomentosa*	0.1	0.3
Enneapogon polyphyllus	0.1	0.2
Eremophila forrestii subsp. *forrestii*	0.5	0.9
Eremophila lanceolata	0.1	1.7
Evolvulus alsinoides var. *villosicalyx*	0.1	0.1
Hakea chordophylla	0.1	0.5
Iseilema sp.	0.1	0.05
Maireana tomentosa subsp. *tomentosa*	0.1	0.3
Perotis rara	0.1	0.1
Psydrax suaveolens	0.1	1.2
Pterocaulon sp.	0.1	0.1
Ptilotus exaltatus	0.1	0.3
Ptilotus helipteroides	0.1	0.1
Ptilotus obovatus	0.5	0.6
Ptilotus schwartzii var. *schwartzii*	0.1	0.3
Rhagodia sp. Hamersley (M. Trudgen 17794) P3	0.1	1.5
Salsola australis	0.1	0.3
Sclerolaena cornishiana	0.1	0.2
Sida calyxhymenia	1.5	1.3
Sida fibulifera	0.1	0.1
Solanum lasiophyllum	0.1	0.5
Themeda triandra	0.1	0.4
Triodia pungens	1	0.3

Site: GH33
Location: HD1 Development Envelope **Type:** Quadrat
Phase 3 Date: 30/05/2019 **Described by**: LD
MGA Zone: 50 **Easting:** 679150 **Northing:** 7444005
Habitat: Plain
Soil: Light reddish brown Clay loam
Rock type: Ironstone
Veg code: P7
Vegetation: *Acacia aptaneura*, *Acacia catenulata* subsp. *occidentalis* and *Grevillea berryana* tall shrubland over *Triodia melvillei* very open hummock grassland
Veg Condition: Very Good
Fire Age: Very long unburnt



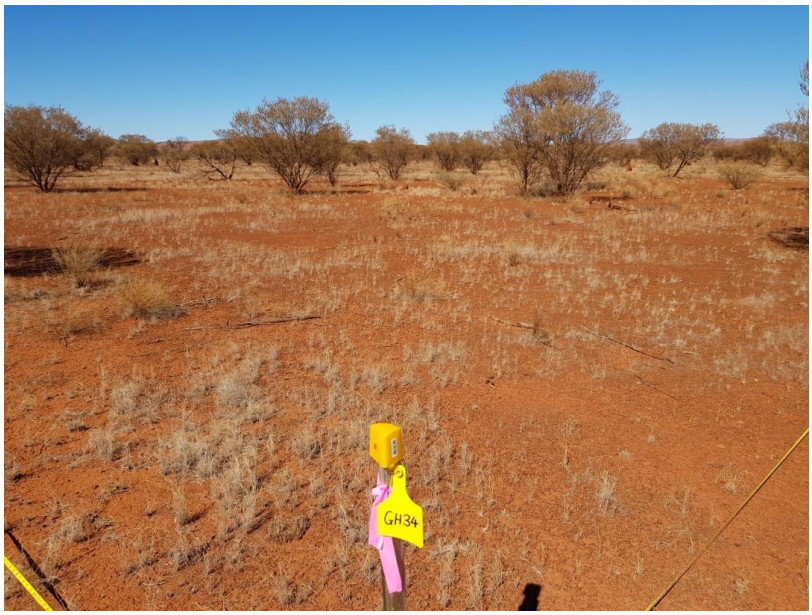
Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	12	3
Acacia catenulata subsp. *occidentalis*	8	5.5
Aristida contorta	0.5	0.1
Aristida obscura	0.1	0.1
Aristida sp.	0.1	0.4
**Bidens bipinnata*	0.1	0.1
Cheilanthes sieberi subsp. *sieberi*	0.1	0.1
Digitaria ammophila	0.1	0.1
Enneapogon sp.	0.1	0.1
Eremophila latrobei subsp. *filiformis*	0.1	1.2
Grevillea berryana	2	4
Hibiscus sp.	0.1	0.5

Name	Cover (%)	Height (m)
Maireana tomentosa subsp. *tomentosa*	0.1	0.2
Poaceae sp.	0.1	0.2
Polycarpaea corymbosa var. *corymbosa*	0.1	0.1
Psydrax latifolia	1	2.2
Psydrax suaveolens	0.1	1.2
Ptilotus obovatus	0.1	0.5
Ptilotus roei	0.1	0.1
Ptilotus schwartzii var. *schwartzii*	0.1	0.3
Rhagodia sp. Hamersley (M. Trudgen 17794) P3	0.1	2.2
Sida calyxhymenia	0.1	0.3
Solanum lasiophyllum	0.1	0.3
Triodia melvillei	2	0.4

* denotes weed species

Site: GH34
Location: HD1 Development Envelope **Type:** Quadrat
Phase 3 Date: 30/05/2019 **Described by:** LD
MGA Zone: 50 **Easting:** 678896 **Northing:** 7445314
Habitat: Plain
Soil: Light reddish brown Light clay
Rock type: Ironstone
Veg code: P6
Vegetation: *Acacia aptaneura* tall open shrubland over *Ptilotus schwartzii* var. *schwartzii* scattered low shrubs over *Aristida* sp. scattered tussock grasses
Veg Condition: Very Good
Fire Age: Very long unburnt



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	6	3.5
Acacia catenulata subsp. *occidentalis*	0.1	5
Aristida contorta	0.1	0.1
Aristida sp.	1	0.3
Asteraceae sp.	0.1	0.2
**Bidens bipinnata*	0.1	0.1
Cheilanthes sieberi subsp. *sieberi*	0.1	0.2
Digitaria ammophila	0.1	0.2
Enchylaena tomentosa var. *tomentosa*	0.1	0.2
Eragrostis sp.	0.1	0.1
Gomphrena sp.	0.1	0.1
Ptilotus obovatus	0.1	0.3

Name	Cover (%)	Height (m)
Ptilotus roei	0.1	0.1
Ptilotus schwartzii var. *schwartzii*	1	0.3
Rhagodia sp. Hamersley (M. Trudgen 17794) P3	0.1	0.5
Solanum lasiophyllum	0.1	0.1

* denotes weed species

Site: GH35
Location: HD1 Development Envelope **Type:** Quadrat
Phase 3 Date: 29/05/2019 **Described by:** LD
MGA Zone: 50 **Easting:** 724508 **Northing:** 7462708
Habitat: Major creek
Soil: Light reddish brown Sandy clay
Veg Code: D6
Vegetation: *Melaleuca argentea*, *Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* open forest over *Acacia citrinoviridis* scattered tall shrubs over *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) scattered low shrubs
Veg Condition: Good
Fire Age: Very long unburnt



Species List:

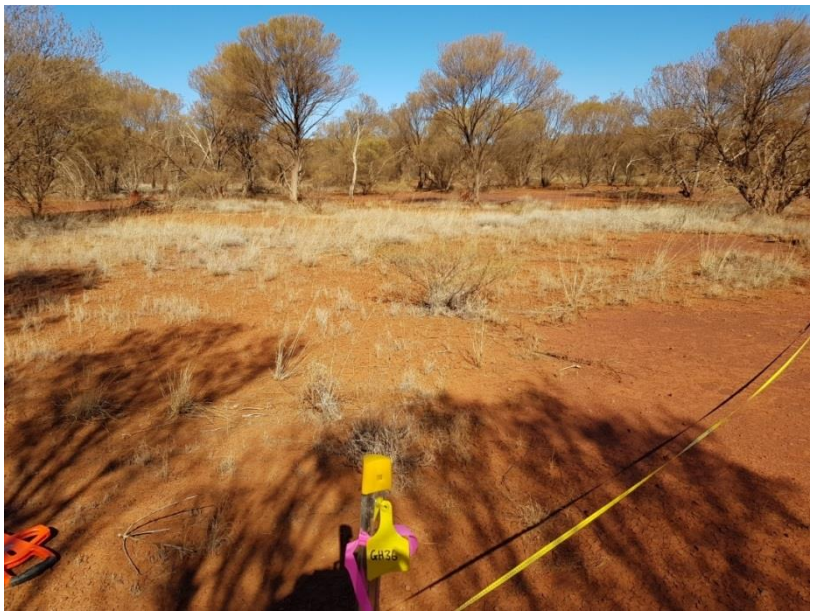
Name	Cover (%)	Height (m)
Acacia bivenosa	0.1	1.1
Acacia citrinoviridis	1	4
Acacia pyrifolia	0.1	2.5
Acacia tetragonophylla	0.1	0.2
Amaranthus mitchellii	0.1	0.2
Amaranthus undulatus	0.1	0.2
Atalaya hemiglauca	0.5	3
**Bidens bipinnata*	0.1	0.1
Bonamia pilbarensis	0.1	0.1
Bothriochloa ewartiana	0.1	0.2
**Cenchrus ciliaris*	0.1	0.3
**Cenchrus setiger*	0.1	0.3

Name	Cover (%)	Height (m)
Cleome viscosa	0.1	0.2
Clerodendrum tomentosum var. *lanceolatum*	0.1	0.2
Corchorus crozophorifolius	0.1	0.9
Cymbopogon ambiguus	0.1	0.4
**Cynodon dactylon*	0.1	0.4
Cyperus vaginatus	0.5	0.3
Dicladanthera forrestii	0.1	0.2
Duperreya commixta	0.1	0.1
Dysphania melanocarpa forma *melanocarpa*	0.1	0.1
Eragrostis cumingii	0.1	0.2
Eriachne pulchella subsp. *dominii*	0.1	0.2
Eucalyptus camaldulensis subsp. *obtusa*	18	17
Eucalyptus victrix	2	15
Eulalia aurea	0.1	0.4
Euphorbia biconvexa	0.1	0.2
Evolvulus alsinoides var. *villosicalyx*	0.1	0.1
Goodenia sp.	0.1	0.1
Gossypium robinsonii	0.1	1.5
Josephinia eugeniae	0.1	0.2
**Lactuca serriola*	0.1	0.4
**Malvastrum americanum*	0.1	0.2
Melaleuca argentea	35	12
**Melinis repens*	0.1	0.5
Paspalidium rarum	0.1	0.2
Phyllanthus maderaspatensis	0.1	0.2
Pluchea dentex	0.1	0.2
Pluchea rubelliflora	0.1	0.4
Polycarpaea corymbosa var. *corymbosa*	0.1	0.2
Pterocaulon sp.	0.1	0.1
Ptilotus exaltatus	0.1	0.1
Rhagodia eremaea	0.1	0.3
Rhynchosia minima	0.1	0.2
Rostellularia adscendens var. *clementii*	0.1	0.2
**Solanum nigrum*	0.1	0.2
**Sonchus oleraceus*	0.1	0.1
Sporobolus australasicus	0.1	0.1

Name	Cover (%)	Height (m)
Stemodia grossa	0.1	0.4
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	1	0.6
Themeda triandra	0.1	0.5
Typha domingensis	0.1	1.2
Vigna lanceolata var. *lanceolata*	0.1	0.1

* denotes weed species

Site: GH36
Location: HD1 Development Envelope **Type:** Quadrat
Phase 3 Date: 30/05/2019 **Described by:** LD
MGA Zone: 50 **Easting:** 681093 **Northing:** 7444679
Habitat: Plain
Soil: Light reddish brown Clay loam
Rock type: Ironstone
Veg code: P5
Vegetation: *Acacia aptaneura* tall shrubland over *Aristida obscura*, *Aristida contorta* and *Aristida ingrata* very open tussock grassland
Veg Condition: Very Good
Fire Age: Very long unburnt



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	26	6
Anthobolus leptomerioides	0.1	0.5
Aristida contorta	1	0.1
Aristida ingrata	1	0.5
Aristida obscura	2	0.3
Aristida sp.	0.1	0.1
**Bidens bipinnata*	0.1	0.3
Cheilanthes sieberi subsp. *sieberi*	0.1	0.2
Digitaria ammophila	0.1	0.3
Eremophila latrobei subsp. *filiformis*	0.1	1.4
Eriachne tenuiculmis	0.1	0.3
Hibiscus sp.	0.1	0.3

Name	Cover (%)	Height (m)
Maireana tomentosa subsp. *tomentosa*	0.1	0.3
Poaceae sp.	0.1	0.2
Psydrax suaveolens	0.1	0.2
Ptilotus exaltatus	0.1	0.2
Ptilotus obovatus	0.1	0.3
Rhagodia sp. Hamersley (M. Trudgen 17794) P3	0.1	1.3
Salsola australis	0.1	0.3
Solanum lasiophyllum	0.1	0.5
Triodia melvillei	0.1	0.5
Triodia pungens	0.1	0.2

* denotes weed species

Site: GH37
Location: HD1 Development Envelope **Type:** Quadrat
Phase 3 Date: 31/05/2019 **Described by:** LD
MGA Zone: 50 **Easting:** 682857 **Northing:** 7444808
Habitat: Plain
Soil: Light reddish brown Clay loam
Rock type: Ironstone
Veg code: P6
Vegetation: *Corymbia candida* subsp. *candida* scattered low trees over *Acacia aptaneura* tall open shrubland over *Themeda triandra* and *Eragrostis* sp. very open tussock grassland
Veg Condition: Very Good
Fire Age: >10 years



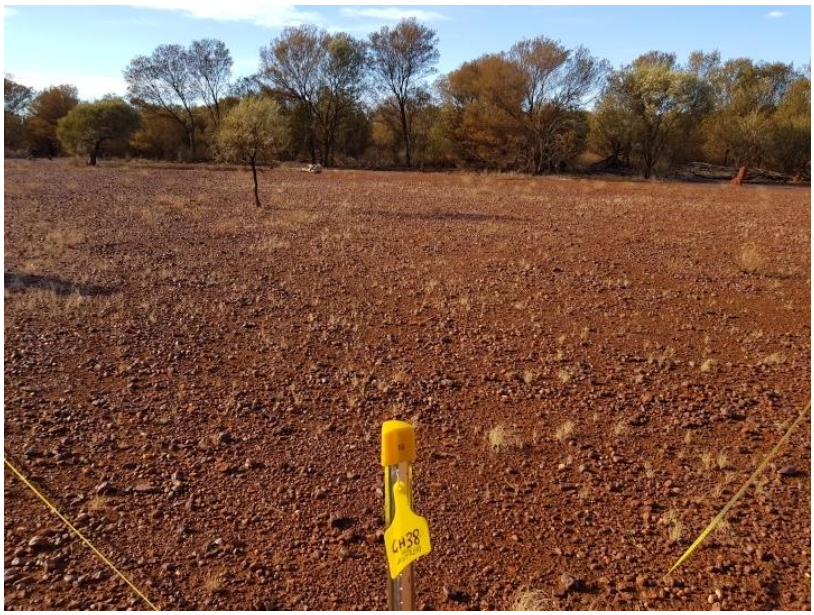
Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	7	5
Aristida contorta	0.1	0.2
Aristida ingrata	0.1	0.5
Aristida sp.	0.1	0.3
**Bidens bipinnata*	0.1	0.4
Centipeda minima subsp. *macrocephala*	0.1	0.1
Cheilanthes sieberi subsp. *sieberi*	0.1	0.2
Corymbia candida	1	8
Digitaria ammophila	0.1	0.1
Enneapogon sp.	0.1	0.3
Eragrostis sp.	1	0.2
Malvaceae sp.	0.1	0.1

Name	Cover (%)	Height (m)
Ptilotus exaltatus	0.1	0.1
Salsola australis	0.1	0.1
Solanum lasiophyllum	0.1	0.1
Sporobolus australasicus	0.1	0.1
Themeda triandra	1	0.5

* denotes weed species

Site: GH38
Location: HD1 Development Envelope **Type:** Quadrat
Date: 31/05/2019 **Described by:** LD
MGA Zone: 50 **Easting:** 679646 **Northing:** 7444390
Habitat: Plain
Soil: Light reddish brown Clay loam
Rock type: Ironstone
Veg code: P7
Vegetation: *Acacia aptaneura*, *Acacia catenulata* subsp. *occidentalis* and *Grevillea berryana* tall shrubland over *Sida calyxhymenia* open shrubland
Veg Condition: Very Good
Fire Age: Very long unburnt



Species List:

Name	Cover (%)	Height (m)
Acacia aptaneura	12	7
Acacia catenulata subsp. *occidentalis*	12	6
Aristida contorta	0.5	0.2
Aristida obscura	0.1	0.1
**Bidens bipinnata*	0.1	0.4
Cheilanthes sieberi subsp. *sieberi*	0.1	0.2
Enneapogon polyphyllus	0.1	0.1
Eragrostis sp.	0.1	0.1
Eremophila latrobei subsp. *filiformis*	0.1	1.2
Grevillea berryana	1	5
Maireana tomentosa subsp. *tomentosa*	0.1	0.3
Poaceae sp.	0.1	0.3

Name	Cover (%)	Height (m)
Psydrax latifolia	1	2.8
Ptilotus exaltatus	0.1	0.1
Ptilotus obovatus	0.1	0.4
Ptilotus roei	0.1	0.1
Ptilotus schwartzii var. *schwartzii*	0.5	0.3
Rhagodia sp. Hamersley (M. Trudgen 17794) P3	0.1	1.2
Sida calyxhymenia	3	1.2
Solanum lasiophyllum	0.1	0.4
Triodia melvillei	0.1	0.4

* denotes weed species

Attachment C: Vegetation Condition Maps

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670000 680000 690000 700000 710000 720000

7480000 7470000 7460000 7450000 7440000

Map Extent
HD2 Proposal Survey Area
HD1 Development Envelope

HD2 Sampling Sites (Astron 2019)

Quadrat
Relevé
Vegetation Mapping Note

HD1 Sampling Sites

Quadrat
Relevé
Vegetation Mapping Note

Vegetation Condition

Excellent
Very Good
Good
Completely Degraded

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C: Overview and legend for vegetation condition maps

Coordinate System: GDA 1994 MGA Zone 50

0 2 4 6 8 10 Kilometres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_VegCondOverview_FigC

672000

673000

7447000

7446000

7445000

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.1: Vegetation condition

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Author: B. Eckermann	Date: 13-12-2019	Coordinate System: GDA 1994 MGA Zone 50
Drawn: C. Dyde	Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_P_VegCond_FigC	0 100 200 300 400 500 Metres

N

674000 675000 676000 677000

7447000

7446000

GHMNKM18

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Figure C.2: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 13-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

674000 675000 676000 677000

7445000

7444000

7443000

GHMNKM17

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.3: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 13-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

678000
679000
680000
681000
7447000
7446000
GHMNKM20
GHMNKM23
© Service Layer Credits: Source: Esri, DigitalGlobe, Geoeye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.4: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

678000 679000 680000 681000

7445000

7444000

7443000

GH34

GHMNKM19

GH38

GH36

GH33

GH35

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Figure C.5: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 13-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

682000
683000
684000
7446000
7445000
7444000
GH37
GHMNKM21
GHMNKM22
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.6: Vegetation condition

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Drawn: C. Dyde	Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_P_VegCond_FigC

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

685000
686000
687000
688000
7448000
7447000

Source: Layer Credits: Source: Esri, DigitalGlobe, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.7: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

685000
686000
687000
688000
7446000
7445000
7444000
GH32
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.8: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

689000 690000 691000 692000

7450000

7449000

7448000

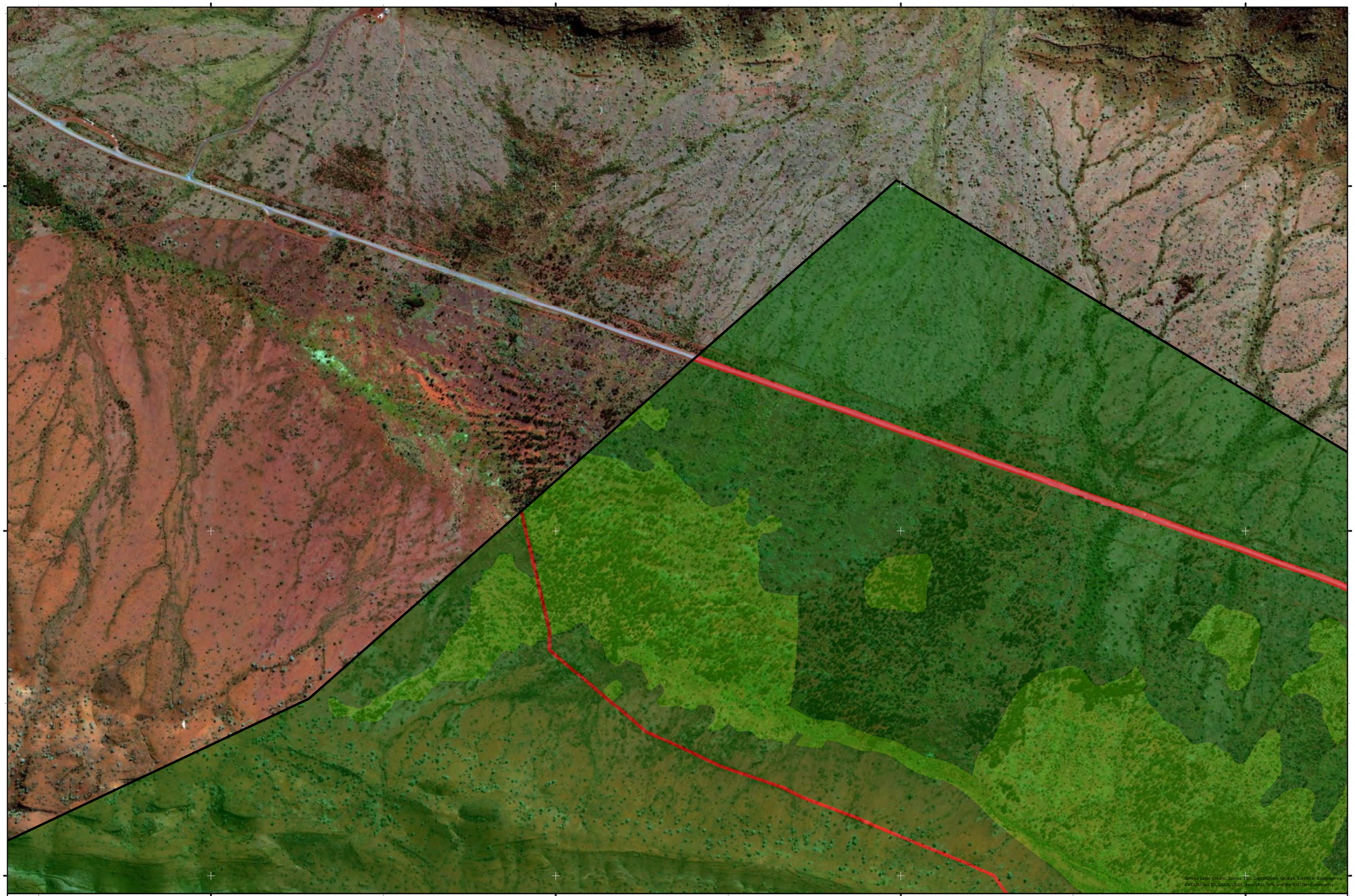

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Figure C.9: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

689000
690000
691000
692000
7447000
7446000

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.10: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

693000
694000
695000
696000
7451000
7450000
7449000

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.11: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

693000 694000 695000 696000

7448000

7447000

7446000

GHMNKM04

GHMNKM02 GHMNKM03

GHMNKM01

GHMNBE004

GHMNLD01 GHMNLD02

HD29

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.12: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 13-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

693000 694000 695000 696000

7445000

7444000

HD51

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.13: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 13-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

697000 698000 699000 700000

7451000

7450000

Service layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.14: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

697000
698000
699000
700000
7449000
7448000
7447000
GHMNBE002
GHMNBE001
GHMNBE006
HD20
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.15: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

697000 698000 699000 700000

7446000

7445000

HD27
HD31
HD25
HD32
HD34
MNLV13
MNLV12
HD50
MNMH18
HD21

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.16: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

697000 698000 699000 700000

7444000 7443000 7442000

MNMH37 MNMH19 MNMH34 MNMH33 HD42 MNMH32 MNMH31 HD44 MNMH35 MNMH36 HDR13 Weal Well Creek

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.17: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann Drawn: C. Dyde Date: 13-12-2019 Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

701000

702000

703000

7453000

7452000

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.18: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

701000
702000
703000
7451000
7450000
7449000
MNBE11
MNBE10
HD49
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Figure C.19: Vegetation condition
Coordinate System: GDA 1994 MGA Zone 50
0 200 400 600 800 1,000 Metres
N
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delivering environmental intelligence™
Author: B. Eckermann
Drawn: C. Dyde
Date: 13-12-2019
Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

701000
702000
703000
7448000
7447000
GHR10
GHMNBE007
HD01
GHR28
GH27
GH01
HDR19
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.20: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

701000
702000
703000
7446000
7445000
7444000
HD08
HD22
MNMH28
MNBE02
HDR03
HDR18
HD23
Weeli Wolli Creek
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.21: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

701000
702000
703000
7443000
7442000
MNLV07
GH06
GH05
GH04
GHMNBE003
Weeli Wolli Creek
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.22: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

704000
705000
706000
707000
7455000
7454000
7453000

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Figure C.23: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

704000
705000
706000
707000
7452000
7451000
7450000
Pebble Mouse Creek
MNBE13
MNBE14
HD53
HD48
HD52
GH11
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.24: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

704000
705000
706000
707000
7449000
7448000
MNBE12
MNBE15
MNBE09
HD55
HD54
HD02
GH03
GH02
GH12
GHMNBE005
GHMNBE008
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.25: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

704000
705000
706000
707000
7447000
7446000
7445000
GH09
GH07
GH08
HD12
HD10
HD09
HD28
HD11
MNMH01
MNLV01
MNMH27
HD30
HD18
HD14
HDR07
HDR05
MNMH07
MNLV02
Weeli Wolli Creek
MNMH02
MNMH06
MNMH03
HD16
MNMH05
MNMH04
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.26: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

704000
705000
706000
707000
7444000
7443000
Weeli Wolli Creek
MNLV05
HDR09
MNLV04
MNLV06
MNMH16
MNMH17
HD33
MNMH15
MNMH10
HD19
MNMH09
MNMH14
HD17
MNMH11
MNMH12
HD47
MNMH13
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.27: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

708000
709000
710000
711000
7456000
7455000

Survey Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.28: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

708000 709000 710000 711000

7454000

7453000

7452000

BHD10-AR

Pebble Mouse Creek

Pebble Mouse Creek

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.29: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

708000
709000
710000
711000
7451000
7450000
GHR16
HDR10
HDR16
HD26
MNBE08
MNBE07
HD03
GHR30
GH11
HD46
MNMH23
MNMH22
MNMH24
MNMH21
HD40
HD39
HD35
MNMH20
MNMH25
HDR02
MNLV09
MNMH26
MNLV08
HD41
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Rio Tinto
Hope Downs 1 Development Envelope – Vegetation Mapping
Figure C.30: Vegetation condition
Coordinate System: GDA 1994 MGA Zone 50
0 200 400 600 800 1,000 Metres
N
astron
delivering environmental intelligence™
Author: B. Eckermann
Drawn: C. Dyde
Date: 13-12-2019
Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

708000 709000 710000 711000

7449000

7448000

7447000

GHMNKM05

GH13

GH15

Weeli Wolli Creek

Weeli Wolli Creek

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.31: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

delivering environmental intelligence™

Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

718000
719000
720000
7478000
7477000
7476000
7475000

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.32: Vegetation condition

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Author: B. Eckermann	Date: 13-12-2019	Coordinate System: GDA 1994 MGA Zone 50
Drawn: C. Dyde	Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_P_VegCond_FigC	Metres 0 100 200 300 400 500

N

716000

717000

718000

7474000

7473000

7472000

Service Layer Credits: Source: DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.33: Vegetation condition

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Author: B. Eckermann	Date: 13-12-2019
Drawn: C. Dyde	Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_P_VegCond_FigC

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

714000

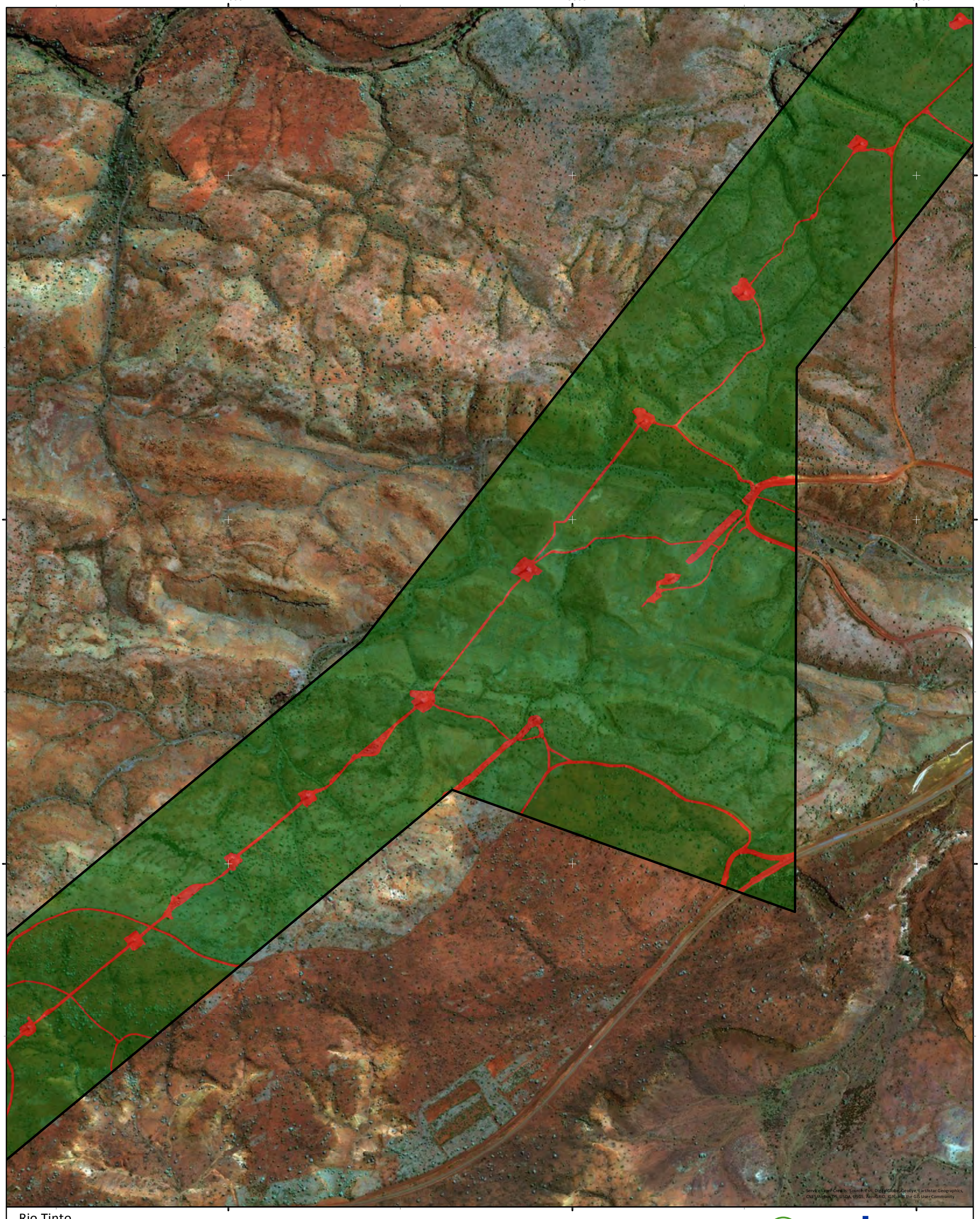
715000

716000

7471000

7470000

7469000



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure C.34: Vegetation condition

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Author: B. Eckermann	Date: 13-12-2019	Coordinate System: GDA 1994 MGA Zone 50
Drawn: C. Dyde	Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_P_VegCond_FigC	0 100 200 300 400 500 Metres

N

711000
712000
713000
7468000
7467000
7466000

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.35: Vegetation condition

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Author: B. Eckermann	Date: 13-12-2019	Coordinate System: GDA 1994 MGA Zone 50
Drawn: C. Dyde	Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_P_VegCond_FigC	0 100 200 300 400 500 Metres

N

711000
712000
713000
714000
7465000
7464000
7463000

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.36: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

712000
713000
714000
715000
7462000
7461000

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.37: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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delivering environmental intelligence™

Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

712000
713000
714000
715000
7460000
7459000
7458000

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.38: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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delivering environmental intelligence™

Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

712000
713000
714000
715000
7457000
7456000

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.39: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

astron delivering environmental intelligence™

Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

712000
713000
714000
715000
7455000
7454000
7453000
BHD05-AR
GHMNKM13
GHMNDR03
GH24
Pebble Mouse Creek
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.40: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

712000
713000
714000
715000
7452000
7451000
7450000
Pebble Mouse Creek
Pebble Mouse Creek
GHMNKM16
GH17
MNBE03
HD24
HD04
HD05
HD07
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.41: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

712000
713000
714000
715000
7449000
7448000
HDR01
Weeli Wolli Creek
Weeli Wolli Creek
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.42: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

716000
717000
718000
719000
7462000
7461000

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.43: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

716000
717000
718000
719000
7460000
7459000
7458000
GHMNKM14
GHMNKM15
Pebble Mouse Creek
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.44: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

716000
717000
718000
719000
7457000
7456000
GH21
GH22
GH23
GH26
GH25
GHMNKM07
GHMNKM08
GHMNDR02
GHMNBE010
Pebble Measures Creek
Rio Tinto
Hope Downs 1 Development Envelope – Vegetation Mapping
Figure C.45: Vegetation condition
Coordinate System: GDA 1994 MGA Zone 50
0 200 400 600 800 1,000 Metres
N
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delivering environmental intelligence™
Author: B. Eckermann
Drawn: C. Dyde
Date: 13-12-2019
Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

716000
717000
718000
719000
7455000
7454000
7453000
GHMNDR01
GH20
Pebble Mouse Creek
Pebble Mouse Creek
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.46: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann	Drawn: C. Dyde	Date: 13-12-2019	Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

716000 717000 718000 719000

7452000

7451000

7450000

GHMNKM06

Pebble-Mouse Creek

GH19

HD43

HD06

HD37

MNMH08

HDR11

MNLV03

HDR08

HD13

HD15

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.47: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

716000
717000
718000
719000
7449000
7448000
Weali Wolli Creek
Weali Wolli Creek
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.48: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

720000 721000 722000 723000

7465000

7464000

7463000

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.49: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

720000
721000
722000
723000
7462000
7461000
Pebble Mouse Creek
Weall Wolli Creek
Weall Wolli Creek
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.50: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

720000
721000
722000
723000
7460000
7459000
7458000
Pebble Mouse Creek
Weeli Wolli Creek
GH31
Weeli Wolli Creek
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.51: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

720000
721000
722000
723000
7457000
7456000
Wedil Wolil Creek
GHMNBE009
GHMNKM08
GHMNKM09
GHMNKM10
GHMNKM11
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.52: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

720000
721000
722000
723000
7455000
7454000
7453000
GHMNKM12
GH13
GH14
West Woll Creek
West Woll Creek
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.53: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

720000
721000
722000
723000
7452000
7451000
7450000
HDR14
MNBE06
MNBE04
MNBE05
HD38
HDR12
HDR06
MNBE01
HDR04
West Wolfi Creek
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.54: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

720000
721000
722000
723000
7449000
7448000
West Wolli Creek

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.55: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

astron
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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

724000
725000
726000
7465000
7464000
7463000
GH29
Weeli Wolli Creek
Weeli Wolli Creek
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.56: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

724000
725000
726000
7462000
7461000
GH35
Weeli Wolli Creek

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.57: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

724000
725000
726000
7460000
7459000
7458000

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure C.58: Vegetation condition

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_LS_VegCond_FigC

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Attachment D: Confidence Mapping

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670000 680000 690000 700000 710000 720000

7480000 7470000 7460000 7450000 7440000

HD2 Proposal Survey Area

HD1 Development Envelope

Confidence Mapping

High

Medium

Low

Disturbed

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure D.1: Confidence rating

Coordinate System: GDA 1994 MGA Zone 50

0 2 4 6 8 10 Kilometres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_FigD1_Confidence

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Attachment E: Conservation Significant Flora Locations

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680000

690000

700000

7450000

7440000

Map Extent

HD2 Proposal Survey Area

HD1 Development Envelope

Conservation Significant Flora

- *Aristida lazaridis* P2
- *Goodenia nuda* P4
- *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) P3
- *Rhagodia* sp. Hamersley (M. Trudgen 17794) P3
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) P3

Conservation Significant Flora (Astron 2019)

- *Aristida lazaridis* P2
- *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) P3
- *Grevillea saxicola* P3
- *Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2
- *Ptilotus mollis* P4
- *Rhagodia* sp. Hamersley (M. Trudgen 17794) P3

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure E.1: Conservation Significant Flora locations

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_FigE1_CSFlora

700000 710000 720000 730000

7460000

7450000

HD2 Proposal Survey Area

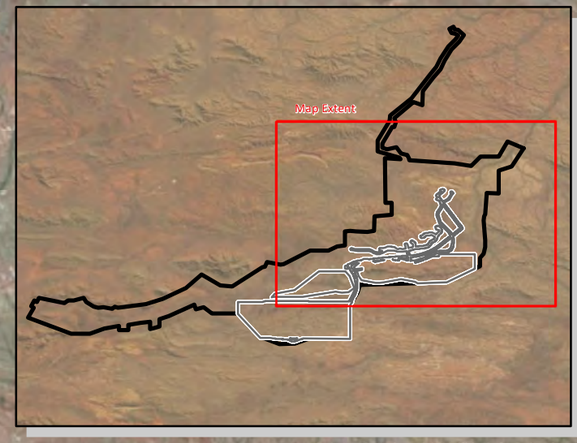
HD1 Development Envelope

Conservation Significant Flora

- *Acacia bromilowiana* P4
- *Acacia subtiliformis* P3
- *Eremophila magnifica* subsp. *magnifica* P4
- *Eremophila magnifica* subsp. *velutina* P4
- *Eremophila* sp. Hamersley Range (K. Walker KW 136) P3
- *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) P3
- *Grevillea saxicola* P3
- *Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2
- *Lepidium catapycnon* P4
- *Rostellularia adscendens* var. *latifolia* P3
- *Stylidium weeliwolli* P3
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) P3

Conservation Significant Flora (Astron 2019)

- *Acacia bromilowiana* P4
- *Acacia subtiliformis* P3
- *Eremophila magnifica* subsp. *magnifica* P4
- *Eremophila* sp. Hamersley Range (K. Walker KW 136) P3
- *Eremophila* sp. West Angelas (S. van Leeuwen 4068) P1
- *Goodenia lyrata* P3
- *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) P3
- *Grevillea saxicola* P3
- *Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2
- *Lepidium catapycnon* P4
- *Ptilotus mollis* P4
- *Rhagodia* sp. Hamersley (M. Trudgen 17794) P3
- *Triodia* sp. Mt Ella (M.E. Trudgen 12739) P3



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope – Vegetation Mapping

Figure E.2: Conservation Significant Flora locations

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_FigE2_CSFlora

Table E.1: Conservation significant flora recorded in the HD1 Development Envelope (GDA94, Zone 50). Due to changes in the survey boundary some records fall outside the HD1 Development Envelope. This excludes data recorded in the HD2 Proposal area, which is presented in Astron Environmental Services (2019).

Species	Cover (%)	Abundance	Easting (mE)	Northing (mN)	Survey area
Acacia subtiliformis P3	0.1	5	720671	7455937	HD1
	1	40	720886	7455162	HD1
	3	200	720844	7455102	HD1
Aristida lazaridis P2	0.1	1	686056	7445183	HD1
	0.1	2	685965	7445340	HD1
	0.1	2	686024	7445334	HD1
	0.1	6	686056	7445221	HD1
	0.1	8	686048	7445319	HD1
	0.1	8	686219	7445333	HD1
	0.1	15	686049	7445342	HD1
	0.1	15	697265	7446934	HD1
	0.1	15	697281	7446976	HD1
	0.1	15	697281	7446978	HD1
	0.1	15	697302	7446969	HD1
	0.1	20	686187	7445283	HD1
	0.1	25	686073	7445227	HD1
	0.1	25	686209	7445316	HD1
	0.1	30	686174	7445366	HD1
	0.1	35	686093	7445353	HD1
	0.1	40	686275	7445364	HD1
	0.1	40	697285	7446920	HD1
	0.1	50	686105	7445331	HD1
	0.1	50	697293	7446940	HD1
	0.5	2	697282	7446909	HD1
	0.5	2	697308	7446958	HD1
	1	5	697240	7446906	HD1
	1	5	697244	7446902	HD1
	1	5	697251	7446909	HD1
	1	5	697255	7446948	HD1
	1	5	697265	7446958	HD1
	1	5	697303	7446951	HD1
	1	5	697309	7446965	HD1
	1	10	697830	7448660	HD1
	1	25	686054	7445283	HD1
	1	60	697874	7447684	HD1
	2	10	697264	7446971	HD1

Species	Cover (%)	Abundance	Easting (mE)	Northing (mN)	Survey area
	2	10	697265	7446961	HD1
	2	10	697278	7446977	HD1
	2	50	686089	7445268	HD1
	5	50	685488	7445430	HD1
	0.1	1	695148	7442930	Outside
	0.1	1	695160	7442927	Outside
	0.1	1	695162	7442946	Outside
	0.1	1	696380	7443426	Outside
	0.1	2	695108	7443044	Outside
	0.1	2	695140	7442958	Outside
	0.1	2	695174	7442941	Outside
	0.1	2	695213	7442923	Outside
	0.1	2	695217	7442917	Outside
	0.1	2	695297	7445053	Outside
	0.1	3	695044	7442982	Outside
	0.1	3	695049	7442973	Outside
	0.1	3	695053	7442975	Outside
	0.1	3	695072	7442989	Outside
	0.1	3	695075	7442985	Outside
Aristida lazaridis P2	0.1	3	695081	7442981	Outside
	0.1	3	695086	7442955	Outside
	0.1	3	695100	7442951	Outside
	0.1	3	695122	7442941	Outside
	0.1	3	695180	7442937	Outside
	0.1	3	695182	7442935	Outside
	0.1	3	695191	7442929	Outside
	0.1	3	695200	7442926	Outside
	0.1	3	695207	7442923	Outside
	0.1	3	695217	7442915	Outside
	0.1	3	695335	7445124	Outside
	0.1	3	695373	7445109	Outside
	0.1	3	695409	7445161	Outside
	0.1	4	695153	7442952	Outside
	0.1	4	695171	7442921	Outside
	0.1	4	695176	7442918	Outside
	0.1	4	695188	7442910	Outside
	0.1	4	695332	7445052	Outside
	0.1	4	695384	7445179	Outside
	0.1	4	707596	7445865	Outside

Species	Cover (%)	Abundance	Easting (mE)	Northing (mN)	Survey area
Aristida lazaridis P2	0.1	5	695058	7442973	Outside
	0.1	5	695125	7442965	Outside
	0.1	5	695132	7442960	Outside
	0.1	5	695135	7442959	Outside
	0.1	5	695333	7445061	Outside
	0.1	5	695434	7445163	Outside
	0.1	5	707600	7445863	Outside
	0.1	6	707597	7445862	Outside
	0.1	8	695120	7442965	Outside
	0.1	10	695311	7445082	Outside
	0.1	10	695363	7445107	Outside
	1	8	695187	7442912	Outside
	1	10	695050	7442997	Outside
	1	10	695059	7442994	Outside
	1	10	695066	7442990	Outside
	1	10	695070	7442967	Outside
	1	10	695073	7442959	Outside
	1	10	695077	7442956	Outside
	2	20	695088	7442978	Outside
	2	20	695093	7442975	Outside
	2	20	695102	7442970	Outside
	2	20	695106	7442965	Outside
	2	20	695107	7442964	Outside
	2	20	695111	7442971	Outside
	2	20	695114	7442969	Outside
	2	20	695116	7442966	Outside
	3	10	695122	7443062	Outside
Eremophila magnifica subsp. *magnifica* P4	0.1	2	714763	7453626	HD1
	0.1	10	714717	7453736	HD1
	0.5	15	714759	7453640	HD1
Grevillea saxicola P3	0.5	5	708228	7450370	HD1
	0.1	8	721493	7450527	Outside
	0.1	8	721763	7450724	Outside
	1	3	721421	7450580	Outside
	1	3	721496	7450590	Outside
	1	3	721631	7450682	Outside
	1	3	721694	7450687	Outside
	1	3	721710	7450718	Outside
	1	3	721732	7450669	Outside

Species	Cover (%)	Abundance	Easting (mE)	Northing (mN)	Survey area
Lepidium catapycnon P4	0.1	50	721222	7450505	Outside
	1	10	721384	7450572	Outside
Rhagodia sp. Hamersley (M. Trudgen 17794) P3	0.1	1	676728	7444925	HD1
	0.1	1	678846	7445312	HD1
	0.1	1	681038	7444692	HD1
	0.1	1	686178	7445167	HD1
	0.1	1	686256	7445209	HD1
	0.1	2	679105	7444008	HD1
	0.1	2	685952	7445012	HD1
	0.1	2	685981	7444995	HD1
	0.1	2	694889	7446787	HD1
	0.1	3	685899	7445066	HD1
	0.1	3	686248	7445107	HD1
	0.1	4	685976	7445213	HD1
	0.1	6	694942	7446782	HD1
	0.1	12	679598	7444386	HD1
Rostellularia adscendens var. latifolia P3	0.1	7	724368	7462726	HD1
	0.1	16	724444	7462734	HD1
	0.1	16	724473	7462756	HD1
	0.1	24	724382	7462729	HD1
	0.1	30	724412	7462718	HD1

Attachment F: Introduced Flora Locations

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680000

690000

700000

7450000

7440000

Map Extent

HD2 Proposal Survey Area

HD1 Development Envelope

Introduced Flora Species

- **Bidens bipinnata*
- **Cenchrus ciliaris*
- **Cenchrus setiger*
- **Malvastrum americanum*
- **Sonchus oleraceus*
- **Vachellia farnesiana*

Introduced Flora Species (Astron 2019)

- **Bidens bipinnata*
- **Brassica tournefortii*
- **Cenchrus ciliaris*
- **Cenchrus setiger*
- **Chloris virgata*
- **Cynodon dactylon*
- **Datura leichhardtii* subsp. *leichhardtii*
- **Flaveria trinervia*
- **Malvastrum americanum*
- **Setaria verticillata*
- **Sigesbeckia orientalis*
- **Solanum nigrum*
- **Sonchus oleraceus*
- **Vachellia farnesiana*

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure F.1: Introduced flora locations

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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710000

720000

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Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Map Extent

HD2 Proposal Survey Area

HD1 Development Envelope

Introduced Flora Species

- **Aerva javanica*
- **Argemone ochroleuca*
- **Bidens bipinnata*
- **Cenchrus ciliaris*
- **Cenchrus setiger*
- **Chloris virgata*
- **Citrullus colocynthis*
- **Conyza bonariensis*
- **Cynodon dactylon*
- **Datura leichhardtii* subsp. *leichhardtii*
- **Euphorbia hirta*
- **Flaveria trinervia*
- **Lactuca serriola*
- **Malvastrum americanum*
- **Melinis repens*
- **Rumex vesicarius*
- **Setaria verticillata*
- **Sigesbeckia orientalis*
- **Sisymbrium orientale*
- **Solanum nigrum*
- **Sonchus oleraceus*
- **Tribulus terrestris*
- **Tridax procumbens*
- **Vachellia farnesiana*

Introduced Flora Species (Astron 2019)

- **Bidens bipinnata*
- **Brassica tournefortii*
- **Cenchrus ciliaris*
- **Cenchrus setiger*
- **Chloris virgata*
- **Conyza bonariensis*
- **Datura leichhardtii* subsp. *leichhardtii*
- **Flaveria trinervia*
- **Lactuca serriola*
- **Malvastrum americanum*
- **Rumex vesicarius*
- **Setaria verticillata*
- **Sigesbeckia orientalis*
- **Solanum nigrum*
- **Sonchus oleraceus*
- **Vachellia farnesiana*

Rio Tinto

Hope Downs 1 Development Envelope – Vegetation Mapping

Figure F.2: Introduced flora locations

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Author: B. Eckermann | Drawn: C. Dyde | Date: 13-12-2019 | Figure Ref: 14292A-19-BIDR-1RevA_191213_HD1_FigF2_Weeds

Table F.1: Locations of weed species recorded in the HD1 Development Envelope (GDA94, Zone 50). This excludes data recorded in the HD2 Proposal area, which is presented in Astron Environmental Services (2019).

Species	Cover (%)	Abundance	Easting (mE)	Northing (mN)
**Bidens bipinnata*	0.1	10	716067	7452516
	0.1	60	724452	7462705
	0.1	75	686138	7445026
	0.1	100	678846	7445312
	0.1	100	679598	7444386
	0.1	100	695686	7446956
	0.1	100	725700	7463927
	0.1	200	679105	7444008
	0.1	200	681038	7444692
	0.1	200	682804	7444804
	0.1	300	695767	7446999
	0.1	300	707957	7448407
	0.1	500	678443	7446076
	1	150	697824	7447704
**Cenchrus ciliaris*	0.1	3	695773	7446913
	0.1	40	724452	7462705
	0.1	50	725700	7463927
**Cenchrus setiger*	0.1	10	724452	7462705
	5	20	674309	7444787
**Conyza bonariensis*	0.1	15	725700	7463927
**Cynodon dactylon*	0.1	20	724452	7462705
	0.1	30	725700	7463927
**Euphorbia hirta*	0.1	12	725700	7463927
**Flaveria trinervia*	0.1	6	725700	7463927
**Lactuca serriola*	0.1	10	724452	7462705
	0.1	80	725700	7463927
**Malvastrum americanum*	0.1	1	724452	7462705
	0.1	3	719078	7456593
	0.1	3	722139	7453971
	0.1	10	725700	7463927
**Melinis repens*	0.1	10	724452	7462705
** Setaria verticillata*	0.1	10	725700	7463927
**Sigesbeckia orientalis*	0.1	8	725700	7463927
**Solanum nigrum*	0.1	2	725700	7463927
	0.1	15	724452	7462705
**Sonchus oleraceus*	0.1	5	697277	7446966
	0.1	50	724452	7462705
	0.1	50	725700	7463927

Species	Cover (%)	Abundance	Easting (mE)	Northing (mN)
**Tridax procumbens*	0.5	10	725738	7463856
**Vachellia farnesiana*	0.1	7	725700	7463927
	0.1	15	697819	7447708

B.3: Targeted Riparian Values Assessment of the Greater Hope Downs 1 Area

RioTinto



Hope Downs 2 Proposal

Targeted Riparian Survey of the Greater Hope Downs 1 Area

November 2023

RioTinto

Disclaimer and Limitation

This report has been prepared by Rio Tinto's Iron Ore Group (Rio Tinto), on behalf of Hamersley HMS Pty Limited (the Proponent), specifically for the Hope Downs 2 Iron Ore Proposal. Neither the report nor its contents may be referred to without the express approval of Rio Tinto, unless the report has been released for referral and assessment of proposals.

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4	Wendy Hudleston	Sally Pickard	28/07/2023	Sally Pickard	14/08/23
5	Wendy Hudleston	Jeremy Naaykens	20/11/2023	Sally Pickard	20/11/2023

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1. Introduction

Rio Tinto is progressing with the assessment of its Hope Downs 2 (HD2) Proposal. In order to support the Environmental Impact Assessment (EIA) process and improve understanding of environmental values in the area, Rio Tinto have undertaken a targeted study (desktop and field survey) of riparian vegetation communities within and surrounding the proposed development envelope. This study was completed to provide updated and targeted vegetation mapping as well as an assessment of the significance of local riparian values within the Hope Downs 2 Proposal area (the Proposal).

1.1. Study Objectives

The key objective of this targeted survey was to further study riparian ecosystems (beyond baseline flora and vegetation studies) on moderate to major sized drainage systems within and surrounding the Proposal. Proposed outcomes of this study were to produce refined riparian vegetation mapping (of higher detail) along with Groundwater Dependent Vegetation (GDV) likelihood mapping, relevant surface water mapping and ultimately a detailed significance assessment of the riparian communities mapped across the Study Area. The proposed objectives were created in order to identify, characterise and contextualise any riparian ecosystems (and potential GDV) occurring within and surrounding the Hope Downs 2 Development Envelope.

The current study used aerial photo interpretation, remote sensing tools/analyses (namely NDVI/NDMI persistence mapping), historical flora and vegetation surveys, select field investigations and a targeted survey to assess riparian systems in and around the proposed Development Envelope, hereafter known as the Study Area.

This report has been prepared to address the information requirements outlined in the Environmental Scoping Document (ESD) for the Environmental Review Document (ERD) as presented in Table 1-1.

Table 1-1: Work required to address riparian/Groundwater Dependent Ecosystem (GDE) associated with the Proposal

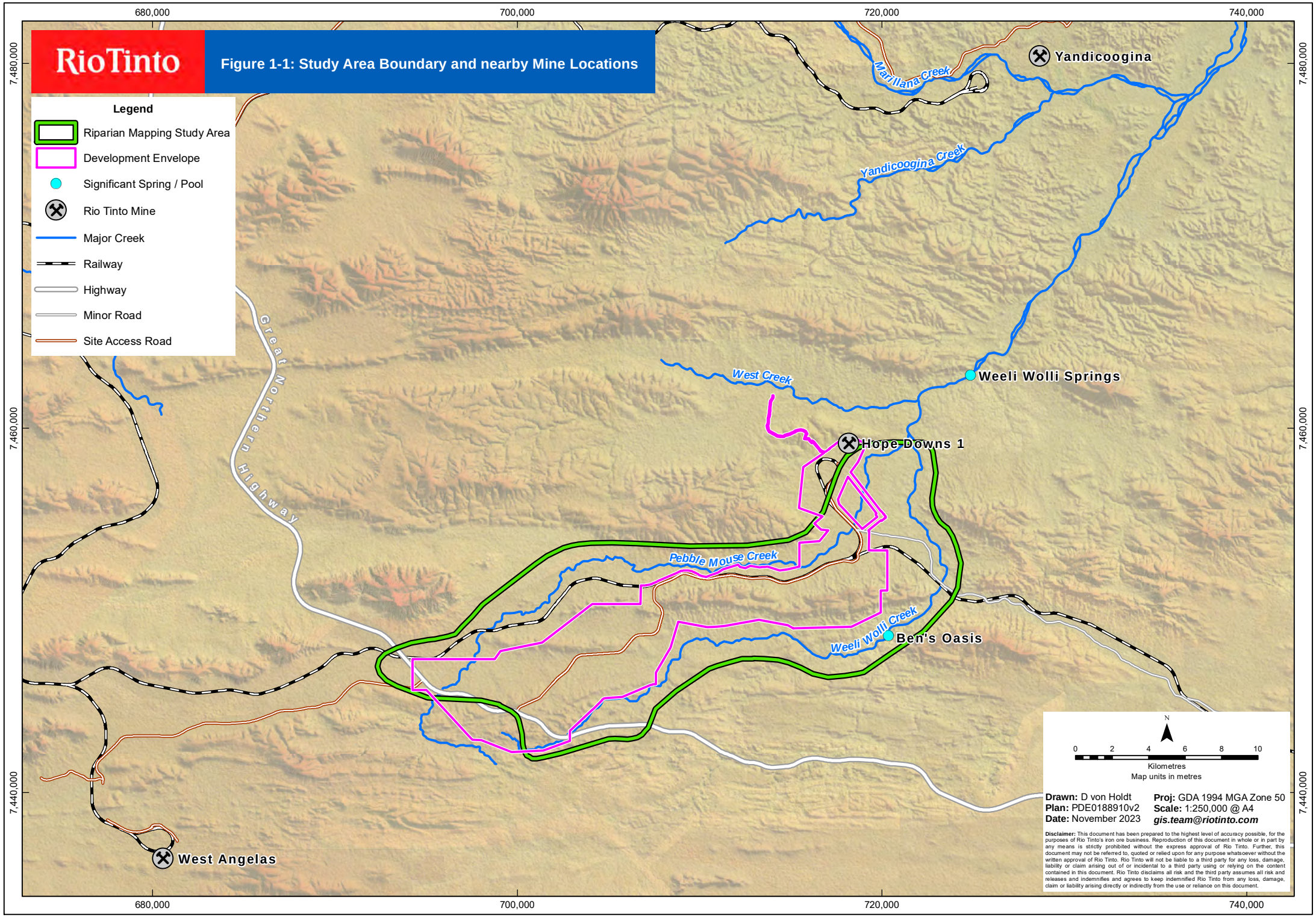
Description
Flora and Vegetation
• Describe and assess the extent of any cumulative impacts within local, regional and State contexts as appropriate. • Describe and quantify the potential direct and indirect impacts of the construction and operational elements of the proposal on identified environmental values. • Include an assessment of impacts to groundwater/surface water dependent vegetation, including riparian vegetation. • Include a quantitative assessment of levels of impact on significant flora, listed ecological communities and all vegetation units.
Inland Waters
• Describe and assess potential cumulative groundwater and surface water impacts, including changes in groundwater levels, surface water flows within the relevant catchments, and possible impacts to GDV and GDEs within the Weeli Wolli Spring PEC, including “Ben’s Oasis”. • Assess the nature, extent and duration of potential impacts of groundwater abstraction with a focus on possible impacts.

1.2. The Study Area

The Study Area incorporates the majority of Pebble Mouse Creek (PMC), stretching approximately 35 km, and a section of Weeli Wolli Creek (WWC) (which focuses on the west tributary of WWC) stretching approximately 40 km (Figure 1-1).

Although the Study Area covers a large portion of Hope Downs 1, it does not cover any of Weeli Wolli Spring (WWS). WWS is located approximately 5 km’s downstream of the north-eastern tip of the Study Area. The small spring up stream of WWS, colloquially named “Ben’ s Oasis” which consists of

series of pools and associated GDV/riparian vegetation occurring along WWC is covered by the Study Area.


RioTinto
Figure 1-1: Study Area Boundary and nearby Mine Locations
Legend
Riparian Mapping Study Area
Development Envelope
Significant Spring / Pool
Rio Tinto Mine
Major Creek
Railway
Highway
Minor Road
Site Access Road
680,000
700,000
720,000
740,000
7,480,000
7,460,000
7,440,000
Yandicoogina
Marillana Creek
Yandicoogina Creek
Weeli Wolli Springs
West Creek
Hope Downs 1
Great Northern Highway
Pebble Mouse Creek
Weeli Wolli Creek
Ben's Oasis
West Angelas
N
0 2 4 6 8 10
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: PDE0188910v2
Date: November 2023
Proj: GDA 1994 MGA Zone 50
Scale: 1:250,000 @ A4
gis.team@riotinto.com
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2. Background Information

2.1. Large creek systems of the Hamersley sub-region

The Hamersley IBRA (Interim Biogeographic Regionalisation for Australia) subregion of the Pilbara IBRA bioregion is essentially represented by those areas occurring on and adjacent to the ranges, valleys, and plateau formations of the Hamersley Ranges (DoE, 2014a). These ranges are unique in the Pilbara due to their size, relatively vast expanses of upland area, and associated large and extremely rugged/rocky habitats.

Rainfall patterns in the Hamersley Ranges (the Hamersley IBRA subregion), when compared to the remainder of the Pilbara bioregion are also different, with higher annual rainfall over the Hamersley Ranges (up to 500 mm). This higher average rainfall is known to be a product of advection and convergence of moist sea breezes together with uplift from orography and heating associated with the steep and rocky features of the Hamersley Range (Charles *et al* 2015).

The climate is hot and semi-arid, with annual evaporation typically exceeding annual rainfall. Rainfall occurs as localised, infrequent, high intensity thunderstorms between prolonged periods of drought. The region is warmest and wettest between December and March, with average maximum temperatures often above 40°C. During the winter months temperatures fall to around 25°C.

Within the Hamersley subregion these factors combine to produce a significant number of large and relatively unique creek systems. The number and spread of these large creek systems, along with the spatial boundaries of their respective catchments, are depicted in Figure 2-1. To provide a comparative look at the size of each of these creek systems the areal extent of the catchment of each is provided below in Table 2-1.

The creek systems within the Hamersley's that form the focus of this study are Weeli Wolli Creek and one of its tributaries Pebble Mouse Creek. The Weeli Wolli Creek system forms part of the overall catchment of the Fortescue River Basin, which includes the Fortescue Marsh. The Fortescue Marsh is the largest ephemeral wetland in the Pilbara region and is recognised as being nationally important. The Fortescue Marsh extends over approximately 1,048 square kilometres (km^2) and lies within a broader catchment area of the upper Fortescue River (29,791 km^2). The catchment of the Fortescue Marsh is also rich in ore deposits and multiple mining operations operate in the region.

Creeks in the Pilbara are typically ephemeral and flashy hydrological systems, with flow only occurring after occasional, localised intense rainfall events. The area often experiences periodic heavy rainfall during summer because of both monsoonal effects and cyclones. Although the average surface flow is 2.8 GL/year it has been as high as 22 GL during an exceptional flood year. The pisolite and calcrete, where present below the water table, constitute a significant aquifer which is recharged via direct rainfall infiltration and creekline infiltration (Johnson & Wright 2001).

For most its length, Weeli Wolli Creek behaves and supports similar biota to that of the majority of typical Pilbara creeks. It is the ecology and nature of Weeli Wolli Springs (WWS) and its associated PEC's that make the creek unique in the region.

Table 2-1: Major Creeks of the Hamersley Range

Creek	Approximate Catchment Size (km^2)
Mindy Mindy Creek	372
Joffre Creek	539
Pebble Mouse Creek*	577
Giles creek	598
Munjina Creek	767
Caliwingina Creek	796
Coondiner Creek	883
Mungarathoona Creek	895
Upper Angelo River	1,225
Weelumurra Creek	1,419
Spearhole Creek	1,431
Fortescue south Creek	1,480
Caves Creek	1,532
Boolgeeda Creek	1,623
Upper Hardey River	1,844
Upper Beasley River	2,053
Duck Creek	2,149
Upper Robe River (Bungaroo creek)	2,204
Marillana Creek*	2,230
Turee Creek East Branch	2,284
Weeli Wolli Creek* (Minus Marillana Creek and including internally draining catchments)	2,547
Seven Mile Creek	2,585
Turee Creek	6,753

* Depicts creeks most relevant to the Study Area

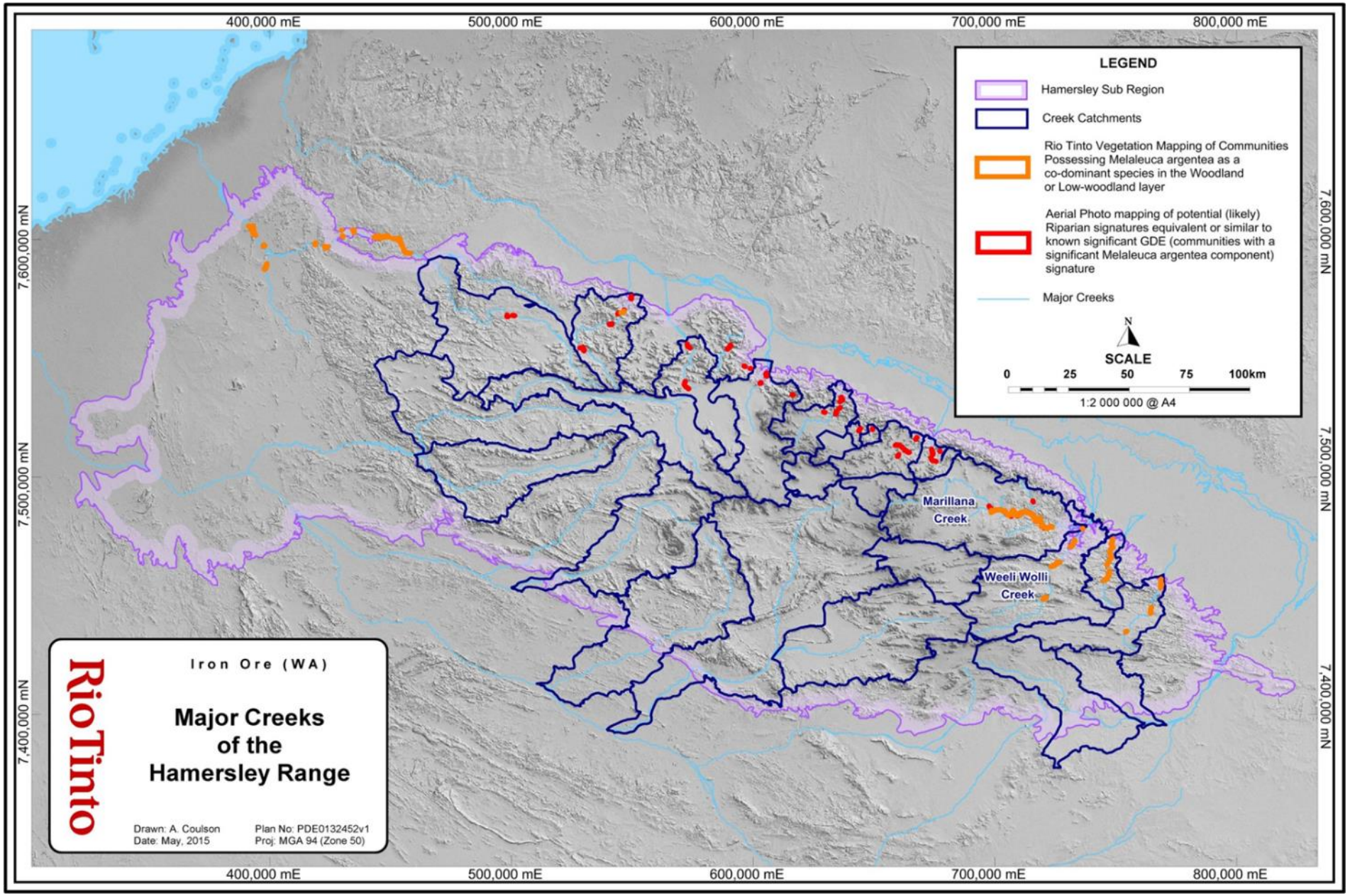


Figure 2-1: Major Creeks of the Hamersley sub-region

2.2. Local Hydrology and catchment characteristics

The Study Area intersects the Weeli Wolli Creek (WWC) catchment and the Pebble Mouse Creek (PMC) catchment. Approximately 40 km of WWC and approximately 35 km of PMC run through the Study Area.

The WWC catchment forms part of the Fortescue River Basin, and including the catchment of Marillana Creek, WWC drains an overall catchment of approximately 4,770 km^2 (if the internally draining portions of its extent are included) (EPA, 2018a) and contributes approximately 5 to 10% of the total catchment area of the Fortescue Marsh. Approximately 40% or ~1000 km^2 of the overall WWC catchment intersects the Study Area. The PMC catchment is approximately 570 km^2 in size (depending on which tributaries are included in its namesake) and represents a major tributary of WWC. The majority of the south tributary of PMC (~90% or 330 km^2) occurs within the bounds of the Study Area, with the north tributary dissecting areas influenced by BHP's Area C and South Flank operations.

The catchment is underlain by formations of the Hamersley and Fortescue Groups, comprising dolomites, basalts, shales and ironstone, with minor felsic volcanics and intrusive dolerite dykes and sills. The Brockman, Marra Mamba Iron formations and Channel Iron Deposits (CID) host most of the known major iron ore deposits in the area. The dolomites of the Wittenoom Formation form a regionally important aquifer.

The WWC catchment includes a large spring (Weeli Wolli Spring) and associated pools that support unique flora and fauna communities. The main part of Weeli Wolli Springs (WWS) is located approximately 8 km to the northeast of the Study Area and holds high biodiversity value, along with being representative of two Pilbara PEC's. An increase in significant threats (i.e. cattle grazing, inappropriate fire regimes and mining practices) has resulted in the listing of the WWS community as a Priority 1 (P1), Priority Ecological Community (PEC). In addition to this, WWS is also representative of the Springs and River Pools PEC (Appendix J:) due to (among other things) the assemblage of relictual macrophytes which it supports.

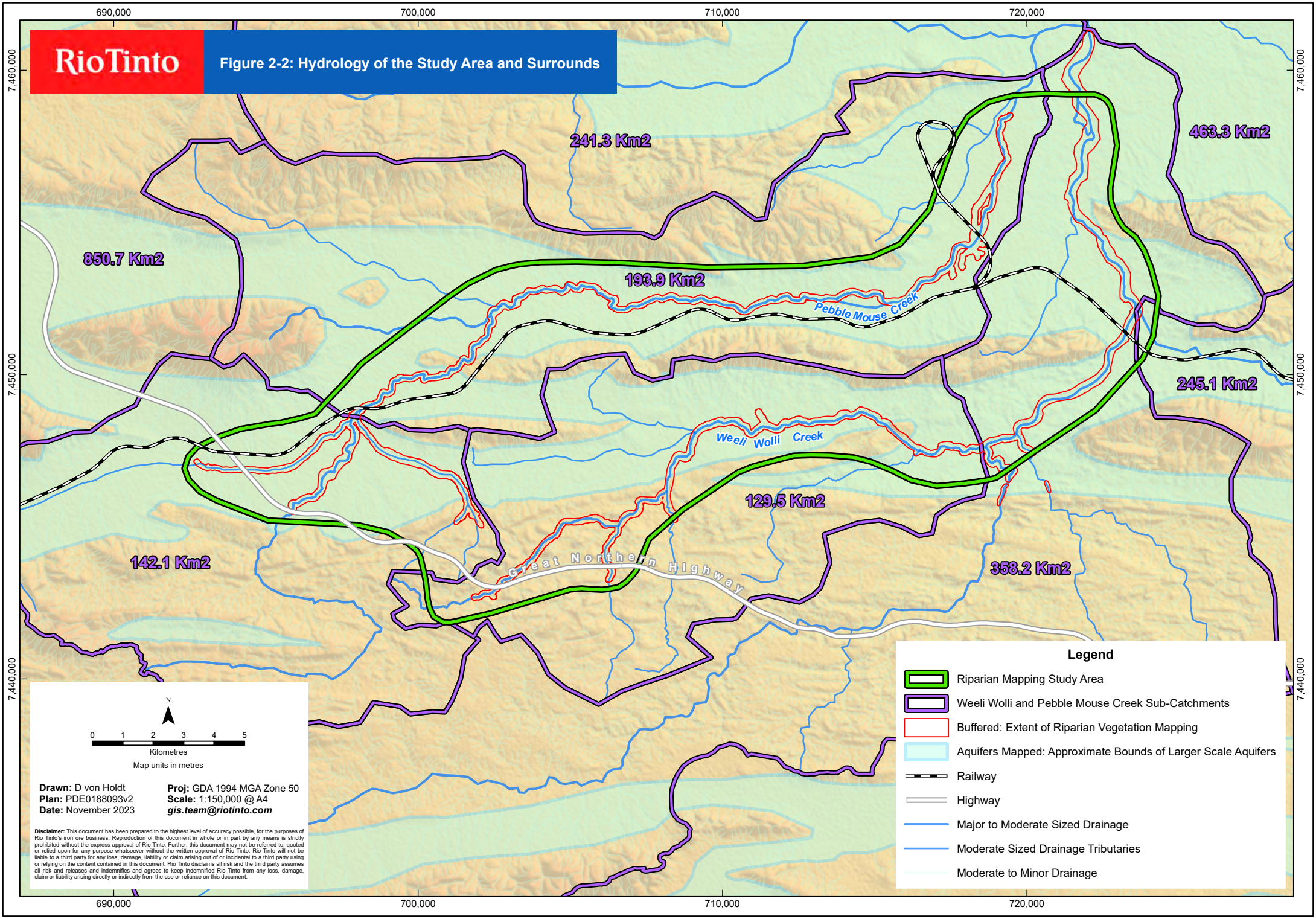
The Weeli Wolli Spring PEC (Appendix I:) is also mapped to occur at "Ben's Oasis", which is another significant feature on WWC and occurs within the Study Area on the west branch of WWC. This feature represents a small spring and permanent pool where groundwater emerges from outcropping Wittenoom Formation.

With the exception of the WWS (downstream of the Study Area) reach and the preceding "Ben's Oasis" reach on its west tributary, WWC broadly represents a typical ephemeral Pilbara creek system. One of its tributaries, and a focus of this study is PMC. Pebble Mouse Creek represents a highly ephemeral creek system, and while its minor tributaries dissect steep range systems within its catchment, the majority of larger channels of PMC dissect relatively broad alluvial valleys dominated by fine loamy sediments supporting a relatively sparse core-riparian zone flanked by broad and sparsely but variably vegetated floodplains.

The catchment of WWC in the area surrounding the Hope Downs 1 mining hub has been exposed to substantial water abstraction associated with dewatering at the Hope Downs mine. In addition, in the area of WWS, substantial discharge of surplus mine dewater associated with dewatering at the Hope Downs mine has also occurred. Prior to dewatering at Hope Downs 1, WWS was naturally groundwater fed, but for now it remains supported by discharge from HD1.

The south tributary of PMC previously joined the north tributary and WWC just to the north of the HD1 mine, but now open-cut mining has led to this tributary being diverted around the NE pit and into WWC approximately 2 km upstream of its previous confluence with WWC. Beside the area of direct influence from diversion and the influence of seasonal water ponding in the diversion area, PMC remains relatively unchanged.

Figure 2-2 shows the hydrology of the Study Area, including the WWC and PMC sub-catchments, Large Scale Aquifer (LSA) approximate boundary and major to moderate drainage and tributaries.


RioTinto
Figure 2-2: Hydrology of the Study Area and Surrounds
690,000
700,000
710,000
720,000
7,460,000
7,450,000
7,440,000
241.3 Km2
463.3 Km2
850.7 Km2
193.9 Km2
Pebble Mouse Creek
245.1 Km2
Weeli Wolli Creek
129.5 Km2
142.1 Km2
Great Northern Highway
358.2 Km2
N
0 1 2 3 4 5
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: PDE0188093v2
Date: November 2023
Proj: GDA 1994 MGA Zone 50
Scale: 1:150,000 @ A4
gis.team@riotinto.com
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Legend
Riparian Mapping Study Area
Weeli Wolli and Pebble Mouse Creek Sub-Catchments
Buffered: Extent of Riparian Vegetation Mapping
Aquifers Mapped: Approximate Bounds of Larger Scale Aquifers
Railway
Highway
Major to Moderate Sized Drainage
Moderate Sized Drainage Tributaries
Moderate to Minor Drainage

2.3. Local Hydrogeology

Broad Geology & ecohydrological properties

The Study Area predominantly intersects tertiary detritals (which generally overlay the basement lithology) as well as three dominant geological units within the Hamersley Group; the Brockman Iron Formation, the Wittenoom Formation, and the Marra Mamba Iron Formation (MMIF). These units typically have higher permeabilities and are therefore likely to host aquifers throughout. Some of the southern reaches of the Study Area (upper reaches of Weeli Wolli Creek west tributary) intersect the Fortescue Group geology, which is dominated by Jeerinah Formation (basalt) and associated dolerite dyke formations. The Fortescue Group typically possesses very low hydraulic conductivity, and as such, utilisation of regional aquifers within the Hamersley Group is unlikely to influence any riparian features within areas overlying Fortescue Group geology.

From a fluvial point of view, the more porous lithologies like those of the Hamersley Group, at least in situations where basement outcropping is shallow or at surface, tend to soak up a reasonable proportion of the incident rainfall, and resulting surface water flows which their catchments transport. This leads to smaller volumes of water transported per unit of time from such systems, as well as shorter residence times for surface water which ends up either perched within creek channels and their alluvium, or perched over covered or exposed porous basement lithology. This has a flow on effect to the typical ecohydrology of systems dissecting Hammersley Group lithology, which is 2-fold. Where fluvial habitats intersect shallow aquifers supported by the porous lithology, dry season moisture persistence is elevated via the groundwater access/proximity, often supporting mesic and highly productive riparian vegetation. For the remainder of situations (the vast majority) where such aquifers are not accessible, dry season water persistence in the fluvial environment is generally reduced, and riparian vegetation is also typically highly ephemeral.

For fluvial systems dissecting Fortescue Group geology, and particularly the basaltic and doleritic formations, hydraulic conductivity is generally very low, and this reduces the amount of water uptake by the lithology following rainfall events. Particularly in situations where basement outcropping is shallow or at surface, this very low uptake by the environment leads to high rates of catchment shed following rain events and poor infiltration within the channel. This in turn leads to high volumes of water transported per unit of time from such systems (leading to increased scour), as well as potentially longer residence times for surface water which ends up either perched within creek channels and their alluvium (particularly the fine-grained terraces), or perched over covered or exposed basement lithology. More broadly this typically leads to longer dry season water persistence in the fluvial environment, due to channels continuing to transport or perch water over their basement into the dry season, rather than absorbing the water away from riparian root zones. These ecohydrological characteristics tend to support intermediate riparian vegetation, which is somewhat disproportionately mesic (in floristic composition and productivity) in relation to the reporting catchment size.

Proposed abstraction

The proposed development involves above water table mining only. However, the proposal has a construction and operational demand which needs to be met. This demand will either be met by abstracting from the mined orebody aquifers (namely HD2), or via a portion of the surplus from the HD1 operations which is currently being discharged in the vicinity of WWS. There is a high likelihood that it will be a combination of the two sources. For the HD2 aquifer to meet operational demand, modelling estimated that a total combined volume of 38 GL may be abstracted across the life of the project (approximately 13 years).

Relevant Aquifers

Within the Study Area, there are two main geological units that comprise regional aquifers with potential to be utilised/influenced by the development:

1. Wittenoom Formation and closely aligned Marra Mamba Iron Formations.

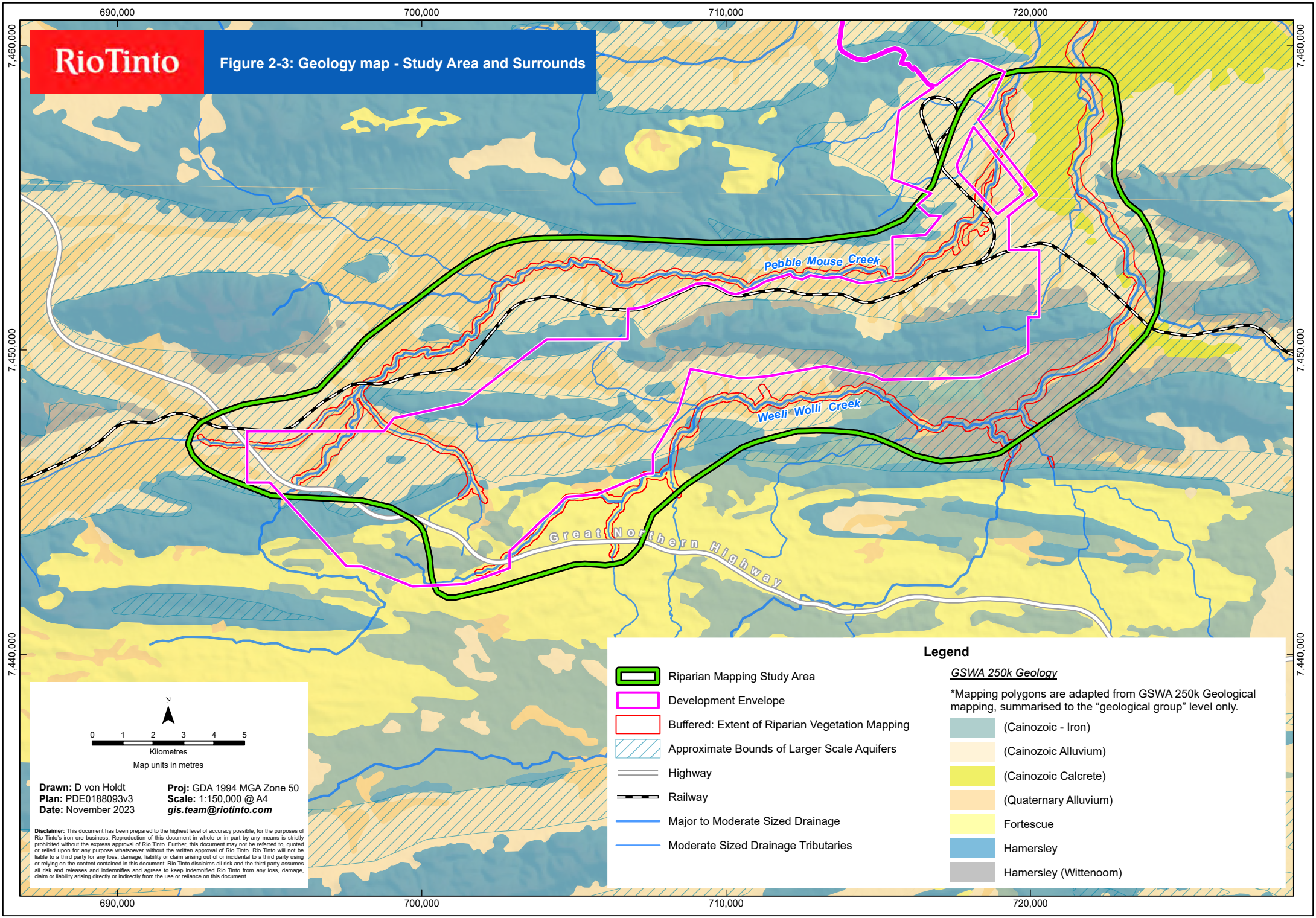
   Occurring at HD1 and HD2, comprising the often karstic dolomite within the Bee Gorge and Paraburdoo Members of the Wittenoom Formation and the mineralised and/or fractured zones of the underlying Mt Newman Member of the Marra Mamba Iron Formation.

2. Brockman Iron Formation

   Occurring at Bedded Hilltop (BHT), and comprising the mineralised zones of the Dales Gorge Member and Joffre Member where fractures are encountered.

The HD2 aquifer is intended as a supply source for the proposal and is considered fairly well isolated from the significant local environmental receptors. In fact, both aquifer complexes are well compartmentalised via the bounds of the key porous geological units, as well as dykes and other aquitards. The result is that modelled abstraction associated with the development and its operational demands is relatively tightly contained within the bounds of the HD2 aquifer. In addition, a large data set of groundwater level response from abstraction at HD1 shows that HD2 is separated from the HD1 aquifer, and as such it is considered that abstraction from HD2 poses no risk to the key receptors in the area (WWS and “Ben’s Oasis” spring systems). These receptors are located in proximity of the HD1 mine (WWS to its northeast), or adjacent to the eastern end (south of) of BHT, and outside of the HD2 groundwater system.

The broad geological groups and the aquifer complexes they are thought to support in the broader HD1 locality are presented in Figure 2-3. To view the position of finer scale aquifer boundaries and compartmentalisation relevant to the groundwater modelling refer to Rio Tinto (2022), for specific mapping outputs.



Rio Tinto
Figure 2-3: Geology map - Study Area and Surrounds
690,000
700,000
710,000
720,000
7,460,000
7,450,000
7,440,000
Pebble Mouse Creek
Weeli Wolli Creek
Great Northern Highway
Legend
Riparian Mapping Study Area
Development Envelope
Buffered: Extent of Riparian Vegetation Mapping
Approximate Bounds of Larger Scale Aquifers
Highway
Railway
Major to Moderate Sized Drainage
Moderate Sized Drainage Tributaries
GSWA 250k Geology
*Mapping polygons are adapted from GSWA 250k Geological mapping, summarised to the "geological group" level only.
(Cainozoic - Iron)
(Cainozoic Alluvium)
(Cainozoic Calcrete)
(Quaternary Alluvium)
Fortescue
Hamersley
Hamersley (Wittenoom)
N
0 1 2 3 4 5
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: PDE0188093v3
Date: November 2023
Proj: GDA 1994 MGA Zone 50
Scale: 1:150,000 @ A4
gis.team@riotinto.com
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2.4. Proposed and historical groundwater abstraction

2.4.1. Historical Influence

Dewatering in the HD1 area has brought about two key changes in groundwater in the area. Firstly, it has dewatered a significant volume of water from the surrounding aquifer such that groundwater heights are no longer high enough for groundwater discharge to occur into and through the WWS area. This impact to the groundwater system is mitigated in the vicinity of the springs by discharge and groundwater mounding at the gabion as well as from a series of irrigation spurs within the initial parts of the springs (prior to the gabion) and broadly correlated with the baseline extent of Obligate Phreatophytic Species (OPS). Secondly it has led to a drawdown cone in the area of the operations which extends below parts of WWC and PMC. At baseline, groundwater heights in the now affected reaches of WWC were in the order of 6 to 10 metres below ground level (mbgl) at the north extent and 15 to 20 mbgl (and potentially deeper) at the southern extent, in the vicinity of where the east and west tributaries of WWC separate. In this zone, since mining has begun, groundwater has transitioned from generally accessible/potentially accessible (but not clearly accessible) to clearly inaccessible. In some areas along WWC, directly east of the HD1 pit's, groundwater has dropped to as low as 70 m, but regardless of depth the outcome of such changes is that the regional aquifer is no longer accessible below an 8 to 10 km stretch of WWC adjacent to the mine. Despite this, monitoring results to date through this area don't show a significant or clearly attributable impact from dewatering apart from general but not substantial reductions in canopy cover in low flow phreatophytes. Furthermore, a census of the condition of every Facultative Phreatophytic Species (FPS) individual in a 4 km stretch of WWC directly adjacent to the mine found that in 2018 only 15 trees were detected to have died since mining began in 2007. This number is clearly in the realm of natural attrition given that it was out of approximately 2000 individuals assessed. Furthermore, as part of this same assessment, no patterns in increased mortality or significantly reduced condition were recorded for floodplain *Eucalyptus camaldulensis* individuals positioned several hundred meters away from the seasonal recharge afforded to trees in or adjacent to the low flow. It was concluded that populations in that area of highest groundwater drawdown were most likely being afforded protection from this influence by the vadose zone and small-scale groundwater reserves seemingly positioned in the extensive calcrete formations in this area which WWC and its floodplains dissect.

For PMC, the story is quite different. Outside of the area of direct influence from its diversion and the influence of seasonal water ponding in the diversion area, PMC remains relatively unchanged. This is predominantly because of the fact that groundwater heights within the regional aquifer in the PMC area are generally beyond 30 mbgl.

2.4.2. Proposed Groundwater changes

The deposits associated with the Proposal (i.e. BHT and HD2 deposits), are proposed to be restricted to above water table (AWT) mining, and as a result the only groundwater abstraction proposed as part of the development is relatively low volume abstraction to support mining construction and operational demands such as dust suppression, infrastructure and processing.

A restriction to AWT mining combined with a general dearth of Groundwater Dependent Ecosystems (GDE's) and potential GDE's in the proposed development/abstraction areas indicates that the risk of impact to riparian ecosystems and potential GDV or associated GDE's is quite low.

Some risks to GDV/GDE's still remain, and this is primarily in the form of the springs at "Ben's Oasis", noting that WWS is further afield and currently supported by mine discharge. Hydrogeological work to date suggests the risk to "Ben's Oasis" remains very low, but given the elevated significance of the feature, further work is ongoing in order to properly understand this small but potentially credible risk.

2.5. Existing Riparian Vegetation Information

Several previous flora and vegetation surveys have been completed in the Greater Hope Downs 1 area (Figure 2-4). Of note are the surveys that have included parts of Pebble Mouse Creek and Weeli Wolli Creek within the current survey bounds (Astron Environmental Services Pty Ltd, 2020; E.M. Mattiske and Associates, 1995; Mattiske Consulting Pty Ltd, 2008; 2010), and the biannual monitoring conducted by Mattiske Consulting Pty Ltd that includes transects within the "Bens Oasis" area.

Astron's (2020) survey included the majority of Pebble Mouse Creek targeted within the current study, as well as some sections of Weeli Wolli Creek and surrounding vegetation on minor drainage. The 27 vegetation units were associated with three major landforms, with 'Vegetation of Drainage Lines' including eight vegetation units described as:

- **D1 –** *Corymbia hamersleyana* sens. lat., *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees to low open woodland over *Petalostylis labicheoides*, *Acacia monticola, A. maitlandii* scattered tall shrubs to tall shrubland over *Dodonaea lanceolata* var. *lanceolata, Androcalva luteiflora* scattered shrubs to open shrubland over *Triodia pungens* very open hummock grassland to open hummock grassland with *Themeda triandra*, *Eriachne mucronata* very open tussock grassland to open tussock grassland.
- **D2 –** *Acacia aptaneura, A. catenulata* subsp. *occidentalis*, *A. pruinocarpa* tall shrubland to tall open scrub over *Petalostylis labicheoides* scattered shrubs to open shrubland over *Triodia pungens* very open hummock grassland with *Chrysopogon fallax* scattered tussock grasses.
- **D3 –** *Corymbia ferriticola*, *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Petalostylis labicheoides*, *Acacia hamersleyensis, Dodonaea viscosa* subsp. *spatulata* tall open shrubland over *Triodia pungens* very open hummock grassland with *Eriachne mucronata*, *Themeda* sp. Mt Barricade (M.E. Trudgen 2471), *Cymbopogon ambiguus* very open tussock grassland to tussock grassland.
- **D4 –** *Eucalyptus victrix*, (*E. camaldulensis* subsp. *obtusa*) low open woodland to open woodland over *Acacia citrinoviridis*, *Petalostylis labicheoides* scattered tall shrubs to tall shrubland over *Androcalva luteiflora*, *Gossypium sturtianum* var. *sturtianum* scattered shrubs to open shrubland over *Triodia longiceps* scattered hummock grasses to very open hummock grassland with *Themeda triandra*, *Eulalia aurea*, (**Cenchrus ciliaris*) very open tussock grassland to tussock grassland and **Bidens bipinnata* scattered herbs.
- **D5 –** *Eucalyptus xerothermica* scattered low trees to low open woodland over *Petalostylis labicheoides, Acacia maitlandii*, *A. pyrifolia* tall open shrubland to tall shrubland over *Androcalva luteiflora* scattered shrubs over *Triodia longiceps* very open hummock grassland to open hummock grassland with *Themeda triandra*, *Eulalia aurea* open tussock grassland to tussock grassland and **Bidens bipinnata* scattered herbs.
- **D6 –** *Melaleuca argentea, Eucalyptus camaldulensis* subsp*. obtusa, (E. victrix*) open forest over *Acacia citrinoviridis, Atalaya hemiglauca* scattered tall shrubs over *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) scattered low shrubs over *Cyperus vaginatus, Typha domingensis* scattered sedges.
- **D7 –** *Acacia citrinoviridis, A. aptaneura, A. pruinocarpa* scattered tall shrubs to tall shrubland over *Senna artemisioides* subsp. *oligophylla* scattered low shrubs over *Triodia longiceps* open hummock grassland to hummock grassland.
- **D8 –** *Eucalyptus xerothermica* scattered low trees to low open woodland over *Acacia aptaneura, A. catenulata* subsp*. occidentalis* tall open shrubland to tall open scrub over *Triodia pungens* scattered hummock grasses to very open hummock grassland with *Themeda triandra* very open tussock grassland to open tussock grassland.

The remaining 19 vegetation units occurred outside of the riparian zones of moderate to major sized drainage, which were the focus of this study. Of these eight riparian vegetation units above, three units (D1, D2, D3) were associated with minor to moderate drainage lines that occurred on the smaller tributaries of Pebble Mouse Creek and Weeli Wolli Creek, and one unit (D6) was mapped outside of the area that the current study focuses on. Areas mapped by Astron (2020) as vegetation units D4, D5, D7 and D8 were of most relevance to the current study.

Mattiske's (2008) survey included the majority of Weeli Wolli Creek targeted within the current assessment and surrounding non-riparian vegetation. The 25 vegetation units mapped by Mattiske (2008) were associated with two major landforms, with 'Flowlines (creeklines and drainage areas)'

including five vegetation units and 'Flats and Broad Plains' including one vegetation unit associated with creeklines, described as:

- **STC C1 –** Open Woodland of *Eucalyptus victrix*, *Eucalyptus camaldulensis* var. *obtusa* over *Acacia citrinoviridis* and *Acacia coriacea* subsp. *pendens* over *Petalostylis labicheoides*, *Gossypium robinsonii*, *Acacia pyrifolia*, *Melaleuca lasiandra*, *Androcalva luteiflora* over *Tephrosia rosea* var. *clementii*, *Themeda triandra*, *Cyperus vaginatus* and *Cleome viscosa* on major creeklines with sandy soils.
- **ATA C2 –** Low Woodland of *Eucalyptus xerothermica* and *Eucalyptus victrix* over *Acacia citrinoviridis*, *Acacia maitlandii*, *Gossypium australe*, *Melaleuca lasiandra*, *Petalostylis labicheoides*, *Androcalva luteiflora* over *Triodia epactia*, *Chrysopogon fallax* and *Triodia pungens* on minor creeklines with sandy soils.
- **MF C3 –** Tall Shrubland of *Acacia arida*, *Acacia bivenosa*, *Acacia ancistrocarpa*, *Acacia maitlandii*, *Acacia monticola* with occasional emergent *Corymbia deserticola* subsp. *deserticola*, *Eucalyptus gamophylla* and *Eucalyptus leucophloia* over *Gompholobium polyzygum*, *Indigofera monophylla*, *Androcalva luteiflora* over mixed *Triodia* species on sandy-loam soils in minor gullies.
- **MR C4 –** Open Woodland of *Eucalyptus victrix, Eucalyptus camaldulensis* var. *obtusa, Melaleuca argentea* over *Acacia citrinoviridis, Acacia coriacea* subsp. *sericophylla* and *Melaleuca lasiandra* over *Cyperus vaginatus* on major creeklines with pools with sandy soils.
- **MF X3 –** Tall Shrubland of *Acacia bivenosa, Acacia monticola, Acacia marramamba, Petalostylis labicheoides* with occasional emergent *Eucalyptus leucophloia* over *Triodia pungens* and *Triodia basedowii* on calcrete soils in minor gullies.
- **ATC M2 –** Low Woodland of *Acacia aneura* var. *aneura* to a Tall Shrubland of *Acacia pyrifolia*, *Acacia bivenosa*, *Acacia ancistrocarpa* and *Acacia maitlandii* with occasional emergent *Eucalyptus xerothermica*, *Corymbia aspera*, *Psydrax latifolia* and *Acacia citrinoviridis* over *Gompholobium polyzygum*, *Androcalva luteiflora*, *Themeda triandra*, *Triodia epactia* and *Triodia pungens* on sandy soils on flats on edges of major creeklines.

The remaining 19 vegetation units occurred outside the riparian zones covered by this study. Of these six riparian vegetation units above, one unit (MF X3) was associated with minor drainage lines that occurred in the small tributaries of Weeli Wolli Creek.

In addition to these, Mattiske's (2010) survey included sections of Weeli Wolli Creek targeted within the current assessment and surrounding non-riparian vegetation that weren't covered by the 2008 survey, and described an additional vegetation unit within the 'Flowlines (creeklines and drainage areas)' landform that was associated with the southwest section of Weeli Wolli Creek and described as follows:

- **MF C5 –** Tall Shrubland of *Acacia bivenosa*, *Acacia maitlandii*, *Acacia monticola* with occasional emergent *Eucalyptus victrix*, *Eucalyptus xerothermica* over *Gossypium australe*, *Gossypium robinsonii*, *Petalostylis labicheoides*, *Melaleuca bracteata*, *Androcalva luteiflora* over mixed *Cymbopogon ambiguus*, *Chrysopogon fallax*, *Cyperus vaginatus*, *Triodia angusta* on sandy-loam soils in minor gullies.

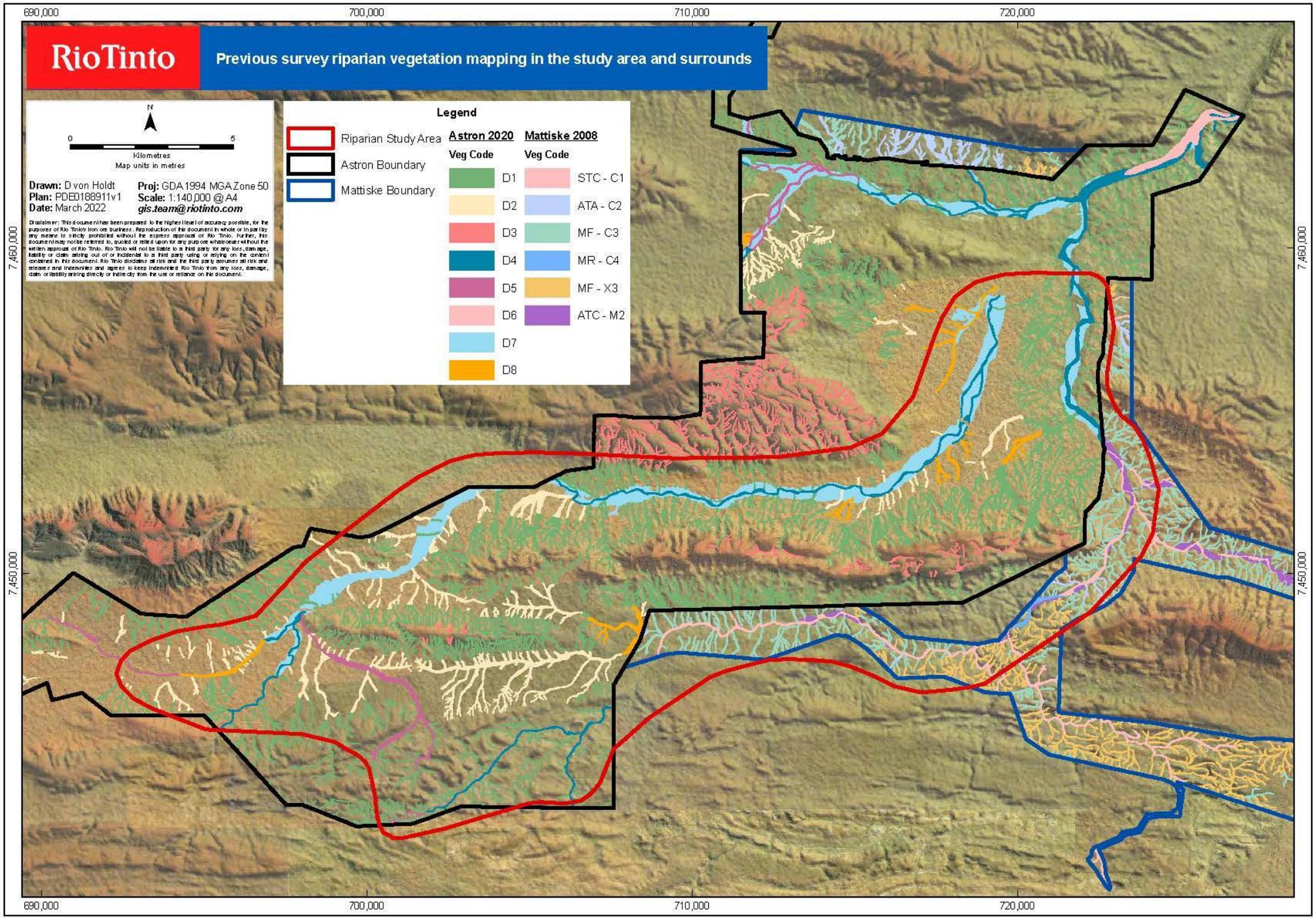

Figure 2-4: Riparian vegetation mapping from flora and vegetation surveys conducted by Astron (2020) and Mattiske (2008) in the Greater Hope Downs area.

2.6. Landsat & Sentinel derived remote sensing products for GDE mapping

The use of remote sensing (RS) techniques which leverage off available historical Landsat or Sentinel imagery is an underused and highly valuable tool that can assist in determining and mapping the presence/absence/potential of GDEs. Previous work undertaken by the CSIRO for the Pilbara region has led to the development of a remote sensing technique capable of mapping/identifying potential GDE presence, as well as their historical changes (Barron *et al*., 2012; Barron *et al*., 2017). This technique is highly applicable to hot tropical regions and works by assessing the degree of persistence exhibited by terrestrial riparian vegetation through remote sensing derived vegetation indices (Normalised Difference Vegetation Index (NDVI)) and their behaviour across seasons.

The GDE delineation methods developed within the Pilbara Water Resources Assessment (PWRA) are based on the spatio-temporal analysis of Landsat 5 imagery for a period from 1987 to 2011 (more than 180 image dates from over 1,000 remotely sensed images) combined with available information on climate variability, water regime and GDE ecohydrological characteristics (Barron & Emelyanova, 2015). This technique allows the development of an understanding of the temporal and spatial variability of land cover classes and the extrapolation of this local knowledge over large scales. Two advantages of RS techniques are the availability of historical (baseline) satellite datasets and the ability to analyse large areas at low cost. As some RS data sources are available for over 30 years (e.g. Landsat), historical changes in land cover and their characteristics can be analysed statistically and linked with known climatic conditions, changes in groundwater and surface water fluxes, as well as with historical land use practices. This analysis assists in development of the baseline for identification of likely GDEs/GDV and for understanding the potential impacts of mining activities on relevant riparian vegetation. Furthermore, future changes in riparian vegetation cover and persistence can be measured against the historical variability within the identified vegetation classes. This in turn helps to separate or contextualise changes due to natural climate variability from changes possibly caused by mining-related activities.

NDVI persistence mapping allows the identification of ground pixels where vegetation is most consistently dense throughout wet and dry seasons, with high persistence indicated by a high percentage of Landsat or Sentinel images having exceeded the chosen threshold at any point on the ground (for the relevant temporal period). It is thus inferred that high persistence vegetation (in the order of 70% persistent and greater) is likely to be accessing a water source other than incident rainfall and typical surface water flows, to maintain growth and productivity throughout the year. This inference generally implies that high persistence is potentially utilising stored groundwater (many potential sources) to satisfy at least part of its environmental water requirements.

Across the Study Area, Landsat remote sensing (RS) derived NDVI and NDMI (Normalised Difference Moisture Index) persistence mapping was reviewed to provide an indication of riparian zones. The persistence mapping highlighted zones with a low potential for the presence of GDV, the location and size of potentially groundwater dependent riparian features, as well as highlighting areas where varying degrees of mesic riparian habitats/communities occurred. This provided information for mapping refinements and an indication of the potential magnitude of groundwater dependence exhibited by relevant local riparian communities.

Trends observed in the Sentinel 2 NDVI persistence mapping, using the same methodology as Barron (2012 & 2017), were essentially the same as that observed in longer temporal period of the Landsat derived NDVI persistence mapping product. Given the finer scale resolution (three times higher resolution) of the Sentinel mapping product, this product was chosen as the primary tool (along with sampling data, vegetation mapping and associated mapping notes) for assessing the likely groundwater dependence of riparian vegetation units across the Study Area.

Sentinel 2 based NDVI persistence mapping is presented in Figure 2-5. NDVI persistence mapping (Sentinel imagery 2016-2021, NDVI threshold of 0.32) for the Greater Hope Downs locality identified some highly persistent areas, particularly around the “Ben’s Oasis” area (Figure 2-5). Note that some

areas of high persistence depicted in the map represent irrigated areas that are watered for substantial periods of the year.

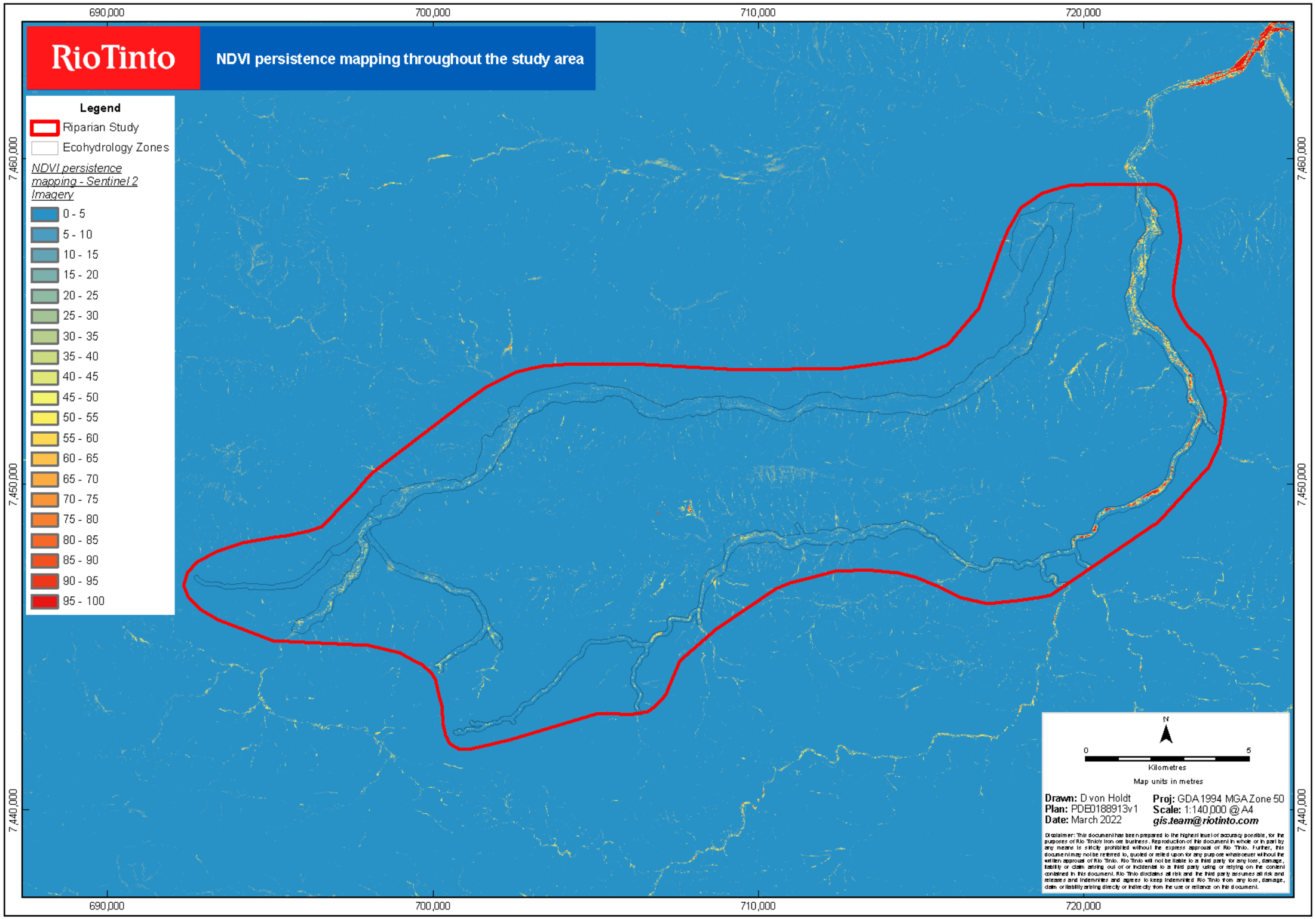

Figure 2-5: NDVI Persistence mapping using Sentinel 2 Imagery for the Greater Hope Downs locality

2.7. Bureau of Meteorology National GDE atlas

The Bureau of Meteorology (BoM) has developed the Groundwater Dependent Ecosystems Atlas (GDE Atlas) as a national dataset of Australian GDEs to inform groundwater planning and management (BoM, 2022). It is the first and only national inventory of GDEs in Australia.

The GDE Atlas web-based mapping application allows for visualisation, analysis and downloading of GDE information for an area of interest without needing specialised software.

The GDE Atlas contains information about three key types of ecosystems: Aquatic ecosystems, Terrestrial ecosystems, and Subterranean ecosystems (explained in Section 3.2). Importantly, the GDE Atlas also includes the national inflow-dependent ecosystems (IDE) layer which is derived from remotely sensed data. This layer indicates the likelihood that a landscape is accessing water in addition to rainfall (such as soil moisture, surface water or groundwater), and generally represents a potential GDE dataset for all areas not yet studied or investigated in any detail.

The GDE mapping in the GDE Atlas comes from two broad sources:

- National assessment – national scale analysis based on a set of rules that describe potential for groundwater/ecosystem interaction and available GIS data.
- Regional studies – more detailed analysis undertaken by various State and regional agencies using a range of different approaches including field work, analysis of satellite imagery and application of rules/conceptual models.

The BoM GDE Atlas indicates that there are numerous moderate to low (from national assessment) potential GDEs over the area of the Proposal and surrounds (Figure 2-6). There were no high potential (from national assessment) GDE sites noted within the Greater Hope Downs locality. Importantly, the sub-regionally significant Weeli Wolli Springs occurs in the mapped area of Figure 2-6, and occurs adjacent to the current Study Area. The absence of this feature highlights the gaps present in the atlas as it currently stands, however value is still placed in this resource as a first point of call.

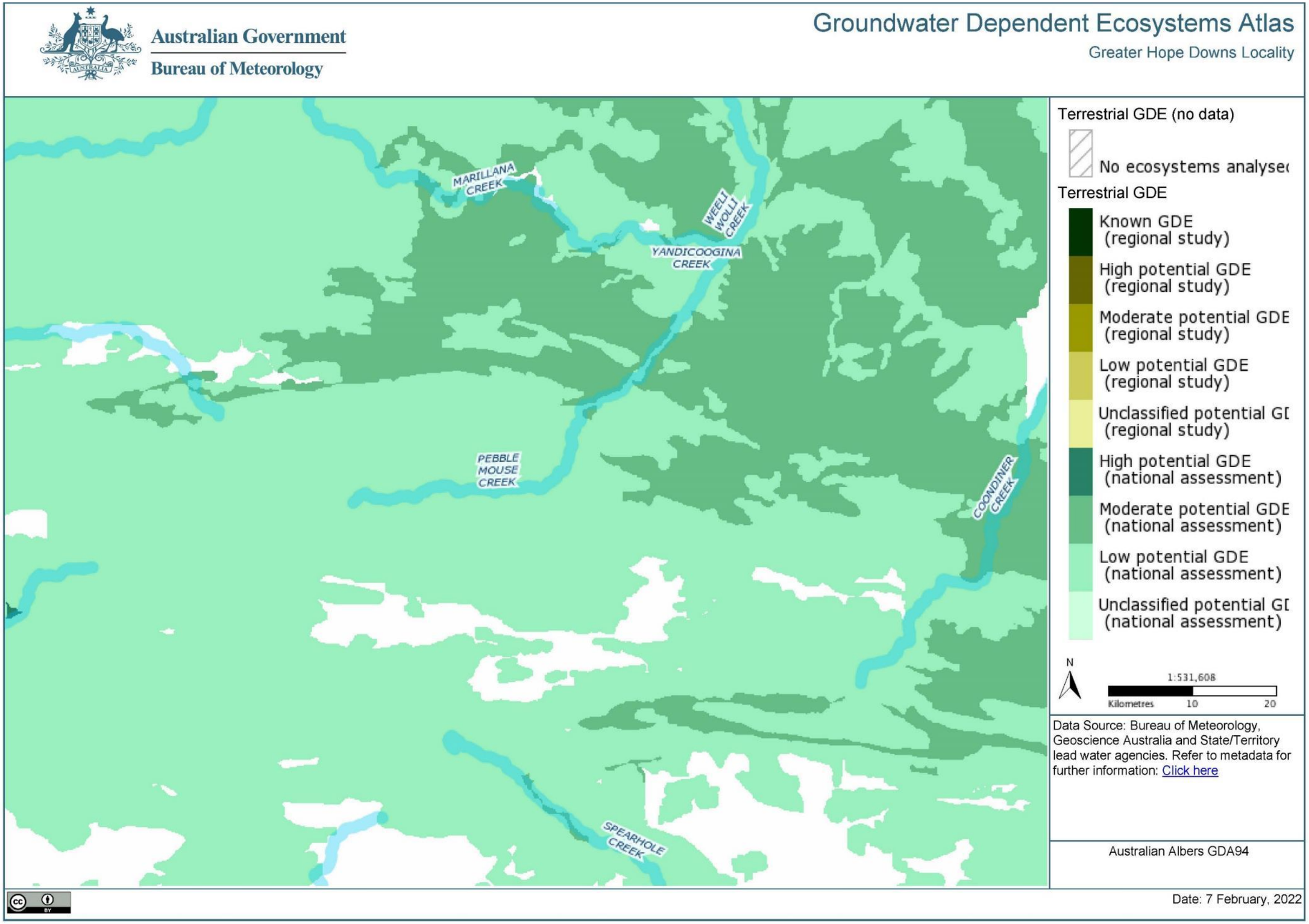

Figure 2-6: BoM GDE Atlas mapping for the Greater Hope Downs locality (Terrestrial GDE mapping Layer) (BoM, 2022).

3. Riparian & Groundwater Dependent Ecosystems

3.1. Protection

Initially, within the EIA process, riparian ecosystems and GDE's are detected and assessed via the "Flora and Vegetation" Environmental Factor Guideline (EPA, 2016a). This guideline allows provisions for survey work and biodiversity-based assessment of potential riparian values in a study area, particularly those features which may be dependent on groundwater and thus susceptible to hydrological change. However, following on from this process, Groundwater Dependent Ecosystems (GDEs) are protected under the Environmental Factor Guideline: Inland Waters (EPA, 2018b) when assessing any potential proposal that may impact GDEs. The objective of the Inland Waters Environmental Factor is "to maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected" (EPA, 2018b). For the purposes of EIA, the Environmental Protection Authority (EPA) defines Inland Waters Factor as:

"The occurrence, distribution, connectivity, movement, and quantity (hydrological regimes) of inland water including its chemical, physical, biological, and aesthetic characteristics (quality)" (EPA, 2018b).

Inland Waters include both groundwater (such as superficial and confined aquifers) and surface water systems (such as waterways, wetlands and estuaries) (EPA, 2018b). Both permanent systems and those which hold water for part of the year or occasionally (seasonal and ephemeral systems), are included in the Inland Waters Factor. Waterways are any river, creek, stream or brook, including its floodplain and estuary or inlet and includes systems that flow permanently, for part of the year or occasionally (EPA, 2018b). In this instance, Weeli Wolli Creek is considered a waterway warranting assessment under the Inland Waters Factor guidelines.

Based on these definitions, while it's clear that GDE's are of increased environmental value and thus increased importance for being considered by both the 'Flora and Vegetation' as well as 'Inland Waters' factors, it's also clear that all larger scale riparian features should be considered as part of both guidelines. Being generally dependent upon either ground or surface water systems, larger scale riparian ecosystems are hydrologically sensitive ecosystems whose fostered diversity is predominantly linked to mesic/hydric habitats and the unique floral/faunal assemblages which they support. This highlights that not only does an assessment of their significance require a much more targeted approach, but that targeted assessments of riparian flora and vegetation values such as this are a critical step in underpinning and supporting EIA relating to the Inland Waters Factor.

Environmental value is defined under the EP Act as a beneficial use or an ecosystem health condition. Ecosystem health is the focus of this document (the EP Act) and generally includes the ability of Inland Waters to sustain vegetation, aquatic fauna and birdlife, and the ecological processes that support them (EPA, 2018b). For the purposes of EIA, the EPA focusses on 'significant ecosystems'. Significant ecosystems which relate to the Study Area will predominantly be defined based on the presence of terrestrial and aquatic GDEs and the communities/species they support.

3.2. Background

GDEs are ecosystems that rely upon groundwater for their continued existence (BoM, 2022). GDE's can be represented by many different assemblages of biota which rely on groundwater, and as a result come in many forms.

For terrestrial systems there are three key types of GDE (BoM, 2022);

1. **Aquatic ecosystems;** that rely on the surface expression of groundwater – this includes surface water ecosystems which may have a groundwater component, such as rivers, wetlands and springs.

2. **Terrestrial ecosystems;** that rely on the subsurface presence of groundwater–this includes all vegetation ecosystems.
3. **Subterranean ecosystems;** this includes cave and aquifer ecosystems.

Aboveground terrestrial GDE's are typically characterised by the presence of flora species that rely on groundwater (i.e. phreatophytes). Phreatophytes may be classified as either obligate or facultative phreatophytes depending on their reliance on groundwater (Eamus *et al*., 2016):

- Obligate phreatophytes are flora species confined to habitats with access to groundwater.
- Facultative phreatophytes are flora species that can utilise groundwater to satisfy a proportion of their ecological water requirement (EWR) when it is available. However, some individuals may also satisfy their EWR by relying solely on uptake from upper unsaturated soils layers where groundwater is inaccessible.

This study has adopted a novel approach to support the process of identifying, characterising and contextualising GDEs/GDV occurring within the Study Area. The novel approach, in simple terms, has utilised remote sensing analyses to guide the desktop identification of the presence, and importantly, absence of potential GDE's. The results of the remote sensing analyses were used to guide the distribution of field investigations and resultant confidence in the completeness of the associated findings.

Broadly this study focused on identifying and mapping riparian vegetation within the Study Area. Further to this, a focus on identifying and characterising significant 'mesic' representations of riparian vegetation (i.e. occurring in mesic habitats) helped the study to determine the value, extent and sensitivity of potential occurrences of GDV. For the purpose of this study, 'mesic' vegetation is defined as that vegetation with a composition (both overstorey and understorey components) indicative of the presence of riparian habitat possessing at least a moderately continuous (outside of drought) supply of soil moisture (and potentially surface moisture). Such habitats will typically be inhabited by species which are able to be classified as mesophytic or hydrophytic in their habitat/environmental preferences. This relatively continuous supply of moisture is typically indicative of the availability of at least intermittent groundwater sources of varying scale. In the arid Pilbara climate, such sources are of high importance to specific assemblages of 'mesic' riparian vegetation. The presence of mesic vegetation has been initially used to identify the presence of potentially significant GDV, which is then used as an indicator for the potential presence of:

- Groundwater Dependent Ecosystems (GDEs) – ecosystems which rely on permanent or intermittent access to groundwater to meet some or all their EWRs; or
- Inflow Dependent Ecosystems (IDEs)[1] – ecosystems likely to access a water source in addition to rainfall (e.g. surface water, water stored in the unsaturated zone or smaller groundwater sources).

In general, the structure and composition of creekline vegetation in the Pilbara tends to be driven by the inter and intra-annual availability of moisture. As such, the structure and composition of vegetation present is often the most reliable indicator of the longer term inter/intra-annual availability of moisture, often providing valuable insight into groundwater proximity (and consistency of access), surface water permanence and therefore the potential sensitivity of a riparian ecosystem to fluctuations in water availability.

[1] Refer to Section 2.7 for a modified definition of this term which is introduced by the Bureau of Meteorology as part of the Australian Groundwater Dependent Ecosystems Atlas (BoM, 2022).

In larger riparian systems of the Pilbara, groundwater can typically be contained within shallow, unconsolidated sedimentary aquifers close to the surface (Landman, 2001). These shallow aquifers often support riparian vegetation which can be classified as a GDE.

Ecosystems that rely on the presence or input of groundwater are associated with terrestrial vegetation complexes, river base flow systems, wetlands, and caves (Hatton & Evans, 1998). GDEs can have various levels of dependency on or utilisation of groundwater, ranging from complete dependence to occasional supplementary use. It is for this reason it is important to define the vegetation present and to estimate the likely dependence of such vegetation on groundwater and surface-water sources to contextualise the potential influence of local scale hydrogeological impacts.

Although GDEs only cover a comparatively small proportion of the land surface, they provide specific ecosystem functions supporting unique and important biological diversity at both local and regional scales (Boulton & Hancock, 2006; Humphreys, 2006; Murray *et al*., 2006; Thurgate *et al*., 2001). In addition to environmental benefits, GDEs often have significant social, economic, and spiritual values (Murray *et al*., 2006). Protection of GDEs is commonly considered an important criterion in sustainable water resource management, particularly when human water management is in competition with environmental water demands.

3.3. Groundwater Dependent species

Groundwater Dependent Ecosystems tend to support relatively dense and diverse vegetation communities. Such vegetation tends to contain an above average proportion of mesophytic or potentially hydrophytic species which often thrive in areas where groundwater proximity (or other sources of increased moisture) significantly increases the availability of moisture. It is these species, which are indicative of the presence of perennial to sub-perennial (and ephemeral) mesic conditions/habitats, which are typically quite restricted in their distribution and extent and therefore of elevated significance or conservation value. In an arid climate like the Pilbara, this elevated value is attributed to the restricted nature of such mesic conditions, and the functions provided by the moisture they harbor.

Species that broadly utilise groundwater are referred to as phreatophytes, and they may be classified as either obligate or facultative phreatophytes depending on their level of dependence on groundwater. Obligate phreatophytes are plants that are completely or highly dependent on groundwater. This dependence can be continual, seasonal or episodic. Obligate phreatophytes are often associated with surface expressions of groundwater rather than purely the subsurface presence of groundwater, and they are highly sensitive to large changes in groundwater regime and respond negatively to rapid groundwater drawdown. Not all phreatophytic species display the same degree of dependency on groundwater and the dependency within species has been shown to vary both spatially and temporally (Eamus & Froend, 2006). Obligate phreatophytes are those species for which access to groundwater is critically important to their presence in the landscape. Such species can only inhabit areas where they have access to groundwater in order satisfy at least some proportion of their EWR (Eamus *et al.,* 2006).

Facultative phreatophytes are plants that can access groundwater but are not totally reliant on groundwater to fulfil their water requirements. Rather, they utilise groundwater opportunistically, particularly during times of drought when moisture reserves in the unsaturated (vadose) zone of the soil profile become depleted. The framework for assessing 'Environmental Water requirements of Groundwater Dependent Ecosystems' published by REM, CSIRO and SKM (2007) defines facultative GDEs as plants that require access to groundwater in some landscapes, but in other landscapes can utilise alternate sources of water to maintain ecosystem function, i.e. the presence or absence of groundwater is not critical in determining ecosystem occurrence (compared with obligate GDEs).

Facultative phreatophytes may utilise groundwater to satisfy a proportion of their EWR but, if required, may also satisfy their total EWR via stored soil water reserves (Eamus *et al.*, 2006). Facultative phreatophytes are generally associated with the subsurface presence of groundwater rather than surface water. Most facultative phreatophytes are large woody trees and shrubs with deep root systems capable of accessing the capillary fringe of the water table which may occur at considerable depth within the soil profile.

Knowledge surrounding the groundwater use strategies of plants in the Pilbara is generally restricted to keystone trees species, and as a result there is limited knowledge in this space for understorey species. Table 3-1 presents the different classes of groundwater dependence (water use strategies) relevant to tree species in the Pilbara, and the most relevant species considered as being attributable to each. This table has been produced through the synthesis of a number of references on the subject along with the observations of species/groundwater height interactions across multiple sites in the Pilbara (Rio Tinto, 2018a, 2018b, 2019a, 2020).

Table 3-1: Tree species dependence on groundwater

Species dependence on Groundwater	Plant Physiology/water use strategy	Relevant Species in the Pilbara
Very High	Wetland Obligate Phreatophyte/Hydrophyte[2]	Obligate phreatophytes (i.e. *Melaleuca argentea*) plus presence of hydrophytic macrophytes (e.g. *Schoenus falcatus, Eleocharis geniculata, Cladium procerum*)
High	Obligate Phreatophyte	*Melaleuca argentea, Livistona alfredii*[3]
Moderate	Facultative Phreatophyte (in anomalous cases can be a vadophyte)	*Eucalyptus camaldulensis, Sesbania formosa*[4]
Low to Moderate	Facultative Phreatophyte/Vadophyte[5]	*Eucalyptus victrix, Eucalyptus xerothermica, Corymbia candida/aspera*
Low (virtually negligible)	Vadophyte/Xerophyte[6]	*Eucalyptus leucophloia, Corymbia hamersleyana, Corymbia deserticola and others*

It is generally recognised that obligate phreatophytes are those species with the highest degree of groundwater dependence (i.e. smallest acceptable depth to saturation which they will tolerate), and as such are often the best indicator within the Pilbara of consistently shallow groundwater tables, or permanent surface water presence. The structure and composition of creekline vegetation is generally considered to be heavily driven by the degree and consistency of moisture availability. As a result, the

[2] Hydrophytes are plants which live in waterlogged soil or partly or wholly submerged in water. Generally associated with aquatic flora.

[3] The groundwater use strategy of *Livistona alfredii* is not completely understood, however mature individuals are generally observed in situations that would suggest it is an obligate phreatophyte, requiring access to groundwater

[4] *Sesbania formosa* may be an obligate phreatophyte. Environmental data would suggest it is a phreatophyte, but there is some question as to whether its groundwater use strategy is obligate in nature.

[5] Vadophytes are plants commonly associated with drainage lines which rely on moisture in the soil surface profiles and are independent of groundwater.

[6] Xerophytes are plants which are adapted to dry environments. Xerophytic adaptations including waxy covering over the stomata, very few stomata, or stomata that only open at night, the development of a dense, hairy leaf covering, the ability to drop leaves during dry periods, the ability to reposition or fold leaves to reduce sunlight absorption all prevent water loss, while fleshy stems or leaves store water.

structure and composition of vegetation types present in a riparian system is an important longer-term indicator of groundwater proximity and surface water permanence. Furthermore, such insight into the degree of moisture permanency also provides insight into the associated values and significance of a riparian ecosystem. It is for these reasons that often the most reliable and effective indicator for moisture permanency and therefore inherent hydrological sensitivity is the composition and structure of vegetation present.

Such concepts underpin the basis for a potential conservation framework for terrestrial and aquatic GDE features in the arid zones of Australia's North. The concept relies on the fact that there is inevitably a suite of species in any region whose distributions are inherently restricted in the environment due to their sensitivity to variability in water access, i.e. which possess decreased ability to persist in areas which periodically dry out. In effect the presence of at least some of these species in a riparian habitat becomes a good indicator of increasing degrees of consistency in moisture availability (or high water permanence) and thus indicative of a hydrological refuge. By this logic, habitats possessing increasing numbers of species which are most indicative of high water permanence (and thus which cannot exist without perennial moisture availability) represent increasingly restricted, and important refugial habitats for mesophytic/hydrophytic diversity. These habitats invariably support restricted faunal assemblages who also need permanent access to moisture. By understanding which species indicate increasing degrees of moisture permanence and where they might sit on this scale, we can also use the presence, composition and relative abundance of these species to help quantify values, ecosystem services and ultimately riparian significance.

A recently listed (2018) Priority Ecological Community (PEC) by The Department of Biodiversity, Conservation and Attractions (DBCA), introduces some of these concepts in a conservation context and provides a description of some of the associated values. The PEC is titled "Riparian flora and plant communities of springs and river pools with high water permanence of the Pilbara". The PEC is described as including flora with restricted distributions or populations that are highly disjunct or are major range extensions from northern and eastern Australia (DBCA, 2021). Detail in its description indicates that in the Pilbara these taxa are almost exclusively restricted to the riparian zones of permanent wetlands with high soil moisture maintained by groundwater flows.

To help identify these values (and potential degrees of groundwater dependence) at a fine scale, and with increased detail it is important to understand the habitat specificity of different mesophytic/hydrophytic species and thus how reliant they may be on varying degrees of water availability/consistency. In the Pilbara, a non-exhaustive list of mesophytic/hydrophytic species indicative of sub-perennial to perennial moisture availability is likely to contain many of the taxa listed in Table 3-2 (in conceptual order of importance/usefulness and therefore decreasing reliance on consistent/elevated moisture availability; refer to Table 3-3 for further detail) (adapted from information provided by WAH (2022), ALA (2022), and Pilbara environmental observations by J. Naaykens (Rio Tinto)).

Riparian zones or water gaining sites which contain obligate phreatophytes (such as *Melaleuca argentea* and/or an abundance of facultative phreatophytes) and a few of the following species are considered to provide good evidence of high moisture availability and its degree of persistence/permanence.

Table 3-2: Pilbara mesophytic/hydrophytic species likely to indicate sub-perennial to perennial moisture availability.

Species	Lifeform	Indicator Guild Level
Melaleuca argentea	**Tree**	**Very High**
Cladium procerum	**Macrophyte/sedge**	**Very High**
Adiantum capillus-veneris	**Fern**	**Very High**
Pteris vittata	**Fern**	**High**
Imperata cylindrica	**Reed/Grass**	**Very High**
Various sedge spp. including *Schoenus* spp., *Baumea* spp., *Fimbristylis* spp., etc.	**Macrophyte/sedge**	**Moderate - Very High**
Sesbania formosa	**Tree**	**Very High**
****Phoenix dactylifera*** **(Date palm)**	**Palm**	**Standard Riparian**
Eucalyptus camaldulensis	**Tree**	**Very High**
Acacia ampliceps	**Shrub**	**High**
Cullen leucanthum	**Shrub**	**High**
Melaleuca bracteata	**Shrub**	**Moderate – High**
Lobelia **spp.**	**Herb**	**High**
Stylidium **spp.**	**Herb**	**Moderate - High**
Melaleuca linophylla	Shrub	Moderate - High
Melaleuca glomerata	Shrub	Moderate
Eucalyptus victrix	Tree	Very High
Atalaya hemiglauca	Tree	Moderate
Acacia coriacea subsp. *pendens*	Tree/shrub	Moderate
Eleocharis **spp. (Particularly *E. geniculata*)**	**Macrophyte/sedge**	**Moderate – High/High**
Potamogeton **spp.**	**Aquatic Macrophyte**	**High**
Fuirena ciliaris	**Macrophyte/sedge**	**Moderate - High**
Schoenoplectus subulatus	Aquatic Macrophyte	Moderate
Typha domingensis	Aquatic Macrophyte/sedge	Moderate
Cyperus iria	Macrophyte/sedge	Moderate - Low
Duma **spp.**	**Macrophyte/shrub**	**Moderate**
Cyperus vaginatus	Macrophyte/sedge	Moderate
Schoenoplectiella spp.	Macrophyte/sedge	Moderate
Marsilea spp.	Macrophyte/fern	Low
Gossypium sturtianum	Shrub	Moderate
Acacia citrinoviridis	Tree	Standard Riparian
Acacia sclerosperma	Shrub	Low
Peplidium sp. E Evol. Fl. Fauna Arid Aust. (A.S. Weston 12768)	Herb	Standard Riparian
Sesbania spp.	Shrub	Moderate
Sorghum spp.	Grass	Standard Riparian
Eragrostis surreyana	Grass	Moderate - High
Geijera salicifolia	Tree	Standard Riparian
Commelina ensifolia R.Br.	Herb	Standard Riparian
Trigonella suavissima Lindl.	Herb	Standard Riparian

Note: Species in **bold** identify some of the best upper level indicators of moisture availability/permanence

Outside of the list provided within Table 3-2, the following keystone Pilbara phreatophytes (and thus mesophytic/hydrophytic species) are well accepted as species indicating the potential presence of GDV and thus a GDE within the hot tropical regions of Australia's northwest.

3.3.1. *Melaleuca argentea*

In the Pilbara, *Melaleuca argentea* is thought to depend on groundwater almost exclusively and is therefore considered to be an obligate phreatophyte (Graham *et al.*, 2003; Lamontagne *et al.*, 2005; Landman *et al.*, 2003; McLean, 2014, O'Grady *et al.*, 2006).

Due to its dependence on groundwater, *Melaleuca argentea* is often the best indicator of consistently shallow groundwater tables or permanent (perennial) surface water presence and subsequently, this species is also widely considered the best available indicator for the presence of GDV and therefore a GDE.

3.3.2. *Eucalyptus camaldulensis*

Eucalyptus camaldulensis is a small to large tree (typically 5 to 20 m but can grow to more than 30 m) with smooth white bark and a generally spreading form. This species displays a great diversity in height, form, trunk and leaf morphology (WAH, 2022; Colloff, 2014) across the State and Australia.

Eucalyptus camaldulensis is one of the most iconic and broadly distributed *Eucalyptus* species in Australia and more is known about this species than nearly all others. Across its broad geographic distribution, *Eucalyptus camaldulensis* populations display high genetic diversity with regard to hydraulic architecture, water relations and salt tolerance, reflecting how different populations have evolved and adapted to local climates and hydrogeological regimes (Colloff, 2014). Furthermore, this diversity is also shown by the various sub-species (there are at least seven recognised sub-species) known to occur in Australia. In the Pilbara, *Eucalyptus camaldulensis* is typically represented by *Eucalyptus camaldulensis* subsp. r*efulgens*, and subsp. o*btusa* (as well as subsp. *arida* along the eastern boundary between the Pilbara and the Little Sandy Desert*)* and commonly occurs along water courses and riverbanks, growing in deep alluvial sand and sandy loams (WAH, 2022).

Trees in riparian zones exposed to flood events (often in more open areas subject to less competition) tend to have short, thick stems with irregular crowns or multiple stems diverging from a short trunk. Often stems sprout from epicormic buds in living tissue of the bole or root stock and new stems can arise from horizontal stems fallen by flood, fire or windstorms. In less dynamic environments, fast-growing trees can grow tall and straight with relatively even form similar to that seen in silvicultural plantations. *Eucalyptus camaldulensis* supports a large root system consisting of vertical tap roots with lateral roots branching off at right angles at several levels, and sinker roots extending downwards from laterals. Mature trees are thought to have a zone of water influence which will tend to extend at least 20 m and can often extend to more than 40 m around individuals (Colloff, 2014). A study by Hulme (2008) found examples of lateral root extensions in the order of 100 m. This extensive reach would suggest a significant reliance on soil pore water stored in the vadose zone.

Vertical sinker roots provide support for the aboveground part of the tree and deep penetration of soil over a wider area than would be possible via a single taproot. Extension of the root system also allows for access to oxygen from unsaturated portions of the soil profile during periods of inundation, thus enhancing flood tolerance. Mature trees are thought to have roots to depths of at least 9 to 10 m and possibly as deep as 30 m (Davies, 1953 cited in Colloff, 2014). Adventitious roots can grow out from boles or branches in response to flooding and as a way of increasing oxygen uptake and as a form of vegetative propagation. Woody roots of this species are known to have large xylem vessels for fast, efficient rates of water transport and rapid recovery following water stress (Heinrich, 1990 cited in Colloff, 2014).

Eucalyptus camaldulensis has the ability to utilise water from a range of different sources including rainfall, floodwater, stored soil water and groundwater and is therefore considered to be a facultative

phreatophyte (Mensforth *et al*., 1994). When conditions are favourable, *Eucalyptus camaldulensis* tends to employ a 'going for growth' strategy that involves vigorous growth rates and high rates of uptake and transpiration from a dependable water source, often provided by groundwater, river base-flow, or floodwaters that sustain groundwater recharge (Gibson, Bachelard, and Hubick, 1994; Marshall *et al*., 1997; Morris & Collopy, 1999). Consequently, *Eucalyptus camaldulensis* is generally regarded as being more reliant on groundwater than *Eucalyptus victrix*. When stressed, *Eucalyptus camaldulensis* reduces transpiration and water demand by shedding leaves and sometimes also whole branches (particularly lower limbs).

Where large *Eucalyptus camaldulensis* trees are present and common, groundwater is generally within the reach of the root zone, and in some environments depth to groundwater is a good predictor of the condition of *Eucalyptus camaldulensis* stands. Some studies have observed a sharp decline in tree health and stand condition below a threshold depth or around 10 to 12 m (England *et al*., 2009 cited in Colloff, 2014). However, some case studies have also shown reasonable resilience in vegetation health when access to groundwater is removed. What is often evident is that not all systems are equal and in certain sized catchments (generally larger ones) it appears that the frequency of replenishment of the vadose soil resource is great enough to maintain healthy populations of *Eucalyptus camaldulensis* without access to the broader water table. Conversely, there are times where drought may determine that the vadose soil resource is inadequate, and in turn fails to sustain local populations. In areas where *Eucalyptus camaldulensis* has established with groundwater depths at approximately 10 mbgl, susceptibility to impact from hydrological change may be significantly reduced.

3.3.3. *Eucalyptus* victrix

Eucalyptus victrix is a small to medium tree (typically 5 to 15 m but can grow to more than 20 m) with smooth white bark (sometimes with a box type stocking to 1 m) and a spreading form that typically occurs on red loamy or sandy soils and clay loams on floodplains, incised channel zones, and in low lying areas across the Pilbara and other areas in the north-west of Western Australia (WAH, 2022).

Mature *Eucalyptus victrix* trees commonly support a large dimorphic root system, consisting of a prominent tap root and a network of laterally expansive roots near the soil surface and in the top 1 to 2 m of the soil profile, which can extend to at least 10 to 20 m away from the main stem (and further). From the lateral roots, vertical sinker roots can also develop and potentially extend tens of metres to water table depth (Florentine 1999).

Eucalyptus victrix typically draws the majority of its water requirement from soil pore moisture (the vadose zone). During extended dry periods *Eucalyptus victrix* can also use groundwater opportunistically as required and are a facultative phreatophyte during these situations.

Previous studies have shown that when provided with access to groundwater, *Eucalyptus victrix* can maintain high leaf water potentials and high rates of tree water use during times of drought (O'Grady *et al.*, 2009; Pfautsch *et al*., 2011; Pfautsch *et al*., 2014). *Eucalyptus victrix* however, also demonstrates a strong ability to regulate water losses when water supplies are limited via regulation of stomatal conductance (Pfautsch *et al*., 2014) and structural modifications including leaf die-off, crown defoliation and adjustment of leaf area to sapwood area ratio. Such changes enable trees to maintain constant water use despite increasing evaporative demand if sufficient water is available (O'Grady *et al*., 2009). As a result, the water use strategy of *Eucalyptus victrix* appears to be highly plastic and opportunistic, enabling survival in a wide range of ecohydrological settings (Pfautsch *et al.*, 2014).

Work by Loomes (2010), assessing the range of depth to groundwater for a subset of Pilbara riparian species, found that in large Pilbara rivers, the mean minimum water level depth occurring under *Eucalyptus victrix* populations was somewhat greater than that for *Eucalyptus camaldulensis*, providing some support for the view that *Eucalyptus victrix* is found in slightly drier areas than *Eucalyptus camaldulensis* and may not be as responsive to water table fluctuations.

Despite being a relatively plastic species, major adjustments to hydraulic architecture in large trees takes time and as such *Eucalyptus victrix* growing over historically shallow groundwater exhibits much greater susceptibility to hydrological change than trees that have developed over historically deeper groundwater, as highlighted in a recent study by Pfautsch *et al.* (2014).

Mature *Eucalyptus victrix* trees display a moderate level of flooding tolerance and are able to tolerate temporary inundation in the range of weeks to months at most. The presence of adventitious roots and stem hypertrophy (the ability to increase the size of component cells) provides a level of tolerance to waterlogging in seedlings and saplings, allowing them to survive in flood-prone areas (Florentine 1999; Florentine & Fox, 2002a). In fact, flooding events are believed to play a major role in the reproductive cycle of *Eucalyptus victrix*, particularly for seedling establishment (Florentine & Fox, 2002b).

3.3.4. *Sesbania Formosa*

Sesbania formosa is a small tree, at times growing to 13 m in height, but more commonly in the 5 to 10 m height range. *Sesbania formosa* occurs across a variety of habitats, however most habitats are generally associated with creeks, rivers, and arid/tropical swamps (e.g. Dragon Tree Soak in the Great Sandy Desert). In the Pilbara, *Sesbania formosa* is commonly located along creeks and rivers with groundwater close to the surface.

Work completed by Loomes (2010) found that the mean minimum water level depth occurring under *Sesbania formosa* populations ranged from 1 to 4 m below the surface. This places it amongst other facultative phreatophytic trees (*Eucalyptus camaldulensis*) and mesophytic small trees/shrubs (e.g. *Atalaya hemiglauca, Melaleuca glomerata* and *Melaleuca bracteata*) (Loomes, 2010).

Sesbania formosa is less well studied than the other species discussed above, and as such its groundwater use strategy is less accepted. This species is clearly a phreatophyte, which at times behaves like a facultative phreatophyte, and in many cases occurs in habitats indicative of an obligate groundwater use strategy.

3.3.5. Other key potentially Groundwater Dependent Species (GDS)

Several other key woody shrub species which occur in the Pilbara and are either potentially groundwater dependent or are associated with GDE's are as follows (in decreasing order of importance):

- *Livistona alfredii* (Priority 4);
- *Acacia ampliceps;*
- *Melaleuca bracteata;*
- *Melaleuca glomerata;*
- *Melaleuca linophylla;* and
- *Acacia coriacea* subsp. *pendens.*

Compared to the phreatophytic tree species discussed above, significantly less is known about the groundwater dependence of these species. This may be linked to the shallower roots systems possessed by these species. These species have been recorded in areas with consistent water availability which could potentially indicate reliance on groundwater sources.

Further to the list of species provided in Table 3-2, RTIO have developed the "Pilbara Riparian Ecohydrological Framework (PREF)" which is a hierarchical list of defined and increasingly important guilds of riparian ecohydrological indicator species. These species are split into a hydrological hierarchy which provides insight into the quality and degree of long-term stability or variability of the hydrological habitat.

The species used in the PREF have been constructed by considering the degrees of spatial correlation between species presence/absence data with anomalously persistent vegetation and surface water using remote sensing (detected using NDVI persistence mapping; as per Barron *et al.* 2012). The validation work used in the inception of the PREF has been completed using a large dataset collected from on-ground work. This validation process for the PREF was outlined within a presentation by Jeremy Naaykens at the WBSI Biodiversity conference 2021; Resilient Landscapes (Rio Tinto, 2021). RTIO are currently in the process of seeking a peer review for this framework.

In the PREF, from left to right the species are listed in increasingly order of reliance on persistent moisture availability and are unlikely to maintain viable populations from year to year if the riparian habitat of interest experience dry periods either annually, interannually, or over decadal time scales. This plant guild provides valuable insights into the inter and intra-annual consistency of moisture and sensitivities of riparian ecosystems to fluctuations in water availability. The PREF will be used to map riparian community types and to provide some insight into how represented these community types are in the study area and surrounds.

Table 3-3: Draft (2022) Pilbara Riparian Ecohydrological Framework (PREF) table for interpreting increasing degrees of availability, consistency and permanence of moisture/water (i.e. consistently mesic/hydric conditions).

Pilbara Riparian Ecohydrological Framework (PREF)						
Key Riparian Habitat Type & Plant Guild		← Increasingly Mesophytic/ Hydrophytic Indicator Guilds				
		Very High Level i.e. soil moisture availability or surface water availability is perennial	**High Level** i.e. soil moisture availability or surface water availability is clearly perennial to sub-perennial	**Moderate - High Level** i.e. soil moisture availability or surface water availability is perennial to sub-perennial	**Moderate Level** i.e. soil moisture availability or surface water availability is sub-perennial	**Low Level** i.e. soil moisture availability or surface water availability is sub-perennial to ephemeral
Keystone Mesophytes	Terrestrial Habitats - Overstorey	*Melaleuca argentea* (mature and abundant)	*Sesbania formosa* (abundant)	*Sesbania formosa* (present)	*Eucalyptus camaldulensis* (open woodland to woodland)	*Eucalyptus victrix* (scattered trees to woodland)
		Sesbania formosa (abundant and mature)	*Melaleuca argentea* (present - either scattered or sporadic)	*Melaleuca argentea* (potentially present - generally only an associated species, typically immature)	*Eucalyptus victrix* (open forest)	*Eucalyptus xerothermica* (abundant)
		Eucalyptus camaldulensis & *E. victrix* (usually present but generally in a lower abundance or occurring more peripherally)	*Eucalyptus camaldulensis* (open forest & greater)	*Eucalyptus camaldulensis* (open forest & greater)	Potentially includes larger more abundant tree populations of the following species: *Acacia coriacea* subsp. *pendens, Eucalyptus xerothermica, Atalaya hemiglauca, Terminalia circumalata*	*Terminalia circumalata* (present)
	Keystone constituents		*Eucalyptus victrix* (usually present but generally a peripheral component)	*Eucalyptus victrix* (usually present but generally a peripheral component)		
Mesophytes	Terrestrial Habitats - understorey i.e. habitats with increasingly consistent subsurface soil moisture only	*Sesbania formosa*	*Acacia ampliceps*	*Melaleuca bracteata*	*Gossypium sturtianum*	*Melaleuca glomerata* (present-scattered)
		Samolus spp. (verging on aquatic)	*Cullen leucanthum*	*Gymnanthera cunninghamii* (common) (priority species)	*Melaleuca linophylla* (present-scattered) *Melaleuca lasiandra* (north/north east edge of Pilbara) *Melaleuca glomerata* (abundant/dominant)	*Acacia coriacea* subsp. *pendens* & *Acacia sericophylla*
		Imperata cylindrica (verging on aquatic)	*Myoporum montanum*	*Melaleuca alsophila* (present)	*Plumbago zeylanica* (becoming common/abundant)	*Atalaya hemiglauca* (present-isolated)
			Ficus virens & *F. virens* var. *dasycarpa*	*Melaleuca xerophila* (lake edges, brackish groundwater)	*Dodonaea lanceolata* (becoming common/abundant)	*Plumbago zeylanica* (present-isolated)
			Ficus aculeata (common abundance)	*Adriana tomentosa*	*Cyperus vaginatus* (abundant to highly abundant)	*Acacia sclerosperma*
			Melaleuca nervosa or potentially M. alsophila (abundant) (north to north east edge of Pilbara)	*Ficus aculeata* (scattered to isolated abundance)	*Kirganelia baccata* (previously *Phyllanthus baccatus*) (present-isolated)	*Cyperus vaginatus* (present-isolated)
				Melaleuca linophylla (abundant/dominant)	*Abutilon amplum*	*Typha domingensis* (present-isolated)
				Kirganelia baccata (previously *Phyllanthus baccatus*) (common)	*Gymnanthera cunninghamii* (present-isolated) (priority species)	*Eulalia aurea* (abundant)
				Lawrencia glomerata	*Duma florulenta* (soaks, alluvial features)	*Stylobasium spathulatum* (becoming common/abundant)
				Tinospora smilacina	*Muellerolimon salicorniaceum* (salt marshes, brackish floodplains)	*Rhynchosia bungarensis* (priority species)
				Eragrostis surreyana (priority species)	*Flueggea virosa subsp. melanthesoides*	*Sesbania cannabina* (present-scattered)
				Commicarpus australis	*Atalaya hemiglauca* (common)	*Enteropogon ramosus*
				Pseudoraphis spinescens	*Sesbania cannabina* (abundant)	
					Commicarpus australis	
					**Echinochloa colona*	
					Leptochloa digitata	
Hydrophytes	Aquatic Habitats i.e. surface water habitats (including situations where surface water may be ephemeral, but where saturated sub-surface moisture is typically perennial) Blue highlighted taxa represent species more commonly present in such habitats which appear to be good groundwater discharge indicators	*Phragmites karka*	*Imperata cylindrica*	*Potamogeton* spp. (potential initial groundwater discharge indicator)	*Schoenoplectus subulatus*	*Cyperus vaginatus* (abundant)
		Cladium procerum (priority species)	*Pteris vittata*	*Schoenus falcatus* (potential initial groundwater discharge indicator)	*Ammannia baccifera* (present) (or *Ammannia multiflora*)	*Typha domingensis* (present-isolated)
		Eriocaulon cinereum	*Schoenus falcatus* (abundant)	*Eleocharis geniculata* (potential initial groundwater discharge indicator)	*Chara* spp. (abundant)	*Ammannia baccifera* (present-isolated)
		Adiantum capillus-veneris (priority species)	*Fimbristylis littoralis*	*Stylidium fluminense*	*Typha domingensis* (abundant)	*Chara* spp. (present-isolated)
		Acrostichum speciosum	*Eleocharis spiralis*	*Samolus repens*	*Eleocharis pallens*	*Myriophyllum* spp. (and other similar aquatic taxa)
		Ampelopteris prolifera (priority species)	*Fimbristylis sieberiana* (present) (potential initial groundwater discharge indicator) (priority species)	*Sonchus hydrophilus* (moderate to high)	*Striga curviflora*	*Stemodia grossa* (becoming abundant)
		Machaerina rubiginosa (previously *Baumea rubiginosa*)	*Fimbristylis cephalophora* (basalt)	*Schenkia australis*	*Fimbristylis microcarya*	*Marsilea* spp.
		Machaerina juncea (previously *Baumea juncea*)	*Eleocharis dulcis* (north Pilbara)	*Ruppia polycarpa*	*Cyperus difformis*	*Wahlenbergia tumidifructa*
		Juncus kraussii (Millstream)	*Stylidium weeliwolli* (priority species)	*Ammania baccifera* (abundant)	*Najas* spp. (present)	*Elytrophorus spicatus*
		Livistona alfredii (priority species)	*Eleocharis sphacelata*	*Fuirena ciliaris*	*Myriophyllum verrucosum* (present)	*Schoenoplectiella laevis*
		Ceratopteris thalictroides	*Samolus* sp. Millstream (and potentially *Samolus junceus*)	*Pseudoraphis spinescens*		*Cyperus leptocarpus* (previously *Lipocarpha microcephala*)
		**Nymphaea pubescens* (Millstream)	*Schoenus punctatus*	*Cyperus polystachyos*		*Glinus oppositifolius*
		Nymphoides indica	*Potamogeton* spp. (abundant) (potential groundwater discharge indicator)	*Cyperus dactylotes*	Medium to Low (other uncommon Cyperus species): *Cyperus bifax, C. cunninghamii, C. hesperius, C. iria, C. squarrosus*	
		Fimbristylis ferruginea (Millstream)	*Lobelia arnhemiaca*	*Schenkia clementii*		
		Stuckenia pectinata [&]	*Vallisneria* spp. (potential groundwater discharge indicator)	*Ludwigia perennis*	Low (Poorly known, poorly collected Cyperus species): **Cyperus involucratus, C. ixiocarpus, C. nervulosus, C. pulchellus, C. pygmaeus, C. rigidellus*	
		**Arundo donax*	*Sporobolus virginicus* (inland settings - not coastal/saline)	*Najas* spp. (abundant)		
			Eragrostis elongata	*Diplachne fusca*		

Orange indicates Poaceae species

Note: In some cases, the abundance of a particular species is noted as the determinant for its inclusion in different indicator categories. Where only a genus is listed; includes all species in that genus.
[&] New taxa whose position within the guilds is not yet confidently understood (requiring further investigation).

3.4. GDE's concepts and relevant terminology

Groundwater comes in many forms and occurs on many scales (e.g. small (to micro scale) perched aquifers versus local alluvial aquifers (unconsolidated), versus broader local/regional aquifers (consolidated)), and as such there is often high uncertainty about the source(s) of groundwater which vegetation might depend on, and the ability of mining to influence these sources. Furthermore, all water used by plants comes from the ground, and so the complex interactions and interdependencies which occur between vadose ground water (sourced from direct rainfall and surface water flows) and the suite of micro, small and local and regional scale aquifers potentially supporting riparian communities, makes defining GDE's a difficult process. In most cases it requires detailed and resource-intensive work conducted at a fine scale to define their groundwater dependence and likely impact from proposed development. Importantly these types of investigations can be lengthy and expensive and don't integrate well with the risk-based assessment approach associated with traditional EIA methods.

The Bureau of Meteorology (BoM), who developed and manage the GDE Atlas of Australia (BoM, 2020) have dealt with this issue by using alternative terminology for features other than those ecosystems which are known to be GDE's. Ecosystems that could not be confidently identified or inferred as GDE's due to lack of data, but which may be using groundwater, are considered as potentially Inflow Dependent Ecosystems (IDE) (SKM, 2012). Inflow Dependent Ecosystems are defined in the Atlas as vegetation ecosystems that are likely to use a water source in addition to rainfall, such as water stored in the unsaturated zone, surface water or groundwater. In general, this terminology is applied in the Atlas because for much of the continent it's not yet clear whether riparian formations[7] represent GDE's; generally due to a lack of hydrological/ecological data or complexities around groundwater sources potentially being accessed. In the Atlas they are presented using likelihood mapping which infers some level of risk that GDE's may be present. Inflow Dependent Ecosystems layers (presented as GIS layers within the Atlas) allow the presentation of a more complete understanding of the likely water use of ecosystems analysed during development of the GDE Atlas.

Inflow Dependent Ecosystems terminology and logic can also be applied to 'mesic' riparian formations which are potentially groundwater dependent, but where it's not yet clear whether they represent GDE's due to; a lack of hydrological/ecological data or because they are likely dependent on aquifers stored in lithological or alluvial formations which are either small to micro in scale, or intermittent/seasonal in nature. Generally, these small to micro scale groundwater features are not clearly indicated in the hydrological data on account of their size/seasonality, and as such they fit more appropriately into the low-data/low-confidence category as an IDE. Alternatively, IDE features which generally possess lower abundances of known phreatophytes, but which occur on creeklines receiving surface water regimes of elevated magnitude/frequency, can also reasonably be considered to depend on seasonal surface water recharge events (i.e. inflow dependent) and associated residence times of vadose and micro scale groundwater sources. As a result the remainder of riparian features are classified as GDE's when they are either known/demonstrated to be GDE's (through hydrogeological or ecological data), or can realistically be inferred to be GDE's due to groundwater data indicating the presence of moderate to larger scale aquifers in reach of resident vegetation. For the purpose of the current study this will be the preferred definitions/distinctions relevant to the 'GDE' and 'IDE' terminology.

BoM GDE Atlas terminology for IDE defines it as:

[7] In this document the term "riparian formation" (or vegetation formation) is referring to a non-descript potentially unbounded section of riparian vegetation which is of interest/question for whatever reason. It is not necessarily representing a vegetation unit, but more often than not, is referring to a section of enhanced vigour, structure or density, or associated with a certain reach or fluvial profile of interest. In simple terms, it is purely a section/area of riparian vegetation of interest.

Ecosystems that are likely to be using another source of water in addition to rainfall. IDEs include groundwater dependent ecosystems as well as ecosystems which rely on sources of water other than rainfall (e.g., surface water, water stored in the unsaturated zone, irrigation) (SKM 2012).

In many cases, within arid tropical regions, riparian formations likely to be at least partially supported by groundwater or other inflows tend to exhibit and possess similar characteristics which can be more broadly described as being representative of a 'mesic' environment/habitat. One where specific overstorey and understorey components establish in increasing abundance (or proportion to 'ephemeral' biota) in response to increasing degrees of moisture availability. While the source of this moisture is often not yet clear, and in some cases could be purely from surface water inflows (but in more 'mesic' cases is likely to be linked to some type of aquifer), what's initially most important is identifying the presence, magnitude and characteristics of such 'mesic' vegetation communities. On the flip side, riparian representations not indicating the presence of moisture levels elevated above that expected in typical arid zone riparian formations can be appropriately termed as more 'ephemeral' in nature and thus of low to very-low risk of being groundwater dependent.

Establishing the presence and characteristics of 'mesic' communities and their distribution in an area can then form the inventory with which to further study, assess and thus predict potential for impact as a result of proposed hydrological change in the areas of elevated risk. For these reasons, the following assessment tends to favour the use of the concept of identifying and classifying 'mesic' riparian formations (as opposed to more ephemeral riparian communities), rather than the identification of GDV and GDE's. However, while the terminology is relatively interchangeable, the 'mesic' terminology is more appropriate for all representations identified given that work to understand the scale, connectivity and variability of the supporting water sources has not yet been done for all.

Given the potentially variable water use strategies of phreatophytic species in the Pilbara, it becomes important to distinguish between these lower sensitivity groundwater dependent ecosystems/vegetation, and those which are truly phreatophytic and therefore depend on groundwater almost exclusively to meet their water requirements. To address this disparity, the terms 'Facultative Phreatophytic Vegetation' (FPV) and 'Obligate Phreatophytic Vegetation' (OPV) are proposed to provide distinction between the facultative, often markedly less significant/sensitive phreatophytic vegetation and those high value communities possessing obligate phreatophytes. Note: these are not well-recognised terms and have been created for the purpose of this and other related studies from other associated, well accepted terms such as obligate phreatophytes and GDV.

For the purpose of this study, OPV is defined as representing communities which:

> *Encompasses vegetation associations and sub-associations, whose structure is at least co-dominated by one obligate phreatophyte, namely* Melaleuca argentea *(i.e. possesses vegetation described as being dominated by one or more species within the tree or tall shrub stratum and which includes the species* Melaleuca argentea *as one of these described dominant species).*

FPV is defined as representing communities which:

> *Encompasses vegetation associations and sub-associations, whose structure is at least co-dominated by one facultative phreatophyte (typically either* Eucalyptus camaldulensis *or* Eucalyptus victrix*) (i.e. possesses vegetation described as being dominated by one or more species within the tree or tall shrub stratum and which includes a facultative phreatophytic species as one of these described dominant species), but which is not co-dominated by any obligate phreatophytes and which typically does not possess obligate phreatophytes as an associated species.*

3.5. Factors contributing to biological significance

Riparian vegetation and Groundwater Dependent ecosystems involve both Environmental Protection Authority (EPA) factors Flora and Vegetation and Inland Waters. Therefore, the guidelines for significance for both factors have been considered for this targeted riparian survey assessment.

The EPA factor guideline for Flora and Vegetation (EPA 2016a) states that, vegetation may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority ecological communities
- restricted distribution
- degree of historical impact from threatening processes
- a role as a refuge
- providing an important function required to maintain ecological integrity of a significant ecosystem.

The EPA factor guideline for Inland Waters (EPA 2018b) states that "For the purposes of EIA and in relation to ecosystem health, the EPA is focussed on impacts to significant ecosystems. Significant ecosystems include, but are not limited to:

- Ramsar sites. Wetlands of International Importance as listed under the Ramsar Convention, an international treaty on the conservation of important wetlands
- Conservation category or Resource enhancement management wetlands as mapped in the Geomorphic Wetlands of the Swan Coastal Plain dataset as managed by the Department of Biodiversity, Conservation and Attractions
- wetlands listed in the Directory of Important Wetlands in Australia
- wetlands protected by Environmental Protection Policies under Part III of the Environmental Protection Act 1986
- wild rivers, as identified by the Australian Heritage Commission and Department of Water and Environmental Regulation
- wetland types which may be poorly represented in the conservation reserves system
- springs and pools, particularly in arid areas
- ecosystems which support significant flora, vegetation and fauna species or

communities, including migratory waterbirds, bats, and subterranean fauna

- ecosystems which support significant amenity, recreation and cultural values
- saline lakes, estuaries and near shore ecosystems reliant on groundwater or surface water inputs
- downstream marine ecosystems."

3.6. Relevant high-value riparian vegetation communities within the Hamersley's and their associated distribution

The climate of the Pilbara is essentially classified as arid-tropical possessing an average precipitation to evaporation ratio of less than 0.2 (McKnight 2000). With annual precipitation generally falling within the range of 250 to 450 mm, the Pilbara can be mistaken for being semi-arid, but with high average

temperatures and an average evaporation rate in the vicinity of 2000 mm per year, the effective precipitation in the region is minimal and therefore classified as arid. Because of such climatic factors, water gaining sites which are exposed to surface water supply from larger catchments, and which can lock away significant amounts of water from evaporation, become quite important. Within the Hamersley Ranges and plateau, the rocky/rugged upland environments, eco-physical settings, and unique geological formations provide a suite of novel opportunities for surface water inputs to be stored and provided more consistently to biota in key fluvial locations. Such fluvial systems create riparian corridors which can provide refuge for a diversity of moisture loving species which wouldn't otherwise be present in areas possessing a similar climate classification. Consequently, these riparian features provide value to the region as custodians of biological diversity through their provision of ecological services and habitat diversity/complexity.

Beyond the general importance and functions of large creek systems in hot and often dry climates such as that of the Pilbara, drainage systems which provide the right catchment size and environmental conditions (generally related to underlying geology, elevation, slope, meander shape and creek profile etc.) to create surface or groundwater permanence are considered most valuable. This value is primarily a product of the restricted vegetation communities they can sustain, and by association the fauna assemblages they support. The permanence of the water present ensures the landforms ability to create and sustain communities such as OPV of a high structural and species diversity, and potentially support associated conservation significant fauna assemblages. These attributes in turn create value and therefore significance due to the restricted distribution of these perennial habitats. With respect to conservation significance, features such as this tend to possess elevated and potentially high conservation significance as they are generally few in number, restricted to small areal extents, and sensitive to perturbation.

4. Methods

Several methods were used to facilitate the aims of the current targeted flora and vegetation study. The aims focus on improving the understanding of riparian vegetation present, their distribution and associated ecohydrology, in moderate and greater sized drainage systems in and around the HD1 development area.

This broader focus led to the development of the following aims for which the described methods are relevant. These aims were to;

1. Complete survey tasks which enable the production of accurate and targeted riparian vegetation mapping.
    i. Increase the density and coverage of the systematic sampling site array
    ii. Compile appropriate targeted vegetation mapping notes and desktop mapping products which aid the mapping refinement process
2. Identify ecohydrological characteristics relevant to the different drainage reaches and riparian ecosystems present within the Study Area.
3. Assess local vegetation for the presence of relevant ephemeral, mesophytic and hydrophytic riparian indicator species of value to the riparian mapping and assessment process.
4. Gather evidence on the distribution and persistence of surface water features across the Study Area.
5. Provide updated and refined riparian vegetation mapping for the Study Area, as well as:
    i. Relevant ecohydrological zone mapping
    ii. GDV likelihood mapping
    iii. Persistent riparian surface water mapping
6. Provide findings on the types of riparian communities and degrees of representation across the Study Area and surrounds.

Given the low hydrological risk posed by the development on local drainage systems, one of the listed aims was the production of non-exhaustive GDV likelihood mapping. The aim of this mapping is for the purpose of providing a cursory assessment of the degree of potential GDV exposure present within the Study Area. Further to the GDV likelihood mapping, a systematic assessment of the presence of surface water features was conducted in order to map the presence of persistent surface water features in moderate and greater sized drainage across and directly adjacent to the Study Area.

The final aim listed above was one of the most important components of the whole study. This was to conduct a systematic assessment on each of the mapped vegetation units and in some cases (where relevant) on specific reaches of different vegetation units. This involved classifying units into a riparian hierarchy to determine the likely biodiversity values held by each of the riparian communities assessed.

4.1. Desktop Tasks and Investigations

For the broader riparian vegetation mapping process, the following key desktop tasks were conducted:

1. Consideration of historical and recent baseline flora and vegetation surveys conducted in the locality, including determination of the most relevant and up to date mapping units available for the Study Area.
2. Within riparian habitats of relevant moderate and greater sized drainage; assess the array of historical flora and vegetation sampling, and design an infill sampling program to support the study aims.
3. The development and use of Landsat and Sentinel derived NDVI persistence mapping for the locality (as per Barron et al., 2017) in order to guide targeted field traverses into relevant habitats and ecotypes.
4. Map out the presence of both low level and particularly moderate level Facultative Phreatophytic Species (FPS) in key reaches of WWC and particularly PMC in order to understand the relative

abundance of each and to help inform the mapped structure and dominance of keystone overstorey species within local riparian vegetation.

5. Development and upload of relevant mobile GIS layers for field validation and to support the field and desktop based riparian vegetation mapping processes.
6. Assess trends in remote sensing derived NDVI persistence mapping and available groundwater height monitoring (from monitoring bores) to help inform ecohydrological characteristics/zones and GDV likelihood within relevant Study Area drainage reaches.
7. Following field work; use various desktop resources, analyses, remote sensing, monitoring data and outputs in conjunction with field data to support the process of vegetation delineation and mapping.

   Steps 1 & 2 above are described in more detail within section 4.2 (namely section 4.2.1), with step 3 detailed in section 2.6 and further in section 4.1.1. Step 4 above is described in detail in section 4.3.1 & 4.3.2, while steps 5, 6 & 7 are described in section 4.2 and 4.2.1.

For the purpose of completing GDV likelihood mapping across the Study Area, the following key desktop tasks were conducted to help identify the presence of phreatophytes, 'Mesic' riparian assemblages and potential GDV:

1. Development and interpretation of Landsat and Sentinel derived NDVI persistence mapping (1987-2021 & 2016-2021 respectively) for the locality as per Barron *et al.* (2017) in order to help interpret ecohydrological characteristics and water-availability across the Study Area.
2. Consideration of GDE and IDE identification layers provided by the BoM GDE atlas (BoM, 2022), as well as height data from local groundwater monitoring bores.
3. Consideration of historical and recent baseline flora and vegetation surveys (particularly systematic sampling sites) conducted in the locality.
4. Development and upload of relevant mobile GIS layers for field validation and to support the field and desktop based GDV likelihood mapping tasks (including persistence mapping, desktop phreatophyte mapping, historical vegetation mapping and systematic sampling sites); and
5. Following field work and the creation of targeted riparian vegetation mapping for the Study Area; various desktop resources, analyses and outputs in conjunction with field data were used to support the process of GDV delineation and likelihood mapping.

The following section outlines the approach and application behind Step 1. The tools used in steps 2 and 3 are discussed in Sections 2.7 and 2.5 respectively. Step 5 involved the consideration and integration of all relevant data at a desktop level following field and desktop-based tasks.

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The riparian ecotype hierarchy provided in PREC aims to provide a logical approach to classifying ecosystem gradients and degrees of community restriction based on the typical structural and compositional gradients which have been observed within riparian ecosystems of the Pilbara, and which are predominantly linked to moisture/ecohydrological gradients.

4.1.1. NDVI Persistence Mapping use – GDV likelihood identification and riparian mapping

Sentinel derived NDVI and NDMI (as well as Sentinel Water Mask (SWM)) persistence mapping was used to visually identify areas of persistent vegetation cover and canopy hydration (as well as surface water) as potential locations of GDEs, but also as indications of zones experiencing differing ecohydrological characteristics. Persistence mapping was produced over the locality using a web-based application (developed by NGIS in conjunction with Rio Tinto) which interfaces with the Earth Engine cloud based spatial data repository (Google© Product). Exported outputs from this web portal have been quality checked and thematically mapped by the Rio Tinto Biological assessments team (Jeremy Naaykens) following the methods of Barron *et al.* (2017) and Barron *et al.* (2012). The Sentinel aerial imagery utilised

all available imagery which spans a five-year period from 2016 to 2021 (10 m pixel size) and an NDVI or NDMI threshold of 0.32 and 0.1 respectively was also applied (Barron *et al.* 2017).

From the persistence mapping, groups of pixels returning mean NDVI/NDMI persistence values above 60-70 %, are indicating a relevant range of inter/intra-seasonal index persistence. Such a persistence range is indicative of imagery and thus vegetation exhibiting minimal drying signal in the drier months of the year such that additional water sources such as groundwater are likely to be implicated in the ongoing health/characteristics of the target riparian vegetation. The magnitude and spatial extent of NDVI/NDMI persistence, in combination with the landforms and vegetation visible in aerial imagery were used to help define likelihood of the presence of GDV for each of the mapped riparian communities or potential GDE features either known, sighted on imagery, or identified in persistence mapping. The broad range of persistence values attained across the sites was correlated with known and extensive GDE/GDV located along parts of WWC and particularly within and around Weeli Wolli Springs (WWS), directly to the northeast of the Study Area. GDV located within WWS has persistent, shallow access to ground and surface water throughout the year. The persistence ranges (generally informed by mean to maximum NDVI/NDMI values within an area of interest) utilised to inform riparian mapping trends and GDV likelihood ratings in this assessment included the following likelihoods:

- **90 – 100 %**: increased reliance on groundwater (larger scale aquifers) for ecosystem function likely; associated with dense *Eucalyptus camaldulensis* dominated (± *Melaleuca argentea*) communities; generally associated with areas of shallow groundwater and potential groundwater discharge such as the informally named “Ben’s Oasis” and associated features;
- **80 – 89 %**: reliance on groundwater (larger scale/small scale aquifers) for ecosystem function likely; associated with sparse to dense *E. camaldulensis* dominated (± *E. victrix*) communities; generally associated with areas of shallow groundwater, supportive basement morphology and some gorge/gully features;
- **60 – 79 %**: some to limited reliance on groundwater (small scale aquifers) for ecosystem function likely; generally associated with FPS dominated canopies on bends in creeks and increased canopy density of riparian vegetation, *E. victrix* (and *E. camaldulensis*) main phreatophyte present. Smaller scatterings or groupings of pixels in the order of 60-70% persistence may be indicative of reaches where vegetation represents an IDE, but where Eco physical characteristics are such that surface water has a higher residence time; and
- **40 – 59 %**: vegetation likely to be mostly representative of IDE riparian vegetation predominantly reliant on seasonal surface flows and factors which increase residence time of vadose recharge events.

Across the Study Area, Landsat and Sentinel derived Remote Sensing (RS) derived NDVI persistence mapping was used to:

1. Provide an indication of the temporal characteristics of moisture availability within riparian zones across the Study Area;
2. Provide an indication of riparian zones which showed low potential for the presence of GDV;
3. Indicate the location and size of potentially groundwater dependent riparian features; and
4. Provide an indication of the potential magnitude of groundwater or surface water dependence exhibited by of each identified feature.

As a result, NDVI persistence mapping combined with high resolution aerial photographic interpretation informed key areas of interest for field validation/investigation and the post field work GDV likelihood mapping process.

It was also recognised that there are limitations of NDVI persistence mapping. These limitations are primarily associated with the pixel size (30m) of Landsat derived imagery. This pixel size determines that riparian features no wider than 20-30m can be missed, or underrepresented (through pixel mixing) by Landsat derived persistence mapping. It is noted that for most drainage systems, such issues are uncommon and where it occurs, reduced patch size of potential GDE features typically determines reduced significance (and reduced risk), but also such features are often picked up by aerial photo interpretation and baseline surveys. Further to this the use and review of Sentinel 2 persistence mapping and the resulting 10m pixel which it provides, allows such limitations to be circumnavigated.

A secondary issue is that in some areas, vegetation can be purely represented by overstorey trees only (i.e. no understorey) and where the overstorey is relatively sparse, truly groundwater dependent riparian overstorey formations can fail to meet the applied 0.32 NDVI threshold producing a false negative in the mapping. This situation is uncommon, but importantly most often occurs in larger drainage systems where bed scour removes the understorey in key zones. Typically in such situations, adjacent un-scoured and similarly groundwater influenced areas return RS pixel values which help identify the presence of potential GDV and trigger field investigation of the area.

4.2. Field work

The primary field work completed for this study and described in this section occurred over 7 days from the 12th till the 17th of July 2021. The work was conducted by three Botanists (Jeremy Naaykens & Cassie Reynolds – Rio Tinto, and Carmel Winton – Biologic). Data and observations from five separate additional field trips in the Hope Downs 1 area (all conducted by Jeremy Naaykens – Principal advisor ecohydrology and Botanist RTIO) was also used for this study:

1. 26th of July 2017- Reconnaissance of “Ben’s Oasis” Spring and vegetation communities
   - Compositional observations,
   - Surface water presence and abundance observations and
   - *Melaleuca argente*a distribution observations
2. 13-14th of December 2018 – Further work at “Ben’s Oasis” & checks along Pebble Mouse Creek (PMC).
   - Collection of Compositional data in and around “Ben’s Oasis”,
   - Extensive traverses and data collection for the presence, age and distribution of *Melaleuca argentea*, both upstream and downstream of the main “Ben’s Oasis” pool over a 5km reach of Weeli Wolli Creek.
   - Phreatophyte abundance/dominance and general vegetation composition – spot checks at 4 locations along PMC for the purpose of ground truthing of aerial photo interpretations of Eucalyptus camaldulensis abundance.
3. 22 February 2020 – Priority flora Spot checks along pebble mouse creek
   - Spot checks in 4 locations on PMC, near operations, for the presence of *Aristida lazaridis* (along with phreatophyte abundance ground truthing).
4. 1st of October 2020 - Initial investigations of a small potential GDE on the upper tributaries of WWC
   - Foot traverse along WWC looking at phreatophyte abundance and mesophyte composition/abundance in the understorey from south of HD2 deposit to the highway.
5. 2-3rd of June 2021- Study Area Reconnaissance visit (J. Naaykens & C. Reynolds).
   - Included vegetation spot checks along parts of WWC and PMC.

4.2.1. Riparian vegetation mapping with a focus on ecohydrology and potential GDV characteristics and distribution

To achieve the riparian vegetation mapping aims of this study, a targeted survey was conducted as defined under the EPA Technical Guidance; Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016). Targeted field investigations of features of interest and extent/locations were supported by NDVI persistence mapping described above. Persistence mapping was used to identify, prioritise and select areas requiring field validation. In addition, this mapping provided supporting information regarding the extent and type of riparian formations present. This type of mapping is particularly helpful in determining where more mesic communities as opposed to more ephemeral communities were distributed.

While the core focus of this study was to refine the baseline vegetation mapping to focus on riparian values while increasing the accuracy and detail of the resulting mapping, a secondary focus was to enable this mapping to inform the presence and distribution of potential and clear GDV. In order to do this, the study also focused on detecting and recording potentially groundwater dependent vegetation (GDV), as an indicator of the potential presence of GDE's and IDE's.

In order to appropriately refine the baseline mapping to highlight riparian values, the vegetation mapping traverses and investigations conducted focused on gathering information on the distribution and compositional characteristics of 'mesic' riparian vegetation (and potential GDEs) within Pebble Mouse and Weeli Wolli Creeks. This was primarily achieved primarily by gathering information about the structure, distribution and maturity of facultative phreatophytic species/vegetation, and where appropriate obligate phreatophytic species/vegetation. In addition, gathering information about the presence/absence and abundance of mesophytic and hydrophytic indicator species (as per the PREF) was also prioritised.

Given that relatively ephemeral FPV was thought to be dominant in the area, with Obligate Phreatophytic Species (OPS), namely *Melaleuca argentea*, likely rare; particular focus was made on understanding the distribution and abundance patterns exhibited by *Eucalyptus camaldulensis* (River Red Gums). Despite this, there was also a focus on making sure any OPV representations were detected. OPV vegetation incorporates species possessing the highest degree of sensitivity to changes in groundwater hydrology, potentially associated with mining. Furthermore, data on the age structure of communities dominated by OPS obligate phreatophytes was gathered as it tends to provide information about the longer-term stability and consistency of shallow groundwater access.

The above field survey techniques and associated survey effort were then used along with desktop and remote sensing mapping products/analyses to delineate and describe vegetation types encountered in the Study Areas. Vegetation types described and delineated as part of this targeted riparian study represent a "structural vegetation classification", as per the Technical Guidance for Flora and Vegetation Surveys (EPA 2016b). This approach was chosen (rather than using a floristic classification) as it is thought to be most relevant for riparian vegetation surveys focused on facilitating ecohydrological assessments and in particular in assessing the likely groundwater dependence of resident vegetation. Structural vegetation classification uses vegetation structure and consideration of patterns in the dominance of relevant species within each stratum to describe differences between vegetation units. Structural vegetation classification provides information on the height of key strata present, foliar cover and dominant species.

The vegetation mapping process and the resultant field survey effort attributed to the Study Area was generally focused on riparian units occurring within the major riparian habitats of the Study Area. As part of this process, a higher degree of survey effort was afforded to the riparian units in the main incised channel zone (low flow channels) of local drainage systems compared to the fringing communities of the terrace and outer floodplain communities. Mapping of the outer riparian habitats (and the riparian zone) along Pebble Mouse and Weeli Wolli Creeks has previously been completed by Astron (2020) and Mattiske (2008; 2010), so mapping in these low risk areas (from a both a significance and hydrological sensitivity sense) relied upon this previous mapping to increase the degree of community validation applied.

A total of 25 quadrats/relevés were sampled as part of the current study and including the historical sampling sites the available sampling array totalled was 62 sites. The location of sampling sites conducted

as part of the current study were designed to fill in identified gaps in key historical surveys. The location of current and historical sampling sites are presented in Figure 4-1.

It should be noted that a vegetation map is essentially a model, and as such the spatial validity of the boundaries and the vegetation associations depicted to lie within those boundaries, is only true a portion of the time. In general, the accuracy of the model is directly correlated to the amount of ground-truthing which is done per unit area of the model, and the scale of the community descriptions created. Another factor influencing the accuracy of the vegetation model is generally considered to be the complexity of environmental factors influencing vegetation ecology, but for the surveyor this is an uncontrolled factor and is therefore not generally considered in detail. Importantly, as aerial photo resolution increases, an increasing level of information, model accuracy, and canopy classification is being derived by using on ground data (particularly vegetation photos) to interpret and validate desktop classification of aerial imagery data.

All vegetation types mapped as part of this study, were described using Aplin's (1979) framework for "Vegetation Structural Classes" (Specht, 1970). This framework is presented in Appendix A:, along with vegetation condition scale used in this study (Trudgen, 1988). As such all communities established as part of this study are generally considered to represent sub-associations (equivalent to the NVIS classification). Community descriptions were created by identifying dominants (where present) for all relevant strata available, rather than restricted to the three traditional strata, such that they represent relatively detailed vegetation descriptions, approximately equivalent to level 5 mapping within the National Vegetation Information System (NVIS) (DoE, 2014b). Additional key (sub-dominant) phreatophytic species were included in brackets and represented by '+/-' to indicate relatively lower frequencies of occurrence in the vegetation type.

Given the focus of this study; some vegetation types mapped and described as part of this study are lacking some of the compositional differentiation which comes from sampling over multiple phases (as part of a detailed survey (EPA 2016b). Furthermore, some of the non-core riparian communities of the floodplain and high-flow riparian habitats are less adequately sampled and described/delineated throughout the Study Area as the focus of this study was on improving accuracy and detail in the core-riparian zone and supporting the delineation of potential groundwater dependent ecosystems. Given this focus; the reduced level of detail provided for such communities (which are generally of lower likely significance and potential groundwater dependence) is considered relatively inconsequential when considering the riparian values of the Study Area as well as potential hydrologically derived impacts.

4.2.2. Quadrat and Relevé Sampling

In both the WWC and PMC stretches of the Study Area it was determined that sampling additional quadrats/relevés to those historically established was required to supplement floristic composition data and improve mapping confidence in the area. This additional sampling occurred from the 11-17th of July 2021, along with some of the targeted mapping traverses and ground truthing tasks completed for the Study Area. However, leveraging historical vegetation mapping by Astron (2019) and Mattiske (2010), the position of quadrats/relevés were able to be chosen to confirm the vegetation structure and floristic composition initially mapped via these studies thus better informing the vegetation mapping refinement process.

Quadrats (flora sampling sites of a fixed area) were preferentially used as the primary method to gather quantitative data on floristic composition. Quadrat positions were initially chosen at the desktop level to ensure that the sampling array was appropriate and took into account previous sampling and historical vegetation mapping boundaries. While the spatial location of corner points were accurately recorded using an standard accurate GPS (1-4 m accuracy), none of the corners were permanently marked in the field, as re-sampling was not planned and the majority of corner posts were in the low flow zone and as such would not last long term. All quadrats established were of 2,500 m^2 in area and most were either 50 x 50 m or 25 x 100 m in dimension. This quadrat area of 2,500 m^2 is recognised as providing an adequate sample of species presence for Pilbara vegetation and is the standard quadrat size for botanical survey work in the region (Clarke 2009). Where the dimensions of a community did not allow a square quadrat, a rectangular

quadrat of equivalent area was established instead. Measuring tapes were used to ensure sampling was broadly confined to the boundaries of the quadrats.

In the remainder of cases relevés were used either to overcome spatial constraints or to more rapidly acquire additional sampling effort. A relevé is an unbounded flora sampling site with a similar area to a standard quadrat. In this survey relevés were sampled in a more traditional fashion where the same information is recorded as for a quadrat, and the degree of sampling effort dedicated to sampling of flora is similar, but the boundaries of the sampling unit are not confined. Relevé sampling was often undertaken if the vegetation type had a confined irregular shape (e.g. along creeklines), making establishment of a standard quadrat in a single vegetation type difficult. The following information (and more) was recorded for each quadrat and relevé:

- Location: Universal Transverse Mercator (UTM) coordinates recorded in GDA 94 datum in Zone 50 (to an accuracy of typically ±4 m), using a handheld GPS unit; coordinates were recorded for all four corners of a quadrat and for the centre point of a relevé;
- Vegetation description: a broad description based on the height and estimated cover value of dominant species in all relevant strata (Aplin 1979; see Appendix A:);
- Habitat description: a description of the landform and habitat;
- Broad soil type: a description of the soil colour, texture and any stony surface mantle;
- Fire history: approximate time since last fire, where applicable;
- Vegetation condition ranking: considering evidence of grazing, physical disturbance, weed invasion etc. (after Trudgen 1988; see Appendix A:);
- The estimated percent foliar cover and height of each flora species present within the relevant community which the quadrat/relevé is positioned to represent; and
- A set of four colour photographs of each site (usually taken in an North/East/South/West fashion from a position in the quadrat which allows representative views of the vegetation community being sampled.

Overall, a total of 25 systematic sampling sites were established, including 11 quadrats and 14 relevés sampled in the Study Area, as well as 10 vegetation points (detailed vegetation mapping data points) and 2 reference sites sampled outside of the Study Area. The location of the additional quadrats and relevés established in the survey area as part of this study is provided in Figure 4-1.

In terms of the historical systematic sampling sites which were used to support the vegetation mapping refinement process; an additional 10 quadrats/relevés sampled by Astron (2020) were considered along with 9 vegetation mapping data points. In addition, approximately 27 quadrats/relevés sampled by Mattiske in 2008 & 2010 were also utilised, which means that all up more than 60 quadrats and relevés were considered across the Study Area as part of the mapping refinement process. The raw quadrat data from these quadrats are provided in Appendix M: along with a table presenting coordinates for each site (MGA Zone 50, GDA 94). A list of all of the systematic sampling sites utilised in the current study are provided in Appendix N: and presented in Figure 4-1.

None of the additional quadrats and relevés sampled as part of this study were seasonally sampled, that is, surveyed over two seasonally favourable phases. In addition to the new and historical sampling sites which were utilised in this study, two riparian vegetation monitoring transects (both on WWC in the “Ben’s Oasis” area) and the embedded quadrat data from each was also considered in the vegetation mapping process (Mattiske 2019; from surveys from 2008-2019).

Identification of vascular flora specimens was conducted in the field or in the office following the field survey. In cases where a plant specimen was common and known to the botanist, the identification was confirmed and noted in the field. If the species was difficult to determine without microscopic examination, belonged to a recognised species complex, was poorly collected or otherwise unusual, a voucher specimen was collected.

All voucher specimens were identified by Steven Dillon from the WA Herbarium using flora keys, consulting appropriate publications and relevant experts, checking voucher reference collections, and comparing the specimens to the main herbarium. Nomenclature followed the current listing of scientific names recognised by the WA Herbarium (unless specified). All data were entered into a Microsoft Access Vegetation Database structure.

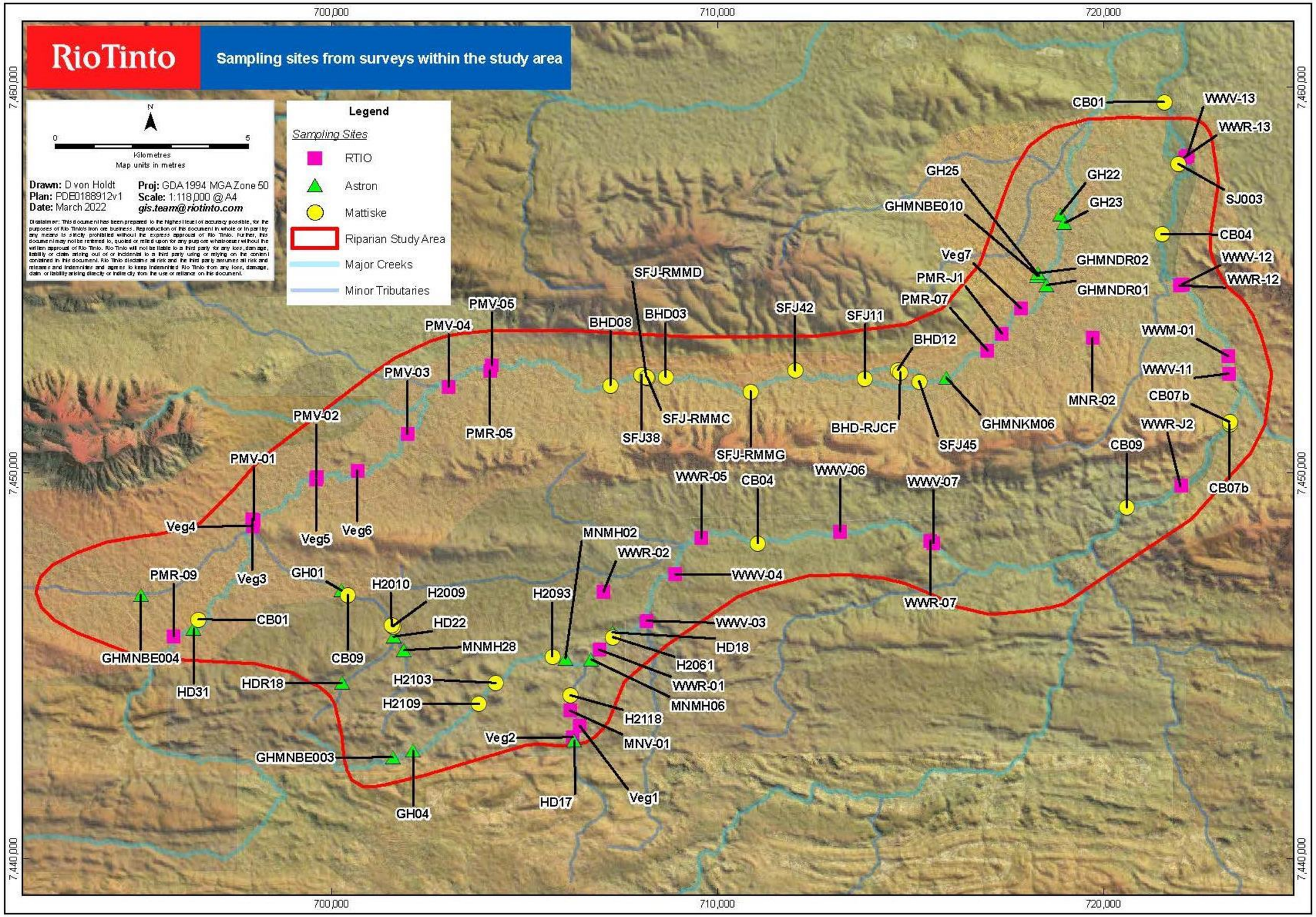

Figure 4-1: The location and spread of Quadrats and Relevés conducted by Rio Tinto (2021) (pink squares) as part of the current study, along with sampling sites conducted by Astron (2020) (green triangles) and Mattiske (2008; 2010; 2014) (yellow circles) also considered in this study.

4.3. Riparian mapping techniques utilised

A number of techniques were applied to the vegetation mapping process used in this targeted study. These techniques were utilised to help achieve the core study goal of both increasing the level of detail presented in the vegetation mapping while refining the mapping to be more relevant and focused on the riparian and ecohydrology disciplines.

The application of these techniques can be summarised in the following list of steps/tasks:

1. Leverage previous baseline vegetation mapping and associated vegetation units;
2. Utilise the Increased array of systematic sampling sites and mapping notes to refine the vegetation mapping to focus on informing riparian attributes and relevant trends in ecohydrology across the Study Area
3. Aim to provide an increased level of detail (low to moderate level gains) within the resulting vegetation mapping
4. When refining the vegetation mapping and associated vegetation descriptions:
    - Consider the distribution and abundance, but ultimately established structure of keystone overstorey species with particular focus on those keystone overstorey species which are broadly identified as potential phreatophytes.
    - Consider the compositional trends observed within riparian communities and the distribution of these trends with specific focus on both the broadly Ephemeral riparian taxa, as well as that of mesophytic and hydrophytic taxa across the Study Area.
    - Leverage the RTIO “Pilbara Riparian Ecohydrological Framework (PREF)” and included indicator guilds to inform which understorey constituents are more strongly associated with mesic (or conversely strictly ephemeral habitats) riparian habitats and relevant to informing relevant ecohydrological trends;
5. To improve vegetation mapping boundaries and associated trends;
    - Utilise aerial photography interpretation and resulting desktop mapping of the abundance/distribution of overstorey phreatophytes to improve vegetation descriptions and particularly mapping boundary accuracy.
    - Leverage improved overstorey mapping accuracy to also improve mapping and extrapolation of understorey assemblages more consistently associated with interpreted overstorey trends.
    - Review groundwater depth trends (from monitoring bores), broad geological and topographical trends and available evidence of surface water persistence across the Study Area to influence vegetation mapping where relevant and ultimately to confirm agreement with those trends described in the resulting riparian vegetation mapping.

Some of these tasks and techniques above are described in more detail in the follow section.

One of the core tasks of this study was to appropriately refine the riparian vegetation mapping across the Study Area, in order to provide more targeted and thus more detailed riparian mapping and community delineation. As a result of this requirement and of the relatively ephemeral nature of the majority of the drainage systems throughout the Study Area, the mapping process was heavily underpinned by the previous baseline vegetation mapping units and boundaries. Leveraging this resource, the core mapping tasks of the current study were to increase the longitudinal delineation of vegetation units in the riparian zone (with some increases in lateral delineation, i.e. the addition of floodplain units) via refinements in the composition and structure of the resulting mapping units. These refinements were predominantly facilitated by additional systematic sampling sites, targeted mapping notes in key focus areas, and desktop mapping of the distribution and abundance of key phreatophytes.

As stated in section 4, the mapping refinement process was supported by increasing the density and coverage of the systematic sampling site array. Following completion of the additional systematic sampling, all of the resulting sampling site data (including historical sites) were reviewed to identify

trends in overstorey structure and composition as well as specific patterns in the understorey composition and also the varying dominance of certain large riparian shrub species. In particular, a focus was placed on species which have been implicated as increasingly good indicators of elevated moisture stability via the PREF. However, in this case a secondary lens of focus was also placed on species which are either indicative of the highly ephemeral end of the ecohydrological spectrum, or whose abundance may be indicative of the presence of fine grained substrates such as clays which may not only inspire different community assemblages, but which also support extended residence time of surface water in the upper soil profiles.

In particular, the mapping refinement task was supported by desktop mapping (supported by ground-truthing of selected areas) of the presence and abundance of the keystone phreatophytes *Eucalyptus camaldulensis* (focus) and *E. victrix* (reduced effort). Methods used to relatively confidently map the presence (and alternatively absence) of these species at a desktop level are described in more detail below in sections 4.3.1 & 4.3.2. This technique has been successfully utilised by the author (aerial imagery quality allowing) in a number of locations within the Hamersley sub-region. In this case and in some of the previous use cases, ground-truthing of desktop mapping outcomes has only uncovered a very low error rate (approximately 1-5% error). In comparison, the error rate identified following ground truthing of traditional methods (i.e. extrapolation of abundances from systematic sampling sites and targeted mapping notes) seems quite high but variable, with some areas/practitioners producing low error rates and others being quite high. Ultimately traditional approaches are constrained by the large distances over which extrapolation is required, whereas the suggested desktop mapping approach is aided by low levels of extrapolation but does require appropriate imagery and interpretation abilities.

In a riparian setting, the abundance and distribution of key phreatophytes tend to reflect changing patterns in the temporal availability of surface and groundwater sources across the drainage systems being studied. Generally common riparian tree species present within the Pilbara, together form a hierarchy of likely water availability (among other eco-physical characteristics) across the drainage system continuum. As an example, this hierarchy might typically follows this general order;

1. *Melaleuca argentea* (OPS)
2. *Sesbania Formosa* (?OPS)
3. *Eucalyptus camaldulensis* (FPS)
4. *Eucalyptus victrix* (FPS)
5. *Eucalyptus xerothermica* (? Vadophyte)
6. *Corymbia hamersleyana* (Vadophyte)

With species at the bottom of this list being present and abundant or dominant in the driest drainage settings (or on the periphery/floodplain of wetter settings) and species at the top being abundant/dominant in the wettest of settings. As a result, the relative presence/abundance of each of these species can be observed and used to infer trends/patterns in water availability both from typical and concentrated surface water sources as well as groundwater sources, as species in the upper half of the list start to become abundant or dominant. It is for this reason that it is quite useful to have access to relatively accurate and comprehensive mapping of the abundance/distribution of local phreatophytes (and other relevant tree species) when refining riparian mapping. Particularly if that riparian mapping is also supporting assessments of the likelihood of GDV being present or making assertions around the ecohydrological characteristics of different drainage reaches. Alternatively, for the process of riparian mapping, it's quite useful to be able to review aerial imagery in areas where questions remain around the relative abundance of key overstorey components, or extrapolation of field data is required over longer distances. Regardless of the situation, such mapping and interpretation techniques are extremely useful for more enabling mapped boundaries to more accurately reflect the overstorey structure and relative abundance of species in described vegetation units. Ultimately these improvements in accuracy flow on to providing vegetation mapping boundaries which infer increasingly relevant patterns of water availability, particularly where they relate to phreatophyte distribution.

In this study, desktop mapping of the abundance of *Eucalyptus victrix* and particularly *Eucalyptus camaldulensis* was heavily relied upon to confirm proposed refinements to the vegetation mapping. In particular, these related to areas where *E. victrix* was observed to be dominant, rather than co-dominant, thus allowing better alignment with observed ecohydrological trends also utilised across the Study Area.

The same trends in vadophyte and phreatophyte abundance are also generally reflected in the presence/absence and diversity of mesophytic and hydrophytic understorey constituents. Sampling sites and mapping notes were used in the Study Area to confirm these associations and alignments between overstorey structure and phreatophyte abundance with mesic understorey composition. Following this process, desktop mapping and aerial photo interpretation of phreatophyte abundance/distribution can also be used to more accurately extrapolate the presence of key mesic and alternatively ephemeral understorey compositions in association with overstorey cues in aerial imagery which are able to be systematically assessed across the Study Area.

As the most hydrologically sensitive Pilbara vegetation communities are typically those with a significant component of *Melaleuca argentea*, an initial review was undertaken to identify desktop tools and resources suitable for helping identify the likely distribution of *Melaleuca argentea* dominated communities in the Study Area (i.e. OPV). Utilising observations from previous field work it was concluded that *Melaleuca argentea* was generally absent in the Study Area except in an approximately 4 km stretch of Weeli Wolli Creek surrounding the "Ben's Oasis" spring feature in the south-eastern portion of the Study Area. To make sure the distribution of this species, and particularly areas where mature populations were present, was adequately captured, a field plan capable of ground-truthing the predicted and potential spatial distribution markers for OPV and FPV communities in this area was developed. This plan predominantly leveraged extensive field traverses in the areas upstream and downstream of "Ben's Oasis" area during the main field trip for this study. On two separate occasions "Ben's Oasis" was visited and field traverses and observations were completed which were also utilised in this study (26th of July 2017 and 3-14th of December 2018).

Field traverses were set up in such a way that they regularly intersected lateral vegetation boundaries across the creek profile. As well as collecting data on the presence of this species, vegetation boundaries where mature, well-established populations of this species occurred were consistently marked with a GPS. Aerial photo interpretation techniques relevant to the canopy signature of this species were utilised at the desktop level to extrapolate the ground points in a highly accurate fashion, in order to provide high confident boundary delineation for this important community. By allowing both young "more transient" populations of *M. argentea* as well as long term mature and dominant/co-dominant populations of to be delineated, the resulting vegetation mapping provided a way of contextualising and assessing the potential for hydrological changes to impact the more sensitive and likely obligate phreatophytic riparian communities of the Study Area.

Together, the above described techniques were found to be appropriate for the purpose of achieving the core study goal of both increasing the level of detail presented in the vegetation mapping while refining the mapping to be more relevant and focused on the riparian and ecohydrology disciplines.

4.3.1. Aerial photographic interpretation of over storey phreatophyte species composition

To support identification, delineation and mapping of GDEs within the Study Area, aerial photographic interpretation and classification of the extent and relative abundance of groundwater dependant phreatophytes in the overstorey was undertaken. With respect to the GDE mapping process this is a critical task which substantially increases the power of the resultant riparian map and GDE classification it supports. In most cases one of the key tasks in this process is to spatially delineate FPV communities with a tree stratum either dominated by *Eucalyptus camaldulensis*, co-dominated by *Eucalyptus camaldulensis* and *Eucalyptus victrix*, or dominated by *Eucalyptus victrix* alone. *Eucalyptus camaldulensis* is the more groundwater dependent of the riparian eucalypts (at times potentially representing an obligate phreatophyte), which commonly occur in the Study Area. For this

reason, mapping the presence, distribution and dominance of *Eucalyptus camaldulensis* (outside of OPV) is an important step in the process of mapping varying degrees of potential community related groundwater dependence. This is particularly relevant for GDE identification where true obligate phreatophytes are absent. In such cases, FPV with a canopy dominated by *Eucalyptus camaldulensis* alone is that community most likely to represent a GDE (broadly speaking).

Traditionally, *Melaleuca argentea, Eucalyptus camaldulensis* and *Eucalyptus victrix* distribution (and thus vegetation community data) mapping requires regular field notes (along with quadrat and relevé sampling) on the presence/absence and abundance of these species on the ground to facilitate extrapolation throughout the relevant mapped areas. Within the many riparian formations in the Pilbara; it is noted that canopy, stem and reproductive material which often allow relatively confident differentiation between the two eucalypt species; are either not present or are insufficient to aid bulk differentiation during the field survey. The variable reflection of light off respective tree canopies which is provided to a botanist on the ground; substantially influences their ability to record meaningful amounts of data from canopy cues to classify canopies when later conducting the desktop mapping. Furthermore, it is relatively impossible (due to field time constraints) to capture adequate on ground data to accurately map the canopy abundance/presence of the three key phreatophytic species. For this reason, where possible, aerial photo interpretation is often the best tool for mapping the distribution of *Eucalyptus camaldulensis* and *Eucalyptus victrix*. Only with the more recent advent of extensive capture of high-resolution aerial imagery (sub 0.2 m) has the aerial photo differentiation of typical Pilbara riparian eucalypts been possible in a consistent and relatively confident manner. Up until now this type of imagery has not allowed the differentiation of *Melaleuca argentea*; with it typically exhibiting a very similar canopy signature to that of *Eucalyptus victrix* in aerial photography. Now with the ability to capture sub 0.1 m aerial imagery the differentiation of *Melaleuca argentea* become possible. Using a 0.05 m resolution aerial image, validated with adequately detailed ground data it has been confirmed that this type of canopy classification can be achieved.

Overall, the use of this methodology (in combination with on-ground data) to classify canopy composition via the riparian vegetation map enables accurate identification and mapping of GDE's and potential GDE's. This process was aided significantly using recent high resolution (0.05 m) true colour aerial imagery. Furthermore, where available, 7-band Worldview imagery further assisted identification (by improving the clarity of visual cues) of individuals/stands of *Eucalyptus camaldulensis* and *Eucalyptus victrix*. The use of Worldview imagery allowed more accurate mapping of communities as possessing dominant or co-dominant overstorey populations of these species. Worldview imagery also provides a useful alternative view to vegetation which provides increased visual differentiation between overstorey and understorey vegetation. This in-turn helps to inform the process of interpreting vegetation structure/density which further increases the power of the riparian map to interpret groundwater access and dependence.

In order of relative usefulness for basic aerial photo interpretation (and similar for worldview) of dominant Pilbara riparian eucalypt trees; Individuals or groups of *Eucalyptus camaldulensis* within the riparian environment were distinguished on aerial photography from *Eucalyptus victrix* on the basis of:

1. Darker green canopy colour signature of *Eucalyptus camaldulensis* (as opposed to quite grey canopies of the alternative species);
2. Denser canopy cover signature of *Eucalyptus camaldulensis*;
3. Different branch signature of *Eucalyptus camaldulensis* canopy architecture; and
4. Larger (spatial extent) canopy footprint of *Eucalyptus camaldulensis*.

On worldview imagery, there are also visual cues which can be utilised which generally relate to canopy vigour, but also to the associated understorey (particularly that of grass layers) signature which tends to accompany the larger more (biologically) productive *Eucalyptus camaldulensis* stands.

The available aerial photography and worldview imagery was considered to be of a high quality suitable for the application of the visual assessment described above and was found to be robust when ground-truthed using field data. Rio Tinto (2015, 2018a, 1018b) have previously proven the use of aerial imagery to accurately locate *Eucalyptus camaldulensis* trees from Weeli Wolli Creek (Yandicoogina Operations) and from the Robe River in the Western Pilbara.

Examples of the aerial signature of *E. camaldulensis* trees from Weeli Wolli Creek (Yandicoogina Operations) are provided below in Plate 4-1. The examples presented in Plate 4-1 were chosen due to their location on an open floodplain, where canopy density is reduced and as such surrounding canopy species don't inhibit the display of the above described characters, providing a clear example of the application of the species differentiation process. Plate 4-2 shows similar examples of key Eucalypt aerial signatures from the Robe River in the Western Pilbara.

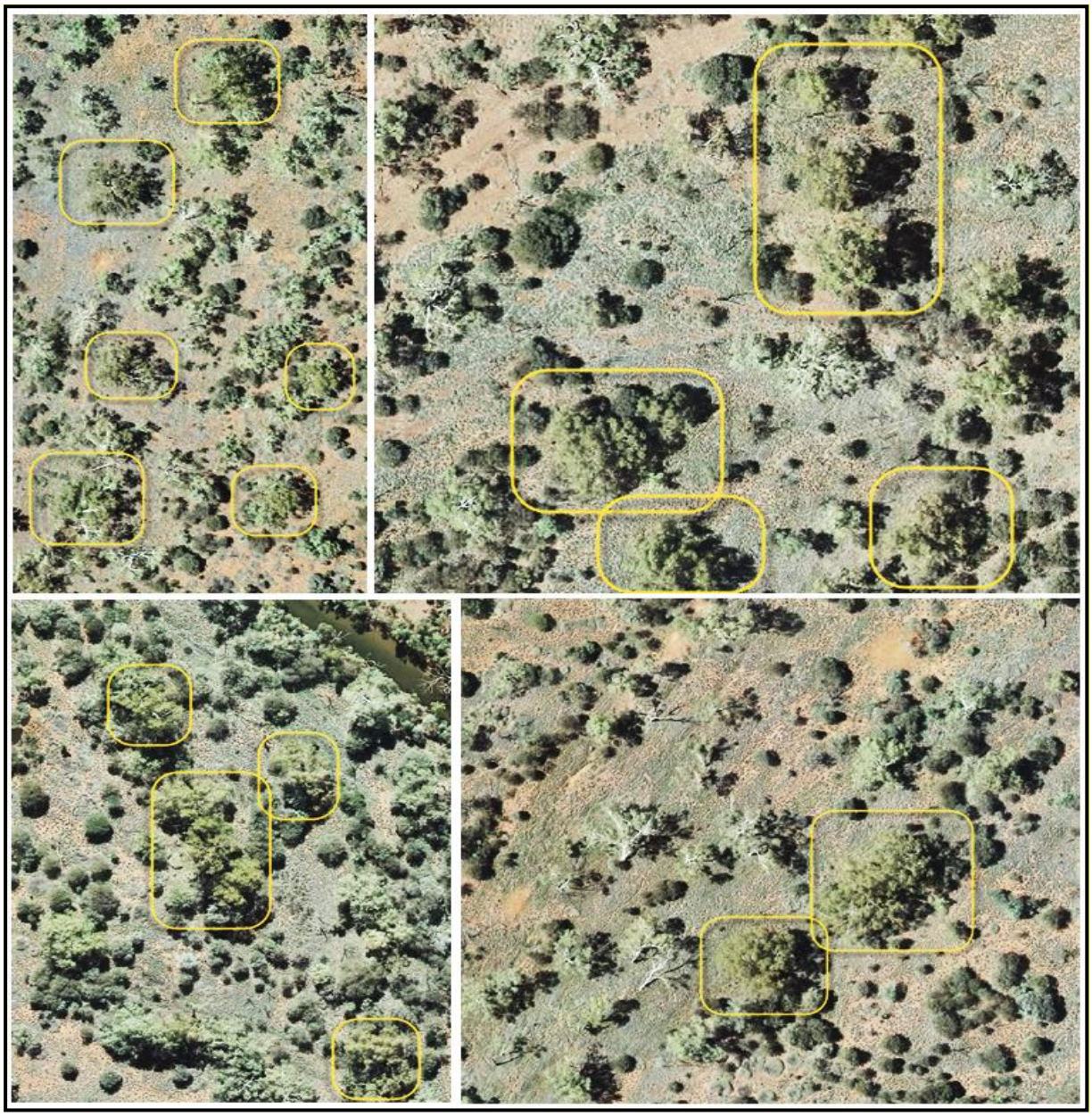

Plate 4-1: Aerial photos showing examples of *Eucalyptus camaldulensis* canopies (inside orange polygons) on high resolution aerial photography (Weeli Wolli Creek)

Note: Beyond the more obvious shrub features, the majority of the remaining eucalypt canopies present in these plates are considered to be *E. victrix* as indicated by the relatively obvious white branch and trunk colouration, open branching habit and lighter foliage colour.

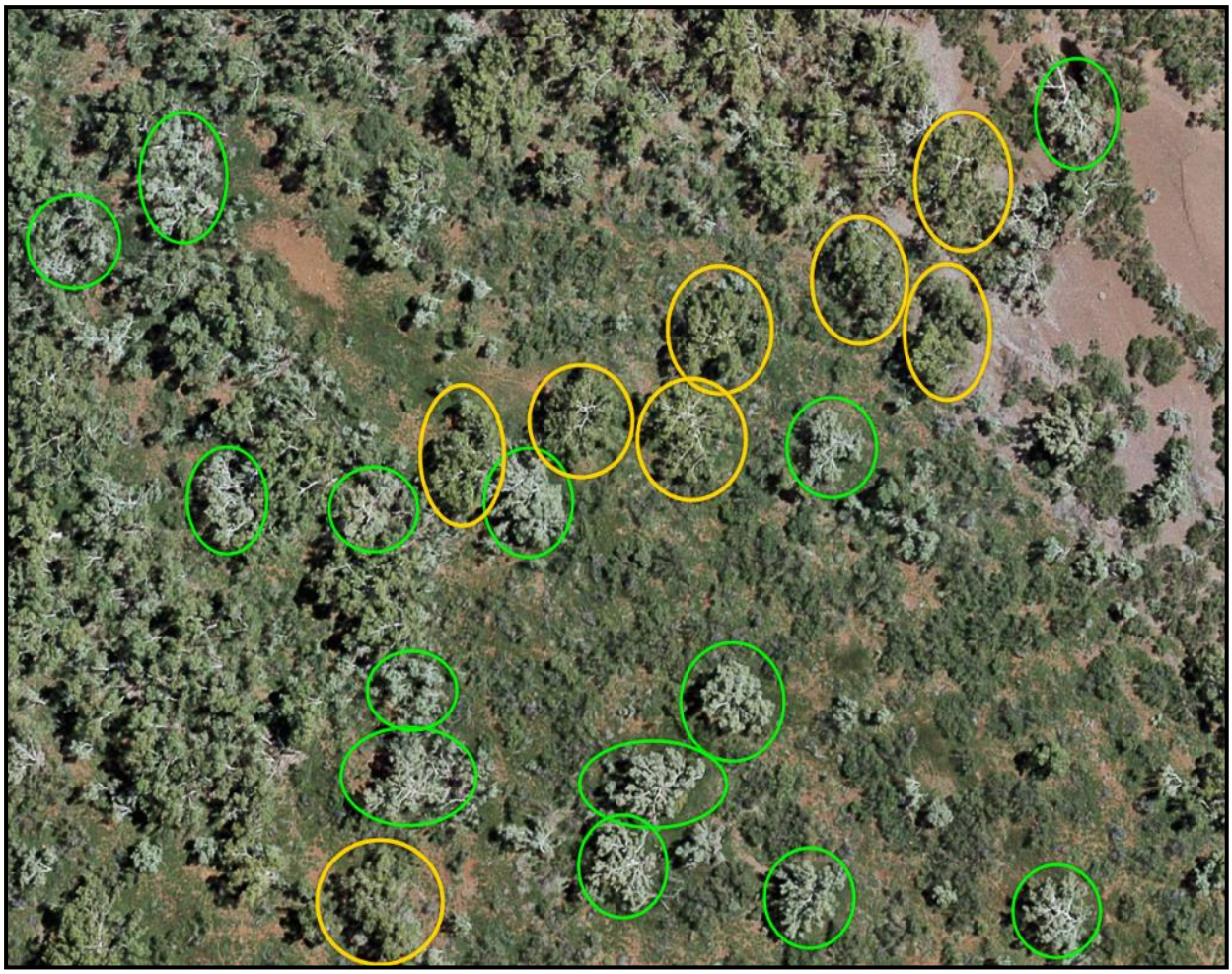

Plate 4-2: Aerial photos showing examples of *Eucalyptus camaldulensis* canopies (inside orange polygons), and *E. victrix* (inside green polygons), on high resolution aerial photography within the Robe River (April 2017)

The other core riparian vegetation canopy constituent of ecohydrological importance whose presence/absence can potentially be interpreted at the desktop level with some ground-truthing assistance is *Melaleuca argentea*. This is done using aerial imagery based interpretation of the presence of canopies consistent with *Melaleuca argentea* surrounding low flow channels. The canopy cue which is utilised leverages the grey/silvery component of mature canopies of *Melaleuca argentea* as compared to the darker more vigorous green of the canopy of *Eucalyptus camaldulensis*. Outside of low flow channels, and particularly outside of the core riparian zone, relevant canopy signatures are likely to be confused with *Eucalyptus victrix*. This canopy cue is not as relevant for stands of young *M. argentea* whose canopy is much more similar in colour to *E. camaldulensis*.

This approach is significantly supported by the use of ARC-GIS World imagery (ArcGIS 2021) high resolution imagery archives. At the appropriate scale, this imagery source provides relatively consistent spectral characteristics such that ground reflection properties and exposure/contrast is much more consistent and the generally more silver canopies of *Melaleuca argentea* can be differentiated from Eucalypts on most occasions. There are caveats on this interpretation; in particular, away from the low flow channels in areas where vegetation persistence is low, or where the accuracy of persistence signatures is reduced by bed-scouring (such as within river channels); silver canopies are not consistently able to be interpreted (often actually representing *E. victrix*). As a result the interpretive power of this approach is restricted, and in general its use needs to be confined to around low flow/high flow channels or areas of high vegetation persistence. Examples of how ARC-GIS World Imagery (and other google imagery sources) can be used to differentiate canopies of riparian Eucalypts from that of mature *Melaleuca argentea* canopies are presented in Plate 4-3 to Plate 4-5. In

these plates, green shapes are indicating Eucalypt spp. canopies (most likely *E. camaldulensis*) and orange shapes are *Melaleuca argentea* canopies; all examples confirmed by on-ground data.



Plate 4-3: *Melaleuca argentea* canopy differentiation - Example 1



Plate 4-4: *Melaleuca argentea* canopy differentiation - Example 2

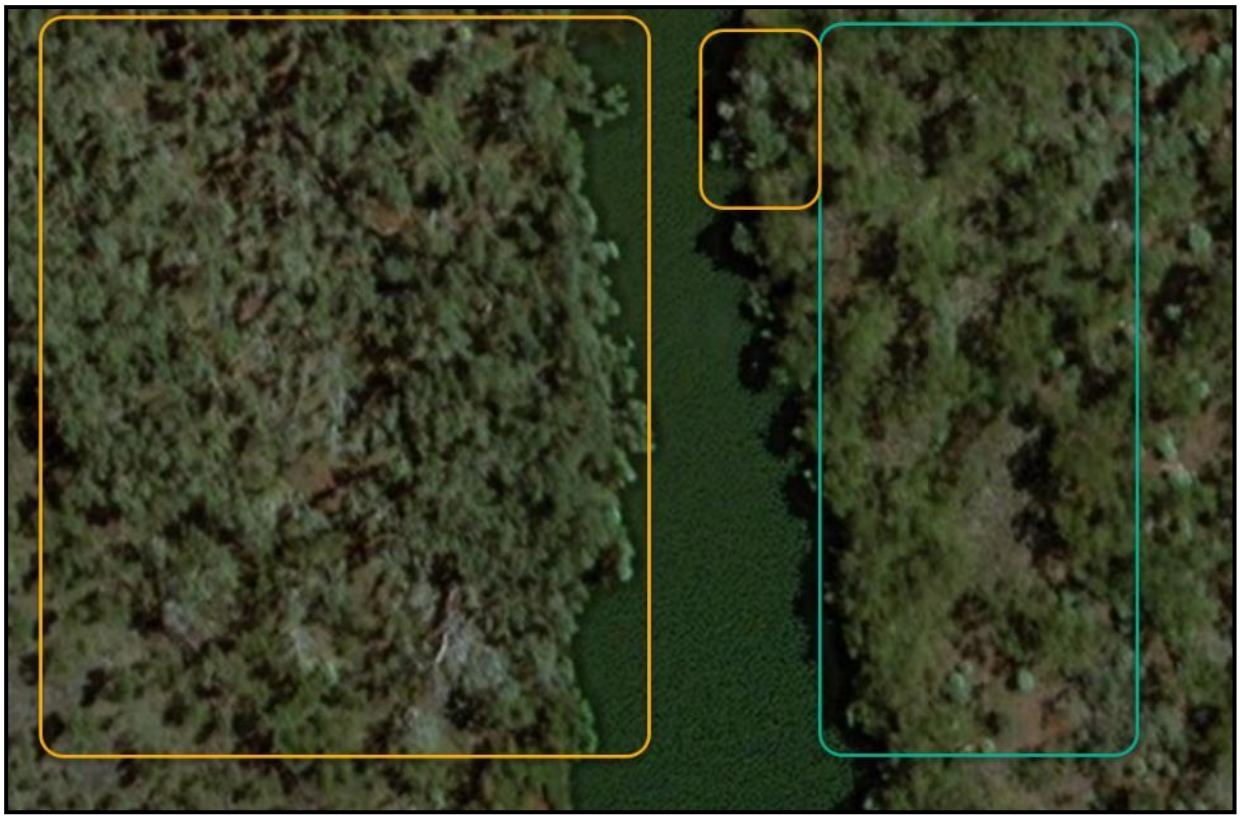

Plate 4-5: *Melaleuca argentea* canopy differentiation - Example 3

4.3.2. Use of aerial photo phreatophyte interpretation to support riparian mapping

As outlined in section 4.3.1, it is possible to conduct desktop interpretation of aerial photography to provide mapping of the distribution and abundance of the key phreatophyte species which tend to dominate riparian overstorey's in the Pilbara. This technique is particularly appropriate once adequate ground-truthing of the resulting desktop mapping is completed to ensure that the cues being provided by the imagery used are relatively accurate and consistent. Furthermore, this approach has been utilised successfully (aerial imagery quality allowing) by the author in a number of locations within the Hamersley sub-region, where ground-truthing has only uncovered a very low error rate (approximately 1-5% error).

However, when considering this error rate, the error rate of the on-ground survey alternative should also be considered. On-ground field validation by the author (using hand lens-based leaf checks along with other character suites) of the respective abundance placed on both *E. camaldulens*is and *E. victrix* yielded from quadrat sampling by other botanical practitioners, has indicated much higher error rates. This error rate is quite variable, depending on site conditions and practitioners, but is likely to be in the order of 2-50% based on initial indications and a relatively low validation sample size. The source of this error, and the associated variability is most likely to be partly due to site selection biases, and also due to inaccurate extrapolation of close quarters ID's to the other individuals in the wider quadrat and surrounds. With extrapolation throughout the site strongly influence by differing viewing angles and associated solar artefacts.

However, rather than question the validity of this result; both the relatively low rate of error in the aerial interpretations as well as the potentially high error rates in quadrat data, it appears more logical to consider the merits of the two different approaches. Looking at canopy characteristics from the sky perspective, normalises the solar conditions and colour palates/contrasts which are available to be utilised in the identification of dominance/abundance data for the respective target species. While the

resolution of these traits are heavily reduced when compared to on ground sites, this technique also has the advantage of a much larger range of gaze and thus is less biased by clusters of varying abundance which can be hard to look past when on the ground. By comparison, when on the ground looking out and up at trees, this perspective determines that in every direction you are looking, different solar irradiance conditions are being experienced, both influencing the colour of leaf, stem and bark characters, but also the degree of reflection from these surfaces. Furthermore, these complications are significantly greater in the early and late parts of the day. In particular; for *E. camaldulensis*, the degree of leaf shine or reflectance is highly variable on the ground, depending on the direction and time of day, but this trait also represents an important and influential character trait for this species which has a very shiny cuticle as opposed the waxy cuticle of *E. victrix*.

In general, the advantages of looking at patterns in dominance/abundance of overstorey canopy composition from the sky are quite clear, and so assuming aerial photography is of an appropriate resolution and colour/contrast then this approach can be quite superior for gathering data to support vegetation mapping. This is especially true in the riparian space, where the relative abundances of overstorey species can effectively be leveraged to interpret varying degrees of water availability and parallel potential increases in hydrological risk. Therefore, where appropriate, it seems clear that utilising both on-ground and aerial approaches and continuing to ground-truth the adequacy of the aerial images used, is a better approach than using on-ground data alone. Even if it's done for a sample area of differing vegetation units to make sure that both the scale of the mapping project, associated mapping descriptions/boundaries, on ground data and aerial interpreted data all generally agree.

4.4. An assessment of riparian vegetation communities across the Study Area

An assessment of the riparian vegetation and representation across the Study Area was completed as part of this study.

Riparian ecosystem diversity and representation is primarily driven by moisture availability patterns. It is therefore acknowledged that riparian flora of increasing habitat specificity to restricted mesic/hydric habitats are likely to be important indicators of riparian community representation and thus importance. An evaluation of the representation of these vegetation units locally and regionally were completed for the purpose of EIA.

To do this the study will rely on completing and conducting 6 different steps and assessment processes; the first 4 of which are conducted in order to create appropriately targeted riparian vegetation mapping and the final four of which focus on assessing and classifying each riparian unit in order to provide significance ratings:

1. Adequate sampling of riparian vegetation communities to allow a commensurate assessment of local riparian values.
2. Consideration of compositional trends observed within riparian communities and the distribution of these trends with specific focus on both the broadly Ephemeral riparian taxa, as well as that of mesophytic and hydrophytic taxa across the Study Area.
3. Consideration of the distribution and abundance, but ultimately established structure of keystone overstorey species with particular focus on those keystone overstorey species which are broadly identified as potential phreatophytes.

4. Using this information, conduct targeted riparian vegetation mapping which gives insight into the riparian values and different ecohydrological processes occurring within larger drainage systems (i.e. broadly Moderate[8] and above sized drainage) covered by the Study Area.
5. Identify which mesophytic and hydrophytic species are typically present in each of the mapped vegetation units, what ecohydrological indicator guild they fit in based on the "RTIO Pilbara Riparian Ecohydrological Framework" (PREF) (for externally draining riparian features) (See Table 3-3), and where relevant what's their likely abundance.
6. Use the info gathered in steps 2, 3 and 5 to map and classify each riparian vegetation unit into Ecotypes (see Table 4-1). For ecotype classifications, in some cases riparian units will not fit into the classification perfectly, or simply that additional factors of relevance need to be incorporated.
    a. the following factors might influence the final classification: Consideration of any relevant state conservation listings which the community may be associated with or representative of;
    b. The associated composition of mesophytic/hydrophytic taxa, and particularly the presence/absence of some of the more highly restricted and relictual hydrophytes from the 'High' to 'Very-High' level indicator guilds (Table 3-3);
    c. Consideration of the presence and nature of relevant surface water features, including monitoring data which supports assertions around the persistence/permanence of relevant features;
    d. Consideration of the relevance of the eco-physical setting/characteristics of the landscape or lithology which riparian communities have established upon,
    e. Consideration of the distribution and therefore degree to which the community in question is spatially restricted in the environment, the degree of representation outside of the Study Area of the community, and potential rarity of this feature within local, sub-regional, and regional scales;
    f. Consideration of whether the community in question provides any atypical ecosystem services which should be highlighted/incorporated; and
    g. Consideration of the condition and inherent resilience to perturbation/s of the community in question. This should consider those potential hydrological influences which may not be traditionally considered, such as disturbance provided by surface flows, altered flow patterns, fluvial weed abundance, exposure to surplus mine water discharge, reductions to catchment size etc.

Step 5

The RTIO developed "Pilbara Riparian Ecohydrological Classification" and the relevant indicator guild lists (PREF) is presented in Table 3-3. By surveying a riparian feature & assigning presence/absence data to the framework table, an assessment of restriction is facilitated via the presence of increasing diversity both;

- Vertically down the framework through successive ecological plant groups;
- And horizontally across the frameworks ecohydrological plant guilds.

Where communities possess increasing diversity at the 'High' and Very High' indicator guild end of the scale, such communities are inferred to possess habitats which support increasingly stable long term hydrological conditions. These diversity gradients are thus used to infer:

- increasing availability and stability of moisture;
- increasing habitat quality &
- increasing hydrophytic biodiversity & rarity of riparian assemblage.

[8] Broadly moderate and above sized drainage refers to drainage typically greater than 25 km^2 (and up to, or greater than, 2000 km^2) and is likely to have GDV present. See table in Appendix E: for detailed drainage classification information.

This ecotype classification has been developed based on a broad analysis and ongoing observations of the spectrum of riparian communities present within the Pilbara. This classification attempts to deal with both externally draining features (the focus of the classification) as well as lightly dealing with more internally draining type features.

Substantial efforts were made to identify relevant ‘mesic’ riparian formations and their associated mesophytic and hydrophytic constituents of moderate to high potential significance within the Study Area. This identification process was greatly assisted by assessing NDVI persistence mapping for the presence of vegetation persistence anomalies in the order of 70% persistence and greater. Such information is thought to be critical in this process as these assemblages and their constituents typically represent highly restricted communities of increasing significance.

In addition, with respect to assessing condition; the current condition of riparian vegetation at the time of consideration will have an influence on its significance. Therefore, it is important to also incorporate the historical anthropogenic impacts into the resultant significance. This process is important as it helps to contextualise the traditional condition ranking attributed to local vegetation as part of baseline surveys. Often the condition attributed to vegetation as part of baseline surveys is significantly skewed by the presence of weeds typically common/abundant within most Pilbara/North-West drainage systems. The proliferation of weeds in these types of habitats (once they have arrived) are linked to natural disturbance processes which fluvial environments provide. As a result, it is important to contextualise their presence and abundance and acknowledge that weeds are proliferating in these environments due to natural processes and not necessarily directly due to anthropogenic disturbance. This third step attributes a more landform based and locally relevant consideration of condition and degree of modification into the significance attributed to any riparian community being assessed.

Table 4-1: Pilbara Riparian Ecotypes used for mapping

	Broad Riparian/GDE Type and key Characters	Subtype	Detailed structural descriptions & Keystone species notes	Alternative/additional keystone constituents characteristics	Typical Mesophyte Hydrophyte composition characteristics	Typical surface water conditions/characteristics
Type 1 - Aquatic GDE	**Generally Aquatic GDE's & associated obligate Terrestrial GDV** · Typically including permanent groundwater fed pools · Including obligate Terrestrial GDV Generally coinciding consistently with shallow Groundwater (Permanently* 0-4 m below ground level). · Typically associated with open forest scale overstorey riparian formations	1A	Aquatic & terrestrial GDE type riparian formations of varying size, generally in excellent condition and often occurring in an A class Reserve. Generally, always possessing Obligate Phreatophytic species (OPS) and Obligate Phreatophytic Vegetation (OPV). In some cases, Rights reserved sites, heritage values and multiple conservation listings can lead to classification to this tier without being in an A class reserve. Example: Millstream, some of the Karijini Gorge formations.		Generally possessing multiple 'Very High' and 'High' Level Hydrophytic indicator species suggesting a Very High degree of moisture permanence in the associated habitats. Multiple 'High' and 'Moderate-High' (Likely also 'Very High' examples) Mesophytic indicator species generally common in associated terrestrial GDE habitats.	Typically including multiple permanent groundwater fed pools and an array of Semi-permanent and persistent pool surface water features
		1B	Aquatic & terrestrial GDE type riparian formations of moderate to large scale, generally in excellent to good condition. Generally, always possessing substantial mature OPV (Obligate Phreatophytic Vegetation) formations and a series of permanent aquatic pool environments with associated interconnected pools systems of differing permanence (i.e. semi-permanent and persistent pool)			
		1C	Terrestrial type GDE with varying Aquatic formations (less substantiated) of at least moderate scale, generally in good condition. Generally possessing OPV (Obligate Phreatophytic Vegetation) formations.		Generally possessing multiple 'High' and 'Moderate-High' (and likely an occasional 'Very High' level) Level Hydrophytic & likely Mesophytic indicator species suggesting a high to very high degree of moisture permanence in the associated habitats.	Typically including permanent groundwater fed pools and likely an array of potentially Semi-permanent and Persistent pool surface water features
Type 2 - Obligate Terrestrial GDE	**Broadly Obligate Terrestrial GDV /GDE's** · At times Including some semi-permanent to permanent aquatic habitats · Generally coinciding with groundwater of various sources typically occurring less ≤ 5 m from the surface · Typically including persistent pool aquatic habitats. · Typically associated with woodland to open forest scale overstorey riparian formations	2A	Typically, moderate to large scale Terrestrial type Riparian GDE formations. Always possessing riparian formations co-dominated by mature OPS (Melaleuca argentea) and OPV (or other well accepted species with obligate groundwater use patterns). Generally, possess semi-permanent and persistent pool pool formations in key locations (permanent pools also present, but uncommon). May be small to moderate scale, but if so, typically possessing demonstrated permanent surface water formations.		Generally possessing multiple 'High' and 'Moderate-High' (potentially an occasional 'Very High' example) level Mesophytic indicator species, as well as multiple 'Moderate-High' and occasional 'High' level hydrophytic indicator species. These assemblages indicate a high level of permanency of moisture availability.	Likely to possess a permanent aquatic habitat, but small in extent/restricted. Generally, possess semi-permanent and persistent pool formations in key locations.
		2B	Typically, moderate to large scale Terrestrial type Riparian GDE formations. Generally possessing relatively obligate phreatophytic vegetation dominated by keystone species typically classed as moderate level FPS (Facultative Phreatophytic Species) at times with mature or at least transient-young outcrops of known OPS. As such community has relatively obligate groundwater requirements, either via a high-density FPS overstorey, or via the presence of OPS or potential OPS species. Small scale versions generally associated with outcrops of Mature OPS.		Generally possessing occasional 'High' level and multiple 'Moderate-High' to 'Moderate' level Mesophytic indicator species, as well as some 'Moderate-High' level and multiple 'Moderate' level hydrophytic indicator species. These assemblages indicate a moderate to high level of permanency of moisture availability.	Typically associated with multiple persistent pool to semi-permanent pool formations in key locations.
		2C	Small to Moderate scale (but lower significance) Terrestrial type Riparian GDE formations. Often possessing relatively obligate phreatophytic vegetation (in terms of water use) which is always dominated by keystone species typically classed as FPS (Facultative Phreatophytic Species – predominantly moderate level). Potential for a single OPS flora species to be present as an associated species only. Often represented by smaller scale formations occurring in upland gorge features, often with multiple receptors occurring sporadically at locations within the relevant landform and associated with small scale structural features impeding groundwater flow and/or increasing permeability.		Generally possessing occasional 'Moderate-High' level and multiple 'Moderate' to 'Low' level Mesophytic indicator species, as well as multiple 'Moderate' level (and the occasional 'Moderate-High' level) hydrophytic indicator species. These assemblages indicate a moderate to high level of permanency of moisture availability.	Typically associated with some persistent pool to semi-permanent pool formations in key locations.

IDE: Inflow dependent Ecosystem. i.e. features most likely dependent on the inflow and accumulation, above the surface and in the vadose zone (potentially including very small scale seasonal groundwater sources) of seasonal (and potentially inter-seasonal) surface water flows.

OPV: Obligate phreatophytic vegetation; i.e. vegetation whose water requirements are likely obligate (but not necessarily because they possess obligate phreatophytic species such as Melaleuca argentea, i.e. may only possess FPS) such that removal of or changes to access is likely to lead to significant changes in structure and/or composition of the vegetation in question.

* Significance ratings are a broad guide relating to the classifications provided. Not all features will fit well into their classification, so in such cases ratings should be revised based on the feature characteristics. Further factors should generally be considered including drainage size classification, terrestrial and aquatic fauna info where available/applicable and other biotic and ecophysical characteristics; to gain a final significance rating.

4.5. GDV likelihood mapping

The deposits associated with the Proposal, are proposed to be restricted to above water table mining, and as a result the only groundwater abstraction proposed as part of the development is low volume abstraction to support mining infrastructure and processing. Given the low hydrological risk posed by the development on local riparian ecosystems and drainage systems, one of the listed aims of the riparian study was the production of non-exhaustive Groundwater Dependent Vegetation (GDV) likelihood mapping across the Study Area scope. The aim of this mapping is for the purpose of providing a cursory assessment of the degree of potential GDV exposure present within the Study Area. This rating is to be applied to riparian vegetation units, and where relevant to specific reaches or portions of mapped vegetation units.

The rating being applied is most equivalent to determining where riparian communities might sit on the scale of groundwater dependence, rather than whether they are explicitly groundwater dependent. For this reason, the term GDE Likelihood is avoided, as it has a higher potential to confuse the conversation. Therefore, the key question summarised by the rating being applied is:

> Based on biological and physical lines of evidence, what is the likelihood of groundwater access/reliance and if so, how clear and consistent might that access be, and what's the potential for meaningful change to riparian vegetation if that access is reduced/removed.

Riparian communities determined to sit at the 'negligible' GDV likelihood end of the ratings scale, are unlikely to be groundwater dependent and vegetation characteristics exhibited, are a result of the accumulation of other water sources. However, it's also acknowledged that riparian habitats which tend to accumulate surface water can support riparian vegetation with characteristics (enhancement, persistence, presence of FPS, elevated density etc.) similar to vegetation with low degrees of access to groundwater. For this reason, features occurring at the low end of the GDV Likelihood rating scale can be both an IDE, or represent low likelihood GDV. However, in the case of features with low degrees of access to groundwater, the potential for meaningful changes to vegetation if that access is removed is also low. I.e., most likely to lead to reduced condition/density, but not necessarily changes in structure, with changes in composition being highly unlikely, particularly with respect to dominant/co-dominant constituents. This is important for two reasons; not only is the potential for a significant impact low, but also these fairly ephemeral types of riparian vegetation are generally very well represented. As a result, low level impacts to such riparian examples are comparatively more acceptable than to those which are more clearly representative of GDV and additionally represent more restricted community types.

Features generally attracting determinations of low GDV likelihood are inherently complicated, as at this end of the scale, its increasingly unclear whether groundwater access is available and meaningful, and whether instead the feature is just benefiting from the accumulation of surface water or positioned where micro scale seasonal groundwater sources may be forming. However, because significant impact to such communities are both highly unlikely, and comparatively more acceptable, determinations at this end of the scale become less critical, and relatively inconsequential with respect to the EIA process. Despite this, the identification of riparian communities with low GDV likelihood ratings, remains important, as it allows them to be considered later in the EIA process, particularly if for other reasons the potential for significant impact is increased or because the value of the feature becomes atypically elevated due to other factors such as heritage etc.

The data collected in the field, as well as the desktop tasks (see section 4.1) provide the platform for completing the GDV likelihood assessment and mapping process. To interpret and attribute Groundwater Dependent Vegetation (GDV) likelihood ratings to riparian vegetation within the Study Area; the following qualitative factors were considered where appropriate:

- water use strategy (i.e. obligate phreatophyte, facultative phreatophyte (low and moderate level), etc.) and associated potential groundwater dependence associated with the dominant species in the overstorey (and in some cases understorey);
- obligate phreatophyte age structure (particularly noting the presence of a mature component);
- obligate phreatophyte structural dominance (i.e. whether it is dominant or co-dominant in the tree strata); distribution within the creek bed profile;
- vegetation cover/structure (i.e. stand density);
- consideration of depth to groundwater and stability in adequately monitored areas;
- consideration of NDVI persistence mapping anomalies and patterns;
- proximity to surface water flow paths as well as ephemeral and persistent surface water bodies;
- consideration of the catchment size and likely surface water flow regime provide to the area in question; and
- in relation to landforms being dissected by drainage systems, consider the influence of topography, dominant lithology, the presence of basement outcropping and the general proximity of basement lithology to the drainage surface, and;
- consideration of inherent significance; broadly as a measure of the degree of restriction of these vegetation types in the landscape, the magnitude of associated values, and thus the degree of conservatism required for likelihood ratings.

The resulting rating applied by this process is thought to provide an interpretation of the likelihood that riparian communities are dependent on groundwater and importantly to what degree.

Of the factors considered above, catchment size is quite important in relation to features at the lower end of the scale of GDV likelihood. Consideration of the size and frequency of the surface water contribution which might report to riparian habitats is important. This helps to perceive how likely it is that specific vegetation types could rely predominantly on this source of moisture both annually and intra-annually. This also allows consideration of how the baseline composition of riparian communities might respond to changes in surface water availability and changes in the stability of moisture availability. Finally, and where available, groundwater monitoring data is ultimately used to validate and finesse outcomes based on the quality and temporal span of the data available.

As riparian vegetation in the Pilbara tends to rely on both surface water and groundwater sources; any determination of GDV likelihood is uniquely influenced by what proportion of a communities EWR is met by each of these sources. Furthermore, it must also be considered how floristic composition influences community requirements for minimum levels of moisture abundance and stability. Such factors also influence how important groundwater access might be and thus the GDV likelihood potentially attributed to a community.

4.6. Systematic riparian surface water mapping

In order to add value and give context to the riparian vegetation mapping, associated riparian significance assessment and the GDV likelihood mapping; it was determined that a relatively robust surface water mapping process should be conducted for the moderate to major scale drainage systems present throughout the Study Area scope and immediate surrounds. However, the scope of this surface water assessment would not cover minor drainage systems, and in particular it would not cover surface water features occurring in minor incised gully systems present in the rugged range systems occurring in the Study Area and surrounds. Systematic and relatively accurate detection of such surface water features is inherently constrained by the typical size of these features and the issues faced by their occlusion by topography, vegetation and shading.

The surface water mapping task was proposed in order to give an indication of the likely abundance and nature of surface water within and directly surrounding the riparian mapping Study Area. Areas directly around the Study Area were also considered in this process as not only was surface water relatively absent in the Study Area (beyond “Ben’s Oasis”), at least in terms of persistent surface water formations, but it was deemed that there was value in contextualising this result further afield.

The surface water mapping process utilised a number of evidence lines to establish the presence of surface water bodies which exhibited atypical residence times in the environment. This was done with the aim of identifying surface water bodies which behaved distinctly different from those truly ephemeral water bodies in terms of being more consistent in their position, and in their persistence beyond the core surface water flow season. Truly ephemeral water bodies can be both extensively distributed in the wet season and relatively random as to where they occur from year to year. Such surface water features are common and of low value, whereas more consistently located and persistent surface water features provide more valuable services and benefits for local biota.

Initially the surface water mapping process utilised a persistence based analysis of the temporal trends in a water mapping index called Sentinel Water Mask (SWM). The important distinction to note with the SWM index is that it is more appropriate for surface water persistence analyses. This is because the spectral characteristics are such that hydrated canopy and surface water present on different zones of the index such that surface water alone can be identified alone by utilising a threshold in a persistence analysis. In this case that threshold is a SWM index of 0.59/0.6, such that SWM indices returning for ground pixels of Sentinel 2 imagery, of approximately 0.59-1.0, are likely to be indicative of surface-water bodies in the realm of 8-10m wide or greater. See Plate 4-6 for a depiction of the location on the index where both hydrated canopy and surface water typically present in the Pilbara.

A Sentinel 2 imagery based persistence analysis of the SWM index for top of atmosphere imagery from March 2016 to March 2021 was utilised for the remote sensing component of the mapping process. Persistence mapping was systematically searched for persistence pixels returning over low-flow channels within the riparian zone of the Study Area. Either single pixels and their persistence value were recorded or clusters of pixels, their number of pixels and the maximum persistence value returned for that cluster was recorded for potential surface water features.

Following the systematic use of remote sensing to detect the size and temporal nature of potential water features, aerial orthophoto imagery was scanned for the presence of surface water in winter and dry season periods across the drainage systems in the study scope. The key part of this process was checking for surface water features which also occurred in approximately 1-3 (typically at least 2) appropriately timed and appropriately detailed/contrasting aerial image sources from Google earth and ESRI. Ultimately imagery captured in the period of august to November was ideal. For the majority of the Study Area, imagery timed in December, May, June, July, and 2 September images were generally available.

Scanning aerial imagery was firstly done to validate the remote-sensing data where persistent surface water anomalies were detected in remote sensing. Then following that, the remaining parts of the Study Area were scanned for surface water formation visible on the aerial photo. By checking the temporal changes in presence and extent of detected surface water features on progressively later (i.e., later in the year and the dry season) aerial photography, interpretations were able to be made about how persistent those features may be but also why they didn’t feature in the remote sensing data. Generally surface water features which didn’t present in the remote sensing data were either partially occluded by vegetation/topography, or generally of a small spatial extent (i.e. <8 m wide).

These data sources (remote sensing and aerial photo interpretation) were combined with recent and historical field observations of surface water presence and extent (particularly those gathered in the “Ben’s Oasis” area, as well as some ephemeral pools observed near systematic sampling sites). In addition, relevant groundwater monitoring data was reviewed to round out the process and provide a

combined list of ephemeral, persistent pool, and higher rated surface water features for the Study Area.

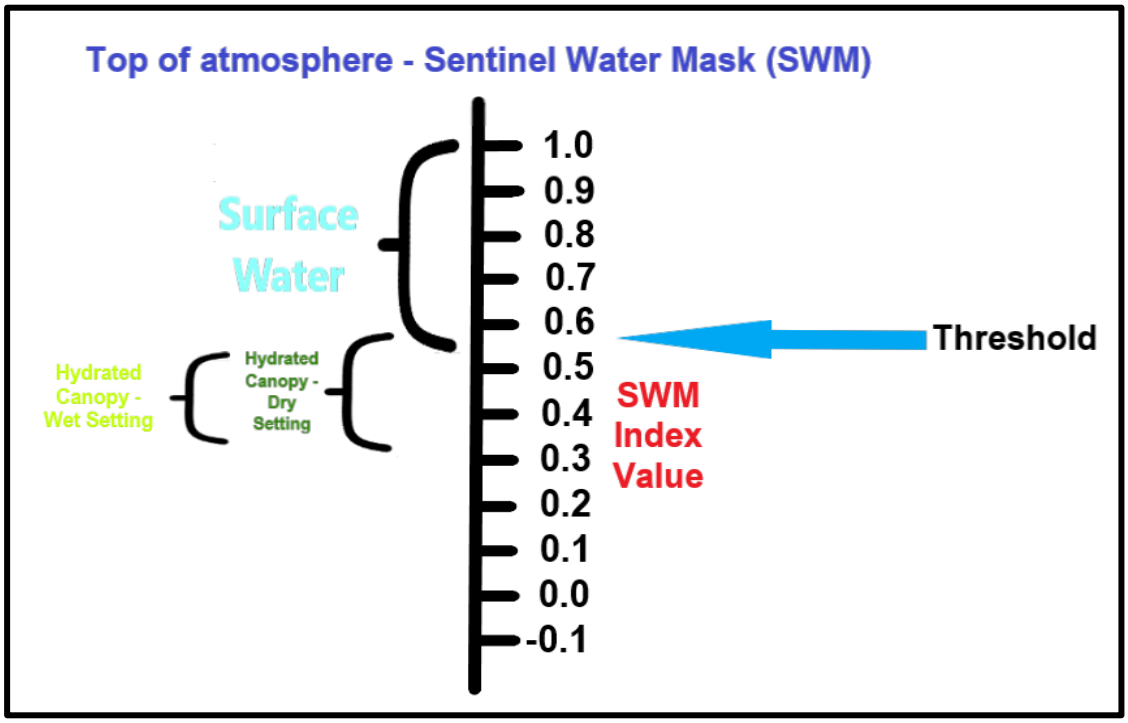

Plate 4-6**: The position of key moisture variables on the SWM index scale (ground-truthed using known Pilbara riparian settings)**

Pool Classifications

Permanent Pools and Semi-Permanent Pools are groundwater fed (typically from regional groundwater). Permanent pools are permanently connect to the groundwater and represent surface expressions of groundwater and rely on the groundwater interacting with the surface. They can be either a continuous expression of the groundwater table at the surface or result from groundwater discharge at a specific point or zone of groundwater impedance.

In some cases, "permanent" pools may experience short periods of low to no groundwater contribution, typically late in the year, or during drought periods, but in general despite such periods of evaporation are rarely completely emptied.

For habitat purposes and biological value, a permanent pool will not necessarily need to meet traditional hydrological size and depth criteria. Instead, it should consistently contain surface water, even if only of a very small spatial extent, and during droughts, at least moist sediments should be evident at the base of the pool. In the arid Pilbara climate, genuinely permanent pools are rare, with many initially considered permanent turning out to be semi-permanent. At a minimum, permanent pools will typically be accompanied by the facultative phreatophyte *Eucalyptus camaldulensis*, and in many cases (but not always) will be associated with populations of obligate phreatophytes such as *Melaleuca argentea* (and at times *Sesbania formosa*). Other useful indicators for interpreting pool permanence include restricted/refugial and relictual submerged and emergent macrophytes, along with key perennial mesophytic shrubs.

Ideally, the determination of pool permanence should be made utilising appropriate groundwater data or modelling. Alternatively, pool permanence can be interpreted from the outcomes of regular late season visits over multiple years, combined with aerial imagery or remote sensing analyses. In addition, interpretations of permanence can be supported by the use of key hydrophytic and hyporheic indicator species.

Semi-permanent pools are surface water features with seasonal or intermittent connectivity to a groundwater table or source. They are typically present when the groundwater table is above the surface at a location, persisting for a period after the groundwater drops below the surface (annually), either slowly evaporating or quickly disappearing upon disconnection from the groundwater source. Confirming intermittent or seasonal groundwater contribution is important for the identification of this pool type.

The following pools are seasonally fed by rainfall; persistent pools are ephemeral pools with extended hydroperiods and ephemeral pools.

Persistent pools are derived from ephemeral rainfall-driven surface water flows but resist quick dissipation or drainage into underlying sediments/lithology or evaporation to the atmosphere. This pool type typically perches over sediments or basement rock and exhibits prolonged existence without rapid evaporation. They persist above the ground surface for extended periods, often throughout and beyond the wet season, and potentially into or throughout winter. In some settings, increasingly persistent examples of this pool type may have some temporary alluvial baseflow contribution.

Persistent ephemeral pools tend to remain present due to; consistent shading, impervious sediments supporting prolonged perching, presence over relatively impermeable basement lithology, favourable basement morphology encouraging seasonal perching, location at the base of incised rocky gullies or gorges with topographical and aspect-related shading, and various other topographic or ecophysical circumstances that reduce evaporation and infiltration.

In some years and settings, persistent pools can remain throughout the year, but where they are wholly rainfall or surface-flow derived, but sustained by volume and reduced evaporation and infiltration, these pools should continue to be categorised as persistent, as evaporation occurs, these pools will deplete in the absence of contributions from groundwater. However, it is important to record these pools with extended hydroperiods as these areas could support other biotic and abiotic values.

Ephemeral pools are short lived and can be widely dispersed after rainfall and surface flows, with their locations often varying unpredictably from year to year. Typically, these features either rapidly infiltrate/evaporate or are sustained by sub-surface flows for a short period, with their presence limited to the wet season months (December to March) or a few months following winter rainfall events.

5. Results

5.1. Identified Ecohydrology zones

During the field survey, broad ecological and hydrological patterns were observed within both Pebble Mouse and Weeli Wolli Creeks. Key mesophytic, hydrophytic and ephemeral understorey floral assemblages, along with other structural cues in vegetation distribution and the abundance of keystone overstorey species and phreatophytes; were observed to occur in discrete parts of the Study Area. Patterns in the presence/absence, abundance and persistence of surface-water features and associated habitats were also observed. In addition, topographical characteristics of the landscape, the proximity (depth) of basement rock types to the alluvial surfaces of drainage and the broad geological characteristics of different lithologies have been considered throughout the Study Area. All of these factors were considered in order to be able to map out relevant ecohydrological zones within the Study Area Figure 5-1.

The codes, names, descriptions, groundwater conditions and notes relating to each of the zones is provided in Table 5-1.

Both the ecological and surface/subsurface hydrology patterns observed were thought to impart relevant information on the distribution of different hydrological/hydrogeological regimes as well the likely distribution and magnitude of biodiversity values. These observations are summarised in the following ecohydrological zonation developed for the Study Area.

Four broad ecohydrological classifications were applied: Mesic, Ephemeral Plus, Broadly Ephemeral and Highly ephemeral. The highly ephemeral zones generally represented those areas where the creek reaches in question occurred in broader valley habitats and as such the core riparian zones were flanked by broad (in some cases up to +600 m wide) fine grained floodplains and high flow channel profiles. Both due to the generally inaccessible groundwater conditions and the broad nature of the creek profile in these ecohydrological zones; riparian vegetation, even in the core riparian zone of the low flow channel and banks, was generally quite sparse and low in stature. As a result the structure, composition and productivity of these zones was highly ephemeral in nature and as such, the overstorey of the more productive zones was predominantly dominated by low level FPS.

The “Broadly Ephemeral” classification represents those creek reaches which were generally quite ephemeral in nature (i.e. predominantly supported by wet season surface flows alone), but also possessed a more typical density of riparian vegetation and were overstorey density was elevated and Moderate level FPS were also typically co-dominant with low level FPS. The one example of this zone mapped was also present in relatively topographically confined country such that the riparian zone was relatively narrow and as such, surface flows were also focused in a small riparian zone, helping to support a denser vegetation and slightly more mesic composition.

The “Ephemeral Plus” classification represents those zones with similarly ephemeral type vegetation and hydrological processes, but for various reasons (increased surface water, shallow groundwater, geological factors etc.) hydrological conditions are partly enhanced and as a result water availability to riparian vegetation is higher.

The final “Mesic” classification relates to spring type ecohydrological scenarios, in this case the informally named “Ben’s Oasis” area, where shallow groundwater and associated groundwater discharge in key areas supports a much more mesic (and at times Hydrophytic) assemblage of riparian habitats with moderate to high water availability and reliance on groundwater access.

Details of the characteristics of each of the differing zones identified in the Study Area, which have been assigned to these broader ecohydrological classifications are presented in Table 5-1. Where zones are referred to as confined, this identifies that the breadth of the respective creek reach is topographically confined and as such the riparian zone is laterally compressed, focusing surface water into a smaller area. The alternative is for the creek reach to be broad and thus laterally unconfined leading to surface water flows feeding a much larger riparian zone. For each of the identified zones,

changes in composition, both in the dominance and abundance of overstorey components, but particularly in the understorey composition and the diversity/magnitude of understorey mesophytic taxa. For specific information about mesophyte/hydrophyte composition of each zone, refer to the information provided for each of the vegetation units within Table 5-11.

Table 5-1: Ecohydrology zones identified throughout the Study Area

FID	Code	Ecohydrology Classification/Label	Formation, Position, Geology	Ecohydrology Zone Notes	GW Access
7	M1	Mesic - Shallow groundwater & surface discharge	Confined Moderate drainage. Predominantly Basalt (Fortescue formation)	Reach generally occurs over areas of shallow groundwater/basement lithology and some GW discharge zones. Supports one broadly permanent pool and GW discharge zone and other persistent pool to Semi-permanent pools in the downstream outflow zone.	Broader aquifer generally accessible i.e., 2-5 mbgl near west boundary, 0-1m through "Ben's Oasis", and approximately 2 mbgl at east boundary (vegetation not necessarily reflective of this depth at east boundary - basement shallow). Shallow Basement may also mean that practically speaking, vegetation may find it hard to access GW in some areas.
8	Eph-Plus-GW1	Ephemeral Plus - partially* GW Enhanced - 1	Confined Moderate drainage - Some apparent Spring influence. Predominantly Basalt (Fortescue formation)	Reach generally contains sections of elevated vegetation persistence and accompanying low to moderate level mesic species composition. Likely due to basement proximity, shallow GW at South-west end and influence of outflow from adjacent spring.	Broader aquifer generally accessible in the south-west but trending towards inaccessibility in the north-east i.e., 2-5 mbgl near west boundary, getting deeper as the creek moves north-east reach 25 mbgl at the North-East boundary.
6	Eph-Plus-GW2	Ephemeral Plus - partially* GW Enhanced - 2	Confined Moderate drainage. Predominantly Basalt (Fortescue formation)	Reach quite topographically confined. Groundwater becomes potentially accessible at east end of reach (within 5m), however basement remains shallow through this area, (likely less than 5m deep) which potentially restricts access.	Broader aquifer trending into accessibility i.e., 30 mbgl in west, 10 in east and approximately 5 mbgl at east boundary (vegetation not necessarily reflective of this depth at east boundary - basement shallow and likely restrictive)
10	Eph-Plus-SW-C	Ephemeral Plus - SW & Calcrete Enhanced	Broad Major drainage. Calcrete over Hamersley Formation	Creek reach occurring over substantial calcrete formations prior to Weeli Wolli Springs. Ecohydrology already influenced by adjacent mining abstraction.	Broader aquifer generally inaccessible 30-40 mbgl (40 mbgl in the south and approximately 30 mbgl at the north boundary). (Historically, this area possessed GW 10-20 mbgl - dewatering has reduced this).
9	Eph-Plus-SW	Ephemeral Plus - SW Enhanced	Confined Major drainage - Some Mesic outcropping. Hamersley Formation	Reach contains outcrops of elevated vegetation persistence and accompanying low level mesic species composition. Structure and composition in area likely from increased surface water input regime due to reporting catchment increases.	Broader aquifer generally inaccessible (25-50 mbgl - 25 mbgl in the south, and approximately 40 mbgl at the north boundary).
4	Eph-Plus-LI	Ephemeral Plus - Lithology enhanced	Confined Moderate sized drainage - Upper. Basalt (Fortescue formation))	Reach directly overlying basalt basement which generally supports minimal infiltration, leading to higher surface water persistence in low points and fractured/weathered basement below low flow channels. Composition somewhat reflects this.	Broader aquifer clearly inaccessible 30-50 mbgl, basement lithology likely implicated in the presence of more frequent perched small scale groundwater sources.
5	Eph-1	Broadly Ephemeral - 1	Broad Moderate sized drainage. Hamersley Formation	Reach moderately broad, and floodplain soils quite fine due to upstream basalt influence.	Broader aquifer clearly inaccessible (40-50 mbgl)
11	H-Eph-1	Highly Ephemeral (low density veg) - 1	Broad Moderate drainage - Lower. Hamersley Formation	Very broad nature of the creek profile and floodplain determines that the established riparian formations are highly ephemeral, and support relatively low vegetation densities in the low flow and floodplain habitats.	Broader aquifer clearly inaccessible 30-50 mbgl
2	H-Eph-2	Highly Ephemeral (low density veg) - 2	Broad Moderate sized drainage - Upper. Basalt influence in Hamersley formation	Broad creek profile and floodplain leading to sparse highly ephemeral vegetation. However, reach directly downstream from Fortescue formation and influence of basalt sediment outflow leading to increased seasonal moisture persistence in terraces.	Broader aquifer clearly inaccessible 50-70 mbgl
3	H-Eph-3	Highly Ephemeral (low density veg) - 3	Broad Moderate sized drainage - Upper. Hamersley Formation	Minor Basalt influence in sediment compositions. Very broad creek profile & floodplain determines that the established riparian formations are highly ephemeral, and support relatively low vegetation densities in the low flow and floodplain habitats.	Broader aquifer clearly inaccessible 40-50 mbgl
0	H-Eph-4	Highly Ephemeral (low density veg) - 4	Upper Tributary - minor to moderate sized drainage. Basalt influence in Hamersley formation	Broad creek profile and floodplain leading to sparse highly ephemeral vegetation.	Broader aquifer clearly inaccessible 50-70 mbgl
1	H-Eph-5	Highly Ephemeral (low density veg) - 5	Upper Tributary - minor to moderate sized drainage. Basalt influence in Hamersley formation	Broad creek profile and floodplain with some Basalt influence leading to sparse highly ephemeral vegetation.	Broader aquifer clearly inaccessible 50-70 mbgl

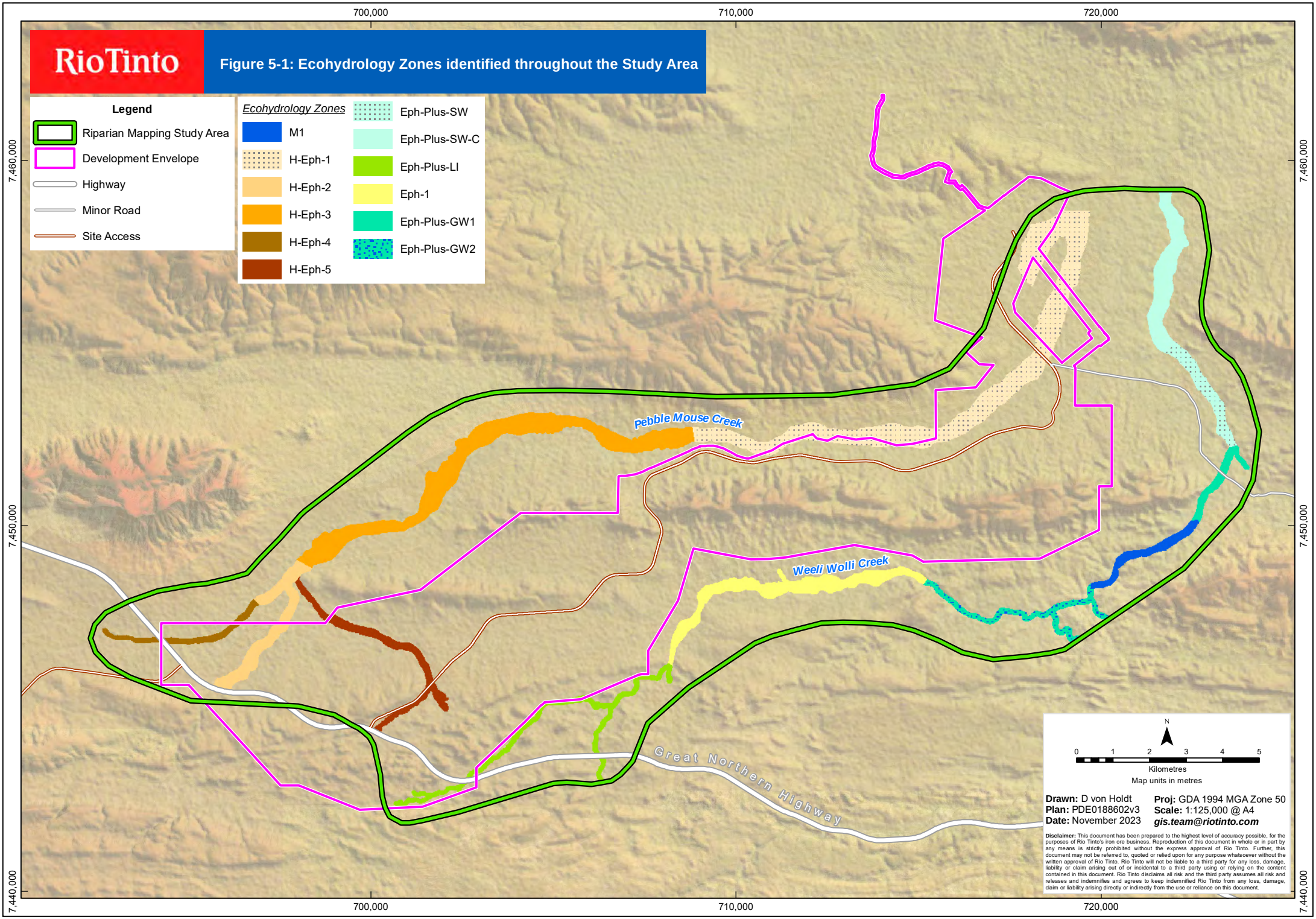
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Figure 5-1: Ecohydrology Zones identified throughout the Study Area
Legend
Riparian Mapping Study Area
Development Envelope
Highway
Minor Road
Site Access
Ecohydrology Zones
M1
H-Eph-1
H-Eph-2
H-Eph-3
H-Eph-4
H-Eph-5
Eph-Plus-SW
Eph-Plus-SW-C
Eph-Plus-LI
Eph-1
Eph-Plus-GW1
Eph-Plus-GW2
Pebble Mouse Creek
Weeli Wolli Creek
Great Northern Highway
700,000
710,000
720,000
7,460,000
7,450,000
7,440,000
N
0 1 2 3 4 5
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: PDE0188602v3
Date: November 2023
Proj: GDA 1994 MGA Zone 50
Scale: 1:125,000 @ A4
gis.team@riotinto.com
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5.2. Riparian vegetation units and associated mapping

Fifteen vegetation units were described in the Greater Hope Downs area. Summary information for these units is presented in Table 5-2. Detailed descriptions for all 15 units are presented in Appendix C:.

Previous vegetation mapping by Astron (2020) mapped four vegetation units; D4, D5, D7 and D8, across the larger drainage units covered by the Astron study (See section 2.5 for full coverage of this Study Area). Vegetation mapping in the current study leveraged these baseline vegetation units where relevant, making minor modifications as well as adding new vegetation units in order to provide an adequately detailed complement of vegetation units across the moderate to major sized drainage systems the current Study Area. To do this the current study utilised vegetation observations from multiple reconnaissance field visits, and collected targeted riparian mapping notes, ground-truthing data, and Quadrat/Relevé data from 2021 survey work. These data sources were considered along with relevant historical flora and vegetation surveys in order to provide a more focused riparian scope, and higher level of detail required for the task of providing a targeted riparian vegetation mapping and an assessment of their values/significance.

As an example of the level of detail provided, the previously mapped D4 unit (Astron 2020), was mapped across most of the riparian zone for moderate to major sized drainage in the greater Hope Downs 1 area. In the current study, the important D4 vegetation assemblage was modified and split into seven vegetation units along Pebble Mouse and Weeli Wolli Creeks, with the vegetation description of D4 being slightly modified and assigned to the area most closely related to the original description. Changes to the differentiation of the previous D4 unit was done to increase riparian mapping accuracy and context. This was based on both current and historical vegetation mapping and quadrat data (Astron, 2020; Mattiske, 2008; 2010) as well as finer scale consideration of the distribution and abundance of keystone species (particularly overstorey phreatophytes) throughout Pebble Mouse and Weeli Wolli Creeks. Areas previously mapped as D4 along Pebble Mouse Creek were assigned to either C4B, C4Bx-2 or C3C along Pebble Mouse Creek, or C2B, CB4x-1 or C3A along Weeli Wolli Creek.

Floodplain units previously mapped as D7 (Astron, 2020) or ATC-M2 (Mattiske 2008; 2010) were split into three vegetation units; CF-X3, CF-X1 and CF-X2, associated with varying floodplains adjacent to Pebble Mouse Creek and Weeli Wolli Creek.

Vegetation units mapped and assessed across the study area (Table 5-2) are all considered to occur within the riparian zone of the moderate to major sized creek systems within the study area. However, not all of the vegetation units mapped in the study area are considered to possess the elevated environmental value representative of “riparian vegetation”. For the purpose of this study (and successive similar studies), the Rio Tinto Ecohydrology team have defined those vegetation communities/habitats which possess an adequate structural complexity, appropriately elevated biodiversity and ecohydrological value and suite of fluvial and riparian characteristics deemed to warrant the riparian vegetation classification and receive appropriate management. For this purpose the Rio Tinto Ecohydrology team have defined this adequately elevated riparian vegetation type as ‘core riparian vegetation’. The remainder of vegetation occupying the riparian zone, but of reduced value and complexity has been defined as ‘floodplain & associated riparian vegetation’. Within the study area and across the riparian zone (Table 5-2 and Appendix C:), all mapped vegetation units, except for the three floodplain units (CF-X1, CF-X2 and CF-X3), were considered likely to be classed as ‘core riparian vegetation’. Only the C1A vegetation unit of ‘Ben’s Oasis’ was considered to represent the ‘core riparian vegetation – riverine’ definition which highlights increasingly elevated riparian biodiversity values.

To further clarify the key riparian zones (see Appendix D for ‘riparian zone’ definition) of relevance in this space, riparian definitions, ‘core riparian vegetation’ (including riverine) and ‘floodplain & associated riparian vegetation’, have been formed to outline the approach applied to come to these conclusions. The main distinction proposed is that while the ‘riparian zone’ and associated riparian vegetation communities are considered to more broadly cover the floodplain habitats (where water flows much less frequently), it is within the low flow channel and bench/bank complex that core riparian vegetation will generally establish and meet specific characteristics worthy of the classification. Vegetation defined as ‘core riparian vegetation’ (see Appendix D for full definition) is what the Rio Tinto Ecohydrology team propose to define as riparian vegetation worthy of increased management provisions.

Broad floodplain units have been excluded from the 'core riparian vegetation' definition as these formations are typically flanking the core riparian zone where such characteristics are clearly and significantly reduced in value. Floodplain units can be defined under the 'floodplain & associated riparian vegetation' definition (see Appendix D for full definition).

One of the core tasks conducted in respect to the process of increasing the detail and ecohydrological relevance of riparian mapping in the Study Area, was the process of accurately assessing the distribution of keystone phreatophytes. To do this, all detectable mature *Eucalyptus camaldulensis* individuals were identified at a desktop level using high resolution aerial photography within representative reaches of the target drainage systems within the Study Area. This process was also done for *E. victrix*, but in a smaller number of representative areas across the Study Area to that of *E. camaldulensis*. The reduced coverage for *E. victrix* was on account of the fact that in areas where *E. camaldulensis* is not present, it is more easily assumed that *E. victrix* is the replacing keystone species, and this assumption was also ground-truthed. This was done in order to accurately determine the relevant abundance and dominance of both *E. camaldulensis* and *E. victrix*. This in turn allowed better delineation of vegetation units whose description reflected the varying degree of dominance exhibited by these two species. Main keystone species differences for which this technique was aimed at supporting accurate delineation for were:

- Locations where *E. camaldulensis* were dominant
- Locations where *E. camaldulensis* and *E. victrix* were consistently co-dominant, and;
- Locations where *E. victrix* were consistently dominant
- Locations where other keystone species were dominant in the overstorey.

Examples of this mapping are presented in Figure 5-2 to Figure 5-5 for various reaches and vegetation units within the Study Area.

Previous vegetation mapping in various studies for the area generalised the dominance of these key species across the majority of larger drainage systems in the area. In most cases this was in the form of a vegetation unit which mapped *E. camaldulensis* and *E. victrix* as codominant in the overstorey. The consequence of such generalisations is that for creeks and reaches where this is inaccurate, the significance of the riparian features and also the likelihood that they support GDV is typically overestimated. The alternative is also true where creeks may support riparian vegetation of a greater density and also greater abundance of *E. camaldulensis*. Furthermore such vegetation is often accompanied by a uniquely mesic understorey composition which is also likely to miss representation in standard baseline vegetation mapping of riparian areas. For these reasons, accurate mapping of the abundance and dominance of keystone overstorey species and phreatophytes, not only allows for a complement of riparian vegetation units which accurately delineate vegetation with key overstorey differences, but it also typically aligns with and allows for those units to reflect key compositional changes in the understorey. Changes which not only allow for a detailed reflection of compositional change, but which also speak to changes in ecohydrology and potential for communities to rely on alternative water sources like groundwater.

The other factors which the resulting riparian vegetation mapping takes into consideration is topography, and the relevant broad geological groups. Across the Study Area, riparian corridors are broadly contained in broad alluvial valleys, low undulating range systems, and occasionally in incised gully/gorge type settings. These three topographical settings have both an effect on the vegetation which has established, but also on the presence/absence of adjacent floodplain landforms, which in turn influences vegetation and productivity.

Geology is also influential in the Study Area. PMC and WWC both dissect both Hamersley and Fortescue geological groups. These two geological groups broadly possess different hydraulic properties. Infiltration within Fortescue group lithology is typically quite low, whereas within Hamersley group it is generally much higher. Following rainfall, this typically leads to Fortescue catchments shedding surface water via drainage quite quickly, and Hamersley less so. Faster shedding equals more frequent effective surface water flows within Fortescue group creeks. Where basement is shallow, it can lead to small groundwater sources more often being perched over favourable basement morphology and within weathered basement lithology. Within local creeks flowing over Fortescue geology, on average we tend to see a greater abundance of *E. camaldulensis*, more examples of persistent pool surface water features, and an abundance of some moderate to high level mesophytic shrub species such as *Melaleuca bracteata* and *M. glomerata*. These are all signs that surface water

flows and potentially small, perched groundwater sources are providing a more persistent source of water available for riparian vegetation. An example of such vegetation within the Study Area is vegetation unit C4Bx-1 and C2B.

Another characteristic of Fortescue lithology is that a portion of the sediment which weathers from this lithology is very fine. The fine nature of this weathered sediment often leads to the formation of clay soils where it accumulates adequately. These fine-grained sediments not only accumulate in broad valleys, typically on terraces and adjacent floodplains, but they also flow on and accumulate in the adjacent Hamersley group valleys. Creek terraces and floodplains with a substantial proportion of these fine such clay sediments not only support clay loving species and at times diverse ephemeral communities, but they also tend to hold water near the surface for longer periods post wet season, than other more typically loamy soils derived from Hamersley group lithology. In turn this can lead to the provision of different ecohydrological habitats and associated vegetation assemblages. Within the Study Area vegetation units C5B, C5C C4Bx-2 and CF-X2 are examples of riparian units which occur on fine-grained sediments likely to have accumulated following weathering of Fortescue group lithology.

Alternatively, Hamersley group creeks tend to flow less frequently that Fortescue group creeks, but their typically greater rates of infiltration can also more often lead to the provision of accessible alluvial aquifers and increased recharge to regional aquifers. This can in turn lead to the establishment of a range of differing riparian vegetation types from highly ephemeral, such as the C4B unit (and corresponding CF-X3 floodplain unit) to the enhanced ephemeral C3A unit, to the increasingly mesic C2A and ultimately C1A OPV unit which occurs where the regional Hamersley aquifer appears forced to the surface by Wittenoom basement material.

Table 5-2: Summary of riparian vegetation units within the Study Area

Final Unit (Standardised riparian classification)	Initial Vegetation Unit	Area (Ha)	Vegetation Label	Vegetation Summary Description	Creek Profile position	Drainage classification (i.e. reporting catchment estimate)	Mapping confidence notes
C1A	D14a	6.48	"Ben's Oasis" Core Riparian unit (WWC)	*M. argentea* & *Eucalyptus camaldulensis* open forest over mixed mesic shrublands	Low Flow Channels and banks (and Permanent to Semi Permanent Pools)	Moderate Drainage* (< 450km2)	Mapping Confidence High
C2A	D14b	23.74	"Ben's Oasis" Fringing riparian unit (WWC)	*E. camaldulensis* Woodland (to open forest) over open mesic shrublands (Scattered young *Melaleuca argentea* present in some locations)	Low Flow Channels and banks	Moderate Drainage* (< 450km2)	Mapping Guided by vegetation mapping from Multiple Mattiske Surveys from 2009 and earlier. Mapping confidence reduced but considered adequate.
C2B	D12	2.88	West WWC - Basalt & Calcite bend	Small *E. camaldulensis* Woodland over mixed open shrubland with *Melaleuca bracteata*.	Low Flow Channels and banks	Moderate Drainage (< 150km2)	Mapping Guided by vegetation mapping from Mattiske 2009 Survey. Mapping confidence reduced but considered adequate.
C3A	D15	106.84	Lower WWC Main (Pre Weeli-Wolli Springs)	*Eucalyptus camaldulensis* subsp. *obtusa, E. victrix* woodland over open Semi-Mesic Shrublands with *Triodia longiceps*	Low Flow Channels and banks	**Major Drainage* (< 500-750km2)**	Mapping Confidence Moderate
C3B	D04	98.94	Middle WWC West confined	*E. camaldulensis* & *E. victrix* Woodland (variable) over mixed open shrubland with *Petalostylis labicheoides*	Low Flow Channels and banks	Moderate Drainage (< 200-400km2)	Mapping Guided by vegetation mapping from Multiple Mattiske Surveys from 2009 and earlier. Mapping confidence reduced but considered adequate.
C4C	D18	1.41	WWC west - small, incised gorge/gully	*Corymbia ferriticola* and *Eucalyptus victrix* low open woodland over mixed open shrubland with rocky influence.	Low Flow Channel and fringing rocky banks	Moderate Drainage (< 200-400km2)	Mapping Guided by vegetation mapping from Multiple Mattiske Surveys from 2009 and earlier. Mapping confidence reduced but considered adequate.
C4Bx-1	D13	49.58	Upper WWC West Basalt	*Eucalyptus victrix, E. xerothermica* woodland	Low Flow Channels and banks	Moderate Drainage (< 150km2)	Mapping Confidence High
C3C	D11	21.15	Middle Pebble Mouse Creek - Less ephemeral bends (slightly mesic)	*Eucalyptus victrix, E. xerothermica* and *E. camaldulensis* woodland	Low Flow Channels and banks	Moderate Drainage (< 150-300km2)	Mapping Confidence Low-Moderate
C4B	D09	86.66	Lower Pebble Mouse Creek broad	*Eucalyptus victrix* low open woodland over *Acacia citrinoviridis* tall open shrubland.	Low Flow Channels and banks	Moderate Drainage (< 250-350km2)	Confidence in mapping is High
C4Bx-2	D10	88.31	Upper Pebble Mouse Creek broad	*Eucalyptus victrix, E. xerothermica* low open woodland over variable tall open shrubland of *Acacia aneura* complex.	Low Flow Channels and banks	Moderate Drainage (< 100-300km2)	Confidence in mapping is High
C5B	D05	80.98	Lower Pebble Mouse Creek East tributary (fine grained)	*Eucalyptus xerothermica* low open woodland over mixed tall open shrubland with *Petalostylis labicheoides* and *Triodia longiceps* hummocks	Low flow channels bank and terrace	Moderate Drainage (< 100km2)	Mapping Confidence High
C5C	D08	40.42	Lower Pebble Mouse Creek West tributary (fine grained)	*Eucalyptus xerothermica* scattered low trees over variable tall open shrubland of *Acacia aneura* complex.	Low flow channels bank and terrace	Moderate Drainage (< 100km2)	Mapping Confidence High-Moderate
CF-X1	DF16	284.09	WWC Floodplain (variable) - Lower (and middle)	*Eucalyptus xerothermica* & *E. victrix* (+/-) scattered trees over mixed Acacia spp. tall open shrublands with *Acacia citrinoviridis*.	Floodplain (and High flow Channels)	Major Drainage* (< 500-750km2) to Moderate Drainage (< 100-400km2)	Mapping Guided by vegetation mapping from Multiple Mattiske Surveys from 2009 and earlier. Mapping confidence reduced but considered adequate.
CF-X2	DF17	450.6	Floodplain – Upper Pebble Mouse Creek	*Eucalyptus xerothermica* scattered low trees over scattered tall shrubs and *Triodia longiceps* hummocks	Floodplain (and High flow Channels)	Moderate Drainage (< 150-300km2)	Mapping Confidence Low-Moderate
CF-X3	DF7	494.9	Floodplain – Lower Pebble Mouse Creek	*Eucalyptus xerothermica* scattered low trees over scattered tall shrubs with *Acacia citrinoviridis* and *Triodia longiceps* hummocks	Floodplain (and High flow Channels)	Moderate Drainage (< 250-350km2)	Mapping Confidence High

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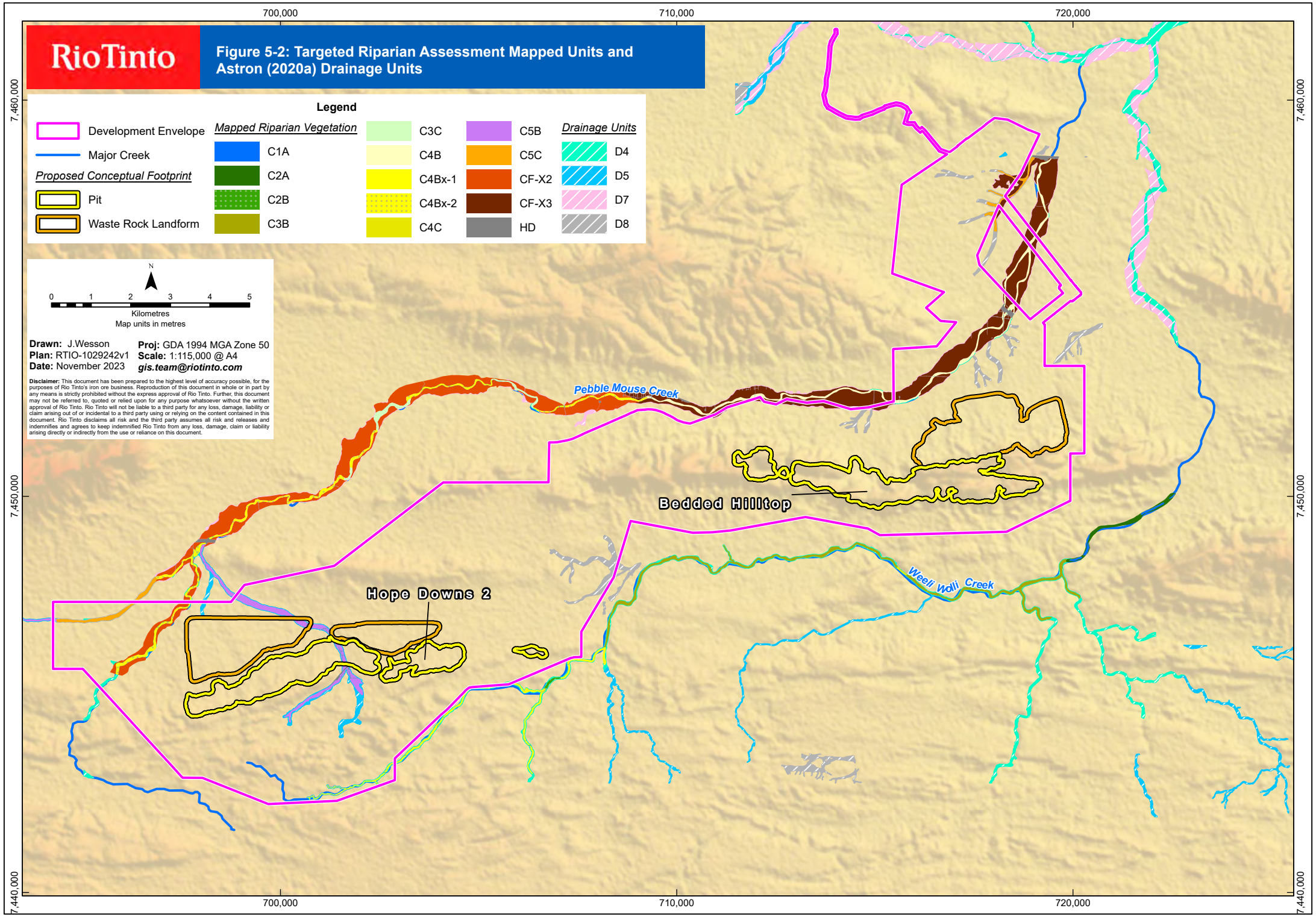
Figure 5-2: Targeted Riparian Assessment Mapped Units and Astron (2020a) Drainage Units



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Plan: RTIO-1029242v1
Date: November 2023

Proj: GDA 1994 MGA Zone 50
Scale: 1:115,000 @ A4
gis.team@riotinto.com

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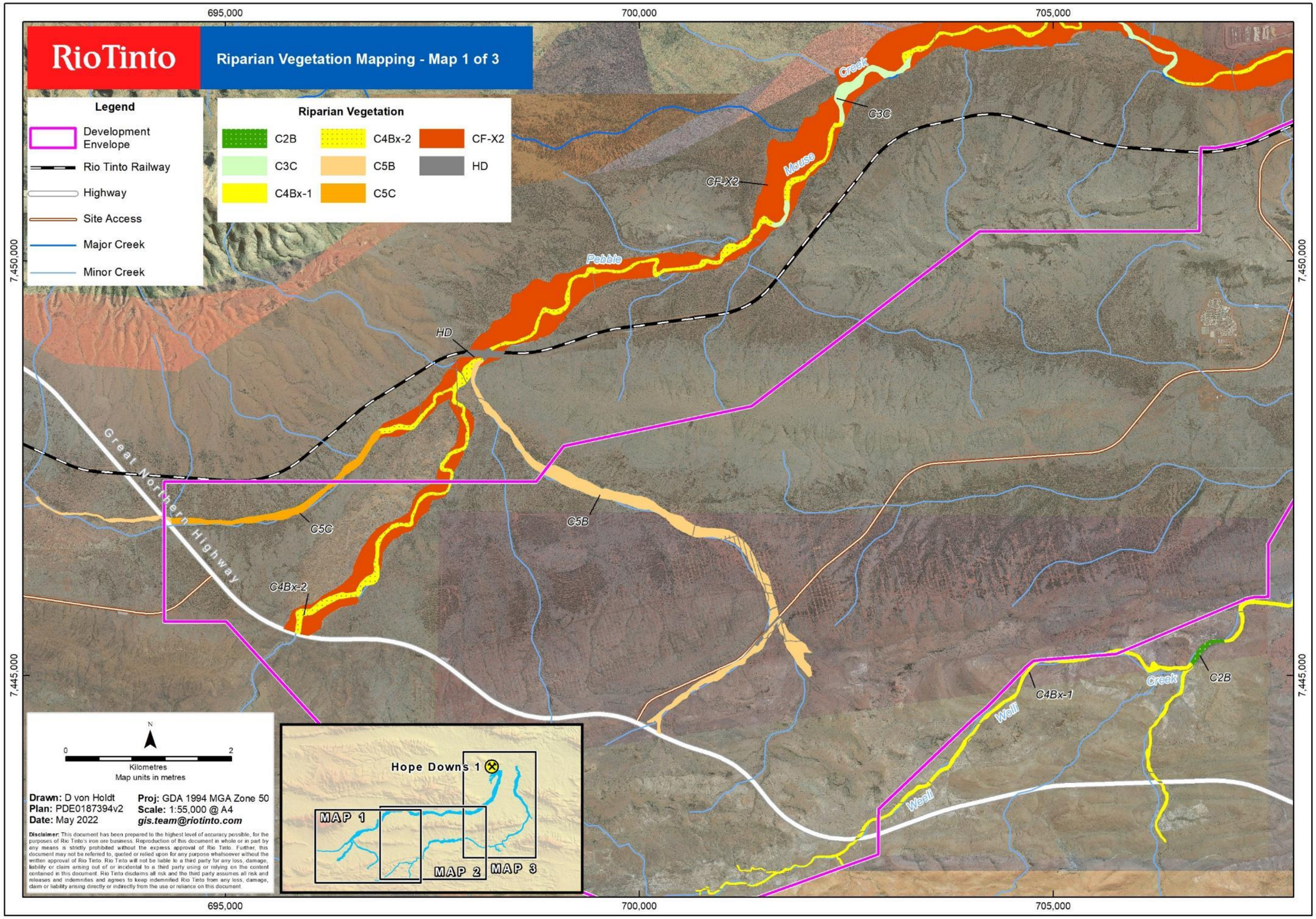


Figure 5-3: Riparian vegetation mapping in the west of the Study Area (Map 1 of 3).

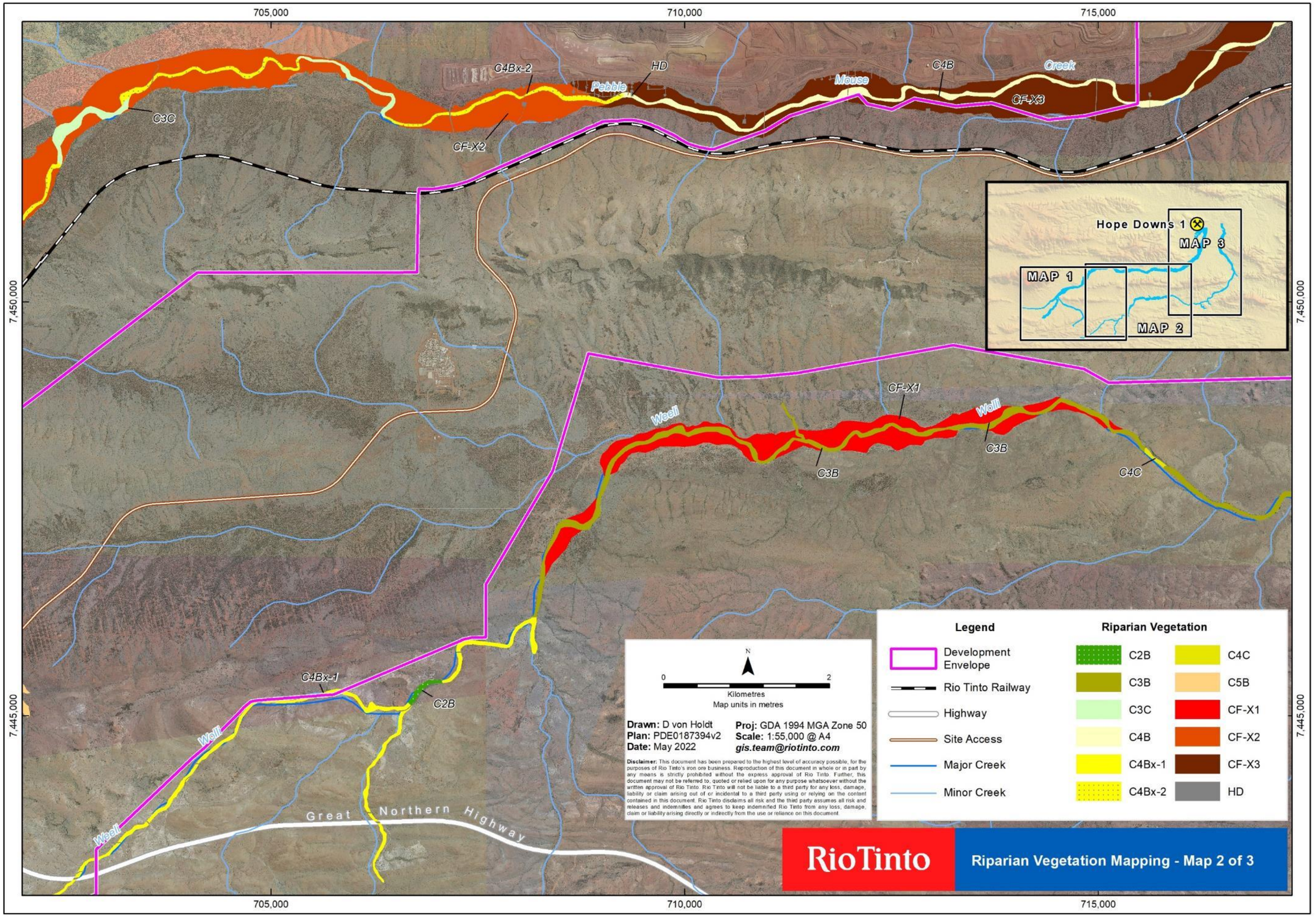


Figure 5-4: Riparian vegetation mapping in the centre area of the Study Area (Map 2 of 3).

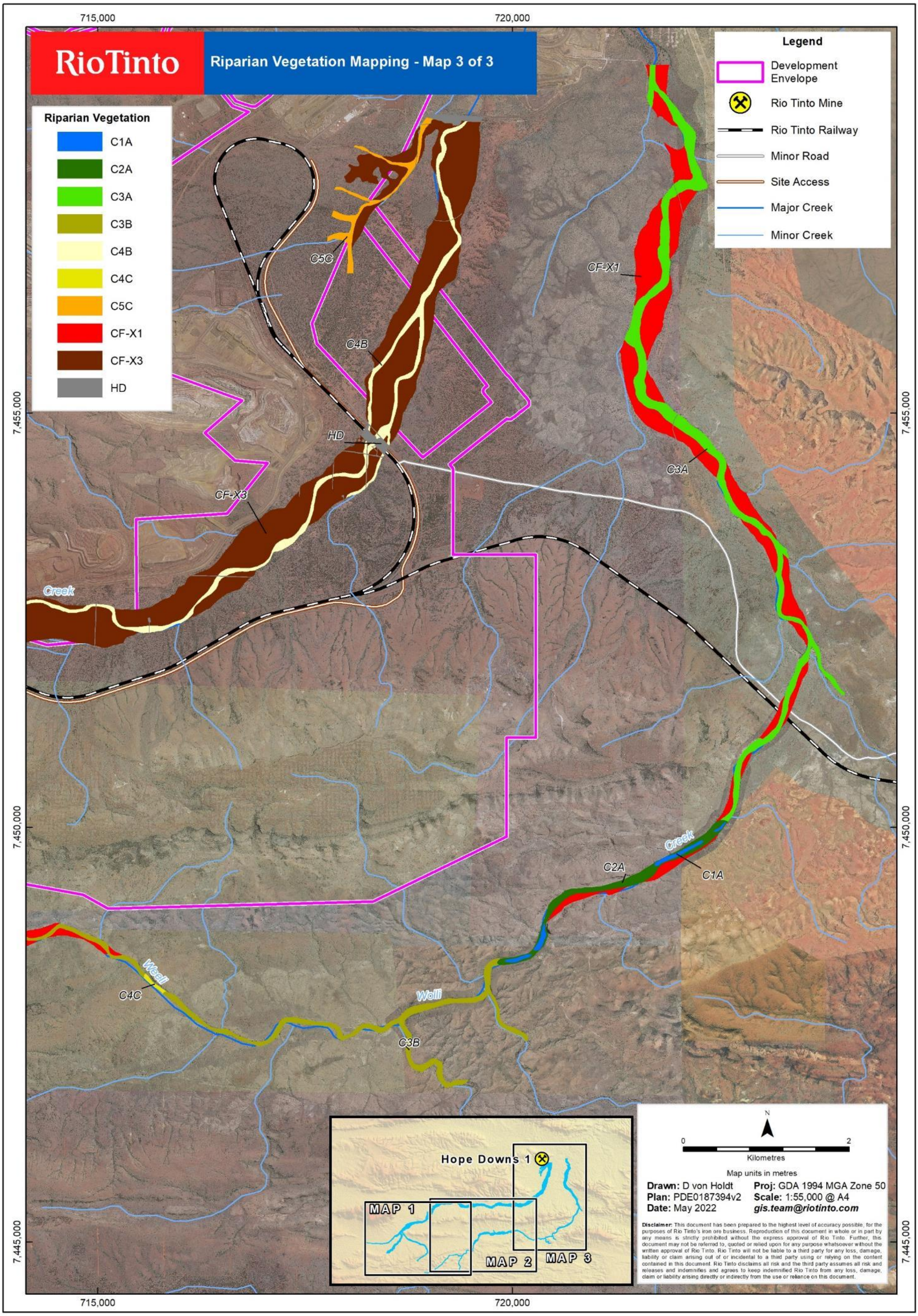


Figure 5-5: Riparian vegetation mapping in the east of the Study Area (Map 3 of 3).

5.3. Riparian Flora

A total of 207 species from 120 genera and 47 families were recorded from sampling conducted in riparian areas during the Rio Tinto (2021) riparian survey (Appendix K:). Additional data from surveys by Astron (2020) and Mattiske (2008, 2010) increased the total number of species recorded in the area to 418 species from 163 genera and 57 families (Appendix L:). Importantly, the current survey was able to detect new riparian taxa, with sampling in the current study detecting 63 new taxa not detected or identified in the previous Astron (2019) and Mattiske (2008, 2010) surveys.

5.3.1. Key Riparian Flora Species

Of the species recorded both in this current study and historical surveys/sampling, certain riparian taxa can often be of use/value for interpreting various aspect of the riparian ecosystem they occur in.

Table 5-3 lists the riparian species of note which assisted this study in the determination of the following attributes;

- Riparian vegetation descriptions and unit boundaries;
- Ecohydrological characteristics (including potential for vegetation to have some/no dependence on groundwater access);
- Unique riparian understorey compositions (particularly those which might infer presence/absence of stable mesic riparian habitats);
- Relevant soil characteristics which might influence broader vegetation trends and;
- Riparian significance/value attributed to each vegetation unit mapped.

Blue shading in the cells within Table 5-3 indicate where taxa were generally influential in the area of ecohydrology and the detection of mesic habitats and increasing moisture stability, with blue text indicating the more influential of the taxa in this space. Green shaded cells indicate those taxa which both were involved in the detection of the lower end of the mesic habitat scale, but also in the nature of the ephemeral habitats being considered as well as the persistence of any ephemeral surface water features likely present or detected. Such taxa can also be used to interpret the presence of riparian habitats or soil and geological conditions which were more likely to facilitate accumulation and post wet season persistence of ephemeral surface water. Grey shaded cells indicate species which were specifically used to interpret soil/geology based ecohydrological characteristics of some of the ephemeral habitats as well as significance/condition ratings outside of commonly considered taxa.

Within cells of Table 5-3, red highlighted text indicates priority flora, while purple highlighted text indicates introduced species of relevance to riparian habitats.

Table 5-3: Key riparian flora species recorded from the Study Area

Overstorey	Understorey	Less mesic: Sedges/Grasses/Herbs	Submerged/emergent macrophytes and aquatic/fine Herbs
Melaleuca argentea	*Cullen leucanthum*	*Cyperus cunninghamii & C. cunninghamii subsp. cunninghamii*	*Stylidium weeliwolli*
Eucalyptus camaldulensis subsp. *obtusa*	*Acacia ampliceps*	*Cyperus iria*	*Eleocharis geniculata*
Eucalyptus victrix	*Melaleuca bracteata*	*Cyperus squarrosus*	*Sonchus hydrophilus*
Corymbia aspera	*Melaleuca glomerata*	*Cyperus difformis*	*Schoenoplectus subulatus*
Eucalyptus xerothermica	*Tinospora smilacina*	*Cyperus vaginatus*	*Schoenoplectiella laevis*
Acacia coriacea subsp. *pendens*	*Gossypium sturtianum*	*Eulalia aurea*	*Ammannia baccifera & A. multiflora*
Atalaya hemiglauca	*Dodonaea lanceolata*	*Stemodia grossa*	*Chara* sp.
Clerodendrum floribundum	*Abutilon amplum*	*Aristida lazaridis*	*Typha domingensis*
Corymbia ferriticola	*Stylobasium spathulatum*	**Melinis repens & *Sigesbeckia orientalis*	*Marsilea hirsuta*
Ficus brachypoda	*Denhamia cunninghamii*	*Commelina ensifolia*	*Wahlenbergia tumidifructa*
	Olearia fluvialis	*Rostellularia adscendens var. latifolia*	
	Dodonaea viscosa	*Bothriochloa ewartiana & Dichanthium sericeum subsp. Humilis & Eriachne benthamii*	
	Pittosporum angustifolium	*Sorghum plumosum*	
	Ehretia saligna var. saligna	**Urochloa mosambicensis & *Chloris virgata*	

5.3.2. Conservation Significant Flora

A total of four Priority listed flora species were recorded from the riparian zone of Weeli Wolli Creek, Pebble Mouse Creek and their associated tributaries within the Study Area. The four Priority listed species and their locations are detailed below and in Figure 5-6.

Aristida lazaridis (Priority 2)

Aristida lazaridis was recorded in ten locations and from five vegetation units (Table 5-4). Astron (2020) conducted extensive targeted searches for this species in key habitats and as a result recorded *A. lazaridis* in two locations. Together, this data, along with the targeted searches conducted for this species in the current study allowed *A. lazaridis* population abundance mapping to be provided for this species within Figure 5-6. This mapping is designed to help inform significance assessments for each of the riparian vegetation unit by adding information to inform the likelihood of the presence of Priority flora in different riparian units. *Aristida lazaridis* population abundance mapping in Figure 5-6 suggests that while it is not restricted to these units, in general this species was common within and therefore preferred the habitats provided by vegetation units C4Bx-2 (and the flanking CF-X2 floodplain unit), and C4Bx-1. In addition, this species had a scattered to isolated distribution within the C3B unit and the CF-X1 floodplain unit which flanks it.

Table 5-4: Locations of *Aristida lazaridis* recorded from the Study Area

Transect	Vegetation Unit	Easting	Northing
PMV-02	C4Bx-2	699610	7449885
PMV-04	C3C	703027	7452229
PMV-05	C4Bx-2	704158	7452794
WWV-03	C3B	708166	7446164
WWV-04	C3B	708960	7447443
WWV-06	C3B	713182	7448477
Opportunistic	C3B	697946	7448764
Opportunistic	CF-X1	702496	7448764
HD18	C4Bx-1	707275	7445867
HD31	C4Bx-2	696428	7445960

Rostellularia adscendens var. *latifolia* (Priority 3)

Rostellularia adscendens var. *latifolia* was recorded in four locations and from three vegetation units (Table 5-5).

Table 5-5: Locations of *Rostellularia adscendens var. latifolia* recorded from the Study Area

Transect	Vegetation Unit	Easting	Northing
PMV-04	C3C	703027	7452229
PMV-05	C4Bx-2	704158	7452794

Transect	Vegetation Unit	Easting	Northing
WWV-11	C3A	723237	7452571
WWV-12	C3A	722005	7454931

Rhagodia sp. Hamersley (M. Trudgen 17794) (Priority 3)

Astron (2020) recorded one individual of *Rhagodia* sp. Hamersley (M. Trudgen 17794) (Table 5-6).

Table 5-6: Location of *Rhagodia* sp. Hamersley (M. Trudgen 17794) recorded from the Study Area

Transect	Vegetation Unit	Easting	Northing
GHO1	C5B	700255	7446956

Stylidium weeliwolli (Priority 3)

One individual of *Stylidium weeliwolli* was recorded in transect WWR-J2, and a further seven opportunistic records were made as part of this study (Table 5-7).

Table 5-7: Location of *Stylidium weeliwolli* recorded from the Study Area

Transect	Vegetation Unit	Easting	Northing
WWR-J2	C1A	721993	7449670
Opportunistic	C1A	720379	7448726
Opportunistic	C1A	720387	7448733
Opportunistic	C1A	720376	7448749
Opportunistic	C1A	720378	7448775
Opportunistic	C1A	720338	7448603
Opportunistic	C1A	721981	7449669
Opportunistic	C1A	722150	7449766

5.3.3. Flora of 'Other' Significance

The Study Area supports a diverse array of flora that can be considered to be of 'other' significance as defined by EPA (2016). This includes range extensions, unusual/unique flora, relictual flora and flora that are representative of GDE.

Three flora species of 'other' significance were recorded during the current study and by Astron (2020) as occurring within the riparian zone of Weeli Wolli Creek and Pebble Mouse Creek. These flora species and their locations are detailed below and in Figure 5-6.

Eulalia sp. 'Three River Station'

The current study recorded *Eulalia* sp. 'Three River Station' at one location (Table 5-8). This taxon is currently not recognised by the Western Australian Herbarium (WAH), though it continues to present in the field as a different *Eulalia* species to those recognised in WA, forming continuous mats of rhizomatous grass beds. The species is distinct and appears well represented in the Pilbara, but it remains a potential species of interest requiring further taxonomical investigation.

Table 5-8: Location of *Eulalia* sp. 'Three River Station' recorded from the Study Area

Transect	Vegetation Unit	Easting	Northing
Veg4	C4Bx-2	721993	7449670

**Urochloa mosambicensis*

*The current study recorded *Urochloa mosambicensis* at three locations within the Study Area (Table 5-9). These records are a substantial range extension for this introduced weed taxon. **Urochloa mosambicensis* is an African native that has become naturalised throughout Queensland, the Northern Territory, and is currently restricted to the Kimberley region of Western Australia. There are no previous records of this taxon in the Pilbara region, though the climate is likely able to support the species spread into the region (tropical/hot climate).

Table 5-9: Locations of **Urochloa mosambicensis* recorded from the Study Area.

Transect	Vegetation Unit	Easting	Northing	Easting	Northing
MNV-01	C4Bx-1	706178	7443836	706241	7443765
WWR-J2	C1A	721993	7449670		
WWV-04	C3B	708960	7447443	708898	7447371

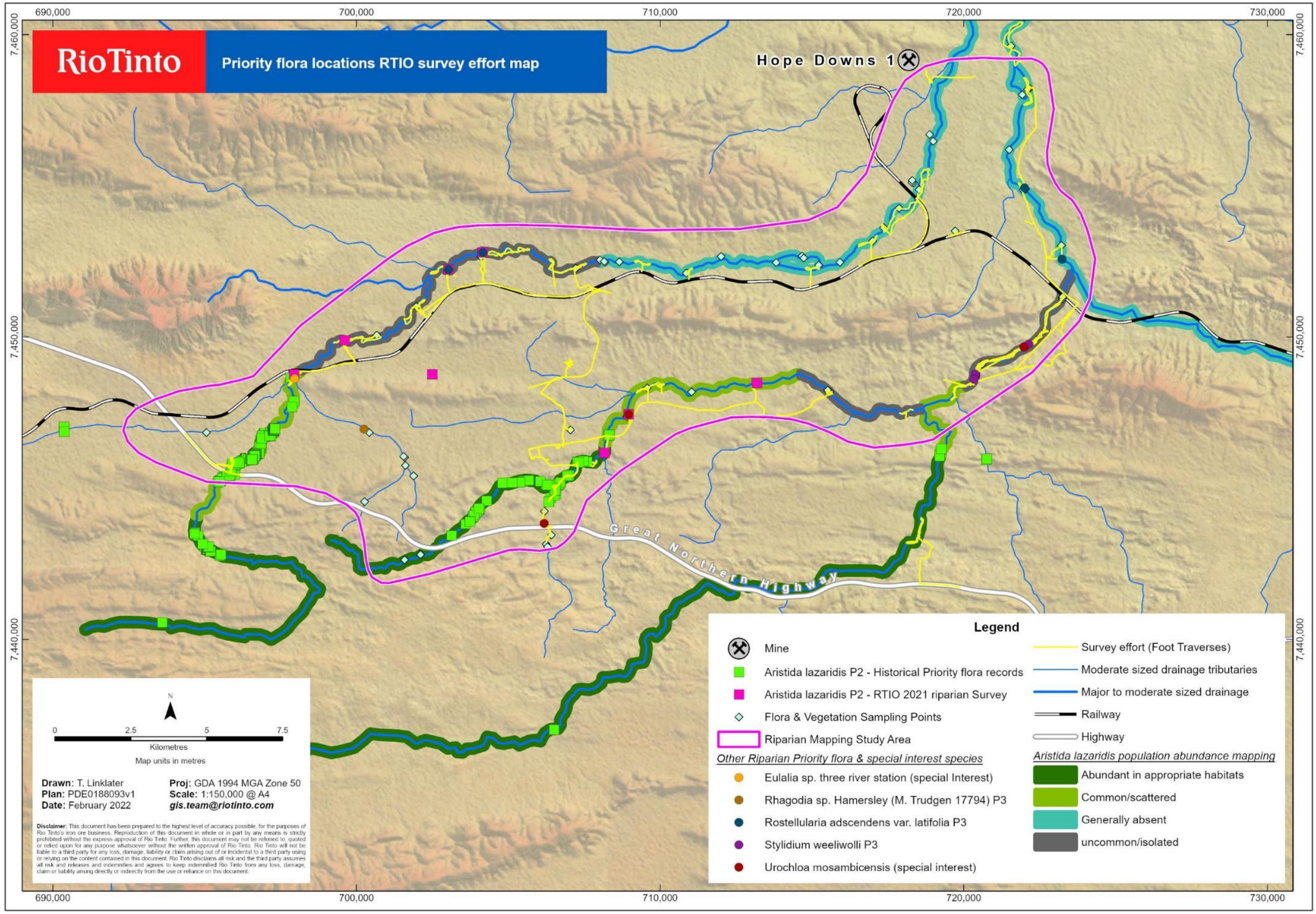


Figure 5-6: Priority flora locations and survey effort.

5.4. Assessment of riparian vegetation communities across the Study Area

A core objective of the current study, apart from producing targeted and appropriately detailed Riparian vegetation mapping, was to determine the degrees of restriction for all the mapped riparian vegetation units and their associated habitats. Approximately eight different steps were undertaken to complete the current significance assessment (see Section 4.4). This included steps such as:

- Considering the likelihood of the unit representing GDV as well as the mapped ecohydrological zone which is falls within.
- mapping the reporting catchment to each vegetation unit and classifying its drainage size.
- Determining the suite of relevant mesophytic and hydrophytic indicator species present in each and their abundance.
- Providing notes on relevant indicator species, as well as overstorey keystone species and structure as well as any other taxa which were of relevance to the assessment.
- Discuss mapped riparian units and their representation in the study area and surrounds

Within the study area, 15 vegetation units have been mapped. Vegetation units C1A and C2A may be sub-regionally significant as it is currently mapped as part of the occurrence of the Weeli Wolli Springs PEC. The rest of the units are discussed in more detail in section 6.1.Table 5-11 below provides detailed descriptions of riparian vegetation throughout the Study Area.

Table 5-10: Table of riparian vegetation units and their representation throughout the Study Area

Vegetation Units	Drainage Size Classification	Representation
C1A	Moderate	Restricted
C2A	Moderate	Restricted
C2B	Moderate	Restricted
C3A	Major	Restricted
C3B	Moderate	Well represented
C4C	Moderate	Restricted
C4Bx-1	Moderate	Restricted
C3C	Moderate	Restricted*
C4B	Moderate	Well represented
C4Bx-2	Moderate	Restricted*
C5B	Moderate	Well represented
C5C	Moderate	Well represented
CF-X1	Major to Moderate	Well represented
CF-X2	Moderate	Well represented
CF-X3	Moderate	Well represented

Restricted* based on the comparison of targeted and detailed mapping completed compared to database records which contains broader baseline vegetation mapping units.

5.4.1. Influence of the Major Drainage classification

The term “Major Drainage” can typically be applied to drainage systems in a very ad-hoc fashion when attempting to classify their size as part of baseline studies. As a result, any nominal biodiversity significance ratings which are linked to such a classification are often disproportionately applied to the drainage systems in question.

The automatic assertion of ‘High’ significance, which is often applied to drainage systems classed as “Major” drainage systems via baseline surveys, is quite simplistic and is predominantly linked to the Hamersley subregion based ‘Ecosystems at Risk’ (EAR) listings provided as part of the 2002 biodiversity audit of WA (DEC 2002). Not only is this audit relatively out of date, but the “Other Ecosystems at risk” component referred to here is considered to be made relatively redundant by the proceeding PEC listings process which was introduced after the audit, and thus is likely defunct. This guidance continues to be used as the basis for considering the significance of other potentially lower significance communities not captured by the TEC and PEC listings, and still has some merit. However the EAR list does not provide any detailed descriptions, and as such is poorly guided. Furthermore, while this list calls out “All major Ephemeral watercourses” as an EAR, it does not provide a definition for major drainage/watercourses, leading to the term being inconsistently applied. As mentioned, this approach is quite simplistic, and generally counterproductive to a proper assessment of significance which takes into account the flora and vegetation values of the drainage in question. While previous biodiversity studies in the area did map a number of major drainage features, this study utilised a drainage classification (Appendix E) which instead classified some of those systems as clearly moderate in size and reporting catchment. In addition, the automatic rating of ‘High’ significance for major drainage systems was not found to be consistent with the on-ground survey findings and alternative, more measures approaches to assigning significance were utilised.

Table 5-11: Descriptions of riparian vegetation throughout the Study Area

New Riparian code	Vegetation Label	GDV likelihood Rating	Drainage size classification	Position within creek Profile	Mesophyte/hydrophyte indicator species presence/abundance	Mesic Indicator Species – Relevant Notes	Notes relevant to degrees of restriction
C1A	*M. argentea* & *Eucalyptus camaldulensis* open forest over mixed mesic shrublands	High to Very High	Moderate Drainage* (< 450km2)	Low Flow Channels and banks (and Permanent to Semi Permanent Pools)	**High:** *Cullen leucanthum, Stylidium weeliwolli* **Moderate-High**: *Eleocharis geniculatus, Tinospora smilacina, Sonchus hydrophilus, Ammannia baccifera* (A) **Moderate:** *Gossypium sturtianum* (A), *Dodonaea lanceolata* (A), *Abutilon amplum, Schoenoplectus subulatus* **Low:** *Acacia coriacea* subsp. *pendens, Atalaya hemiglauca, Eulalia aurea* (A), *Stemodia grossa* (A), *Cyperus vaginatus* (A), *Typha Domingensis* (A), *Chara* spp. (A) **Keystone**: *Melaleuca argentea* (A-Mature) plus *Eucalyptus camaldulensis* (A) & *E. victrix* (I)	Reduced diversity of hydrophytes, and some question marks as to how permanent the surface water features are at this feature may reduce the overall significance of the feature. Reduced hydrophyte diversity likely a product of consistent cattle disturbance in and around the permanent water feature.	Small-Moderate scale GDE feature, which supports a known *permanent pool, plus some potentially semi-permanent pools. Restricted as it possesses a relatively permanent aquatic habitat. Indicators: 0 very high 2 High.
C2A	*E. camaldulensis* Woodland (to open forest) over open mesic shrublands (Scattered young *Melaleuca argentea* present in some locations)	High	Moderate Drainage* (< 450km2)	Low Flow Channels and banks	**High**: *Cullen leucanthum* (U). **Moderate-High:** *Tinospora smilacina* (U), *Sonchus hydrophilus, Ammannia baccifera* (A). **Moderate**: *Gossypium sturtianum* (A), *Dodonaea lanceolata* (A), *Abutilon amplum, Schoenoplectus subulatus.* **Low:** *Acacia coriacea* subsp. *pendens, Atalaya hemiglauca, Eulalia aurea* (A), *Stemodia grossa* (A), *Cyperus vaginatus* (A), *Typha Domingensis* (U), *Chara* spp. (U). **Keystone:** *E. camaldulensis* (A) *E. victrix* (S), *M. argentea* (U)		Small-Moderate scale feature; potentially supports a semi-permanent pool and persistent pool pools, Classified as a PEC due to link with WWS. Indicators: 0 very high 1 High.
C2B	Small *E. camaldulensis* Woodland over mixed open shrubland with *Melaleuca bracteata*.	Moderate	Moderate Drainage (< 150km2)	Low Flow Channels and banks	**Moderate-High:** *Melaleuca bracteata* (A). **Moderate:** *Gossypium sturtianum*. **Low:** *Cyperus vaginatus* (C), *Eulalia aurea* (C), *Melaleuca glomerata* (C). **Keystone:** *Eucalyptus camaldulensis* (woodland) plus *E. victrix* (S).	Associated with a significant Heritage site/artefact scatter. Substantial calcite precipitation present on the western terraces adjacent to	Low number of mesophytes

New Riparian code	Vegetation Label	GDV likelihood Rating	Drainage size classification	Position within creek Profile	Mesophyte/hydrophyte indicator species presence/abundance	Mesic Indicator Species – Relevant Notes	Notes relevant to degrees of restriction
						the creek, as well as indications that GW seepage from the accent slopes is likely.	
C3A	*Eucalyptus camaldulensis* subsp. *obtusa*, *E. victrix* woodland over open Semi-Mesic Shrublands with *Triodia longiceps*	Moderate + To Moderate-Low (variable)	**Major Drainage* (< 500-750km2)**	Low Flow Channels and banks	**Moderate**: *Abutilon amplum, Atalaya hemiglauca*, **Low:** *Acacia coriacea* subsp. *pendens*, *Cyperus vaginatus, Dodonaea lanceolata*. **Keystone Species:** *Eucalyptus camaldulensis*, *Eucalyptus victrix* (woodland).	Some impact already experienced in this area due to dewatering of HD1 - Some reduced mesic diversity likely already experienced.	Moderate - due to position on WWC main and position on Major drainage
C3B	*E. camaldulensis* & *E. victrix* woodland (variable) over mixed open shrubland with *Petalostylis labicheoides*	Low TO Low + (variable) Phreatophytes likely to part relate to small seasonal Fractured rock aquifers	Moderate Drainage (< 200-400km2)	Low Flow Channels and banks	**Moderate-High***: *Tinospora smilacina* **Moderate-Low:** *Abutilon amplum, Atalaya hemiglauca, Gossypium sturtianum* var. *sturtianum*, *Cyperus cunninghamii* subsp. *cunninghamii* (S), *Cyperus iria* (S), **Low**: *Stemodia grossa* (C), *Cyperus vaginatus* (C), **Keystone Species:** *Eucalyptus camaldulensis, E. victrix* (woodland).		Increased due to position on WWC, topographic confinement of channel (increasing structural complexity) and position on Moderate + drainage

New Riparian code	Vegetation Label	GDV likelihood Rating	Drainage size classification	Position within creek Profile	Mesophyte/hydrophyte indicator species presence/abundance	Mesic Indicator Species – Relevant Notes	Notes relevant to degrees of restriction
C4C	*Corymbia ferriticola* and *Eucalyptus victrix* low open woodland over mixed open shrubland with rocky influence.	Low + - Persistent pool Pool	Moderate Drainage (< 200-400km2)	Low Flow Channel and fringing rocky banks	**Moderate:** *Tinospora smilacina* (I), **Moderate-Low:** *Atalaya hemiglauca* (C), *Cyperus cunninghamii* subsp. *cunninghamii* (I), **Low**: *Eulalia aurea* (A), **Low (-)**: *Clerodendrum floribundum* var. *floribundum* (I), *Gossypium sturtianum* var. *sturtianum* (C), **Keystone:** *Corymbia ferriticola* (C) & *Eucalyptus victrix* (C) (open woodland)	Tier 3C based on structure and keystone species, 3B+ based on mesophyte diversity and presence of Persistent pool waterbody.	Increased due to position on WWC, topographic confinement of channel and position in incised valley, position on Moderate + drainage and presence of persistent pool water body and associated ephemeral aquatic fauna assemblages.
C4Bx-1	*Eucalyptus victrix, E. xerothermica* woodland	Low +	Moderate Drainage (< 150km2)	Low Flow Channels and banks	**High:** *Acacia ampliceps* (I), **Moderate-High**: *Melaleuca bracteata* (C), **Moderate-Low**: *Abutilon amplum, Gossypium sturtianum* var. *sturtianum* (C), *Dodonaea lanceolata*, *Typha domingensis*, **Low (-):** *Acacia coriacea* subsp. *pendens*, *Cyperus vaginatus* (C), *Eulalia aurea* (C), *Melaleuca glomerata* (C), *Stemodia grossa* (C), *Stylobasium spathulatum* (C-A), **Keystone Species:** *Eucalyptus victrix* (A) & *E. xerothermica* (A) (Woodland), plus *E. camaldulensis* (S-I)	Keystone species structure alone, potentially 3A based on elevated mesic diversity and common presence of *M. bracteata* in the system, Tier Class reflects combination of structure and Mesophyte diversity. EC also common	Increased due to position on lower WWC, but predominantly the elevated persistence of water within the creek channel and substrates due to basalt basement geology and the associated elevated/cryptic mesophyte diversity and structure which comes with this hydrology.
C3C	*Eucalyptus victrix, E. xerothermica* and *E. camaldulensis* woodland	Low +	Moderate Drainage (< 150-300km2)	Low Flow Channels and banks	**Low (-)**: *Eulalia aurea* (C), **Keystone Species:** *E. victrix*. (A - Woodland), plus *E. camaldulensis* (S)	Others likely present - Only one sampling site for this unit	Increased due to position on Moderate drainage and increased local abundance of E. camaldulensis.

New Riparian code	Vegetation Label	GDV likelihood Rating	Drainage size classification	Position within creek Profile	Mesophyte/hydrophyte indicator species presence/abundance	Mesic Indicator Species – Relevant Notes	Notes relevant to degrees of restriction
C4B	*Eucalyptus victrix* low open woodland over *Acacia citrinoviridis* tall open shrubland.	Very Low	Moderate Drainage (< 250-350km2)	Low Flow Channels and banks	**Moderate - Low:** *Atalaya hemiglauca*, *Cyperus iria* (S), *Cyperus squarrosus* (S), *Schoenoplectiella laevis* (S), **Low (-):** *Stemodia grossa* (C), *Eulalia aurea* (C), **Keystone Species:** *Eucalyptus victrix* (A - Woodland), Plus *E. camaldulensis* (S-I)		Nominally attributed well represented due to riparian classification
C4Bx-2	*Eucalyptus victrix, E. xerothermica* low open woodland over variable tall open shrubland of *Acacia aneura* complex.	Low -	Moderate Drainage (< 150-300km2)	Low Flow Channels and banks	**Moderate:** *Gossypium sturtianum* var. *sturtianum* (C), **Moderate-Low:** *Cyperus difformis, Cyperus iria, Abutilon amplum,* **Low (-):** *Cyperus vaginatus, Eulalia aurea* (C), Stemodia grossa (S), **Keystone:** *Eucalyptus victrix* & *E. xerothermica* (A) (Woodland) plus *E. camaldulensis* (S)		Nominally attributed well represented due to riparian classification
		Low -	Moderate Drainage (< 150km2)	Low Flow Channels and banks	**Moderate**: *Gossypium sturtianum* var. *sturtianum* (C), **Moderate-Low**: C*yperus difformis, Cyperus iria, Abutilon amplum,* **Low (-):** *Cyperus vaginatus, Eulalia aurea* (C), *Stemodia grossa* (S), **Keystone**: *Eucalyptus victrix* (A - Woodland) plus *E. camaldulensis* (S)		Nominally attributed well represented due to riparian classification
C5B	*Eucalyptus xerothermica* low open woodland over mixed tall open shrubland with *Petalostylis labicheoides* and *Triodia longiceps* hummocks	Very Low -	Moderate Drainage (< 100km2)	Low flow channels bank and terrace	**Low:** *Stemodia grossa* (C), *Gossypium sturtianum* var. *sturtianum* (S), **Keystone:** *E. xerothermica* (C-A), Plus *E. victrix* (I), *E. camaldulensis* (I).		Nominally attributed well represented due to riparian classification

New Riparian code	Vegetation Label	GDV likelihood Rating	Drainage size classification	Position within creek Profile	Mesophyte/hydrophyte indicator species presence/abundance	Mesic Indicator Species – Relevant Notes	Notes relevant to degrees of restriction
C5C	*Eucalyptus xerothermica* scattered low trees over variable tall open shrubland of *Acacia aneura* complex.	Very Low	Moderate Drainage (< 100km2)	Low flow channels bank and terrace	**Mesic Species generally absent**, but *Eucalyptus victrix* likely to be present in an isolated fashion.		Nominally attributed well represented due to riparian classification where unit includes low flow and floodplain creek profiles.
CF-X1	*Eucalyptus xerothermica* & *E. victrix* (+/-) scattered trees over mixed *Acacia* spp. tall open shrublands with *Acacia citrinoviridis.*	Moderate to Low (variable)	Major Drainage* (< 500-750km2)	Floodplain (and High flow Channels)	**Moderate-Low:** Atalaya hemiglauca (C-I), **Low:** Corymbia aspera (C-I), **Keystone:** Eucalyptus xerothermica (A), Plus Eucalyptus victrix (C) & Eucalyptus camaldulensis (C-I) (S)	In major drainage examples of this unit, where the floodplain includes substantial high flow channels, Eucalyptus victrix and particularly E. camaldulensis (as well as Atalaya hemiglauca) abundance increases from isolated to common.	Nominally attributed well represented due to riparian classification where unit represents the floodplain creek profile.
		Moderate (variable)	Moderate Drainage* (< 450km2)	Floodplain (and High flow Channels)	**Moderate-Low:** *Atalaya hemiglauca* (C-I), **Low:** *Corymbia aspera* (C-I), **Keystone:** *Eucalyptus xerothermica* (A), Plus *E. victrix* (C) & *E. camaldulensis* (C-I) (S)	In moderate drainage examples of this unit, where the floodplain includes high flow channels, *Eucalyptus victrix* and *E. camaldulensis* (as well as *Atalaya hemiglauca*) abundance may increase from isolated to common.	Nominally attributed well represented due to riparian classification where unit represents the floodplain creek profile.

New Riparian code	Vegetation Label	GDV likelihood Rating	Drainage size classification	Position within creek Profile	Mesophyte/hydrophyte indicator species presence/abundance	Mesic Indicator Species – Relevant Notes	Notes relevant to degrees of restriction
		Low-Very Low	Moderate Drainage (< 100-400km2)	Floodplain (and High flow Channels)	**Moderate-Low:** *Atalaya hemiglauca* (C-I), **Low:** *Corymbia aspera* (C-I), **Keystone:** *Eucalyptus xerothermica* (A), Plus *E. victrix* (C) & *E. camaldulensis* (C-I) (S)	In moderate drainage examples of this unit, where the floodplain includes high flow channels, *Eucalyptus victrix and E. camaldulensis* (as well as *Atalaya hemiglauca*) abundance may increase from isolated to common.	Nominally attributed well represented due to riparian classification where unit represents the floodplain creek profile.
CF-X2	*Eucalyptus xerothermica* scattered low trees over scattered tall shrubs and *Triodia longiceps* hummocks	Very Low	Moderate Drainage (< 150km2)	Floodplain (and High flow Channels)	**Moderate-Low:** *Atalaya hemiglauca* (I), **Low** (-): *Abutilon amplum* (I), **Keystone:** *Eucalyptus xerothermica* (A), Plus *E. camaldulensis* (I), *E. victrix* (I-C).	Represents the partially basalt lithology influenced floodplains of the Study Area (i.e., fine grained terraces with a substantial clay component)	Nominally attributed well represented due to riparian classification where unit represents the floodplain creek profile.
		Very Low	Moderate Drainage (< 150-300km2)	Floodplain (and High flow Channels)	**Moderate-Low:** *Atalaya hemiglauca* (I), **Low (-):** *Abutilon amplum* (I), **Keystone:** *Eucalyptus xerothermica* (A), Plus *E. camaldulensis* (I), *E. victrix* (I-C).	Represents the increasingly basalt lithology influenced floodplains of the Study Area (i.e., fine grained terraces with a substantial clay component)	Nominally attributed well represented due to riparian classification where unit represents the floodplain creek profile.
CF-X3	*Eucalyptus xerothermica* scattered low trees over scattered tall shrubs with *Acacia citrinoviridis* and *Triodia longiceps* hummocks	Very Low -	Moderate Drainage (< 250-350km2)	Floodplain (and High flow Channels)	**Moderate-low:** *Atalaya hemiglauca* (I), *Cyperus iria* (I), **Low (-):** *Abutilon amplum* (I), *Stylobasium spathulatum* (I), **Keystone:** *Eucalyptus xerothermica* (C), Plus *E. victrix* (I)		Nominally attributed well represented due to riparian classification where unit represents the floodplain creek profile.

(A) = Abundant; (C) = Common; (I) = Isolated; (S) = Scattered; (U) = Understorey

5.5. GDV likelihood mapping

For the current development proposal, mine pit dewatering (to allow safe mining) is not required, and groundwater abstraction volumes will be relatively small and limited to supporting some of the operational requirements of the development. For this reason, a non-exhaustive assessment of GDV likelihood was completed for the riparian vegetation units and relevant creek reaches mapped across the Study Area. This involved completing an assessment of the likelihood that both; individual mapped vegetation units, or specific reaches within units, would support vegetation with a potential for dependence on groundwater. While this was predominantly guided by the depth to water recorded for the broader aquifers monitored across the Study Area (see Table 5-1 for supporting groundwater info), it was also guided by structural and floristic vegetation characteristics, particularly where communities possessed an elevated diversity and abundance of mesophytic and hydrophytic indicator species (as per the Riparian ecohydrological assessment framework presented in (Table 3-3). Furthermore, where these two evidence streams have partially or completely contradicted each other, the likelihood rating was moderated based on the likelihood that alluvial aquifers or small scale generally perched groundwater sources may be helping to support vegetation. While such situations generally determine that there is low likelihood of developmental abstraction influencing vegetation, they remain included in the process as catchment changes or similar can be influential in such groundwater sources and thus ongoing vegetation condition.

Generally speaking, particularly within the development envelope area (i.e., on PMC and upper reaches of WWC) the likelihood that creek reaches and their associated mapped vegetation units would support GDV or potential GDV was quite low. This is not only because of the average depth to groundwater for the broader aquifers in the locality was beyond 30m, but also because the riparian vegetation density was generally quite sparse. Noting that the GDV ratings were not always purely linked to the boundaries of vegetation units, but that in many cases they were attributed to specific reaches of mapped units, a summary of the ratings or range of ratings applied to different vegetation units is provided in Table 5-12. As a result, to get a more complete comprehension of the distribution of GDV likelihood, these ratings are best viewed via the GDV likelihood mapping. The results of the GDV likelihood mapping are presented in Figure 5-7 to Figure 5-10.

Table 5-12: Summary of GDV likelihood ratings for each vegetation unit in the Study Area

Vegetation Unit	Relevant Notes	GDV likelihood Rating
C1A	Groundwater discharge known to occur; broader aquifers shallow here.	'High - Very High'
C2A	Broader aquifers shallow here.	'High'
C2B	Extensive calcite deposition on west banks/terrace, basalt basement relatively shallow. Evidence of somewhat persistent surface water pools here.	'Moderate'
C3A	Rating variable depending on reach.	'Moderate +' & 'Moderate-Low'
C3B	Rating variable depending on reach. Phreatophytes likely to be partly related to small seasonal perched or fractured rock aquifers, particularly in the east where basement is shallow.	'Low' & 'Low +'
C3C		'Low +'
C4C	Persistent pool pool present.	'Low +'
C4Bx-1	Basalt basement generally shallow.	'Low +'
C4Bx-2		'Low -'
C4B		'Very Low'
C5B		'Very Low -'
C5C		'Very Low'
CF-X1	Rating variable depending on reach. *Higher rating where on "Major Drainage" in the east of the Study Area, lower where on moderate drainage in the west of the Study Area. Floodplain unit, GDV potential typically low.	'Moderate', 'Moderate - Low' & 'Low-Very Low'
CF-X2	Floodplain unit - GDV potential generally low.	'Very Low'
CF-X3	Floodplain unit - GDV potential generally low.	'Very Low -'

* In many cases this higher rating occurring on the floodplain is due to the proximity of the floodplain to the core riparian zone and lateral simplification of the likelihood polygons when mapping. However, where vegetation is associated with major drainage or similar this can also be due to the presence of high flow channels with increased likelihood of access to relevant groundwater sources.

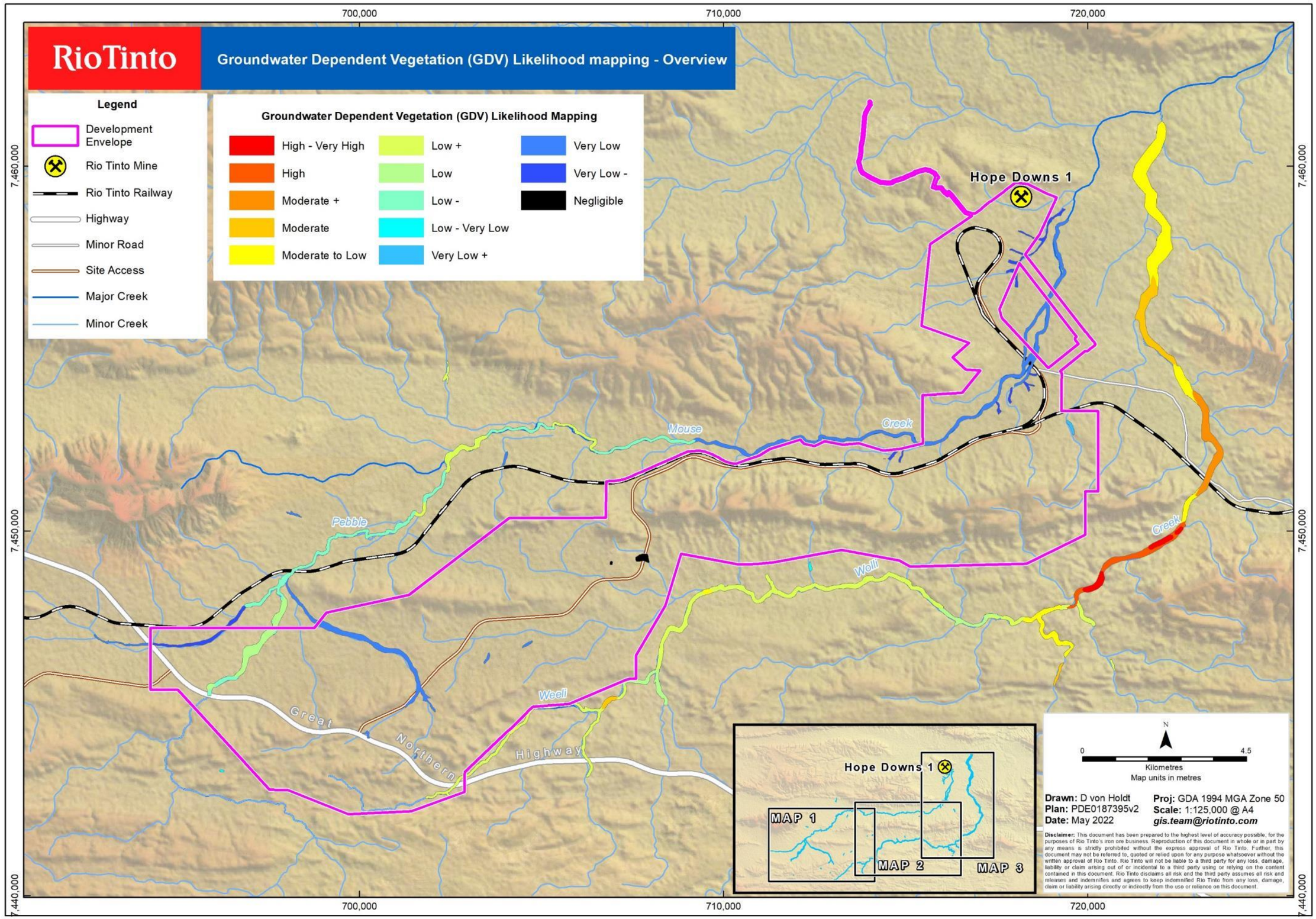


Figure 5-7: Overview of Groundwater Dependent Vegetation (GDV) likelihood mapping across the Study Area

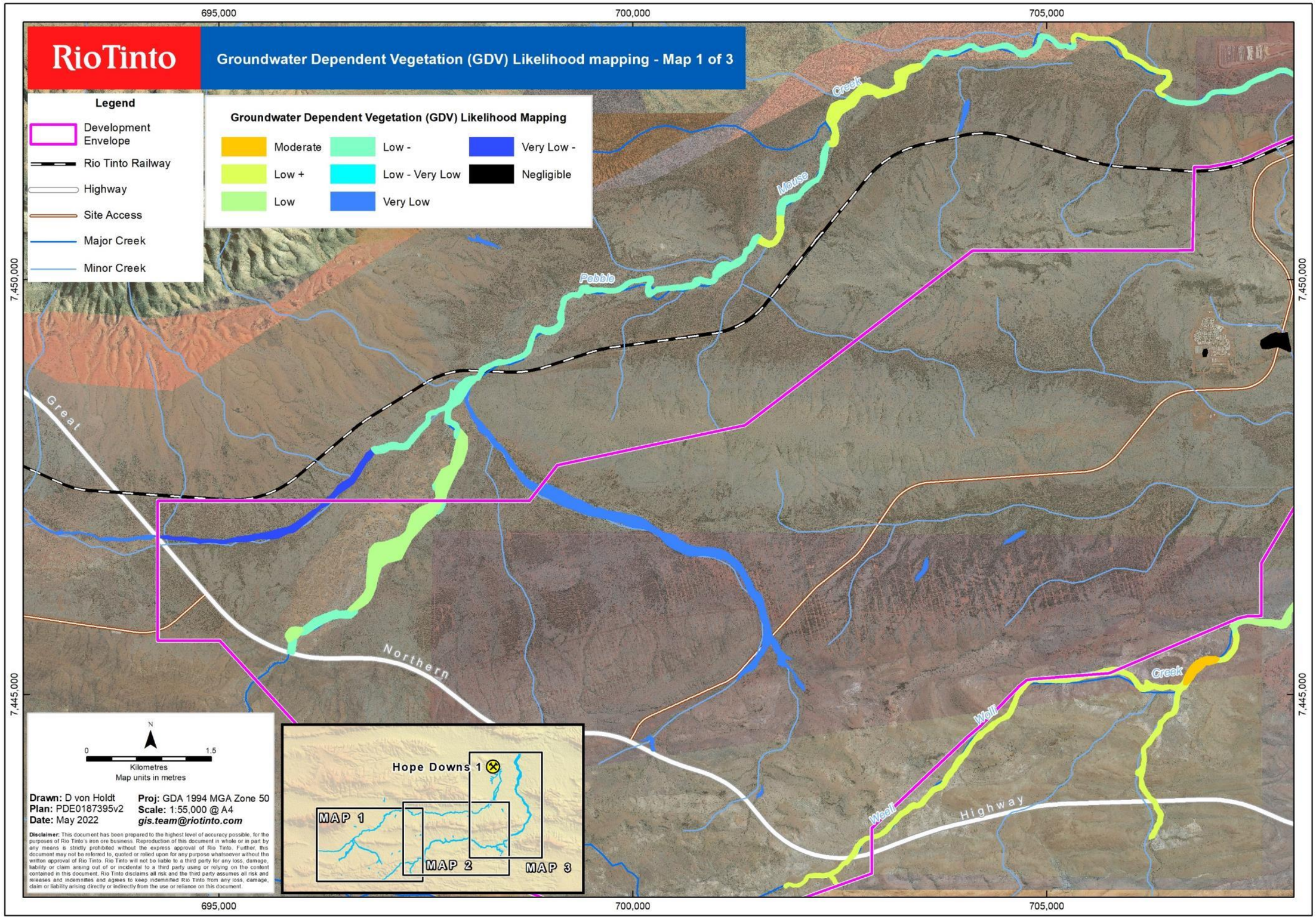


Figure 5-8: Groundwater Dependent Vegetation (GDV) likelihood mapping in the west of the Study Area (Map 1 of 3)

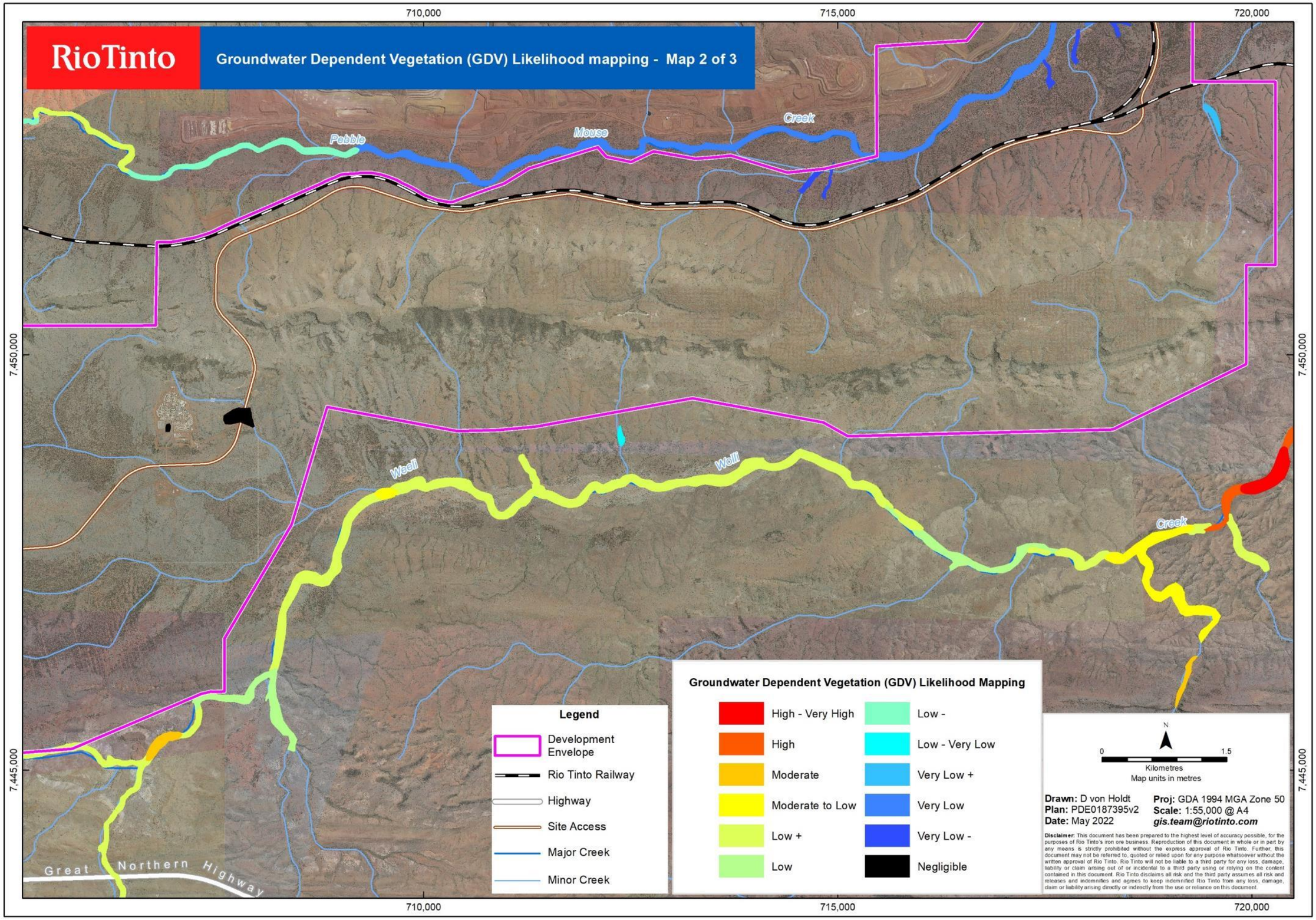


Figure 5-9: Groundwater Dependent Vegetation (GDV) likelihood mapping in the central area of the Study Area (Map 2 of 3)

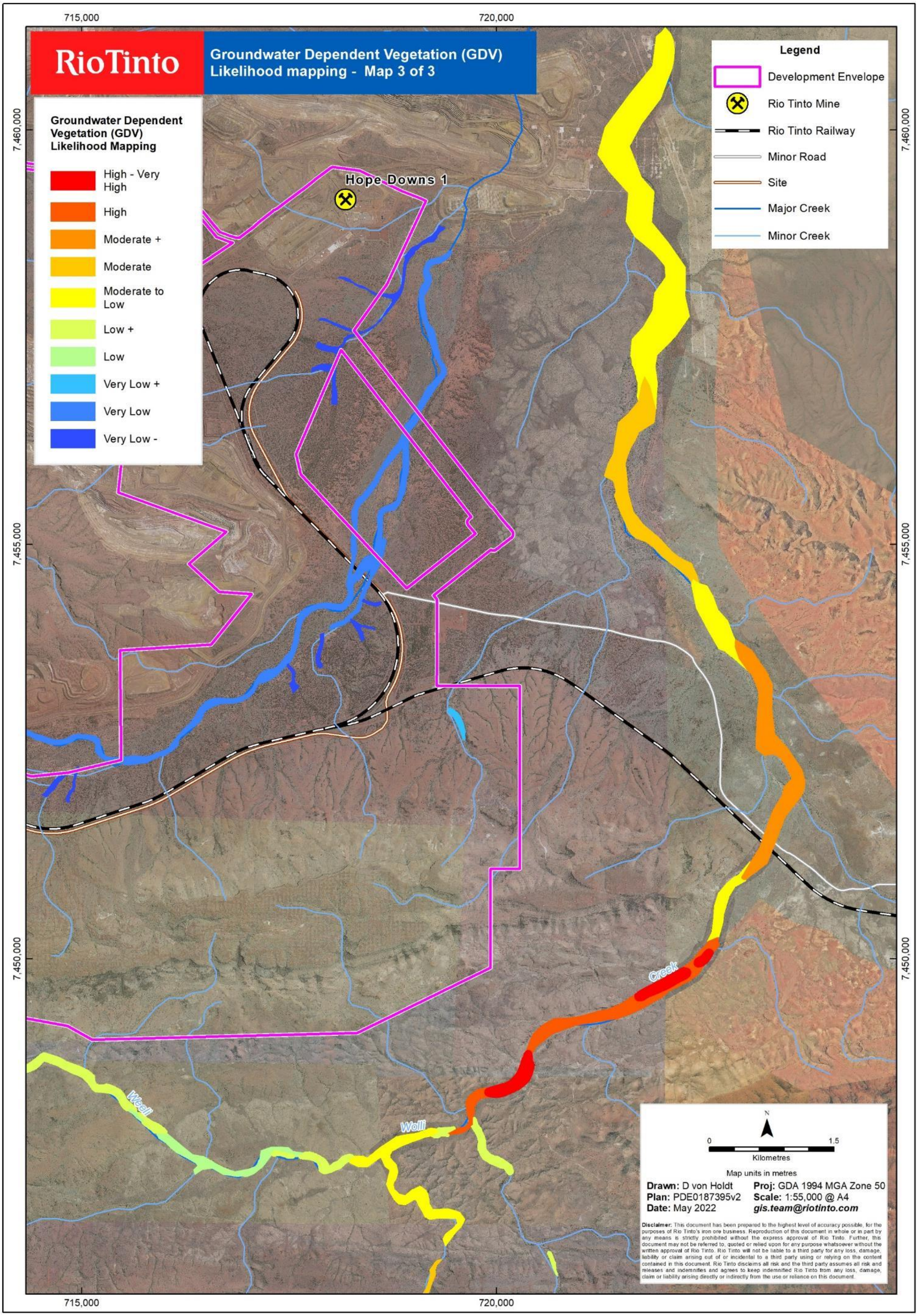


Figure 5-10: Groundwater Dependent Vegetation (GDV) likelihood mapping in the east of the Study Area (Map 3 of 3).

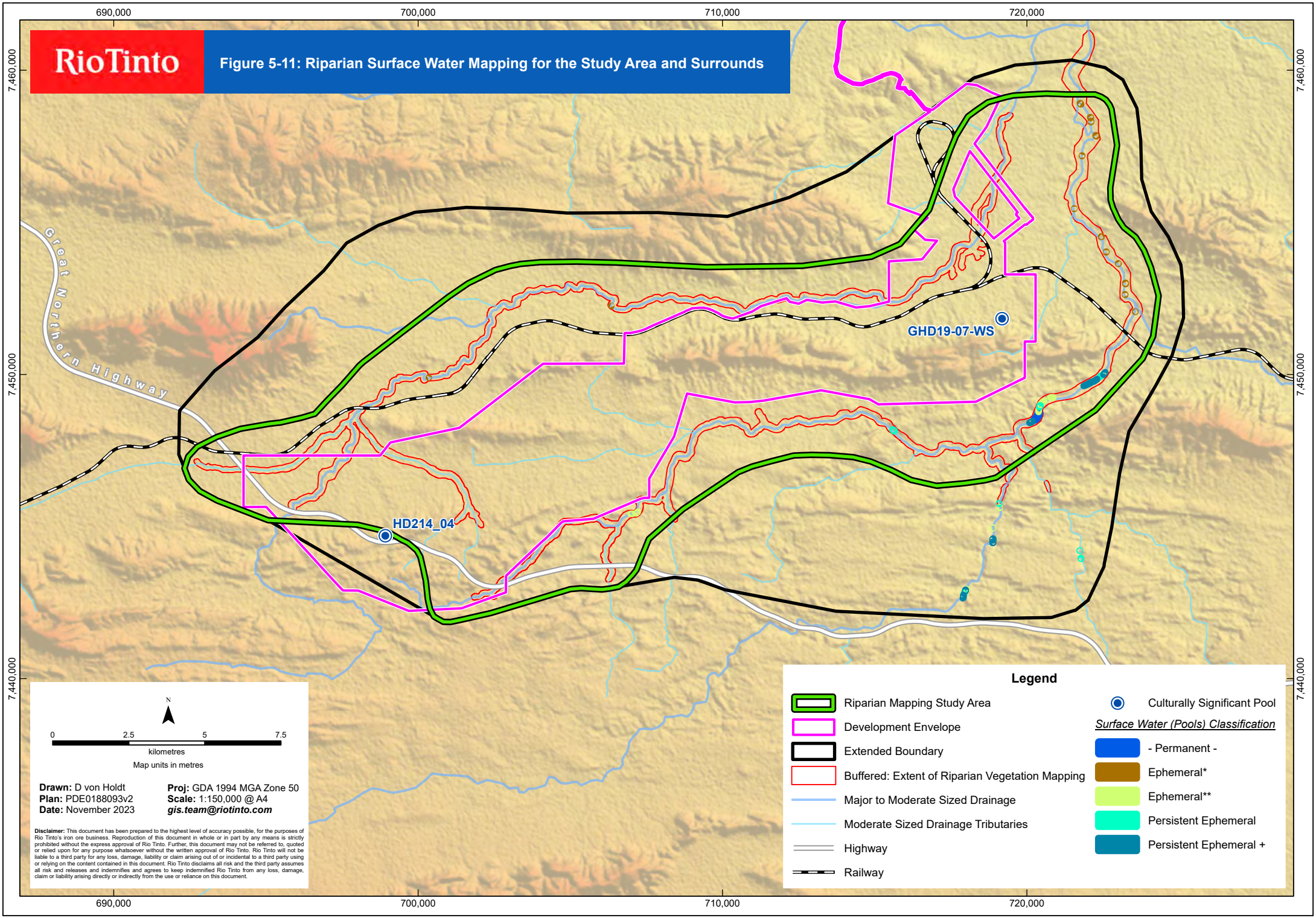
5.6. Surface water mapping

To give context to the riparian vegetation mapping, associated values/degrees of restriction and the GDV likelihood mapping; it was determined that a relatively robust surface water mapping process should be conducted. This was done to give an indication of the likely abundance and nature of surface water within and directly surrounding the riparian mapping Study Area. Areas directly around the Study Area were also considered in this process as surface water was relatively absent in the Study Area (beyond “Ben’s Oasis”), at least in terms of persistent surface water formations.

The surface water mapping process used a persistence map which utilised a water mapping index called Sentinel Water Mask (SWM), as well as multiple (generally 2-3) appropriately timed and appropriately detailed/contrasting aerial image sources from Google earth and ESRI. These data sources were combined with recent and historical field observations, as well as relevant groundwater monitoring data to provide a combined picture of the likely distribution of areas where surface water more persistently accumulates in the environment. While the terminology ephemeral and persistent pool features quite consistently in the results for the Study Area, the terms shouldn’t be thought about too literally. Ultimately ephemeral surface water could be everywhere at the right time of the year, and so the ephemeral and persistent pool terms are referring to areas more likely to support surface water outside of the wet season (and potentially early winter), or well into and potentially beyond the winter period in the case of Persistent pool surface water. Technically semi-permanent pools are classified as pools which intermittently or seasonally have connection to the groundwater table, and permanent pools most likely have effective permanent connection with or discharge from the groundwater table. It should be noted that this study did not consider ephemeral and greater classed pools which occur in minor drainage systems; particularly those surface water features which occur in incised drainage within the surrounding ranges. These types of features are not capable of being detected by such a combination of data sources as they are typically too small and too hidden within unfavourable topography to be able to be confidently detected and assessed.

A more detailed description of the methods used is provided in Section 4.6 along with relevant details surrounding the different surface water/pool classifications. The resulting surface water mapping is presented within Figure 5-11 and the detailed data to support this mapping is presented in Appendix H:. The extended area of consideration (outside of the riparian mapping Study Area) with respect to surface water mapping is also indicated in Figure 5-12, in order to show the full scope of this mapping product.

In general, there was a relative dearth of persistent surface water within the Study Area, with even the lower class “ephemeral” type pools being generally absent within the proposed development areas on larger drainage systems focused on by this study. The majority of locations typically supporting persistent or greater surface water pools being present in the “Ben’s Oasis” area. In this area the broader groundwater table becomes shallow and is seemingly forced over, or discharges out of the outcropping Wittenoom Formation which occurs in the area. Outside of this area, persistent surface water occurred where drainage passed through larger incised gully/gorge type formations. This is particularly true in the Wonmunna area, just southeast of the Study Area, but included in the surface water mapping area. In this area several features occur where tributaries of WWC repeatedly cross Hamersley/Fortescue geological group boundaries, through incised range formations. The resulting conditions mean that at several locations, persistent surface water pools occur over favourable basement outcropping. These features are not only clearly visible late in the dry season on multiple aerial photographs and as well as some being know aquatic fauna sampling sites; but some are also known to support traditional engravings, likely testament to their value as water sources.


RioTinto
Figure 5-11: Riparian Surface Water Mapping for the Study Area and Surrounds
690,000
700,000
710,000
720,000
7,460,000
7,450,000
7,440,000
Great Northern Highway
GHD19-07-WS
HD214_04
Legend
Riparian Mapping Study Area
Development Envelope
Extended Boundary
Buffered: Extent of Riparian Vegetation Mapping
Major to Moderate Sized Drainage
Moderate Sized Drainage Tributaries
Highway
Railway
Culturally Significant Pool
Surface Water (Pools) Classification
- Permanent -
Ephemeral*
Ephemeral**
Persistent Ephemeral
Persistent Ephemeral +
N
0
2.5
5
7.5
kilometres
Map units in metres
Drawn: D von Holdt
Plan: PDE0188093v2
Date: November 2023
Proj: GDA 1994 MGA Zone 50
Scale: 1:150,000 @ A4
gis.team@riotinto.com
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6. Discussion

6.1. Restricted riparian flora and vegetation values within the Study Area

Restricted riparian flora and vegetation values within the current Study Area are generally restricted to the “Ben’s Oasis” area (C1A, and C2A units)This is predominantly due to “Ben’s Oasis’s” relatively permanent aquatic and hyporheic habitats, and elevated diversity of mesophytic and hydrophytic taxa, which are supported by the shallow groundwater system present in the area.

In addition, vegetation on those reaches of WWC which are classed as major drainage which support major drainage habitats/vegetation with elevated productivity and slightly mesic understory compositions (C3A vegetation unit) have been classified as limited in extent., and so too. Importantly a substantial part of this vegetation unit and drainage area, has experienced significant groundwater drawdown since the inception of mining at the HD1 mine site. Fortunately, the portions of this area which historically benefited from some level of groundwater access (still relatively low at ~10-15 mbgl pre-mining) also occur on a significantly large and deep calcrete formation. Tree health monitoring and systematic FPS investigations in this area have so far indicated no significant decline in tree health or increase in tree mortality, and as such the more obvious conclusion has been 2 fold;

1. Continual rehydration of calcrete formations in the area has ensured sufficient stored water availability for local GDV and FPS; and
2. For riparian vegetation on major drainage, groundwater in the realm of 10+mbgl typically wont form a meaningful portion of environmental water requirements, and as such seasonal flow regimes and related vadose recharge and temporary surficial aquifers will be more influential.

To a lesser degree the C4C, C2B, C3A and C4Bx-1 units on moderate drainage of WWC also warrant consideration to be limited in extent. Units C3C and C4Bx-2 have been delineated as restricted due to comparison to database records which contain broader baseline vegetation mapping units (Appendix ,B). The remainder of the vegetation in the Study Area is relatively well represented in the locality and broader sub-region.

“Ben’s Oasis”

The “Ben’s Oasis” spring area is currently mapped as a small representation of the “Weeli Wolli Spring Community” PEC (Priority Ecological Community). A detailed description of this PEC is provided in Appendix I:. The main Weeli Wolli spring occurrence is listed based on the associated riparian woodland and forest associations being unusual as a consequence of the composition of the understorey. Specifically, the sedge and herb-field communities that fringe many of the pools and associated water bodies along the main channels of WWC are highly restricted within Pilbara riparian Communities. The spring and creekline are also noted for their relatively high diversity of stygofauna and because it supports a very rich microbat assemblage including a threatened species.

With respect to the riparian flora values of WWS, a number of key, highly restricted hydrophytes are unique and important components of the WWS riparian community. These are:

- *Cladium procerum*;
- *Stylidium weeliwolli*;
- *Fimbristylis sieberiana*;
- *Imperata cylindrica*;
- *Fimbristylis oxystachya*;
- *Fimbristylis rara*; and others.

Furthermore a number of restricted understorey mesophytes are abundant in the midstorey of this community; These are:

- *Acacia ampliceps*;

- *Cullen leucanthum*;
- *Atalaya hemiglauca*; and
- *Gossypium sturtianum*.

While the broader Weeli Wolli Springs (WWS) have been listed as a PEC for many reasons, including stygofauna, aquatic invertebrates, ant/spider/beetle, and bat assemblages, it's likely that the diversity of highly restricted and hydrologically sensitive hydrophytes recorded at the spring are potentially the most important indicators of long-term hydrological stability at the site and thus the quality of riparian habitats it supports. The riparian flora diversity known to occur in the WWS area is likely to be a reliable indicator for the provision of riparian habitats capable of supporting similarly diverse/restricted faunal assemblages.

Importantly, in comparison to the WWS area, the "Ben's Oasis" area only supports one of the key hydrophytes listed above; *Stylidium weeliwolli*. Based on the riparian classification presented and used in this study, the C1A vegetation dominated zones of "Ben's Oasis" are considered to be restricted.

The significantly reduced hydrophyte diversity present at "Ben's Oasis" suggests that the site may not be a good quality representation of the Weeli Wolli Springs PEC. More accurately, the reduced hydrophyte diversity of "Ben's Oasis" casts doubts around the long term stability of the aquatic habitats of the spring and ultimately the reliability of the groundwater discharge at the site. This doubt is also partly supported by initial remote sensing analyses (mean monthly aggregate NDVI trends across the full Landsat catalogue) which focus on the insights which can be gained from the long term seasonal phenometrics of vegetation-cover/hydration at the "Ben's Oasis" aquatic GDE. In addition, the aquifer system and associated hydrogeological conceptualisation which "Ben's Oasis" is dependent upon is different to the WWS aquifer system. Detailed work is currently being undertaken to better understand the conceptualisation of the site and the characteristics of the groundwater system and associated discharge. The outcomes of this work will be important for enabling a better understanding of the nature of the riparian habitats present at the spring.

6.2. Significant riparian flora and vegetation values within the greater Hope Downs 1 Area

Weeli Wolli Springs

Outside of the Study Area and more broadly within the Greater Hope Downs 1 locality, significant riparian flora and vegetation values predominantly occur in the Weeli Wolli Springs area. Weeli Wolli Springs represents a large scale aquatic GDE formation which also supports substantial obligate terrestrial GDV formations and refugial and relictual flora throughout the springs.

6.3. Significant riparian vegetation values in the broader locality

The distribution of significant riparian vegetation aquatic GDE features in the broader locality are Mindy Mindy Springs which is approximately 25 km ENE of "Ben's Oasis", and 21 km ESE of WWS, Munjina Gorge Springs feature which lies approximately 75 km NW of "Ben's Oasis" and 65 km NW of WWS. Both of these features are sub-regionally and likely regionally significant features with some of the highest diversity of restricted and likely relictual/refugial hydrophytic and mesophytic taxa in the Pilbara.

For other limited features (i.e., broadly obligate riparian vegetation) the following are likely to possess some relatively permanent aquatic GDE type habitats within proximity to the Study Area:

- Yandicoogina gorge springs occur approximately 11.5 km northwest of WWS, and 25 km north of "Ben's Oasis";
- west of Yandicoogina gorge are two other, less well known features occurring 12 and 20 km, located further along the northern edge of the Hancock Range which these features are positioned along.
- Similar quality features (some of which are generally larger) occur approximately 19km to the east of WWS on a number of the tributaries of Mindy Mindy Creek. Some other similar quality, but now impacted features occur on parts of Marillana Creek to the northwest of WWS, next followed by a small scale but significant feature on an unnamed creek approximately 30 km's to the east of WWS.

- Finally, to complete the list of upper Tier 2 features in a 50 km radius of the Study Area, the lower reaches of Coondiner creek support significant aquatic GDE's along with some of the smaller tributaries to Coondiner in that area also supporting somewhat lower quality but poorly known features.

6.4. Key findings of the study

The majority of the riparian communities in the Study Area well represented and highly ephemeral riparian ecosystems, occurring on moderate to occasionally major sized drainage and supporting open woodlands to woodlands of mixed facultative phreatophytic species. Within the development envelope, riparian communities are primarily restricted to moderate sized and highly ephemeral drainage systems supporting open woodlands (predominantly low stature) of the low level facultative phreatophyte *Eucalyptus victrix*. Within the Study Area, the spring, aquatic GDE and supported riparian communities at the unofficially named "Bens Oasis" represent the only high value riparian features. Despite this, the value of this area is likely to be significantly lower than that of the nearby WWS's, regardless of the changes realised there in recent years.

Across the Study Area, significant riparian flora was generally lacking outside of a group of mesophyte/hydrophyte species detected in the "Ben's Oasis" area. Instead, riparian habitats across the Study Area generally only supported relatively well represented, low abundance populations of low to moderate level mesophytes. Within the development envelope, only low-level riparian indicator species were detected and in general this was coupled with a dominance of ephemeral riparian taxa, particularly within PMC. Instead, the P2 flora species *Aristida lazaridis* was the significant riparian flora species of the development envelope, and its presence in the area is likely connected to the delivery of fine basaltic origin sediments from the upstream Fortescue Group lithologies which is has a demonstrated affinity with.

Vegetation mapped by this study as representing GDV of moderate to high likelihood was also lacking within the Study Area outside "Ben's Oasis". In fact, all the vegetation units mapped to occur within the development envelope were classed as 'Low' GDV likelihood and lower. These conclusions find support in the existing groundwater monitoring data within the area. Consequently, the applied likelihoods and the trends they indicate are reasonable.

In terms of restriction, mapped vegetation communities (C1A, and C2A units) in the Study Area were found to be restricted, and as such confirms that the "Ben's Oasis" area clearly supports the most significant riparian ecosystems of the Study Area. Furthermore, this feature and particularly the extent of the C1A vegetation unit and more specifically where this unit occurs around the only permanent pool confidently recorded in the Study Area; represents the only clear aquatic GDE occurrence in the Study Area. Other vegetation communities with may be locally restricted are C4C, C4Bx-1, C3c and C4Bx-2, this could be attributed to detailed nature of the targeted mapping completed for purpose of the Riparian Values Assessment.

The remainder of the riparian vegetation units mapped in the Study Area are well represented, containing highly ephemeral and sparsely vegetated units.

The riparian surface water mapping exercise which was conducted provided insight into restricted habitats. In general, outside the cluster of features present in the "Ben's Oasis" area, significant and persistent surface water was generally lacking from the riparian Study Area. Furthermore, while some persistent pool water bodies are mapped in the Study Area (outside "Ben's Oasis"), they are both outside of the Development Envelope and likely to be supported by surface water or very small scale and seasonal flow derived surficial aquifers which are highly unlikely to be influenced by the proposal.

None of the riparian ecosystems and communities mapped within the development envelope as part of this study possess features/characteristics which are consistent with them representing 'Major Drainage'. The previous guidance, which has often led to major ephemeral drainage features automatically being assigned at least high local significance ratings (Section 5.4.1), is deemed inappropriate for the level of rigour and detail which this assessment applies. Instead, catchment characteristics, ecohydrological trends and flora and vegetation survey data was considered when classifying the drainage and allocating ecotypes and representation of these units in the area. .

7. Conclusions

The riparian ecosystems and associated vegetation communities distributed throughout the Study Area, and particularly within the development envelope, are generally well represented locally and sub-regionally. They are well represented and possess 'Low' to Very-Low' potential to represent GDV/GDE's.

The "Ben's Oasis" area supports an aquatic GDE and is a restricted ecosystem in the Study Area, and likely possessing sub-regional significance. This feature sits outside the development envelope and hydrogeological modelling suggests it is disconnected from the hydrological influence of the proposal. The resulting hydrological risk posed to this riparian system is considered to be very low. While the "Ben's Oasis" feature is linked to WWS through its PEC status, the floristic composition present is substantially different to that at WWS's in key life-forms, particularly with respect to highly sensitive aquatic macrophytes and hydrophytes. This fact may determine that the risk faced by changes to the aquatic habitats there is significantly reduced.

Persistent surface water is generally absent from the development envelope and apart from various water bodies and a permanent pool in the "Ben's Oasis" area, they are highly restricted within the Study Area.

Based on these conclusions and distribution of riparian vegetation in the Study Area, the activities associated with the proposal do not appear to pose a significant risk to riparian ecosystems and values in the Hope Downs 1 area. Indirect risks to riparian ecosystems in the area are predominantly restricted to weed incursion, dust deposition and disturbance related fine sediment transport/deposition. These risks are considered low within the Study Area, but dust and particularly sediment deposition should be considered where infrastructure is placed close to tributaries of WWC which occur upstream of "Bens Oasis".

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9. Appendices

Appendix A: Vegetation structure and condition scale used for vegetation description and mapping formulated within this study.

Vegetation Structure and Condition Scale

Vegetation Structural Classes*

Stratum	Canopy Cover (%)				
	70-100%	**30-70%**	**10-30%**	**2-10%**	**<2%**
Trees over 30 m	Tall closed forest	Tall open forest	Tall woodland	Tall open woodland	Scattered tall trees
Trees 10-30 m	Closed forest	Open forest	Woodland	Open woodland	Scattered trees
Trees under 10 m	Low closed forest	Low open forest	Low woodland	Low open woodland	Scattered low trees
Shrubs over 2 m	Tall closed scrub	Tall open scrub	Tall shrubland	Tall open shrubland	Scattered tall shrubs
Shrubs 1-2 m	Closed heath	Open heath	Shrubland	Open shrubland	Scattered shrubs
Shrubs under 1 m	Low closed heath	Low open heath	Low shrubland	Low open shrubland	Scattered low shrubs
Hummock grasses	Closed hummock grassland	Hummock grassland	Open hummock grassland	Very open hummock grassland	Scattered hummock grasses
Grasses, Sedges, Herbs	Closed tussock grassland / bunch grassland / sedgeland / herbland	Tussock grassland / bunch grassland / sedgeland / herbland	Open tussock grassland / bunch grassland / sedgeland / herbland	Very open tussock grassland / bunch grassland / sedgeland / herbland	Scattered tussock grasses / bunch grasses / sedges / herbs

* Based on Muir (1977), and Aplin's (1979) modification of the vegetation classification system of Specht (1970): Aplin T.E.H. (1979). The Flora. Chapter 3 In O'Brien, B.J. (ed.) (1979). *Environment and Science*. University of Western Australia Press; Muir B.G. (1977). Biological Survey of the Western Australian Wheatbelt. Part II: Vegetation and habitat of Bendering Reserve. *Records of the Western Australian Museum*, Suppl. No. 3; Specht R.L. (1970). Vegetation. In: *The Australian Environment*. 4th edn (Ed. G.W. Leeper). Melbourne.

Vegetation Condition Scale*

E = Excellent (=Pristine of BushForever) Pristine or nearly so; no obvious signs of damage caused by the activities of European man.
VG = Very Good (= Excellent of BushForever) Some relatively slight signs of damage caused by the activities of European man. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds such as **Sonchus oleraceus* or **Cucumis* spp., or occasional vehicle tracks.
G = Good (= Very Good of BushForever) More obvious signs of damage caused by the activities of European man, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or by selective logging. Weeds as above, possibly plus some more aggressive ones such as **Cenchrus* spp.
P = Poor (= Good of BushForever) Still retains basic vegetation structure or ability to regenerate to it after very obvious impacts of activities of European man, such as grazing, partial clearing (chaining) or frequent fires. Weeds as above, probably plus some more aggressive ones such as **Cenchrus* spp.
VP = Very Poor (= Degraded of BushForever) Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species including very aggressive species such as **Prosopis* spp.
D = Completely Degraded (= Completely Degraded of BushForever) Areas that are completely or almost completely without native species in the structure of their vegetation; ie. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

* Based on Trudgen M.E. (1988). A Report on the Flora and Vegetation of the Port Kennedy Area. Unpublished report prepared for Bowman Bishaw and Associates, West Perth.

Appendix B: Area calculations for Riparian Vegetation Units mapped inside and outside of the Development Envelope.

Riparian Vegetation Units	Astron Vegetation Unit	Degrees of Restriction	Vegetation Extent Inside the Development Envelope (ha)	Vegetation Extent Outside Development Envelope in Study Area (ha)	Total Area (ha)	Amount of similar vegetation in RTIO regional database (ha)
C1A	-	Restricted	0	6.48	6.48	2616.81
C2A	-	Restricted	0	23.74	23.74	1,466.58
C2B	-	Restricted	0	2.89	2.89	392.11
C3A	-	Restricted	0	106.85	106.85	140.3
C3B	-	Well represented	0	98.95	98.95	7,556.01
C4C	-	Restricted	0	1.41	1.41	1.41
C4Bx-1	D5	Restricted	10.29	39.29	49.58	2537.63
C3C	-	Restricted*	0	21.15	21.15	381.94
C4B	D4	Well represented	28.24	58.42	86.66	14,996.45
C4Bx-2	D4	Restricted*	18.34	69.97	88.31	381.94
C5B	D5	Well represented	63.72	17.27	80.98	20,253.46
C5C	-	Well represented	24.5	15.92	40.43	14,428.97
CF-X1	-	Well represented	284.09	284.09	284.09	1408.87
CF-X2	D7	Well represented	46.53	404.07	450.60	9561.37
CF-X3	D7	Well represented	185.16	309.74	494.90	9,782.50

Restricted* based on the comparison of targeted and detailed mapping completed compared to database records which contains broader baseline vegetation mapping units.

Appendix C: Restriction ratings of mapped riparian units

Vegetation unit	In/Out of proposed Development Envelope	Occurrences	Drainage Size Classification	PREC ecotype	Representation of PREC type & community	Notes to support determination of restriction
C1A	**Outside**	**1**	**Moderate**	**Type 2**	**Restricted**	**A spring community (PREC type 2A) mapped occurrence of the Weeli Wolli Springs PEC and supports a GDE.**
C2A	**Outside**	**1**	**Moderate**	**Type 2**	**Restricted**	**Associated with a spring (PREC type 2C), associated with a mapped occurrence of the Weeli Wolli Springs PEC, supports GDV.**
C3A	Outside	1	Major	**Type 3**	**Restricted***	Major Drainage, associated with the main tributary of Weeli Wolli Creek.
C2B, C4C	Outside	2	Moderate	**Type 3**	**Restricted***	Restricted communities, C2B: restricted riparian assemblage associated with a heritage site and supports atypical ecohydrology, C4C: restricted riparian assemblage associated with a deeply incised gully, and an uncommon riparian vegetation assemblage.
C4Bx-1	Inside	1	Moderate	**Type 3**	**Restricted***	Moderate drainage dissecting basalt ranges which increase residence time of surface water flows. Additionally, riparian assemblages with an abundant cover of *Melaleuca bracteata* in the understorey are uncommon in the Pilbara.
C3B		1	Moderate	**Type 3**	Well Represented	Common riparian unit on moderate drainage dissecting Hamersley group geology
C3C	Outside	1	Moderate	**Type 3**	Well Represented	Common riparian unit on moderate drainage dissecting Hamersley group geology
C4B, C4Bx-2	Inside	2	Moderate	**Type 3**	Well Represented	Common riparian unit on moderate drainage dissecting Hamersley group geology
C5B, C5C	Inside	2	Moderate	**Type 4**	Well Represented	Common riparian unit on moderate drainage dissecting Hamersley group geology
CF-X1	Outside	1	Major to Moderate	**Type 4**	Well Represented	Common floodplain unit on moderate drainage dissecting Hamersley group geology
CF-X2, CF-X3	Inside	2	Moderate	**Type 4**	Well Represented	Common floodplain unit on moderate drainage dissecting Hamersley group geology

Appendix D: Vegetation units, descriptions and mapping notes for all Riparian vegetation types mapped as part of the current study. Note: Sites from historical surveys are indicated by: [1] Astron (2020), [2] Mattiske (2008), [3] Mattiske (2010), [4] Mattiske (2019).

Final Unit (Standardised riparian classification)	Initial New Vegetation Unit	Previous Unit (Astron or Mattiske)	Landscape Position	Vegetation Description			Sites	Notes
				Upper Strata	Middle Strata	Lower Strata		
C1A	D14a	MR-C4 /STC-C1[2]	Creekline	*Eucalyptus camaldulensis* subsp. *obtusa*, and *Melaleuca argentea* open forest	*Acacia citrinoviridis, A. coriacea* subsp. *pendens, Melaleuca glomerata* tall open shrubland over *Dodonaea viscosa* subsp. *mucronata*, *Gossypium sturtianum* var. *sturtianum*, *Stylobasium spathulatum* shrubland	**Cenchrus ciliaris*, *Themeda triandra* tussock grassland and *Cyperus vaginata* isolated sedges	WWJ2 WW22[4], WW23[4]	Represents the key areas supporting clearly obligate terrestrial GDE/GDV vegetation (i.e., OPS dominated/co-dominated) fringing areas of permanent to persistent-ephemeral surface water associated with the feature informally named "Ben's Oasis" (and the associated outlier occurrence of the Weeli Wolli springs PEC), and its associated on-flow areas. Also represents areas where mature *Melaleuca argentea (*OPS) *populations form the* dominant overstorey species.
C2A	D14b	MR-C4 /STC-C1[2]	Creekline	*Eucalyptus camaldulensis* subsp. o*btusa* woodland (variable - at times open wood/open forest)	*Acacia citrinoviridis*, *A. coriacea* subsp. *pendens*, *Melaleuca glomerata* tall open shrubland over *Dodonaea viscosa* subsp. *mucronata*, *Gossypium sturtianum* var. *sturtianum, Stylobasium spathulatum* open shrubland	*Cyperus vaginata* isolated sedges and **Cenchrus ciliaris*, *Eulalia aurea, Themeda triandra* isolated tussock grasses	CB09[2]	Represents dense likely obligate phreatophytic GDE/GDV vegetation (i.e., FPS dominated) fringing and associated with "Ben's Oasis" (and its broader on-flow areas) and locally shallow groundwater, but generally not possessing *Melaleuca argentea* or possessing it purely as an associated species (generally young). Instead FPS species generally dominate the overstorey.
C2B	D12	D4[1] and MF-C5[3]	Creekline	*Eucalyptus camaldulensis* subsp. *obtusa* woodland	*Melaleuca bracteata, Acacia bivenosa, Gossypium sturtianum* var. *sturtianum* open shrubland	**Cenchrus ciliaris, Eulalia aurea*, *Themeda triandra* tussock grassland	WW1 MNMH06[1]	Represents a small section of Weeli Wolli Creek adjacent to a significant heritage site, possessing some persistent pool pools, an increased abundance of Eucalyptus camaldulensis and an area possessing *Melaleuca bracteata as a* dominant understorey species
C3A	D15	D4[1] and STC-C1[2]	Creekline	Eucalyptus camaldulensis subsp. obtusa, E. victrix woodland	*Acacia citrinoviridis, A. coriacea* subsp. *pendens*, *Atalaya hemiglauca* tall open shrubland over *Corchorus crozophorifolius, Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186), *Acacia pyrifolia* low open shrubland	*Themeda triandra, *Cenchrus ciliaris, Bothriochloa ewartiana* open tussock grassland to tussock grassland and *Triodia longiceps* open hummock grassland	WW11, WW12-V&R, WW13-V&R, WWM1 CB01[2], CB04[2], CB07b[2], HC069[2]	Represents the north-east extent of Weeli Wolli Creek in the Study Area, where several tributaries of WWC combine and the riparian zone receives more than 500km2 of catchment such that the creek represents Major Drainage.
C3B	D4	STC-C1 / ATA-C2[2]	Creekline	*Eucalyptus camaldulensis* subsp. *obtusa*, *E. victrix* woodland (+/- Open woodland)	*Petalostylis labicheoides, Androcalva luteiflora, Gossypium sturtianum* var. *sturtianum* open shrubland	*Themeda triandra, Eulalia aurea*, (**Cenchrus ciliaris*) tussock grassland	WW3, WW4, WW5, WW6, WW7-R	Central reaches of the western arm of Weeli Wolli Creek within the Study Area and occurring on the downstream side of the Fortescue formation catchment boundary.
C3C	D11	D4[1]	Creekline	*Eucalyptus victrix* (*E. camaldulensis* subsp. *obtusa*), *E. xerothermica* woodland (to open woodland)	Mulga (*Acacia aneura* complex) tall open shrubland over *Acacia pyrifolia, Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186), *Petalostylis labicheoides* open shrubland	*Bothriochloa ewartiana, Cymbopogon ambiguus, Eulalia aurea* tussock grassland	PM4	Represents reaches of the south-western extent of Pebble Mouse Creek within the Study Area where *Eucalyptus camaldulensis* subsp. *obtusa* occurs more commonly but still doesn't represent a dominant overstorey species (*E. victrix* remains dominant). Also includes some sections of this creek not previously mapped or that were previously mapped as a combined floodplain without a separate core riparian zone unit identified
C4B	D9	D4[1]	Creekline	*Eucalyptus victrix* low open woodland (to woodland)	*Acacia citrinoviridis* (*Atalaya hemiglauca*) tall open shrubland over *Corchorus crozophorifolius, Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) low open shrubland	*Themeda triandra, Eulalia aurea*, **Cenchrus ciliaris* tussock grassland	PM7, Veg7 GH23[1], GHMNBE010[1], GHMNDR01[1], GHMNDR02[1], GHMNDR06[1], BHD-RJCF, SFJ-RMMG	Represents the downstream reaches and north-east extent of Pebble Mouse Creek within the Study Area. Most of this reach of pebble mouse creek generally possesses quite a broad floodplain (500-700m wide) and more braided low-flow/high-flow channel assemblages such that the riparian community in the low-flow channels being quite sparse and strongly ephemeral such that E. victrix is generally dominant but sparse and of low stature in the overstorey.
C4C	D18	STC-C1 / ATA-C2[2]	Gorge	*Corymbia ferriticola* and *Eucalyptus victrix* low open woodland	*Acacia pruinocarpa, A. citrinoviridis* and *Atalaya hemiglauca* tall shrubland over *Dodonaea pachyneura* open shrubland	*Eulalia aurea, Themeda triandra, Aristida burbidgeae* very open tussock grassland	WW7-V	Represents an approximately 300m stretch of Weeli Wolli Creek which dissects a ridgeline (Hamersley formation) such that the creekline is within an incised-gully/gorge for a short distance. In the most incised portion of the gully a persistent-ephemeral pool is supported over the rocky basement and associated boulder field. Presence of *Cyperus cunninghamii* and *Tinospora smilacina are indicative of the somewhat mesic conditions in the gully.*

Final Unit (Standardised riparian classification)	Initial New Vegetation Unit	Previous Unit (Astron or Mattiske)	Landscape Position	Vegetation Description			Sites	Notes
C5B	D5	D5[1]	Creekline	*Eucalyptus xerothermica* low open woodland	*Petalostylis labicheoides, Acacia maitlandii, A. pyrifolia* tall open shrubland to tall shrubland over *Androcalva luteiflora* scattered shrubs	*Triodia longiceps* very open hummock grassland to open hummock grassland with *Themeda triandra, Eulalia aurea* open tussock grassland to tussock grassland and **Bidens bipinnata* scattered herbs	GH01[1], SC002[2], H20093, H20103, HD22[1], HDR18[1], MNMH28[1]	Vegetation mapping consistent with Astron (2020). Represents vegetation on smaller tributaries (lower end moderate sized drainage) of the upper reaches (eastern tributary) of Pebble mouse Creek, where low flow channels are not well defined and as such a broad floodplain/channel assemblage is mapped as a combined riparian vegetation unit.
C5C	D8	D8[1]	Creekline	*Eucalyptus xerothermica* scattered low trees to low open woodland	*Acacia aptaneura, A. catenulata* subsp. *occidentalis* tall open shrubland to tall open scrub	*Triodia pungens* scattered hummock grasses to very open hummock grassland with *Themeda triandra* very open tussock grassland to open tussock grassland		Vegetation mapping consistent with Astron (2020). Represents vegetation on smaller tributaries (lower end moderate sized drainage) of the upper reaches (western tributary) of Pebble mouse Creek, where low flow channels are not well defined (or possess similar vegetation) and as such a broad floodplain/channel assemblage is mapped as a combined riparian vegetation unit.
C4Bx-1	D13	D4 /D5[1] and MF-C5[3]	Creekline	*Eucalyptus victrix, E. xerothermica* woodland (to open woodland)	*Petalostylis labicheoides, Gossypium sturtianum* var. *sturtianum, Androcalva luteiflora* (*Melaleuca bracteata* +/-) open shrubland	*Eulalia aurea, Bothriochloa ewartiana, Themeda triandra* tussock grassland	MN01, Veg2 HD17[1], HD18[1], MNMH02[1], GH04[1], H2061[3], H2093[3], H2103[3], H2109[3], H2118[3]	Represents the south-west extent of Weeli Wolli Creek in the Study Area where *Melaleuca bracteata* sporadically occurs as a dominant understorey species. Also contains *Melaleuca glomerata*
C4Bx-2	D10	D4[1]	Creekline	*Eucalyptus victrix, E. xerothermica* low open woodland (to woodland)	Mulga (*Acacia aneura* complex) tall sparse shrubland over *Acacia pyrifolia, A. dictyophleba, *Vachellia farnesiana, Petalostylis labicheoides* low open shrubland	*Themeda triandra, Bothriochloa ewartiana, Eulalia aurea* tussock grassland	PM1, PM2, PM3, PM5, PM9, Veg4 BHD03, BHD08, HD31[1]	Represents the south-west extent of Pebble Mouse Creek in the Study Area where *Eucalyptus camaldulensis* subsp. *obtusa* sporadically occurs. Also includes some sections not previously mapped or that were mapped as floodplain without a separate creekline unit identified
CF-X1	DF16	D7[1] and ATC-M2[2]	Floodplain	*Eucalyptus xerothermica* (*E. victrix* +/-) scattered trees	Mulga (*Acacia aneura* complex), *A. pruinocarpa* and *A. citrinoviridis* (*A. coriacea* subsp. *pendens* +/-) tall open shrubland (variable)	*Themeda triandra* open tussock grassland and *Triodia pungens* sparse hummock grassland	HC036[2], SJ003[2]	Includes additional areas where no floodplain was previously delineated (middle WWC). Now represents floodplains associated with Weeli Wolli Creek. In the lower areas (Major Drainage), Eucalyptus camaldulensis is a common addition in and around the high flow channels.
CF-X2	DF17	D7[1]	Floodplain	*Eucalyptus xerothermica* scattered low trees	*Acacia aptaneura, A. pruinocarpa* scattered tall shrubs to tall shrubland	*Triodia longiceps* open hummock grassland to hummock grassland and *Themeda triandra*, *Bothriochloa ewartiana*, *Chrysopogon fallax* open tussock grassland to tussock grassland	PM5-R, Veg3, Veg5, Veg6 HC007[2], SFJ38, SFJ-RMMC, SFJ-RMMD	Represents the floodplain associated with Pebble Mouse Creek in the south-west of the Study Area. Differs in the reduced occurrence of *Acacia citrinoviridis*. Some sections not previously mapped within the current targeted area
CF-X3	DF7	D7[1]	Floodplain	*Eucalyptus xerothermica* scattered low trees	*Acacia citrinoviridis, A. aptaneura, A. pruinocarpa* scattered tall shrubs to tall shrubland	*Triodia longiceps* open hummock grassland to hummock grassland	PMJ1 GH22[1], GH25[1], SFJ11, SFJ45, BHD12, SFJ42	Vegetation mapping consistent with Astron (2020), although a restricted distribution of the previous extent confined to the floodplain associated with Pebble Mouse Creek in the north-east of the Study Area. Contains *Acacia citrinoviridis* as a dominant middle strata species

Appendix E: Defining riparian vegetation

The following definitions represent a wholistic approach to defining the riparian zone, key types of riparian vegetation, and particularly riparian vegetation formations of increasingly elevated value which are worthy of increased management and potentially indicative of habitats supporting fauna/biodiversity values of even higher value. The proposed definitions would be appropriate for informing and guiding flora and vegetation surveys, informing Environmental Impact Assessment (EIA), and for inclusion within environmental approval documentation, as they are clear, prescriptive and serve multiple purposes/contexts. For the management of EIA considering clearing limits, it is proposed that riparian vegetation possessing elevated values which should be conditioned is likely to align with the definition of 'riverine' and 'riparian vegetation'.

Riparian zone

The riparian zone within drainage systems generally supports vegetation of increasing structural complexity as compared to surrounding landscapes. A series of drainage profile positions/features are generally present within the riparian zone. The location and characteristics of these profile features relate to fluvial processes such as surface flow regimes and are responsible for establishing key profile positions within the riparian zone. These drainage profile features typically occupy the following positions/zones:

- the bank-to-bank zone, which includes the low flow channel, immediate banks and any internal bench formations.
- the broader bank and adjacent terrace zones which occur beside and away from the main channel, which often support denser vegetation (i.e., riparian vegetation, which may extend beyond the bank).
- the floodplain zone beyond the terrace/bank - where vegetation density clearly transitions to a lower density), which includes:
- the broader floodplain.
- other high flow channels (these features can support higher density riparian vegetation).
- smaller channelised features (e.g claypans, braided channels) which may occur on the floodplain and support differing vegetation.

Internally draining features

These features are characterised by closed topography which generally do not drain externally (to the sea). These internally draining features form floodplain like areas where there is generally a lack of larger channelised fluvial habitats. Higher density vegetation will tend to occur in low points of these internally draining floodplain. In such habitats, where inundation occurs more regularly, ephemeral wetlands or similar can form. The vegetation in these areas can either be classed as 'floodplain and associated' or even 'riparian', depending on the complexity and density of flora species present.

Key types of riparian vegetation

Riverine vegetation

Riverine vegetation are typically highly complex and contain hydrophytic riparian vegetation. Riverine vegetation is likely dependent on either surface water flow regimes or groundwater sources of an elevated frequency or accessibility to provide an elevated level of water availability and persistence. These hydrological regimes help to establish flora diversity, structural complexity, and increased habitat quality, which in-turn supports valuable biotic assemblages such as fauna.

Riverine riparian vegetation will likely support mature stands of obligate phreatophytes such as *Melaleuca argentea* and/or *Sesbania formosa* or other stands of obligate riparian vegetation typically in the form of an open forest of *Eucalyptus camaldulensis*, over a mesic/hydric understorey assemblage. Within riverine vegetation, areas with persistent surface water will possess elevated biodiversity values often including refugial or relictual species, a high diversity of hydrophytic flora comprised of submerged and emergent macrophytes, herbs, and tussock grasses.

Within the Pilbara, this type of riparian vegetation is likely to occur within larger fluvial systems supporting scattered semi-permanent to permanent surface water features, broad multi-channel fluvial profiles, and

broader floodplains. Riverine vegetation is mostly likely to occur in regional drainage features with greater than 1500 km^2 of reporting catchment i.e., rivers or upper-order creek systems. At a minimum, riverine vegetation is likely to occur on major drainage with greater than 500 km^2 of reporting catchment (inclusive of large creeks and above). However, equivalent vegetation formations can also occur on smaller drainage systems, where shallow groundwater sources are responsible for abundant and stable moisture sources.

It is important to note that the riverine equivalent of riparian vegetation will not always be present in larger drainage systems, or other sized drainage systems. More typically, drainage systems will support 'riparian vegetation' and 'floodplain and associated vegetation', these are described below.

Riparian vegetation

In general, riparian vegetation includes vegetation which possesses an elevated degree of structural complexity and value. An annual to intra-annual hydrological regime which supports the establishment, at a minimum* of an open woodland density of approximately 2-10% cover of keystone overstorey riparian species. These keystone species include *Melaleuca argentea* (MA), *Eucalyptus camaldulensis* (EC), *Eucalyptus victrix* (EV), and potentially** *Corymbia candida* or *Eucalyptus xerothermica* over an understorey assemblage typically dominated by mesic perennial riparian species (i.e., at least a selection of species listed in the Pilbara Riparian Ecological Framework (PREF)) over at least a tussock grass co-dominated grass/herb layer.

Riparian vegetation will typically occupy the low flow channel and associated habitats, including both bank, internal benches, and inner terrace positions. As vegetation does not generally grow within the confines of sharp boundaries, blended vegetation or ecotones can occur. In areas where alluvial substrates are highly favourable or where groundwater is shallow or associated with rivers, riparian vegetation as described, can extend to the terrace, high flow channels and even parts of the floodplain. Within larger drainage systems, riparian vegetation can occur on high flow channels dissecting the floodplain, more often occurring when the associated vegetation is aligned with a clearly defined channel or bank formation.

Internally draining settings

In such habitats and where there is generally an absence of larger channelised fluvial habitats, while uncommon, riparian vegetation is most likely to occupy catchment low points which support higher inundation frequencies. These areas can support a higher density of vegetation along with ephemeral wetland flora assemblages due to increased water availability in the landform.

Floodplain & associated vegetation

These vegetation types occur on the floodplain and are much sparser, less complex and are less hydrologically sensitive than drainage derived vegetation. Floodplain and associated vegetation types generally occur on broad floodplain landforms which receive overland surface water flow or standing water accumulation approximately every two or more years. The vegetation assemblage in these areas will generally possess an overstorey component of a much lower density compared to vegetation in the low/high flow channel zones.

The overstorey of these vegetation units will generally be dominated by a lower density of less clearly defined riparian tree species other than MA, EC and EV, such as other *Corymbia* & *Eucalyptus* species, *Corymbia hamersleyana and Eucalyptus xerothermica* and *Acacia citrinoviridis* as well as *Hakea* and other *Acacia* species. This can include a low abundance of less than 2% cover of key riparian species which may also include *E. victrix* and occasionally *E. camaldulensis*. The understorey of these vegetation units will typically include ephemeral to xerophytic perennial species over mixed ephemeral tussock/hummock grassland and/or herblands.

Functionally, vegetation which occurs on floodplains do not typically represent 'riparian vegetation'. However, these areas should still be considered as part of the riparian zone and consequently floodplain vegetation should be considered as 'associated vegetation'.

*In general, riparian vegetation is typically represented by higher density overstorey vegetation (i.e., woodland and above), however this is dependent on the fluvial characteristics of the drainage system being considered. The definition provided in this document aims to include the complete spectrum of riparian vegetation which typically establish on larger drainage systems. Moderate and minor sized drainage systems have been included despite not typically supporting riparian vegetation. In addition, varying density of overstorey

vegetation such as open woodland have been included in this definition as these lower vegetation densities can still possess elevated riparian zone biodiversity values.

**As either co-dominant constituents along with the EC, EV, or MA. Where these species are singularly dominant, they could potentially be representative of riparian vegetation where a clear open woodland (or greater) are associated with surface water channelling or ponding features. There are other keystone mesophytic species listed in the PREF which possess similar characteristics, which could be considered to represent an assemblage of riparian vegetation.

Appendix F: Drainage Classification and Characteristics

Relevant Terms/definitions/References:	*GDV presence (i.e. vegetation clearly representing Groundwater Dependent Vegetation) is typically determined by considering the presence of obligate phreatophytes, obligate phreatophytic vegetation, complex vegetation structure, consideration of surface water regime, and likely proximity of groundwater.
	**Potential GDV presence is generally determined purely by establishing the presence of known keystone Phreatophytes in the drainage system.
	***Focus area is the general portion of the drainage system in question which occurs in the Study Area/area of interest.
	See relevant references below to drainage size classes used here from the surface hydrology discipline.

Drainage Size Ranking	Catchment characteristics		Drainage size criteria & characteristics	
	Headwaters Local /Non-local	Catchment size reporting to focus area***.	Species based Criteria	Presence of 'GDV'* **Or** 'Potential GDV'**
Major Drainage - Regional - (Generally rivers, but can include very large Creeks)	Derived Regionally Upstream catchment distributed regionally (i.e. crossing multiple localities) before reporting to focus area.	~ >1500 km^2 (generally >2000 km^2)	Key indicator species of Major Drainage (i.e. rivers, major creeks, and their associated persistent pools) are present and dominant. Obligate phreatophytes (namely *Melaleuca argentea*) are common and intermittently dominant.	The associated vegetation is almost always representative of potential GDV or possessing reaches clearly representative of GDV.
Major Drainage	Derived Non-locally Headwaters of catchment clearly positioned outside Study Area and locality (i.e. derived non-locally) before reporting-to/intersecting focus area.	~ 400 km^2 - 1500 km^2 (generally >500 km^2 and up to 2000 km^2)	Key indicator species of Major Drainage (i.e. rivers, major creeks, and seasonally wet locations and their associated persistent pools) are present and dominant in at least bed/bank/bench fluvial positions. Typical intermediate-level riparian indicator species are also common.	The associated vegetation is almost always representative of potential GDV, and commonly possesses extensive portions of vegetation clearly representative of GDV.
Moderate drainage	Typically derived locally Headwaters of catchment generally positioned locally (i.e. arising in or in the vicinity of the Study Area) or in some cases extending into areas directly adjacent to the locality.	~ 25 - 400 km^2 (potentially up to 500 km^2)	Typical intermediate-level riparian indicator species are generally dominant. Key indicator species of major drainage are often still present but are generally not dominant and are more typically exhibit a scattered to rare distribution in the riparian zone.	The associated vegetation is often representative of potential GDV and can possesses small portions of vegetation clearly representative of GDV.
Minor Drainage	Derived Locally Headwaters of catchment clearly positioned locally (i.e. arising in the vicinity of the Study Area).	~ <25 km^2 (generally <10 km^2)	A combination of low-level riparian taxa and species typically associated with more xerophytic (to vadophytic) habitats (i.e. hills and/or plains) are generally co-dominant. Typical intermediate-level indicator species are at times present but dominant. Species indicative of major drainage are generally rare to absent.	The associated vegetation is rarely representative of potential GDV. – (While increasingly rare, minor drainage can possess very small portions of vegetation clearly representative of GDV - typically where drainage interacts with variable topography and basement lithology).

References:
Hydrological recipes: estimation techniques in Australian hydrology - Grayson et al., (1996)
Estimation of peak flows for small to medium sized rural catchments - Pilgrim (1987)
ARR Project 13 – Goyen et al., (2014)
ARR Project 5 - Rahman et al., (2015)

Appendix G: Pool Classifications

Water source characteristics		Pool Type	Definition and characteristics
Water source	**Temporal characteristics**		
Groundwater (GW) fed pools (typically regional groundwater)	***Permanently* connected to GW**	**Permanent Pools**	Permanent pools represent surface expressions of groundwater and rely on the groundwater interacting with the surface. They can be either a continuous expression of the groundwater table at the surface or result from groundwater discharge at a specific point or zone of groundwater impedance. In some cases, "permanent" pools may experience short periods of low to no groundwater contribution, typically late in the year, or during drought periods, but in general despite such periods of evaporation are rarely completely emptied. For habitat purposes and biological value, a permanent pool will not necessarily need to meet traditional hydrological size and depth criteria. Instead, it should consistently contain surface water, even if only of a very small spatial extent, and during droughts, at least moist sediments should be evident at the base of the pool. In the arid Pilbara climate, genuinely permanent pools are rare, with many initially considered permanent turning out to be semi-permanent. At a minimum, permanent pools will typically be accompanied by the facultative phreatophyte *Eucalyptus camaldulensis*, and in many cases (but not always) will be associated with populations of obligate phreatophytes such *as Melaleuca argentea* (and at times *Sesbania formosa*). Other useful indicators for interpreting pool permanence include restricted/refugial and relictual submerged and emergent macrophytes, along with key perennial mesophytic shrubs. Ideally, the determination of pool permanence should be made utilising appropriate groundwater data or modelling. Alternatively, pool permanence can be interpreted from the outcomes of regular late season visits over multiple years, combined with aerial imagery or remote sensing analyses. In addition, interpretations of permanence can be supported by the use of key hydrophytic and hyporheic indicator species.
	Seasonally connected to GW	**Semi-Permanent Pools**	Semi-permanent pools are surface water features with seasonal or intermittent connectivity to a groundwater table or source. They are typically present when the groundwater table is above the surface at a location, persisting for a period after the groundwater drops below the surface (annually), either slowly evaporating or quickly disappearing upon disconnection from the groundwater source. Confirming intermittent or seasonal groundwater contribution is important for the identification of this pool type.
Seasonal rainfall derived surface water (SW) pools	**Temporally persistent rainfall derived surface water pools**	**Persistent Pools** **(ephemeral pools with extended hydroperiods)**	Persistent pools are derived from ephemeral rainfall-driven surface water flows but resist quick dissipation or drainage into underlying sediments/lithology or evaporation to the atmosphere. This pool type typically perches over sediments or basement rock and exhibits prolonged existence without rapid evaporation. They persist above the ground surface for extended periods, often throughout and beyond the wet season, and potentially into or throughout winter. In some settings, increasingly persistent examples of this pool type may have some temporary alluvial baseflow contribution. Persistent pool pools tend to remain present due to; consistent shading, impervious sediments supporting prolonged perching, presence over relatively impermeable basement lithology, favourable basement morphology encouraging seasonal perching, location at the base of incised rocky gullies or gorges with topographical and aspect-related shading, and various other topographic or ecophysical circumstances that reduce evaporation and infiltration.

			In some years and settings, persistent pools can remain throughout the year, but where they are wholly rainfall or surface-flow derived but sustained by volume and reduced evaporation and infiltration, these pools should continue to be categorised as persistent, as evaporation occurs, these pools will deplete in the absence of contributions from groundwater. However, it is important to record these pools with extended hydroperiods as these areas could support other biotic and abiotic values.
	Temporary, rainfall derived Surface water pools which typically persist for short periods after rainfall events	**Ephemeral Pools**	Ephemeral pools are short lived and can be widely dispersed after rainfall and surface flows, with their locations often varying unpredictably from year to year. Typically, these features either rapidly infiltrate/evaporate or are sustained by sub-surface flows for a short period, with their presence limited to the wet season months (December to March) or a few months following winter rainfall events.

Appendix H: Classifications of surface water mapped across the Study Area

Mapped Surface water Classification	Detailed surface water classification/Interpretation	Data source for surface water mapping and permanence interpretation	Relevant Notes	Notes relating to Remote sensing product - Sentinel Water Mask (SWM) Index persistence map (pixel values relate to the percentage of images where the 0.6 index threshold is met. Each pixel 10x10m).	Centroid - Easting	Centroid - Northing
Permanent Pool *	Permanent Pool - “Ben’s Oasis” main pool	Aerial photo interpretation, Field Observation, and groundwater monitoring	*Relatively Permanent pool, supported by monitoring with Mature Melaleuca argentea woodland to open forest. Essentially permanent, but not "Clearly Permanent". Some potential for pool to no longer receive groundwater discharge and dry out following an extended drought period.	No persistent pixels detected - pools clearly shrouded by vegetation. Some elevated SWM persistence here, patchy and influenced by vegetation (max 66%)	720349	7448634
Persistent pool +	Persistent pool Pool	Aerial photo interpretation, Field Observation, and groundwater monitoring	Showing signs of groundwater influence. Upstream of “Ben’s Oasis” permanent main pool - Mature MA woodland here	No persistent pixels detected - pools either too small or shrouded by vegetation - Elevated SWM persistence	720141	7448430
Persistent pool +	Persistent pool Pool (to semi-permanent)	Remote sensing, aerial photo interpretation & Field Observation	Basement (Hamersley Group) outcropping here	Max Pixel value 48 (6 pixels) - Elevated SWM persistence (max 75%)	718882	7444481
Persistent pool +	Persistent pool Pool (potentially greater)	Remote sensing, aerial photo interpretation & Field Observation	Basement (Hamersley Group) outcropping here	Max Pixel value 30 (9 pixels) - Elevated SWM persistence (max 73%)	718885	7444578
Persistent pool +	Persistent pool Pool (to semi-permanent)	Remote sensing, aerial photo interpretation & Field Observation	Basement (Hamersley Group) outcropping here	No persistent pixels detected - pools either too small or shrouded by vegetation - Minor Elevated SWM persistence	717983	7442899
Persistent pool +	Persistent pool Pool (to semi-permanent)	Remote sensing, aerial photo interpretation & Field Observation	Basement outcropping here	No persistent pixels detected - pools either too small or shrouded by vegetation - Minor Elevated SWM persistence	717915	7442705
Persistent pool +	Persistent pool Pool	Aerial photo interpretation and field observations	Basement outcropping here (? Wittenoom) - Some young Melaleuca argentea here	No persistent pixels detected - pools either too small or shrouded by vegetation - Minor Elevated SWM persistence	722547	7450034
Persistent pool +	Persistent pool Pool (parts potentially semi-permanent)	Remote sensing, aerial photo interpretation & Field Observation	Area showing groundwater influence. Mature Melaleuca argentea woodland here. Vegetation cover Constrains classification	No persistent pixels detected - pools shrouded by vegetation - Minor Elevated SWM persistence (vegetation clearly shrouding)	722097	7449729
Persistent pool	Persistent pool Pool	Remote sensing, aerial photo interpretation & Field Observation	Basement (Hamersley Group) outcropping here	Max Pixel value 8 (1 pixels) - Minor Elevated SWM persistence	717946	7442813
Persistent pool	Persistent pool Pool	Aerial photo interpretation and field observations	Basement (Hamersley Group) outcropping here	No persistent pixels detected - pools either too small or shrouded by vegetation -? Minor Elevated SWM persistence	715620	7448164
Persistent pool	Persistent pool Pool (To Ephemeral)	Remote sensing, aerial photo interpretation & Field Observation	Some young Melaleuca argentea here	No persistent pixels detected - pools either too small or shrouded by vegetation - Minor Elevated SWM persistence	722424	7449941
Persistent pool	Persistent pool Pool (To Ephemeral)	Remote sensing, aerial photo interpretation, groundwater monitoring & Field Observation	Downstream of “Ben’s Oasis” permanent main pool - More consistent end of Pool	Max Pixel value 33 (20+ pixels) - Elevated SWM persistence (max 72%)	720431	7448956
Persistent pool	Persistent pool Pool	Aerial photo interpretation and field observations	Basement outcropping here	No persistent pixels detected - pools either too small or shrouded by vegetation - Minor Elevated SWM persistence	719084	7445756
Persistent pool	Persistent pool Pool	Aerial photo interpretation and field observations	Basalt (Fortescue Group) basement outcropping here	No persistent pixels detected - pools either too small or shrouded by vegetation - Elevated SWM persistence (max 45%)	721739	7444210
Persistent pool	Persistent pool Pool	Remote sensing, aerial photo interpretation & Field Observation	Basalt (Fortescue Group) basement outcropping here	No persistent pixels detected - pools either too small or shrouded by vegetation - Some Elevated SWM persistence (max 33%)	721775	7443957

Mapped Surface water Classification	Detailed surface water classification/Interpretation	Data source for surface water mapping and permanence interpretation	Relevant Notes	Notes relating to Remote sensing product - Sentinel Water Mask (SWM) Index persistence map (pixel values relate to the percentage of images where the 0.6 index threshold is met. Each pixel 10x10m).	Centroid - Easting	Centroid - Northing
Ephemeral**	Ephemeral to Persistent pool Pool (Potentially Greater)	Remote sensing, aerial photo interpretation, groundwater monitoring & Field Observation	Downstream of “Ben’s Oasis” permanent main pool - Less consistent end of Pool - Variable presence	Max Pixel value 40 (32 pixels) - Strong SWM persistence signal (72% maximum upstream end of pool)	720492	7449056
Ephemeral**	Ephemeral to persistent pool Pool	Aerial photo interpretation and field observations	Substantial calcite precipitation here on banks and terrace - Adjacent HS	No persistent pixels detected - pools either too small or shrouded by vegetation - No Elevated SWM persistence pixels	707016	7445420
Ephemeral**	Ephemeral to persistent pool Pool	Aerial photo interpretation and field observations	Substantial calcite precipitation here on banks and terrace - Adjacent HS	No persistent pixels detected - pools either too small or shrouded by vegetation - No Elevated SWM persistence pixels	707197	7445465
Ephemeral**	Ephemeral to persistent pool Pool	Remote sensing, aerial photo interpretation & Field Observation; however, vegetation cover constrains classification.	Vegetation cover Constrains classification. Potentially greater persistence.	No persistent pixels detected - pools either too small or shrouded by vegetation -? Minor Elevated SWM persistence	720827	7449244
Ephemeral**	Ephemeral to persistent pool Pool	Remote sensing, aerial photo interpretation & Field Observation	Some young Melaleuca argentea here	Max Pixel value 11 (2 Pixels) - Minor Elevated SWM persistence	718888	7444959
Ephemeral**	Ephemeral to persistent pool Pool	Aerial photo interpretation and field observations	Basalt (Fortescue Group) basement outcropping here	No persistent pixels detected - pools either too small or shrouded by vegetation - Minor Elevated SWM persistence	718022	7442941
Ephemeral**	Ephemeral to persistent pool Pool	Aerial photo interpretation and field observations	Basement (Hamersley Group) outcropping here)	No persistent pixels detected - pools either too small or shrouded by vegetation - Some Elevated SWM persistence (max 29%)	719104	7445627
Ephemeral**	Ephemeral to persistent pool Pool	Remote sensing, aerial photo interpretation, groundwater monitoring & Field Observation	Downstream of “Ben’s Oasis” permanent main pool - Post main pool outflow zone over Wittenoom outcropping. Quite exposed to evaporation due to minimal vegetation cover, which may influence variability of surface water expression. *Stylidium weeliwolli* common here.	No overly persistent pixels detected - Minor Elevated SWM persistence- pools likely too narrow/shallow	720387	7448818
Ephemeral*	Ephemeral Pool (Potentially to persistent pool Pool)	Remote Sensing, plus some aerial photo interpretation.	Lower Weeli Wolli Creek - Pools not generally visible late in the dry season (i.e. post winter) on aerial imagery - likely relatively ephemeral	Max Pixel value 6 (3 pixels) - Elevated SWM persistence (relatively low)	721765	7458898
Ephemeral*	Ephemeral Pool (Potentially to persistent pool Pool)	Remote Sensing, plus some aerial photo interpretation.	Lower Weeli Wolli Creek - Pools not generally visible late in the dry season (i.e. post winter) on aerial imagery - likely relatively ephemeral	Max Pixel value 11 (1 pixels) - Elevated SWM persistence (relatively low)	722091	7458445
Ephemeral*	Ephemeral Pool (Potentially to persistent pool Pool)	Remote Sensing, plus some aerial photo interpretation.	Lower Weeli Wolli Creek - Pools not generally visible late in the dry season (i.e. post winter) on aerial imagery - likely relatively ephemeral	Max Pixel value 11 (2 pixels) - Elevated SWM persistence (relatively low)	722106	7458310
Ephemeral*	Ephemeral Pool (Potentially to persistent pool Pool)	Remote Sensing, plus some aerial photo interpretation.	Lower Weeli Wolli Creek - Pools not generally visible late in the dry season (i.e. post winter) on aerial imagery - likely relatively ephemeral	Max Pixel value 8 (2 pixels) - Elevated SWM persistence (relatively low)	722270	7457847
Ephemeral*	Ephemeral Pool (Potentially to persistent pool Pool)	Remote Sensing, plus some aerial photo interpretation.	Lower Weeli Wolli Creek - Pools not generally visible late in the dry season (i.e. post winter) on aerial imagery - likely relatively ephemeral	Max Pixel value 6 (1 pixels) - Elevated SWM persistence (relatively low)	721813	7457187
Ephemeral*	Ephemeral Pool (Potentially to persistent pool Pool)	Remote Sensing, plus some aerial photo interpretation.	Lower Weeli Wolli Creek - Pools not generally visible late in the dry season (i.e., post winter) on aerial imagery - likely relatively ephemeral	Max Pixel value 8 (1 pixels) - Elevated SWM persistence (relatively low)	721557	7455448
Ephemeral*	Ephemeral Pool (Potentially to persistent pool Pool)	Remote Sensing, plus some aerial photo interpretation.	Lower Weeli Wolli Creek - Pools not generally visible late in the dry season (i.e., post winter) on aerial imagery - likely relatively ephemeral	Max Pixel value 6 (1 pixels) - Elevated SWM persistence (relatively low)	722447	7454529
Ephemeral*	Ephemeral Pool (Potentially to persistent pool Pool)	Remote Sensing, plus some aerial photo interpretation.	Lower Weeli Wolli Creek - Pools not generally visible late in the dry season (i.e., post winter) on aerial imagery - likely relatively ephemeral	Max Pixel value 10 (3 pixels) - Elevated SWM persistence (relatively low)	722605	7454024

Mapped Surface water Classification	Detailed surface water classification/Interpretation	Data source for surface water mapping and permanence interpretation	Relevant Notes	Notes relating to Remote sensing product - Sentinel Water Mask (SWM) Index persistence map (pixel values relate to the percentage of images where the 0.6 index threshold is met. Each pixel 10x10m).	Centroid - Easting	Centroid - Northing
Ephemeral*	Ephemeral Pool (Potentially to persistent pool Pool)	Remote Sensing, plus some aerial photo interpretation.	Lower Weeli Wolli Creek - Pools not generally visible late in the dry season (i.e., post winter) on aerial imagery - likely relatively ephemeral	Max Pixel value 8 (1 pixels) - Elevated SWM persistence (relatively low)	723005	7453646
Ephemeral*	Ephemeral Pool (Potentially to persistent pool Pool)	Remote Sensing, plus some aerial photo interpretation.	Lower Weeli Wolli Creek - Pools not generally visible late in the dry season (i.e., post winter) on aerial imagery - likely relatively ephemeral	Max Pixel value 12 (6 pixels) - Elevated SWM persistence (relatively low)	723241	7452992
Ephemeral*	Ephemeral Pool (Potentially to persistent pool Pool)	Remote Sensing, plus some aerial photo interpretation.	Lower Weeli Wolli Creek - Pools not generally visible late in the dry season (i.e., post winter) on aerial imagery - likely relatively ephemeral	Max Pixel value 6 (1 pixels) - Elevated SWM persistence (relatively low)	723561	7452064
Ephemeral*	Ephemeral Pool (Potentially to persistent pool Pool)	Remote Sensing, plus some aerial photo interpretation.	Lower Weeli Wolli Creek - Pools not generally visible late in the dry season (i.e., post winter) on aerial imagery - likely relatively ephemeral	Max Pixel value 8 (1 pixels) - Elevated SWM persistence (relatively low)	723228	7452625
Ephemeral*	Ephemeral Pool (Potentially to persistent pool Pool)	Field Observation	Shallow Pools observed in creek channel low points while conducting field work in June of a wet year - likely additional small pools of similar nature which were not encountered in these creek reaches despite extensive aerial photo searching in multiple years	No persistent pixels detected - pools either too small or shrouded by vegetation - No Elevated SWM persistence pixels	706343	7452252
Ephemeral*	Ephemeral Pool (Potentially to persistent pool Pool)	Field Observation	Shallow Pools observed in creek channel low points while conducting field work in June of a wet year - likely additional small pools of similar nature which were not encountered in these creek reaches despite extensive aerial photo searching in multiple years	No persistent pixels detected - pools either too small or shrouded by vegetation - No Elevated SWM persistence pixels	700350	7449895

Appendix I: Weeli Wolli Spring PEC

Weeli Wolli Spring – DBCA info

Extract of the "Nomination of a Western Australian ecological community for listing as threatened, priority, change of status or delisting" for Assemblages of Weeli Wolli Spring and Creek (Pilbara) (Priority 1).

Description

Weeli Wolli is the aboriginal term for running water.
Weeli Wolli Spring appears superficially to be a typical spring site in the Pilbara. However, the site is an area of high floristic richness as a result of the varied geology and landscape, and the system is a good representation of Pilbara riparian habitat.

The vegetation associations present at Weeli Wolli Spring resemble riparian vegetation found throughout the Hamersley Range and inland Pilbara, and are dominated by an open to moderately dense woodland of *Eucalyptus camaldulensis* (River Red Gum) over scattered *E. victrix* (Coolabah) and *Acacia citrinoviridis* (Black Mulga). In areas of surface water expression or near surface water tables a forest community comprising *E. camaldulensis* and *Melaleuca argentea* (Silver Cadjeput) over *Atalaya hemiglauca* (White Wood) dominates. In terms of vegetation associations, the spring's riparian woodland and forest associations are unusual because of the composition of the understorey (Van Leeuwen 2000).

The sedge and herbfield communities that fringe many of the pools and associated water bodies along the main channels of Weeli Wolli Creek have not been recorded from other wetland sites in the Pilbara, probably because of difference in the hydrological processes, streambed gradients, water flow rates and because of the deleterious impacts of trampling and grazing by livestock elsewhere (Van Leeuwen 2000).

Biota (2006) noted that the relatively high diversity of stygofauna in the Weeli Wolli Spring and creekline area was probably attributed to the large-scale calcrete and alluvial aquifer system associated with the creek (Biota 2006; DEC preliminary Pilbara Biological Survey data). The Pilbara Biological Survey has also revealed that the valley of Weeli Wolli Spring supports the richest microbat assemblage recorded during this survey.

Biological Components

In summary, the flora and the stygofauna are the two main groups of biota that are considered to distinguish the assemblage of Weeli Wolli Spring and Creek. However, the microbat fauna were also found to be unusual, diverse and regionally significant in the preliminary Pilbara Biological Survey data (see below). Other groups of biota associated with site are also described below.

Flora and Vegetation

(Personal communication S. Van Leeuwen)
Riparian tree species that occur in the spring include *Melaleuca argentea, Eucalyptus camaldulensis* and *E. victrix*. Species richness probably similar to Millstream wetlands and other riparian habitat in the Pilbara.

Flora of conservation significance that occur in the spring (from van Leeuwen 2000) include:

- *Stylidium weeliwolli*
  Endemic to northwestern Australia and known from only three locations. The population at Weeli Wolli Spring is the largest known comprising several thousands of plants in ephemeral herbfields fringing spring outflows and associated waterbodies.

- *Fimbristylis sieberiana*
  Sedge is known from 11 localities in northern WA, of which four are in the Pilbara. At Weeli Wolli, this species is common in the herbfields that fringe pools.

Plant taxa recorded from Weeli Wolli Spring that are biologically significant (from van Leeuwen 2000) include:

- *Fimbristylis oxystachya*
  Tropical taxon known from Kimberley, Weeli Wolli Spring and three other Pilbara sites.

- *Fimbristylis rara*
  Tropical taxon known from the Kimberley, Weeli Wolli and three other Pilbara sites.

- *Gossypium sturtianum*
  Typically from central Australia and Exmouth - Cape Range area.
  The Weeli Wolli occurrence is the only population known in the Pilbara. At the spring, this taxon grows sympatrically with *G. robinsonii* and at some sites forms a 'hybrid swarm', which is of significant biological interest with respect to conservation of genetic diversity.

Elytrophorus spicatus, Mollugo cerviana, Rotala diandra and *Rotala mexicana* are also of biological interest as they represent disjunct outliers from distributions that are either predominantly tropical or concentrated in the central Australian deserts. The occurrence of such disjunct outlying populations for tropical species is indicative of the Weeli Wolli Spring area being a refugial/relictual habitat. Further evidence of this is the fact that the nearest relative taxonomically to *S. weeliwolli* is *S. calcaratum*, a southwest Australian species (from van Leeuwin 2000).

Flora recorded in Florabase, or during survey of the site by CALM staff in 1998 for Weeli Wolli Spring include: *Abutilon dioicum, Acacia bivenosa, Acacia citrinoviridis, Acacia coriacea* subsp. *pendens, Acacia tumida* var. *tumida, Ammannia baccifera, Atalaya hemiglauca, Clerodendrum floribundum* var. *angustifolium*, *Eucalyptus camaldulensis, Eucalyptus victrix, Gastrolobium grandiflorum, Gossypium robinsonii, Jasminum didymum* subsp. *lineare, Lobelia quadrangularis, Melaleuca argentea, Melaleuca leucadendra, Melaleuca eleuterostachya, Plumbago zeylanica, Ptilotus calostachyus, Sesbania cannabina, Stylidium weeliwolli* (P2), *Tephrosia rosea, Triumfetta leptacantha* (P3), *Stemodia grossa, Santalum lanceolatum*.

Aquatic invertebrates

"*Wandesia* sp. P1 (nr glareosa) (PSW)", interstitial water mite, known from three localities in eastern Pilbara (Weeli Wolli, Cangan Pool on Cangan Creek and Miningarra Creek). Note that only two other species of Australian *Wandesia* are described and both are restricted to south-eastern Australia. "*Austraturus* P1", a water mite known only from Weeli Wolli and Millstream so far. "*Guineaxonopsis* sp. P1 (PSW)", an un-named water mite known only from Weeli Wolli and Miningarra Creek so far. Mark Harvey lists an undescribed species from north-west WA so this may be the same species.

Stygofauna

Stygofauna have been recorded in the interstitial gravel habitat of Weeli Wolli Spring where discharge dewatering is occurring. The stygofauna included Crustacea belonging to the groups *Amphipoda*, *Copepoda*, *Bathynellacea*, *Ostracoda*, and *Isopoda*. Eberhard and Humphreys (1999) considered that these stygofauna are significant and vulnerable to even slight drawdown effects.

Biota (2006) provides a table of stygofaunal taxa, and notes their status and wider distribution. However, the aim of the report was to indicate the status and wider distribution of fauna that occurred within the drawdown impact zone for Hope Downs mine, and therefore does not provide much information about the status of animals located in Weeli Wolli Spring, which was considered at that time to be outside of the direct impact zone for primary drawdown impacts. The report does however contain information about the genetic status of amphipod groups located in the 'drawdown impact zone' and within Weeli Wolli Spring and creek (Finston 2006, reported in Biota 2006). Finston noted that combined information from allozyme and DNA analyses for amphipods indicated the presence of five genetic groups representing a likely four or five species. Finston noted the need for further morphological work to confirm the genetic studies.

The five groups of amphipods represented were as follows (Finston 2006):
Group A: quite widespread, probably a good species. Located in bores in the adjacent Hope Downs Impact Zone, Weeli Wolli Spring and creek.

Group B: Likely single status species. Located in two bores within Weeli Wolli Spring and one in the Impact Zone.

Group C: Requires more detailed morphological work to clarify single species status. Located in one Weeli Wolli Spring site, and three Impact Zone sites.

Group D: 'Species' only located in Weeli Wolli Spring bore, and 'taxon' with similar profile located in Ethel Gorge region.

Group E: Located in 'Impact Zone' only, taxonomic status uncertain.

Preliminary data from Pilbara Biological Survey for Weeli Wolli Spring and Creek (reports in preparation)

Stygofauna (personal communication S. Halse)

- *Arrenurus* sp. nov.

One recorded only from Weeli Wolli. It may be more widespread in samples.

- *Pygolabis weeliwolli*

Occurs in the upper Fortescue west of Newman – Weeli Wolli, Fortescue Marsh, Area C sites.

- *Notacandona boultoni*

Has been recorded only from Weeli Wolli.

- *Notocandona modesta*

Has been recorded only from Weeli Wolli and Pebble Mouse Creek, north of Weeli Wolli.

- *Ainudrilus* sp. WA26

Known only from Weeli Wolli.

- 'Maarka wolli' ms

Name is known only from Weeli Wolli and Pebble Mound Creek, although a similar species occurs around Newman.

The other species are all more widespread.

Aquatic Invertebrates (personal communication A. Pinder)
The surface water list for Weeli Wolli is higher than average for Pilbara sites (at 186 taxa, cf average for 2 sampling occasions of 147 taxa) but the lists contain nothing that is restricted to this site or vicinity. In multivariate analyses Weeli Wolli grouped within a large group of sites dominated by springs or spring-fed pools.

Ground Ants (personal communication B. Durrant)
The site is quite rich with 21 species and although there were no singletons the species *Opisthopsis haddoni* Emery was only found at 2 PBS sites (both in the SE corner), but the species is actually found throughout Australia. Main thing to take from ant data is that there was a low number of true eremaean species, with most being either Australia wide species or torresian. However *Leptogenys centralis* appears confined to the central south of the Pilbara but according to CSIRO Ants Online it is distribution is South Australia (Lake Eyre Basin).

Ground Spiders (personal communication B. Durrant)
Weeli Wolli (RHNC10) is an unusual site for the spiders. There were 8 species collected there but 4 were *Salticids* and 4 were *Zodariids*. None of these species were singletons but it is unusual to have such a poor higher taxonomic richness at a site.

Scorpions (personal communication B. Durrant)
Weeli Wolli (RHNC10) and site NW11 were the only two sites that recorded 5 scorpion species out of the 17 from the Pilbara Biological Survey. All five species were widespread through the survey. So it was the equal richest scorpion site in the Pilbara Biological Survey (304 sites sampled).

Ground Beetles (personal communication N. Guthrie)

- Carabids - all are fairly widespread or found at more than 10 sites, really not restricted in any sense
- Tenebrionids - bear in mind *Chalcopteroides* is a large and difficult group requiring revision. The other we simply couldn't get anywhere with it, may occur in other collections from other areas.
- Scarabids- *Automolius* sp. mainly an eastern high rainfall genus- 2 described species known to occur in the north west and south west WA plus 5 described species known from the south west WA only. Currently this taxon is considered to be probably new- no species of the genus recorded from interior deserts.
- Three new species of *Heteronyx*, no other known material present in other collections. *Heteronyx tepperi* is widespread (arid zone thru to east of Murray-Darling River) so not restricted in any sense
- Weevils- *Cyphicerini* gen.indet sp.indet.

In the Beetle community analysis Weeli Wolli comes out by itself or is it with other wetland/riparian sites or Hamersley Range sites.

Reptiles (personal communication A. Burbidge)
Recorded 8 reptile species at the Weeli Wolli site (RHNC10), plus two frogs. The reptiles were mostly common and widespread, but *Carlia munda* is at or close to its southern limit of distribution here, and *Lerista neander* is at or near its northern limit. The frogs were the common and widespread *Litoria rubella* and an as yet unidentified frog from a wet pit.

Birds (personal communication A. Burbidge)
Recorded 36 bird species and a total of 70 species have been recorded from within a few km of the spring; so for the Pilbara, the area is rich in bird species. Again, most are common and widespread, but the Grey Honeyeater is rare (but not threatened) and was only recorded at one of the Pilbara survey sites (but not this one). The Grey Fantail is rare in the Pilbara, normally only occurring at a few sites like Weeli Wolli and Millstream. The Western Gerygone is uncommon in the Pilbara. The record of Azure Kingfisher is one of only three from the Pilbara – i.e. it is a vagrant. Barking Owls are not rare, but in the Pilbara they are restricted to sites like Weeli Wolli – i.e. with large cadjeputs.

Mammals (personal communication L. Gibson)
Nothing of significance at Weeli Wolli.

Bats (personal communication N. McKenzie)
Data collected during the Pilbara Biological Survey has revealed that the richest assemblages of microbats found in the Pilbara are associated with well developed, continually productive riparian site set in ranges country, and that the regional populations of two species are confined to these riparian environments (*Nyctophilus bifax daedalus* and *Chalinolobus mo*rio). Loss of complexity in riparian vegetation, reduced permanence of pools and loss of suitable cave roosts, are all likely to reduce this microbat richness. There is a need to ensure that highly developed riparian sites in ranges country, such as Weeli Wolli, are included in conservation reserves (Weeli Wolli, Cattle Gorge, Turee Creek etc).

The valley of Weeli Wolli Spring appears to be regionally unique from a microbat viewpoint. It supports the richest microbat assemblage recorded during our survey, and is also the only area in northern WA known to support a population of *Chalinolobus morio*, a species elsewhere restricted to southern Australia (van Dyke and Strahan 2008). In fact, Weeli Wolli has every species of microbat known from the region's landward environments. Additionally, it is the only location known in northern Western Australia where *Tadarida australis* can persist through the hot and humid summer months (see Bullen and McKenzie 2005). We speculate that occasional cool air floods through the Weeli Wolli valley during summer nights may reduce atmospheric enthalpy to levels in which these two, otherwise temperate-adapted species, can forage for long enough to meet their metabolic requirements.
Survey

This spring is the only one known that contains this particular suite of flora (Van Leeuwen 2000). No other similar springs were located during the three years of the DEC Pilbara Biological survey, or during routine flora and vegetation surveys listed above, or as undertaken by survey effort. Dr Stephen Van Leeuwen worked in the Pilbara Region for 15 years and does not know of another similar spring in the Pilbara.

Other surveys of the area include:

- Weston and Trudgen (1995) undertook a vegetation and flora survey of Marillana/Weeli Wolli Creeks and Paleochannel.
- Ecologia (1996) - flora and fauna survey of Weeli Wolli Creek
- A brief report by S. Van Leeuwen, S (2000). 'Vegetation and Flora of the Weeli Wolli Spring Area' provided a summary of botanical characteristics of the area.
- Biota (2006) - survey of invertebrate fauna of Weeli Wolli Spring and Creek and some adjacent areas.
- The three-year Pilbara Biological Survey by DEC included aspects of invertebrate, mammal and flora survey for the Pilbara region as a whole (surveys completed 2007, some preliminary results above).

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Appendix J: Riparian flora and plant communities of springs and river pools with high water permanence of the Pilbara Region PEC

Riparian flora and plant communities of the Pilbara – DBCA info

Extract of the "Nomination of a Western Australian ecological community for listing as threatened, priority, change of status or delisting" for Riparian flora and plant communities of springs and river pools with high water permanence of the Pilbara Region (Priority 2).

Description

A subgroup of river pools and springs identified by Lyons (2015) included sites which had the highest mean permanence of water of all site groups sampled across the Pilbara, coupled with the highest mean annual rainfall.

The soil of the sites contained the highest percentage of gravel and were otherwise typically sandy. There were also high levels of exchangeable calcium reported in the soil, likely to reflect the contribution of calcium-rich groundwater to the riparian zone substrate.

The distribution is restricted to sites in Hamersley Range from Millstream to Karijini National Park and Munjina Gorge. The location of the springs are confined to the mesic rocky gullies in the Pilbara IBRA Region including the Chichester and Hamersley sub regions.

Occurrences of this community are disjunct with sites typically associated with groundwater discharge in gorge and valley wetlands that are often couples with significant shading.
The hydrological conditions that support the groundwater dependent overstorey trees and moisture dependent understorey taxa are potentially threatened from a combination of groundwater drawdown, dewatering and surface water diversion associated with mining activities. The effects of the hydrological change on this community are unknown, however has the potential to cause significant change based on changes that have occurred at Weeli Wolli Spring. There is also potential for wholescale catchment change relating to mining activities. Additional threatening processes include inappropriate/altered fire regimes and weed invasion (*Cenchrus ciliaris)* and deleterious impacts of trampling and grazing by livestock.

Biological components:

Flora and Vegetation

The vegetation present at springs and river pools with high water permanence are differentiated from other riparian vegetation found throughout the Hamersley Range and inland Pilbara owing to the presence of significant indicator species.

In areas of surface water expression or near surface water tables, a forest community comprised of *Melaleuca argentea* and *Eucalyptus camaldulensis* subsp. *refulgens* dominate trees over shrubs grasses and sedges. There were also *Acacia ampliceps, Typha domingensis* and *Cyperus vaginatus* fringing many of the pools and associated water bodies.

Significant in this subgroup was the presence of relictual taxa and outliers of the Kimberley and eastern Australia. Including *Livistona alfredii* (P4) (Millstream fan-palm) occurred at Palm pool, Millstream; *Cladium procerum* occurred at both Millstream, Karijini National Park and recently identified (Jeremy Naaykens pers comm.) at Munjina Gorge; *Adiantum capillus-veneris* (P2) occurs at Fortescue Falls. This fern has a scattering of localised populations across much of Australia. *Imperata cylindrica* sampled at Millstream and Karijini National Park, Caves Creek and at Munjina Gorge; and *Fimbristylis sieberiana* P3 and *Schoenus falcatus* occur at a number of sites

The mean species richness (18.4 taxa) is believed to be similar to Millstream wetlands and other riverine riparian habitats in the Pilbara. *Melaleuca argentea* and *Eucalyptus camaldulensis* subsp. *Refulgens* were present in the dominant riparian forest community occurring across majority of the sites.

Indicator species used to assist with defining the community include:

- *Fimbristylis sieberiana* P3
  Distribution Pilbara/Kimberley
- *Schoenus falcatus* (not threatened)
  Distribution Pilbara/Kimberley/Gascoyne
- *Cladium procerum* P2
  Distribution Pilbara population is major disjunction from SE Australian distribution.
- *Imperata cylindrica* (not threatened)
  Distribution Kimberley/Pilbara
- *Adiantum capillus-veneris* P2
  Distribution: Pilbara – scattered locations in Australia.
- *Phragmites karka* (not threatened)
  Distribution Kimberley/Pilbara

No information on fauna or stygofauna was provided in this TEC/PEC nomination form.

Non-biological components

Rocky gully mesic habitats of the Pilbara bioregion. Areas of sheltered gorges, upland creeks and rocky gullies/gorges. Floors of some gorges contain permanent wetlands and support unusual riverine species.

Extensive aquifer systems of the Pilbara discharge groundwater to form permanently flowing creeks, or contribute to permanent pools within river channels. Springs and spring fed river pools with high water permanence and associated gorges provide an important mesic refuge.

Processes

Maintenance of the spring and pools would be dependent on the hydrologic regime that has been established over many millennia. Uninterrupted flow of springs and creeks with sustained high-water permanence maintains the endemic and relictual flora. Changes to the hydrologic regime, including increased inundation or drying are likely to result in changes to flora populations and communities.

The permanent springs and associated vegetation are important habitats for a large number of species. The habitats may be susceptible to trampling by feral stock and other disturbance (KNPMP).

Uniqueness

Most springs in the Pilbara tend to show similar species composition to many permanent (probably groundwater fed) river pools, however, the riparian flora and plant communities of springs and river pools with high water permanence sites are unique given the presence of restricted taxa and outliers from the Kimberley and eastern Australia.

The following have described how the community is unique and how it differs from any other ecological community:
Lyons, M.N. (2015). The riparian flora and plant communities of the Pilbara region of Western Australia.
Eight major wetlands groups were defined by classifying 98 wetlands in terms of species presence /absence data. Site group 6.1 showed distinct separation in both composition and abiotic parameters. Site group 6.1 showed the highest water permanence and soil exchangeable Calcium (consistent with groundwater discharge) of all floristic groups identified in the survey.
Studies of springs elsewhere in Australia confirm that the springs of the Pilbara are floristically distinct from the remainder of Australia.

Gibson et al. (2000) sampled a small number of springs in the Carnarvon Basin IBRA in a study of 58 ephemeral and permanent wetlands. Springs were small scale and along with other Carnarvon Basin wetlands were dominated by taxa with Eremaean and Southwestern distributions in contrast to Pilbara wetlands that capture elements of the Eremaean and Tropical flora.

Kenneally et al (1991); Russell-Smith (1991)
Studies conclude the spring flora in the Kimberley and Northern Territory contained a majority of rainforest elements.

Fensham and Fairfax (200); Fensham and Price (2004)
Detailed studies of springs of the Great Artesian Basin show a completely distinctive flora from that of Pilbara riparian zones.

Survey Effort

Lyons (2015) - undertook site classification of 103 survey sites based on species presence/absence. Classification at 8-group level. Group 6 Springs and river pools with high water permanence with subgroup 6.1. Ninety-eight wetlands were selected to capture the diversity of wetland types present in each of the five major drainage basins of the Pilbara. The selected wetlands were part of an integrated survey that covered and examined how the major geographic and site environments correlate with floristic composition, and included a sample Rudall River (Great Sandy Desert IBRA). Data sets for this study were linked with studies of aquatic invertebrates by Pinder et al (2010)

Regional survey: Prior to Lyons (2015), only two previous studies of the riparian flora of the Pilbara have been undertaken by Masini (1998) and Masini and Walker (1989).
Localised studies have been undertaken for the purpose of environmental impact assessment for proposed mining.

With additional surveys, it is likely that other gorges in Karijini National Park for example Dales may fit within this subset. A spring in the upper reaches of Munjina Gorge (east branch), located on Juna Downs Pastoral lease may also fit into the subset (awaiting data), however “indicator” species are present.

Distinctiveness/detectability of the community

Lyons (2015) - Eight major groups were defined by classifying wetlands in terms of species presence /absence data. Floristic patterning strongly aligned with major wetland types (geomorphic /hydrological) groups.

Threats

Hydrological change:
The greatest threat to the riparian springs and rivers pools relates to potential hydrological change from cumulative impact owed to a combination of groundwater drawdown due to mine dewatering and surface water diversion activities. There is also potential for wholescale catchment changes relating to associated mining activities relating to changes in surface water regimes in terms of magnitude and frequency of runoff as a result of diversion or catchment interception by planned mining activities resulting in groundwater recharge to the alluvial aquifer of reinjection bores. Planned injection of surplus water has the potential to result in groundwater mounding, thereby changing the water balance and potential to impact riparian communities
Cattle grazing:
Increases weed invasion; selectively graze species, erode banks, eutrophic water.
Fire:
Too frequent, increase in weed invasion; favours fire tolerant species, leaves banks bare of vegetation and prone to erosion.
Weed invasion:
Competing with natives; increase in fire risk, altering structure. Buffel-grass (*Cenchrus ciliaris*) does occur in springs, but its extent is limited by the absence of suitable sandy substrate.
Recreational activities:
Increase in vegetation disturbance, littering, campfires, tracks

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Appendix K: Species list from quadrats and relevés conducted as part of this study (207 species in total).

Family	Species	Status
Acanthaceae	*Dicladanthera forrestii*	
	Dipteracanthus australasicus subsp*. australasicus*	
	Rostellularia adscendens var. *clementii*	
	Rostellularia adscendens var*. latifolia*	P3
Amaranthaceae	*Achyranthes aspera*	
	Alternanthera nana	
	Alternanthera nodiflora	
	Gomphrena canescens	
	Gomphrena cunninghamii	
	Ptilotus auriculifolius	
	Ptilotus exaltatus	
	Ptilotus helipteroides	
	Ptilotus obovatus	
	Ptilotus polystachyus	
Apocynaceae	*Cynanchum ?pedunculatum*	
Asteraceae	**Bidens bipinnata*	
	Brachyscome ciliaris	
	Centipeda minima	
	Chrysocephalum apiculatum subsp*. pilbarense*	
	**Flaveria trinervia*	
	**Lactuca ?saligna*	
	Olearia fluvialis	
	Peripleura arida	
	Pluchea dentex	
	Pluchea rubelliflora	
	Pterocaulon sphacelatum	
	**Sigesbeckia orientalis*	
	Sonchus hydrophilus	
	**Sonchus oleraceus*	
Boraginaceae	*Ehretia saligna* var*. saligna*	
	Heliotropium cunninghamii	
	Trichodesma zeylanicum	

Family	Species	Status
Brassicaceae	*Lepidium phlebopetalum*	
Campanulaceae	*Wahlenbergia tumidifructa*	
Capparaceae	*Capparis lasiantha*	
Caryophyllaceae	*Polycarpaea longiflora*	
Characeae	*Chara* sp.	
Chenopodiaceae	*Dysphania melanocarpa* forma *melanocarpa*	
	Dysphania rhadinostachya	
	Enchylaena tomentosa var. *tomentosa*	
	Rhagodia eremaea	
	Salsola australis	
	Sclerolaena cornishiana	
Cleomaceae	*Arivela viscosa*	
Convolvulaceae	*Convolvulus remotus*	
	Duperreya commixta	
	Evolvulus alsinoides var. *decumbens*	
	Evolvulus alsinoides var. *villosicalyx*	
	Ipomoea muelleri	
	Polymeria ambigua	
Cucurbitaceae	*Cucumis variabilis*	
Cyperaceae	*Cyperus cunninghamii* subsp. *cunninghamii*	
	Cyperus iria	
	Cyperus vaginatus	
Elatinaceae	*Bergia pedicellaris*	
Euphorbiaceae	*Euphorbia australis* var. *subtomentosa*	
	Euphorbia biconvexa	
	Euphorbia boophthona	
	Euphorbia coghlanii	
Fabaceae	*Acacia adsurgens*	
	Acacia ampliceps hybrid	
	Acacia aneura	
	Acacia aptaneura	
	Acacia aptaneura x *paraneura*	
	Acacia bivenosa	
	Acacia citrinoviridis	
	Acacia colei var. *colei*	

Family	Species	Status
Fabaceae	*Acacia coriacea* subsp. *pendens*	
	Acacia dictyophleba	
	Acacia incurvaneura	
	Acacia macraneura	
	Acacia maitlandii	
	Acacia pachyacra	
	Acacia pruinocarpa	
	Acacia pyrifolia	
	Crotalaria medicaginea var. *neglecta*	
	Cullen ?leucanthum	
	Glycine canescens	
	Indigofera georgei	
	Indigofera linnaei	
	Isotropis forrestii	
	Isotropis iophyta	
	Petalostylis labicheoides	
	Rhynchosia minima	
	Senna artemisioides subsp. *filifolia*	
	Senna artemisioides subsp. x *artemisioides*	
	Senna glutinosa subsp. ×*luerssenii*	
	Senna pleurocarpa var. *pleurocarpa*	
	Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	
	**Vachellia farnesiana*	
Goodeniaceae	*Goodenia lamprosperma*	
	Goodenia prostrata	
	Goodenia stellata	
	Scaevola amblyanthera var. *centralis*	
Haloragaceae	*Haloragis gossei var. gossei*	
Lamiaceae	*Clerodendrum floribundum*	
	Clerodendrum floribundum var. *floribundum*	
Loranthaceae	*Amyema miquelii*	
Lythraceae	*Ammannia baccifera*	
Malvaceae	*Abutilon amplum*	
	Abutilon fraseri subsp. *fraseri*	
	Abutilon otocarpum	

Family	Species	Status
Malvaceae	*Abutilon* sp. Dioicum (A.A. Mitchell PRP 1618)	
	Androcalva luteiflora	
	Corchorus crozophorifolius	
	Corchorus tridens	
	Gossypium robinsonii	
	Gossypium sturtianum var. *sturtianum*	
	**Malvastrum americanum*	
	Melhania oblongifolia	
	Sida fibulifera	
	Sida sp. L (A.M. Ashby 4202)	
	Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	
Marsileaceae	*Marsilea hirsuta*	
Menispermaceae	*Tinospora smilacina*	
Moraceae	*Ficus brachypoda*	
Myrtaceae	*Corymbia ferriticola*	
	Eucalyptus camaldulensis	
	Eucalyptus camaldulensis subsp. *obtusa*	
	Eucalyptus gamophylla	
	Eucalyptus ?kingsmillii	
	Eucalyptus trivalva	
	Eucalyptus victrix	
	Eucalyptus xerothermica	
	Melaleuca argentea	
	Melaleuca bracteata	
	Melaleuca glomerata	
Nyctaginaceae	*Boerhavia coccinea*	
Oleaceae	*Jasminum didymum* subsp. *lineare*	
Phrymaceae	*Peplidium* sp. C Evol. Fl. Fauna Arid Aust. (N.T. Burbidge & A. Kanis 8158)	
Phyllanthaceae	*Phyllanthus maderaspatensis*	
Pittosporaceae	*Pittosporum angustifolium*	
Plantaginaceae	*Stemodia grossa*	
Poaceae	*Aristida burbidgeae*	
	Aristida contorta	
	Aristida holathera var. *holathera*	
	Aristida latifolia	

Family	Species	Status
Poaceae	*Aristida lazaridis*	P2
	Aristida pruinosa	
	Bothriochloa ewartiana	
	**Cenchrus ciliaris*	
	**Cenchrus setiger*	
	**Chloris virgata*	
	Chrysopogon fallax	
	Cymbopogon ambiguus	
	Dichanthium sericeum subsp. *sericeum*	
	Digitaria ctenantha	
	Enneapogon caerulescens	
	Enneapogon lindleyanus	
	Enneapogon polyphyllus	
	Enneapogon robustissimus	
	Enteropogon ramosus	
	Eragrostis cumingii	
	Eragrostis elongata	
	Eragrostis pergracilis	
	Eragrostis tenellula	
	Eriachne benthamii	
	Eriachne mucronata	
	Eriachne pulchella	
	Eulalia aurea	
	Eulalia sp. Three river station	
	Iseilema membranaceum	
	**Melinis repens*	
	Panicum decompositum	
	Paraneurachne muelleri	
	Paspalidium clementii	
	Paspalidium constrictum	
	Paspalidium rarum	
	Perotis rara	
	Setaria dielsii	
	Setaria surgens	
	**Setaria verticillata*	

Family	Species	Status
Poaceae	*Sorghum plumosum*	
	Sporobolus australasicus	
	Themeda avenacea	
	Themeda triandra	
	Triodia epactia	
	Triodia longiceps	
	Triodia pungens	
	Triodia wiseana	
	**Urochloa mosambicensis*	
	Urochloa occidentalis	
	Urochloa occidentalis var*. ciliata*	
	Urochloa piligera	
Portulacaceae	*Portulaca oleracea*	
Proteaceae	*Hakea lorea* subsp*. lorea*	
Pteridaceae	*Cheilanthes sieberi* subsp*. sieberi*	
Rubiaceae	*Psydrax suaveolens*	
Santalaceae	*Anthobolus leptomerioides*	
	Santalum lanceolatum	
Sapindaceae	*Atalaya hemiglauca*	
	Dodonaea lanceolata	
	Dodonaea pachyneura	
	Dodonaea viscosa subsp*. mucronata*	
Scrophulariaceae	*Eremophila ?compacta*	
	Eremophila forrestii subsp*. forrestii*	
	Eremophila longifolia	
Solanaceae	*Nicotiana occidentalis* subsp*. obliqua*	
	Solanum chippendalei	
	Solanum cleistogamum	
	Solanum lasiophyllum	
	Solanum nigrum	
Stylidiaceae	*Stylidium weeliwolli*	P3
Surianaceae	*Stylobasium spathulatum*	
Violaceae	*Afrohybanthus aurantiacus*	
Zygophyllaceae	*Roepera iodocarpa*	
	Tribulus astrocarpus	

Appendix L: Combined species list from sampling conducted as part of this study and riparian quadrats and relevés from relevant riparian habitats sampled by Astron (2019) and Mattiske (2008, 2010, 2014) (418 species in total).

Family	Species	Current	Astron	Mattiske
Acanthaceae	*Dicladanthera forrestii*	x	x	x
	Dipteracanthus australasicus			x
	Dipteracanthus australasicus subsp. *australasicus*	x		x
	Rostellularia adscendens var. *clementii*	x		
	Rostellularia adscendens var. *latifolia* (P3)	x		
Amaranthaceae	*Achyranthes aspera*	x		
	Alternanthera denticulata		x	x
	Alternanthera nana	x	x	x
	Alternanthera nodiflora	x		x
	Amaranthus cuspidifolius			x
	Amaranthus mitchellii			x
	Gomphrena canescens	x		
	Gomphrena cunninghamii	x		x
	Ptilotus aervoides			x
	Ptilotus astrolasius		x	x
	Ptilotus auriculifolius	x		x
	Ptilotus exaltatus	x	x	x
	Ptilotus exaltatus var. *exaltatus*			x
	Ptilotus helipteroides	x	x	x
	Ptilotus nobilis			x
	Ptilotus obovatus	x	x	x
	Ptilotus obovatus var. *obovatus*			x
	Ptilotus polystachyus	x		x
Apocynaceae	*Cynanchum floribundum*			x
	Cynanchum ?pedunculatum	x		
	Marsdenia sp. (indet.)		x	
Asteraceae	**Bidens bipinnata*	x	x	x
	Brachyscome ciliaris	x		
	Centipeda minima	x		x
	Centipeda minima subsp. *macrocephala*		x	
	Chrysocephalum apiculatum			x

Family	Species	Current	Astron	Mattiske
	Chrysocephalum apiculatum subsp. *pilbarense*	x	x	
Asteraceae	*Chrysocephalum gilesii*			x
	**Erigeron bonariensis*		x	
	**Flaveria trinervia*	x	x	x
	**Lactuca ?saligna*	x		
	Leiocarpa semicalva			x
	Olearia fluvialis	x		
	Peripleura arida	x	x	
	Pluchea dentex	x	x	x
	Pluchea rubelliflora	x	x	
	Pluchea sp. (indet.)		x	
	Pterocaulon serrulatum			x
	Pterocaulon serrulatum var. *velutinum*		x	
	Pterocaulon sp. (indet.)		x	
	Pterocaulon sphacelatum	x	x	x
	Pterocaulon sphaeranthoides			x
	Rhodanthe margarethae			x
	Rutidosis helichrysoides			x
	Rutidosis helichrysoides subsp. *helichrysoides*			x
	**Sigesbeckia orientalis*	x	x	x
	Sonchus hydrophilus	x		
	**Sonchus oleraceus*	x	x	x
	Streptoglossa decurrens			x
Araliaceae	*Trachymene oleracea*			x
Boraginaceae	*Ehretia saligna* var. *saligna*	x		
	Heliotropium cunninghamii	x		x
	Heliotropium inexplicitum			x
	Heliotropium tanythrix		x	
	Heliotropium tenuifolium		x	
	Trichodesma zeylanicum	x		x
	Trichodesma zeylanicum var. *zeylanicum*		x	x
Brassicaceae	*Lepidium echinatum*			x
	Lepidium phlebopetalum	x		x
	Lepidium sp. (indet.)		x	
	Stenopetalum decipiens			x

Family	Species	Current	Astron	Mattiske
Campanulaceae	*Wahlenbergia tumidifructa*	x	x	x
Capparaceae	*Capparis lasiantha*	x	x	x
	Capparis spinosa			x
Caryophyllaceae	*Polycarpaea corymbosa*			x
	Polycarpaea corymbosa var. *corymbosa*		x	
	Polycarpaea holtzei			x
	Polycarpaea longiflora	x		x
Celastraceae	*Maytenus* sp. Mt Windell (S. van Leeuwen 846)		x	
Characeae	*Chara* sp. (indet.)	x		
Chenopodiaceae	*Dysphania kalpari*		x	x
	Dysphania melanocarpa forma *melanocarpa*	x		
	Dysphania rhadinostachya	x		x
	Dysphania rhadinostachya subsp. *rhadinostachya*		x	x
	Dysphania sp. (indet.)			x
	Enchylaena tomentosa			x
	Enchylaena tomentosa var. *tomentosa*	x	x	
	Maireana planifolia			x
	Maireana villosa			x
	Rhagodia eremaea	x	x	x
	Rhagodia sp. Hamersley (M. Trudgen 17794) (P3)		x	
	Salsola australis	x	x	x
	Sclerolaena cornishiana	x	x	x
Cleomaceae	*Arivela viscosa*	x	x	x
Commelinaceae	*Commelina ensifolia*			x
Convolvulaceae	*Bonamia pilbarensis*		x	
	Convolvulus angustissimus			x
	Convolvulus clementii		x	x
	Convolvulus remotus	x		
	Duperreya commixta	x	x	x
	Evolvulus alsinoides			x
	Evolvulus alsinoides var. *decumbens*	x	x	
	Evolvulus alsinoides var. *villosicalyx*	x	x	
	Ipomoea muelleri	x		
	Ipomoea plebeia			x
	Ipomoea polymorpha			x

Family	Species	Current	Astron	Mattiske
	Polymeria ambigua	x		x
Cucurbitaceae	*Cucumis melo*		x	
	Cucumis variabilis	x	x	x
Cyperaceae	*Bulbostylis barbata*			x
	Bulbostylis turbinata		x	x
	Cyperus bulbosus			x
	Cyperus cunninghamii			x
	Cyperus cunninghamii subsp. *cunninghamii*	x		
	Cyperus iria	x		x
	Cyperus squarrosus			x
	Cyperus vaginatus	x	x	x
	Fimbristylis microcarya			x
	Schoenoplectiella laevis			x
Elatinaceae	*Bergia pedicellaris*	x		x
Euphorbiaceae	*Adriana tomentosa* var. *tomentosa*			x
	Euphorbia australis			x
	Euphorbia australis var. *subtomentosa*	x	x	
	Euphorbia biconvexa	x	x	x
	Euphorbia boophthona	x	x	x
	Euphorbia coghlanii	x	x	x
	Euphorbia sp. (indet.)		x	x
	Euphorbia tannensis			x
	Euphorbia trigonosperma		x	x
Fabaceae	*Acacia adsurgens*	x		
	Acacia ampliceps hybrid	x		
	Acacia aneura	x		
	Acacia aneura var. *aneura*			x
	Acacia aptaneura	x	x	x
	Acacia aptaneura x *paraneura*	x		
	Acacia bivenosa	x	x	x
	Acacia citrinoviridis	x	x	x
	Acacia colei var. *colei*	x		
	Acacia coriacea subsp. *pendens*	x		x
	Acacia dictyophleba	x	x	
	Acacia hamersleyensis			x

Family	Species	Current	Astron	Mattiske
	Acacia inaequilatera			x
Fabaceae	*Acacia incurvaneura*	x		
	Acacia macraneura	x		
	Acacia maitlandii	x	x	x
	Acacia monticola			x
	Acacia pachyacra	x		x
	Acacia paraneura			x
	Acacia pruinocarpa	x	x	x
	Acacia pteraneura			x
	Acacia pyrifolia	x	x	x
	Acacia sibirica		x	
	Acacia sp. (indet.)		x	
	Acacia tenuissima			x
	Acacia tetragonophylla		x	x
	Crotalaria cunninghamii			x
	Crotalaria medicaginea			x
	Crotalaria medicaginea var. *neglecta*	x	x	
	Crotalaria novae hollandiae			x
	Cullen ?leucanthum	x		
	Cullen leucochaites			x
	Cullen pogonocarpum			x
	Glycine canescens	x	x	x
	Indigofera fractiflexa			x
	Indigofera georgei	x	x	x
	Indigofera linnaei	x		
	Indigofera monophylla		x	
	Isotropis forrestii	x		x
	Isotropis iophyta	x	x	
	Petalostylis labicheoides	x	x	x
	Rhynchosia minima	x	x	x
	Senna artemisioides			x
	Senna artemisioides subsp. *filifolia*	x		
	Senna artemisioides subsp. *Helmsii*		x	
	Senna artemisioides subsp. *oligophylla*		x	
	Senna artemisioides subsp. *oligophylla* x *helmsii*			x

Family	Species	Current	Astron	Mattiske
	Senna artemisioides subsp. x *artemisioides*	x	x	x
Fabaceae	*Senna artemisioides* subsp. x *sturtii*			x
	Senna glaucifolia			x
	Senna glutinosa			x
	Senna glutinosa subsp. *chatelainiana*			x
	Senna glutinosa subsp. *glutinosa*		x	
	Senna glutinosa subsp. ×*luerssenii*	x		
	Senna notabilis			x
	Senna pleurocarpa var. *pleurocarpa*	x		
	Senna stricta		x	
	Senna venusta			x
	Swainsona maccullochiana			x
	Tephrosia rosea			x
	Tephrosia rosea var. *clementii*			x
	Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	x	x	x
	Tephrosia sp. (indet.)			x
	**Vachellia farnesiana*	x	x	x
	Vigna lanceolata			x
	Vigna lanceolata var. *lanceolata*		x	
	Vigna sp. Hamersley Clay (A. A. Mitchell PRP 113)			x
Goodeniaceae	*Goodenia lamprosperma*	x	x	
	Goodenia microptera			x
	Goodenia muelleriana			x
	Goodenia prostrata	x		x
	Goodenia sp. (indet.)		x	
	Goodenia stellata	x	x	x
	Goodenia stobbsiana			x
	Scaevola amblyanthera			x
	Scaevola amblyanthera var. *centralis*	x	x	
	Scaevola browniana		x	
	Scaevola parvifolia subsp. *Pilbarae*		x	
Haloragaceae	*Haloragis gossei*		x	x
	Haloragis gossei var. *gossei*	x		
	Haloragis odontocarpa		x	
	Haloragis sp. (indet.)			x

Family	Species	Current	Astron	Mattiske
Hemerocallidaceae	*Tricoryne* sp. Hamersley Range (S. van Leeuwen 915)		x	x
Lamiaceae	*Clerodendrum floribundum*	x		x
	Clerodendrum floribundum var. *angustifolium*		x	
	Clerodendrum floribundum var. *floribundum*	x		
	Prostanthera albiflora			x
Lauraceae	*Cassytha* sp. (indet.)		x	
Loranthaceae	*Amyema miquelii*	x		
Lythraceae	*Ammannia baccifera*	x		
	Ammannia multiflora			x
	Rotala diandra			x
Malvaceae	*Abutilon amplum*	x	x	
	Abutilon fraseri			x
	Abutilon fraseri subsp. *fraseri*	x		
	Abutilon otocarpum	x	x	x
	Abutilon oxycarpum			x
	Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)	x	x	
	Androcalva luteiflora	x	x	x
	Corchorus crozophorifolius	x	x	x
	Corchorus lasiocarpus subsp. *lasiocarpus*		x	
	Corchorus lasiocarpus subsp. *parvus*		x	
	Corchorus tridens	x	x	x
	Corchorus walcottii			x
	Gossypium australe		x	x
	Gossypium robinsonii	x	x	x
	Gossypium sturtianum var. *sturtianum*	x	x	
	Hibiscus burtonii			x
	Hibiscus coatesii		x	
	Hibiscus sp. Mt Robinson (G. Byrne 3537)			x
	Hibiscus sturtii		x	x
	Hibiscus sturtii var. *campylochlamys*		x	
	**Malvastrum americanum*	x	x	x
	Melhania oblongifolia	x	x	x
	Sida arenicola			x
	Sida echinocarpa		x	x
	Sida ectogama			x

Family	Species	Current	Astron	Mattiske
	Sida fibulifera	x	x	x
Malvaceae	*Sida rohlenae*			x
	Sida sp. Articulation below (A A. Mitchell PRP 1605)		x	
	Sida sp. L (A.M. Ashby 4202)	x		
	Sida sp. Shovelanna Hill (S. van Leeuwen 3842)			x
	Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	x	x	x
	Sida sp. (indet.)			x
	Triumfetta clementii			x
	Waltheria indica		x	x
Marsileaceae	*Marsilea hirsuta*	x		x
Menispermaceae	*Tinospora smilacina*	x		
Molluginaceae	*Trigastrotheca molluginea*		x	
Moraceae	*Ficus brachypoda*	x		x
Myrtaceae	*Corymbia aspera*			x
	Corymbia ferriticola	x		
	Corymbia hamersleyana			x
	Corymbia hamersleyana (sens lat.)		x	
	Eucalyptus camaldulensis	x		x
	Eucalyptus camaldulensis subsp. *obtusa*	x	x	
	Eucalyptus gamophylla	x		x
	Eucalyptus ?kingsmillii	x		
	Eucalyptus leucophloia			x
	Eucalyptus leucophloia subsp. *leucophloia*		x	
	Eucalyptus socialis subsp. *eucentrica*		x	
	Eucalyptus trivalva	x		
	Eucalyptus victrix	x	x	x
	Eucalyptus xerothermica	x	x	x
	Melaleuca argentea	x		x
	Melaleuca bracteata	x	x	x
	Melaleuca glomerata	x	x	x
	Melaleuca lasiandra			x
Nyctaginaceae	*Boerhavia burbidgeana*			x
	Boerhavia coccinea	x	x	x
	Boerhavia sp. (indet.)			x
Oleaceae	*Jasminum didymum*			x

Family	Species	Current	Astron	Mattiske
	Jasminum didymum subsp*. lineare*	x	x	x
Papaveraceae	**Argemone ochroleuca*			x
Phrymaceae	*Peplidium muelleri*			x
	Peplidium sp. C Evol. Fl. Fauna Arid Aust. (N.T. Burbidge & A. Kanis 8158)	x		
Phyllanthaceae	*Notoleptopus decaisnei*			x
	Phyllanthus erwinii		x	x
	Phyllanthus maderaspatensis	x	x	x
Pittosporaceae	*Pittosporum angustifolium*	x		x
Plantaginaceae	*Stemodia grossa*	x	x	x
Poaceae	*Acrachne racemosa*		x	x
	Amphipogon sericeus			x
	Aristida burbidgeae	x		
	Aristida contorta	x	x	x
	Aristida holathera			x
	Aristida holathera var*. holathera*	x	x	
	Aristida inaequiglumis		x	
	Aristida ingrata		x	x
	Aristida latifolia	x		
	Aristida lazaridis (P2)	x	x	
	Aristida obscura		x	
	Aristida pruinosa	x		
	Bothriochloa ewartiana	x	x	x
	**Cenchrus ciliaris*	x	x	x
	**Cenchrus setiger*	x	x	x
	**Chloris virgata*	x	x	x
	Chrysopogon fallax	x	x	x
	Cymbopogon ambiguus	x	x	x
	Cymbopogon obtectus			x
	Cymbopogon procerus			x
	Cynodon convergens		x	x
	**Cynodon dactylon*		x	
	Dactyloctenium radulans			x
	Dichanthium sericeum			x
	Dichanthium sericeum subsp*. humilius*		x	
	Dichanthium sericeum subsp*. sericeum*	x		

Family	Species	Current	Astron	Mattiske
	Digitaria brownii		x	x
Poaceae	*Digitaria ctenantha*	x		x
	Enneapogon caerulescens	x	x	x
	Enneapogon lindleyanus	x	x	x
	Enneapogon polyphyllus	x	x	x
	Enneapogon robustissimus	x	x	x
	Enteropogon ramosus	x	x	x
	Eragrostis cumingii	x	x	x
	Eragrostis elongata	x		
	Eragrostis eriopoda		x	x
	Eragrostis leptocarpa			x
	Eragrostis pergracilis	x		
	Eragrostis tenellula	x	x	x
	Eriachne benthamii	x	x	
	Eriachne mucronata	x	x	x
	Eriachne pulchella	x	x	x
	Eriachne pulchella subsp. *dominii*		x	
	Eriachne pulchella subsp. *pulchella*		x	
	Eriachne tenuiculmis			x
	Eulalia sp. 'Three River Station'	x		
	Eulalia aurea	x	x	x
	Iseilema eremaeum		x	
	Iseilema membranaceum	x		x
	Iseilema vaginiflorum		x	x
	**Melinis repens*	x		
	Panicum decompositum	x	x	
	Panicum effusum		x	
	Paraneurachne muelleri	x	x	x
	Paspalidium basicladum			x
	Paspalidium clementii	x	x	x
	Paspalidium constrictum	x		
	Paspalidium rarum	x	x	x
	Perotis rara	x	x	x
	Schizachyrium fragile		x	
	Setaria dielsii	x	x	x

Family	Species	Current	Astron	Mattiske
	Setaria surgens	x		x
Poaceae	**Setaria verticillata*	x	x	
	Sorghum plumosum	x		
	Sporobolus australasicus	x	x	x
	Themeda avenacea	x		
	Themeda triandra	x	x	x
	Tragus australianus			x
	Triodia angusta			x
	Triodia basedowii			x
	Triodia epactia	x		
	Triodia longiceps	x	x	x
	Triodia pungens	x	x	x
	Triodia wiseana	x	x	x
	Triraphis mollis		x	x
	**Urochloa mosambicensis*	x		
	Urochloa occidentalis	x		x
	Urochloa occidentalis var*. ciliata*	x		
	Urochloa piligera	x		
	Urochloa subquadripara			x
Polygalaceae	*Polygala isingii*		x	
Polygonaceae	**Rumex vesicarius*			x
Portulacaceae	*Portulaca oleracea*	x		
	Portulaca oleracea/intraterranea			x
Proteaceae	*Grevillea wickhamii* subsp*. hispidula*		x	
	Hakea chordophylla		x	x
	Hakea lorea			x
	Hakea lorea subsp*. lorea*	x	x	x
Pteridaceae	*Cheilanthes sieberi*			x
	Cheilanthes sieberi subsp*. sieberi*	x	x	
Rubiaceae	*Dolichocarpa crouchiana*			x
	Psydrax latifolia			x
	Psydrax suaveolens	x	x	
	Synaptantha tillaeacea			x
Santalaceae	*Anthobolus leptomerioides*	x		
	Santalum lanceolatum	x	x	x

Family	Species	Current	Astron	Mattiske
	Santalum spicatum		x	x
Sapindaceae	*Atalaya hemiglauca*	x	x	x
	Dodonaea lanceolata	x		
	Dodonaea lanceolata var. *lanceolata*		x	
	Dodonaea pachyneura	x		
	Dodonaea petiolaris		x	
	Dodonaea viscosa			x
	Dodonaea viscosa subsp. *mucronata*	x		
Scrophulariaceae	*Eremophila ?compacta*	x		
	Eremophila forrestii			x
	Eremophila forrestii subsp. *forrestii*	x		
	Eremophila longifolia	x		x
	Eremophila jucunda			x
	Eremophila sp. Hamersley Range (K. Walker KW 136) (P3)			x
	Eremophila tietkensii			x
Solanaceae	**Datura leichhardtii*			x
	**Datura leichhardtii* subsp. *leichhardtii*		x	x
	Nicotiana benthamiana			x
	Nicotiana occidentalis subsp. *obliqua*	x		x
	Nicotiana rosulata			x
	Nicotiana sp. (indet.)		x	x
	Solanum chippendalei	x		
	Solanum cleistogamum	x	x	
	Solanum gabrielae			x
	Solanum horridum			x
	Solanum lasiophyllum	x	x	x
	Solanum nigrum	x		
	Solanum phlomoides		x	
	Solanum sp. (indet.)			x
Stylidiaceae	*Stylidium weeliwolli* (P3)	x		
Surianaceae	*Stylobasium spathulatum*	x	x	x
Typhaceae	*Typha domingensis*			x
Violaceae	*Afrohybanthus aurantiacus*	x	x	x
Zygophyllaceae	*Roepera eichleri*			x
	Roepera iodocarpa	x		

Family	Species	Current	Astron	Mattiske
	Tribulus astrocarpus	x		x
Zygophyllaceae	*Tribulus suberosus*			x

Appendix M: Site Data from Quadrats, Relevés and Mapping Notes collected as part of the current study.

SITE	MNR-02
PROJ	HD2 Riparian Survey
DATE	12-Jul-21
SITE_TYPE	Relevé
SITE_DIM	
HABITAT	Minor drainage line
SOIL	Silty loam
ROCK_TYPE	Ironstone
VEGETATION	Open *Eucalyptus xerothermica* woodland over *Acacia citrinoviridis* tall shrubland over *Themeda triandra* tussock grassland
VEG_COND	Excellent
FIRE_AGE	5-10 yrs, >10 yrs
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	719715
NORTH	7453506
LATITUDE_GDA	-23.10235
LONGITUDE_GDA	119.14379



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
MNR-02	1	*Abutilon fraseri* subsp. *fraseri*	12/07/2021	Coll	0.1	40	
MNR-02	2	*Acacia aptaneura*	12/07/2021	Coll	4	600	
MNR-02	3	*Acacia bivenosa*	12/07/2021		2	350	
MNR-02	4	*Acacia citrinoviridis*	12/07/2021		20	800	
MNR-02	5	*Acacia pruinocarpa*	12/07/2021		1.5	600	
MNR-02	6	*Acacia pyrifolia*	12/07/2021		2	250	
MNR-02	7	**Bidens bipinnata*	12/07/2021		0.1	30	
MNR-02	8	*Bothriochloa ewartiana*	12/07/2021	Coll	2	50	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
MNR-02	9	*Cymbopogon ambiguus*	12/07/2021		0.1	40	
MNR-02	10	*Dicladanthera forrestii*	12/07/2021	Coll	0.1	20	
MNR-02	11	*Duperreya commixta*	12/07/2021		0.1	50	
MNR-02	12	*Enneapogon polyphyllus*	12/07/2021		0.1	20	
MNR-02	13	*Enneapogon robustissimus*	12/07/2021		0.1	40	
MNR-02	14	*Eucalyptus xerothermica*	12/07/2021		8	100	
MNR-02	15	*Evolvulus alsinoides* var. *villosicalyx*	12/07/2021		0.1	20	
MNR-02	16	*Glycine canescens*	12/07/2021		0.5	50	
MNR-02	17	*Indigofera georgei*	12/07/2021	Coll	0.1	30	
MNR-02	18	*Isotropis iophyta*	12/07/2021		0.1	50	
MNR-02	19	**Malvastrum americanum*	12/07/2021		0.1	40	
MNR-02	20	*Petalostylis labicheoides*	12/07/2021		2	200	
MNR-02	21	*Ptilotus obovatus*	12/07/2021		1	60	
MNR-02	22	*Senna artemisioides* subsp. *filifolia*	12/07/2021	Coll	0.1	150	
MNR-02	23	*Sida* ?sp. L (A.M. Ashby 4202)	12/07/2021	Coll	0.1	150	
MNR-02	24	*Themeda triandra*	12/07/2021		55	60	
MNR-02	25	*Triodia longiceps*	12/07/2021	Coll	5	70	
MNR-02	26	*Triodia pungens*	12/07/2021	Coll	1	50	

SITE	MNV-01
PROJ	HD2 Riparian Survey
DATE	12-Jul-21
SITE_TYPE	Quadrat
SITE_DIM	100m x 25m
HABITAT	Medium drainage line; creek in undulating basalt
SOIL	Silty clay loam
ROCK_TYPE	Basalt
VEGETATION	Open *Eucalyptus victrix* woodland over *Melaleuca bracteata*, *Melaleuca glomerata* and *Gossypium sturtianum* var. *sturtianum* open shrubland over **Cenchrus ciliaris*, *Bothriochloa ewartiana*, *Themeda triandra* tussock grassland
VEG_COND	Very Good; weeds and cattle disturbance present
FIRE_AGE	5-10 yrs
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	706178
NORTH	7443836
LATITUDE_GDA	-23.10138
LONGITUDE_GDA	119.01307



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
MNV-01	1	*Abutilon otocarpum*	12/07/2021	Coll	0.1	10	
MNV-01	2	*Acacia bivenosa*	12/07/2021	Coll	5	280	
MNV-01	3	*Acacia citrinoviridis*	12/07/2021	Coll	0.1	150	
MNV-01	4	*Alternanthera nana*	12/07/2021	Coll	0.1	20	
MNV-01	5	*Androcalva luteiflora*	12/07/2021	Coll	0.1	100	
MNV-01	6	*Bothriochloa ewartiana*	12/07/2021	Coll	8	70	
MNV-01	7	**Cenchrus ciliaris*	12/07/2021	Coll	35	60	
MNV-01	8	**Cenchrus setiger*	12/07/2021	Coll	7	60	
MNV-01	9	*Convolvulus remotus*	12/07/2021	Coll	0.1	100	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
MNV-01	10	*Cucumis variabilis*	12/07/2021	Coll	0.1	100	
MNV-01	11	*Cymbopogon ambiguus*	12/07/2021	Coll	0.1	100	
MNV-01	12	*Cyperus vaginatus*	12/07/2021	Coll	1.5	100	
MNV-01	13	*Eragrostis cumingii*	12/07/2021	Coll	0.1	10	
MNV-01	14	*Eragrostis tenellula*	12/07/2021	Coll	0.1	10	
MNV-01	15	*Eucalyptus victrix*	12/07/2021	Coll	14	700	
MNV-01	16	*Eulalia aurea*	12/07/2021	Coll	0.5	90	
MNV-01	17	*Evolvulus alsinoides* var. *decumbens*	12/07/2021	Coll	0.1	20	
MNV-01	18	*Glycine canescens*	12/07/2021	Coll	0.1	120	
MNV-01	19	*Gossypium sturtianum* var. *sturtianum*	12/07/2021	Coll	2	150	
MNV-01	20	*Jasminum didymum* subsp. *lineare*	12/07/2021	Coll	0.1	150	
MNV-01	21	*Melaleuca bracteata*	12/07/2021	Coll	22	250	
MNV-01	22	*Melaleuca glomerata*	12/07/2021	Coll	0.5	200	
MNV-01	23	*Petalostylis labicheoides*	12/07/2021	Coll	0.1	180	
MNV-01	24	*Phyllanthus maderaspatensis*	12/07/2021	Coll	0.1	10	
MNV-01	25	*Pluchea rubelliflora*	12/07/2021	Coll	0.1	20	
MNV-01	26	*Stemodia grossa*	12/07/2021	Coll	0.1	30	
MNV-01	27	*Themeda triandra*	12/07/2021	Coll	5	70	
MNV-01	28	*Triodia longiceps*	12/07/2021	Coll	0.1	70	
MNV-01	29	**Urochloa mosambicensis*	12/07/2021	Coll	0.1	120	Substantial range extension; Not recorded in the Pilbara previously.

SITE	PMR-05
PROJ	HD2 Riparian Survey
DATE	12-Jul-21
SITE_TYPE	Relevé
SITE_DIM	
HABITAT	Drainage area/Floodplain
SOIL	Clay loam
ROCK_TYPE	Ironstone
VEGETATION	*Eucalyptus xerothermica* open woodland over mulga (*Acacia aptaneura, Acacia macraneura*) and *Acacia pruinocarpa* over *Enneapogon polyphyllus*, *Bothriochloa ewartiana* and *Triodia longiceps* tussock and hummock grasses
VEG_COND	Excellent
FIRE_AGE	5-10 yrs, >10 yrs
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	704101
NORTH	7452649
LATITUDE_GDA	-23.02207
LONGITUDE_GDA	118.99163



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMR-05	1	*Abutilon amplum*	12/07/2021	Coll	0.1	60	
PMR-05	2	*Acacia aptaneura*	12/07/2021		3	500	
PMR-05	3	*Acacia macraneura*	12/07/2021	Coll	17	500	
PMR-05	4	*Acacia pruinocarpa*	12/07/2021		5	400	
PMR-05	5	*Aristida contorta*	12/07/2021		0.5	20	
PMR-05	6	*Arivela viscosa*	12/07/2021		0.1	70	
PMR-05	7	*Bothriochloa ewartiana*	12/07/2021	Coll	5	70	
PMR-05	8	*Chrysopogon fallax*	12/07/2021		1	60	
PMR-05	9	*Dipteracanthus australasicus* subsp. *australasicus*	12/07/2021		0.1	30	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMR-05	10	*Duperreya commixta*	12/07/2021		0.1	50	
PMR-05	11	*Enchylaena tomentosa* var*. tomentosa*	12/07/2021	Coll	0.5	40	
PMR-05	12	*Enneapogon lindleyanus*	12/07/2021		2	50	
PMR-05	13	*Enneapogon polyphyllus*	12/07/2021		8	30	
PMR-05	14	*Eucalyptus xerothermica*	12/07/2021		12	800	
PMR-05	15	*Evolvulus alsinoides* var*. villosicalyx*	12/07/2021		0.5	200	
PMR-05	16	**Malvastrum americanum*	12/07/2021		0.1	50	
PMR-05	17	*Pterocaulon sphacelatum*	12/07/2021		0.1	50	
PMR-05	18	*Ptilotus obovatus*	12/07/2021		0.5	60	
PMR-05	19	*Rhagodia eremaea*	12/07/2021	Coll	1	120	
PMR-05	20	*Salsola australis*	12/07/2021		0.1	20	
PMR-05	21	*Sporobolus australasicus*	12/07/2021		0.1	10	
PMR-05	22	*Themeda triandra*	12/07/2021		3	60	
PMR-05	23	*Tribulus astrocarpus*	12/07/2021	Coll	0.1	1	
PMR-05	24	*Triodia longiceps*	12/07/2021	Coll	12	60	

SITE	PMR-07
PROJ	HD2 Riparian Survey
DATE	12-Jul-21
SITE_TYPE	Relevé
SITE_DIM	
HABITAT	Medium drainage line
SOIL	Silty clay loam
ROCK_TYPE	Ironstone
VEGETATION	*Eucalyptus victrix* woodland over *Acacia citrinoviridis* and *Atalaya hemiglauca* tall shrubland over *Bothriochloa ewartiana*, *Themeda triandra* and *Chrysopogon fallax* tussock grassland
VEG_COND	Excellent
FIRE_AGE	5-10 yrs, >10 yrs
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	716995
NORTH	7453173
LATITUDE_GDA	-23.01571
LONGITUDE_GDA	119.11731



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMR-07	1	*Acacia citrinoviridis*	12/07/2021		40	800	
PMR-07	2	*Acacia pyrifolia*	12/07/2021		2	180	
PMR-07	3	*Afrohybanthus aurantiacus*	12/07/2021		0.1	30	
PMR-07	4	*Alternanthera nana*	12/07/2021		0.1	10	
PMR-07	5	*Aristida contorta*	12/07/2021		0.1	30	
PMR-07	6	*Atalaya hemiglauca*	12/07/2021		0.5	250	
PMR-07	7	**Bidens bipinnata*	12/07/2021		0.1	20	
PMR-07	8	*Bothriochloa ewartiana*	12/07/2021		20	70	
PMR-07	9	*Chrysopogon fallax*	12/07/2021		3	70	
PMR-07	10	*Corchorus crozophorifolius*	12/07/2021		4	150	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMR-07	11	*Crotalaria medicaginea* var. *neglecta*	12/07/2021		0.1	30	
PMR-07	12	*Dicladanthera forrestii*	12/07/2021	Coll	0.5	30	
PMR-07	13	*Dipteracanthus australasicus* subsp. *australasicus*	12/07/2021	Coll	0.1	50	
PMR-07	14	*Duperreya commixta*	12/07/2021		0.1	50	
PMR-07	15	*Enneapogon lindleyanus*	12/07/2021		0.5	70	
PMR-07	16	*Enteropogon ramosus*	12/07/2021		1	70	
PMR-07	17	*Eragrostis tenellula*	12/07/2021		0.1	10	
PMR-07	18	*Eriachne pulchella*	12/07/2021		0.1	10	
PMR-07	19	*Eucalyptus victrix*	12/07/2021		17	1500	
PMR-07	20	*Evolvulus alsinoides* var. *villosicalyx*	12/07/2021		0.1	20	
PMR-07	21	*Glycine canescens*	12/07/2021		0.5	50	
PMR-07	22	*Gomphrena cunninghamii*	12/07/2021		0.1	10	
PMR-07	23	*Heliotropium cunninghamii*	12/07/2021		0.1	20	
PMR-07	24	*Isotropis iophyta*	12/07/2021		0.1	60	
PMR-07	25	**Malvastrum americanum*	12/07/2021		0.1	60	
PMR-07	26	*Phyllanthus maderaspatensis*	12/07/2021		0.5	30	
PMR-07	27	*Polycarpaea longiflora*	12/07/2021		0.1	20	
PMR-07	28	*Pterocaulon sphacelatum*	12/07/2021		0.1	50	
PMR-07	29	*Ptilotus exaltatus*	12/07/2021		0.1	50	
PMR-07	30	*Ptilotus obovatus*	12/07/2021		0.5	60	
PMR-07	31	*Rhynchosia minima*	12/07/2021		0.1	50	
PMR-07	32	*Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186)	12/07/2021		1	60	
PMR-07	33	*Themeda triandra*	12/07/2021		8	80	
PMR-07	34	*Trichodesma zeylanicum*	12/07/2021		0.5	100	
PMR-07	35	*Triodia longiceps*	12/07/2021		0.5	60	

SITE	PMV-02
PROJ	HD2 Riparian Survey
DATE	13-Jul-21
SITE_TYPE	Quadrat
SITE_DIM	100m x 25m
HABITAT	Minor drainage line
SOIL	Silty loam
ROCK_TYPE	Ironstone
VEGETATION	*Eucalyptus victrix, Eucalyptus xerothermica* and *Eucalyptus camaldulensis* open woodland over **Vachellia farnesiana, Acacia incurvaneura, Acacia pyrifolia* open shrubland over *Themeda triandra, Bothriochloa ewartiana, Eulalia aurea* tussock grassland
VEG_COND	Very Good; Cattle grazing
FIRE_AGE	3-5 yrs; evidence of fire scar
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	699610
NORTH	7449885
LATITUDE_GDA	-23.04757
LONGITUDE_GDA	118.94819



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMV-02	1	*Acacia colei* var. *colei*	13/07/2021	Coll	0.1	200	
PMV-02	2	*Acacia dictyophleba*	13/07/2021		3	180	
PMV-02	3	*Acacia incurvaneura*	13/07/2021		8	400	
PMV-02	4	*Acacia maitlandii*	13/07/2021		0.1	50	
PMV-02	5	*Acacia pruinocarpa*	13/07/2021		0.5	300	
PMV-02	6	*Acacia pyrifolia*	13/07/2021		3	200	
PMV-02	7	*Alternanthera nodiflora*	13/07/2021		0.1	30	
PMV-02	8	*Aristida lazaridis*	13/07/2021	Coll	3	100	Priority 2
PMV-02	9	*Arivela viscosa*	13/07/2021		0.1	20	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMV-02	10	**Bidens bipinnata*	13/07/2021		4	30	
PMV-02	11	*Bothriochloa ewartiana*	13/07/2021		5	100	
PMV-02	12	*Brachyscome ciliaris*	13/07/2021	Coll	0.1	20	
PMV-02	13	*Centipeda minima*	13/07/2021	Coll	0.1	5	
PMV-02	14	*Cheilanthes sieberi* subsp. *sieberi*	13/07/2021		0.1	20	
PMV-02	15	*Convolvulus remotus*	13/07/2021		0.1	20	
PMV-02	16	*Crotalaria medicaginea* var. *neglecta*	13/07/2021	Coll	0.1	20	
PMV-02	17	*Cucumis variabilis*	13/07/2021		0.1	20	
PMV-02	18	*Cymbopogon ambiguus*	13/07/2021		1	10	
PMV-02	19	*Cyperus vaginatus*	13/07/2021		1	70	
PMV-02	20	*Dichanthium sericeum* subsp. *sericeum*	13/07/2021		1.5	100	
PMV-02	21	*Dicladanthera forrestii*	13/07/2021		0.1	20	
PMV-02	22	*Duperreya commixta*	13/07/2021		0.1	30	
PMV-02	23	*Enneapogon robustissimus*	13/07/2021		1	100	
PMV-02	24	*Enteropogon ramosus*	13/07/2021		3	100	
PMV-02	25	*Eragrostis elongata*	13/07/2021	Coll	0.1	30	
PMV-02	26	*Eucalyptus camaldulensis*	13/07/2021		2	2000	
PMV-02	27	*Eucalyptus victrix*	13/07/2021		13	2000	
PMV-02	28	*Eucalyptus xerothermica*	13/07/2021		4	500	
PMV-02	29	*Eulalia aurea*	13/07/2021		8	100	
PMV-02	30	*Evolvulus alsinoides* var. *decumbens*	13/07/2021		0.1	20	
PMV-02	31	**Flaveria trinervia*	13/07/2021	Coll	0.1	30	
PMV-02	32	*Glycine canescens*	13/07/2021		0.1	50	
PMV-02	33	*Indigofera linnaei*	13/07/2021	Coll	0.1	30	
PMV-02	34	*Isotropis iophyta*	13/07/2021		1	50	
PMV-02	35	*Panicum decompositum*	13/07/2021	Coll	0.5	100	
PMV-02	36	*Phyllanthus maderaspatensis*	13/07/2021		0.1	20	
PMV-02	37	*Pterocaulon sphacelatum*	13/07/2021		0.1	20	
PMV-02	38	*Rhynchosia minima*	13/07/2021		0.1	20	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMV-02	39	*Senna artemisioides* subsp. *filifolia*	13/07/2021	Coll	1	200	
PMV-02	40	*Senna artemisioides* subsp. x *artemisioides*	13/07/2021		0.1	10	
PMV-02	41	*Setaria surgens*	13/07/2021		0.1	30	
PMV-02	42	*Sida fibulifera*	13/07/2021	Coll	0.1	20	
PMV-02	43	*Stemodia grossa*	13/07/2021		0.1	30	
PMV-02	44	*Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186)	13/07/2021		1	40	
PMV-02	45	*Themeda avenacea*	13/07/2021	Coll	1	100	
PMV-02	46	*Themeda triandra*	13/07/2021		12	120	
PMV-02	47	*Triodia longiceps*	13/07/2021		3	100	
PMV-02	48	*Urochloa occidentalis*	13/07/2021		0.1	20	
PMV-02	49	**Vachellia farnesiana*	13/07/2021		5	200	
PMV-02	50	*Wahlenbergia tumidifructa*	13/07/2021		0.1	20	

SITE	PMV-01
PROJ	HD2 Riparian Survey
DATE	12-Jul-21
SITE_TYPE	Quadrat
SITE_DIM	100m x 25m
HABITAT	Minor drainage line
SOIL	Silty loam
ROCK_TYPE	Ironstone
VEGETATION	*Eucalyptus victrix, Eucalyptus xerothermica, Acacia aptaneura* x *paraneura* open woodland over **Vachellia farnesiana, Acacia pyrifolia, Acacia maitlandii* open shrubland over *Enneapogon robustissimus, Dichanthium sericeum* subsp. *sericeum*, **Cenchrus ciliaris* tussock grassland
VEG_COND	Excellent
FIRE_AGE	3-5 yrs; evidence of fire scar
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	697978
NORTH	7448781
LATITUDE_GDA	-23.05774
LONGITUDE_GDA	118.93241



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMV-01	1	*Acacia aptaneura* x *paraneura*	12/07/2021	Coll	4	350	
PMV-01	2	*Acacia dictyophleba*	12/07/2021	Coll	4	200	
PMV-01	3	*Acacia maitlandii*	12/07/2021	Coll	8	200	
PMV-01	4	*Acacia pyrifolia*	12/07/2021		8	180	
PMV-01	5	*Alternanthera nana*	12/07/2021		0.01	20	
PMV-01	6	*Aristida pruinosa*	12/07/2021	Coll	3	100	
PMV-01	7	*Arivela viscosa*	12/07/2021		0.1	30	
PMV-01	8	**Bidens bipinnata*	12/07/2021		2	20	
PMV-01	9	*Bothriochloa ewartiana*	12/07/2021	Coll	2	100	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMV-01	10	**Cenchrus ciliaris*	12/07/2021		4	50	
PMV-01	11	*Cheilanthes sieberi* subsp*. sieberi*	12/07/2021	Coll	0.1	20	
PMV-01	12	*Chrysocephalum apiculatum* subsp*. pilbarense*	12/07/2021	Coll	0.1	20	
PMV-01	13	*Chrysopogon fallax*	12/07/2021	Coll	1	60	
PMV-01	14	*Convolvulus remotus*	12/07/2021	Coll	0.1	100	
PMV-01	15	*Cymbopogon ambiguus*	12/07/2021		2	100	
PMV-01	16	*Dichanthium sericeum* subsp*. sericeum*	12/07/2021	Coll	10	50	
PMV-01	17	*Dicladanthera forrestii*	12/07/2021	Coll	0.1	20	
PMV-01	18	*Duperreya commixta*	12/07/2021	Coll	0.2	100	
PMV-01	19	*Enneapogon caerulescens*	12/07/2021	Coll	1	50	
PMV-01	20	*Enneapogon polyphyllus*	12/07/2021	Coll	0.1	40	
PMV-01	21	*Enneapogon robustissimus*	12/07/2021	Coll	7	80	
PMV-01	22	*Enteropogon ramosus*	12/07/2021	Coll	1	100	
PMV-01	23	*Eremophila longifolia*	12/07/2021	Coll	1	200	
PMV-01	24	*Eriachne mucronata*	12/07/2021	Coll	0.1	40	
PMV-01	25	*Eucalyptus victrix*	12/07/2021		15	1800	
PMV-01	26	*Eucalyptus xerothermica*	12/07/2021		2	400	
PMV-01	27	*Eulalia aurea*	12/07/2021		2	100	
PMV-01	28	*Euphorbia australis* var*. subtomentosa*	12/07/2021	Coll	0.1	-	Prostrate
PMV-01	29	*Evolvulus alsinoides* var*. decumbens*	12/07/2021		0.1	20	
PMV-01	30	*Glycine canescens*	12/07/2021		0.6	50	
PMV-01	31	*Gossypium robinsonii*	12/07/2021		0.1	200	
PMV-01	32	*Gossypium sturtianum* var*. sturtianum*	12/07/2021		0.1	150	
PMV-01	33	*Isotropis iophyta*	12/07/2021	Coll	1	100	
PMV-01	34	**Malvastrum americanum*	12/07/2021		0.5	50	
PMV-01	35	*Olearia fluvialis*	12/07/2021	Coll	0.1	30	
PMV-01	36	*Petalostylis labicheoides*	12/07/2021		2	200	
PMV-01	37	*Phyllanthus maderaspatensis*	12/07/2021	Coll	0.1	20	
PMV-01	38	*Pterocaulon sphacelatum*	12/07/2021	Coll	0.1	20	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMV-01	39	*Ptilotus ?auriculifolius*	12/07/2021	Coll	0.1	50	
PMV-01	40	*Rhynchosia minima*	12/07/2021		0.1	20	
PMV-01	41	*Santalum lanceolatum*	12/07/2021		0.5	200	
PMV-01	42	*Senna artemisioides* subsp. x *artemisioides*	12/07/2021	Coll	1	180	
PMV-01	43	*Setaria dielsii*	12/07/2021	Coll	0.1	100	
PMV-01	44	*Setaria surgens*	12/07/2021	Coll	0.1	30	
PMV-01	45	*Sida fibulifera*	12/07/2021		0.1	20	
PMV-01	46	*Stemodia grossa*	12/07/2021		0.1	20	
PMV-01	47	*Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186)	12/07/2021	Coll	0.1	30	
PMV-01	48	*Themeda triandra*	12/07/2021		12	100	
PMV-01	49	*Triodia longiceps*	12/07/2021		0.5	40	
PMV-01	50	*Urochloa occidentalis*	12/07/2021	Coll	1	100	
PMV-01	51	**Vachellia farnesiana*	12/07/2021		2	220	
PMV-01	52	*Wahlenbergia tumidifructa*	12/07/2021	Coll	0.1	20	

SITE	PMV-03
PROJ	HD2 Riparian Survey
DATE	13-Jul-21
SITE_TYPE	Relevé
SITE_DIM	100m x 25m
HABITAT	Major drainage line
SOIL	Sandy clay loam
ROCK_TYPE	Basalt, Ironstone
VEGETATION	*Eucalyptus victrix, Eucalyptus xerothermica, Eucalyptus camaldulensis* open woodland over *Acacia dictyophleba*, **Vachellia farnesiana, Acacia maitlandii* open shrubland over *Themeda triandra, Bothriochloa ewartiana, Eulalia aurea* tussock grassland
VEG_COND	Excellent
FIRE_AGE	5-10 yrs
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	701967
NORTH	7451011
LATITUDE_GDA	-23.03712
LONGITUDE_GDA	118.97103



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMV-03	1	*Acacia dictyophleba*	13/07/2021		6	250	
PMV-03	2	*Acacia incurvaneura*	13/07/2021	Coll	1	200	
PMV-03	3	*Acacia macraneura*	13/07/2021	Coll	5	400	
PMV-03	4	*Acacia pyrifolia*	13/07/2021		2	30	
PMV-03	5	*Aristida holathera* var. *holathera*	13/07/2021	Coll	0.1	30	
PMV-03	6	*Corchorus tridens*	13/07/2021	Coll	0.1	10	
PMV-03	7	*Dicladanthera forrestii*	13/07/2021	Coll	0.1	20	
PMV-03	8	*Digitaria ctenantha*	13/07/2021	Coll	1	50	
PMV-03	9	*Enneapogon polyphyllus*	13/07/2021	Coll	1	30	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMV-03	10	*Eucalyptus camaldulensis*	13/07/2021		1	1500	
PMV-03	11	*Eucalyptus victrix*	13/07/2021		8	1800	
PMV-03	12	*Eucalyptus xerothermica*	13/07/2021		3	1000	
PMV-03	13	*Goodenia prostrata*	13/07/2021	Coll	0.1	20	
PMV-03	14	*Heliotropium cunninghamii*	13/07/2021	Coll	0.1	30	
PMV-03	15	*Indigofera georgei*	13/07/2021	Coll	0.1	20	
PMV-03	16	*Paraneurachne muelleri*	13/07/2021	Coll	0.1	50	
PMV-03	17	*Polymeria ambigua*	13/07/2021	Coll	0.1	10	
PMV-03	18	*Sida fibulifera*	13/07/2021		0.1	20	
PMV-03	19	*Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186)	13/07/2021	Coll	1	50	
PMV-03	20	*Urochloa occidentalis* var. *ciliata*	13/07/2021	Coll	2	40	
PMV-03	21	**Vachellia farnesiana*	13/07/2021		3	200	

SITE	PMV-04
PROJ	HD2 Riparian Survey
DATE	13-Jul-21
SITE_TYPE	Relevé
SITE_DIM	100m x 25m
HABITAT	Major drainage line
SOIL	Sandy clay loam
ROCK_TYPE	Ironstone
VEGETATION	*Eucalyptus camaldulensis, Eucalyptus victrix, Eucalyptus xerothermica* open woodland over *Acacia pyrifolia, Tephrosia rosea* var. Fortescue creeks (M.I.H. brooker 2186), *Petalostylis labicheoides* low shrubland over *Cymbopogon ambiguus, Eulalia aurea, Bothriochloa ewartiana* tussock grassland
VEG_COND	Very Good; evidence of cattle grazing
FIRE_AGE	5-10 yrs
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	703027
NORTH	7452229
LATITUDE_GDA	-23.02599
LONGITUDE_GDA	118.98121



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMV-04	1	*Acacia aptaneura*	13/07/2021	Coll	1	500	
PMV-04	2	*Acacia incurvaneura*	13/07/2021	Coll	2	1000	
PMV-04	3	*Acacia pyrifolia*	13/07/2021		12	70	
PMV-04	4	*Anthobolus leptomerioides*	13/07/2021	Coll	0.1	100	
PMV-04	5	*Aristida lazaridis*	13/07/2021	Coll	0.1	50	Priority 2
PMV-04	6	*Bothriochloa ewartiana*	13/07/2021		12	50	
PMV-04	7	*Cymbopogon ambiguus*	13/07/2021	Coll	8	100	
PMV-04	8	*Enchylaena tomentosa* var. *tomentosa*	13/07/2021	Coll	0.1	50	
PMV-04	9	*Eucalyptus camaldulensis*	13/07/2021		12	1800	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMV-04	10	*Eucalyptus victrix*	13/07/2021		7	2200	
PMV-04	11	*Eucalyptus xerothermica*	13/07/2021		1	200	
PMV-04	12	*Eulalia aurea*	13/07/2021		3	50	
PMV-04	13	*Hakea lorea* subsp. *lorea*	13/07/2021	Coll	0.1	400	
PMV-04	14	*Olearia fluvialis*	13/07/2021		0.1	200	
PMV-04	15	*Petalostylis labicheoides*	13/07/2021		3	100	
PMV-04	16	*Rostellularia adscendens* var. *latifolia*	13/07/2021	Coll	0.1	200	Priority 3
PMV-04	17	*Sida fibulifera*	13/07/2021	Coll	0.1	15	
PMV-04	18	*Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186)	13/07/2021		5	50	

SITE	PMV-05
PROJ	HD2 Riparian Survey
DATE	13-Jul-21
SITE_TYPE	Quadrat
SITE_DIM	100m x 25m
HABITAT	Medium drainage line
SOIL	Silty loam
ROCK_TYPE	Ironstone
VEGETATION	*Eucalyptus victrix, Eucalyptus camaldulensis, Eucalyptus xerothermica* open woodland over *Acacia macraneura, Acacia aptaneura, *Vachellia farnesiana, Senna artemisioides* subsp. x *artemisioides* tall shrubland over *Themeda triandra*, *Bothriochloa ewartiana, Eulalia aurea* tussock grassland
VEG_COND	Excellent
FIRE_AGE	5-10 yrs, >10 yrs
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	704158
NORTH	7452794
LATITUDE_GDA	-23.02076
LONGITUDE_GDA	118.99217



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMV-05	1	*Abutilon fraseri* subsp*. fraseri*	13/07/2021	Coll	0.1	10	
PMV-05	2	*Acacia aptaneura*	13/07/2021	Coll	1	500	
PMV-05	3	*Acacia dictyophleba*	13/07/2021		0.5	300	
PMV-05	4	*Acacia macraneura*	13/07/2021	Coll	5	500	
PMV-05	5	*Acacia pyrifolia*	13/07/2021		1.5	150	
PMV-05	6	*Alternanthera nana*	13/07/2021		0.1	10	
PMV-05	7	*Androcalva luteiflora*	13/07/2021		0.2	150	
PMV-05	8	*Aristida lazaridis*	13/07/2021		0.1	60	Priority 2
PMV-05	9	*Arivela viscosa*	13/07/2021		0.1	40	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMV-05	10	**Bidens bipinnata*	13/07/2021		0.5	20	
PMV-05	11	*Boerhavia coccinea*	13/07/2021		0.1	10	
PMV-05	12	*Bothriochloa ewartiana*	13/07/2021		8	70	
PMV-05	13	*Chrysocephalum apiculatum* subsp*. pilbarense*	13/07/2021	Coll	0.1	30	
PMV-05	14	*Chrysopogon fallax*	13/07/2021		1	60	
PMV-05	15	*Crotalaria medicaginea* var*. neglecta*	13/07/2021		0.1	20	
PMV-05	16	*Cucumis variabilis*	13/07/2021		0.1	30	
PMV-05	17	*Cymbopogon ambiguus*	13/07/2021		2.5	70	
PMV-05	18	*Dichanthium sericeum* subsp*. sericeum*	13/07/2021		1	50	
PMV-05	19	*Dicladanthera forrestii*	13/07/2021	Coll	0.1	20	
PMV-05	20	*Dipteracanthus australasicus* subsp*. australasicus*	13/07/2021	Coll	0.1	20	
PMV-05	21	*Duperreya commixta*	13/07/2021		0.1	50	
PMV-05	22	*Enneapogon lindleyanus*	13/07/2021		0.1	30	
PMV-05	23	*Enneapogon robustissimus*	13/07/2021		0.1	40	
PMV-05	24	*Enteropogon ramosus*	13/07/2021		3	70	
PMV-05	25	*Eremophila longifolia*	13/07/2021		0.5	350	
PMV-05	26	*Eucalyptus camaldulensis*	13/07/2021		4	1500	
PMV-05	27	*Eucalyptus victrix*	13/07/2021		12	2000	
PMV-05	28	*Eucalyptus xerothermica*	13/07/2021		2	700	
PMV-05	29	*Eulalia aurea*	13/07/2021		5	70	
PMV-05	30	*Euphorbia australis* var*. subtomentosa*	13/07/2021	Coll	0.1	-	Prostrate
PMV-05	31	*Evolvulus alsinoides* var*. villosicalyx*	13/07/2021		0.1	20	
PMV-05	32	*Glycine canescens*	13/07/2021		0.2	50	
PMV-05	33	*Hakea lorea* subsp*. lorea*	13/07/2021		0.1	300	
PMV-05	34	*Indigofera georgei*	13/07/2021		0.1	40	
PMV-05	35	*Isotropis forrestii*	13/07/2021		0.1	100	
PMV-05	36	*Lepidium phlebopetalum*	13/07/2021	Coll	0.1	10	
PMV-05	37	**Malvastrum americanum*	13/07/2021		0.1	30	
PMV-05	38	*Nicotiana occidentalis* subsp*. obliqua*	13/07/2021	Coll	0.1	20	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMV-05	39	*Petalostylis labicheoides*	13/07/2021		0.5	200	
PMV-05	40	*Phyllanthus maderaspatensis*	13/07/2021		0.1	30	
PMV-05	41	*Pterocaulon sphacelatum*	13/07/2021		0.1	60	
PMV-05	42	*Ptilotus obovatus*	13/07/2021		0.1	30	
PMV-05	43	*Rhagodia eremaea*	13/07/2021	Coll	0.1	120	
PMV-05	44	*Rhynchosia minima*	13/07/2021		0.1	30	
PMV-05	45	*Rostellularia adscendens* var. *latifolia*	13/07/2021	Coll	0.1	20	Priority 3
PMV-05	46	*Salsola australis*	13/07/2021		0.1	20	
PMV-05	47	*Senna artemisioides* subsp. x *artemisioides*	13/07/2021		4	200	
PMV-05	48	*Sida fibulifera*	13/07/2021		0.1	10	
PMV-05	49	*Solanum lasiophyllum*	13/07/2021		0.1	20	
PMV-05	50	*Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186)	13/07/2021		0.5	50	
PMV-05	51	*Themeda triandra*	13/07/2021		17	60	
PMV-05	52	*Triodia longiceps*	13/07/2021		6	40	
PMV-05	53	**Vachellia farnesiana*	13/07/2021		3	300	

SITE	WWR-02
PROJ	HD2 Riparian Survey
DATE	12-Jul-21
SITE_TYPE	Relevé
SITE_DIM	
HABITAT	Minor drainage line
SOIL	Clay loam
ROCK_TYPE	Ironstone
VEGETATION	Open *Eucalyptus trivalv*a woodland over tall *Acacia aneura* shrubland over *Themeda triandra, Chrysopogon fallax* tussock grassland
VEG_COND	Excellent
FIRE_AGE	5-10 yrs, >10 yrs
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	707046
NORTH	7446927
LATITUDE_GDA	-23.07337
LONGITUDE_GDA	119.02113



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWR-02	1	*Abutilon fraseri* subsp. *fraseri*	12/07/2021	Coll	0.1	40	
WWR-02	2	*Acacia aneura*	12/07/2021	Coll	3	500	
WWR-02	3	*Acacia aptaneura*	12/07/2021	Coll	37	500	
WWR-02	4	*Acacia pachyacra*	12/07/2021	Coll	0.1	160	
WWR-02	5	*Acacia pruinocarpa*	12/07/2021		0.5	300	
WWR-02	6	*Chrysopogon fallax*	12/07/2021		3	60	
WWR-02	7	*Dipteracanthus australasicus* subsp. *australasicus*	12/07/2021	Coll	6	30	
WWR-02	8	*Duperreya commixta*	12/07/2021		0.1	100	
WWR-02	9	*Enneapogon polyphyllus*	12/07/2021	Coll	0.1	20	
WWR-02	10	*Eremophila forrestii* subsp. *forrestii*	12/07/2021	Coll	0.1	150	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWR-02	11	*Eucalyptus trivalva*	12/07/2021	Coll	8	500	
WWR-02	12	*Eucalyptus xerothermica*	12/07/2021		1	500	
WWR-02	13	*Euphorbia coghlanii*	12/07/2021	Coll	0.1	5	
WWR-02	14	*Evolvulus alsinoides* var. *villosicalyx*	12/07/2021	Coll	0.1	20	
WWR-02	15	*Goodenia stellata*	12/07/2021	Coll	0.1	1	
WWR-02	16	*Paraneurachne muelleri*	12/07/2021		0.1	30	
WWR-02	17	*Perotis rara*	12/07/2021		0.1	10	
WWR-02	18	*Psydrax suaveolens*	12/07/2021	Coll	0.1	100	
WWR-02	19	*Ptilotus obovatus*	12/07/2021	Coll	2	50	
WWR-02	20	*Senna artemisioides* subsp. x *artemisioides*	12/07/2021	Coll	0.1	180	
WWR-02	21	*Sida* sp. L (A.M. Ashby 4202)	12/07/2021	Coll	0.1	30	
WWR-02	22	*Themeda triandra*	12/07/2021	Coll	12	70	
WWR-02	23	*Triodia longiceps*	12/07/2021		0.5	50	

SITE	WWR-05
PROJ	HD2 Riparian Survey
DATE	14-Jul-21
SITE_TYPE	Relevé
SITE_DIM	
HABITAT	Major drainage line
SOIL	Sandy loam
ROCK_TYPE	Ironstone, Creek stone
VEGETATION	*Eucalyptus victrix, Eucalyptus camaldulensis* open woodland over **Vachellia farnesiana, Gossypium sturtianum* var. *sturtianum*, *Acacia dictyophleba* shrubland over **Cenchrus ciliaris*, *Bothriochloa ewartiana, Themeda triandra* tussock grassland
VEG_COND	Excellent
FIRE_AGE	3-5 yrs
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	709575
NORTH	7448312
LATITUDE_GDA	-23.06055
LONGITUDE_GDA	119.04561



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWR-05	1	*Acacia dictyophleba*	14/07/2021		2	200	
WWR-05	2	*Acacia macraneura*	14/07/2021	Coll	1	500	
WWR-05	3	*Bothriochloa ewartiana*	14/07/2021		8	100	
WWR-05	4	**Cenchrus ciliaris*	14/07/2021		18	100	
WWR-05	5	*Eucalyptus camaldulensis*	14/07/2021		13	2000	
WWR-05	6	*Eucalyptus victrix*	14/07/2021		13	2000	
WWR-05	7	*Gossypium sturtianum* var. *sturtianum*	14/07/2021		4	200	
WWR-05	8	*Hakea lorea* subsp. *lorea*	14/07/2021		1	400	
WWR-05	9	*Themeda triandra*	14/07/2021		5	100	
WWR-05	10	**Vachellia farnesiana*	14/07/2021		8	200	

SITE	WWR-07
PROJ	HD2 Riparian Survey
DATE	12-Jul-21
SITE_TYPE	Relevé
SITE_DIM	
HABITAT	Medium drainage line
SOIL	Silty loam
ROCK_TYPE	Basalt, Ironstone
VEGETATION	*Eucalyptus victrix, Eucalyptus xerothermica* open woodland over *Petalostylis labicheoides, Gossypium robinsonii, Gossypium sturtianum* var. *sturtianum* tall shrubland over *Bothriochloa ewartiana, Themeda triandra, Eulalia aurea* tussock grassland
VEG_COND	Excellent
FIRE_AGE	5-10 yrs, >10 yrs
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	715518
NORTH	7448243
LATITUDE_GDA	-23.06041
LONGITUDE_GDA	119.10360



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWR-07	1	*Acacia dictyophleba*	12/07/2021		2	200	
WWR-07	2	*Bothriochloa ewartiana*	12/07/2021		15	60	
WWR-07	3	*Eucalyptus victrix*	12/07/2021		8	700	
WWR-07	4	*Eucalyptus xerothermica*	12/07/2021		2	500	
WWR-07	5	*Eulalia aurea*	12/07/2021		5	60	
WWR-07	6	*Gossypium robinsonii*	12/07/2021		3	400	
WWR-07	7	*Gossypium sturtianum* var. *sturtianum*	12/07/2021		2	150	
WWR-07	8	*Petalostylis labicheoides*	12/07/2021		10	400	
WWR-07	9	*Themeda triandra*	12/07/2021		5	50	

SITE	WWR-12
PROJ	HD2 Riparian Survey
DATE	15-Jul-21
SITE_TYPE	Relevé
SITE_DIM	
HABITAT	Minor drainage line
SOIL	Sandy clay loam
ROCK_TYPE	
VEGETATION	*Eucalyptus camaldulensis, Acacia citrinoviridis, Atalaya hemiglauca* open woodland over *Petalostylis labicheoides, Acacia bivenosa* sparse shrubland over **Cenchrus ciliaris, Themeda triandra, Bothriochloa ewartiana* tussock grassland
VEG_COND	Good; weeds and cattle disturbance present
FIRE_AGE	5-10 yrs
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	721954
NORTH	7454861
LATITUDE_GDA	-22.99982
LONGITUDE_GDA	119.16543



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWR-12	1	*Acacia bivenosa*	15/07/2021		2	150	
WWR-12	2	*Acacia citrinoviridis*	15/07/2021		12	600	
WWR-12	3	*Acacia pruinocarpa*	15/07/2021		0.5	200	
WWR-12	4	*Atalaya hemiglauca*	15/07/2021		4	500	
WWR-12	5	*Bothriochloa ewartiana*	15/07/2021		8	100	
WWR-12	6	**Cenchrus ciliaris*	15/07/2021		42	100	
WWR-12	7	*Eucalyptus camaldulensis*	15/07/2021		8	2000	
WWR-12	8	*Eucalyptus xerothermica*	15/07/2021		2	1800	
WWR-12	9	**Malvastrum americanum*	15/07/2021		0.1	40	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWR-12	10	*Melhania oblongifolia*	15/07/2021		0.1	30	
WWR-12	11	*Petalostylis labicheoides*	15/07/2021		2	200	
WWR-12	12	*Pterocaulon sphacelatum*	15/07/2021		0.1	100	
WWR-12	13	*Stylobasium spathulatum*	15/07/2021	Coll	0.5	150	
WWR-12	14	*Themeda triandra*	15/07/2021		12	100	
WWR-12	15	*Triodia longiceps*	15/07/2021		8	100	

SITE	WWR-13
PROJ	HD2 Riparian Survey
DATE	15-Jul-21
SITE_TYPE	Relevé
SITE_DIM	
HABITAT	Drainage area/Floodplain
SOIL	Sandy clay loam
ROCK_TYPE	
VEGETATION	*Eucalyptus camaldulensis, Acacia citrinoviridis, Atalaya hemiglauca* open woodland over *Androcalva luteiflora, Pterocaulon sphacelatum* over *Triodia longiceps* hummock grassland
VEG_COND	Good; weeds and grazing from cattle/camels present
FIRE_AGE	5-10 yrs
NOTES	Banks of WW
POSITION	C
DATUM	WGS84
ZONE	50
EAST	722097
NORTH	7458181
LATITUDE_GDA	-22.96983
LONGITUDE_GDA	119.16635



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWR-13	1	*Acacia citrinoviridis*	15/07/2021		13	500	
WWR-13	2	*Acacia coriacea* subsp. *pendens*	15/07/2021	Coll	2	400	
WWR-13	3	*Androcalva luteiflora*	15/07/2021		6	100	
WWR-13	4	*Atalaya hemiglauca*	15/07/2021		8	500	
WWR-13	5	**Bidens bipinnata*	15/07/2021		1	20	
WWR-13	6	**Cenchrus ciliaris*	15/07/2021		18	80	
WWR-13	7	*Eucalyptus camaldulensis*	15/07/2021		8	2000	
WWR-13	8	*Hakea lorea* subsp. *lorea*	15/07/2021		2	500	
WWR-13	9	*Iseilema membranaceum*	15/07/2021	Coll	0.5	10	
WWR-13	10	**Malvastrum americanum*	15/07/2021		2	30	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWR-13	11	*Melhania oblongifolia*	15/07/2021	Coll	0.1	20	
WWR-13	12	*Perotis rara*	15/07/2021	Coll	0.1	20	
WWR-13	13	*Pterocaulon sphacelatum*	15/07/2021		3	80	
WWR-13	14	*Rhynchosia minima*	15/07/2021		4	50	
WWR-13	15	*Themeda triandra*	15/07/2021		5	70	
WWR-13	16	*Triodia longiceps*	15/07/2021	Coll	48	120	

SITE	WWR-01
PROJ	HD2 Riparian Survey
DATE	12-Jul-21
SITE_TYPE	Relevé
SITE_DIM	
HABITAT	Medium drainage line
SOIL	Silty loam
ROCK_TYPE	Basalt, Calcrete, Quartz
VEGETATION	*Eucalyptus camaldulensis* woodland over *Melaleuca bracteata*, *Acacia bivenosa* shrubland over **Cenchrus ciliaris, Themeda triandra* tussock grassland
VEG_COND	Excellent
FIRE_AGE	5-10 yrs, >10 yrs
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	706934
NORTH	7445416
LATITUDE_GDA	-23.08702
LONGITUDE_GDA	119.02024



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWR-01	1	*Acacia bivenosa*	12/07/2021		7	300	
WWR-01	2	*Acacia citrinoviridis*	12/07/2021		1.5	600	
WWR-01	3	*Androcalva luteiflora*	12/07/2021		1	150	
WWR-01	4	*Bothriochloa ewartiana*	12/07/2021		1	60	
WWR-01	5	**Cenchrus ciliaris*	12/07/2021		50	60	
WWR-01	6	**Cenchrus setiger*	12/07/2021		0.1	50	
WWR-01	7	*Cymbopogon ambiguus*	12/07/2021		1	60	
WWR-01	8	*Cyperus vaginatus*	12/07/2021	Coll	1	40	
WWR-01	9	*Dichanthium sericeum* subsp. *sericeum*	12/07/2021		0.1	40	
WWR-01	10	*Duperreya commixta*	12/07/2021		0.1	50	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWR-01	11	*Enteropogon ramosus*	12/07/2021		0.1	80	
WWR-01	12	*Eragrostis pergracilis*	12/07/2021	Coll	0.1	30	
WWR-01	13	*Eremophila longifolia*	12/07/2021		0.5	250	
WWR-01	14	*Eucalyptus camaldulensis*	12/07/2021		35	1200	
WWR-01	15	*Eucalyptus xerothermica*	12/07/2021		1	700	
WWR-01	16	*Eulalia aurea*	12/07/2021		10	60	
WWR-01	17	*Glycine canescens*	12/07/2021		0.1	50	
WWR-01	18	*Gossypium sturtianum* var. *sturtianum*	12/07/2021		3.5	150	
WWR-01	19	*Jasminum didymum* subsp. *lineare*	12/07/2021		0.1	50	
WWR-01	20	*Melaleuca bracteata*	12/07/2021		18	300	
WWR-01	21	*Melaleuca glomerata*	12/07/2021		1	200	
WWR-01	22	*Petalostylis labicheoides*	12/07/2021		1	200	
WWR-01	23	*Pluchea dentex*	12/07/2021		0.1	20	
WWR-01	24	*Pterocaulon sphacelatum*	12/07/2021		0.1	30	
WWR-01	25	*Rhynchosia minima*	12/07/2021		0.1	50	
WWR-01	26	*Senna artemisioides* subsp. x *artemisioides*	12/07/2021		0.1	150	
WWR-01	27	*Themeda triandra*	12/07/2021		5	50	
WWR-01	28	**Vachellia farnesiana*	12/07/2021		0.1	120	

SITE	WWV-03
PROJ	HD2 Riparian Survey
DATE	12-Jul-21
SITE_TYPE	Quadrat
SITE_DIM	100m x 25m
HABITAT	Medium drainage line
SOIL	Silty loam
ROCK_TYPE	Ironstone
VEGETATION	Open *Eucalyptus camaldulensis*, *Eucalyptus victrix, Eucalyptus xerothermica* woodland over *Gossypium sturtianum* var. *sturtianum*, *Petalostylis labicheoides, Androcalva luteiflora* open shrubland over **Cenchrus ciliaris, Eulalia aurea, Sorghum plumosum* tussock grassland
VEG_COND	Excellent
FIRE_AGE	5-10 yrs, >10 yrs
NOTES	Undulating hills either side of creekline (*Eucalyptus leucophloia* and *Triodia* sp.). Floodplain on east side of creek with *Eucalyptus gamophylla*, *Acacia maitlandii* and *Triodia* sp.
POSITION	C
DATUM	WGS84
ZONE	50
EAST	708166
NORTH	7446164
LATITUDE_GDA	-23.08011
LONGITUDE_GDA	119.03216



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWV-03	1	*Abutilon otocarpum*	12/07/2021		0.1	20	
WWV-03	2	*Acacia ampliceps* hybrid	12/07/2021	Coll	1	180	
WWV-03	3	*Acacia bivenosa*	12/07/2021	Coll	1	300	
WWV-03	4	*Acacia coriacea* subsp. *pendens*	12/07/2021		0.1	200	
WWV-03	5	*Acacia dictyophleba*	12/07/2021		2	150	
WWV-03	6	*Acacia maitlandii*	12/07/2021		0.5	200	
WWV-03	7	*Alternanthera nodiflora*	12/07/2021		0.1	10	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWV-03	8	*Androcalva luteiflora*	12/07/2021		2.5	150	
WWV-03	9	*Aristida holathera* var. *holathera*	12/07/2021	Coll	0.1	50	
WWV-03	10	*Aristida lazaridis*	12/07/2021		1.5	60	Priority 2
WWV-03	11	*Bothriochloa ewartiana*	12/07/2021		2	60	
WWV-03	12	**Cenchrus ciliaris*	12/07/2021		8	70	
WWV-03	13	*Cheilanthes sieberi* subsp. *sieberi*	12/07/2021		0.1	10	
WWV-03	14	*Chrysopogon fallax*	12/07/2021		1	60	
WWV-03	15	*Cyperus vaginatus*	12/07/2021		0.1	50	
WWV-03	16	*Dichanthium sericeum* subsp. *sericeum*	12/07/2021		0.1	40	
WWV-03	17	*Dodonaea lanceolata*	12/07/2021	Coll	0.1	100	
WWV-03	18	*Duperreya commixta*	12/07/2021		0.1	50	
WWV-03	19	*Enteropogon ramosus*	12/07/2021	Coll	0.1	80	
WWV-03	20	*Eragrostis pergracilis*	12/07/2021	Coll	0.1	30	
WWV-03	21	*Eragrostis tenellula*	12/07/2021		0.1	20	
WWV-03	22	*Eucalyptus ?kingsmillii*	12/07/2021	Coll	0.5	300	
WWV-03	23	*Eucalyptus camaldulensis*	12/07/2021		18	1800	
WWV-03	24	*Eucalyptus gamophylla*	12/07/2021		0.2	300	
WWV-03	25	*Eucalyptus victrix*	12/07/2021		8	2000	
WWV-03	26	*Eucalyptus xerothermica*	12/07/2021		2.5	400	
WWV-03	27	*Eulalia aurea*	12/07/2021		16	70	
WWV-03	28	*Evolvulus alsinoides* var. *villosicalyx*	12/07/2021		0.1	20	
WWV-03	29	*Glycine canescens*	12/07/2021	Coll	1	50	
WWV-03	30	*Goodenia prostrata*	12/07/2021		0.1	10	
WWV-03	31	*Gossypium sturtianum* var. *sturtianum*	12/07/2021		12	180	
WWV-03	32	*Jasminum didymum* subsp. *lineare*	12/07/2021		0.1	70	
WWV-03	33	*Melhania oblongifolia*	12/07/2021	Coll	0.1	20	
WWV-03	34	**Melinis repens*	12/07/2021	Coll	0.1	60	
WWV-03	35	*Petalostylis labicheoides*	12/07/2021		8	200	
WWV-03	36	*Phyllanthus maderaspatensis*	12/07/2021	Coll	0.1	20	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWV-03	37	*Pluchea dentex*	12/07/2021	Coll	0.1	30	
WWV-03	38	*Pluchea rubelliflora*	12/07/2021	Coll	0.1	30	
WWV-03	39	*Pterocaulon sphacelatum*	12/07/2021		0.1	40	
WWV-03	40	*Ptilotus exaltatus*	12/07/2021		0.1	30	
WWV-03	41	*Rhynchosia minima*	12/07/2021		0.1	30	
WWV-03	42	*Senna artemisioides* subsp. x *artemisioides*	12/07/2021	Coll	0.5	180	
WWV-03	43	*Senna pleurocarpa* var. *pleurocarpa*	12/07/2021	Coll	0.1	50	
WWV-03	44	*Sida fibulifera*	12/07/2021		0.1	20	
WWV-03	45	*Sorghum plumosum*	12/07/2021	Coll	12	70	
WWV-03	46	*Stemodia grossa*	12/07/2021		0.1	10	
WWV-03	47	*Themeda triandra*	12/07/2021		4	40	
WWV-03	48	*Triodia wiseana*	12/07/2021	Coll	0.1	30	
WWV-03	49	*Urochloa piligera*	12/07/2021	Coll	1	60	
WWV-03	50	**Vachellia farnesiana*	12/07/2021		0.1	200	

SITE	WWV-04
PROJ	HD2 Riparian Survey
DATE	14-Jul-21
SITE_TYPE	Quadrat
SITE_DIM	100m x 25m
HABITAT	Major drainage line
SOIL	Sandy loam
ROCK_TYPE	Ironstone
VEGETATION	*Eucalyptus camaldulensis, Eucalyptus victrix, Eucalyptus xerothermica* open woodland over **Vachellia farnesiana*, *Petalostylis labicheoides, Acacia maitlandii* open shrubland over **Cenchrus ciliaris, Sorghum plumosum, Themeda triandra* tussock grassland
VEG_COND	Very Good; weeds and grazing present
FIRE_AGE	5-10 yrs
NOTES	Creekline bed & banks
POSITION	C
DATUM	WGS84
ZONE	50
EAST	708898
NORTH	7447371
LATITUDE_GDA	-23.06913
LONGITUDE_GDA	119.03914



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWV-04	1	*Abutilon amplum*	14/07/2021	Coll	0.1	70	
WWV-04	2	*Acacia aptaneura*	14/07/2021	Coll	2.5	400	
WWV-04	3	*Acacia dictyophleba*	14/07/2021		1.5	200	
WWV-04	4	*Acacia maitlandii*	14/07/2021		0.1	200	
WWV-04	5	*Acacia pruinocarpa*	14/07/2021		3	200	
WWV-04	6	*Alternanthera nodiflora*	14/07/2021	Coll	0.1	20	
WWV-04	7	*Androcalva luteiflora*	14/07/2021		2	180	
WWV-04	8	*Anthobolus leptomerioides*	14/07/2021	Coll	0.1	100	
WWV-04	9	*Aristida lazaridis*	14/07/2021		0.5	60	Priority 2

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWV-04	10	*Bergia pedicellaris*	14/07/2021	Coll	0.1	10	
WWV-04	11	**Bidens bipinnata*	14/07/2021		0.1	20	
WWV-04	12	*Bothriochloa ewartiana*	14/07/2021		1	70	
WWV-04	13	**Cenchrus ciliaris*	14/07/2021		7	60	
WWV-04	14	**Cenchrus setiger*	14/07/2021		1.5	60	
WWV-04	15	*Centipeda minima*	14/07/2021		0.1	5	
WWV-04	16	*Cheilanthes sieberi* subsp. *sieberi*	14/07/2021		1	20	
WWV-04	17	*Cyperus vaginatus*	14/07/2021		0.5	50	
WWV-04	18	*Dichanthium sericeum* subsp. *sericeum*	14/07/2021		0.1	50	
WWV-04	19	*Duperreya commixta*	14/07/2021		0.1	50	
WWV-04	20	*Enteropogon ramosus*	14/07/2021		0.1	70	
WWV-04	21	*Eragrostis tenellula*	14/07/2021		0.1	10	
WWV-04	22	*Eremophila longifolia*	14/07/2021		1	200	
WWV-04	23	*Eucalyptus camaldulensis*	14/07/2021		15	2500	
WWV-04	24	*Eucalyptus victrix*	14/07/2021		4	2000	
WWV-04	25	*Eucalyptus xerothermica*	14/07/2021		2	800	
WWV-04	26	*Eulalia aurea*	14/07/2021		0.5	70	
WWV-04	27	**Flaveria trinervia*	14/07/2021		0.1	30	
WWV-04	28	*Glycine canescens*	14/07/2021		0.1	-	Climber
WWV-04	29	*Goodenia stellata*	14/07/2021	Coll	0.1	5	
WWV-04	30	*Gossypium sturtianum* var. *sturtianum*	14/07/2021		0.1	150	
WWV-04	31	*Hakea lorea* subsp. *lorea*	14/07/2021		2	400	
WWV-04	32	*Haloragis gossei* var. *gossei*	14/07/2021	Coll	0.1	20	
WWV-04	33	*Ipomoea muelleri*	14/07/2021		0.1	30	
WWV-04	34	*Isotropis forrestii*	14/07/2021		0.1	60	
WWV-04	35	**Melinis repens*	14/07/2021		0.1	50	
WWV-04	36	*Peripleura arida*	14/07/2021	Coll	0.1	50	
WWV-04	37	*Petalostylis labicheoides*	14/07/2021		6	200	
WWV-04	38	*Phyllanthus maderaspatensis*	14/07/2021		0.1	30	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWV-04	39	*Pluchea dentex*	14/07/2021	Coll	1.5	30	
WWV-04	40	*Pluchea rubelliflora*	14/07/2021		0.1	30	
WWV-04	41	*Pterocaulon sphacelatum*	14/07/2021		0.1	40	
WWV-04	42	*Ptilotus obovatus*	14/07/2021		0.1	30	
WWV-04	43	*Santalum lanceolatum*	14/07/2021		1	400	
WWV-04	44	*Senna artemisioides* subsp. x *artemisioides*	14/07/2021		3	150	
WWV-04	45	*Setaria surgens*	14/07/2021		0.1	30	
WWV-04	46	**Sonchus oleraceus*	14/07/2021	Coll	0.1	120	
WWV-04	47	*Sorghum plumosum*	14/07/2021		9	70	
WWV-04	48	*Stemodia grossa*	14/07/2021		0.1	20	
WWV-04	49	*Themeda triandra*	14/07/2021		11	60	
WWV-04	50	*Triodia longiceps*	14/07/2021		0.5	50	
WWV-04	51	**Urochloa mosambicensis*	14/07/2021	Coll	0.1	100	Substantial range extension; Not recorded in the Pilbara previously.
WWV-04	52	**Vachellia farnesiana*	14/07/2021		5	200	
WWV-04	53	*Wahlenbergia tumidifructa*	14/07/2021		0.1	20	

SITE	WWV-06
PROJ	HD2 Riparian Survey
DATE	14-Jul-21
SITE_TYPE	Quadrat
SITE_DIM	100m x 25m
HABITAT	Major drainage line
SOIL	Sandy loam
ROCK_TYPE	Ironstone, Basalt
VEGETATION	*Eucalyptus victrix, Eucalyptus xerothermica* open woodland over *Petalostylis labicheoides, Gossypium sturtianum* var. *sturtianum*, **Vachellia farnesiana* shrubland over *Themeda triandra*, *Bothriochloa ewartiana, *Cenchrus ciliaris* tussock grassland
VEG_COND	Very Good; weeds and cattle disturbance present
FIRE_AGE	3-5 yrs; evidence of fire scar
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	713182
NORTH	7448477
LATITUDE_GDA	-23.05859
LONGITUDE_GDA	119.08078



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWV-06	1	*Acacia dictyophleba*	14/07/2021		1	180	
WWV-06	2	*Acacia maitlandii*	14/07/2021		1	100	
WWV-06	3	*Acacia pyrifolia*	14/07/2021		2	160	
WWV-06	4	*Androcalva luteiflora*	14/07/2021		3	200	
WWV-06	5	*Aristida lazaridis*	14/07/2021	Coll	0.1	80	Priority 2
WWV-06	6	*Boerhavia coccinea*	14/07/2021	Coll	0.1	20	
WWV-06	7	*Bothriochloa ewartiana*	14/07/2021		15	70	
WWV-06	8	**Cenchrus ciliaris*	14/07/2021		6	70	
WWV-06	9	*Centipeda minima*	14/07/2021		0.1	5	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWV-06	10	*Cheilanthes sieberi* subsp. *sieberi*	14/07/2021		0.1	20	
WWV-06	11	*Cucumis variabilis*	14/07/2021		0.1	50	
WWV-06	12	*Cymbopogon ambiguus*	14/07/2021		1	120	
WWV-06	13	*Cyperus iria*	14/07/2021	Coll	0.1	20	
WWV-06	14	*Cyperus vaginatus*	14/07/2021		2	100	
WWV-06	15	*Dichanthium sericeum* subsp. *sericeum*	14/07/2021		0.1	50	
WWV-06	16	*Duperreya commixta*	14/07/2021		0.5	20	
WWV-06	17	*Enneapogon polyphyllus*	14/07/2021		1	50	
WWV-06	18	*Enneapogon robustissimus*	14/07/2021		0.5	70	
WWV-06	19	*Enteropogon ramosus*	14/07/2021		0.1	100	
WWV-06	20	*Eragrostis elongata*	14/07/2021		0.1	30	
WWV-06	21	*Eragrostis tenellula*	14/07/2021	Coll	0.1	20	
WWV-06	22	*Eremophila longifolia*	14/07/2021		0.5	150	
WWV-06	23	*Eriachne benthamii*	14/07/2021	Coll	0.1	40	
WWV-06	24	*Eucalyptus victrix*	14/07/2021		8	1700	
WWV-06	25	*Eucalyptus xerothermica*	14/07/2021		1	800	
WWV-06	26	*Eulalia aurea*	14/07/2021		3	40	
WWV-06	27	*Evolvulus alsinoides* var. *decumbens*	14/07/2021		0.1	20	
WWV-06	28	*Glycine canescens*	14/07/2021		0.1	50	
WWV-06	29	*Goodenia prostrata*	14/07/2021	Coll	0.1	20	
WWV-06	30	*Gossypium sturtianum* var. *sturtianum*	14/07/2021		5	200	
WWV-06	31	*Indigofera georgei*	14/07/2021	Coll	0.1	20	
WWV-06	32	*Isotropis iophyta*	14/07/2021		0.1	20	
WWV-06	33	**Malvastrum americanum*	14/07/2021		0.1	20	
WWV-06	34	**Melinis repens*	14/07/2021	Coll	0.1	100	
WWV-06	35	*Peplidium* sp. C Evol. Fl. Fauna Arid Aust. (N.T. Burbidge & A. Kanis 8158)	14/07/2021	Coll	0.1	5	
WWV-06	36	*Petalostylis labicheoides*	14/07/2021		12	200	
WWV-06	37	*Phyllanthus maderaspatensis*	14/07/2021		0.1	20	
WWV-06	38	*Pluchea rubelliflora*	14/07/2021	Coll	0.1	20	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWV-06	39	*Pterocaulon sphacelatum*	14/07/2021		0.1	30	
WWV-06	40	*Ptilotus obovatus*	14/07/2021		0.1	40	
WWV-06	41	*Rhynchosia minima*	14/07/2021		0.5	50	
WWV-06	42	*Senna artemisioides* subsp. x *artemisioides*	14/07/2021	Coll	0.1	100	
WWV-06	43	*Setaria surgens*	14/07/2021		0.1	30	
WWV-06	44	*Sida fibulifera*	14/07/2021		0.1	20	
WWV-06	45	*Sorghum plumosum*	14/07/2021		6	140	
WWV-06	46	*Stemodia grossa*	14/07/2021		0.1	20	
WWV-06	47	*Themeda triandra*	14/07/2021		14	100	
WWV-06	48	*Triodia longiceps*	14/07/2021		2	50	
WWV-06	49	**Vachellia farnesiana*	14/07/2021		4	200	

SITE	WWV-07
PROJ	HD2 Riparian Survey
DATE	12-Jul-21
SITE_TYPE	Quadrat
SITE_DIM	100m x 25m
HABITAT	Gorge
SOIL	Silty loam
ROCK_TYPE	Banded Ironstone
VEGETATION	*Corymbia ferriticola, Eucalyptus victrix, Acacia pruinocarpa* open woodland over *Dodonaea pachyneura* very open shrubs over *Eulalia aurea, Themeda triandra, Aristida burbidgeae* very open tussock grassland
VEG_COND	Excellent
FIRE_AGE	>10 yrs
NOTES	Bottom of gorge with small pools of water, no water plants observed
POSITION	C
DATUM	WGS84
ZONE	50
EAST	715586
NORTH	7448181
LATITUDE_GDA	-23.06096
LONGITUDE_GDA	119.10427



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWV-07	1	*Abutilon* sp. Dioicum (A.A. Mitchell PRP 1618)	12/07/2021	Coll	0.1	150	
WWV-07	2	*Acacia aptaneura* x *paraneura*	12/07/2021	Coll	1	500	
WWV-07	3	*Acacia citrinoviridis*	12/07/2021		3.5	700	
WWV-07	4	*Acacia maitlandii*	12/07/2021	Coll	0.1	200	
WWV-07	5	*Acacia pruinocarpa*	12/07/2021		9	600	
WWV-07	6	*Acacia pyrifolia*	12/07/2021		0.1	50	
WWV-07	7	*Afrohybanthus aurantiacus*	12/07/2021	Coll	0.1	30	
WWV-07	8	*Alternanthera nana*	12/07/2021	Coll	0.1	10	
WWV-07	9	*Aristida burbidgeae*	12/07/2021	Coll	1.5	50	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWV-07	10	*Arivela viscosa*	12/07/2021		0.1	20	
WWV-07	11	*Atalaya hemiglauca*	12/07/2021		3	300	
WWV-07	12	**Bidens bipinnata*	12/07/2021		0.1	20	
WWV-07	13	*Boerhavia coccinea*	12/07/2021	Coll	0.1	10	
WWV-07	14	*Capparis lasiantha*	12/07/2021	Coll	0.1	50	
WWV-07	15	**Cenchrus ciliaris*	12/07/2021		0.5	80	
WWV-07	16	**Cenchrus setiger*	12/07/2021		0.5	80	
WWV-07	17	*Clerodendrum floribundum* var. *floribundum*	12/07/2021	Coll	0.5	300	
WWV-07	18	*Corchorus crozophorifolius*	12/07/2021	Coll	0.1	30	
WWV-07	19	*Corymbia ferriticola*	12/07/2021	Coll	4	600	
WWV-07	20	*Cucumis variabilis*	12/07/2021		0.1	50	
WWV-07	21	*Cymbopogon ambiguus*	12/07/2021	Coll	1	70	
WWV-07	22	*Cynanchum ?pedunculatum*	12/07/2021	Coll	0.1	30	
WWV-07	23	*Cyperus cunninghamii* subsp. *cunninghamii*	12/07/2021	Coll	0.1	40	
WWV-07	24	*Dodonaea pachyneura*	12/07/2021	Coll	2	200	
WWV-07	25	*Duperreya commixta*	12/07/2021		1	100	
WWV-07	26	*Enneapogon lindleyanus*	12/07/2021	Coll	0.5	80	
WWV-07	27	*Enteropogon ramosus*	12/07/2021	Coll	0.1	60	
WWV-07	28	*Eremophila ?compacta*	12/07/2021	Coll	0.1	100	
WWV-07	29	*Eriachne benthamii*	12/07/2021	Coll	0.5	40	
WWV-07	30	*Eriachne mucronata*	12/07/2021	Coll	0.5	30	
WWV-07	31	*Eucalyptus victrix*	12/07/2021		3	800	
WWV-07	32	*Eulalia aurea*	12/07/2021		2	60	
WWV-07	33	*Euphorbia biconvexa*	12/07/2021	Coll	0.1	2	
WWV-07	34	*Euphorbia boophthona*	12/07/2021	Coll	0.1	40	
WWV-07	35	*Evolvulus alsinoides* var. *decumbens*	12/07/2021	Coll	0.1	40	
WWV-07	36	*Ficus brachypoda*	12/07/2021	Coll	0.5	150	
WWV-07	37	*Glycine canescens*	12/07/2021		0.1	10	
WWV-07	38	*Gomphrena cunninghamii*	12/07/2021	Coll	0.1	10	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWV-07	39	*Jasminum didymum* subsp*. lineare*	12/07/2021		0.1	100	
WWV-07	40	*Nicotiana occidentalis* subsp*. obliqua*	12/07/2021	Coll	0.5	50	
WWV-07	41	*Paraneurachne muelleri*	12/07/2021	Coll	0.1	40	
WWV-07	42	*Paspalidium clementii*	12/07/2021	Coll	0.1	20	
WWV-07	43	*Paspalidium rarum*	12/07/2021	Coll	0.1	10	
WWV-07	44	*Petalostylis labicheoides*	12/07/2021		0.1	200	
WWV-07	45	*Phyllanthus maderaspatensis*	12/07/2021	Coll	0.1	50	
WWV-07	46	*Polycarpaea longiflora*	12/07/2021	Coll	0.1	10	
WWV-07	47	*Pterocaulon sphacelatum*	12/07/2021		0.1	20	
WWV-07	48	*Ptilotus exaltatus*	12/07/2021		0.1	100	
WWV-07	49	*Ptilotus obovatus*	12/07/2021	Coll	0.1	30	
WWV-07	50	*Ptilotus polystachyus*	12/07/2021		0.1	40	
WWV-07	51	*Rhynchosia minima*	12/07/2021		0.1	30	
WWV-07	52	*Solanum chippendalei*	12/07/2021	Coll	0.1	50	
WWV-07	53	*Themeda triandra*	12/07/2021	Coll	2	60	
WWV-07	54	*Tinospora smilacina*	12/07/2021	Coll	0.1	100	
WWV-07	55	*Triodia pungens*	12/07/2021	Coll	0.1	60	
WWV-07	56	*Urochloa piligera*	12/07/2021	Coll	0.1	100	
WWV-07	57	**Vachellia farnesiana*	12/07/2021		0.1	200	

SITE	WWV-11
PROJ	HD2 Riparian Survey
DATE	15-Jul-21
SITE_TYPE	Quadrat
SITE_DIM	50m x 50m
HABITAT	Medium drainage line
SOIL	Silty loam
ROCK_TYPE	Ironstone
VEGETATION	*Eucalyptus camaldulensis, Eucalyptus victrix* woodland over *Acacia citrinoviridis, Acacia coriacea* subsp. *pendens* shrubland over *Themeda triandra, Eulalia aurea, *Cenchrus ciliaris* tussock grassland
VEG_COND	Excellent
FIRE_AGE	5-10 yrs, >10 yrs
NOTES	Floodplain of *Triodia ?basedowii/wiseana*, *Acacia bivenosa, Acacia pruinocarpa* on basalt
POSITION	C
DATUM	WGS84
ZONE	50
EAST	723237
NORTH	7452571
LATITUDE_GDA	-23.02032
LONGITUDE_GDA	119.17827



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWV-11	1	*Abutilon amplum*	15/07/2021	Coll	0.1	20	
WWV-11	2	*Abutilon otocarpum*	15/07/2021		0.1	20	
WWV-11	3	*Acacia bivenosa*	15/07/2021		0.1	120	
WWV-11	4	*Acacia citrinoviridis*	15/07/2021		15	700	
WWV-11	5	*Acacia coriacea* subsp. *pendens*	15/07/2021		8	1000	
WWV-11	6	*Acacia pyrifolia*	15/07/2021		0.1	120	
WWV-11	7	*Alternanthera nodiflora*	15/07/2021		0.1	30	
WWV-11	8	*Amyema miquelii*	15/07/2021		0.1	1000	Growing on *Eucalyptus* sp.
WWV-11	9	*Androcalva luteiflora*	15/07/2021		2	120	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWV-11	10	**Bidens bipinnata*	15/07/2021		0.1	20	
WWV-11	11	*Bothriochloa ewartiana*	15/07/2021		1	70	
WWV-11	12	**Cenchrus ciliaris*	15/07/2021		7	70	
WWV-11	13	**Cenchrus setiger*	15/07/2021		0.1	60	
WWV-11	14	*Cheilanthes sieberi* subsp. *sieberi*	15/07/2021		0.1	10	
WWV-11	15	*Corchorus crozophorifolius*	15/07/2021		0.1	50	
WWV-11	16	*Cymbopogon ambiguus*	15/07/2021		0.1	60	
WWV-11	17	*Cyperus vaginatus*	15/07/2021		0.1	40	
WWV-11	18	*Dicladanthera forrestii*	15/07/2021	Coll	0.1	30	
WWV-11	19	*Dodonaea lanceolata*	15/07/2021	Coll	1	150	
WWV-11	20	*Duperreya commixta*	15/07/2021		0.1	50	
WWV-11	21	*Enteropogon ramosus*	15/07/2021	Coll	0.1	60	
WWV-11	22	*Eragrostis elongata*	15/07/2021	Coll	0.1	30	
WWV-11	23	*Eucalyptus camaldulensis*	15/07/2021		25	2500	
WWV-11	24	*Eucalyptus victrix*	15/07/2021		5	2000	
WWV-11	25	*Eulalia aurea*	15/07/2021		2	70	
WWV-11	26	*Evolvulus alsinoides* var. *villosicalyx*	15/07/2021		0.1	20	
WWV-11	27	*Glycine canescens*	15/07/2021		0.1	50	
WWV-11	28	*Gossypium robinsonii*	15/07/2021		0.1	100	
WWV-11	29	*Gossypium sturtianum* var. *sturtianum*	15/07/2021		0.2	150	
WWV-11	30	*Iseilema membranaceum*	15/07/2021		0.1	10	
WWV-11	31	*Jasminum didymum* subsp. *lineare*	15/07/2021		0.1	50	
WWV-11	32	**Malvastrum americanum*	15/07/2021		0.1	30	
WWV-11	33	*Melhania oblongifolia*	15/07/2021	Coll	0.1	30	
WWV-11	34	*Paspalidium constrictum*	15/07/2021	Coll	0.1	40	
WWV-11	35	*Petalostylis labicheoides*	15/07/2021		0.2	200	
WWV-11	36	*Phyllanthus maderaspatensis*	15/07/2021	Coll	0.1	20	
WWV-11	37	*Pluchea dentex*	15/07/2021		0.1	30	
WWV-11	38	*Pterocaulon sphacelatum*	15/07/2021		0.1	30	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWV-11	39	*Rhynchosia minima*	15/07/2021		0.5	50	
WWV-11	40	*Rostellularia adscendens* var. *latifolia*	15/07/2021	Coll	0.1	10	Priority 3
WWV-11	41	*Setaria surgens*	15/07/2021		0.1	30	
WWV-11	42	**Sigesbeckia orientalis*	15/07/2021	Coll	0.1	10	
WWV-11	43	*Sorghum plumosum*	15/07/2021	Coll	0.1	70	
WWV-11	44	*Stemodia grossa*	15/07/2021		0.1	30	
WWV-11	45	*Stylobasium spathulatum*	15/07/2021		0.1	150	
WWV-11	46	*Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186)	15/07/2021		0.1	50	
WWV-11	47	*Themeda triandra*	15/07/2021		18	70	

SITE	WWV-12
PROJ	HD2 Riparian Survey
DATE	12-Jul-21
SITE_TYPE	Quadrat
SITE_DIM	50m x 50m
HABITAT	Major drainage line
SOIL	Silty loam
ROCK_TYPE	Ironstone
VEGETATION	*Eucalyptus victrix, Eucalyptus camaldulensis* open woodland over *Acacia citrinoviridis, Acacia coriacea* subsp. *pendens* tall open shrubland over *Eulalia aurea, Themeda triandra* very open tussock grassland
VEG_COND	Excellent
FIRE_AGE	5-10 yrs, >10 yrs
NOTES	Very open creek bed; Very little vegetation
POSITION	C
DATUM	WGS84
ZONE	50
EAST	722033
NORTH	7454890
LATITUDE_GDA	-22.99955
LONGITUDE_GDA	119.16619



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWV-12	1	*Acacia citrinoviridis*	12/07/2021		6	400	
WWV-12	2	*Acacia coriacea* subsp. *pendens*	12/07/2021		4.5	400	
WWV-12	3	*Acacia pyrifolia*	12/07/2021		0.1	50	
WWV-12	4	*Alternanthera nodiflora*	12/07/2021		0.1	20	
WWV-12	5	**Bidens bipinnata*	12/07/2021		0.1	10	
WWV-12	6	*Bothriochloa ewartiana*	12/07/2021		0.5	60	
WWV-12	7	**Cenchrus ciliaris*	12/07/2021		1	60	
WWV-12	8	**Cenchrus setiger*	12/07/2021		0.1	60	
WWV-12	9	*Centipeda minima*	12/07/2021		0.1	5	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWV-12	10	*Cheilanthes sieberi* subsp*. sieberi*	12/07/2021		0.1	10	
WWV-12	11	*Corchorus crozophorifolius*	12/07/2021		0.5	70	
WWV-12	12	*Cymbopogon ambiguus*	12/07/2021		0.1	40	
WWV-12	13	*Cyperus vaginatus*	12/07/2021		0.1	50	
WWV-12	14	*Dodonaea lanceolata*	12/07/2021	Coll	0.5	60	
WWV-12	15	*Eragrostis tenellula*	12/07/2021		0.1	10	
WWV-12	16	*Eriachne benthamii*	12/07/2021	Coll	0.1	30	
WWV-12	17	*Eucalyptus camaldulensis*	12/07/2021		4	1500	
WWV-12	18	*Eucalyptus victrix*	12/07/2021		10	2000	
WWV-12	19	*Eulalia aurea*	12/07/2021		0.5	60	
WWV-12	20	*Euphorbia biconvexa*	12/07/2021	Coll	0.1	20	
WWV-12	21	*Isotropis iophyta*	12/07/2021		0.1	50	
WWV-12	22	*Nicotiana occidentalis* subsp*. obliqua*	12/07/2021	Coll	0.1	30	
WWV-12	23	*Phyllanthus maderaspatensis*	12/07/2021		0.1	30	
WWV-12	24	*Pluchea dentex*	12/07/2021		0.1	20	
WWV-12	25	*Rhynchosia minima*	12/07/2021		0.1	50	
WWV-12	26	*Rostellularia adscendens* var*. latifolia*	12/07/2021	Coll	0.1	10	Priority 3
WWV-12	27	*Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186)	12/07/2021		0.5	40	
WWV-12	28	*Themeda triandra*	12/07/2021		0.5	60	
WWV-12	29	*Triodia pungens*	12/07/2021	Coll	0.1	30	
WWV-12	30	*Urochloa occidentalis* var*. ciliata*	12/07/2021		0.1	10	

SITE	WWV-13
PROJ	HD2 Riparian Survey
DATE	12-Jul-21
SITE_TYPE	Quadrat
SITE_DIM	50m x 50m
HABITAT	Major drainage line
SOIL	Silty loam
ROCK_TYPE	Ironstone
VEGETATION	*Eucalyptus camaldulensis, Eucalyptus victrix* open woodland over *Acacia citrinoviridis, Atalaya hemiglauca* open tall shrubland over *Corchorus crozophorifolius, Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) open low shrubland over *Themeda triandra*, *Eulalia aurea, *Cenchrus ciliaris* open tussock grassland
VEG_COND	Excellent
FIRE_AGE	5-10 yrs, >10 yrs
NOTES	Open wide creek bed site; Sparse pockets of vegetation
POSITION	C
DATUM	WGS84
ZONE	50
EAST	722164
NORTH	7458221
LATITUDE_GDA	-22.96946
LONGITUDE_GDA	119.16699



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWV-13	1	*Acacia citrinoviridis*	12/07/2021		6	500	
WWV-13	2	*Acacia pyrifolia*	12/07/2021		0.1	120	
WWV-13	3	*Atalaya hemiglauca*	12/07/2021		1	350	
WWV-13	4	**Cenchrus ciliaris*	12/07/2021		0.5	70	
WWV-13	5	*Corchorus crozophorifolius*	12/07/2021	Coll	2.5	70	
WWV-13	6	*Cymbopogon ambiguus*	12/07/2021		0.5	60	
WWV-13	7	*Duperreya commixta*	12/07/2021		0.1	100	
WWV-13	8	*Enneapogon lindleyanus*	12/07/2021	Coll	0.1	30	
WWV-13	9	*Enteropogon ramosus*	12/07/2021		0.1	70	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWV-13	10	*Eragrostis elongata*	12/07/2021	Coll	0.1	30	
WWV-13	11	*Eragrostis tenellula*	12/07/2021		0.1	10	
WWV-13	12	*Eriachne benthamii*	12/07/2021		0.5	40	
WWV-13	13	*Eucalyptus camaldulensis*	12/07/2021		7	1500	
WWV-13	14	*Eucalyptus victrix*	12/07/2021		4	1500	
WWV-13	15	*Eulalia aurea*	12/07/2021		1.5	60	
WWV-13	16	*Goodenia lamprosperma*	12/07/2021	Coll	0.1	20	
WWV-13	17	*Jasminum didymum* subsp*. lineare*	12/07/2021		0.1	100	
WWV-13	18	*Phyllanthus maderaspatensis*	12/07/2021		0.1	20	
WWV-13	19	*Pluchea dentex*	12/07/2021		0.1	20	
WWV-13	20	*Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186)	12/07/2021	Coll	1	50	
WWV-13	21	*Themeda triandra*	12/07/2021		1.5	60	

SITE	PMR-09
PROJ	HD2 Riparian Survey
DATE	15-Jul-21
SITE_TYPE	Relevé
SITE_DIM	
HABITAT	Medium drainage line
SOIL	Sandy/Silty loam
ROCK_TYPE	BIF, Basalt
VEGETATION	*Eucalyptus victrix* (and scattered *Eucalyptus camaldulensis*) open woodland over *Acacia pyrifolia, Gossypium robinsonii, Androcalva luteiflora* open shrubland over *Eulalia aurea, Enteropogon ramosus, Bothriochloa ewartiana* tussock grassland
VEG_COND	Good
FIRE_AGE	5-10 yrs
NOTES	Pebble Mouse Creek beside Great Northern Highway on creek bend. Moderate drainage on broad alluvial (clay/silt) floodplain low flow + island bench + bank + some terrace sampled. Sand deposited on benches. With gravel in low flow. No bedrock visible.
POSITION	C
DATUM	WGS84
ZONE	50
EAST	695909
NORTH	7445761
LATITUDE_GDA	-23.08525
LONGITUDE_GDA	118.91261



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMR-09	1	*Abutilon amplum*	15/07/2021	Coll	0.1	60	
PMR-09	2	*Abutilon fraseri* subsp. *fraseri*	15/07/2021	Coll	0.1	30	
PMR-09	3	*Acacia adsurgens*	15/07/2021	Coll	0-2	200	
PMR-09	4	*Acacia bivenosa*	15/07/2021		0-2	200	
PMR-09	5	*Acacia dictyophleba*	15/07/2021		0-2	200	
PMR-09	6	*Acacia maitlandii*	15/07/2021		0-2	200	
PMR-09	7	*Acacia pruinocarpa*	15/07/2021		0-10	200	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMR-09	8	*Acacia pyrifolia*	15/07/2021		2-10	200	
PMR-09	9	*Achyranthes aspera*	15/07/2021	Coll	0-2	60	
PMR-09	10	*Alternanthera nodiflora*	15/07/2021		0-2	40	
PMR-09	11	*Androcalva luteiflora*	15/07/2021		0-10	150	
PMR-09	12	*Aristida contorta*	15/07/2021		0.1	20	
PMR-09	13	*Aristida holathera* var. *holathera*	15/07/2021		0.1	60	
PMR-09	14	**Bidens bipinnata*	15/07/2021		0-2	20	
PMR-09	15	*Bothriochloa ewartiana*	15/07/2021	Coll	0-2	100	
PMR-09	16	*Capparis lasiantha*	15/07/2021		0.1	100	
PMR-09	17	*Cheilanthes sieberi* subsp. *sieberi*	15/07/2021		0.1	20	
PMR-09	18	*Chloris virgata*	15/07/2021	Coll	0-2	70	
PMR-09	19	*Chrysopogon fallax*	15/07/2021		0-2	100	
PMR-09	20	*Crotalaria medicaginea* var. *neglecta*	15/07/2021		0.1	30	
PMR-09	21	*Cymbopogon ambiguus*	15/07/2021		0.1	80	
PMR-09	22	*Cyperus iria*	15/07/2021	Coll	0.1	30	
PMR-09	23	*Cyperus vaginatus*	15/07/2021	Coll	0.1	70	
PMR-09	24	*Dichanthium sericeum* subsp. *sericeum*	15/07/2021	Coll	0.1	50	
PMR-09	25	*Dodonaea viscosa* subsp. *mucronata*	15/07/2021	Coll	0.1	200	
PMR-09	26	*Duperreya commixta*	15/07/2021		0.1	-	Climber
PMR-09	27	*Dysphania melanocarpa* forma *melanocarpa*	15/07/2021	Coll	0.1	10	
PMR-09	28	*Dysphania rhadinostachya*	15/07/2021		0.1	50	
PMR-09	29	*Ehretia saligna* var. *saligna*	15/07/2021	Coll	0-2	300	
PMR-09	30	*Enchylaena tomentosa* var. *tomentosa*	15/07/2021	Coll	0.1	50	
PMR-09	31	*Enneapogon lindleyanus*	15/07/2021		0-2	40	
PMR-09	32	*Enneapogon polyphyllus*	15/07/2021		0-2	30	
PMR-09	33	*Enteropogon ramosus*	15/07/2021		0-10	100	
PMR-09	34	*Eragrostis cumingii*	15/07/2021	Coll	0.1	30	
PMR-09	35	*Eremophila longifolia*	15/07/2021		0.1	200	
PMR-09	36	*Eucalyptus camaldulensis* subsp. *obtusa*	15/07/2021		0-2	2000	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMR-09	37	*Eucalyptus victrix*	15/07/2021		10-30	1200	
PMR-09	38	*Eucalyptus xerothermica*	15/07/2021		0.1	1000	
PMR-09	39	*Eulalia aurea*	15/07/2021		0-10	100	
PMR-09	40	*Evolvulus alsinoides* var. *villosicalyx*	15/07/2021		0.1	30	
PMR-09	41	*Glycine canescens*	15/07/2021	Coll	0-10	50	
PMR-09	42	*Gossypium robinsonii*	15/07/2021		0-10	200	
PMR-09	43	*Gossypium sturtianum* var. *sturtianum*	15/07/2021		0-2	200	
PMR-09	44	*Isotropis forrestii*	15/07/2021		0-2	100	
PMR-09	45	*Jasminum didymum* subsp. *lineare*	15/07/2021		0-2	100	
PMR-09	46	**Malvastrum americanum*	15/07/2021		0-2	50	
PMR-09	47	*Marsilea hirsuta*	15/07/2021		0.1	10	
PMR-09	48	*Panicum decompositum*	15/07/2021	Coll	0.1	100	
PMR-09	49	*Petalostylis labicheoides*	15/07/2021		0-2	200	
PMR-09	50	*Phyllanthus maderaspatensis*	15/07/2021		0-2	40	
PMR-09	51	*Pittosporum angustifolium*	15/07/2021	Coll	0.1	100	
PMR-09	52	*Pluchea rubelliflora*	15/07/2021	Coll	0.1	50	
PMR-09	53	*Pterocaulon sphacelatum*	15/07/2021		0-2	50	
PMR-09	54	*Ptilotus auriculifolius*	15/07/2021	Coll	0.1	50	
PMR-09	55	*Ptilotus exaltatus*	15/07/2021		0-2	50	
PMR-09	56	*Ptilotus obovatus*	15/07/2021		0-2	60	
PMR-09	57	*Rhynchosia minima*	15/07/2021		0-2	-	Climber
PMR-09	58	*Roepera iodocarpa*	15/07/2021	Coll	0.1	10	
PMR-09	59	*Salsola australis*	15/07/2021		0.1	50	
PMR-09	60	*Santalum lanceolatum*	15/07/2021		0.1	200	
PMR-09	61	*Scaevola amblyanthera* var. *centralis*	15/07/2021	Coll	0.1	30	
PMR-09	62	*Senna artemisioides* subsp. x *artemisioides*	15/07/2021		0-2	150	
PMR-09	63	*Senna glutinosa* subsp. ×*luerssenii*	15/07/2021		0.1	100	
PMR-09	64	*Sida fibulifera*	15/07/2021		0.1	20	
PMR-09	65	*Stemodia grossa*	15/07/2021		0-2	50	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMR-09	66	*Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186)	15/07/2021		0-10	70	
PMR-09	67	*Themeda triandra*	15/07/2021		0-2	100	
PMR-09	68	*Triodia epactia*	15/07/2021		0-2	70	
PMR-09	69	*Triodia longiceps*	15/07/2021		0-2	120	
PMR-09	70	**Vachellia farnesiana*	15/07/2021		0-2	150	

SITE	PMR-J1
PROJ	HD2 Riparian Survey
DATE	15-Jul-21
SITE_TYPE	Relevé
SITE_DIM	
HABITAT	Drainage area/Floodplain; slightly undulating
SOIL	Silty loam/Sand
ROCK_TYPE	BIF
VEGETATION	Scattered *Eucalyptus victrix* and *Acacia citrinoviridis* trees over *Acacia citrinoviridis* tall shrubland over *Triodia longiceps* hummock grassland
VEG_COND	Very Good; evidence of cattle
FIRE_AGE	5-10 yrs
NOTES	Pebble Mouse Creek near Baby Hope. Broad floodplain, slightly undulating. North side of creek. No bedrock exposed, some cobble.
POSITION	C
DATUM	WGS84
ZONE	50
EAST	717362
NORTH	7453611
LATITUDE_GDA	-23.01171
LONGITUDE_GDA	119.12083



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMR-J1	1	*Abutilon amplum*	15/07/2021	Coll	0.1	60	
PMR-J1	2	*Acacia citrinoviridis*	15/07/2021		10-30	600	
PMR-J1	3	*Acacia pruinocarpa*	15/07/2021		0-10	200	
PMR-J1	4	*Acacia pyrifolia*	15/07/2021		0-2	100	
PMR-J1	5	*Afrohybanthus aurantiacus*	15/07/2021		0-2	60	
PMR-J1	6	*Atalaya hemiglauca*	15/07/2021		0-2	200	
PMR-J1	7	*Corchorus crozophorifolius*	15/07/2021		0.1	50	
PMR-J1	8	*Crotalaria medicaginea* var. *neglecta*	15/07/2021		0.1	30	
PMR-J1	9	*Dicladanthera forrestii*	15/07/2021	Coll	0-2	10	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
PMR-J1	10	*Dipteracanthus australasicus* subsp. *australasicus*	15/07/2021		0-2	30	
PMR-J1	11	*Duperreya commixta*	15/07/2021		0.1	-	Climber
PMR-J1	12	*Enneapogon polyphyllus*	15/07/2021		0-2	20	
PMR-J1	13	*Eriachne mucronata*	15/07/2021		0-10	70	
PMR-J1	14	*Eucalyptus victrix*	15/07/2021		0.1	1000	
PMR-J1	15	*Evolvulus alsinoides* var. *villosicalyx*	15/07/2021		0.1	10	
PMR-J1	16	*Gomphrena canescens*	15/07/2021		0.1	30	
PMR-J1	17	*Gomphrena cunninghamii*	15/07/2021		0-2	20	
PMR-J1	18	*Heliotropium cunninghamii*	15/07/2021	Coll	0.1	50	
PMR-J1	19	*Indigofera georgei*	15/07/2021		0.1	100	
PMR-J1	20	*Isotropis forrestii*	15/07/2021		0-2	60	
PMR-J1	21	*Melhania oblongifolia*	15/07/2021	Coll	0.1	30	
PMR-J1	22	*Paraneurachne muelleri*	15/07/2021		0-2	50	
PMR-J1	23	*Phyllanthus maderaspatensis*	15/07/2021		0.1	50	
PMR-J1	24	*Portulaca oleracea*	15/07/2021		0.1	10	
PMR-J1	25	*Pterocaulon sphacelatum*	15/07/2021		0-2	60	
PMR-J1	26	*Ptilotus exaltatus*	15/07/2021		0-2	60	
PMR-J1	27	*Ptilotus helipteroides*	15/07/2021		0-2	30	
PMR-J1	28	*Sclerolaena cornishiana*	15/07/2021	Coll	0.1	10	
PMR-J1	29	*Sida* sp. spiciform panicles (E. Leyland s.n. 14/8/90)	15/07/2021		0.1	150	
PMR-J1	30	*Solanum cleistogamum*	15/07/2021	Coll	0.1	50	
PMR-J1	31	*Sporobolus australasicus*	15/07/2021		0-2	10	
PMR-J1	32	*Trichodesma zeylanicum*	15/07/2021		0-2	60	
PMR-J1	33	*Triodia epactia*	15/07/2021		0-2	100	
PMR-J1	34	*Triodia longiceps*	15/07/2021		30-70	120	

SITE	WWR-J2
PROJ	HD2 Riparian Survey
DATE	15-Jul-21
SITE_TYPE	Relevé
SITE_DIM	
HABITAT	Major drainage line
SOIL	
ROCK_TYPE	
VEGETATION	*Melaleuca argentea* and *Eucalyptus camaldulensis* open woodland over *Dodonaea viscosa* subsp. *mucronata*, *Gossypium sturtianum*, *Stylobasium spathulatum* open shrubland over **Cenchrus ciliaris*, *Themeda triandra* tussock grassland
VEG_COND	
FIRE_AGE	
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	721993
NORTH	7449670
LATITUDE_GDA	-23.04667
LONGITUDE_GDA	119.16656



Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWR-J2	1	*Abutilon amplum*	16/07/2021	Coll	0.1	70	
WWR-J2	2	*Acacia citrinoviridis*	16/07/2021		0-2	600	
WWR-J2	3	*Acacia coriacea* subsp. *pendens*	16/07/2021		0-2	600	
WWR-J2	4	*Acacia pyrifolia*	16/07/2021		0.1	200	
WWR-J2	5	*Ammannia baccifera*	16/07/2021		0.1	20	
WWR-J2	6	*Androcalva luteiflora*	16/07/2021		0.1	100	
WWR-J2	7	*Arivela viscosa*	16/07/2021		0.1	50	
WWR-J2	8	*Atalaya hemiglauca*	16/07/2021		0-2	300	
WWR-J2	9	**Bidens bipinnata*	16/07/2021		0.1	10	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWR-J2	10	*Bothriochloa ewartiana*	16/07/2021		0.1	100	
WWR-J2	11	**Cenchrus ciliaris*	16/07/2021		2-10	60	
WWR-J2	12	*Centipeda minima*	16/07/2021	Coll	0.1	5	
WWR-J2	13	*Chara* sp.	16/07/2021		0-2	-	Macro
WWR-J2	14	*Chrysopogon fallax*	16/07/2021		0.1	120	
WWR-J2	15	*Clerodendrum floribundum*	16/07/2021		0.1	200	
WWR-J2	16	*Corchorus crozophorifolius*	16/07/2021		0.1	70	
WWR-J2	17	*Crotalaria medicaginea* var. *neglecta*	16/07/2021		0.1	30	
WWR-J2	18	*Cullen ?leucanthum*	16/07/2021	Coll	0.1	200	
WWR-J2	19	*Cymbopogon ambiguus*	16/07/2021		0.1	100	
WWR-J2	20	*Cyperus vaginatus*	16/07/2021	Coll	0-2	100	
WWR-J2	21	*Dichanthium sericeum* subsp. *sericeum*	16/07/2021		0.1	70	
WWR-J2	22	*Dicladanthera forrestii*	16/07/2021		0.1	30	
WWR-J2	23	*Digitaria ctenantha*	16/07/2021		0.1	50	
WWR-J2	24	*Dodonaea viscosa* subsp. *mucronata*	16/07/2021	Coll	2-10	200	
WWR-J2	25	*Duperreya commixta*	16/07/2021		0.1	-	Climber
WWR-J2	26	*Enneapogon caerulescens*	16/07/2021		0.1	30	
WWR-J2	27	*Enneapogon lindleyanus*	16/07/2021		0.1	50	
WWR-J2	28	*Enneapogon polyphyllus*	16/07/2021		0.1	20	
WWR-J2	29	*Enteropogon ramosus*	16/07/2021		0-2	100	
WWR-J2	30	*Eragrostis cumingii*	16/07/2021		0-2	20	
WWR-J2	31	*Eucalyptus camaldulensis* subsp. *obtusa*	16/07/2021		2-10	2000	
WWR-J2	32	*Eucalyptus victrix*	16/07/2021		0-2	1500	
WWR-J2	33	*Eulalia aurea*	16/07/2021		0-2	100	
WWR-J2	34	*Euphorbia australis* var. *subtomentosa*	16/07/2021		0.1	-	Prostrate
WWR-J2	35	*Evolvulus alsinoides* var. *villosicalyx*	16/07/2021		0.1	30	
WWR-J2	36	*Glycine canescens*	16/07/2021		0-10	-	Climber
WWR-J2	37	*Gossypium robinsonii*	16/07/2021		0-2	200	
WWR-J2	38	*Gossypium sturtianum* var. *sturtianum*	16/07/2021		0-10	200	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWR-J2	39	*Ipomoea muelleri*	16/07/2021		0.1	30	
WWR-J2	40	**Lactuca ?saligna*	16/07/2021	Coll	0.1	30	
WWR-J2	41	**Malvastrum americanum*	16/07/2021		0-2	60	
WWR-J2	42	*Melaleuca argentea*	16/07/2021		2-10	1500	
WWR-J2	43	*Melaleuca bracteata*	16/07/2021		0-2	250	
WWR-J2	44	*Melaleuca glomerata*	16/07/2021		0-2	500	
WWR-J2	45	*Melhania oblongifolia*	16/07/2021		0.1	50	
WWR-J2	46	**Melinis repens*	16/07/2021	Coll	0.1	100	
WWR-J2	47	*Nicotiana occidentalis* subsp. *obliqua*	16/07/2021	Coll	0.1	20	
WWR-J2	48	*Paspalidium constrictum*	16/07/2021	Coll	0.1	60	
WWR-J2	49	*Petalostylis labicheoides*	16/07/2021		0-2	200	
WWR-J2	50	*Phyllanthus maderaspatensis*	16/07/2021		0-2	30	
WWR-J2	51	*Pluchea rubelliflora*	16/07/2021		0-2	60	
WWR-J2	52	*Pterocaulon sphacelatum*	16/07/2021		0-2	60	
WWR-J2	53	*Ptilotus obovatus*	16/07/2021		0.1	30	
WWR-J2	54	*Rhynchosia minima*	16/07/2021		0-2	-	Climber
WWR-J2	55	*Rostellularia adscendens* var. *clementii*	16/07/2021		0.1	20	
WWR-J2	56	*Senna artemisioides* subsp. x *artemisioides*	16/07/2021		0.1	200	
WWR-J2	57	*Setaria dielsii*	16/07/2021	Coll	0-2	50	
WWR-J2	58	*Setaria verticillata*	16/07/2021		0-2	50	
WWR-J2	59	*Sida fibulifera*	16/07/2021		0-2	30	
WWR-J2	60	*Sigesbeckia orientalis*	16/07/2021	Coll	0-2	60	
WWR-J2	61	*Solanum nigrum*	16/07/2021		0.1	20	
WWR-J2	62	*Sonchus hydrophilus*	16/07/2021		0.1	100	
WWR-J2	63	**Sonchus oleraceus*	16/07/2021		0.1	100	
WWR-J2	64	*Stemodia grossa*	16/07/2021		0-2	30	
WWR-J2	65	*Stylidium weeliwolli*	16/07/2021		0.1	10	Priority 3
WWR-J2	66	*Stylobasium spathulatum*	16/07/2021		0-10	200	
WWR-J2	67	*Themeda triandra*	16/07/2021		0-10	100	

Site	Rec	Name	Date	Collection?	Cover (%)	Height (cm)	Spec Notes
WWR-J2	68	**Urochloa mosambicensis*	16/07/2021	Coll	0.1	30	Substantial range extension; Not recorded in the Pilbara previously.
WWR-J2	69	**Vachellia farnesiana*	16/07/2021		0.1	150	

SITE	Veg1
PROJ	HD2 Riparian Survey
DATE	12-Jul-21
SITE_TYPE	Vegetation Mapping Note
HABITAT	
SOIL	
ROCK_TYPE	
VEGETATION	*Eucalyptus victrix* (with scattered *Eucalyptus xerothermica*) open woodland over *Acacia bivenosa, Melaleuca bracteata* (and scattered *Gossypium sturtianum* subsp. *sturtianum*) shrubland over *Themeda triandra, *Cenchrus ciliaris, Eulalia aurea* open tussock grassland
VEG_COND	
FIRE_AGE	
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	706420
NORTH	7443450
LATITUDE_GDA	-23.10483
LONGITUDE_GDA	119.01549

Site	Rec	Name	Date	Cover (%)	Height (cm)	Spec Notes
Veg1	1	*Acacia bivenosa*	12/07/2021	0-10	300	
Veg1	2	**Cenchrus ciliaris*	12/07/2021	2-30 combined grasses	60	
Veg1	3	*Eucalyptus victrix*	12/07/2021	0-10	1500	
Veg1	4	*Eucalyptus xerothermica*	12/07/2021	scattered	700	
Veg1	5	*Eulalia aurea*	12/07/2021	2-30 combined grasses	70	
Veg1	6	*Gossypium sturtianum var. sturtianum*	12/07/2021	scattered	150	
Veg1	7	*Melaleuca bracteata*	12/07/2021	2-30	250	
Veg1	8	*Melaleuca glomerata*	12/07/2021	0-2	200	
Veg1	9	*Themeda triandra*	12/07/2021	2-30 combined grasses	60	
Veg1	10	*Triodia longiceps*	12/07/2021	0-2	50	

SITE	Veg2
PROJ	HD2 Riparian Survey
DATE	12-Jul-21
SITE_TYPE	Vegetation Mapping Note
HABITAT	
SOIL	
ROCK_TYPE	
VEGETATION	*Eucalyptus victrix* open woodland over *Petalostylis labicheoides*, *Acacia bivenosa* tall shrubland over *Melaleuca glomerata*, *Dodonaea lanceolata, Acacia dictyophleba, Gossypium sturtianum* over *Themeda triandra, Eulalia aurea* open tussock grassland
VEG_COND	
FIRE_AGE	
NOTES	No *Eucalyptus camaldulensis* between Veg 2 and quadrats
POSITION	C
DATUM	WGS84
ZONE	50
EAST	706247
NORTH	7443146
LATITUDE_GDA	-23.10759
LONGITUDE_GDA	119.01384

Site	Rec	Name	Date	Cover (%)	Height (cm)	Spec Notes
Veg2	1	*Acacia bivenosa*	12/07/2021	2-30 combined tall shrubs	300	
Veg2	2	*Acacia dictyophleba*	12/07/2021	0-30 combined low shrubs	200	
Veg2	3	*Dodonaea lanceolata*	12/07/2021	0-30 combined low shrubs	100	
Veg2	4	*Eucalyptus victrix*	12/07/2021	0-10	1500	
Veg2	5	*Eulalia aurea*	12/07/2021	2-10 combined grasses	70	
Veg2	6	*Gossypium sturtianum var. sturtianum*	12/07/2021	0-30 combined low shrubs	150	
Veg2	7	*Melaleuca glomerata*	12/07/2021	0-30 combined low shrubs	200	
Veg2	8	*Petalostylis labicheoides*	12/07/2021	2-30 combined tall shrubs	300	
Veg2	9	*Themeda triandra*	12/07/2021	2-10 combined grasses	60	

SITE	Veg3
PROJ	HD2 Riparian Survey
DATE	13-Jul-21
SITE_TYPE	Vegetation Mapping Note
HABITAT	
SOIL	
ROCK_TYPE	
VEGETATION	Scattered *Eucalyptus victrix* over *Eucalyptus xerothermica*, *Acacia aptaneura*, *Acacia pruinocarpa* open woodland over *Petalostylis labicheoides, Acacia dictyophleba* open shrubland over *Themeda triandra, Bothriochloa ewartiana* tussock grassland
VEG_COND	
FIRE_AGE	
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	697944
NORTH	7448796
LATITUDE_GDA	-23.05760
LONGITUDE_GDA	118.93207

Site	Rec	Name	Date	Cover (%)	Height (cm)	Spec Notes
Veg3	1	*Acacia aptaneura*	13/07/2021	2-10 combined tall shrubs/low trees	500	
Veg3	2	*Acacia dictyophleba*	13/07/2021	2-30 combined shrubs	200	
Veg3	3	*Acacia pruinocarpa*	13/07/2021	2-10 combined tall shrubs/low trees	200	
Veg3	4	*Acacia pyrifolia*	13/07/2021	2-30 combined shrubs	100	
Veg3	5	*Bothriochloa ewartiana*	13/07/2021	10-70 combined grasses	70	
Veg3	6	*Eremophila longifolia*	13/07/2021	2-30 combined shrubs	200	
Veg3	7	*Eucalyptus victrix*	13/07/2021	0-2	1500	
Veg3	8	*Eucalyptus xerothermica*	13/07/2021	2-10 combined tall shrubs/low trees	700	
Veg3	9	*Petalostylis labicheoides*	13/07/2021	2-30 combined shrubs	200	
Veg3	10	*Themeda triandra*	13/07/2021	10-70 combined grasses	60	

Site	Rec	Name	Date	Cover (%)	Height (cm)	Spec Notes
Veg3	11	*Triodia longiceps*	13/07/2021	0-2	50	
Veg3	12	**Vachellia farnesiana*	13/07/2021	2-30 combined shrubs	200	

SITE	Veg4
PROJ	HD2 Riparian Survey
DATE	13-Jul-21
SITE_TYPE	Vegetation Mapping Note
HABITAT	
SOIL	
ROCK_TYPE	
VEGETATION	*Eucalyptus xerothermica* and *Acacia aptaneura* open woodland/tall shrubland (with occasional emergent *Eucalyptus victrix*) over *Acacia dictyophleba, Petalostylis labicheoides* open shrubland over *Triodia longiceps* hummock and *Eulalia* sp. Three river station, *Chrysopogon fallax, Themeda triandra* tussock grassland
VEG_COND	
FIRE_AGE	
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	697964
NORTH	7448624
LATITUDE_GDA	-23.05915
LONGITUDE_GDA	118.93229

Site	Rec	Name	Date	Cover (%)	Height (cm)	Spec Notes
Veg4	1	*Acacia aptaneura*	13/07/2021	2-10 combined tall shrubs/low trees	500	
Veg4	2	*Acacia dictyophleba*	13/07/2021	0-10 combined shrubs	200	
Veg4	3	*Aristida latifolia*	13/07/2021	2-10 combined tussock grasses	70	
Veg4	4	*Chrysopogon fallax*	13/07/2021	2-10 combined tussock grasses	60	
Veg4	5	*Eucalyptus victrix*	13/07/2021	0-2	1500	
Veg4	6	*Eucalyptus xerothermica*	13/07/2021	2-10 combined tall shrubs/low trees	700	
Veg4	7	*Eulalia* sp. Three river station	13/07/2021	2-10 combined tussock grasses	70	
Veg4	8	*Petalostylis labicheoides*	13/07/2021	0-10 combined shrubs	200	
Veg4	9	*Senna artemisioides subsp. x artemisioides*	13/07/2021	0-2	150	

Site	Rec	Name	Date	Cover (%)	Height (cm)	Spec Notes
Veg4	10	*Themeda triandra*	13/07/2021	2-10 combined tussock grasses	60	
Veg4	11	*Triodia longiceps*	13/07/2021	2-30	50	

SITE	Veg5
PROJ	HD2 Riparian Survey
DATE	13-Jul-21
SITE_TYPE	Vegetation Mapping Note
HABITAT	
SOIL	
ROCK_TYPE	
VEGETATION	*Eucalyptus xerothermica* open woodland over *Acacia aptaneura*, *Acacia pruinocarpa* shrubland over *Themeda triandra*, *Chrysopogon fallax* open tussock grassland
VEG_COND	
FIRE_AGE	
NOTES	As you move towards outer floodplain Mulga becomes more abundant and *Acacia pruinocarpa*
POSITION	C
DATUM	WGS84
ZONE	50
EAST	699593
NORTH	7449824
LATITUDE_GDA	-23.04813
LONGITUDE_GDA	118.94803

Site	Rec	Name	Date	Cover (%)	Height (cm)	Spec Notes
Veg5	1	*Acacia aptaneura*	13/07/2021	2-30	500	
Veg5	2	*Acacia pruinocarpa*	13/07/2021	0-2	200	
Veg5	3	*Arivela viscosa*	13/07/2021	0-2	30	
Veg5	4	*Chrysopogon fallax*	13/07/2021	2-30 combined tussock grasses	60	
Veg5	5	*Eremophila longifolia*	13/07/2021	0-2	200	
Veg5	6	*Eucalyptus xerothermica*	13/07/2021	0-10	700	
Veg5	7	*Ptilotus obovatus*	13/07/2021	0-2	30	
Veg5	8	*Rhagodia eremaea*	13/07/2021	0-2	120	
Veg5	9	*Themeda triandra*	13/07/2021	2-30 combined tussock grasses	60	
Veg5	10	*Triodia longiceps*	13/07/2021	0-10	50	

SITE	Veg6
PROJ	HD2 Riparian Survey
DATE	13-Jul-21
SITE_TYPE	Vegetation Mapping Note
HABITAT	
SOIL	
ROCK_TYPE	
VEGETATION	*Eucalyptus xerothermica, Acacia aptaneura* open woodland over *Acacia aptaneura* tall shrubland over *Rhagodia eremaea*, *Eremophila longifolia* open shrubland over *Bothriochloa ewartiana*, *Themeda triandra, Aristida contorta* open tussock grassland
VEG_COND	
FIRE_AGE	
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	700665
NORTH	7450060
LATITUDE_GDA	-23.04587
LONGITUDE_GDA	118.95846

Site	Rec	Name	Date	Cover (%)	Height (cm)	Spec Notes
Veg6	1	*Acacia aptaneura*	13/07/2021	0-10 combined trees	500	
Veg6	2	*Acacia aptaneura*	13/07/2021	2-30	500	
Veg6	3	*Aristida contorta*	13/07/2021	0-30 combined tussock grasses	20	
Veg6	4	*Bothriochloa ewartiana*	13/07/2021	0-30 combined tussock grasses	70	
Veg6	5	*Eremophila forrestii subsp. forrestii*	13/07/2021	0-2	150	
Veg6	6	*Eremophila longifolia*	13/07/2021	0-2	200	
Veg6	7	*Eucalyptus xerothermica*	13/07/2021	0-10 combined trees	700	
Veg6	9	*Ptilotus obovatus*	13/07/2021	0-2	30	
Veg6	10	*Rhagodia eremaea*	13/07/2021	0-10	120	
Veg6	11	*Themeda triandra*	13/07/2021	0-30 combined tussock grasses	60	

SITE	Veg7
PROJ	HD2 Riparian Survey
DATE	15-Jul-21
SITE_TYPE	Vegetation Mapping Note
HABITAT	
SOIL	
ROCK_TYPE	
VEGETATION	*Acacia citrinoviridis* (and occasional *Eucalyptus victrix*) woodland over *Acacia pyrifolia, Corchorus crozophorifolius, Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) open shrubland over *Triodia longiceps* open hummock grassland
VEG_COND	
FIRE_AGE	
NOTES	
POSITION	C
DATUM	WGS84
ZONE	50
EAST	717869
NORTH	7454260
LATITUDE_GDA	-23.00578
LONGITUDE_GDA	119.12568

Site	Rec	Name	Date	Cover (%)	Height (cm)	Spec Notes
Veg7	1	*Acacia citrinoviridis*	15/07/2021	10-30	600	
Veg7	2	*Acacia pyrifolia*	15/07/2021	0-2	100	
Veg7	3	*Atalaya hemiglauca*	15/07/2021	0-2	300	
Veg7	4	*Corchorus crozophorifolius*	15/07/2021	0-10	70	
Veg7	5	*Eucalyptus victrix*	15/07/2021	0-2	1500	
Veg7	6	*Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186)	15/07/2021	0-10	50	
Veg7	7	*Triodia longiceps*	15/07/2021	0-10	50	

Appendix N: List of all sampling sites, both historical and current, used in this study and their locations.

Source	ID	SITE_ID	SAMPLING_METHOD	Easting	Northing
RTIO	2	MNV-01	Quadrat	706178	7443836
RTIO	5	PMV-02	Quadrat	699610	7449885
RTIO	6	PMV-01	Quadrat	697978	7448781
RTIO	9	PMV-05	Quadrat	704158	7452794
RTIO	17	WWV-03	Quadrat	708166	7446164
RTIO	18	WWV-04	Quadrat	708898	7447371
RTIO	19	WWV-06	Quadrat	713182	7448477
RTIO	20	WWV-07	Quadrat	715586	7448181
RTIO	21	WWV-11	Quadrat	723237	7452571
RTIO	22	WWV-12	Quadrat	722033	7454890
RTIO	23	WWV-13	Quadrat	722164	7458221
RTIO	1	MNR-02	Relevé	719715	7453506
RTIO	3	PMR-05	Relevé	704101	7452649
RTIO	4	PMR-07	Relevé	716995	7453173
RTIO	7	PMV-03	Relevé	701967	7451011
RTIO	8	PMV-04	Relevé	703027	7452229
RTIO	11	WWR-02	Relevé	707046	7446927
RTIO	12	WWR-05	Relevé	709575	7448312
RTIO	13	WWR-07	Relevé	715518	7448243
RTIO	14	WWR-12	Relevé	721954	7454861

RTIO	15	WWR-13	Relevé	722097	7458181
RTIO	16	WWR-01	Relevé	706934	7445416
RTIO	31	PMR-09	Relevé	695909	7445761
RTIO	32	PMR-J1	Relevé	717362	7453611
RTIO	33	WWR-J2	Relevé	721993	7449670
RTIO	10	WWM-01	Vegetation Sampling Point	723212	7453027
RTIO	24	Veg1	Vegetation Sampling Point	706420	7443450
RTIO	25	Veg2	Vegetation Sampling Point	706247	7443146
RTIO	26	Veg3	Vegetation Sampling Point	697944	7448796
RTIO	27	Veg4	Vegetation Sampling Point	697964	7448624
RTIO	28	Veg5	Vegetation Sampling Point	699593	7449824
RTIO	29	Veg6	Vegetation Sampling Point	700665	7450060
RTIO	30	Veg7	Vegetation Sampling Point	717869	7454260
Astron	A1	HD17	Quadrat	706292	7443062
Astron	A2	HD18	Quadrat	707275	7445867
Astron	A3	HD22	Quadrat	701608	7445751
Astron	A4	HD31	Quadrat	696428	7445960
Astron	A5	HDR18	Relevé	700267	7444557
Astron	A6	MNMH02	Vegetation Sampling Point	706059	7445189
Astron	A7	MNMH06	Vegetation Sampling Point	706727	7445168
Astron	A8	MNMH28	Vegetation Sampling Point	701881	7445406
Astron	A9	GH01	Quadrat	700255	7446956

Astron	A10	GH04	Quadrat	702109	7442804
Astron	A11	GH22	Quadrat	718877	7456696
Astron	A12	GH23	Quadrat	718990	7456473
Astron	A13	GH25	Quadrat	718335	7455098
Astron	A14	GHMNBE003	Vegetation Sampling Point	701584	7442631
Astron	A15	GHMNBE004	Vegetation Sampling Point	695055	7446840
Astron	A16	GHMNBE010	Vegetation Sampling Point	718292	7455111
Astron	A17	GHMNDR01	Vegetation Sampling Point	718529	7454873
Astron	A18	GHMNDR02	Vegetation Sampling Point	718301	7455179
Astron	A19	GHMNKM06	Vegetation Sampling Point	715921	7452470
Mattiske	M1	BHD03	Quadrat	708653	7452488
Mattiske	M2	BHD08	Quadrat	707221	7452271
Mattiske	M3	BHD12	Quadrat	714674	7452675
Mattiske	M4	BHD-RJCF	Relevé	714730	7452611
Mattiske	M5	SFJ11	Quadrat	713822	7452457
Mattiske	M6	SFJ38	Quadrat	708019	7452545
Mattiske	M7	SFJ42	Quadrat	712006	7452664
Mattiske	M8	SFJ45	Quadrat	715223	7452374
Mattiske	M9	SFJ-RMMC	Relevé	708182	7452469
Mattiske	M10	SFJ-RMMD	Relevé	708155	7452497
Mattiske	M11	SFJ-RMMG	Relevé	710862	7452111
Mattiske	M12	CB01	Quadrat	721559	7459620

Mattiske	M13	CB04	Quadrat	721493	7456193
Mattiske	M14	CB07b	Quadrat	723249	7451264
Mattiske	M15	CB09	Quadrat	720599	7449104
Mattiske	M16	H2009	Quadrat	701584	7446020
Mattiske	M17	H2010	Quadrat	701553	7446052
Mattiske	M18	H2061	Quadrat	707283	7445745
Mattiske	M19	H2093	Quadrat	705717	7445242
Mattiske	M20	H2103	Quadrat	704246	7444556
Mattiske	M21	H2109	Quadrat	703816	7444021
Mattiske	M22	H2118	Quadrat	706189	7444235
Mattiske	M23	CB01	Quadrat	696550	7446200
Mattiske	M24	CB04	Quadrat	711036	7448184
Mattiske	M25	CB07b	Quadrat	723251	7451321
Mattiske	M26	CB09	Quadrat	700421	7446841
Mattiske	M27	SJ003	Quadrat	721928	7458009

APPENDIX C TERRESTRIAL FAUNA

C.1: Hope Downs 2 Proposal Fauna Survey Report

Hope Downs 2 Proposal
Fauna Survey
March 2019

Prepared for
Rio Tinto



astron

Report Reference: 14292-19-BISR-1Rev3_200821

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Hope Downs 2 Proposal
Fauna Survey

Prepared for
Rio Tinto

Job Number: 14292-19

Reference: 14292-19-BISR-1Rev3_200821

Revision Status

Rev	Date	Description	Author(s)	Reviewer
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Approval

Rev	Date	Issued to	Authorised by	
			Name	**Signature**
A	11/10/2019	T. Savage	B. Lucas	
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2	06/02/2020	T. Savage	S. Pearse	
3	21/08/2021	M. Doak	B. Lucas	

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Abbreviations

Abbreviation	Definition
ARU	Autonomous Recording Unit
Astron	Astron Environmental Services
BC Act	*Biodiversity Conservation Act 2016*
BHT	Bedded Hilltop
COI	Cytochrome c oxidase subunit I
CR	Critically Endangered
DBCA	Department of Biodiversity, Conservation and Attractions
DD	Data Deficient
DNA	Deoxyribonucleic acid
EN	Endangered
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESA	Environmentally Sensitive Area
GDA94	Geocentric Datum of Australia 1994
ha	Hectares
HD1	Hope Downs 1
HD2	Hope Downs 2
IA	International Agreement (Migratory under the EPBC Act and Schedule 5 under the BC Act)
IBRA	Interim Biogeographic Regionalisation for Australia
km	Kilometres
m	Metres
MGA	Map Grid of Australia
mm	Millimetres
MNES	Matters of National Environmental Significance
P	Priority
PEC	Priority Ecological Community
sp.	Species
SRE	Short Range Endemic
Survey area	Hope Downs 2 Development Envelope, which includes two deposits: Hope Downs 2 and Bedded Hilltop (10,817.7 ha)
TEC	Threatened Ecological Community
VU	Vulnerable
WAM	Western Australian Museum
WM	Wonmunna

Executive Summary

Rio Tinto is evaluating the potential development of additional iron ore deposits at Hope Downs 2 (HD2) in the Pilbara region of Western Australia. Astron Environmental Services was commissioned to undertake a Level 2 fauna and Short Range Endemic assessment of the HD2 Development Envelope (the survey area, which is 10,817.7 hectares) over three separate phases of fauna surveying.

Vertebrate Fauna

Eight broad fauna habitat types were recorded in the survey area: Minor Drainage, Gorge/Gully, Breakaway, Rocky Hill, Low Hill and Slopes, Alluvial Plain, Mulga Woodland and Stony Plain. Areas of cleared habitat were present within the HD2 and Bedded Hilltop areas where exploration drilling had occurred in the form of drill pads and drill access tracks. The Gorge/Gully and Breakaway habitats in the survey area were considered important for fauna due to the microhabitats they provide such as caves and the potential for semi-permanent water pools. These areas contained a high diversity of microhabitats representing important sites of refuge and habitat for conservation listed fauna, such as the Northern Quoll, Pilbara Leaf-nosed Bat and Ghost Bat.

There were 174 vertebrate fauna species recorded within the survey area, comprising two amphibians, 55 reptiles, 84 birds and 33 mammals (including seven introduced mammal species). The fauna species assemblage recorded during the survey is considered typical of the Hamersley subregion.

Seven vertebrate species of conservation significance were recorded during the survey: Northern Quoll (*Dasyurus hallucatus*) (EN; EN); Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) (VU; VU); Ghost Bat (*Macroderma gigas*) (VU; VU); Oriental Plover (*Charadrius veredus*) (IA; IA); *Lerista macropisthopus remota* (P2); Letter-winged Kite (*Elanus scriptus*) (P4); and Western Pebble-mound Mouse (*Pseudomys chapmani*) (P4). Three of these species (Northern Quoll, Pilbara Leaf-nosed Bat and Ghost Bat) are classified under the *Environment Protection and Biodiversity Conservation Act 1999* as Matters of National Environmental Significance.

The Northern Quoll was recorded 14 times in the form of motion camera detection images (10 records), scat recordings (three records) and a solitary individual captured during the Phase 2 fauna survey. The seemingly large number of recordings, relative to the local vicinity and the micro-niches found in the preferred fauna habitats at Bedded Hilltop, suggests a resident population exists within the survey area.

The Pilbara Leaf-nosed Bat was recorded at three of the 23 bat detector locations. Recordings at all three locations were deemed to indicate low activity levels. The Pilbara Leaf-nosed Bat records were from foraging individuals in Gorge/Gully and Breakaway fauna habitats with all calls at least three hours after dusk and not consistent with the presence of a permanent roost cave nearby.

The Ghost Bat was recorded on nine occasions within the survey area through acoustic recordings (calls), scats recorded in nocturnal feed caves and an individual sighted during spotlighting within the HD2 area. Seven caves (two Category 3 roost caves with occasional occupancy and five Category 4 nocturnal roost caves) were recorded within the survey area. Based on regional records, this species has a strong presence in the vicinity of the survey area. The survey results are consistent with the Ghost Bat foraging in low numbers on the HD2 and Bedded Hilltop ridges.

Short Range Endemic Invertebrate Fauna

Five habitats were considered more conducive to relictual Short Range Endemic invertebrates: Breakaway, Mulga Woodland, Minor Drainage, Gorge/Gully and Rocky Hill. Most of these latter habitats are associated with an isolated ridge running in an east-west direction, so most of the breakaways and rocky slopes are south-facing and therefore conducive to Short Range Endemic invertebrates.

The field surveys generated a total of 202 samples (comprising 358 individuals) from Short Range Endemic target taxa representing 66 different taxa. Seventeen of these species were known to be widespread, 48 were potential Short Range Endemics and one was a confirmed Short Range Endemic, *Karaops banyjima*. Of these Short Range Endemic category taxa, 32 were identified to the level of species or morphospecies:

- seven spiders: *Karaops banyjima*, *Karaops* sp. 'ARA001', *Aurecocrypta* 'MYG315', *Aurecocrypta* 'sp. indet. (AESHD1)', *Synothele* 'MYG309', *Synothele* 'MYG311' and *Yilgarnia* 'MYG197'
- nine pseudoscorpions: *Tyrannochthonius* 'sp. indet. (AESHD1)', *Tyrannochthonius* 'sp. indet. (AESHD2)', *Austrohorus* 'sp. indet. (AESHD5)', *Beierolpium* 'sp. indet. (AESHD1)', *Beierolpium* 'sp. indet. (AESHD2)', *Euryolpium* 'sp. indet. (AESHD6)', *Euryolpium* 'sp. indet. (AESHD7)', 'Genus 7/4 PSE118' and '*PSEAAA* sp. indet. (AESHD4)'
- four scorpions: *Lychas* 'bituberculatus complex', *Lychas* 'hairy tail complex', *Lychas* 'multipunctatus complex' and *Urodacus* 'HD1'
- seven centipedes: *Sepedonophilus* 'HD1', *Sepedonophilus* 'HD2', *Mecistocephalus* 'HD1', *Mecistocephalus* 'HD2', *Mecistocephalus* 'HD3', *Cryptops* 'HD1' and *Orphnaeus* 'HD1'
- three millipedes: *Antichiropus* 'wonmunna', *Austrostrophus* 'Clade A' and *Austrostrophus* 'Clade E'
- two isopods: *Buddelundia* '10ma' and *Buddelundia* '77'.

Seventeen Short Range Endemic taxa sampled represented ambiguously identified groups:

- three spiders: *Synothele* sp., *Aname* sp. and Nemesiidae sp.
- five pseudoscorpions: *Anatemnus* sp., *Sundochernes* sp., *Euryolpium* sp., *Indolpium* sp. and Olpiidae sp.
- two centipedes: *Sepedonophilus* sp. and Geophilomorpha sp.
- two millipedes: *Antichiropus* sp. and *Austrostrophus* sp.
- five isopods: *Buddelundia* sp., Buddelundiinae sp., *Pseudodiploexochus* sp., *Troglarmadillo* sp. and Philosciidae sp.

Several Short Range Endemic category invertebrates were found in multiple habitat types, suggesting that they may be less specialised with respect to their habitat preferences:

- *Lychas* 'bituberculatus complex', from Stony Plain, Alluvial Plain and Low Hills and Slopes
- *Sepedenophilus* 'HD1', from Gorge/Gully and Mulga Woodland
- *Mecistocephalus* 'HD1', from Rocky Hills, Gorge/Gully and Mulga Woodland
- *Austrostrophus* 'Clade E', from Stony Plain, Alluvial Plain and Mulga Woodland

- *Antichiropus* 'wonmunna', from Mulga Woodland in the survey area, but from gully slopes and riparian vegetation outside of the survey area.

These species are likely to be found outside of the limits of the survey area.

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1 Introduction

1.1 Project Background

Rio Tinto is evaluating the potential development of additional iron ore deposits at Hope Downs 2 (HD2) in the Pilbara region of Western Australia, approximately 68 km north-west of Newman. Astron Environmental Services (Astron) was commissioned to undertake a multiple-phase Level 2 fauna survey of the 10,817.7 ha HD2 Development Envelope, which includes two deposits: HD2 and Bedded Hilltop, and herein is referred to as the survey area (Figure 1). This report presents the findings of the Level 2 surveys completed in November/December 2017, May 2018 and March 2019 as an overarching assessment.

1.2 Scope and Objectives

The objective was to undertake a terrestrial Level 2 vertebrate fauna and Short Range Endemic (SRE) invertebrate fauna assessment through a desktop assessment and field survey, and to incorporate data from previous biological surveys conducted in the vicinity of the survey area. The resultant data have been utilised to produce this report, which is intended to support and inform the environmental assessment process in accordance with the requirements of the Environmental Protection Authority. The scope of works was to undertake a:

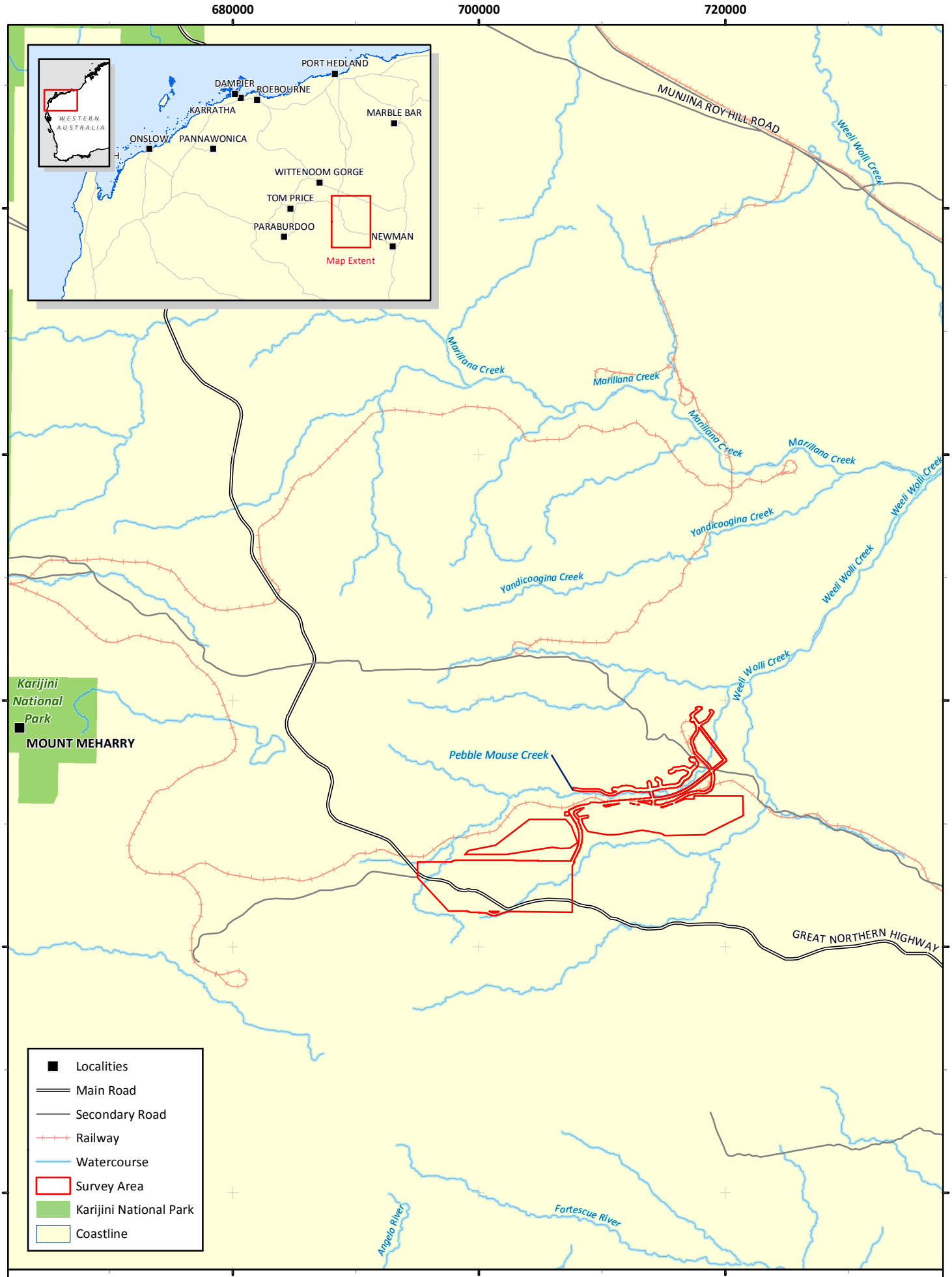
- desktop assessment, including database searches and literature review of available resources
- terrestrial vertebrate fauna field survey, including:
  - systematic fauna sampling
  - targeted Matters of National Environmental Significance (MNES) species sampling and searches
  - fauna habitat mapping.
- targeted SRE field survey, including:
  - targeted survey and searches
  - dry pitfall trap sampling
  - SRE fauna habitat mapping.

Astron conducted the fauna survey in accordance with the regulatory guidance detailed in Table 1 and Rio Tinto Data Standards (Rio Tinto 2019).

The scope and key limitations of the survey are outlined in Table 1. Section 3.7 of this report provides more detail on the limitations of the survey.

Table 1: Summary of Astron's vertebrate fauna and SRE invertebrate fauna assessment.

Level of survey	Survey area size	Survey timing	Relevant regulatory guidance documents	Key survey limitations
Level 2 terrestrial vertebrate and SRE fauna survey	10,817.7 ha	21 November to 2 December 2017 (Phase 1) 18 to 27 May 2018 (Phase 2) 8 to 18 March 2019 (Phase 3)	• Position Statement No. 3 (Environmental Protection Authority 2002) • Technical Guidance - Sampling Methods for Terrestrial Fauna (Environmental Protection Authority 2016a) • Technical Guidance – Sampling of Short Range Endemic Invertebrate Fauna (Environmental Protection Authority 2016b) • Technical Guidance - Terrestrial Fauna Surveys (Environmental Protection Authority 2016c) • *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) referral guideline for the Endangered Northern Quoll *Dasyurus hallucatus* (Department of the Environment and Energy 2016) • Survey Guidelines for Australia's Threatened Reptiles, Birds, Mammals and Bats (Department of Sustainability Environment Water Population and Communities 2011b; Department of the Environment 2010b; Department of Sustainability Environment Water Population and Communities 2011a; Department of the Environment 2010a) • Interim Guidelines for Preliminary Surveys of the Night Parrot (*Pezoporus occidentalis*) in Western Australia (Department of Parks and Wildlife 2017)	• Rainfall in the three months preceding Phase 2 and Phase 3 was below average, this led to potentially dry unfavorable conditions for SRE and vertebrate fauna sampling. However the rainfall received during the Phase 3 survey itself enabled a good sampling opportunity for vertebrate fauna and SRE species. • Only one SRE taxa could be assigned a species name and 17 of the 49 SRE invertebrate taxa could not be identified. • These are classified as minor limitations for vertebrate and SRE fauna as they are not expected to have a major impact on survey outcomes.



Rio Tinto

Hope Downs 2 Proposal Fauna Survey

Figure 1: Survey area location

astron
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Author: J. Johnston	Date: 12-11-2019
Drawn: C. Dyde	Figure Ref: 14292B-19-BIDR-3RevB_191112_Fig01_Locn

Datum: GDA 1994 - Projection: MGA Zone 50

0 5 10 15 20 Km

N

2 Environmental Context

2.1 Physical Environment

2.1.1 Climate

The climate of the Pilbara region of Western Australia is classified as arid tropical with two distinct seasons: a hot, wet summer (October – April) and a mild, dry winter (May – September) (Bureau of Meteorology 2019).

Based on long-term climatic data from the nearest Bureau of Meteorology weather station at Newman Aero (Station 007176) (approximately 90 km south-east of the survey area) the mean annual rainfall since 1971 is 329.5 mm. The mean maximum daily temperatures since 1996 range between 23.0°C and 39.2°C, and range above 30°C for much of the year (Bureau of Meteorology 2019) (Figure 2).

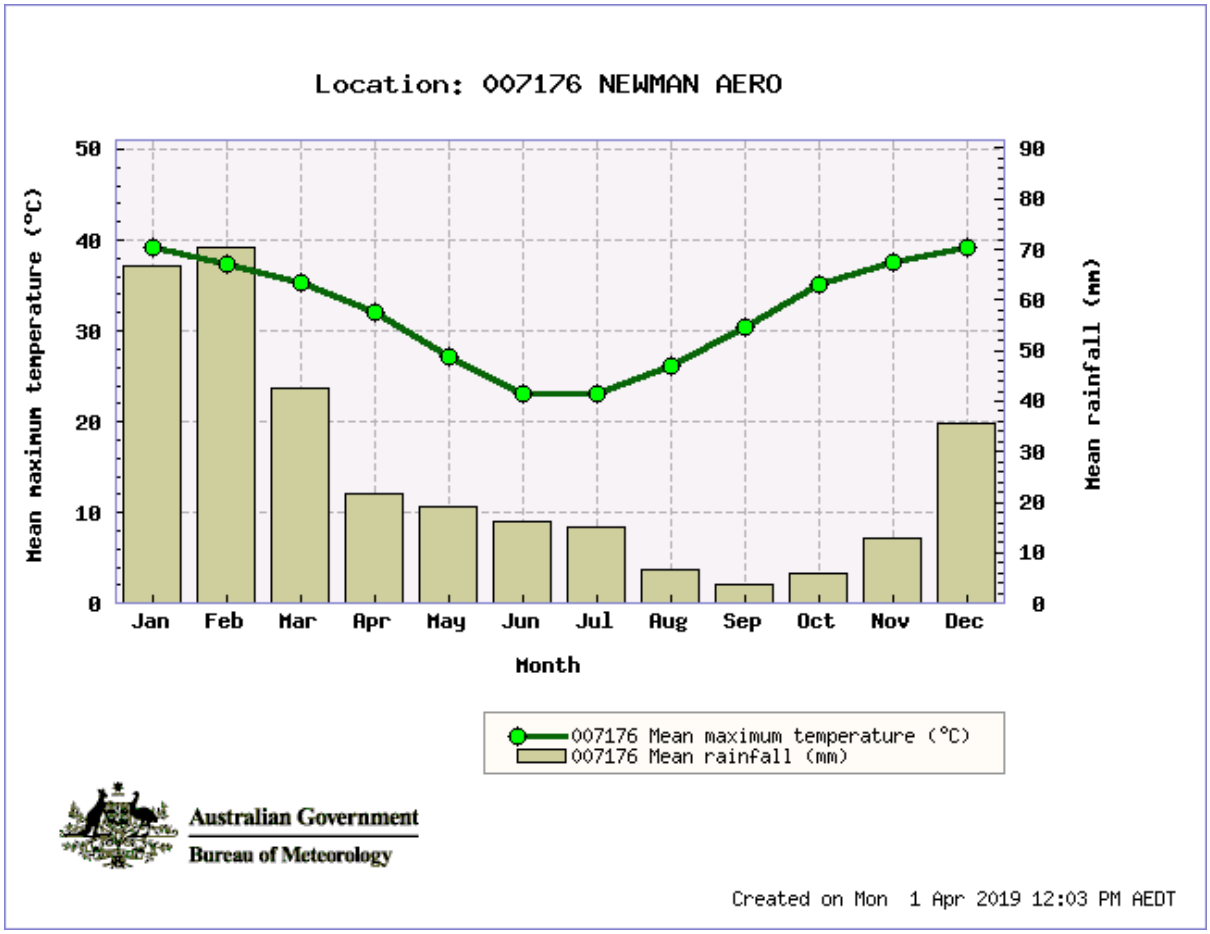


Figure 2: Climate data for Newman Aero Station (Station 007176). Mean annual rainfall data has been calculated from 1971 – 2019 and mean maximum temperature has been calculated from 1996 – 2019 (Bureau of Meteorology 2019).

2.1.2 Geology and Soils

The surface geology of the survey area is comprised of 10 units (Stewart et al. 2008), with Colluvium 3841 being the most dominant (Table 2). Geological mapping of the survey area and surrounds is presented in Figure A.1 (Appendix A).

Table 2: Geological units of the survey area (Stewart et al. 2008).

Geological name	Label	Area (ha)
Alluvium 38485: Channel and flood plain alluvium; gravel, sand, silt, clay, locally calcreted.	Qa	431.4
Brockman Iron Formation: banded iron-formation, chert, mudstone and siltstone.	Lchk	681.7
calcrete 38497 - Pisolitic, nodular or massive calcrete; ferruginous inclusions; calcareous cementing of bedrock and transported materials; locally with intercalated chalcedony; as low mounds, in playa lakes, or as valley calcrete; locally dissected and karstified	Czk	18.1
Colluvium 38491: Colluvium, sheetwash, talus; gravel piedmonts and aprons over and around bedrock; clay-silt-sand with sheet and nodular kankar; alluvial and aeolian sand-silt-gravel in depressions and broad valleys in Canning Basin; local calcrete, reworked laterite.	Qrc	2,587.8
Fortescue Group: Metadolerite, dolerite, gabbro; medium to coarse grained, massive grey-green rock, usually foliated.	Adf	763.6
Jeerinah Formation: Shale, sandstone, siltstone, mudstone, dolomite, local microbanded chert, jaspilite, conglomerate; fine-grained massive rhyolite; mafic tuff with local accretionary lapilli and agglomerate; thin basalt/dolerite and andesitic basalt flows.	Awfj	1,443.9
Marra Mamba Iron Formation: Chert, ferruginous chert, jaspilite, banded iron-formation, minor shale, siltstone, mudstone.	Achm	2,328.3
Mount McRae Shale and Mount Sylvia Formation: Interbedded shale, chert, banded iron-formation.	Ashm	1,212.5
Weeli Wolli Formation: Banded iron-formation (commonly jaspilitic), mudstone, siltstone; common interlayered metadoleritic sills.	Lchw	1,036.1
Wittenoom Formation: Calcitic dolomite, interbedded chert and shale in upper and lower parts, volcaniclastic sandstone.	Alhw	314.3

2.1.3 Surface Water and Hydrology

No Wetlands of International Importance (i.e. Ramsar wetlands) or Nationally Important Wetlands occur within the survey area (Department of the Environment and Energy 2017a, 2017b). The nearest Nationally Important Wetland is Fortescue Marshes, located 40 km north of the survey area, which has been nominated as a proposed Ramsar site. Pebble Mouse Creek passes through a large proportion of the survey area. One of the upper tributaries of Weeli Wolli Creek passes through the HD2 area.

2.2 Biological Environment

2.2.1 Interim Biogeographic Regionalisation of Australia

The Interim Biogeographic Regionalisation for Australia (IBRA version 7) divides the Australian continent into 89 bioregions and 419 subregions (Department of the Environment and Energy 2017c). The IBRA regions represent a landscape-based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and fauna. The survey area occurs in the Pilbara bioregion, of which 8.4% is represented in the national reserve system (Department of the Environment and Energy 2016b).

The biodiversity of the 53 subregions recognised in Western Australia was documented as part of a national audit to provide priorities for conservation action (Department of Conservation and Land Management 2002). The survey area occurs within the Hamersley subregion of the Pilbara region and is described in the audit as:

- Hamersley PIL3 – dissected bold plateaux and ranges of flat lying, moderately folded sandstone and quartzite with vegetation described as Mulga low woodland over tussock grasses occurring on fine textured soils in valley floors, with scattered Snappy gum (*Eucalyptus leucophloia*) over *Triodia brizoides* on skeletal soils of the ranges (Kendrick 2001).

2.2.2 Land Systems

Land systems of the Western Australian rangelands have been mapped and described by the Department of Primary Industries and Regional Development (formerly the Department of Agriculture and Food) outlining the distributions and providing comprehensive descriptions of biophysical resources, including soil and vegetation condition. A total of 102 land systems occur in the Pilbara bioregion covering 181,723 km^2. Nine land systems occur in the survey area (Table 3). The layout of these land systems within the survey area is shown in Figure A.2 (Appendix A).

Table 3: Distribution of land systems within the survey area.

Land system	Total area within bioregion (ha)	Total area (ha) (proportion of survey area (%))
Boolgeeda - stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands.	961,847	1,486.0 (13.7)
Calcrete - Low calcrete platforms and plains supporting shrubby hard spinifex grasslands.	134,834	4.9 (<0.1)
Egerton - Highly dissected plains and slopes with sparse mulga shrublands or shrubby hard spinifex grasslands.	66,849	1.4 (<0.1)
McKay - Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands with acacias and occasional eucalypts.	426,124	326.7 (3.0)
Newman - rugged jaspilite plateaux, ridges and mountains with hard spinifex.	1,994,339	4,647.2 (43.0)
Pindering - Gravelly hardpan plains supporting groved mulga shrublands with hard and soft spinifex.	38,738	410.5 (3.8)
Platform - dissected slopes and raised plains supporting shrubby hard spinifex grasslands.	236,390	2,522.2 (23.3)
Rocklea - basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.	2,880,288	1,314.1 (12.1)
Wannamunna - Hardpan plains and internal drainage tracts supporting mulga shrublands and woodlands and occasionally eucalypt woodlands.	63,004	104.5 (1.0)

2.2.3 Pre-European Vegetation

Beard (1975) completed broad-scale (1:1,000,000) pre-European vegetation mapping at an association level. The Beard mapping was later used by the Department of Agriculture and Food (Shepherd, Beeston, and Hopkins 2002) to compile vegetation units that assisted with identifying pre-European and current extents of vegetation throughout Western Australia.

Three pre-European vegetation units, 82, 18 and 29 (Shepherd, Beeston, and Hopkins 2002), are associated with the survey area (Figure A.3, Appendix A). Table 4 summarises the current and pre-European extent of these three vegetation units in the Pilbara bioregion and the survey area.

Table 4: Extent of pre-European vegetation within the survey area (Government of Western Australia 2018).

Vegetation association	Mapping unit (Beard 1975)	Description	Total area (ha) (proportion of survey area (%))	Pre-European extent (ha)	Current extent in bioregion (ha)	Proportion of pre-European extent remaining (%)	Pre-European extent with formal protection (%)
82	e16Lr t3Hi	Hummock grasslands, low tree steppe; snappy gum over *Triodia wiseana*	5,452.2 (50.4)	2,168,702	2,156,558	99.4	13.7
18	a1Li	Low woodland, open low woodland or sparse woodland; mulga (*Acacia aneura*)	5,339.0 (49.4)	580,512	576,389	99.3	29.6
29	a1Lp	Mulga (*Acacia aneura*) and associated species.	26.5 (0.2)	172,083	171,975	99.9	12.8

2.3 State and Commonwealth Conservation Categories and Management

Commonwealth and State regulatory authorities maintain databases of the locations and conservation status of significant flora, fauna and ecological communities in Western Australia.

The EPBC Act provides a legal framework to protect and manage MNES including listed flora, fauna and ecological communities. These listed flora, fauna and ecological communities are allocated a conservation category, which are outlined in Tables B.1 and B.6 (Appendix B).

Ecological communities may be subject to processes that threaten to destroy or significantly modify it across much of its range. These communities are identified as threatened ecological communities (TECs) and are listed at both Commonwealth level under the EPBC Act and State level under the *Biodiversity Conservation Act 2016* (BC Act)[1] (Tables B.1 and B.2, Appendix B). The Department of Biodiversity, Conservation and Attractions (DBCA) maintains a list of priority ecological communities (PECs), which may also be under threat and are assigned one of four Priority rankings according to the criteria outlined in Table B.3 (Appendix B).

Under Western Australian legislation, all native fauna is protected and it is an offence to 'take' protected fauna. The BC Act also provides for native fauna species that have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection to be gazetted as Threatened, Extinct or Specially Protected (Table B.4, Appendix B). In addition, due to the diversity of Western Australia's fauna, many species are known from only a few collections or locations, but have not been adequately surveyed. Such fauna may be rare or threatened, but cannot be considered for declaration as Threatened fauna until adequate surveys have been undertaken. These fauna species are included on a supplementary conservation list managed by DBCA called the *Priority Fauna List*. Priority fauna are categorised according to level of threat and other information and the conservation categories are described in Table B.5 (Appendix B).

2.4 Land Use and Tenure

The survey area is located within the Shire of East Pilbara. The local area is mainly used for mineral exploration and mining activity. Karijini National Park is the nearest conservation reserve, located approximately 35 km to the west of the survey area (Figure 1).

[1] From 1 January 2019, the *Wildlife Conservation Act 1950* has been replaced by the *Biodiversity Conservation Act 2016* (BC Act) and its regulations. Phase 1 and 2 of this study was completed in 2017-18, prior to the BC Act being enacted.

3 Methods

3.1 Desktop Assessment

A desktop assessment was undertaken to assess whether any conservation listed vertebrate and invertebrate species, SRE invertebrate species or communities, or PECs/TECs were likely to occur within the survey area. For vertebrate species, the review focused on key habitats for conservation listed fauna and species of MNES. For SRE invertebrates, the review focused on invertebrate groups with a known high proportion of SRE species (the SRE groups): centipedes (Chilopoda), harvestmen (Opiliones), millipedes (Diplopoda), non-marine snails (Gastropoda), pseudoscorpions (Pseudoscorpiones), scorpions (Scorpiones), terrestrial slaters (Isopoda) and spiders (Araneae).

3.1.1 Database Searches

Environmentally Sensitive Areas (ESAs) are declared by the Minister for Environment under Section 51B of the *Environmental Protection Act 1986* to prevent incremental degradation of important environmental values such as declared rare flora, TECs or significant wetlands. A search for ESAs in the vicinity of the survey area was conducted using Western Australian government datasets (Department of Water and Environmental Regulation 2017) and the Register of the National Estate dataset (Department of the Environment and Energy 2008). In addition, database searches for fauna were conducted with search details summarised in Table 5.

Table 5: Database searches requested.

Database name	Date search results received	Search focus	Search area
NatureMap (Department of Biodiversity, Conservation, and Attractions 2017a)	25/10/2017	Terrestrial fauna and fauna of conservation significance	40 km radius from a central point defined by the coordinates: 23°04'04" S, 119°01'56" E
Threatened and Priority Ecological Communities Database (Department of Biodiversity, Conservation, and Attractions 2017b)	16/11/2017	Listed threatened and priority ecological communities	20 km radius from the survey area boundary
Threatened and Priority Fauna Database (Department of Biodiversity, Conservation, and Attractions 2017b)	03/11/2017	Threatened and Priority fauna species	40 km radius from the survey area boundary
Protected Matters Search Tool (Department of the Environment and Energy 2017d)	25/10/2017	Threatened and Priority fauna species	40 km radius from a central point defined by the coordinates: 23°04'04" S, 119°01'56" E
Western Australian Museum Invertebrate Database (Western Australian Museum 2018)	21/05/2018 - 28/05/2018	Arachnids, myriapods, crustaceans, and molluscs	100 km buffer from survey area bounded by the coordinates: Top left corner (north-west): -22.175902°, 118.070211°; Bottom right corner (south-east): -23.956909°, 120.008080°

3.1.2 Literature Review

Fauna surveys have been previously commissioned by Rio Tinto within the vicinity of the survey area and supplied to Astron for the desktop assessment. The previous survey areas in relation to the current survey area are shown in Figure 3. The reports reviewed as part of this assessment include:

- Biota Environmental Sciences (2006) Hope Downs Rail Corridor (Juna Downs Section) Fauna Survey
- Biota Environmental Sciences (2009) Hope Downs Section 45C Targeted Fauna Review
- Biota Environmental Sciences (2011) Hope Downs Project Life of Mine Targeted Fauna Survey
- Biota Environmental Sciences (2014) Hope Downs South West Marra Mamba Development Targeted Fauna Survey
- Ecologia Environment (2014) Greater West Angelas Terrestrial Fauna Assessment
- Ninox Wildlife Consulting (2009a) A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Infrastructure Corridor Option 1 Near Newman Western Australia
- Ninox Wildlife Consulting (2009b) A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Infrastructure Corridor Option 6 Near Newman Western Australia.

For further contextualisation of the survey records relevant to the local vicinity of the survey area, consideration was also made of recent publicly available Environmental Impact Assessments in proximity to Hope Downs, specifically the work conducted at Southern Flank as part of Mining Area C operations for BHP Billiton Iron Ore:

- Biologic Environmental Survey (2016) Mining Area C – Southern Flank Environmental Impact Assessment for Ghost Bat (*Macroderma gigas*)
- Biologic Environmental Survey (2017) Proposed Mining Area C Development Envelope Vertebrate Fauna Desktop Assessment.

3.1.3 Habitat Characterisation

Using orthophotos provided by Rio Tinto and the available literature, the survey area was split into distinct landform types that were evaluated further for their likelihood of conservation listed vertebrate or SRE species occurrence. The assessment followed several criteria, such as the availability of moisture, extent of shade and shelter, and soil and vegetation types. Emphasis was given to landforms that may contain 'relict' species (surviving in sheltered and moist conditions) and those that may support habitat specialists (i.e. species restricted to rocky outcrops).

3.1.4 Conservation Assessment

Conservation listed vertebrate fauna species returned from the database searches were categorised for likelihood of occurrence within the survey area prior to the field survey, according to the criteria listed in Table B.7 (Appendix B). Post survey, the likelihood table was re-assessed utilising the information obtained during the field survey (Table B.7, Appendix B) and updated accordingly.

SRE invertebrates are species with distributions of less than 10,000 km^2 and their occurrence within their distribution is usually fragmented and highly localised (Harvey 2002; Ponder and Colgan 2002). However, it is often difficult to determine whether or not a species in one of the target SRE groups actually has a range < 10,000 km^2. For the purpose of desktop review, SRE status was determined by

the staff of the Western Australian Museum (WAM) through providing the results of SRE searches of the WAM databases. This assessment was reviewed and supplemented with information contained in previous environmental reports, the published literature and online databases. For morphospecies collected during the survey, the criteria outlined in Table B.8 (Appendix B) were used to determine SRE status. The SRE categories of the WAM (confirmed SRE, potential SRE and widespread species) were used to assess the status of species, with sub-categories applied in accordance with the WAM Taxonomic Services guidelines (Table B.8, Appendix B).

690000 700000 710000 720000 730000

7460000

7450000

Survey Area

Previous Surveys

Hope Downs Project Life of Mine Targeted Fauna Survey (Biota 2011)

Hope Downs Rail Corridor (Juna Downs Section) Fauna Survey (Biota 2006)

Hope Downs South West Marra Mamba Development Targeted Fauna Survey (Biota 2014)

Greater West Angelas Terrestrial Fauna Assessment (Ecologia 2014)

A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Infrastructure Corridor Option 1 Near Newman Western Australia (Ninox 2009a)

Hope Downs Section 45C Targeted Fauna Review (Biota 2009)

A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Infrastructure Corridor Option 6 Near Newman Western Australia (Ninox 2009b)

Biota 2011

Biota 2009

Biota 2014

Biota 2006

Ninox 2009b

Ninox 2009a

Ecologia 2014

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 2 Proposal Fauna Survey

Figure 3: Previous fauna surveys conducted in the vicinity of the survey area

Coordinate System: GDA 1994 MGA Zone 50

0 2 4 6 8 10 Kilometres

N

astron delivering environmental intelligence™

Author: J. Johnston | Drawn: C. Dyde | Date: 12-11-2019 | Figure Ref: 14292B-19-BIDR-3RevB_191112_Fig03_PrevSurveys

3.2 Field Survey

3.2.1 Survey Timing and Personnel

The fauna assessment was conducted over three survey phases (Table 6). All technical survey personnel have over five years of experience conducting Level 2 vertebrate fauna surveys or invertebrate surveys.

Table 6: Details of the fauna surveys completed within the survey area.

Phase	Dates	Personnel	Fauna licence number
1	21 November – 2 December 2017	Matthew Love; Dr Kellie McMaster; Tim Sachse; Michael Brown; Ray Lloyd; Sam Mueller	08-002227-1
2	18 – 27 May 2018	Matthew Love; Dr Kellie McMaster; Tim Sachse; Michael Brown; Dr Palitha Jayasekara	08-002227-1
3	8 – 18 March 2019	Matthew Love, John Trainer, David Keirle, Dr Erich Volschenk	BA27000015

3.2.2 Weather

Daily observations for rainfall and temperature were recorded by Rio Tinto at the HD1 Weather Station; however there was a period between 13 and 31 January 2018 where data was not recorded. Data was substituted for this period from the nearby Hope Downs 4 Weather Station which is approximately 48 km south-east of the HD1 Weather Station. Long term rainfall and temperature observations were sourced from the Newman Aero Bureau of Meteorology station (number 007176), approximately 90 km south-east of the survey area and 87 km south-east of the HD1 Weather Station. Local rainfall and temperatures preceding the survey are presented in Figure 4.

The daily maximum temperatures during the Phase 1 survey averaged 37.2°C ± 2°C and daily minimum temperatures averaged 19.4°C ± 3°C. Mean maximum and minimum daily temperatures were similar during the Phase 1 survey and the long-term means for November (Bureau of Meteorology 2019). Rainfall in the 12 months preceding the Phase 1 survey in November 2017 was 175 mm (50%) above the long-term mean of 329.5 mm. Rainfall in the 12 weeks preceding the Phase 1 survey was 14 mm (14%) below the mean rainfall for the same period.

The daily maximum temperatures during the Phase 2 survey averaged 35.6°C ± 2°C and daily minimum temperatures averaged 18.6°C ± 2°C. Mean maximum daily temperatures were higher during the Phase 2 survey than the long-term mean and the mean minimum daily temperatures were comparable to the long-term mean for May (Bureau of Meteorology 2019). Rainfall in the 12 months preceding the Phase 2 survey in May 2018 was 121 mm (63%) below the long-term mean of 329.5 mm. In the 12 weeks preceding the Phase 2 survey 75 mm of rain was recorded, which equates to 56% below the mean average rainfall for the same time period (136 mm).

The daily maximum temperatures during the Phase 3 survey averaged 37.9°C ± 3°C and daily minimum temperatures averaged 25.5°C ± 4°C. Mean maximum and minimum daily temperatures were warmer during the Phase 3 survey compared to the long-term means for March (Bureau of Meteorology 2019). A total of 14.2 mm of rainfall fell over five days during the Phase 3 survey. Rainfall in the 12 months preceding the Phase 3 survey in March 2019 was 161 mm (51%) below the long-term mean of 329.5 mm. Rainfall in the 12 weeks preceding the Phase 3 survey was 110 mm (37%) below the mean rainfall for the same period.

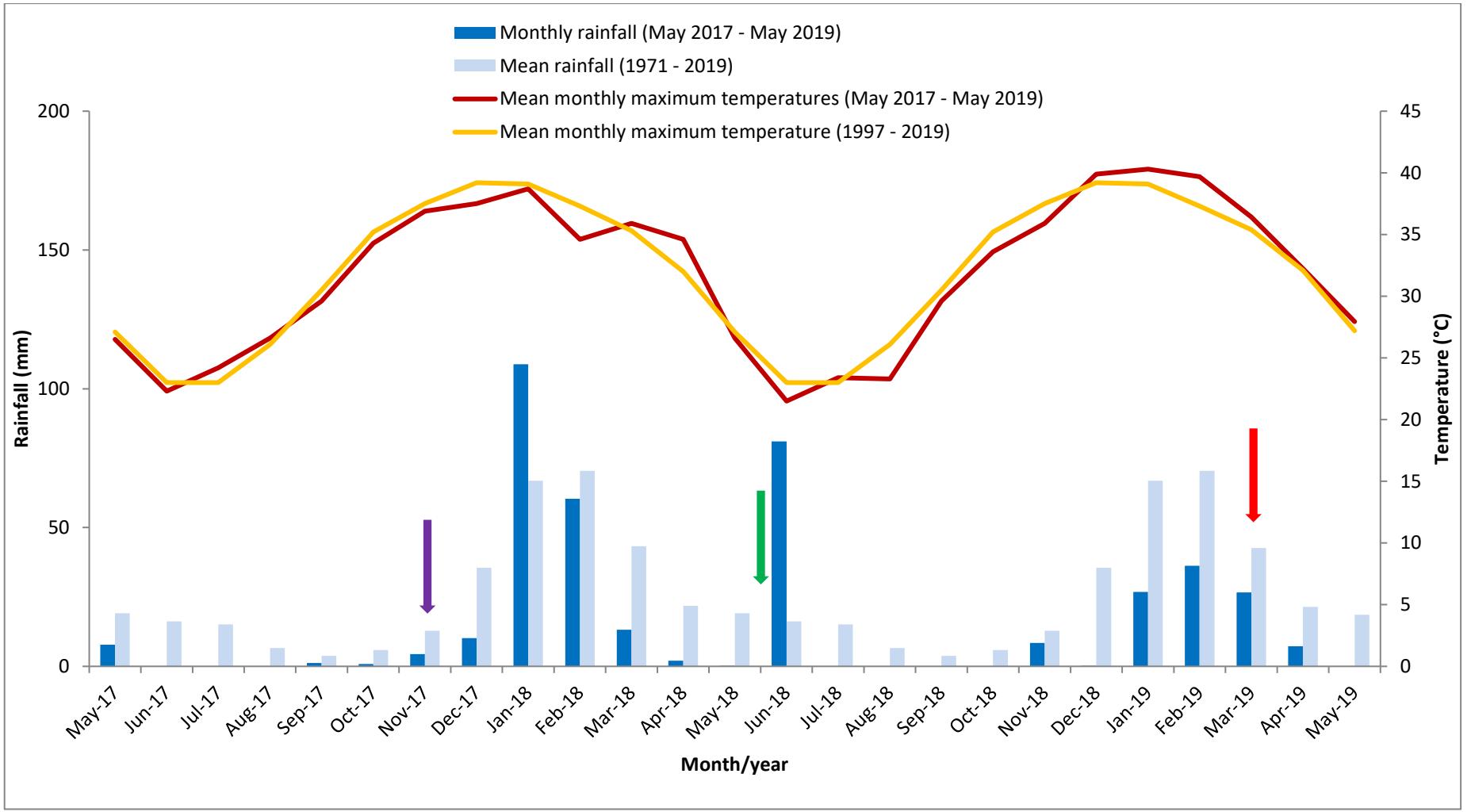


Figure 4: Mean monthly and recorded monthly rainfall (mm) and mean monthly and recorded monthly maximum temperatures (°C). Daily records supplied by Rio Tinto and long term records supplied by the Bureau of Meteorology from the Newman Aero station (number 007176) (Bureau of Meteorology 2019). The purple arrow displays the timing for the Phase 1 survey, the green arrow displays the timing for the Phase 2 survey and the red arrow displays the timing for the Phase 3 survey.

3.2.3 Vertebrate Fauna

3.2.3.1 Habitat Assessment

Twelve fauna habitat assessments conducted within the eight fauna habitat types present in the survey area (Table C.1, Appendix C). The locations of the fauna habitat assessments are shown in Figure C.1 (Appendix C). The following information was collected at each site:

- location – coordinates measured using a handheld GPS (GDA94)
- recorder and date – personnel involved in undertaking the fauna habitat assessment and the survey date
- habitat/landform – position in the landscape - major fauna habitat types were described based on the landform and vegetation
- vegetation type – a broad description of vegetation type and structure
- soils – a brief description of soil type
- microhabitat – presence of specific microhabitat features, for example, leaf litter, logs, burrows, rocky outcrops, rock crevices, hollows, permanent or semi-permanent water
- condition – habitat condition was assessed based on the presence of anthropogenic (human-induced) disturbances, and using the condition ratings suggested by Thompson and Thompson (2010) (Table B.9, Appendix B)
- disturbance – any disturbance such as clearing, fire, weeds, flooding, vehicular, machinery, tracks or grazing
- photographs – a representative photograph was taken of each habitat assessment site.

The information derived from the fauna habitat assessments was used to delineate fauna habitats throughout the survey area, which were then mapped accordingly. The potential for the mapped habitats to provide suitable habitat for MNES species Northern Quoll (*Dasyurus hallucatus*) (EN, EN), Ghost Bat (*Macroderma gigas*) (VU, VU), Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) (VU, VU), Night Parrot (*Pezoporus occidentalis*) (EN, CR) and Pilbara Olive Python (*Liasis olivaceus barroni*) (VU, VU) were ranked according to the criteria listed in Table B.10 (Appendix B).

Any caves identified within the survey area were assessed based on definitions for Ghost Bat usage according to Bat Call WA (2019) (Appendix I) and categorised as:

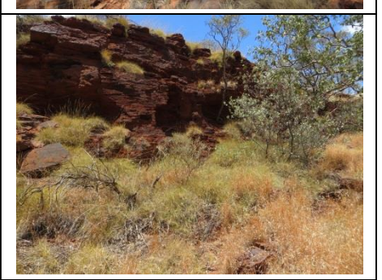
- Category 1 – diurnal roost caves with permanent occupancy
- Category 2 – diurnal roost caves with regular occupancy
- Category 3 – roost caves with occasional occupancy.
- Category 4 – nocturnal roost caves (opportunistic usage).

3.2.3.2 Trapping Sites

A total of 19 trapping sites were sampled within the survey area (Figure C.1, Appendix C). Changes to survey boundaries between surveys resulted in three of the trapping sites being outside the survey area. Eleven trapping sites were sampled during the Phase 1 fauna assessment, and 13 trapping sites during the Phase 2 fauna assessment (Table 7). An additional six trapping sites were sampled during the Phase 3 fauna assessment (Table 7). Further detail on the trapping sites are provided in Table C.1 (Appendix C).

Table 7: Trapping site locations and survey effort.

Site	MGA Zone 50 K		Habitat	Vegetation description	Habitat condition	Date opened	Date closed	Trap nights	No. of traps	Total trap nights	Photo
	Easting (mE)	Northing (mN)									
TS1	697504	7445613	Mulga Woodland	*Acacia catenulata*, (*A. pruinocarpa)* tall shrubland over *Eremophila fraseri* scattered tall shrubs over *Sida* ?*ectogama* open shrubland over *Triodia pungens* very open hummock grassland	1 (Excellent)	22/11/2017	29/11/2017	7	40	280	
						19/05/2018	26/05/2018	7	40	280	
TS2	696308	7446214	Alluvial Plain	*Acacia aptaneura*, (*A. pruinocarpa, Eremophila longifolia*) tall open shrubland over *Ptilotus astrolasius, E. lanceolata, E. forrestii* low open shrubland over *Chrysopogon fallax, Aristida* sp., (*Themeda triandra, Aristida contorta*) tussock grassland	0.8 (Very Good)	22/11/2017	29/11/2017	7	40	280	
						19/05/2018	26/05/2018	7	40	280	
TS3	699311	7446105	Mulga Woodland	*Acacia catenulata*, (*A. pruinocarpa*) tall shrubland over *Eremophila fraseri* scattered tall shrubs over *Sida* ?*ectogama* open shrubland over *Triodia pungens* very open hummock grassland	0.6 (Good)	22/11/2017	29/11/2017	7	40	280	
						19/05/2018	26/05/2018	7	40	280	
TS4	706249	7445883	Stony Plain	*Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia maitlandii* scattered tall shrubs over *Triodia pungens, T. vanleeuwenii* hummock grassland	0.8 (Very Good)	22/11/2017	29/11/2017	7	40	280	
						19/05/2018	26/05/2018	7	40	280	
TS5	705107	7445902	Low Hills and Slopes	*Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia maitlandii* scattered tall shrubs over *Triodia pungens, T. vanleeuwenii* hummock grassland	0.8 (Very Good)	23/11/2017	30/11/2017	7	40	280	
						19/05/2018	26/05/2018	7	40	280	

Site	MGA Zone 50 K		Habitat	Vegetation description	Habitat condition	Date opened	Date closed	Trap nights	No. of traps	Total trap nights	Photo
	Easting (mE)	Northing (mN)									
TS6	707293	7445814	Minor Drainage	*Eucalyptus camaldulensis*, (*E. victrix*) low woodland with *E. xerothermica* scattered low trees over *Petalostylis labicheoides*, (*Melaleuca bracteata*) tall open shrubland *Androcalva luteiflora* scattered shrubs over *Eulalia aurea, Themeda triandra, *Cenchrus ciliaris*, (*Enneapogon* sp.), *Aristida holathera* var. *holathera*) open tussock grassland	0.8 (Very Good)	23/11/2017	30/11/2017	7	40	280	
						19/05/2018	26/05/2018	7	40	280	
TS7	696251	7445929	Minor Drainage	*Eucalyptus victrix, E. xerothermica* low woodland over *Petalostylis labicheoides*, (*Acacia dictyophleba, A. pyrifolia* var. *pyrifolia, Androcalva luteiflora*) tall open scrub over *Triodia longiceps* open hummock grassland with *Themeda triandra*, (*Eulalia aurea, Panicum effusum, Chrysopogon fallax, Enneapogon robustissimus*) tussock grassland and *Chrysocephalum apiculatum* subsp. *pilbarensis* scattered herbs	0.6 (Good)	24/11/2017	1/12/2017	7	40	280	
						19/05/2018	26/05/2018	7	40	280	
TS8	713854	7450029	Breakaway	*Eucalyptus repullulans* scattered low mallee over *Acacia catenulata* subsp. *occidentalis, A. aptaneura*, (*A. incurvaneura, A. mulganeura, Grevillea saxicola*) tall open scrub over *Eremophila latrobei* subsp. *filiformis, Senna artemisioides* subsp. *helmsii* scattered shrubs over *S. stricta* scattered low shrubs over *Triodia pungens* very open hummock grassland with *Enneapogon polyphyllus* scattered tussock grasses	1 (Excellent)	24/11/2017	1/12/2017	7	20	140	
						19/05/2018	26/05/2018	7	20	140	
TS9	712816	7450165	Gorge/Gully	*Eucalyptus repullulans* scattered low mallee over *Acacia aptaneura, A. catenulata* subsp. *occidentalis*, (*A. ayersiana, Grevillea saxicola*) tall open scrub over *Eremophila latrobei* subsp. *filiformis* scattered shrubs over *Triodia pungens, T. vanleeuwenii* scattered hummock grasses	1 (Excellent)	24/11/2017	1/12/2017	7	20	140	
						19/05/2018	26/05/2018	7	20	140	
TS10	718871	7450712	Breakaway	*Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia opaca* and *Corymbia ferriticola* low open woodland over *Grevillea wickhamii*, (*Dodonaea petiolaris, Acacia bromilowiana*) tall open shrubland over *Triodia pungens* very open hummock grassland with *Themeda* sp. Mt Barricade (M.E. Trudgen 2471) open tussock grassland	1 (Excellent)	24/11/2017	1/12/2017	7	20	140	
						19/05/2018	26/05/2018	7	20	140	

Site	MGA Zone 50 K		Habitat	Vegetation description	Habitat condition	Date opened	Date closed	Trap nights	No. of traps	Total trap nights	Photo
	Easting (mE)	Northing (mN)									
TS11	718171	7450286	Gorge/Gully	*Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia opaca* and *Corymbia ferriticola* low open woodland over *Grevillea wickhamii*, (*Dodonaea petiolaris, Acacia bromilowiana*) tall open shrubland over *Triodia pungens* very open hummock grassland with *Themeda* sp. Mt Barricade (M.E. Trudgen 2471) open tussock grassland	1 (Excellent)	24/11/2017	1/12/2017	7	20	140	
						19/05/2018	26/05/2018	7	20	140	
TS12	717063	7450643	Rocky Hill	*Eucalyptus leucophloia* subsp. *leucophloia, Corymbia hamersleyana* low open woodland over *Gompholobium oreophilum, Acacia hilliana* low open shrubland over *Triodia vanleeuwenii*, (*T. wiseana, T. pungens)* open hummock grassland	1 (Excellent)	20/05/2018	27/05/2018	7	34	238	
TS13	717506	7450245	Rocky Hill	*Eucalyptus leucophloia* subsp. *leucophloia, Corymbia hamersleyana* low open woodland over *Gompholobium oreophilum, Acacia hilliana* low open shrubland over *Triodia vanleeuwenii*, (*T. wiseana, T. pungens)* open hummock grassland	1 (Excellent)	20/05/2018	27/05/2018	7	34	238	
TS14*	697906	7448526	Alluvial Plain	*Acacia aptaneura*, (*A. pruinocarpa, Eremophila longifolia*) tall open shrubland over *Ptilotus astrolasius, E. lanceolata, E. forrestii* low open shrubland over *Chrysopogon fallax, Aristida* sp., (*Themeda triandra, Aristida contorta*) tussock grassland	0.8 (Very Good)	09/03/2019	17/03/2019	9	40	360	
TS15*	700605	7448201	Rocky Hill	*Eucalyptus leucophloia* subsp. *leucophloia, Corymbia hamersleyana* low open woodland over *Gompholobium oreophilum, Acacia hilliana* low open shrubland over *Triodia vanleeuwenii*, (*T. wiseana, T. pungens)* open hummock grassland	1 (Excellent)	10/03/2019	17/03/2019	7	34	238	

Site	MGA Zone 50 K		Habitat	Vegetation description	Habitat condition	Date opened	Date closed	Trap nights	No. of traps	Total trap nights	Photo
	Easting (mE)	Northing (mN)									
TS16	706437	7448130	Low Hills and Slopes	*Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia maitlandii* scattered tall shrubs over *Triodia pungens, T. vanleeuwenii* hummock grassland	1 (Excellent)	10/03/2019	17/03/2019	7	40	280	
TS17*	700743	7447421	Stony Plain	*Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia maitlandii* scattered tall shrubs over *Triodia pungens, T. vanleeuwenii* hummock grassland	1 (Excellent)	11/03/2019	18/03/2019	7	40	280	
TS18	705435	7448646	Mulga Woodland	*Acacia catenulata*, (*A. pruinocarpa*) tall shrubland over *Eremophila fraseri* scattered tall shrubs over *Sida* ?*ectogama* open shrubland over *Triodia pungens* very open hummock grassland	1 (Excellent)	09/03/2019	17/03/2019	8	40	320	
TS19	707081	7449700	Breakaway	*Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia opaca* and *Corymbia ferriticola* low open woodland over *Grevillea wickhamii*, (*Dodonaea petiolaris, Acacia bromilowiana*) tall open shrubland over *Triodia pungens* very open hummock grassland with *Themeda* sp. Mt Barricade (M.E. Trudgen 2471) open tussock grassland	1 (Excellent)	09/03/2019	16/03/2019	7	20	140	
Q1	707086	7449689	Gorge/Gully	*Eucalyptus repullulans* low open mallee woodland over *Acacia catenulata* subsp. *occidentalis*, (*A. aptaneura, Grevillea saxicola, A. hamersleyensis* sens. lat., *A. pruinocarpa*) tall open scrub over *Triodia pungens, T. vanleeuwenii* very open hummock grassland	1 (Excellent)	25/05/2018	26/05/2018	1	5	5	No photo available
Total trapping effort										**1,539**	

*Due to changes in survey boundaries between phases, these trapping grids were outside the survey area.

Astron used the following trap design for the fauna assessment:

- 11 trap sites were established with 10 pitfall traps (20 L buckets), six funnel traps, 20 Elliot traps and four cage traps (wire mesh cage trap)
- five trap sites were established as cage/Elliot sites, each with 10 Elliott traps and 10 cage traps arranged in a linear layout along suitable habitat features
- three trap sites were established as funnel sites, each with 10 funnels, 20 Elliott traps and four cage traps arranged in a linear layout.

Pitfall traps were not established within the Breakaway, Gorge/Gully and Rocky Hill trap sites due to the rocky terrain and hard bedrock not being conducive to this type of trap. The ground dwelling reptiles and mammals in this area were targeted through other sampling techniques such as active searching and opportunistic recordings.

Five cage traps were established within the survey area during Phase 2 for one night to target Northern Quolls (Figure C.1 and Table C.1, Appendix C). This trap site was designed as an opportunistic capture of a Northern Quoll from noticeable site occupancy due to the presence of recent scats and foraging evidence. These data are not part of the data analysis detailed in Section 3.6.

All but one nominal trap site contained pitfall and funnel traps that were used in conjunction with a 100 m drift fence running over the centre of the pit, directing animal movement into the pitfall trap. One site (TS16) was designed as two independent lines of 50 m drift fence directing animal movement into the pitfall trap. The trap sites remained open for a minimum of seven nights during the phases of fauna surveying. Traps were cleared each morning within three hours of sunrise to minimise the potential of trap death.

3.2.3.3 Avifauna Surveys

A total of 2,280 minutes (38 hours) of systematic avifauna (bird) censuses were conducted within the survey area.

During the Phase 1 and Phase 2 fauna assessment, bird censuses were undertaken at each trapping grid for 20 minutes each day on four occasions resulting in 80 minutes of survey effort at each site. This equates to a total of 1,920 minutes (32 hours) of avifauna censuses conducted for Phase 1 and Phase 2.

During the Phase 3 fauna assessment the bird census were undertaken at each trapping grid for 20 minutes each day on three occasions resulting in 60 minutes of survey effort at each site for this phase. This equates to a total of 360 minutes (6 hours) of avifauna censuses conducted for Phase 3.

All species were recorded from sightings and/or from species-specific bird calls. Opportunistic records of species across the survey area were also recorded and habitats that may support species of conservation significance were targeted.

3.2.3.4 Motion Sensitive Cameras

Motion sensitive cameras (Moultrie and Reconyx HC600 HyperFire) were set at 35 locations for between three and nine nights with a combined trapping effort of 202 camera trap nights (Figure C.1 and Table C.1, Appendix C). The cameras were baited and placed in prospective/suitable habitat such as cave entrances and water holes aimed at targeting MNES species.

3.2.3.5 Acoustic Bat Surveys

Acoustic ultrahigh frequency equipment was used to record the presence of bats, in particular the Pilbara Leaf-nosed Bat and Ghost Bat. Acoustic recording devices (Song Meter (SM) 2 SM2BAT+ and SM4) were positioned in a total of 23 locations to achieve a broad coverage of the survey area (Figure C.1 and Table C.1, Appendix C). The detectors were set for two to nine nights, resulting in a total of 108 recording nights. The bat echolocation data collected in the field was analysed by Robert Bullen (Bat Call WA 2019). One unit at BAT22 (SM2 7634) failed to operate (Bat Call WA 2019) and BAT11 was found to be outside the survey area due to survey boundary changes; the results have not been included in this report.

3.2.3.6 Night Parrot Survey

Due to the recent discovery of Night Parrot populations in Western Australia, the DBCA have published interim guidelines for Night Parrot surveys in Western Australia (Department of Parks and Wildlife 2017). The survey area is located in the area mapped as 'high priority for survey' for this species so passive acoustic surveys using Autonomous Recording Units (ARUs) were undertaken in the most prospective habitats (Stony Plain habitat containing *Triodia*).

ARUs were positioned at two sites during the Phase 2 and Phase 3 surveys. The ARUs were set at each location for between four and seven nights, resulting in a total of 23 recording nights (Figure C.1 and Table C.1, Appendix C). The ARUs were set for recording between from 1 hour pre-sunset to 1 hour post-dawn. The audio data was recorded at 44.1 kHz sampling rate and covered the frequency range 100 kHz to 21,000 kHz which brackets the Night Parrot call frequency range of 1,500 kHz to 3,500 kHz. The ARU data collected in the field was analysed by Robert Bullen (Bat Call WA 2019).

3.2.3.7 Active Foraging

Active searches were undertaken in microhabitats suitable for ground-dwelling reptiles and mammals. Active searches included the following:

- searching and recording scats, tracks and other traces
- turning over rock and logs and peeling off bark
- raking soil and leaf litter
- searching rocky habitats in cracks and caves, around water bodies and inside bore hole caps.

3.2.3.8 Targeted Searches

The aim of the targeted searches was to identify areas of potentially suitable habitat for conservation significant fauna, such as caves, and secondary signs including tracks, scats, diggings and burrows. Visual observation for conservation significant fauna habitat was ongoing whilst moving through the survey area. Track logs were recorded using a handheld GPS and are shown in Figure C.1 (Appendix C). Any opportunistic sightings of fauna species were recorded whilst traversing the survey area.

3.2.3.9 Nocturnal Spotlighting

Spotlighting at night was undertaken on foot and from vehicles to target fauna that are nocturnal or crepuscular, particularly conservation significant species. A total of 72 person hours of nocturnal spotlighting was undertaken in the survey area over all three phases of the fauna assessment.

Approximately two nights of spotlighting (3 hours per night) was conducted per phase of fauna surveying.

3.2.4 SRE Invertebrates

3.2.4.1 Habitat Assessment

Fauna habitats within the survey area were mapped for their suitability to support SRE invertebrates as part of an initial desktop assessment (Section 3.1) that was further refined following the field survey.

3.2.4.2 Active Foraging

Astron sampled a total of 37 systematic sites (including the 14 pitfall/funnel trapping sites) for SRE fauna across the survey area (Figure C.1, Appendix C). All sites were sampled by active foraging and litter-soil samples. The sites were selected so that they represented the landforms and vegetation associations inferred as prospective in the desktop assessment. Detailed site descriptions, including associated landforms and vegetation features are provided in Table C.1 (Appendix C). The descriptions provide qualitative information about factors influencing the macroclimate (e.g. landform, vegetation type, dominant substrate, and indicative plant species) and microclimate (e.g. amount of organic matter or existing damage).

Foraging was focused under boulders, crevices in rocky outcrops, at the base of tree logs, under loose tree bark, in moist and dry leaf litter accumulations and in *Triodia* clumps, but occurred in all habitats. The search for mygalomorph spider burrows was by visual inspections. Night-time searching for scorpions was undertaken in conjunction with the nocturnal spotlighting. Leaf litter was sifted *in situ* with a 16 mm soil sieve, and potential SRE invertebrates preserved directly in 98% ethanol. Approximately 46 person hours were spent searching the 23 SRE active foraging sites (excluding the pitfall/funnel trapping sites). Any potential SRE invertebrates observed in the dry pitfall or funnel traps at each of the 14 relevant trapping grids were also collected.

3.3 Specimen Identification

All vertebrate fauna were identified in the field. Field guides and accepted scientific peer review references were used for fauna identification. One reptile specimen was vouchered with the WAM to confirm its identification as it was thought to be *Lerista macropisthopus remota*, a P2 species.

The samples were separated and sorted to morphospecies level under a dissecting microscope by Dr Erich Volschenk. Morphological identifications to species level were attempted for all collected specimens. These identifications were based on the available taxonomic literature and keys, environmental reports and online databases. Compound microscopes were used to examine fine taxonomic characters not visible otherwise, for example, trichobothria patterns in pseudoscorpions.

Dr Simon Judd contributed information about isopod distributions, SRE assessment and specimen identification. The remaining identifications (spiders, pseudoscorpions, scorpions and snails) were carried out by Dr Erich Volschenk. Further details on SRE specimen identification are provided in Appendix D (Alacran Environmental Science 2019).

3.4 Taxonomy and Nomenclature

Nomenclature and sequence for vertebrate fauna within this report is as per WAM's *Checklist of the Vertebrates of Western Australia* (Western Australian Museum 2019).

For species identified in the desktop assessment, every effort was made to determine the current scientific name for each taxon, including wherever there was doubt as to their true taxonomy (through subsequent name changes). A comprehensive description of SRE taxonomy and nomenclature is provided in Appendix D (Alacran Environmental Science 2019).

The biology of many SRE species is not well known and the precise distribution and life history are poorly, if at all, documented (Harvey 2002; Harvey et al. 2011). Species identification is often very difficult because few specimens have been collected, reference collections are unavailable, the specimens are the wrong sex or life stage for identification, or they are morphologically cryptic and require DNA analyses. Taxonomic resolution can also be poor, either because there are no published taxonomic revisions for a group in question (terrestrial isopods in Western Australia), or because there is no expert actively working on one of the SRE groups.

3.5 DNA-Barcoding

A number of invertebrates collected could not be identified morphologically, so molecular barcoding techniques were used in an attempt to verify the identity of some of these specimens.

All of the target samples were sourced from field collected specimens detailed in Appendix D (Alacran Environmental Science 2019). Sequences and tissue samples were obtained from the following sources:

- WAM (tissues and comparative sequences): codes beginning with “T” and followed by a string of numbers
- Alacran Environmental Science (comparative sequences and tissues): samples predating 2019 begin with “ESV” and later samples beginning with “AES”
- Genbank (comparative sequences): codes beginning with two letters and followed by six numbers.
- Dr Erich Volschenk scorpion research (comparative sequences): codes beginning with “EVR”.

Sequences of the gene COI (cytochrome c oxidase subunit I) were amplified from muscle tissues obtained from specimens preserved in >95% (WAM tissue collection) or *ca.* 70% to >95% ethanol (wet collections of WAM and Dr Simon Judd). Sequence generation from tissues was undertaken by Xytogen Pty Ltd and AGRF Perth.

Sequence contigs were assembled from forward and reverse amplicons using Geneious R7 version 7.1.9 and were subsequently edited and pruned by eye, prior to consensus sequences being created.

Phylogenetic analyses and sequence alignments undertaken by Alacran were performed with Geneious R7. For each analysis, sequences were assembled and aligned using ClausalW or the Geneious alignment tool. Eight separate analyses were undertaken, with each analysis aiming to assess the identification of the target taxa for the respective group: Selenopidae, Barychelidae, Idopidae, Pseudoscorpiones, *Lychas* (Scorpiones, Buthidae), *Urodacus* (Scorpiones, Urodacidae), Geophilomorpha and Diplopoda. Further details on the barcoding techniques and analyses are provided in Appendix D (Alacran Environmental Science 2019).

Nineteen of the sequences from Barychelidae, Buthidae, Chthoniidae, Olpiidae, Selenopidae, Trigoniulidae and Urodacidae were also provided to WAM to use their sequences to determine the taxonomic identity of the specimens. Provided DNA sequences were each blasted against publicly accessible sequences in GenBank and with data sets derived from current research projects at WAM. The top 20 blast hits for each major taxon were gathered, duplicates removed and analysed with a

Maximum Likelihood phylogenetic analysis using a GTR+G model of evolution and 100 bootstraps (RAxML). Distances were calculated via tree-based estimates of identical bases in Geneious Prime 2019.2.1. Further details on the analyses are provided in Appendix D (Wilson, Huey, and Harvey 2019).

3.6 Statistical Analyses

3.6.1 Sampling Effort

Sampling effort was assessed using species accumulation curves and modelled estimates of the total species pool. Species accumulation curves were created by randomly sampling an incremental number of sites while plotting the total number of species sampled. Species estimators are particular statistical models of species accumulation which estimate the total species pool available. Four species estimators were compared: Chao 2, Jackknife 1, Jackknife 2 and Bootstrap (Colwell and Coddington 1994). Species accumulation curves were created for each faunal group (mammals, birds and herpetofauna) and for the different surveys (Astron Phase 1, 2 and 3 surveys separately and combined). Species estimations shown were based on all phases of survey combined. All analyses were performed in R 3.2.1 (R Development Core Team 2016) using the package "Vegan".

3.6.2 Site Classification

The similarity of species assemblages amongst sites (using all surveys) was assessed using two dimensional ordinations based on Sorensen's index of similarity amongst sites. Significant groupings of sites by habitat type were identified using the ANOSIM function (Clarke, Somerfield, and Gorley 2008) within the package "Vegan". Ordinations and ANOSIM tests were performed for each faunal group (mammals, birds and herpetofauna) separately.

3.7 Limitations

Following completion of the desktop assessment and field survey, a review of any limitations that may affect a complete assessment of the data collected was conducted. The limitations listed in Table 8 are based on those suggested as considerations in Technical Guidance - Terrestrial Fauna Surveys (Environmental Protection Authority 2016c).

Species accumulation curves did not reach an asymptote, particularly for herpetofauna, but when taking into account previous records as well as species recorded from methods other than trapping, then a large portion of the predicted assemblage was recorded. The low number of captures and reduced herpetofauna assemblage recorded during the Astron trapping program is likely due to a combination of dry seasonal conditions experienced during the surveys and the trap methods used. Due to the rocky terrain and hard bedrock within certain habitat types, eight out of the 19 trap sites did not utilise pitfall traps. In addition eight sites (TS12 – TS19) only had a single phase (post-wet season) of trapping. However, the ground dwelling reptiles usually captured through pitfall traps were sampled through other techniques such as active searching and opportunistic recordings. This is considered a very minor limitation, as the herpetofauna assemblage expected to occur in the survey area is common and widespread and is unlikely to include any conservation significant fauna that have not been previously recorded from other fauna assessments conducted in the vicinity (Appendix E). The ground dwelling reptiles and mammals usually captured through pitfall traps were sampled through other techniques such as active searching and opportunistic recordings. Also the single phase sites (TS12-TS19) were conducted during the 'wet season' of the Pilbara region of Western Australia which is seen as the most productive period for sampling vertebrate fauna species.

Due to the number of targeted fauna surveys conducted in the survey area the populations of conservation significant fauna were well documented, particularly for the conservation significant Pilbara Leaf-nosed Bat and Ghost Bat. However, the presence of other conservation significant fauna within the general vicinity of the survey area, such as the Northern Quoll and Night Parrot, were less well known prior to the current surveys. Seventeen of the 49 SRE taxa identified are currently undescribed. Only one SRE specimen could be identified to a valid species name. Many others belong to known but unnamed taxa and many remain to be clarified at the species level.

Table 8: Statement of limitations for the vertebrate and SRE invertebrate fauna survey.

Potential limitation	Degree of limitation	Statement regarding potential limitations
(i) Competency/experience	No limitation	The ecologists responsible for conducting the survey have extensive experience in conducting Level 2 vertebrate and SRE fauna surveys in the Pilbara.
(ii) Scope What faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions.	Very minor limitation (Vertebrates)	The survey scope was completed to an adequate level. Most sampling methods were satisfactorily employed, although the low number of captures and reduced (between 66% and 85% of expected) herpetofauna assemblage recorded is likely due to a combination of dry conditions preceding the surveys and the trap methods used, where eight out of the 19 trap sites did not utilise pitfall traps. However, the ground dwelling reptiles usually captured through pitfall traps were sampled through other techniques such as active searching and opportunistic recordings. The number of herpetofauna species recorded were similar or greater than other previous surveys in the vicinity. The fauna observed and identified are likely to represent a portion of the suite of species that utilise the survey area and were typical of the Hamersley subregion.
(iii) Proportion of fauna identified, recorded and/or collected	Minor Limitation	The fauna observed and identified are likely to represent a portion of the suite of species that utilise the survey area. Fauna habitats were able to be adequately described and a list of species likely to be present was prepared based on this assessment. Species accumulation curves did not reach an asymptote, particularly for herpetofauna, but when taking into account previous records as well as species recorded from methods other than trapping, then a large portion of the predicted assemblage was recorded. It is not possible to determine bat species abundance from echolocation records; bat activity levels provide a relative measure of the abundance of each species within the survey area. Seventeen of the 49 SRE taxa sampled represented ambiguously identified groups.
(iv) Sources of information Previously available information (whether historic or recent) as distinct from new data.	No limitation	Adequate information was available from database searches and previous studies in the survey area and region.
(v) Proportion of task achieved. Further work which might be needed?	No limitation	The survey scope was completed and most sampling methods adequately employed. Trap sites TS12 - TS19 were only sampled over one phase of trapping (post-wet season), however this is seen as the most opportune time to sample vertebrate species in the Pilbara region of Western Australia.

Potential limitation	Degree of limitation	Statement regarding potential limitations
(vi) Timing/weather/season/ cycle	Minor Limitation	Rainfall in the three months preceding all three phases of survey was below average; however rainfall experienced during the Phase 3 survey enabled good SRE and vertebrate sampling opportunities aside from Opiliones (harvestmen spiders). The SRE target group Opiliones often requires a substantial buildup of rainfall preceding surveys to be effective in enabling capture of these species (pers. com. E. Voslchenck 15 May 2019) and 'post wet' season is considered the most optimal time for sampling the majority of vertebrate species. The temperatures during the survey were above or close to the long term average. As such fauna abundance should not have been adversely affected.
(vii) Disturbances For example fire, flood, accidental human intervention which affected results of survey	Minor limitation	Large areas of BHT were affected by recent fires and therefore were not suitable for sampling. No other disturbances were recorded in the survey area that would have affected the survey results.
(viii) Intensity In retrospect, was the intensity adequate?	No limitation	The intensity of the surveys was considered adequate for a Level 2 assessment.
(ix) Completeness Was the relevant area fully surveyed?	No limitation	All main habitats in the survey area were surveyed; coverage of habitat assessments and targeted surveys completed as part of this assessment and previous survey efforts are considered adequate.
(x) Resources Degree of expertise available in animal identification to taxon level.	No limitation	Adequate resources were available to identify fauna species. All technical personnel involved in identification have extensive experience in conducting Level 2 vertebrate and SRE fauna surveys in the Pilbara. Taxonomic experts were consulted for all SRE fauna groups to help identify the selected taxa.
(xi) Remoteness and/or access problems	No limitation	No access constraints affected the survey outcomes.
(xii) Availability of contextual information For example biogeographic information on the region.	No limitation	Database searches and previous vertebrate fauna surveys in the vicinity of the survey area provided contextual information.

4 Results

4.1 Desktop Assessment

4.1.1 Environmentally Sensitive Areas

No ESAs intersected the survey area. The nearest ESA is Hamersley Range National Park (1977 boundary), now referred to as Karijini National Park, the nearest boundary of which occurs approximately 35 km west of the survey area (Department of the Environment and Energy 2008).

4.1.2 Vertebrate Fauna

The database searches and literature review results indicate that 312 vertebrate fauna have been previously recorded in the vicinity of the survey area, including eight amphibian species, 109 reptile species, 147 bird species and 48 mammal species (including nine introduced mammal species) (Table E.1-E.4, Appendix E). Of these, 26 species are of conservation significance, including four reptile species, 15 bird species and seven mammal species (Table F.1, Appendix F). Of these, 10 species were considered to have a 'high' likelihood (inclusive of those recorded within the survey area), four species were considered to have a 'moderate' likelihood and 12 were considered to have a 'low' likelihood of occurrence within the survey area (Table F.1, Appendix F). This is based on their respective ecology, habitats considered likely to be present and any previous records from historic survey and database records.

Previous surveys undertaken for Rio Tinto in the vicinity of the survey area recorded six conservation significant vertebrate fauna species: Pilbara Barking gecko (*Underwoodisaurus seorsus*) (P2), Fork-tailed Swift (*Apus pacificus*) (IA; IA), Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat, and Western Pebble-mound Mouse (*Pseudomys chapmani*) (P4) (Table 9). The Rainbow Bee-eater (*Merops ornatus*), Cattle Egret (*Ardea ibis*) and the Eastern Great Egret (*Ardea modesta*) were previously listed as Migratory (IA) under the EPBC Act and Schedule 5 (IA) under the BC Act but have subsequently been delisted.

Table 9: Summary of literature review results from surveys conducted within the vicinity of the survey area.

Author (year)	Survey area; size (ha)	Survey level	Survey timing	Survey effort	Conservation significant vertebrate fauna recorded	Potential SRE invertebrate fauna recorded
Biota Environmental Sciences (2006)	Hope Downs Rail Corridor (Juna Downs). Size not stated	Level 2 (single phase)	September 2005	The survey focused on areas and habitat, which may not have been sampled in previous assessments. Sampling methods included the use of Elliott traps, avifauna surveys, harp nets, and opportunistic methods.	Ghost Bat (*Macroderma gigas*) Western Pebble-mound Mouse (*Pseudomys chapmani*)	*Quistrachia* aff. *Herberti* *Bothriembryon* ?*Austrostrophus* sp. *Synsphyronus gracilis* *Gaius* sp. A *Gaius* sp. B Ctenizidae sp. A Nemesiidae sp. A Barychelidae sp. A
Biota Environmental Sciences (2009)	Hope Downs 1 Iron Ore mine. Size not stated	Desktop Review	N/A	To provide a desktop and habitat-based review of potential SREs and troglobitic fauna values and habitats within the expanded project footprint for the Hope Downs Iron Ore mine project.	N/A	N/A
Biota Environmental Sciences (2011)	Hope Downs 1 Life of Mine. Size not stated	Targeted/ Level 1	June 2010	Five Elliott trapping transects located within potential Northern Quoll habitat and opportunistic searches.	Northern Quoll (*Dasyurus hallucatus*)	*Missulena* sp. *Synothele* sp. *Conothele* sp. *Aname* sp. *Antichiropus* sp.
Biota Environmental Sciences (2014)	Hope Downs South West Marra Mamba deposit. 2,758 ha	Targeted/ Level 1	September 2013	Four cage and large Elliott trapping transects located within potential Northern Quoll habitat and opportunistic searches. Motion sensor cameras and SM2 acoustic bat echolocation recorders were used to detect the presence of conservation significant fauna species.	Nil	'Sock' *Aname* 'big Angry Red' *Aname* 'Hooded' *Aname*

Author (year)	Survey area; size (ha)	Survey level	Survey timing	Survey effort	Conservation significant vertebrate fauna recorded	Potential SRE invertebrate fauna recorded
Ecologia Environment (2014)	Greater West Angelas. 17,565 ha	Level 2 (dual phase)	September – October 2012 March 2013	Habitat assessments, 12 trapping sites, avifauna censuses at each trapping site, foot traverses, nocturnal searches, targeted searches for both vertebrates and SRE invertebrates, and the use of SM2 acoustic bat echolocation recorders and motion sensor cameras.	Pilbara Barking gecko (*Underwoodisaurus seorsus*) Fork-tailed Swift (*Apus pacificus*) Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) Western Pebble-mound Mouse (*Pseudomys chapmani*)	*Aurecocrypta* sp. indet. *Yilgarnia* 'MYG197' *Urodacus* sp. indet. *Buddelundia* sp. nov. '10 1458A' *Buddelundia* sp. nov. '10 1458B' *Buddelundia* sp. nov. '10 1458C' *Buddelundia* sp. nov. '10 1458D' *Buddelundia* sp. nov. '68WA' Genus indet. sp. indet. *Beierolpium* sp. indet. *Euryolpium* sp. indet. *Xenolpium* sp. indet.
Ninox Wildlife Consulting (2009a)	Hope Downs 4 Option 1 Infrastructure Corridor. Size not stated	Level 2 (single phase)	May 2008	Four trapping sites, Anabat ultrasonic call detector, avifauna census, SRE sampling and opportunistic searches.	Western Pebble-mound Mouse (*Pseudomys chapmani*)	N/A
Ninox Wildlife Consulting (2009b)	Hope Downs 4 Option 6 Infrastructure Corridor. Size not stated	Level 2 (dual phase)	September 2008 April 2009	Six trapping sites, Anabat ultrasonic call detector, avifauna census, SRE sampling and opportunistic searches.	Western Pebble-mound Mouse (*Pseudomys chapmani*)	N/A

4.1.3 SRE Invertebrates

The database searches yielded a total of 12,376 records from within the search area (Appendix D; (Alacran Environmental Science 2019)). Of those, 4,335 records were attributed to SRE and potential SRE species. The SRE and potential SRE groups were represented by 282 taxa of which eight (3%) were named species, 182 (64%) were morphospecies and 92 (33%) were undetermined taxa, e.g. *Tyrannochthonius* sp. and Chthoniidae sp. (Table 10). The majority (260) of these taxa were classified as potential SRE 'Data Deficient' (DD) and 24 were confirmed SREs. The high proportion of potential SREs and undescribed morphospecies indicates a poor state of knowledge about these invertebrates in this region.

Table 10: Summary of Western Australian Museum database search results for SRE and potential SRE taxa.

Order	Named species	Morphospecies	Un-named taxa ("sp.")	Totals
Araneae: Araneomorphae (modern spiders)	2	5	3	**10**
Araneae: Mygalomorphae (trapdoor spiders)	2	78	21	**101**
Opiliones (harvestmen)	0	0	2	**2**
Pseudoscorpiones (pseudoscorpions)	3	31	18	**52**
Schizomida (short-tailed whip scorpions)	0	1	0	**1**
Scorpiones (scorpions)	0	19	6	**25**
Geophilomorpha (earth centipedes)	0	1	9	**10**
Scolopendromorpha (centipedes)	0	0	3	**3**
Polydesmida (flat-back millipedes	0	18	4	**22**
Polyzoniida (sucking millipedes)	0	0	1	**1**
Spirobolida (millipedes)	1	2	5	**8**
Symphyla (pseudocentipedes)	0	0	1	**1**
Isopoda (slaters)	0	25	9	**34**
Eupulmonata (land snails)	0	2	10	**12**
Totals	**8**	**182**	**92**	**282**

Of the 282 SRE taxa recorded from the database search area, 49 records from 15 species were present within the survey area (Table 11).

Table 11: Records of SREs from the database search areas that were present within the survey area.

Order	Family	Species	SRE category status
Arachnida	Actinopodidae	*Missulena* sp.	Potential SRE: DD
	Barychelidae	Barychelidae sp.	Potential SRE: DD
		Synothele 'MYG055'	Potential SRE: DD
		Synothele sp.	Potential SRE: DD
	Halonoproctidae	*Conothele* 'MYG002'	Potential SRE: DD
		Conothele sp.	Potential SRE: DD
	Idiopidae	*Idiosoma* sp.	Potential SRE: DD
	Nemesiidae	*Aname* 'MYG340'	Potential SRE: DD
		Aname sp.	Potential SRE: DD
		Kwonkan 'MYG339'	Potential SRE: DD
		Kwonkan sp.	Potential SRE: DD
		Teyl 'MYG027'	Potential SRE: DD
	Buthidae	*Isometroides* sp.	Potential SRE: DD
	Chthoniidae	*Tyrannochthonius aridus*	Potential SRE: DD
Diplopoda	Trigoniulidae	*Austrostrophus* sp.	Potential SRE: DD

4.2 Field Survey

4.2.1 Vertebrate Fauna Habitat

4.2.1.1 Fauna Habitats in the Survey Area

Eight broad fauna habitat types were recorded in the survey area: Minor Drainage, Gorge/Gully, Breakaway, Rocky Hill, Low Hill and Slopes, Alluvial Plain, Mulga Woodland and Stony Plain (Table 12 and Figure G.1, Appendix G).

Areas of cleared habitat were prevalent throughout the Bedded Hilltop (BHT) and HD2 sections of the survey area and associated with mineral drilling programs such as drill pads and drill access tracks. These areas totalled 832.3 ha (7.7%) and were considered in 'disturbed' condition. The fauna habitats surrounding these areas have been impacted by edge effects, lack of connectivity, grazing and the vegetation is often covered in dust. The majority of the habitats away from the mining operations were considered 'very good' to 'high quality' condition owing to the lack of disturbances from fire, weeds and grazing. The Minor Drainage habitats were heavily impacted by weed species such as **Cenchrus ciliaris* (Buffel Grass) and **Malvastrum americanum* (American Malvastrum), as well as impacts through extensive grazing and erosion from livestock. The Gorge and Breakaway habitats generally had the highest quality fauna habitat condition due to isolation from these threatening processes.

Minor Drainage habitat is a commonly recorded habitat for the Pilbara region and considered to be of moderate value to a wide spectrum of fauna species. The Minor Drainage habitat comprised a reduced diversity and density in vegetation species and communities, particularly when in the creek bed, and when present it was usually less dense and complex when compared to riparian habitats, such as Weeli Wolli Creek located to the east of the survey area. When present, vegetation typically exhibited a moderate diversity of microhabitats, with some tree hollows and woody debris such as

logs and leaf litter. The woody debris provides foraging and sheltering potential to ground dwelling reptiles and mammals. There were limited locations in this habitat that supported the potential for semi-permanent water bodies to form. Ground dwelling fauna are likely to utilise the linear nature of this habitat to traverse between habitats.

Gorge/Gully habitat is one of the more restricted habitats in the survey area. Gorges are a common feature of the Pilbara; however, as they tend to be narrow, linear features, gorges represent a small proportion of the total land area. In addition, they represent important shelter or roosting habitat for a number of MNES species, including the Pilbara Olive Python, Ghost Bat, Pilbara Leaf-nosed Bat and Northern Quoll. They may also support Priority listed species such as the blind snake *Anilios ganei* (P1). Occasional deep caves and semi-permanent rock pools are features within this habitat that can provide refuge for fauna during harsher drier seasonal conditions. There were no standing water bodies present during the survey; however, there are a number of locations where water could potentially pool after significant rain events, particularly within the BHT area. This habitat was considered of high value as it contains a complexity of microhabitats and potentially supports conservation significant fauna species.

Breakaway habitat is a common feature of the Pilbara but because they tend to be narrow, linear features, they represent a small proportion of the total land area. The breakaways of the survey area were often associated with the drop off areas of the Rocky Hill habitat and were specifically pertinent to BHT. Breakaway habitat contained microhabitats such as crevices, overhangs and shallow caves that provide shelter opportunities for MNES species. The caves have the potential to be used as diurnal roosts and nocturnal feeding roosts for the Ghost Bat, potential den sites for the Northern Quoll and Pilbara Olive Python. The Breakaway habitat provides important habitat values to a number of conservation listed species including MNES; therefore, it was considered of high importance for fauna.

Rocky Hill habitat is common and widespread throughout the Pilbara. This habitat generally has low vegetation complexity and low diversity of microhabitats; however, MNES species (such as the Northern Quoll) are likely to traverse and forage within these habitats. Other conservation significant species such as the Western Pebble-mound Mouse, *Anilios ganei* and the Pilbara Barking Gecko may also utilise this habitat. The soils are generally stony and compact, reducing the potential opportunities for burrowing species. Therefore this habitat was considered of moderate value for fauna.

Low Hill and Slopes habitat is widespread and common throughout the Pilbara region and although there are a few conservation listed species that may utilise this habitat, they are unlikely to be restricted to it, with the possible exception of the Western Pebble-mound Mouse. This habitat generally has low vegetation complexity and low diversity of microhabitats available for fauna species to exploit. The soils were generally stony and compact, reducing potential opportunities for burrowing species. This habitat was considered to be of low value to a broad spectrum of fauna species.

Alluvial Plain habitat is associated closely with drainage landforms of the Pilbara as it is often formed from the sediment overflow from drainage systems during flooding events. The Alluvial Plain habitat was considered to be of moderate value to a wide spectrum of fauna species as this habitat typically exhibited a moderate diversity of microhabitats, with some tree hollows and logs and some areas of sandy soils suitable for burrowing. At the time of the survey, the tree hollows of this habitat supported nesting potential for small passerines such as pardalotes, thornbills and multiple species of honeyeaters. Within the survey area the vegetation of this habitat was generally less complex when compared to Minor Drainage habitat, with an absence of large eucalypts. This habitat may provide some limited foraging opportunities for Ghost Bats and Pilbara Leaf-nosed Bats.

Mulga Woodland habitat is characterised by vegetation communities dominated by Mulga (*Acacia aneura*) on a stony mantle. The open to moderately dense woodlands consisted of an understorey composed of sparse tussock or hummock grasses. The woodlands provide nesting and shelter habitats for birds and reptiles and the tussocks and hummocks provide habitat for small birds, reptiles and mammals. Mulga Woodlands are also subject to sheet water flow after rainfall and vegetation is often densely clumped or banded due to the sheet flow, often forming large groves. However due to a low diversity of microhabitats present (generally the understorey and leaf litter were considered sparse), this habitat type was considered of low value to a wide spectrum of fauna species.

Stony Plain habitat is widespread and common throughout the Pilbara region and although there are a few species of conservation significance that may utilise it, they are not restricted to this habitat type. Conservation significant fauna likely to occur in this habitat type include the Western Pebble-mound Mouse. This habitat generally had low vegetation complexity and microhabitat diversity, and was considered to be of low value for fauna.

Table 12: Fauna habitat types recorded in the survey area.

Habitat type	Extent in survey area (proportion)	Broad habitat description	Vegetation description	Microhabitats	Sites	Habitat condition	Value (broad faunal assemblage and MNES species)	Representative photo
Minor Drainage	869.7 ha (8.1%)	Open drainage areas on stony soils. Water bodies only present during times of heavy inundation	*Eucalyptus victrix* (*Eucalyptus camaldulensis*) woodland over *Petalostylis labicheoides* and *Acacia* spp. tall open shrubland over tussock grassland	Hollow bearing trees and logs, thick ground cover/ vegetation, deep leaf litter	BAT9, BAT14, CAM15, CAM19, HA14, HA20, HA31, SRE3, SRE8, SRE14, TS6, TS7,	Good to High Quality	Moderate value to a wide spectrum of fauna species that are likely to reside in Minor Drainage habitats. Low value to target MNES species as they do not provide significant shelter.	
Gorge/ Gully	65.5 ha (0.6%)	Deep often rocky gorges, sometimes with ephemeral or semi-permanent pools	*Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia ferriticola* scattered low trees or *Eucalyptus repullulans* scattered low mallee over *Triodia pungens*, *Triodia vanleeuwenii* very open hummock grassland and scattered tussock grasses	Overhangs, crevices, caves, tree hollows, ephemeral, semi-permanent water	BAT1, BAT2, BAT7, BAT10, BAT17, BAT19, BAT22, BAT24, BAT25, CAM2, CAM3, CAM4, CAM5, CAM9, CAM18, CAM20, CAM22, CAM23, CAM24, CAM27, CAM28, CAM31, CAM32, CAM33, HA1, HA8, HA33, HA35, HA40, Q1, SRE1, SRE2, SRE4, SRE10, SRE13, SRE17, SRE18, SRE19, SRE20, TS10, TS11,	Very Good to High Quality	Primary high value habitat for target MNES species. Provides significant shelter sites and supports a diversity of fauna species.	
Breakaway	241.6 ha (2.2%)	Breakaway or ridge line, falling away to steep scree slope or drainage	*E. leucophloia* subsp. *leucophloia* scattered low trees over *Acacia* spp. tall shrubs over *T. pungens* very open hummock grassland, sometimes with scattered tussock grasses	Caves (roost/feed caves), cracks and crevices, sheltered leaf litter	BAT3, BAT4, BAT6, BAT8, BAT13, BAT16, BAT21, BAT23, BAT26, CAM1, CAM6, CAM7, CAM8, CAM11, CAM12, CAM13, CAM14, CAM17, CAM21, CAM30, CAM34, CAM35, HA4, HA5, HA9, HA24, HA38, SRE5, SRE9, TS8, TS9, TS19	Very Good to High Quality	High value to a low diversity of fauna species that are likely to reside in Breakaway habitats. High value to target MNES species as they are likely to roost and den within this habitat type.	
Rocky Hill	987.9 ha (9.1%)	Stony hills on high ranges with dissected valleys and gorges	*E. leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* scattered low trees to low open woodland over mixed open shrubland over open *Triodia wiseana, T. pungens, T. vanleeuwenii* hummock grassland	Shallow overhangs, boulders and crevices	BAT5, BAT15, CAM10, CAM16, CAM25, CAM26, CAM29, HA3, HA7, HA10, HA11, HA12, HA13, HA34, HA39, SRE11, SRE21, TS4, TS12, TS13, TS15	Good to High Quality	Moderate value for target MNES species as they are likely to traverse and forage within these habitats. Moderate value to a low diversity of fauna species that are rocky habitat specialists.	

Habitat type	Extent in survey area (proportion)	Broad habitat description	Vegetation description	Microhabitats	Sites	Habitat condition	Value (broad faunal assemblage and MNES species)	Representative photo
Low Hills and Slopes	5,460.0 ha (50.5%)	Low stony hills and slopes with dissected valleys and drainage on stony soils	*E. leucophloia* subsp. *leucophloia* and/or *C. hamersleyana* scattered low trees over mixed and *Acacia* spp. open shrubland over open *T. pungens, T. vanleeuwenii* hummock grassland	Termite mounds, *Triodia* hummocks, minimal leaf litter	AU2, HA2, HA17, HA19, HA22, HA25, HA36, HA37, HA41, HA42, TS5, TS16	Very Good to High Quality	Low value to a wide spectrum of fauna species that are likely to reside in within these habitats. Low value to target MNES species as this habitat type offers minimal ecological value to these species.	
Alluvial Plain	161.8 ha (1.5%)	Flood plain surrounding drainage areas	*Acacia pruinocarpa, Acacia aptaneura, Eremophila longifolia* tall open shrubland over tussock grassland	Dense leaf litter, termite mounds and spinifex clumps, cracking clays	TS2, TS14	Very Good	Low value to a wide spectrum of fauna species that are likely to reside in within these habitats. Low value to target MNES species as this habitat type offers minimal ecological value to these species.	
Mulga Woodland	1,031.4 ha (9.5%)	Stands of Mulga groves on clay based stony plains	*Acacia catenulata*, (*A. pruinocarpa*) tall shrubland over *Eremophila fraseri* scattered tall shrubs over *T. pungens* very open hummock grassland	Limited microhabitats, termite mounds, minimal leaf litter	AU1, BAT12, HA6, HA18, HA28, HA29, HA30, HA32, SRE6, SRE7, SRE12, SRE15, SRE16, SRE23, TS1, TS3, TS18	Disturbed to High Quality	Low value to a wide spectrum of fauna species that are likely to reside in within these habitats. Low value to target MNES species as this habitat type offers minimal ecological value to these species.	
Stony Plain	1,167.6 ha (10.8%)	Broad flat low lying plains to undulating plain on soft loamy soils	*A. aptaneura, A. pruinocarpa, A. catenulata* tall shrubland over *T. pungens* (and sometimes *T. vanleeuwenii)* hummock grassland or tussock grassland	Limited leaf litter, termite mounds and spinifex clumps	AU3, AU4, HA15, HA16, HA27, SRE11, SRE22, TS4, TS17	Very Good	Low value to a wide spectrum of fauna species that are likely to reside in within these habitats. Low value to target MNES species as this habitat type offers minimal ecological value to these species.	
Cleared	832.3 ha (7.7%)	Cleared areas from mining and pastoralism activities	Vegetation structure disturbed or absent.	None	None	Highly Degraded	Little value as fauna habitat.	

4.2.1.2 Significant Habitat Areas

None of the fauna habitats were considered to be synonymous with any TECs or PECs relating to terrestrial fauna listed in the Pilbara region (Department of Biodiversity, Conservation, and Attractions 2018).

Gorge/Gully habitats present in the survey area are considered important as refuge sites on a local scale due to the significant microhabitats they provide, such as caves and water pools. This habitat was considered highly suitable foraging and potential shelter for the MNES species Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat and Pilbara Olive Python and would be considered habitat critical to the survival of the Northern Quoll and Ghost Bat under the EPBC Act definitions (Department of Environment 2013; Department of the Environment and Energy 2016; Threatened Species Scientific Committee 2016).

Twelve significant habitat features were recorded throughout the survey area: seven caves and five pebble mounds of the Western Pebble-mound Mouse (Figure G.1 and Table G.1, Appendix G). Of the seven caves, two caves (Caves 1 and 5) were categorised as Category 3 roost caves with occasional occupancy due to the presence of Ghost Bat feeding evidence (scats) and/or the physical properties of the caves were conducive to diurnal roosting. The remaining five caves (Cave 2, 4, 6, 7 and 8) were categorised as Category 4 nocturnal roost caves (opportunistic usage) given the physical properties of the caves. Ghost Bat feeding evidence was recorded in Caves 4 and 7; however, these sites were more overhangs rather than caves and not conducive to diurnal roosting for this species. An additional two Category 4 nocturnal roost caves (Caves 3 and 9) were recorded just outside the survey area (Figure G.1 and Table G.2, Appendix G). One additional pebble mound was also recorded just outside the survey area (Figure G.1 and Table G.1, Appendix G).

The survey area contained habitat with the potential to support semi-permanent surface water, specifically in the Gorge/Gully habitat within the BHT area. However no pools (standing water), semi-permanent wetlands or surface water were recorded in the survey area at the time of survey. All refuge areas in the gorges or gullies of the survey area were generally dry.

4.2.1.3 Habitat Suitability for MNES Species

Northern Quoll

Approximately 107 ha (1%) of the survey area, comprising Gorge/Gully and some Breakaway habitats mainly within the BHT area, was considered 'probable shelter and foraging habitat' (or core habitat as per the referral guidelines (Department of the Environment and Energy 2016)), based on proximity to known quoll records, microhabitat features and orientation aspect (Figure G.2, Appendix G). Approximately 200 ha (2%) of the survey area was considered 'potential shelter and foraging habitat', comprising mainly smaller Breakaway habitat within the HD2 area (Figure G.2, Appendix G). The Gorge/Gully and Breakaway habitats contain rocky environments of high relief that are particularly important for Northern Quolls in the Pilbara as they provide potential denning sites for breeding and shelter and diverse microhabitats for foraging.

Approximately 1,858 ha (17%) of the survey area was considered suitable foraging and dispersal habitat (Minor Drainage and Rocky Hill habitats), particularly where these habitats were in close association with the Gorge/Gully and Breakaway habitats as they provided microhabitats such as crevices and cracks for foraging (Figure G.2, Appendix G). The remaining 8,653 ha (80%) of the survey area was considered to provide limited foraging and dispersal habitat, consisting of Alluvial Plain, Low Hills and Slopes, Mulga Woodland, Stony Plain and Disturbed habitats (Figure G.2, Appendix G).

Pilbara Leaf-nosed Bat

Approximately 307 ha (3%) of the survey area, comprising the Gorge/Gully and Breakaway habitat, was considered potential shelter and foraging habitat for this species due to the presence of nocturnal refuge caves (Figure G.3, Appendix G). Approximately 9,678 ha (89%) of the survey area, which consisted of Alluvial Plain, Minor Drainage, Low Hills and Slopes, Mulga Woodland, Rocky Hill and Stony Plain habitats was considered suitable foraging and dispersal habitat (Figure G.3, Appendix G). The remaining 833 ha (8%) of the survey area, comprising Disturbed areas, was considered to provide limited foraging and dispersal habitat (Figure G.3, Appendix G).

Ghost Bat

Approximately 307 ha (3%) of the survey area, comprising the Gorge/Gully and Breakaway habitat, was considered potential shelter and foraging habitat (Figure G.4, Appendix G), due to the presence of caves that potentially support roost sites. Often Gorge/Gully and Breakaway habitats contain caves and deep shelters that are used as nocturnal feeding roosts by Ghost Bats. During the survey two caves (Caves 1 and 5) were categorised as Category 3 roost caves with occasional occupancy due to the presence of Ghost Bat feeding evidence (scats) and/or the physical properties of the caves were conducive to diurnal roosting. The remaining five caves (Cave 2, 4, 6, 7 and 8) were categorised as Category 4 nocturnal roost caves (opportunistic usage) given the physical properties of the caves. It is considered unlikely that additional significant caves exist within the survey area; however, the possibility cannot be discounted as the survey area was not searched in its entirety. If present, they are likely to be found within the Gorge/Gully and Breakaway habitats only. No previously known or confirmed diurnal roosts or maternal roosts have been recorded in the survey area. Both habitats also contain complex vegetation structures and microhabitats that support prey species and foraging sites for the Ghost Bat.

Approximately 1,858 ha (17%) of the survey area, which consisted of Minor Drainage and Rocky Hill habitats, was considered suitable foraging and dispersal habitat (Figure G.4, Appendix G). The taller trees found in the Minor Drainage habitats provide ideal foraging/hunting perches particularly in areas that have the potential for semi-permanent surface water and contain thicker vegetation. The Rocky Hill habitat contains microhabitats such as boulder piles, cracks and crevices that support a wide range of prey species for the Ghost Bat. The remaining 8,653 ha (80%) of the survey area, comprising the Alluvial Plain, Low Hills and Slopes, Mulga Woodland, Stony Plain and Disturbed habitats, was considered to provide limited foraging and dispersal habitat (Figure G.4, Appendix G).

Night Parrot

None of the habitats of the survey area supported old, large and unburnt *Triodia* clumps that are considered the primary habitat requirement for the Night Parrot (Department of Parks and Wildlife 2017). The Alluvial Plain, Minor Drainage, Mulga Woodland and Stony Plain habitats (3,230 ha, 30%) within the survey area were mapped as suitable foraging and dispersal habitat; however, the Night Parrot is unlikely to occur within the survey area (Figure G.5, Appendix G). However, most of these habitats (particularly within the BHT and HD2 areas) were impacted by recent fires (less than 10 years old), pastoral and mining impacts over a long duration, very sparse ground cover vegetation and a lack of chenopod communities or suitable size/age *Triodia* hummocks and are unlikely to support the Night Parrot. The remaining 7,587 ha (70%) was considered to provide limited foraging and dispersal habitat (Figure G.5, Appendix G).

Pilbara Olive Python

Approximately 307 ha (3%) of the survey area, comprising the Gorge/Gully and Breakaway habitats, was considered as potential shelter and foraging habitat for the Pilbara Olive Python (Figure G.6, Appendix G). The caves and overhangs of the Gorge and Breakaway habitats are likely to provide denning sites and ambush locations frequented by this species.

Approximately 870 ha (8%) of the survey area was considered suitable foraging and dispersal habitat, which consisted of Minor Drainage habitat (Figure G.6, Appendix G). The remaining 9,641 ha (89%) of the survey area was considered to provide limited foraging and dispersal habitat, consisting of Alluvial Plain, Low Hills and Slopes, Mulga Woodland, Rocky Hill, Stony Plain and Disturbed habitats (Figure G.6, Appendix G).

4.2.2 Vertebrate Fauna Species

There were 174 vertebrate fauna species recorded within the survey area over the three phases of fauna surveying (Table 13). A complete list of recorded species is provided in Tables E.5-E.9 (Appendix E). The following sections provide detailed results for each major taxonomic group sampled.

Table 13: Number of vertebrate fauna species recorded during the survey.

Fauna taxonomic group	No. of species recorded	No. of conservation significant species recorded	No. of introduced species recorded
Amphibians	2	0	0
Reptiles	55	1	0
Birds	84	2	0
Mammals	33	4	7
Total	**174**	**7**	**7**

4.2.2.1 Herpetofauna

Two amphibian species were recorded during the fauna assessment: *Litoria rubella* (19 records) and *Cyclorana maini* (four records) (Table E.5, Appendix E). Frogs were either sighted (trapped) or heard calling during targeted searches. No conservation significant species were recorded.

Fifty-five reptile species were recorded the three phases of fauna surveying (Table E.6, Appendix E). The most abundant groups encountered were the skinks (114 records, 43%), followed by the geckos (84 records, 31%). Both of these groups were also the most speciose with 17 species of skinks and 12 species of geckos. The most commonly recorded species were *Carlia munda* (30 records), *Ctenotus pantherinus* (20 records) and *Oedura fimbria* (17 records). The most speciose sites were TS04 (Stony Plain) with 15 species and TS16 (Low Hills and Slopes) with 12 species. Ten species were recorded by methods other than trapping. One conservation significant reptile species was recorded during the survey, *Lerista macropisthopus remota* (P2).

Species accumulation curves did not asymptote when all surveys were considered (Figure 5), and based on estimates of total species richness, between 66% and 85% of the total species pool was recorded (Table 14). Only one of the previous surveys within the vicinity of the survey area used species accumulation curves and determined that 92% of the total expected species was recorded for herpetofauna (Ecologia Environment 2014). The reduced herpetofauna captures are likely to be a combination of the dry seasonal conditions and the trap methods used, with only eight out of the 19

trap sites using pitfall traps (see Section 3.7 for more detail). Ten reptile species (18%) were recorded opportunistically during the fauna assessment.

There was a significant difference in species composition between habitat types (ANOSIM R = 0.458, P = 0.004). The two Mulga Woodland (TS1, TS3) and two Low Hills and slopes (TS5, TS16) sites showed the highest within habitat type similarity, while the Rocky Hills habitat was the most distinct herpetofauna assemblage (Figure 6). This is because three species were recorded only in this habitat type: *Delma butleri*, *Furina ornata* and *Pseudonaja nuchalis*. These species are habitat generalists (and not rock-dwelling specialists), so it is likely they were only recorded in this habitat type due to the higher number of funnel traps used, as they are considered a more effective trap to capture reptiles such as snakes that readily escape pit traps (Environmental Protection Authority 2016a).

Table 14: Total number of herpetofauna taxa systematically sampled in comparison to estimates of the total species pool based on several models.

	Observed	Estimated			
		Chao2	Jackknife 1	Jackknife 2	Bootstrap
Number of species	47	61	64	71	55
Estimated % sampled		77	73	66	85

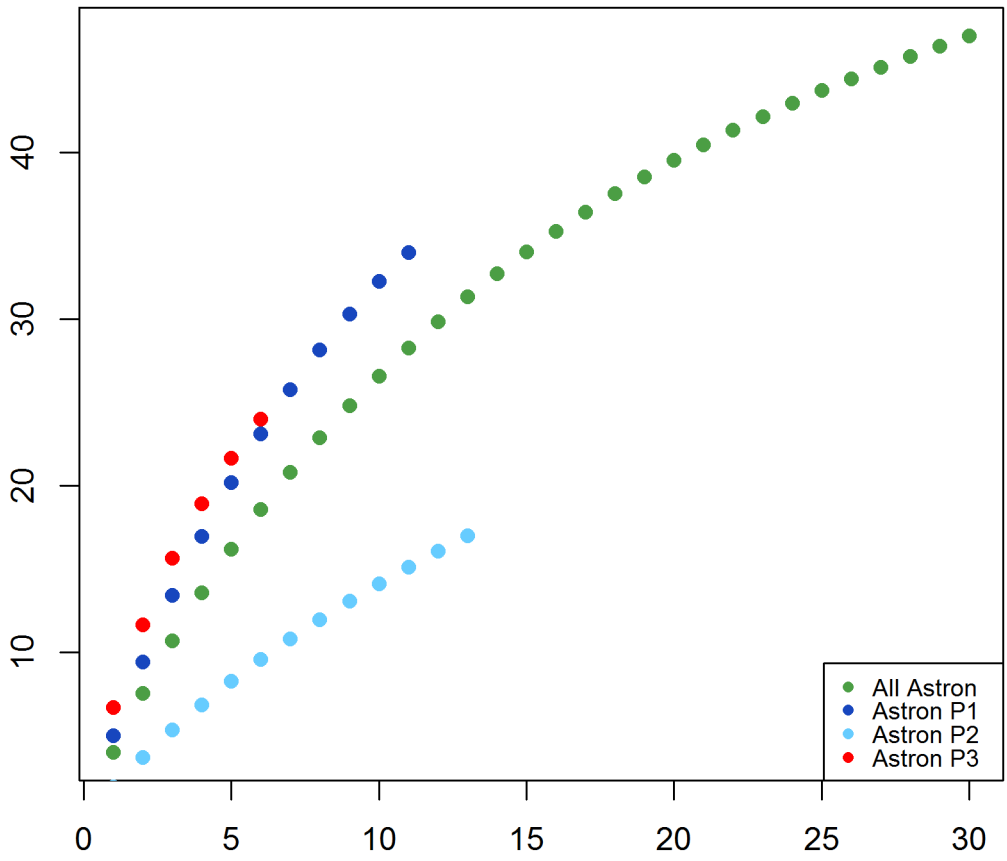


Figure 5: Species accumulation curves for herpetofauna surveys.

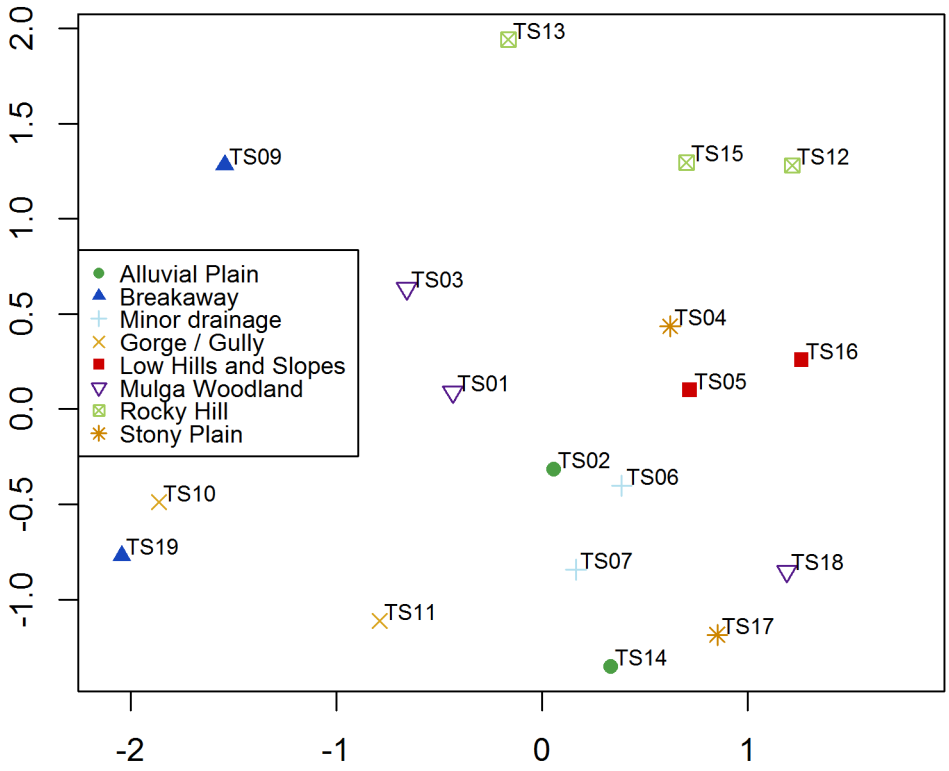


Figure 6: Two-dimensional ordination of herpetofauna species assemblages of each site.

4.2.2.2 Birds

Eighty-four bird species were recorded over the three phases of fauna surveying (Table E.7, Appendix E). The most commonly recorded species was the Weebill (*Smicrornis brevirostris*) with 50 records followed by the Zebra Finch (*Taeniopygia guttata*) with 44 records and the Singing Honeyeater (*Gavicalis virescens*) with 43 records. The most commonly recorded group of birds was the Meliphagidae (honeyeaters), with 120 records, followed by the Acanthizidae (Australasian warblers) with 70 records and Estrildidae (finches) with 63 records. The most speciose families observed were the Accipitridae (eagles, kites and hawks) and Meliphagidae (honeyeaters), which comprised eight and six species, respectively. The most speciose sites were TS6 (Minor Drainage) with 29 species and TS4 (Stony Plain) with 27 species. Of the 84 bird species recorded 19 species (22%) were not recorded at trapping grids, but from targeted and opportunistic searches.

Two bird species of conservation significance was recorded during the survey, Oriental Plover (*Charadrius veredus*) (IA; IA) and the Letter-winged Kite (*Elanus scriptus*) (P4).

The species accumulation curve for total survey effort is tending towards an asymptote (Figure 7), and based on estimates of total species richness, between 71% and 89% of the total species pool was recorded (Table 15). This compares with Ecologia Environment (2014) that recorded between 82% and 98% of the total expected species for birds.

There was a significant difference in species composition between habitat types (ANOSIM R = 0.353, P = 0.003; Figure 8) with the Rocky Hill sites showing the most distinct species composition compared to sites of other habitat types (Figure 8). This is most likely due to the low species richness recorded at the Rocky Hill sites, with only between three and six species recorded. Avifauna of hill tops and hill slopes is typically of low variety as it consists of open vegetation with limited dense vegetation cover from shrubs or trees (Ecologia Environment 2014).

Table 15: Total number of bird taxa systematically sampled in comparison to estimates of the total species pool based on several models.

	Observed	Estimated			
		Chao2	Jackknife 1	Jackknife 2	Bootstrap
Number of species	65	85	82	92	73
Estimated % sampled		76	79	71	89

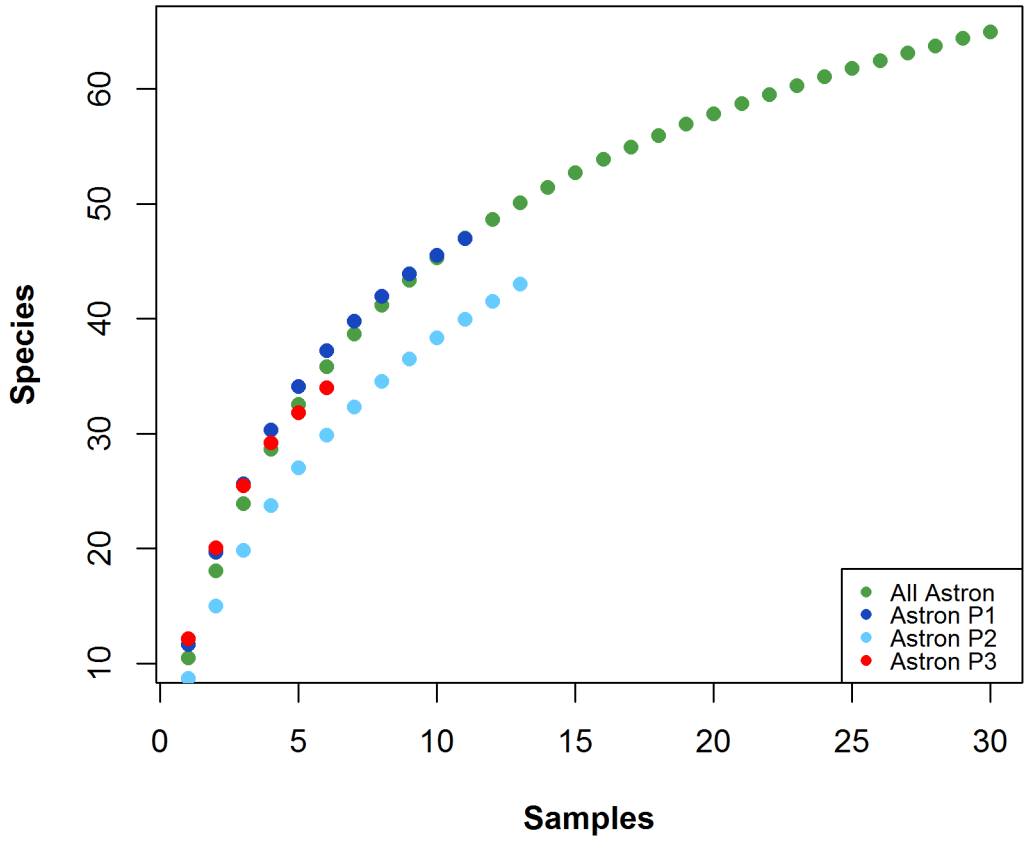


Figure 7: Species accumulation curves for bird surveys.

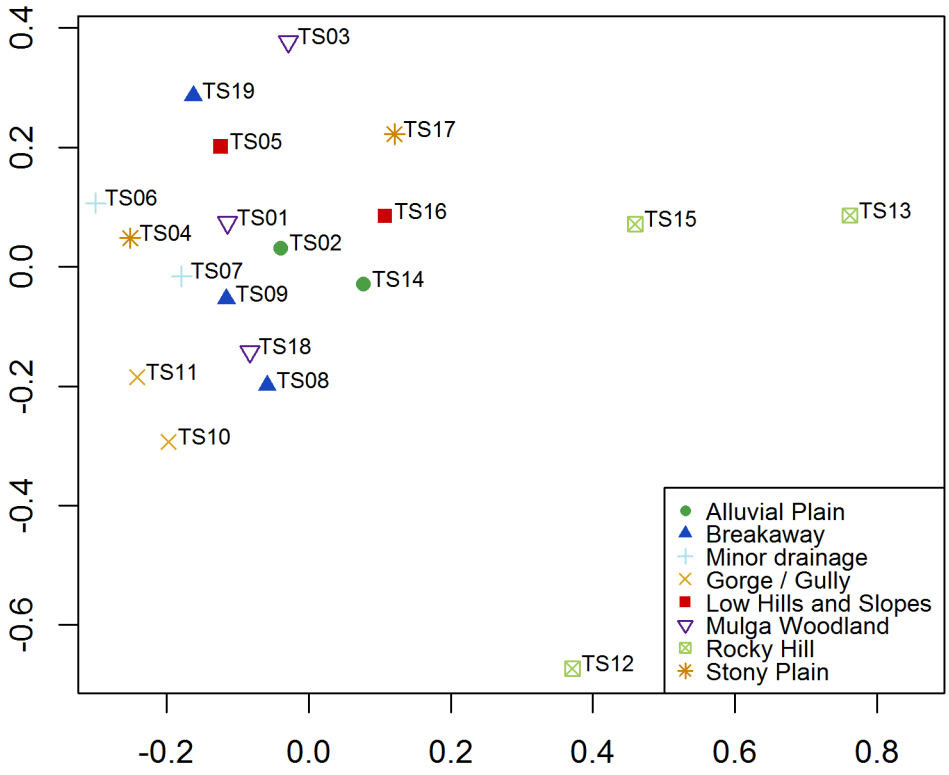


Figure 8: Two-dimensional ordination of bird species assemblages of each site.

4.2.2.3 Mammals

Thirty-three species of mammal were recorded during the three phases of fauna surveying, including seven introduced species: Cat (**Felis catus*), Dog/Dingo (**Canis familiaris*), European Cattle (**Bos taurus*), Camel (**Camelus dromedarius*), Donkey (**Equus asinus*), Rabbit (**Oryctolagus cuniculus*) and House Mouse (**Mus musculus*) (Table E.8, Appendix E). The most commonly recorded species was the Common Rock-rat (*Zyzomys argurus*) with 37 records followed by the Kaluta (*Dasykaluta rosamondae*) with 33 records. The most speciose trapping sites were TS4 (Stony Plain), TS5 (Low Hills and Slopes) and TS6 (Minor Drainage) with five species each. Twelve bat species were recorded from the echolocation recording sites (Table E.9, Appendix E).

Four species of conservation significance were recorded during the survey: Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat and Western Pebble-mound Mouse.

Species accumulation curves were starting to reach an asymptote during the current survey (Figure 9), and based on estimates of total species richness, between 88% and 93% of the total species pool were recorded (Table 16). This compares with Ecologia Environment (2014) that recorded between 81% and 96% of the total expected species for birds. The data do not include bat species, which make up 36% (12 species) of the mammal species recorded. Also seven species were only recorded opportunistically and not using acoustic or trapping methods.

There was no significant difference in species composition between habitat types (ANOSIM R = 0.206, P=0.088, Figure 10), which was considered to be expected as most mammal species are habitat generalists, with the exception of only a few species that are rock-specialists. Rocky sites (i.e. Rocky Hill, Gorges/Gullies and Breakaway habitats) were generally grouped together and showed a slightly different species composition from sites in the other habitat types.

Table 16: Total number of mammal taxa systematically sampled in comparison to estimates of the total species pool based on several models.

	Observed	Estimated			
		Chao2	Jackknife 1	Jackknife 2	Bootstrap
Number of species	14	15	16	15	15
Estimated % sampled		93	88	93	93

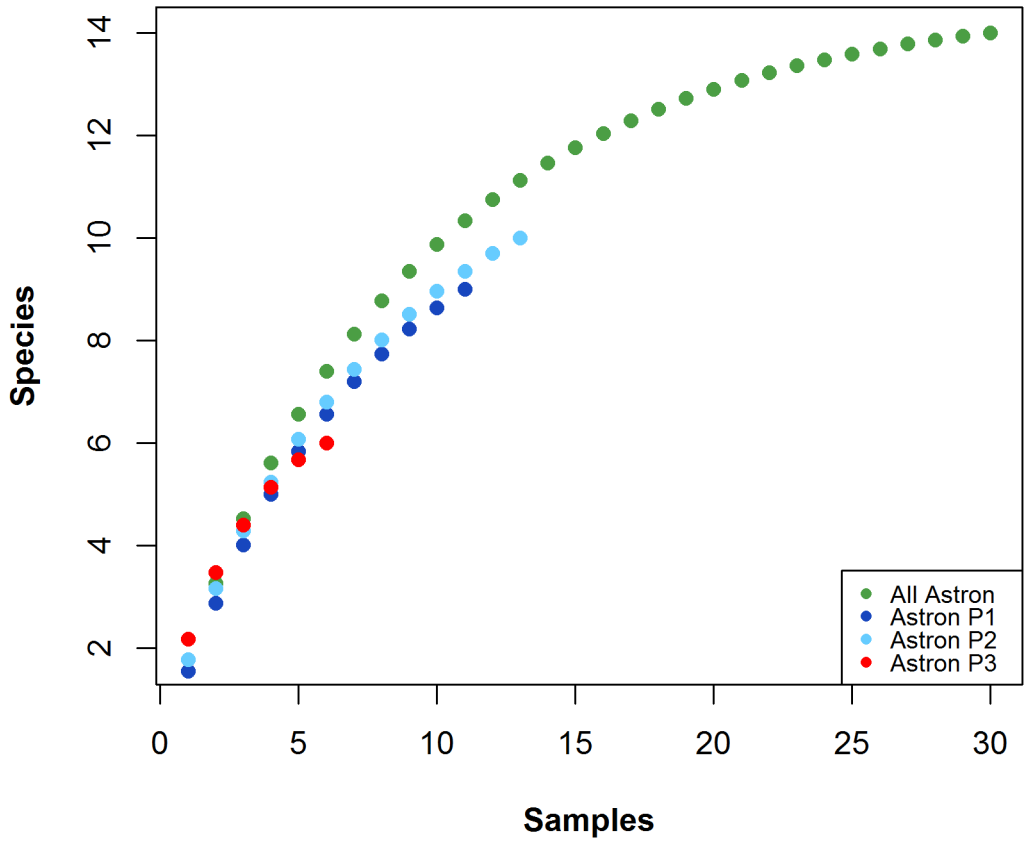


Figure 9: Species accumulation curves for mammal surveys.

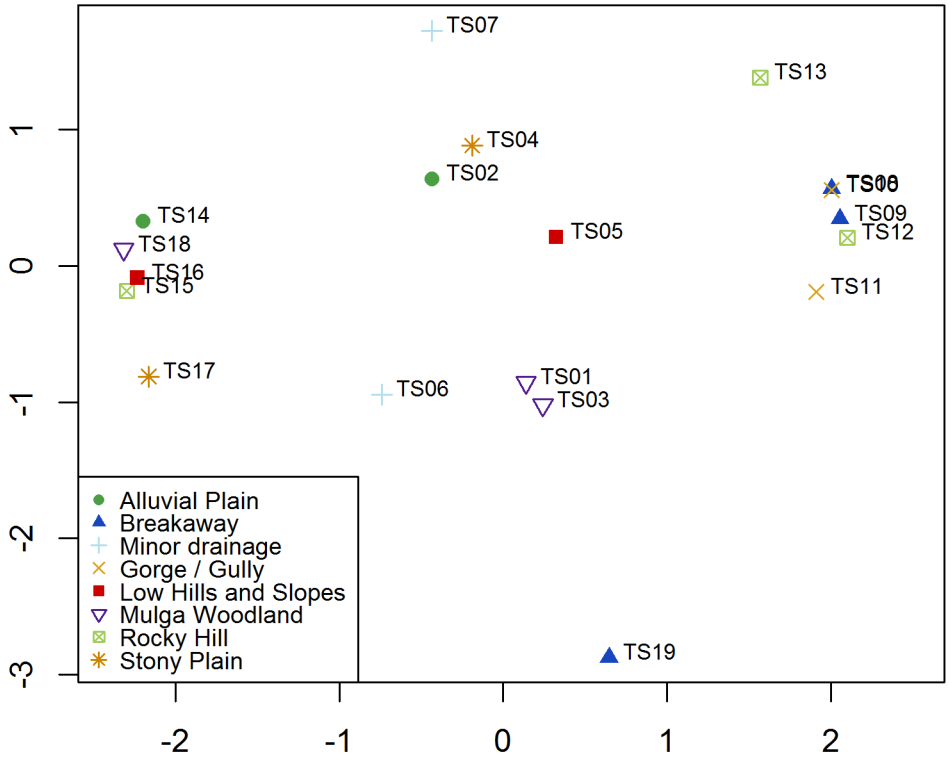


Figure 10: Two-dimensional ordination of mammal species assemblages of each site.

4.2.2.4 *Conservation Listed Species Recorded*

Seven vertebrate species of conservation significance were recorded within the survey area (Figure H.1 and Table H.1, Appendix H).

Northern Quoll (*Dasyurus hallucatus*) (EN; EN)

The Northern Quoll occurs in a variety of habitats (Oakwood 2008) but is commonly found in open lowland savannah forest and rocky escarpments. Rocky areas are a particularly important zone for Northern Quolls in the Pilbara as these areas retain water and provide a diversity of microhabitats. These areas also tend to have greater floristic diversity and productivity resulting in greater prey density compared to non-rocky areas. These rocky areas also provide refuge from feral cats, fire and livestock (Hill and Ward 2010) and provide breeding potential (Department of the Environment 2013).

The Northern Quoll was recorded 14 times during the fauna assessment: one record during Phase 1, 12 records during Phase 2 and one record during Phase 3 (Figure H.1 and Table H.1, Appendix H). The majority of the records were made via motion camera detection (10 records), followed by scat recordings (three records) and a solitary male individual was captured. Most of the records were made at BHT (10 recordings), followed by four records at the Wonmunna (WM) area. No records of the Northern Quoll were made within the HD2 area. The recordings were generally made within the Gorge/Gully or Breakaway fauna habitat types at BHT.

During Phase 2 a capture of an individual Northern Quoll was made at a Gorge/Gully habitat behind the HD1 village camp on the night of 25 May 2018 (potentially early in the evening, released on the morning of 26 May 2018). This individual was male and determined as a sub-adult potentially

looking to expand its individual home range in preparation for the breeding season. The scats recorded in this area are likely to be from the same individual.

The camera recordings were made at two separate locations also on 25 May 2018, suggesting that at least two individuals, possibly three, may be present in the survey area. Camera recordings were also made at two separate locations on the nights of the 22, 23 and 24 May 2018. These two locations are separated by approximately 5 km, suggesting that more than one individual is present in the area.

During Phase 3 a solitary recording of an individual was made at one location on motion camera at BHT. The individual was recorded on 14 March 2019 within a Breakaway habitat type.

The Northern Quoll records within the survey area are significant due to the paucity of previous local and regional records and that the survey area is at the edge of this species' regional distribution. The Northern Quoll has been previously recorded from fauna surveys highlighted in the desktop review, near HD1 mine site (Biota Environmental Sciences 2011). One male Northern Quoll was captured within a drainage line fauna habitat and subsequently recaptured over an additional two nights (Biota Environmental Sciences 2011).

Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) (VU; VU)

Pilbara Leaf-nosed Bats are known to require deep caves characterised by high levels of humidity and stable temperatures (Churchill 2008). This is a result of their limited ability to conserve heat and water (Armstrong 2001; Churchill 1991). Caves deep enough to create this environment are relatively uncommon in the Pilbara, with only 20 to 25 roost sites being known (R. Bullen 2014, pers. comm. 20 Oct 2014). Foraging habitat for the Pilbara Leaf-nosed Bat is diverse and includes riparian vegetation, hummock grassland, and sparse tree and shrub savannah (Duncan, Baker, and Montgomery 1999). Roost sites for the Pilbara Leaf-nosed Bat can be classified (Department of the Environment 2017) based on the following criteria:

- Permanent diurnal roosts—occupied year-round and likely the focus for some part of the nine-month breeding cycle; considered as critical habitat that is essential for daily survival.
- Non-permanent breeding (maternal) roosts—evidence of usage during some part of the nine-month breeding cycle (July to March), but not occupied year-round; considered as critical habitat that is essential for both daily and long-term survival.
- Transitory diurnal roosts—occupied for part of the year only, outside the breeding season (i.e. April to June), and which could facilitate long distance dispersal in the region; considered as critical habitat that is essential for both daily and long-term survival.
- Nocturnal refuge—occupied or entered at night for resting, feeding or other purposes, with perching not a requirement. Excludes overhangs. Not considered critical habitat, but are important for persistence in a local area.

Pilbara Leaf-nosed Bats have also been recorded flying over small watercourses amongst granite boulder terrain, over pools and low shrubs in ironstone gorges, and above low shrubs and around pools in gravelly watercourses with *Melaleuca leucadendron*, such as in Barlee Range Nature Reserve (Armstrong 2001). In the Pilbara, the species has been observed in *Triodia* hummock grasslands covering low rolling hills and shallow gullies, with scattered *Eucalyptus camaldulensis* along the creeks (Armstrong 2001; Churchill 1991).

The Pilbara Leaf-nosed Bat was recorded at three of the23 bat detector locations (BAT13, BAT17 and BAT21) at low activity levels (Appendix I; Bat Call WA (2019)). BAT13 and BAT17 were located within

the BHT area and BAT21 was located within the HD2 area (Figure H.1 and Table H.1, Appendix H). The Pilbara Leaf-nosed Bat records were from foraging individuals in Gorge/Gully and Breakaway fauna habitats, as the calls at all three sites were at least three hours after dusk and are not consistent with the presence of a permanent roost cave nearby (Appendix I; Bat Call WA (2019)). This species was not detected at any of the caves at which bat detectors were placed. This species is likely to forage only occasionally within the survey area taking advantage of benign conditions and dispersing temporarily in search of additional foraging and roosting opportunities (Bat Call WA 2019).

This species was previously recorded by Ecologia Environment (2014) at Greater West Angelas, approximately 15 km south-west of the survey area. Three locations were recorded, all at low levels, with call times not conducive to a roost nearby (Ecologia Environment 2014). A further nine records were recorded within the vicinity of the survey area (Department of Biodiversity, Conservation, and Attractions 2017b).

Ghost Bat (*Macroderma gigas*) (VU; VU)

The preferred habitat of Ghost Bats is considered to be rocky gorges and breakaways that support caves and crevices used as maternity roosts. The Ghost Bat uses different natural formations for various purposes and for groups to persist they generally require habitats that provide:

- a selection of roosting opportunities with night roosts or feeding sites, day roosts and at least one deep cave with characteristics of a maternity roost
- nearby gullies and gorges with vegetation of vertical complexity (diverse vegetation heights and density) and presence of water that would attract prey species
- a productive foraging area within a 5 km to 10 km radius, usually including a good quality riparian drainage line.

Transient roosts and feeding sites are used by small numbers of Ghost Bats, whereas maternity roosts are used by larger colonies (Armstrong and Anstee 2000). Ghost Bats require caves of varying shapes and sizes to fulfil each of its ecological requirements. Cave usage can be classified into three categories: feed caves, day roosts and maternal roosts.

- Feed caves are typically shallow caves or overhangs high in the strata that are poorly insulated from the elements (Armstrong and Anstee 2000). Ghost Bats hunt at night and use feed caves to consume prey they have captured in the surrounding area. Feed caves often contain Ghost Bat scats and/or feeding remnants (typically feathers and small animal bones).
- Day roosts are generally deep, complex caves or disused mines that contain domed ceilings, fissures or passages which create a stable microclimate. These caves are usually lower in the strata making them well insulated. The stable temperature and elevated humidity of these caves relative to the ambient conditions create physiologically benign conditions (McKenzie and Bullen 2009; Armstrong and Anstee 2000; Hall et al. 1997; Leitner and Nelson 1967).
- Maternal roosts like day roosts are generally deep, complex caves or disused mines that contain domed ceilings, fissures or passages which create a stable microclimate and often contain multiple entrances (McKenzie and Hall 2008). Maternal roosts have a stable temperature of 23°C to 28°C and moderate to high relative humidity of 50% to 100% (Armstrong and Anstee 2000; Churchill 1991; Churchill and Helman 1990; Pettigrew et al. 1986).

The Ghost Bat can have a relatively small nightly foraging range (up to 2 km from the roost where it has been studied in Queensland) (Tidemann et al. 1985; Pettigrew et al. 1986), but has the flight capability to range widely (Bullen and McKenzie 2002), perhaps tens of kilometres in a night. This is evident from genetic markers, which suggest that males are particularly likely to disperse long distances throughout the landscape (Worthington Wilmer et al. 1994; 1999).

The Ghost Bat was recorded on nine occasions over the three phases of survey within the survey area through acoustic recordings (calls), scats recorded in nocturnal feed caves and an individual sighted during spotlighting within the HD2 area (Figure H.1 and Table H.1, Appendix H). Four records were made within the HD2 area, four records within the BHT area and one record within the WM area (Figure H.1, Appendix H). One Ghost Bat record (scats recorded in Cave 9) was made outside the survey area boundary (Figure H.1 and Table H.1, Appendix H).

A total of seven caves were recorded within the survey area, two which (Caves 1 and 5) were deemed to be Category 3 roost caves with occasional occupancy. These caves are not considered significant to the long-term presence of the species (Bat Call WA 2019) (Appendix I). The other five previously recorded caves were deemed to be Category 4 nocturnal roost caves (opportunistic usage) and are not considered significant. An additional two caves (Caves 3 and 9), deemed to be Category 4 nocturnal roost caves (opportunistic usage) were recorded outside the survey area (Figure G.1 and Table G.2, Appendix G). It is considered unlikely that additional significant caves exist within the survey area; however, the possibility cannot be discounted as the survey area was not searched in its entirety. If present, they are likely to be found within the Gorge/Gully and Breakaway habitats only.

The individual recorded during Phase 2 nocturnal spotlighting is significant given the sighting was made approximately 1 to 1.5 hours post-civil twilight, so it is likely to have originated from a roost nearby, but possibly outside the survey area. The ridge line where it was recorded is important foraging habitat for this species as another record was made from an echolocation recording device on a separate evening.

An opportunistic recording of a solitary individual found hooked on a fence line was recorded by Biota (2006) in the Hope Downs area, approximately 10 km west of the survey area. Regionally this species has a strong presence in the vicinity of the survey area. In particular, numerous records were made at Southern Flank, approximately 10 km to the north-west of the survey area. Thirty-three caves (12 high value, 21 low value) were recorded at Southern Flank through an extensive search of gorges and gullies (Biologic Environmental Survey 2016). In addition a further 75 records in a 40 km radius around the survey area, mainly to the north and north-east, were detailed through DBCA's Threatened and Priority Fauna Database (Department of Biodiversity, Conservation, and Attractions 2017b).

Oriental Plover (*Charadrius veredus*) (IA, IA)

The Oriental Plover is a non-breeding visitor to Australia, where the species occurs in both coastal and inland areas, mostly in northern Australia. Most records are along the north-western coast, between Exmouth Gulf and Derby in Western Australia (Department of the Environment and Energy 2019). This species occupies sparsely vegetated plains, beaches and tidal flats, and saltworks and sometimes sewage ponds.

One individual was opportunistically sighted during the Phase 3 survey at the HD1 village camp, likely due to the presence of water at the camp. (Figure H.1, Appendix H). This species was not previously recorded from fauna surveys conducted within the vicinity of the survey area (Biota

Environmental Sciences 2006, 2009, 2011, 2014; Ecologia Environment 2014; Ninox Wildlife Consulting 2009a, 2009b).

***Lerista macropisthopus remota* (P2)**

This species favours sandy to sandy loam soils which support *Acacia* shrubland or woodland. It inhabits loose soil under leaf litter at the base of shrubs (Wilson and Swan 2010). Threats to this species are not well known, it is listed as conservation significant due to its very restricted distribution range. This subspecies was described in 1991 and was only known from one locality at the time in the arid central interior of Western Australia, 40 km north-east of Jiggalong (Storr 1991); there are currently no records on NatureMap (Department of Biodiversity, Conservation, and Attractions 2019a). Three records all within 2 km of each other were detailed through DBCA's Threatened and Priority Fauna Database (Department of Biodiversity, Conservation, and Attractions 2017b). The nearest record from the DBCA database is within 4 km of the survey area. From this limited information, it appears that this subspecies is rarely recorded due to a restricted distribution.

One individual was captured during the Phase 3 survey within a Mulga Woodland habitat within the WM area (Figure H.1, Appendix H). This individual was lodged and its identification confirmed at the WAM (#R179612). This species may also be found within the Alluvial Plain and Minor Drainage habitats of the survey area.

Letter-winged Kite (*Elanus scriptus*) (P4)

The Letter-winged Kite is classified as an infrequent non-breeding visitor to Western Australia (Johnstone and Storr 1998). This species inhabits open country and grasslands across arid and semi-arid Australia. When a dry spell follows a number of good seasons, single individuals or small groups of this species appear in north Western Australia, outside of their core range and generally do not stay long in these areas (Menkhorst et al. 2017).

One individual was opportunistically sighted during the Phase 2 survey from Minor Drainage habitat within the HD2 area (Figure H.1, Appendix H). It may also occur within the Stony Plain, Alluvial Plain and Mulga Woodland habitats of the survey area. This species was not previously recorded from fauna surveys conducted within the vicinity of the survey area (Biota Environmental Sciences 2006, 2009, 2011, 2014; Ecologia Environment 2014; Ninox Wildlife Consulting 2009a, 2009b), or identified via desktop review (Department of Biodiversity, Conservation, and Attractions 2017b, 2017a; Department of the Environment and Energy 2017d). The record during the current survey represents a new record for this species within the local area as the nearest record to the survey area is approximately 120 km to the north (Department of Biodiversity, Conservation, and Attractions 2017a). This reflects their habits of translocating across a landscape in response to increased foraging resources (Menkhorst et al. 2017).

Western Pebble-mound Mouse (*Pseudomys chapmani*) (P4)

Extant Western Pebble-mound Mouse populations are widespread in the extensive ranges of the central and southern Pilbara region (Start 2008). The persistence of abandoned mounds in the Gascoyne and Murchison regions and small, isolated, coastal ranges in the Pilbara indicates considerable recent decline (Start 2008). Colonies occur on the gentler slopes of rocky ranges where the ground is covered by stony mulch and vegetated by hard spinifex, often with a sparse overstorey of eucalypts and scattered shrubs, typically *Senna, Acacia* and *Ptilotus* (Start 2008). Mounds are also sited close to narrow ribbons of *Acacia* dominated scrub along incised drainage lines (Start 2008).

The Western Pebble-mound Mouse was recorded nine times during the Astron surveys, comprising of six pebble mounds (three active) and three individual captures. Five pebble mounds were recorded within the Stony Plain, Rocky Hill and Mulga Woodland habitats of the survey area (Figure H.1 and Table H.1, Appendix H). This species is also likely to be found within the Low Hills and Slopes habitat and possibly stony areas within the Alluvial Plain habitat of the survey area. The three individuals and one recently inactive mound (PMM 3) were recorded outside the survey area (Figure H.1 and Table H.1, Appendix H).

Numerous records of this species exist from the vicinity of the survey area, given the commonality of their preferred habitat (stony plains, hills and rises) across the bioregion. The DBCA Threatened and Priority Fauna Database search identified 237 records (Department of Biodiversity, Conservation, and Attractions 2017b). This species was previously recorded from all systematic fauna assessments conducted within the vicinity of the survey area (Biota Environmental Sciences 2006; Ecologia Environment 2014; Ninox Wildlife Consulting 2009a, 2009b).

4.2.2.5 Conservation Listed Species Potentially Occurring in the Survey Area

Three species that were not recorded during the current survey were considered highly likely to occur, given that suitable habitat occurs and a number of records are known from within the vicinity of the survey area.

Pilbara Olive Python (*Liasis olivaceus barroni*) (VU; VU)

The Pilbara Olive Python prefers escarpments, deep gorges, water holes and rock piles associated with permanent pools in rocky areas in the ranges of the Pilbara region (Pearson 1993; Wilson and Swan 2010). Microhabitat preferences of the Pilbara Olive Python are under rock piles, on top of rocks or under spinifex (Tutt et al. 2004). Individuals spend the cooler winter months within caves and rock crevices away from water sources. In the warmer summer months, the pythons are found to move around widely, usually in close proximity to water and rock outcrops (Wilson and Swan 2010).

This species is likely to be found within the Gorge/Gully, Breakaway and Minor Drainage habitats, particularly at sites that have the potential to support semi-permanent water. There are 14 previous records of this species in the vicinity of the survey area (Department of Biodiversity, Conservation, and Attractions 2017b), 10 of which are associated with river systems including Weeli Wolli Creek, Marillana Creek and Tunnel Creek.

***Anilios ganei* (P1)**

The blind snake, *Anilios ganei*, is often poorly collected in vertebrate fauna surveys, but is known from the Hope Downs area. This species has been associated with moist gorges and gullies (Wilson and Swan 2010), but potentially occurs over a wide range of other stony habitats. Given its cryptic

fossorial habit this species is rarely encountered. Little is known of this species' ecology but like most other blind snakes, it is insectivorous, feeding on termites and their eggs, and larvae and pupae of ants (Wilson and Swan 2010).

This species was not previously recorded from fauna surveys conducted within the vicinity of the survey area for Rio Tinto (Biota Environmental Sciences 2006, 2009, 2011, 2014; Ecologia Environment 2014; Ninox Wildlife Consulting 2009a, 2009b), however it has been recorded (four records) within the vicinity of the survey area (Department of Biodiversity, Conservation, and Attractions 2017b). This species is likely to be present within suitable habitats, including the Gorge/Gully, Breakaway and Rocky Hill habitat types of the survey area.

Pilbara Barking Gecko (*Underwoodisaurus seorsus*) (P2)

The Pilbara Barking Gecko is a rock-inhabiting, restricted-range species encountered at mid elevations in the Hamersley Ranges, widely separated from the closest populations of the related Barking Gecko *Underwoodisaurus milii* in the northern Goldfields and Shark Bay in Western Australia (Doughty and Oliver 2011).

This species was recorded at Greater West Angelas (Ecologia Environment 2014) and an additional eight records are detailed within DBCA's Threatened and Priority Fauna Database (Department of Biodiversity, Conservation, and Attractions 2017b) within a 30 km range, with the nearest record to the survey area less than 500 m. This species is likely to be found in elevated fauna habitat such as the Rocky Hill recorded within the BHT area of the survey area.

Four species were not found in the survey area but were all considered to have a moderate likelihood of occurrence: Fork-tailed Swift (*Apus pacificus*) (IA; IA), Grey Falcon (*Falco hypoleucos*) (VU), Peregrine Falcon (*Falco peregrinus*) (OS), and Short-tailed Mouse (*Leggadina lakedownensis*) (P4) (Table F.1, Appendix F). Although suitable habitat is present within the survey area, these species are seasonal migrants that are only present at certain times of the year, species that are not readily trapped during fauna surveys, and/or species with large home ranges.

An additional 12 species not found in the survey area were considered to have a low likelihood of occurrence due to lack of suitable habitats, including the Night Parrot (Table F.1, Appendix F). No calls attributed to the Night Parrot were recorded during two passive acoustic surveys or analysis of the data recorded from the ARUs (Appendix I; Bat Call WA (2019)). The Stony Plain habitat generally did not support old, large and unburnt *Triodia* clumps that are considered the primary habitat requirement for this species, particularly the plains at BHT and HD2, due to the effects of recent fires (less than 10 years old), pastoral and mining impacts over a long duration, very sparse ground cover vegetation and lack of chenopod communities or suitable size/age hummocks. As such, the Night Parrot was classified as having a low likelihood of occurrence in the survey area.

4.2.3 Invertebrate Fauna Habitats

Eight potential SRE habitat types were identified differing in their prospectivity for SRE fauna (Figure G.1, Appendix G). Whilst all of the habitats have the potential to support SREs, five habitats were considered more conducive to relictual SREs: Breakaway, Minor Drainage, Gorge/Gully, Rocky Hill and Mulga Woodland habitats (Table 17). The rocky habitats are associated with an isolated ridge running in an east-west direction, so most of the breakaways and rocky slopes are south-facing and therefore conducive to SREs (Harvey 2002). The Breakaway and Gorge/Gully habitats provide moist, shaded microhabitats that potentially support relictual endemism. These habitats supported Philosciidae sp, *Troglarmadillo* sp. and *Pseudodiploexochus* sp. which, while being ambiguously defined, represent likely SREs. The latter two taxa represent forms that are very rarely sampled from

epigean habitats in the Pilbara and are not arid adapted. The presence of arid sensitive taxa in these habitats indicates that SRE habitats are present. Additional SRE species are likely to occur in these habitats.

The Minor Drainage and Rocky Hill habitats provide a moderate level of habitat suitability for SRE species but lack the moist microhabitats preferred by SRE groups. The pseudoscorpion *Anatemnus* sp. is enigmatic in that it has all of the features of a troglobite (blind and pale) and the only other Pilbara record of this genus is troglobitic. One specimen was sampled from riparian leaf litter of a dry creek line (SRE10). There is a small chance that this species is troglobitic and in rare cases, troglobites have been observed at the entrance of caves during very humid conditions. In the Pilbara, troglobitic *Nocticola* have been sampled from creek gravels (Volschenk personal observations) indicating that Minor Drainage is potential habitat for troglobitic taxa. The Mulga Woodland contained deep leaf litter supporting SRE species and specifically the Mulga Woodland in HD2 was species rich where eight of the nine centipede taxa and four of the five millipede taxa were recorded.

Table 17: SRE fauna habitats present within the survey area, with prospective habitats shaded in grey.

Habitat type	Extent in survey area (ha)	Proportion in survey area (%)
Alluvial Plain	161.8	1.5
Breakaway	241.6	2.2
Minor Drainage	869.7	8.1
Gorge/Gully	65.5	0.6
Low Hills and Slopes	5,460.0	50.5
Mulga Woodland	1,031.4	9.5
Rocky Hill	987.9	9.1
Stony Plain	1,167.6	10.8
Cleared	832.3	7.7
Total	**10,817.7**	**100.0**

Minor Drainage habitats were generally comprised a reduced diversity and density in vegetation species and communities, particularly when in the creek bed, and when present it was usually less dense and complex when compared to major riparian habitats, such as Weeli Wolli Creek located to the east of the survey area. There were limited locations in this habitat that supported the potential for semi-permanent water bodies to form; however, there were some areas of deep, moist leaf litter. This habitat was sampled as sites SRE3, SRE8, SRE14, TS6 and TS7. The potential SRE scorpion *Lychas* 'multipunctatus complex' and potential SRE pseudoscorpions *Anatemnus* sp., *Tyrannochthonius* 'sp. indet. (AESHD2)' and *Beierolpium* 'sp. indet. (AESHD1)' were collected from this habitat.

Gorge/Gully habitat was associated with the Rocky Hill or Breakaway habitats, where deeply carved rock incisions and drainage lines provide shade and diverse microhabitats. Minor creek lines and water run-off lead to higher moisture availability compared to the surrounding areas. This was a relatively uncommon habitat type in the survey area but due to its prospectivity for SRE species it was well sampled; sites included SRE1, SRE2, SRE4, SRE10, SRE13, SRE17, SRE18, SRE19 and SRE20. As a result a substantial number of potential and confirmed SRE species were collected from this habitat type: spiders *Karaops banyjima*, *Karaops* sp. 'ARA001', *Aurecocrypta* 'sp. indet. (AESHD1)' and *Synothele* sp.; pseudoscorpions *Austrohorus* 'sp. indet. (AESHD5)', *Euryolpium* sp., *Indolpium* sp., Olpiidae sp. 'Genus 7/4 PSE118' and *Tyrannochthonius* 'sp. indet. (AESHD2)'; scorpion *Urodacus* 'HD1'; earth centipedes *Sepedonophilus* sp., *Sepedonophilus*'HD1' and *Mecistocephalus* 'HD1';

round-backed millipedes *Austrostrophus* 'Clade A' and *Austrostrophus* sp.; and isopods *Buddelundia* '77', *Troglarmadillo* sp., *Pseudodiploexochus* sp. and Philosciidae sp.

Breakaway habitat was often associated with the drop off areas of the Rocky Hill habitat, specifically within the BHT area. It contained exposed south-facing rock faces with accumulations of rock boulders and scree, conducive to SREs. It provides shelter for SRE fauna and diverse microhabitats for both habitat specialists and moisture-dependent SRE fauna. This habitat type was sampled at sites SRE5 and SRE9. This habitat is small in size, as well as being vertical and linear in the landscape, hence only two sites were sampled. Breakaway habitat was closely associated with Gorge/Gully habitat, so although only two sites were sampled, some of the Gorge/Gully sites sampled also had breakaway features. One potential SRE species was recorded from this habitat: the pseudoscorpion *Euryolpium* 'sp. indet. (AESHD7)'.

Rocky Hill habitat denoted the high-elevation rock features, mostly associated with the BHT deposit running in an east-west direction, meaning most rocky slopes were south-facing and therefore, conducive to SREs. This habitat type was sampled at site SRE21 and dry pitfall trapping (funnel traps only) sites TS12, TS13 and TS15. Based on its rocky microhabitats it is expected to provide habitat for specialist species that live under rocks and gravel, similar to those found in the Breakaway habitats. The potential and confirmed SRE species that were collected from this habitat include the spiders *Karaops banyjima* and *Aname* sp.; pseudoscorpion 'Genus 7/4 PSE118'; and earth centipede *Mecistocephalus* 'HD1'.

Low Hills and Slopes habitat generally had low vegetation complexity and low diversity of microhabitats available for SRE species. No targeted SRE sampling was undertaken in the Low Hills and Slopes habitat as it was not considered prospective SRE habitat; however, vertebrate trap sites TS5 and TS16 were located within this habitat type. Two potential SRE species was recorded from this habitat: the scorpion *Lychas* 'bituberculatus complex' and the isopod *Buddelundia* '10ma'.

Alluvial Plain habitat exhibited a good diversity of microhabitats, with some tree hollows and logs, and some areas of sandy soils suitable for burrowing, dense leaf litter and large *Triodia* hummocks. No targeted SRE sampling was undertaken in the Alluvial Plain habitat as it was not considered prospective SRE habitat; however, vertebrate trap sites TS2 and TS14 were located within this habitat type. In addition some targeted 'blacklighting' for scorpions occurred during the nocturnal surveying events for the fauna assessment, collecting *Urodacus* 'HD1'. A large number of potential SRE species was recorded from this habitat including: the trapdoor spider *Yilgarnia* 'MYG197'*;* pseudoscorpion *Beierolpium* 'sp. indet. (AESHD2)'; scorpions *Lychas* 'bituberculatus complex' and *Lychas* 'multipunctatus complex'; the millipede *Austrostrophus* 'Clade E'; and isopods Buddelundiinae sp. and Philosciidae sp.

Mulga Woodland habitat was characterised by vegetation communities dominated by Mulga with a stony mantle; however, the SRE sites sampled comprised softer soil, suitable for burrowing species. The deep leaf litter were considered important for SRE species within this habitat and often mygalomorph spider burrows are found here. This habitat type was sampled at sites SRE6, SRE7, SRE12, SRE15, SRE16, SRE23, and trap sites at TS1, TS3 and TS18. The Mulga Woodland in HD2 supported numerous centipede taxa: *Mecistocephalus* 'HD1', *Mecistocephalus* 'HD2', *Mecistocephalus* 'HD3', *Sepedonophilus* 'HD1', *Sepedonophilus* 'HD2', Geophilomorpha sp., *Orphnaeus* 'HD1' and *Cryptops* 'HD1'; and the millipede taxa *Antichiropus* sp., *Antichiropus* 'wonmunna', *Austrostrophus* sp. and *Austrostrophus* 'Clade E'. Other SRE species include isopods *Buddelundia* '77', *Buddelundia* sp. and Buddelundiinae sp.; pseudoscorpions '*PSEAAA* sp. indet. (AESHD4)' and *Sundochernes* sp.; and mygalomorphs: *Synothele* sp., *Synothele* 'MYG309' and *Synothele* 'MYG311'.

Stony Plain habitat was generally exposed and had low microhabitat diversity compared to other landforms. The Stony Plain habitat was sampled at sites SRE11 and SRE22 and trap sites TS4 and TS17. Ten potential SRE species were recorded from this habitat: the isopods *Buddelundia* '10ma' and *Buddelundia* '77'; the millipede *Austrostrophus* 'Clade E'; scorpions *Lychas* 'bituberculatus complex' *Lychas* 'hairy tail complex' and *Lychas* 'multipunctatus complex'; pseudoscorpion *Euryolpium* 'sp. indet. (AESHD6)' and mygalomorph spiders: Nemesiidae sp., *Synothele* sp. and *Aurecocrypta* 'MYG315'.

4.2.4 Invertebrate Fauna Species

The field surveys generated a total of 202 samples (comprising 358 individual specimens) from SRE target taxa. Morphological and DNA-barcoding identified 67 different taxa. One species was an SRE (*Karaops banyjima*), 48 were either likely or potential SREs and 18 were known to be widespread (Table 18 and Table E.10, Appendix E). The locations of these species records from the current survey are shown in Figure H.2 and Table H.2 (Appendix H). WAM lodgement details for representative vouchers to date are provided in Appendix J.

Table 18: Summary of the potential SRE species recorded within the survey area.

Order	Family	Species	Taxonomic resolution	SRE status
Araneae	Selenopidae	*Karaops banyjima*	Species confirmed using morphology (DNA sequencing suggested different species)	SRE
	Selenopidae	*Karaops* sp. 'ARA001' DNA	Species confirmed (restricted/unknown distribution)	Potential SRE: DD
	Actinopodidae	*Missulena rutraspina*	Species confirmed (widespread distribution)	Widespread
	Barychelidae	*Aurecocrypta* 'MYG315' DNA	Species confirmed (restricted/unknown distribution)	Potential SRE: DD
	Barychelidae	*Aurecocrypta* 'sp. indet. (AESHD1)' DNA	No DNA matches available	Potential SRE: DD
	Barychelidae	*Synothele* 'MYG309' DNA	Species confirmed (restricted/unknown distribution)	Potential SRE: DD
	Barychelidae	*Synothele* 'MYG311' DNA	Species confirmed (restricted/unknown distribution)	Potential SRE: DD
	Barychelidae	*Synothele* sp.	Not sequenced	Potential SRE: DD
	Barychelidae	*Synothele* 'xkarara'	Species confirmed (widespread distribution)	Widespread
	Idiopidae	*Gaius tealei*	Species confirmed (widespread distribution)	Widespread
	Nemesiidae	*Aname mellosa*	Species confirmed (widespread distribution)	Widespread
	Nemesiidae	*Aname* 'MYG004'	Species confirmed (widespread distribution)	Widespread
	Nemesiidae	*Aname* sp.	Species unknown (not sequenced)	Potential SRE: DD
	Nemesiidae	*Yilgarnia* 'MYG197'	Species confirmed (restricted/unknown distribution)	Potential SRE: DD
	Nemesiidae	Nemesiidae sp.	DNA sequencing failed	Potential SRE: DD
Pseudoscorpiones	Atemnidae	*Anatemnus* sp.	Species unknown (not sequenced)	Potential SRE: DD
	Atemnidae	*Oratemnus* sp.	Species unknown (not sequenced)	Widespread
	Chernetidae	*Sundochernes* sp.	Species unknown (not sequenced)	Potential SRE: DD
	Chthoniidae	*Tyrannochthonius* 'sp. indet. (AESHD1)' DNA	No DNA matches available	Potential SRE: DD
	Chthoniidae	*Tyrannochthonius* 'sp. indet. (AESHD2)' DNA	No DNA matches available	Potential SRE: DD
	Olpiidae	*Austrohorus* 'sp. indet. (AESHD5)' DNA	No DNA matches available	Potential SRE: DD
	Olpiidae	*Beierolpium* '8/4 small'	Species confirmed (widespread distribution)	Widespread

Order	Family	Species	Taxonomic resolution	SRE status
Pseudoscorpiones	Olpiidae	*Beierolpium* 'sp. indet. (AESHD1)' DNA	No DNA matches available	Potential SRE: DD
	Olpiidae	*Beierolpium* 'sp. indet. (AESHD2)' DNA	No DNA matches available	Potential SRE: DD
	Olpiidae	*Beierolpium* '8/4'DNA	Species confirmed (widespread distribution)	Widespread
	Olpiidae	*Euryolpium* 'sp. indet. (AESHD6)' DNA	No DNA matches available	Potential SRE: DD
	Olpiidae	*Euryolpium* 'sp. indet. (AESHD7)' DNA	No DNA matches available	Potential SRE: DD
	Olpiidae	*Euryolpium* sp.	Species unknown (not sequenced)	Potential SRE: DD
	Olpiidae	'Genus 7/4 PSE118' DNA	Species confirmed (restricted/unknown distribution)	Potential SRE: DD
	Olpiidae	'*PSEAAA* sp. indet. (AESHD4)' DNA	No DNA matches available	Potential SRE: DD
	Olpiidae	*Indolpium* sp.	Species unknown (not sequenced)	Potential SRE: DD
	Olpiidae	Olpiidae sp.	DNA sequencing failed	Potential SRE: DD
Scorpiones	Buthidae	*Isometroides* 'pilbara 1'	Species confirmed (widespread distribution)	Widespread
	Buthidae	*Lychas* 'bituberculatus complex'	Unresolved taxonomic clade (restricted/unknown distribution)	Potential SRE: DD
	Buthidae	*Lychas* 'hairy tail complex'	Unresolved taxonomic clade (restricted/unknown distribution)	Potential SRE: DD
	Buthidae	*Lychas* 'harveyi complex'	Unresolved taxonomic clade (widespread distribution)	Widespread
	Buthidae	*Lychas* 'multipunctatus complex'	Unresolved taxonomic clade (restricted/unknown distribution)	Potential SRE: DD
	Buthidae	*Lychas* 'pilbara 1'	Species confirmed (widespread distribution)	Widespread
	Urodacidae	*Urodacus* 'pilbara 12'	Species confirmed (widespread distribution)	Widespread
	Urodacidae	*Urodacus* 'HD1' DNA	No DNA matches available	Potential SRE: DD
Geophilomorpha	Chilenophilidae	*Sepedonophilus* 'HD1' DNA	No DNA matches available	Potential SRE: DD
	Chilenophilidae	*Sepedonophilus* 'HD2' DNA	No DNA matches available	Potential SRE: DD
	Chilenophilidae	*Sepedonophilus* sp.	DNA sequencing failed	Potential SRE: DD

Order	Family	Species	Taxonomic resolution	SRE status
Geophilomorpha	Geophilomorpha^	Geophilomorpha sp.	DNA sequencing failed	Potential SRE: DD
	Mecistocephalidae	*Mecistocephalus* 'HD1' DNA	No DNA matches available	Potential SRE: DD
	Mecistocephalidae	*Mecistocephalus* 'HD2' DNA	No DNA matches available	Potential SRE: DD
	Mecistocephalidae	*Mecistocephalus* 'HD3' DNA	No DNA matches available	Potential SRE: DD
	Oryidae	*Orphnaeus* 'HD1' DNA	No DNA matches available	Potential SRE: DD
Scolopendromorpha	Cryptopidae	*Cryptops* 'HD1' DNA	No DNA matches available	Potential SRE: DD
Polydesmida	Paradoxosomatidae	*Antichiropus* sp.	Species unknown (not sequenced)	Potential SRE: DD
	Paradoxosomatidae	*Antichiropus* 'wonmunna' DNA	Species confirmed (restricted/unknown distribution)	Potential SRE: DD
Spirobolida	Trigoniulidae	*Austrostrophus* 'Clade A' DNA	Species confirmed (restricted/unknown distribution)	Potential SRE: DD
	Trigoniulidae	*Austrostrophus* 'Clade E' DNA	Species confirmed (restricted/unknown distribution)	Potential SRE: DD
	Trigoniulidae	*Austrostrophus* sp.	Species unknown (not sequenced)	Potential SRE: DD
Eupulmonata	Pupillidae	*Gastrocopta* sp.	Species unknown	Widespread
	Pupillidae	*Pupoides* sp.	Species unknown	Widespread
	Subulinidae	*Eremopeas interioris*	Species confirmed (widespread distribution)	Widespread
	Subulinidae	Subulinidae sp.	Species unknown	Widespread
Isopoda	Armadillidae	*Buddelundia* '10ma'	Species confirmed (restricted/unknown distribution)	Potential SRE: DD
	Armadillidae	*Buddelundia* '15'	Species confirmed (widespread distribution)	Widespread
	Armadillidae	*Buddelundia* '16'	Species confirmed (widespread distribution)	Widespread
	Armadillidae	*Buddelundia* '77'	Species confirmed (restricted/unknown distribution)	Potential SRE: DD
	Armadillidae	*Buddelundia* sp.	Species unknown (not sequenced)	Potential SRE: DD
	Armadillidae	Buddelundiinae sp.	Species unknown (not sequenced)	Potential SRE: DD
	Armadillidae	*Pseudodiploexochus* sp.	Species unknown (not sequenced)	Potential SRE: DD
	Armadillidae	*Troglarmadillo* sp.	Species unknown (not sequenced)	Likely SRE
	Philosciidae	Philosciidae sp.	Species unknown (not sequenced)	Potential SRE: DD

DNA putative species recognised with DNA barcoding

Of these SRE category taxa, 32 were identified to the level of species or morphospecies:

- seven spiders: *Karaops banyjima*, *Karaops* sp. 'ARA001', *Aurecocrypta* 'MYG315', *Aurecocrypta* 'sp. indet. (AESHD1)', *Synothele* 'MYG309', *Synothele* 'MYG311' and *Yilgarnia* 'MYG197'
- nine pseudoscorpions: *Tyrannochthonius* 'sp. indet. (AESHD1)', *Tyrannochthonius* 'sp. indet. (AESHD2)', *Austrohorus* 'sp. indet. (AESHD5)', *Beierolpium* 'sp. indet. (AESHD1)', *Beierolpium* 'sp. indet. (AESHD2)', *Euryolpium* 'sp. indet. (AESHD6)', *Euryolpium* 'sp. indet. (AESHD7)', 'Genus 7/4 PSE118' and '*PSEAAA* sp. indet. (AESHD4)'.
- four scorpions; *Lychas* 'bituberculatus complex', *Lychas* 'hairy tail complex', *Lychas* 'multipunctatus complex' and *Urodacus* 'HD1'
- seven centipedes: *Sepedonophilus* 'HD1', *Sepedonophilus* 'HD2', *Mecistocephalus* 'HD1', *Mecistocephalus* 'HD2', *Mecistocephalus* 'HD3', *Cryptops* 'HD1' and *Orphnaeus* 'HD1'
- three millipedes: *Antichiropus* 'wonmunna', *Austrostrophus* 'Clade A' and *Austrostrophus* 'Clade E'
- two isopods: *Buddelundia* '10ma' and *Buddelundia* '77'.

Seventeen SRE taxa sampled represented ambiguously identified groups:

- three spiders: *Synothele* sp., *Aname* sp. and Nemesiidae sp.
- five pseudoscorpions: *Anatemnus* sp., *Sundochernes* sp., *Euryolpium* sp., *Indolpium* sp. and Olpiidae sp.
- two centipedes: *Sepedonophilus* sp. and Geophilomorpha sp.
- two millipedes: *Antichiropus* sp. and *Austrostrophus* sp.
- five isopods: *Buddelundia* sp., Buddelundiinae sp., *Pseudodiploexochus* sp., *Troglarmadillo* sp. and Philosciidae sp.

5 Discussion

5.1 Vertebrate Fauna

5.1.1 Habitats

Habitats within the survey area were not restricted at the local or sub-regional scale and no uncommon geological units or land systems occurred within the survey area. In a regional context, the Gorge and Breakaway habitats in the Pilbara are restricted to the Chichester and Hamersley Ranges, but they are well represented in these areas. The Gorge/Gully habitat, and Breakaway habitat to a lesser extent, were considered important habitat for fauna, including several MNES species. Deeply incised gorges, characteristic of the Hamersley subregion, generally have high levels of species endemism and diversity, and are considered important refuge sites in a local context (Kendrick 2001). This is due to the microhabitats they provide such as caves and semi-permanent water pools that can exist in these refuge type areas and are important for species foraging and sheltering requirements. Gorge/Gully and Breakaway habitats were considered suitable for MNES species including the Northern Quoll, Ghost Bat and Pilbara Leaf-nosed Bat that have all been recorded within the survey area and the Pilbara Olive Python that is considered highly likely to occur.

The Rocky Hill habitat is widespread and common throughout the Pilbara bioregion and is not restricted to the Chichester and Hamersley Ranges. This habitat generally had low vegetation complexity and low diversity of microhabitats as evidenced by a depauperate bird assemblage; however, MNES species such as the Northern Quoll and Pilbara Leaf-nosed Bat are likely to traverse and forage within these habitats.

The Minor Drainage habitats within the survey area were generally comprised of a reduced diversity and density in vegetation species and communities, particularly when compared to riparian habitats, such as Weeli Wolli Creek and are unlikely to provide significant refuge for species, although they may act as foraging or dispersal habitat for some fauna species. Minor drainage line habitats, although not necessarily large in terms of area, are also common and well-represented habitats within the immediate vicinity of the survey area and the wider Pilbara region.

The Low Hills and Slopes, Alluvial Plain, Mulga Woodland and Stony Plain habitat in the survey area provide fewer microhabitat opportunities for terrestrial fauna and are also more widespread in the immediate vicinity as well as the Hamersley subregion and wider bioregion.

5.1.2 Species

5.1.2.1 General Assemblage

The fauna species assemblage recorded during the survey is considered typical of the Hamersley subregion as well as a subset of typical fauna assemblages across the Pilbara bioregion. There were 174 vertebrate fauna species, comprising two amphibians, 55 reptiles, 84 birds and 33 mammals (including seven introduced species) recorded within the survey area. This equates to 56% of the vertebrate fauna species previously recorded for the local vicinity identified from the desktop assessment (312 vertebrate fauna species). However, not all species detailed through the desktop assessment are expected to be recorded during the survey given some species have specific habitat requirements, are seasonal migrants, are cryptic in behaviour and may not be readily trapped. Additionally, at the time of survey the survey area did not contain any permanent or semi-permanent water bodies that would support a number of wetland bird species and other species closely associated with water.

Species accumulation curves did not reach an asymptote for reptiles but were approaching, if not achieved, asymptote for birds and mammals. When taking into account previous records as well as species recorded from methods other than trapping, a large portion of the predicted assemblage was recorded. The lower number of captures and reduced herpetofauna assemblage recorded during the current survey is likely due to the dry seasonal conditions and moderated trap methods used. However, this is considered a very minor limitation that does not negatively impact on the outcome of the survey, as the herpetofauna assemblage expected to occur in the survey area is common and widespread and is unlikely to include any conservation significant fauna that have not been previously recorded from other fauna assessments conducted in the vicinity.

5.1.2.2 *Contextual Analysis*

The total recorded species from the current survey (174 species) is comparable or exceeds other systematic trapping surveys, where 97, 169, 74 and 124 vertebrate fauna species were recorded, respectively (Biota Environmental Sciences 2006; Ecologia Environment 2014; Ninox Wildlife Consulting 2009a, 2009b). However, the species composition is likely to be different due to the additional habitats surveyed, such as cracking clay and major drainage habitats (Ecologia Environment 2014) and a permanent pool on Weeli Wolli Creek (Ninox Wildlife Consulting 2009b), as well as the large area (17,565 ha) covered in the Greater West Angelas fauna assessment (Ecologia Environment 2014).

Although the species accumulation curve indicated that not all herpetofauna were recorded during the current survey (likely due to a combination of seasonal conditions and lack of pitfall traps used at some of the trap sites), the herpetofauna assemblage recorded was similar to other areas within the vicinity. The number of reptile and amphibian species recorded (55 species) is higher than most other Level 2 surveys conducted in the vicinity of the survey area, with the exception of 64 species recorded at Greater West Angelas (Ecologia Environment 2014). This is probably due to the larger size of the Greater West Angelas survey area, greater trapping effort and presence of additional fauna habitats (Ecologia Environment 2014).

The number of bird species recorded during the survey (84 species) is higher than other dual season surveys conducted in the area (37 to 80 species), which is unexpected given the lack of riparian habitats within the survey area compared to previous surveys such as the Greater West Angelas fauna assessment (Ecologia Environment 2014). The lower number of bird species recorded by Biota (2006) and Ninox (2009a) can be attributed to a single season survey only, and that a recent fire had affected 80% of the survey area in the Ninox (2009a) survey.

The current survey recorded a comparatively high number of mammal species (33 species) compared to other Level 2 surveys in the vicinity (13 to 25 species) (Biota Environmental Sciences 2006; Ecologia Environment 2014; Ninox Wildlife Consulting 2009a, 2009b). This was mainly due to the high number of bat species recorded; 12 species were recorded in the current survey compared to a maximum of nine species recorded in previous surveys (Ecologia Environment 2014; Ninox Wildlife Consulting 2009b), as well as a high number of introduced species recorded; six species recorded in the current survey compared to a maximum of three species in previous surveys (Biota Environmental Sciences 2006; Ninox Wildlife Consulting 2009a). The higher number of bat and introduced species recorded during the current survey is likely due to the increased use of sampling methods, such as acoustic bat recorders and motion sensitive cameras compared to the earlier surveys (Ninox Wildlife Consulting 2009b, 2009a; Biota Environmental Sciences 2006).

5.1.2.3 Conservation Significant Species

Of the 26 conservation significant species identified in the desktop assessment, seven species were recorded during the current survey and an additional three species were considered to have a 'high' likelihood of occurrence. Four species were deemed to have a 'moderate' likelihood and 12 species to have a 'low' likelihood.

Three of the five recorded conservation listed species are classified under the EPBC Act as MNES species: Northern Quoll, Pilbara Leaf-nosed Bat and Ghost Bat.

Recorded MNES Species

The Gorge and Breakaway habitats within the survey area were considered highly suitable for the recorded MNES species: Northern Quoll, Pilbara Leaf-nosed Bat and Ghost Bat and would be considered habitat critical to the survival of the Northern Quoll and Ghost Bat under the EPBC Act definitions (Department of Environment 2013, Department of the Environment and Energy 2016, Threatened Species Scientific Committee 2016). The breakaways, gorges and gullies contained microhabitats such as caves and semi-permanent water pools; approximately 307 ha (3%) of potential shelter and foraging habitat was recorded in the survey area. With respect to the Northern Quoll, these habitats were divided into 'probable shelter and foraging habitat' (or critical habitat), which comprised 107 ha (1%) of the Gorge/Gully habitat and some Breakaway habitats, particularly within the BHT area; and 'potential shelter and foraging habitat', comprising 200 ha (2%) of the smaller Breakaway habitats, particularly with the HD2 area.

The remaining habitats of the survey area were classified as 'lower' habitat suitability for these species as these habitats contained no significant refuge sites, shelter, or semi-permanent water and were considered less vital for these species' persistence. Differing foraging strategies exist for the conservation significant bat species recorded for the survey area. The Pilbara Leaf-nosed Bat have greater foraging capabilities and are known to traverse more of the landscape and across wide open plains as opposed to Ghost Bats who are known to follow drainage lines and/or ridgelines searching for prey.

The Northern Quoll was recorded 14 times during the current survey, mainly within the Gorge/Gully or Breakaway habitats. The relatively high number of records for this species within the survey area is significant given only one other record was made from previous fauna assessments in the vicinity of the survey area (Biota Environmental Sciences 2011). Also the survey area is at the fringe of this species' distribution, so generally a lower number of records are made within the Hamersley Ranges when compared to more coastal zones. A sub-adult male was captured during the Phase 2 survey, close to the HD1 village. Males, particularly this sub-adult male, may have been expanding their home range in preparation for the oncoming breeding season at the time of survey. However, a large number of motion camera recordings suggest that a resident population may exist in the survey area, particularly within the BHT area. The BHT deposit is a large isolated ridge in the landscape that contains numerous breakaways, gorges and gullies that support micro-niches important for the Northern Quoll.

The three Pilbara Leaf-nosed Bat recordings made in the survey area were from foraging individuals in Gorge/Gully and Breakaway fauna habitats. The recorded calls at low activity levels were made at least three hours after dusk and are not consistent with the presence of a permanent roost cave nearby (Bat Call WA 2019). This corresponds with the records by Ecologia Environment (2014) at Greater West Angelas, approximately 15 km south-west of the survey area, where call times were also not conducive to a nearby roost (Ecologia Environment 2014). This species is likely to forage occasionally within the survey area taking advantage of benign conditions and dispersing

temporarily in search of additional foraging and roosting opportunities (Bat Call WA 2019). Foraging habitat for this species is much broader than for the Ghost Bat and includes water courses, riparian vegetation, hummock grassland and sparse tree and shrub savannah habitats. Therefore the Pilbara Leaf-nosed Bat is likely to be found across the majority of the survey area, with the exception of cleared habitats.

The Ghost Bat was recorded on nine occasions within the survey area through acoustic recordings (calls), scats recorded in nocturnal feed caves and an individual sighted during spotlighting within the HD2 area. Regionally this species has a strong presence in the vicinity of the survey area, identified from previous fauna assessments in the Hope Downs area by Biota Environmental Sciences (2006), and Southern Flank area (Biologic Environmental Survey 2016), as well as 75 records from DBCA's Threatened and Priority Fauna Database (Department of Biodiversity, Conservation, and Attractions 2017b). Two of the seven caves recorded within the survey area (Caves 1 and 5) were deemed to be Category 3 roost caves with occasional occupancy based on their size and depth; however, no ultrasonic detections were recorded. The other five recorded caves were deemed to be Category 4 nocturnal roost caves (opportunistic usage). These Category 4 caves are common in the landscape as numerous observations suggest that the majority of caves and adits in the Pilbara are used in at least an opportunistic manner by itinerant Ghost Bats (Bat Call WA 2019). The caves recorded within the survey area are not considered significant to the long-term presence of the species (Bat Call WA 2019). The records are consistent with the Ghost Bat foraging in low numbers on the HD2 and BHT ridges (Bat Call WA 2019). It is also consistent with the known regional presence of the Ghost Bat across the central Pilbara region as well as locally on the major ridges immediately to the north of the survey area and west of the HD1 mining area (Bat Call WA 2019). It is highly unlikely that additional significant caves (Category 1 or 2) exist within the survey area.

Other Conservation Significant Species

Other conservation significant species recorded from, or likely to occur, within the survey area included the recorded Oriental Plover, *L. macropisthopus remota*, Letter-winged Kite and Western Pebble-mound Mouse; and the likely to occur Pilbara Barking Gecko, *Anilios ganei* and Pilbara Olive Python.

The Oriental Plover was recorded opportunistically during the Phase 3 survey at the HD1 village camp within the WM area. This species is a seasonal migrant and is only present during certain times of the year and is unlikely to be reliant upon the habitats present within the survey area given more suitable habitat is found outside the survey area.

The fossorial skink, *L. macropisthopus remota* was captured within the Mulga Woodland fauna habitat in the survey area. This ground-dwelling skink often favours sandy to loamy sand based substrates which support *Acacia* shrublands (such as Mulga) and woodlands where it inhabits loose soil under leaf litter usually at the base of shrubs. Threats to this species are not well known, it is listed as contribution significant due to its very restricted distribution range and its basic ecology is seen as poorly known.

One individual Letter-winged Kite was recorded during Phase 2 within Minor Drainage habitat of the survey area. This species is sparsely distributed and rarely encountered across its range and is unlikely to be reliant upon the habitats present within the survey area.

The Western Pebble-mound Mouse was recorded by five pebble mounds within the Stony Plain and Rocky Hill habitat of the survey area. An additional one pebble mound, as well as three individual captures, were also recorded just outside the survey area, indicating they are common within the local area. The Low Hill and Slopes, Stony Plain and Rocky Hill habitats of the survey area are likely to

support this species. These habitats are widespread and common within the vicinity of the survey area and the wider Pilbara region.

The small ground dwelling reptiles, *A. ganei* and Pilbara Barking Gecko, are difficult to detect due to their cryptic behaviours. The trap sites (particularly sites TS12, TS13 and TS15 within Rocky Hill habitat) did not capture these species during the current survey. Suitable Rocky Hill fauna habitat was found mainly within the BHT and WM areas and these areas generally had been heavily impacted from clearing due to exploration drilling operations and recent fire, possibly reducing their potential occurrence.

The Pilbara Olive Python has been previously recorded in the vicinity of the survey area and suitable foraging and denning habitats occur within the Gorge/Gully, Breakaway and Minor Drainage habitats, particularly in the locations that have the potential to support semi-permanent and permanent water, although no surface water was recorded during the survey.

5.2 SRE Invertebrates

5.2.1 Habitats

In general, the survey area appears to have great potential to support SRE species owing to the abundance of ideal habitats. These include the 'typical' SRE target habitats: south facing gorges, rocky slopes and breakaways. Prospective SRE habitats were mapped as Gorge/Gully, Breakaway, Rocky Hills and Minor Drainage habitats in the survey area. These habitats, particularly those associated with the BHT area, were considered as having a high likelihood of supporting SREs. BHT occupies a large portion of an isolated, east-west running ridge and appears to support numerous south facing rocky slopes and breakaways, as well as gullies and gorges. It therefore seems to have all the requirements for supporting relictual SREs species. These habitats supported Philosciidae sp, *Troglarmadillo* sp. and *Pseudodiploexochus* sp. which, while being ambiguously defined, represent likely SREs. The latter two taxa represent forms that are very rarely sampled from epigean habitats in the Pilbara and are not arid adapted. The presence of arid sensitive taxa in these habitats indicates that SRE habitats are present. Additional SRE species are likely to occur in these habitats.

The pseudoscorpion *Anatemnus* sp. has all of the features of a troglobite (blind and pale) and the only other Pilbara record of this genus is troglobitic. One specimen was sampled from a Minor Drainage Line habitat. There is a small chance that this species is troglobitic and in the Pilbara, troglobitic *Nocticola* have been sampled from creek gravels (Dr. E. Volschenk pers. obs.) indicating that this is potential habitat for troglobitic taxa.

In addition the Mulga Woodland contained deep leaf litter supporting SRE species and specifically the Mulga Woodland in HD2 was species rich, where eight of the nine centipede taxa and four of the five millipede taxa were recorded.

Several Short Range Endemic category invertebrates were found in multiple habitat types, suggesting that they may be less specialised with respect to their habitat preferences:

- *Lychas* 'bituberculatus complex', from Stony Plain, Alluvial Plain and Low Hills
- *Sepedenophilus* 'HD1', from Gorge/Gully and Mulga Woodland
- *Mecistocephalus* 'HD1', from Rocky Hills, Gorge/Gully and Mulga Woodland
- *Austrostrophus* 'Clade E', from Stony Plain, Alluvial Plain and Mulga Woodland

- *Antichiropus* 'wonmunna', from Mulga Woodland in the survey area, but from gully slopes and riparian vegetation outside of the survey area.

These species are likely to be found outside of the survey area.

5.2.2 Invertebrate Fauna Species

The database search results revealed a very species rich SRE category invertebrate taxa and most of these taxa were present within the Hamersley Range - the SRE and potential SRE groups were represented by 282 taxa of which eight (3%) were named species, 182 (64%) were morphospecies and 92 (33%) were undetermined taxa. The high degree of morphospecies most likely reflects the poor level of taxonomic knowledge about SREs in this part of the Pilbara. This position is reflected by the high degree of DD potential SRE taxa. Fifteen SRE taxa detailed from the database search were previously recorded within the survey area. Six of these taxa have been assigned to a species or morphospecies.

The field surveys generated a total of 202 samples from SRE target groups comprising 358 individuals. Following morphological identification and DNA-barcoding, the samples were found to comprise 67 different taxa; 18 of which were known to be widespread, one species was a known SRE (*Karaops banyjima*) and 48 were either likely or potential SREs. Of the 32 SREs or potential SREs recorded within the survey area that were identified to the level of species or morphospecies, 11 of these have previously been recorded within the 10,000 km^2 search area but outside the survey area.

Spiders

The search area contained 111 SRE category spider taxa, of which four were named species, 83 were morphospecies and 24 were unidentified taxa. Four of these taxa are SREs and the remainder are potential SRE (DD). Four potential SRE (DD) spider taxa were previously recorded from within the survey area:

- *Synothele* sp.: T116849, T116852
- *Idiosoma* sp.: T116854, T116851
- *Aname* sp.: T116850
- *Kwonkan* 'MYG339': T116853.

Additional species were also revealed to the north and south of the search area, suggesting that a greater diversity of trapdoor spiders might be expected than the survey yielded. It is likely that survey conditions or methods were not optimal for sampling the broader diversity of trapdoor spiders in the area. No harvestmen were recorded during the field survey and no previous records were within the survey area. The absence of Opiliones was difficult to interpret as conditions leading up to both surveys was quite dry and if they are present, the rain experienced during the Phase 3 survey may not have been sufficient to bring them out. If present, they are likely to be in the Gorge/Gully habitat of the BHT and WM areas.

Fifteen spider taxa were collected during these surveys, representing the families Selenopidae, Actinopodidae, Barychelidae, Idiopidae and Nemesiidae. Five of these represented widespread taxa, nine species were potential SRE owing to data deficiency (*Aname* sp., *Synothele* sp., *Yilgarnia* 'MYG197', *Karaops* sp. 'ARA001', Nemesiidae sp., *Aurecocrypta* 'sp. indet. (AESHD1)', *Aurecocrypta* 'MYG315', *Synothele* 'MYG309' and *Synothele* 'MYG311') and one species was a known SRE (*Karaops banyjima*). The assessment identity of *Karaops banyjima, Karaops* sp. 'ARA001', *Aurecocrypta*

'MYG315', *Synothele* 'MYG309' and *Synothele* 'MYG311' were verified using DNA-barcoding methods.

The SRE species *Karaops banyjima* was recorded from three unique localities within the survey area. Two of these localities were represented by Gorge/Gully habitat, and one by the Rocky Hill habitat. The WAM identified the *Karaops banyjima* (AES190099) specimen as *Karaops nyangumarta* as it was highly supported as conspecific with WAMT134063 (and others), sharing 98.88% genetic pairwise similarity (Wilson, Huey, and Harvey 2019). However, this species possesses very different morphological features to *Karaops banyjima*. Further consultation with Dr Sarah Crews, who described both species (Crews 2013), found that the morphological data strongly indicate that the specimen should be *Karaops banyjima*. Hence, the specimen remains as *Karaops banyjima*. This species is an SRE and the type locality is approximately 20 km north of the survey area.

Aurecocrypta 'MYG315' was identified from a single juvenile specimen. *Aurecocrypta* 'MYG315' was recorded from the search area and is a potential SRE owing to data deficiency regarding its distribution limits. The species appears to have a relatively wide distribution, within the constraints of an SRE, with records occurring approximately 5 km to the south of the survey area.

Synothele 'MYG309' and *Synothele* 'MYG311' were confirmed with DNA barcoding and are considered potential SRE: DD. These species were well represented within the search area but outside the survey area. The distribution of these species suggest they are restricted to the Eastern Hamersley range, but that their distributions extend outside of the survey area.

Pseudoscorpions

The search area contained 52 SRE category pseudoscorpion taxa, of which three are named species, 31 were morphospecies and 18 were unidentified taxa. Two species are SREs and the remaining taxa are potential SRE (DD). The field survey sampled 16 pseudoscorpion taxa from four families: Atemidae, Chernetidae, Chthoniidae and Olpiidae. Fourteen of the 16 pseudoscorpion taxa were classified as potential SRE including *Anatemnus* sp., *Austrohorus* 'sp. indet. (AESHD5)', *Beierolpium* 'sp. indet. (AESHD1)', *Beierolpium* 'sp. indet. (AESHD2)', *Euryolpium* 'sp. indet. (AESHD6)', *Euryolpium* 'sp. indet. (AESHD7)', *Euryolpium* sp., 'Genus 7/4 PSE118', '*PSEAAA* sp. indet. (AESHD4)', *Indolpium* sp., Olpiidae sp., *Sundochernes* sp., *Tyrannochthonius* 'sp. indet. (AESHD1)' and *Tyrannochthonius* 'sp. indet. (AESHD2)'.

In the Pilbara, epigean Olpiidae constitute species of *Austrohorus*, *Beierolpium*, *Euryolpium*, *Indolpium*, *Xenolpium,* Genus *PSEAAA* and 'Genus 7/4'. The constituent species of these genera have been problematic to assess using morphology alone. In the current survey, representatives of unresolved (using morphology) putative olpiid taxa from each sample sites were assessed using DNA-barcoding:

- *Austrohorus* 'sp. indet. (AESHD5)' was a distinct species, but its generic placement was ambiguous with an unresolved polytomy of *Austrohorus*, 'Genus 7/4' and *Nanolpium*
- two putative species of *Beierolpium* were recognised using DNA-barcoding: *Beierolpium* 'sp. indet. (AESHD1)' and *Beierolpium* 'sp. indet. (AESHD2)'
- two putative species of *Euryolpium* were recognised using DNA-barcoding: *Euryolpium* 'sp. indet. (AESHD6)' and *Euryolpium* 'sp. indet. (AESHD7)'
- all four specimens of 'Genus 7/4 PSE118' were confirmed with DNA barcoding
- '*PSEAAA* sp. indet. (AESHD4)' was identified by WAM using DNA barcoding.

Two samples were identified to *Euryolpium* sp., but the relationship of these with the two genetic species is not known. With the discovery *Euryolpium* 'sp. indet. (AESHD6)' and *Euryolpium* 'sp. indet. (AESHD7)', both potential SREs, unresolved *Euryolpium* sp. can no longer be regarded as widespread and are here considered to be potential SRE owing to taxonomic data deficiency. Attempts to obtain DNA sequences from this specimen of Olipiidae sp. were unsuccessful.

Four specimens belonging to 'Genus 7/4 PSE118' were confirmed with DNA barcoding. This species is currently regarded as a potential SRE owing to limited knowledge about its distribution. Area search records included a single representative of this species approximately 20 km north of the survey area.

The current survey obtained two samples of *Tyrannochthonius* which were identified as belonging to two different species using DNA barcoding: *Tyrannochthonius* 'sp. indet. (AESHD1)' and *Tyrannochthonius* 'sp. indet. (AESHD2)'. Both species represent potential SREs owing to data deficiency regarding their distribution limits. They either represent new discovered taxa or not-yet-sequenced taxa (Wilson, Huey, and Harvey 2019).

Of note, one specimen from the Atemidae family included a single adult female *Anatemnus* sp. This species was obtained from site SRE10, within a Gorge/Gully fauna habitat type. This species is very unusual by being eyeless and having relatively pale body colour colouration. These features closely resemble those seen in the troglobitic *Anatemnus subvastus*, the only described species in this genus from the Pilbara (Alexander, Burger, and Harvey 2014). The placement of this species into *Anatemnus* is also tentative owing to the uncertain relationship between this genus and several other genera in Atemnidae (Alexander, Burger, and Harvey 2014). This sample represents the first epigean representative of *Anatemnus* from the Pilbara. This species is a potential SRE owing to data deficiency regarding its taxonomy or distribution.

Scorpions

The search contained 25 scorpion taxa, of which none were named, 21 were morphospecies and four were unidentified taxa. One species is an SRE and the remaining 24 taxa are potential SRE (DD).

The field survey yielded eight species of scorpions from the families Buthidae and Urodacidae. Four potential SRE scorpions were collected from the survey area: *Lychas* 'bituberculatus complex', *Lychas* 'hairy tail complex', *Lychas* 'multipunctatus complex' and *Urodacus* 'HD1'. Representatives of *Lychas* are frequently collected in surveys and current investigations on the genus *Lychas* indicate the presence of several species' complexes, some of which appear to contain SREs. *Lychas* 'hairy tail complex' and *Lychas* 'bituberculatus complex' specimens have previously been recorded within approximately 1 km and 3 km of the survey area, respectively. The *Urodacus* specimen collected was a juvenile from site SRE13 and adult males are usually required for morphological identification. Preliminary barcoding analyses could not match this species to any within Alacran's sequence database (Alacran Environmental Science 2019). WAM sequencing found the specimen was supported as a conspecific with WAMT91922 (and others), sharing 93.49% genetic pairwise similarity, which did not allow a conclusion about whether they are conspecific or not (Wilson, Huey, and Harvey 2019). The closely related specimens are also unidentified at present (Wilson, Huey, and Harvey 2019).

Centipedes and Millipedes

The search area contained 13 centipede taxa, of which none were named species, two were morphospecies and 11 were unidentified taxa. All were considered potential SRE (DD). None of the search area records fell within the survey area; however, a large cluster of records of

Mecistocephalidae sp. and *Sepedenophilus* sp. records were recorded from the area immediately south of the survey area.

The field surveys yielded nine centipede taxa representing five families Cryptopidae, Chilenophilidae, Mecistocephalidae, Geophilomorpha and Oryidae. All taxon within the Geophilomorpha and Cryptopidae families are very poorly known in Western Australia. While keys to genera and families are available, there is no working morphological taxonomy for Australian species and all species assessments are currently based on comparisons using DNA sequences. DNA sequencing identified seven of these species, whilst sequencing failed for the other two taxa: *Sepedenophilus* sp. and Geophilomorpha sp. Two of the centipede taxa *Sepedenophilus* 'HD1' and *Mecistocephalus* 'HD1' were sampled from four and three separate locations each. These were represented by Rocky Hills, Gorge/Gully and Mulga Woodland, suggesting that these species may not be restricted to one habitat type.

The search area contained 30 millipede taxa, of which one was a named species, 20 were morphospecies and nine were unidentified taxa. Seventeen of these species were SREs and 13 species were potential SRE (DD). The field survey yielded numerous millipede samples belonging to the families Trigoniulidae and Paradoxosomatidae. The five species of millipede collected during the survey were classified as potential SRE (DD). *Antichiropus* 'wonmunna' was recorded from three separate localities in Mulga Woodland within the HD2 area. This species is also known from five records all within 10 km of the SRE sites SRE15 and SRE23 (Alacran Environmental Science 2019). *Antichiropus* sp. collected from two sites are likely to represent *Antichiropus* 'wonmunna'; however, there is also a chance that one or more may represent different species since multiple species of Paradoxosomatidae have been collected from the same locality (Alacran Environmental Science 2019).

Species delimitation using DNA barcoding indicated the presence of two putative species: *Austrostrophus '*Clade A' and *Austrostrophus* 'Clade E', as the specimens provided were highly supported as conspecific with WAMT122166 (and others) and WAMT100768 (and others), respectively (Wilson, Huey, and Harvey 2019). *Austrostrophus* sp. represents specimens that were not sequenced and were found at sites SRE13, SRE15, SRE16, SRE17, SRE18 and SRE19. In the absence of clear unambiguous identification, this taxon is regarded as a potential SRE owing to data limitation regarding species identity.

Isopods

The search area contained 34 isopod taxa, of which none were named species, 25 were morphospecies and nine were unidentified taxa; all are considered to be potential SRE (DD). The field survey collected seven potential SRE isopod species: *Buddelundia* '10ma', *Buddelundia* '77', *Buddelundia* sp., Buddelundiinae sp., *Pseudodiploexochus* sp., *Troglarmadillo* sp. and *Philosciidae* sp. Buddelundiinae sp. belongs to an undescribed genus closely related to *Buddelundia*. This genus is mostly found in the Pilbara region and lacks the morphological characters used to determine *Buddelundia*. Morphospecies are difficult to define in this group and there is a general lack of sequences with which to make comparisons. The *Buddelundia* '10' species group contains several species, including *Buddelundia* '10ma' recorded in this survey. This taxon has been previously collected from the Marillana and West Angelas areas and is regarded as a potential SRE (DD).

The *Pseudodiploexochus* sp. is only the second record of this genus from the Pilbara. The only other record of this genus in the Pilbara is from the West Angelas area, approximately 25 km south-west of this current record. This previous specimen is part of Simon Judd's isopod collections and is therefore not present in the WAM data records. Members of this genus do not have the well-developed lungs present in most terrestrial Armadillidae. For this reason, they are far more

susceptible to desiccation and are nearly always considered to be SRE in arid or semi-arid environments. *Pseudodiploexochus* sp. is therefore likely to represent an SRE but in the absence of additional taxonomic or distributional data, it is a potential SRE.

The *Troglarmadillo* sp. specimen could not be unambiguously identified; however, it showed closest affinity to *Troglarmadillo*, a genus almost entirely represented by troglobites in the Pilbara. Despite the genus name, the species sampled possesses well developed eyes and has faint body patterning, suggesting that it is not a troglobite. Subterranean *Troglarmadillo* species are nearly always SRE and it is likely that this species will be as well. In the absence of more resolved taxonomic and distributional data, this species is a potential SRE. While there are a number of sources for sequences for Pilbara *Troglarmadillo* species, all of them are from troglobites; therefore, sequencing this specimen is unlikely to provide useful results until more specimens are obtained.

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Appendix A: Background Information Figures

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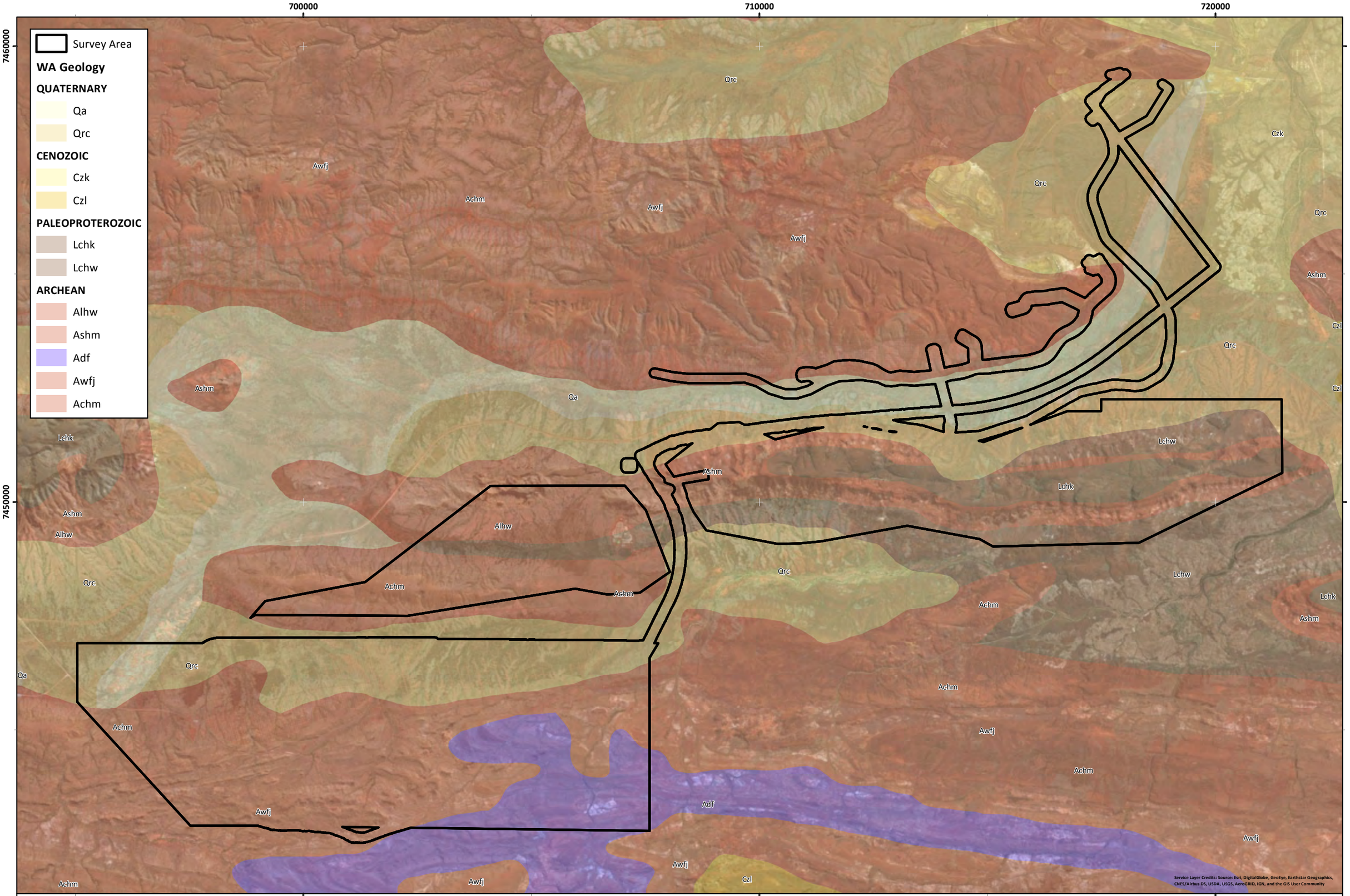

Rio Tinto

Hope Downs 2 Proposal Fauna Survey

Figure A.1: Geological units of the survey area.

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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700000 710000 720000

7460000

7450000

Survey Area

Land System

- Boolgeeda System
- Calcrete System
- Egerton System
- McKay System
- Newman System
- Oakover System
- Pindering System
- Platform System
- River System
- Rocklea System
- Wannamunna System

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 2 Proposal Fauna Survey

Figure A.2: Land systems of the survey area

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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700000 710000 720000

7460000

7450000

Survey Area

System Association

HAMERSLEY_18

HAMERSLEY_29

HAMERSLEY_82

HAMMERSLEY_18

HAMMERSLEY_82

HAMMERSLEY_18

HAMMERSLEY_82

HAMMERSLEY_82

HAMMERSLEY_18

HAMMERSLEY_82

HAMMERSLEY_29

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 2 Proposal Fauna Survey

Figure A.3: Pre-European vegetation of the survey area

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Author: J. Johnston | Drawn: C. Dyde | Date: 31-01-2020 | Figure Ref: 14292B-19-BIDR-3Rev2_200131_FigA3_PreEuroVeg

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Appendix B: Conservation Fauna Categories, Habitat Condition Scales and Likelihood Criteria

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Table B.1: Categories of Threatened Ecological Communities (Department of Environment and Conservation 2013).

PD: Presumed Destroyed
An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant **and either** of the following applies (A or B): A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats **or** B) All occurrences recorded within the last 50 years have since been destroyed.
CR : Critically Endangered
An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as **Critically Endangered** when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting **any one or more of** the following criteria (A, B or C): A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% **and either or both** of the following apply (i or ii): i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii): i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

En: Endangered
An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. An ecological community will be listed as **Endangered** when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting **any one or more** of the following criteria (A, B, or C): A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement **and either or both** of the following apply (i or ii): i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years); ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated. B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii): i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years); ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes; iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes. C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).
VU: Vulnerable
An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range. An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting **any one or more of** the following criteria (A, B or C): A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated. B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Reference: Department of Environment and Conservation 2013, Definitions, Categories and Criteria for Threatened and Priority Ecological Communities DEC (Parks and Wildlife), <https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf.>

Table B.2: Definitions and criteria for Threatened Ecological Communities (Department of Environment and Conservation 2013).

Three categories exist for listing Threatened Ecological Communities under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). An ecological community may be categorised as:

Categories of ecological communities	
Critically endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

Reference: Department of Environment and Conservation 2013, Definitions, Categories and Criteria for Threatened and Priority Ecological Communities DEC (Parks and Wildlife), <https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf.>

Table B.3: Definitions and criteria for Priority Ecological Communities (Department of Environment and Conservation 2013).

Possible Threatened Ecological Communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

P1: Priority One – Poorly-known ecological communities
Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2: Priority Two – Poorly-known ecological communities
Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3: Priority Three – Poorly-known ecological communities
(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4: Priority Four
Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
P5: Priority Five – Conservation dependent ecological communities
Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Reference: Department of Environment and Conservation 2013, Definitions, Categories and Criteria for Threatened and Priority Ecological Communities DEC (Parks and Wildlife), <https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf.>

Table B.4: Conservation codes for Western Australian fauna (Department of Parks and Wildlife 2019).

Code	Conservation category	Definition
CR	Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice under the *Biodiversity Conservation Act 2016*.	Fauna that is rare or likely to become extinct, as critically endangered fauna.
EN	Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice under the *Biodiversity Conservation Act 2016*.	Fauna that is rare or likely to become extinct, as endangered fauna.
VU	Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice under the *Biodiversity Conservation Act 2016*.	Fauna that is rare or likely to become extinct, as vulnerable fauna.
EX	Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice under the *Biodiversity Conservation Act 2016*.	Fauna that is presumed to be extinct.
IA	Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice under the *Biodiversity Conservation Act 2016*.	Birds that are subject to international agreements relating to the protection of migratory birds.
CD	Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice under the *Biodiversity Conservation Act 2016*.	Fauna that are of special conservation need being species dependent on ongoing conservation intervention.
OS	Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice under the *Biodiversity Conservation Act 2016*.	Declared to be fauna that is in need of special protection, otherwise than for the reasons mentioned.

Reference: Department of Parks and Wildlife 2019, *Conservation Codes For Western Australian flora and fauna*, The Government of Western Australia.

Table B.5: Priority species under Western Australian *Biodiversity Conservation Act 2016* (Department of Parks and Wildlife 2019).

Taxa that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora and Priority Fauna Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Taxa that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These taxa require regular monitoring. Conservation Dependent species are placed in Priority 5.

P1: Priority One – Poorly known taxa
Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
P2: Priority Two – Poorly known taxa
Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
P3: Priority Three – Poorly known taxa
Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
P4: Priority Four: Rare, near threatened and other taxa in need of monitoring
(a) Rare. Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. (b) Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
P5: Priority Five: Conservation dependent taxa
Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxa becoming threatened within five years.

Reference: Department of Parks and Wildlife 2019, *Conservation Codes For Western Australian flora and fauna*, The Government of Western Australia.

Table B.6: Categories and definitions for EPBC Act listed fauna species.

Conservation category	Definition
Extinct	Taxa with no reasonable doubt that the last member of the species has died.
Extinct in the wild	Taxa known to survive only in cultivation, in captivity or as a naturalized population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriated seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (EN)	Taxa are not critically endangered; and are facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	Taxa are not critically endangered or endangered; and are facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation dependent (CD)	Taxa are the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or the following subparagraphs are satisfied: i) the taxa is a species of fish; ii) the taxa is the focus of a management plan that provides management actions necessary to stop the decline of, and support the recovery of, the taxa so that its chances of long term survival in nature are maximized; iii) the management plan is in force under a law of the Commonwealth or of a State or Territory; iv) Cessation of the management plan would adversely affect the conservation status of the taxa Fish includes all taxa of bony fish, sharks, rays, crustaceans, molluscs and other marine organisms, but does not include marine mammals/reptiles.
Migratory (IA)	Taxa are considered migratory species on International Agreements; i) if they are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II); ii) all migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA); and iii) Are native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Note: CD and IA are only related to conservation significant fauna

Table B.7: Criteria used to define likelihood occurrence of conservation significant fauna species.

Likelihood of occurrence	Pre-survey	Post-survey
Recorded	N/A	Species or evidence of species recorded during survey.
High	Species has been recorded within the survey area or within 20 km of the survey area and preferred habitat appears to be present.	Core or preferred habitats present in the survey area which are abundant and/or high quality condition. OR Species is known to be cryptic and may not have been detected despite adequate survey effort and suitable habitat present within the survey area. OR Species or evidence of species recorded within the survey area however doubt remains over the taxonomic identification, validity of record.
Moderate	Species has not been recorded from within the survey area, however species has been recorded within the prescribed database search area and suitable habitat appears to be present.	Core or highly suitable habitats present in the survey area, however non-cryptic species that was not detected despite adequate survey effort. OR Core or preferred habitats present in the survey area are mainly in poor or modified condition.
Low	Species recorded from within the prescribed database search area but suitable habitat does not appear to be present.	Species has not been recorded in the survey area despite adequate survey effort. OR Species dependent on specific habitats that do not occur in the survey area. OR Species considered locally extinct.

Table B.8: Criteria used to determine SRE status of invertebrates.

Status	Criteria
Confirmed	This species has a high probability of being an SRE based on expert opinion, reference databases or the scientific literature. Usually, this species belongs to a group that is well known taxonomically and contains a high proportion of SRE species. Example: Millipedes belonging to the genus *Boreohesperus* (Car and Harvey 2013).
Potential	This species has a moderate probability of being an SRE because it belongs to a group with a high proportion of SRE species, has specific biological and/or ecological attributes that may indicate range restriction, or has been collected from a single microhabitat type. Usually, this species will belong to a group with a poorly or moderately resolved taxonomy. Example: Many trapdoor spiders in the infraorder Mygalomorphae (Castalanelli *et al.* 2014). The WAM recognises the uncertainty involved with this category and lists five sub-categories that may help elucidating this status: i) data deficient because there is insufficient information; ii) habitat indicators that are associated with potential SRE status; iii) morphological indicators; iv) molecular evidence; and v) research and expert knowledge held within the WAM (WAMTS staff 2013). These sub-categories are implicitly addressed as part of the species assessments.

Reference: Car, CA & Harvey, MS 2013, 'A review of the Western Australian keeled millipede genus *Boreohesperus* (Diplopoda, Polydesmida, Paradoxosomatidae)', *ZooKeys*, vol. 290, pp. 1-19.

Castalanelli, MA, Teale, RJ, Rix, MG, Kennington, WJ & Harvey, MS 2013, 'Barcoding of mygalomorph spiders (Araneae: Mygalomorphae) in the Pilbara bioregion of Western Australia reveals a highly diverse biota', *Invertebrate Systematics*, vol. 28, pp. 375-85.

Table B.9: Fauna habitat condition scale (Thompson and Thompson 2010).

Habitat condition	Condition description
High Quality Fauna Habitat (1.0)	These areas closely approximate the vegetation mix and quality that would have been in the area prior to any human induced disturbance. The habitat has connectivity with other habitats and is likely to support the most natural vertebrate fauna assemblage.
Very Good Fauna Habitat (0.8)	These areas show minimal signs of human induced disturbance (e.g. grazing, clearing, fragmentation, weeds) and retain almost all of the characteristics of the habitat had it not been disturbed. The habitat has connectivity with other habitats, and fauna assemblages in these areas are likely to be minimally effected by disturbance.
Good Fauna Habitat (0.6)	These areas show signs of human induced disturbance (e.g. grazing, clearing, fragmentation, weeds) but generally retain many of the characteristics of the habitat had it not been disturbed. The habitat still retains some connectivity with other habitats but fauna assemblages in these areas are likely to be affected by disturbance. Fauna assemblages in these areas are likely to be similar to what might be expected in this habitat.
Disturbed Fauna Habitat (0.4)	These areas show signs of human induced significant disturbance (e.g. mining, clearing, tracks and roads). Many of the trees, shrubs and undergrowth have died or have been cleared. These areas may be in the early succession and regeneration stages. Areas may show signs of significant grazing, contain an abundance of weeds or have been damaged by vehicles or machinery. Habitats are fragmented or have limited connectivity with other fauna habitats. Fauna assemblages in these areas are likely to differ significantly from what might be expected in the area had the disturbance not occurred.
Highly Degraded Fauna Habitat (<0.2)	These areas often have a significant human induced loss of vegetation, and / or a large number of vehicle tracks and / or have been completely cleared, and / or areas have been heavily grazed or farmed. There is limited or no fauna habitat connectivity. Fauna assemblages in these areas are likely to differ significantly from what existed prior to the disturbance, and are often depleted compared to what existed prior to the disturbance.

Reference: Thompson, SA & Thompson, GG 2010, *Terrestrial Vertebrate Fauna Assessments for Ecological Impact Assessment*, Terrestrial Ecosystems, Mt Claremont.

Table B.10: Suitability/significance of habitat ranking criteria for the target Matters of National Environmental Significance (MNES) species.

Species	Probable shelter and foraging habitat	Potential shelter and foraging habitat	Suitable foraging and dispersal habitat	Limited foraging and dispersal habitat
Pilbara Olive Python (*Liasis olivaceus barroni*)	N/A	Rocky habitat such as gorges, escarpments and breakaways along with drainage lines including or in close proximity to permanent or semi-permanent water holes.	Drainage lines with dense vegetation enabling transitory behaviours and/or providing foraging potential. Rocky habitats that are not in close proximity to water.	Habitat that has limited sheltering and foraging capacity with no permanent or semi-permanent water.
Northern Quoll *(Dasyurus hallucatus)*	Habitat as described in potential shelter and foraging habitat but is considered core habitat critical to the Northern Quoll. This was determined by proximity to known records and microhabitat features, such as south-facing, extent of habitat and whether it was in close association with a gorge or gully.	Rocky habitats such as ranges, escarpments, mesas, ranges, gorges, breakaways and boulder fields. Also major drainage lines or tree-lined drainage systems that are structurally diverse and contain large diameter trees, termite mounds or hollow logs.	Habitat important for foraging, dispersal and buffering of the species including moderate to small sized drainage lines and native vegetation in close proximity (within 2 km) denning or shelter habitat.	Habitat that has limited sheltering and foraging capacity and not connected to potential denning/shelter and foraging habitat.
Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) and Ghost Bat (*Macroderma gigas*)	N/A	Rocky habitat that contains caves suitable as diurnal or maternity roosts sites, or potentially contains these caves and has not adequately surveyed OR Areas highly suitable for foraging that are likely to be used on a regular basis.	Habitat important for foraging including diverse rocky terrain, moderately sized drainage lines and dense complex vegetation stands.	Habitat that has limited ecological value but may provide capacity for transitory movement across the landscape and/or limited foraging potential.

Species	Probable shelter and foraging habitat	Potential shelter and foraging habitat	Suitable foraging and dispersal habitat	Limited foraging and dispersal habitat
Night Parrot (*Pezoporus occidentalis*)	N/A	Isolated habitat not subjected to predation pressure, fire pressure, and altered habitat from pastoralism and mining activities. Generally roosting habitat that contains old and large spinifex clumps (>50 years unburnt), particularly ring-forming hummocks. OR Areas highly suitable for foraging in close association (<10 km) to potential roosting habitat, including *Triodia* (particularly at times of mass flowering and seeding) and chenopod communities dominated by *Sclerolaena*.	Very little is known on the foraging requirements of the Night Parrot. Habitat within 40 km of potential roosting and nesting sites, potentially important for foraging, including chenopod communities (particularly those dominated by *Sclerolaena*), *Triodia* and areas rich in herbs, including forbs, grasses and grass-like plants.	Habitat that has limited roosting and foraging potential for the Night Parrot.

Appendix C: Survey Sampling Locations

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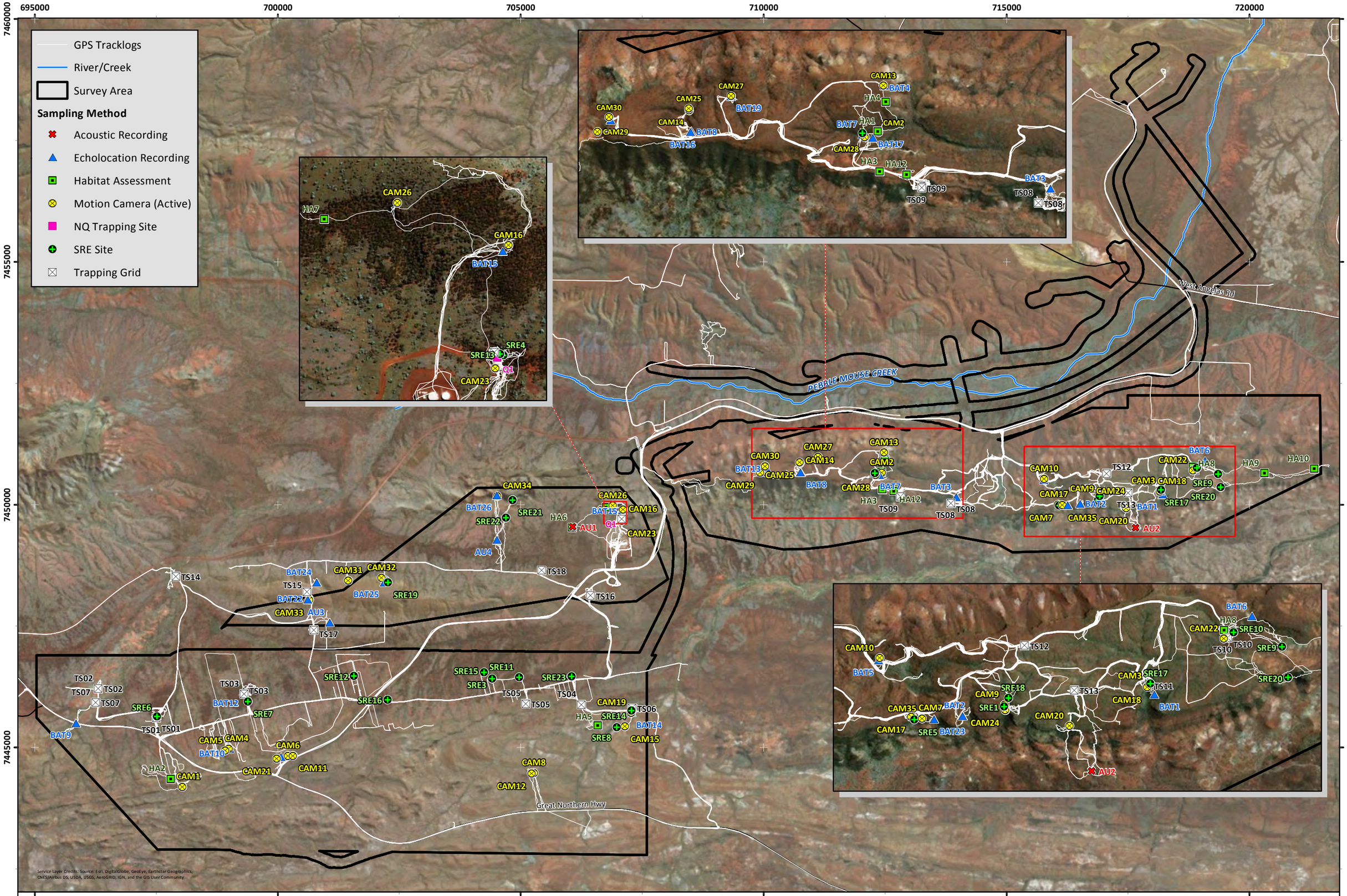

Rio Tinto

Hope Downs 2 Proposal Fauna Survey

Figure C.1: Fauna Sampling Locations within the Survey Area

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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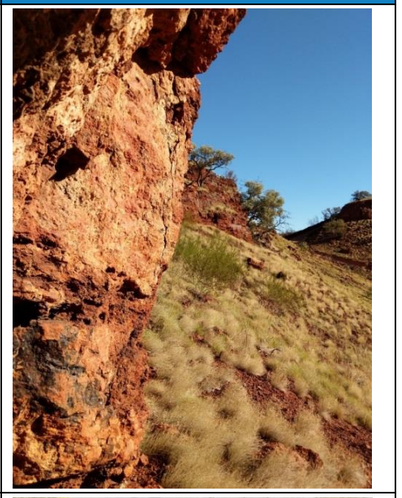
Table C.1: Astron fauna sampling locations.

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
Acoustic/echolocation recording sites												
BAT1	718218	7450208	Bedded Hilltop	1	Echolocation Recording	24/11/17	28/11/17	Gorge/Gully	1	None	Cracks and crevices; leaf litter; tree hollows	No photo available
BAT2	716514	7450015	Bedded Hilltop	1	Echolocation Recording	28/11/17	1/12/17	Gorge/Gully	1	Drill lines	Cracks and crevices; leaf litter; tree hollows	No photo available
BAT3	713964	7450155	Bedded Hilltop	1	Echolocation Recording	24/11/17	28/11/17	Breakaway	1	None	Brief shallow overhang; potential flyway through gully	No photo available
BAT4	712483	7451071	Bedded Hilltop	1	Echolocation Recording	28/11/17	1/12/17	Breakaway	1	Drill lines	Cracks and crevices; boulders	
BAT5	715766	7450509	Bedded Hilltop	1	Echolocation Recording	24/11/17	28/11/17	Rocky Hill	0.8	Tracks, Drill lines	Shallow overhangs; boulders and crevices	No photo available
BAT6	719087	7450901	Bedded Hilltop	1	Echolocation Recording	28/11/17	1/12/17	Breakaway	1	None	Steep sided gorge with numerous overhangs and caves (on edge)	No photo available
BAT7	712290	7450636	Bedded Hilltop	1	Echolocation Recording	24/11/17	28/11/17	Gorge/Gully (entrance of cave)	1	None	Cracks and crevices; boulders	No photo available
BAT8	710766	7450668	Bedded Hilltop	1	Echolocation Recording	28/11/17	1/12/17	Breakaway	1	Drill lines	Caves, hollows and crevices	
BAT9	695851	7445500	Hope Downs 2	1	Echolocation Recording	25/11/17	29/11/17	Minor Drainage	0.8	Grazing, clearing, weeds	Large Eucalypts with potential hollows	No photo available

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
BAT10	699015	7444976	Hope Downs 2	1	Echolocation Recording	29/11/17	1/12/17	Gorge/Gully (entrance of cave)	0.8	Drill lines, clearing	Caves, hollows and crevices	
BAT12	699301	7446157	Hope Downs 2	1	Echolocation Recording	29/11/17	1/12/17	Mulga Woodland	1	Drill lines	Limited microhabitats, sparse leaf litter, some termite mounds	No photo available
BAT13	710050	7450766	Bedded Hilltop	2	Echolocation Recording	18/05/18	23/05/18	Breakaway	0.8	Drill lines	Rocky outcrop, overhangs, crevices	
BAT14	707275	7445721	Hope Downs 2	2	Echolocation Recording	21/05/18	26/05/18	Minor Drainage	0.8	None	Logs, tree hollows, thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	
BAT15	707097	7449888	Wonmunna	2	Echolocation Recording	21/05/18	25/05/18	Rocky Hill	0.6	None	Rocky outcrop, crevices	

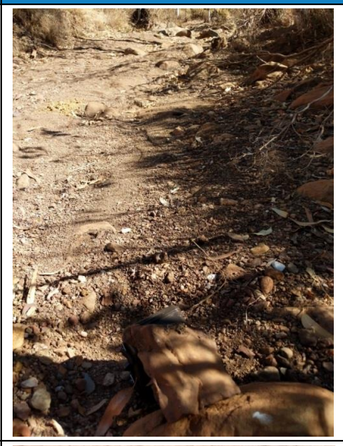
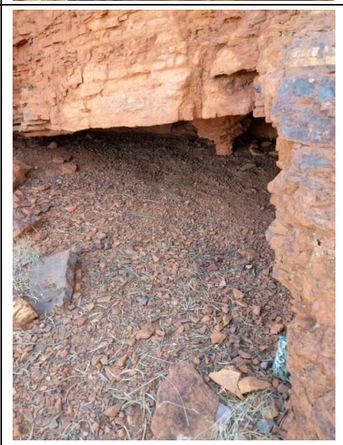
Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
BAT16	710759	7450661	Bedded Hilltop	2	Echolocation Recording	18/05/18	27/05/18	Breakaway	1	Drill lines	Caves	
BAT17	712383	7450606	Bedded Hilltop	2	Echolocation Recording	23/05/18	27/05/18	Gorge/Gully	1	None	Caves	
BAT19	711117	7450976	Bedded Hilltop	2	Echolocation Recording	20/05/18	25/05/18	Gorge/Gully	0.8	Drill lines	Rocky outcrop, caves, overhangs, logs, tree hollows, crevices, thick undergrowth, rock pile, leaf litter	
BAT21	700067	7444800	Hope Downs 2	2	Echolocation Recording	21/05/18	26/05/18	Breakaway	0.8	Roads	South facing, rocky outcrop, overhangs, crevices, rock pile	

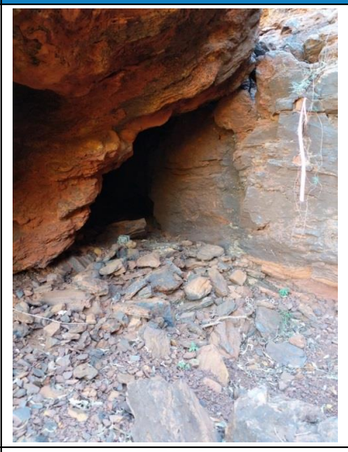
Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
BAT22#	700620	7448044	Wonmunna	3	Echolocation Recording	11/03/19	18/03/19	Gorge/Gully	0.8	Drill lines	South facing, rocky outcrops, overhangs, logs, crevices, rock piles	
BAT23	716260	7450002	Bedded Hilltop	3	Echolocation Recording	13/03/19	18/03/19	Breakaway	1	None	Overhangs, crevices, rock piles, leaf litter	
BAT25	702312	7448352	Wonmunna	3	Echolocation Recording	11/03/19	18/03/19	Gorge/Gully	1	None	Caves	
BAT26	704514	7450194	Wonmunna	3	Echolocation Recording	13/03/19	18/03/19	Breakaway	1	None	Overhangs, crevices, rock pile, leaf litter	

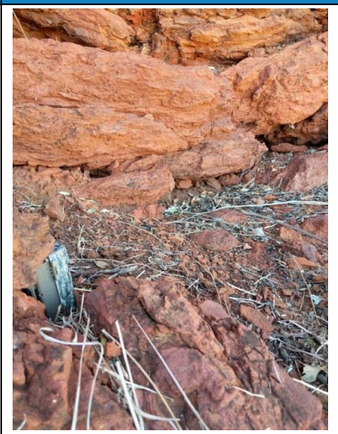
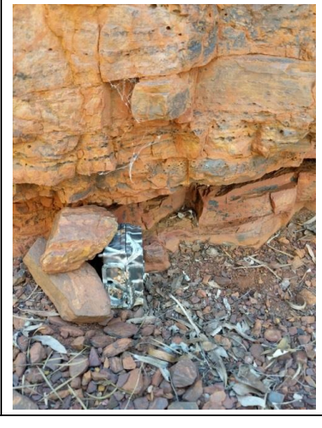
Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
AU1	706071	7449544	Wonmunna	2	Acoustic recording	21/05/18	25/05/18	Mulga Woodland	1	None	Thick undergrowth, old *Triodia*, leaf litter	
AU2	717660	7449529	Bedded Hilltop	2	Acoustic recording	20/05/18	27/05/18	Low Hills and Slopes	1	None	Leaf litter	
AU3	701074	7447576	Wonmunna	3	Acoustic Recording	11/03/19	18/03/19	Stony Plain	0.8	Drill lines	Logs, thick undergrowth, soft soil (burrows), rock piles, old *Triodia*, leaf litter, termite mounds	
AU4	704512	7449271	Wonmunna	3	Acoustic Recording	13/03/19	18/03/19	Stony Plain	1	None	Soft soil (burrows), old *Triodia*, leaf litter, termite mounds	

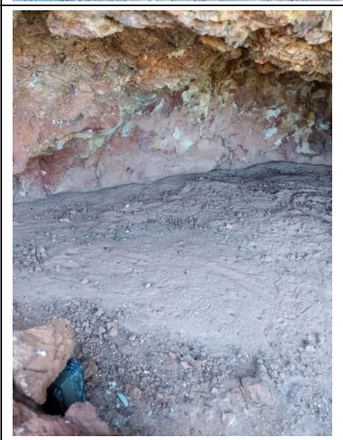
Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
BAT24*	700799	7448403	Wonmunna	3	Echolocation Recording	11/03/19	18/03/19	Gorge/Gully	1	None	Overhangs, crevices, leaf litter	
Motion sensitive camera sites												
CAM1	698036	7444190	Hope Downs 2	1	Camera (active)	26/11/17	1/12/17	Breakaway	1	None	Shallow overhangs; boulders and crevices	No photo available
CAM2	712432	7450658	Bedded Hilltop	1	Camera (active)	24/11/17	1/12/17	Gorge/Gully	1	None	Cracks and crevices; leaf litter; tree hollows	No photo available
CAM3	718157	7450285	Bedded Hilltop	1	Camera (active)	24/11/17	1/12/17	Gorge/Gully	1	None	Cracks and crevices; leaf litter; tree hollows	No photo available
CAM4	698989	7444977	Hope Downs 2	1	Camera (active)	26/11/17	1/12/17	Gorge/Gully	0.8	Tracks, drill lines	Rocky breakaway with shallow overhangs (day shelter)	No photo available
CAM5	698917	7444935	Hope Downs 2	1	Camera (active)	26/11/17	1/12/17	Gorge/Gully	0.8	Tracks, drill lines	Rocky breakaway with shallow overhangs (day shelter)	No photo available
CAM6	700214	7444832	Hope Downs 2	1	Camera (active)	25/11/17	1/12/17	Breakaway	1	None	Rocky breakaway with shallow caves (day shelter)	No photo available
CAM7	716072	7449996	Bedded Hilltop	1	Camera (active)	27/11/17	1/12/17	Breakaway	0.8	Drill lines	Shallow overhangs; boulders and crevices	

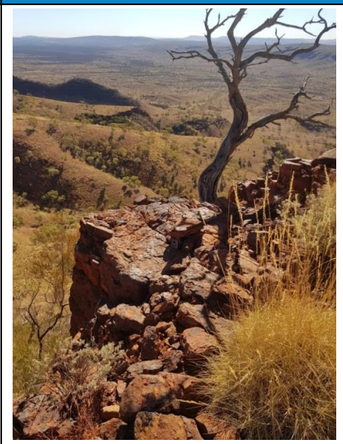
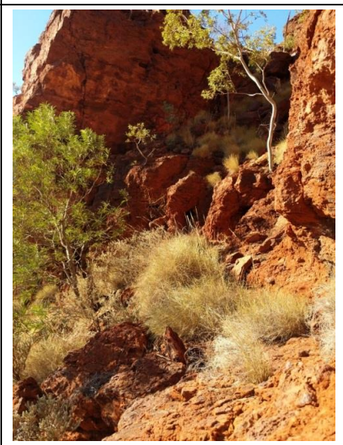
Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
CAM8	705275	7444478	Hope Downs 2	1	Camera (active)	25/11/17	1/12/17	Breakaway	1	None	Rocky breakaway with shallow caves (day shelter)	
CAM9	716887	7450118	Bedded Hilltop	1	Camera (active)	26/11/17	1/12/17	Gorge/Gully	1	None	Shallow overhangs; boulders and crevices	
CAM10	715775	7450532	Bedded Hilltop	1	Camera (active)	24/11/17	1/12/17	Rocky Hill	0.8	Tracks, drill lines	Shallow overhangs; boulders and crevices	No photo available
CAM11	700313	7444832	Hope Downs 2	1	Camera (active)	25/11/17	1/12/17	Breakaway	1	None	Rocky breakaway with shallow caves (day shelter)	No photo available
CAM12	705222	7444468	Hope Downs 2	1	Camera (active)	25/11/17	1/12/17	Breakaway	1	None	Rocky breakaway with shallow caves (day shelter)	
CAM13	712477	7451075	Bedded Hilltop	1	Camera (active)	25/11/17	1/12/17	Breakaway	0.8	Tracks, drill lines	Rock cracks and crevices; overhangs; deep leaf litter and logs; cracks in logs	No photo available
CAM14	710747	7450853	Bedded Hilltop	1	Camera (active)	25/11/17	1/12/17	Breakaway	0.8	Tracks, drill lines	Rock cracks and crevices; overhangs; deep leaf litter and logs; cracks in logs	No photo available

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
CAM15	707148	7445434	Hope Downs 2	2	Camera (active)	23/05/18	26/05/18	Minor Drainage	0.8	Grazing, weeds	Logs, tree hollows, leaf litter	
CAM16	707107	7449901	Wonmunna	2	Camera (active)	21/05/18	25/05/18	Rocky Hill	1	None	Rocky outcrop, caves, overhangs, crevices	
CAM17	716057	7450006	Bedded Hilltop	2	Camera (active)	22/05/18	27/05/18	Breakaway	1	None	South facing, rocky outcrop, overhangs, crevices, rock pile, leaf litter	

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
CAM18	718154	7450273	Bedded Hilltop	2	Camera (active)	20/05/18	27/05/18	Gorge/Gully	1	None	South facing, moist, rocky outcrop, caves, overhangs, logs, tree hollows, crevices, thick undergrowth, rock pile, leaf litter	
CAM19	707275	7445716	Hope Downs 2	2	Camera (active)	21/05/18	26/05/18	Minor Drainage	0.8	Weeds	Logs, tree hollows, thick undergrowth, old *Triodia*, leaf litter	
CAM20	717463	7449927	Bedded Hilltop	2	Camera (active)	20/05/18	20/05/18	Gorge/Gully	0.8	None	South facing, rocky outcrop, tree hollows, crevices, leaf litter	

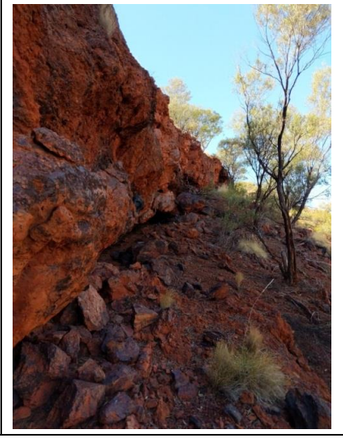
Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
CAM21	699981	7444771	Hope Downs 2	2	Camera (active)	21/05/18	26/05/18	Breakaway	1	None	Rocky outcrop, overhangs, crevices, rock pile, leaf litter	
CAM22	718837	7450704	Bedded Hilltop	2	Camera (active)	20/05/18	26/05/18	Gorge/Gully	1	None	Overhangs	No photo available
CAM23	707082	7449669	Wonmunna	2	Camera (active)	23/05/18	26/05/18	Gorge/Gully	1	Drill lines	South facing, moist, rocky outcrop, overhangs, crevices, rock pile, leaf litter	
CAM24	716893	7450067	Bedded Hilltop	2	Camera (active)	22/05/18	27/05/18	Gorge/Gully	1	None	Rocky outcrop, caves, overhangs, tree hollows, crevices, thick undergrowth, rock pile, leaf litter	

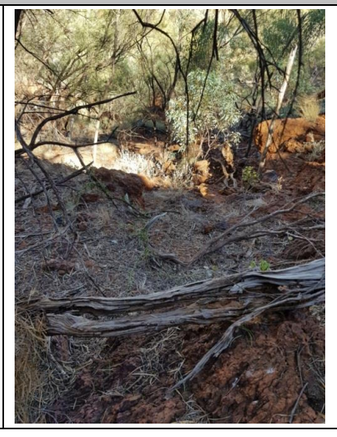
Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
CAM25	710744	7450871	Bedded Hilltop	2	Camera (active)	18/05/18	27/05/18	Rocky Hill	0.8	Drill lines	Caves, overhangs, logs ,tree hollows, crevices, rock pile, leaf litter	
CAM26	706898	7449980	Wonmunna	2	Camera (active)	21/05/18	25/05/18	Rocky Hill	1	None	Rocky outcrop, overhangs, logs, tree hollows	
CAM27	711120	7450982	Bedded Hilltop	2	Camera (active)	20/05/18	27/05/18	Gorge/Gully	0.8	Drill lines	Rocky outcrop, caves, overhangs, logs, tree hollows, crevices, thick undergrowth, rock pile, leaf litter	
CAM28	712309	7450614	Bedded Hilltop	2	Camera (active)	22/05/18	27/05/18	Gorge/Gully	0.8	Drill lines	South facing, rocky outcrop, caves, overhangs, logs, tree hollows, crevices, rock pile, leaf litter	

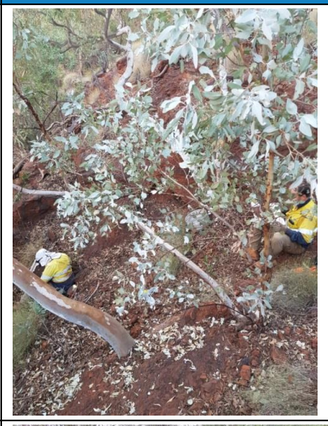
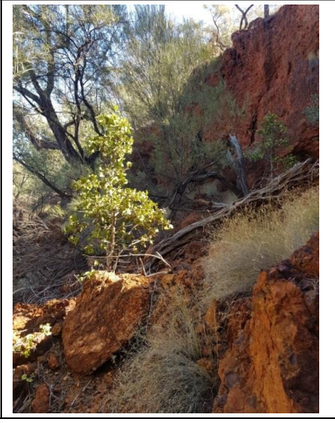
Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
CAM29	709931	7450663	Bedded Hilltop	2	Camera (active)	20/05/18	27/05/18	Rocky Hill	0.6	None	Rocky outcrop, overhangs, logs, tree hollows	
CAM30	710033	7450792	Bedded Hilltop	2	Camera (active)	18/05/18	27/05/18	Breakaway	1	None	Rocky outcrop, overhangs, crevices	
CAM32	702136	7448494	Hope Downs 2	3	Camera (active)	11/03/19	18/03/19	Gorge/Gully	0.8	Drill lines	Rocky outcrop, caves, overhangs, thick undergrowth, rock piles	

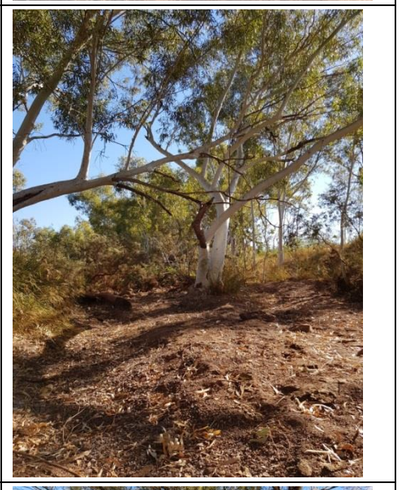
Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
CAM33	700647	7448043	Hope Downs 2	3	Camera (active)	11/03/19	18/03/19	Gorge/Gully	0.8	Drill lines	South facing, rocky outcrop, overhangs, logs, crevices, rock piles	
CAM34	704520	7450177	Wonmunna	3	Camera (active)	13/03/19	18/03/19	Breakaway	1	None	Overhangs, crevices, rock piles, leaf litter	
CAM35	716150	7449991	Bedded Hilltop	3	Camera (active)	11/03/19	18/03/19	Breakaway	1	None	South facing, moist, caves, overhangs, rock piles, leaf litter	
CAM31*	701449	7448438	Hope Downs 2	3	Camera (active)	11/03/19	18/03/19	Gorge/Gully	1	None	Overhangs	

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
Habitat assessment sites												
HA1	712426	7450668	Bedded Hilltop	1	Other	24/11/17	N/A	Gorge/Gully	1	None	Cracks and crevices; leaf litter; tree hollows	
HA2	697800	7444359	Hope Downs 2	1	Other	24/11/17	N/A	Low Hills and Slopes	0.8	Drill lines	Spinifex hummocks and dead stags	
HA3	712444	7450310	Bedded Hilltop	1	Other	25/11/17	N/A	Rocky Hill	0.8	Tracks, drill lines	Tree hollows; rocky outcropping; spinifex hummocks	No photo available
HA4	712497	7450930	Bedded Hilltop	1	Other	25/11/17	N/A	Breakaway	0.8	Tracks, drill lines	Rock cracks and crevices; overhangs; deep leaf litter and logs; cracks in logs	No photo available
HA5	706586	7445460	Hope Downs 2	1	Other	25/11/17	N/A	Breakaway	1	None	Rocky breakaway with shallow caves (day shelter)	No photo available
HA6	706063	7449531	Wonmunna	2	Other	21/05/18	N/A	Mulga Woodland	1	None	Thick undergrowth, old *Triodia*, leaf litter	

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
HA7	706761	7449949	Wonmunna	2	Other	21/05/18	N/A	Rocky Hill	1	None	Rocky outcrop, logs, crevices	
HA8	718838	7450779	Bedded Hilltop	2	Other	22/05/18	N/A	Gorge/Gully	1	None	Rocky outcrop, caves, overhangs, thick undergrowth, old *Triodia*, leaf litter	
HA9	720309	7450652	Bedded Hilltop	2	Other	24/05/18	N/A	Breakaway	1	None	South facing, rocky outcrop, caves, overhangs, crevices	

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
HA10	721334	7450737	Bedded Hilltop	2	Other	24/05/18	N/A	Rocky Hill	1	None	Old *Triodia*, leaf litter	
HA11	721637	7450813	Bedded Hilltop	2	Other	24/05/18	N/A	Rocky Hill	1	None	Rock pile, leaf litter	
HA12	712682	7450284	Bedded Hilltop	2	Other	25/05/18	N/A	Rocky Hill	0.8	Drill lines, roads	Leaf litter	
Active SRE foraging sites												
SRE1	716881	7450100	Bedded Hilltop	1	Other	22/05/18	N/A	Gorge/Gully	0.8	None	Logs, leaf litter	

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
SRE2	712291	7450649	Bedded Hilltop	1	Other	22/05/18	N/A	Gorge/Gully	0.8	None	South facing, rocky outcrop, caves, overhangs, logs, tree hollows, crevices, rock pile, leaf litter	
SRE3	704413	7446421	Hope Downs 2	1	Other	25/05/18	N/A	Minor Drainage	0.8	Drill lines	Logs, crevices, old *Triodia*, leaf litter, termite mounds	
SRE4	707098	7449693	Wonmunna	1	Other	25/05/18	N/A	Gorge/Gully	1	None	South facing, moist, rocky outcrop, overhangs, logs, crevices, rock pile, leaf litter	
SRE5	716083	7449984	Bedded Hilltop	1	Other	22/05/18	N/A	Breakaway	0.8	None	South facing, moist, rocky outcrop, overhangs, logs, crevices, rock pile, old *Triodia*, leaf litter	

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
SRE6	697516	7445637	Hope Downs 2	1	Other	23/05/18	N/A	Mulga Woodland	0.6	Drill lines, roads, rubbish	Soft soil (burrows), leaf litter, termite mounds	
SRE7	699385	7445954	Hope Downs 2	1	Other	23/05/18	N/A	Mulga Woodland	0.4	Drill lines, roads	Soft soil (burrows), leaf litter, termite mounds	
SRE8	706977	7445419	Hope Downs 2	1	Other	23/05/18	N/A	Minor Drainage	0.6	Grazing	Logs, tree hollows, soft soil (burrows), leaf litter	
SRE9	719353	7450631	Bedded Hilltop	1	Other	24/05/18	N/A	Breakaway	1	None	South facing, rocky outcrop, overhangs, logs, tree hollows, crevices, rock pile, leaf litter	

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
SRE10	718923	7450760	Bedded Hilltop	1	Other	24/05/18	N/A	Gorge/Gully	0.8	Drill lines	South facing, rocky outcrop, caves, overhangs, logs, tree hollows, crevices, semi-permanent water, rock pile, leaf litter	
SRE11	704970	7446447	Hope Downs 2	1	Other	25/05/18	N/A	Stony Plain	0.8	Drill lines, roads	Leaf litter	
SRE12	701571	7446480	Hope Downs 2	3	Other	14/03/19	N/A	Mulga Woodland	0.8	Grazing, drill lines	Thick undergrowth, leaf litter, termite mounds	
SRE13	707092	7449696	Wonmunna	3	Other	09/03/19	N/A	Gorge/Gully	0.8	Drill lines	Rocky outcrops, overhangs, logs, rock piles, leaf litter	

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
SRE14	707283	7445763	Hope Downs 2	3	Other	17/03/19	N/A	Minor Drainage	0.8	Grazing, drill lines	Moist, logs, tree hollows, thick undergrowth, rock piles, old *Triodia*, leaf litter	
SRE15	704246	7446549	Hope Downs 2	3	Other	17/03/19	N/A	Mulga Woodland	1	Drill lines	Logs, tree hollows, old *Triodia*, leaf litter	
SRE16	702264	7445989	Hope Downs 2	3	Other	10/03/19	N/A	Mulga Woodland	1	Drill lines	Logs, soft soil (burrows), leaf litter, termite mounds	
SRE17	718183	7450305	Bedded Hilltop	3	Other	11/03/19	N/A	Gorge/Gully	0.8	None	South facing, moist, caves, overhangs, logs, rock piles, leaf litter	

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
SRE18	716920	7450177	Bedded Hilltop	3	Other	11/03/19	N/A	Gorge/Gully	0.8	None	South facing, overhangs, logs, crevices, rock piles, leaf litter	
SRE19	702270	7448405	Wonmunna	3	Other	12/03/19	N/A	Gorge/Gully	0.8	None	South facing, overhangs, logs, crevices, leaf litter	
SRE20	719408	7450358	Bedded Hilltop	3	Other	13/03/19	N/A	Gorge/Gully	1	None	South facing, rocky outcrops, overhangs, logs, tree hollows, crevices, rock piles	
SRE21	704835	7450098	Wonmunna	3	Other	14/03/19	N/A	Rocky Hill	1	None	South facing, rocky outcrops, logs, crevices, rock piles, Leaf litter	

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
SRE22	704698	7449733	Wonmunna	3	Other	14/03/19	N/A	Stony Plain	1	None	Logs, tree hollows, soft soil (burrows), leaf litter	
SRE23	706050	7446465	Hope Downs 2	3	Other	16/03/19	N/A	Mulga Woodland	0.8	Drill lines	Tree hollows, thick undergrowth, old *Triodia*, leaf litter, termite mounds	
Trapping sites												
TS01	697504	7445613	Hope Downs 2	1,2	Trapping grid	22/11/17 19/05/18	29/11/17 26/05/18	Mulga Woodland	1	Tracks	Limited microhabitats, sparse leaf litter, some termite mounds	
TS02	696308	7446214	Hope Downs 2	1,2	Trapping grid	22/11/17 19/05/18	29/11/17 26/05/18	Alluvial Plain	0.8	Grazing	Dense leaf litter, termite mounds and spinifex clumps; cracking clays	

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
TS03	699311	7446105	Hope Downs 2	1, 2	Trapping grid	22/11/17 19/05/18	29/11/17 26/05/18	Mulga Woodland	0.6	Vehicular	Limited microhabitats, sparse leaf litter	
TS04	706249	7445883	Hope Downs 2	1, 2	Trapping grid	22/11/17 19/05/18	29/11/17 26/05/18	Stony Plain	0.8	Grazing, roads	Limited leaf litter, termite mounds and spinifex clumps	
TS05	705107	7445902	Hope Downs 2	1, 2	Trapping grid	23/11/17 19/05/18	30/11/17 26/05/18	Low Hills and Slopes	0.8	Tracks, drill lines	Limited leaf litter, termite mounds and spinifex clumps	
TS06	707293	7445814	Hope Downs 2	1, 2	Trapping grid	23/11/17 19/05/18	30/11/17 26/05/18	Minor Drainage	0.8	Grazing, tracks	Large Eucalypts with hollows; deep leaf litter	
TS07	696251	7445929	Hope Downs 2	1, 2	Trapping grid	24/11/17 19/05/18	1/12/17 26/05/18	Minor Drainage	0.6	Grazing, tracks, roads, weeds	Large Eucalypts with hollows; deep leaf litter; dense grass ground cover	

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
TS08	713854	7450029	Bedded Hilltop	1, 2	Trapping grid	24/11/17 19/05/18	1/12/17 26/05/18	Breakaway	1	None	Rocky overhangs, crevices and small caves; low levels of leaf litter, sparse open vegetation.	
TS09	712816	7450165	Bedded Hilltop	1, 2	Trapping grid	24/11/17 19/05/18	1/12/17 26/05/18	Breakaway	1	None	Rocky overhangs, crevices and small caves; low levels of leaf litter, sparse open vegetation.	
TS10	718871	7450712	Bedded Hilltop	1, 2	Trapping grid	24/11/17 19/05/18	1/12/17 26/05/18	Gorge / Gully	1	None	Rocky overhangs, crevices and small caves; dense deep leaf litter, open vegetation.	
TS11	718171	7450286	Bedded Hilltop	1,2	Trapping grid	24/11/17 19/05/18	1/12/17 26/05/18	Gorge / Gully	1	None	Steep sided gorge with numerous overhangs and caves	
TS12	717063	7450643	Bedded Hilltop	2	Trapping grid	20/05/18	27/05/18	Rocky Hill	1	Drill lines	Rocky outcrop, old *Triodia*, leaf litter	

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
TS13	717506	7450245	Bedded Hilltop	2	Trapping grid	20/05/18	27/05/18	Rocky Hill	1	Drill lines	Logs, thick undergrowth, rock pile, leaf litter	
TS16	706437	7448130	Wonmunna	3	Trapping grid	10/03/19	17/03/19	Low Hills and Slopes	1	None	Leaf litter, termite mounds	
TS18	705435	7448646	Wonmunna	3	Trapping grid	09/03/19	17/03/19	Mulga Woodland	1	None	Tree hollows, thick undergrowth	
TS19	707081	7449700	Wonmunna	3	Trapping grid	09/03/19	16/03/19	Breakaway	1	None	Rocky outcrops, caves, overhangs, logs, crevices, thick undergrowth	
Q1	707086	7449689	Wonmunna	2	Trapping grid	25/05/18	26/05/2018	Gorge/Gully	1	None	South facing, moist, rocky outcrop, caves, overhangs, logs, crevices, leaf litter	No photo available

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
TS14*	697906	7448526	Wonmunna	3	Trapping grid	09/03/19	17/03/19	Alluvial Plain	0.8	Grazing, weeds	Logs, tree hollows, thick undergrowth	
TS15*	700605	7448201	Wonmunna	3	Trapping grid	10/03/19	17/03/19	Rocky Hill	1	None	Rock piles, leaf litter, termite mounds	
TS17*	700743	7447421	Wonmunna	3	Trapping grid	11/03/19	18/03/19	Stony Plain	1	None	Logs, thick undergrowth, old *Triodia*, leaf litter, termite mounds	

Habitat Condition: 1 (Excellent); 0.8 (Very Good); 0.6 (Good); 0.4 (Poor); 0.2 (Very Poor); 0.1 (Completely Degraded)

Failed to operate

*Recorded outside the survey area due to survey boundary changes post survey.

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Appendix D: Alacran Environmental Services and Western Australian Museum Report

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Alacran Environmental Science

Report No. 1901

Short-range Endemic Assessment of Invertebrates from the Hope Downs 2 Level 2 Survey Area

Prepared for

Astron (Rio Tinto)



Antichiropus 'wonmunna'

ABN 33577027061

www.alacranenvironmental.com

Document Version

Version	Author	Date submitted	Delivered to
Version 4	E.S. Volschenk	6 October 2019	Jessica Johnston (Astron)

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Limitation: The purpose of this report is to inform Astron about the identity and distribution of conservation significant invertebrates (short-range endemics) within the proposed Short-range Endemic Assessment of Invertebrates from the Hope Downs 2 Level 2 Survey Area. Alacran Environmental Science accepts no liability or responsibility for any use or reliance on this report for any other purpose. The accuracy and completeness of the information supplied by Astron or other data sources including (but not limited to) The Western Australian Museum, The Australian Bureau of Meteorology or the Western Australian Department of Minerals and Petroleum, have not been reviewed or verified.

EXECUTIVE SUMMARY

This report presents the findings of a desktop study, and the identification and SRE (short-range endemic) assessment of invertebrates sampled during two field surveys undertaken by Astron. The information in this report is intended to be used by Astron in their preparation of an overarching fauna report for Rio Tinto. The aim of that report is to provide information to Rio Tinto to enhance the level of knowledge about fauna within the Hope Downs 2 Level 2 Survey Area (the Study Area). This information is also intended to inform any future environmental impact assessment within the region.

The study area occupies 10,817.7 ha and is located approximately 75 km west north-west of Newman.

The desktop assessment of SRE invertebrates was undertaken within approximately 40,000 km^2 square area (the Search Area) centred on the Study Area. Database searches were undertaken for SRE invertebrate records from the W. A. Museum's Arachnids and Myriapods, Crustaceans and Molluscs databases. These data were subsequently edited to enforce consistency in naming and then filtered for SREs and potential SREs.

The database search yielded 12,376 records from within the Search Area. Of those, 4,335 records were attributed to SRE groups, SREs and Potential SREs. The SRE groups represented 282 taxa, of which eight (2.8%) represented named species, 182 (64.5%) represented named morphospecies and 92 (32.6%) represented unidentified species belonging to taxa known to contain SRE representatives. Twenty-four (24) species and morphospecies represented SREs with the remaining 258 taxa being Potential SRE owing largely to data deficiency (DD).

The field surveys generated a total of 202 samples from SRE target taxa comprising 67 different taxa. Eighteen (18) of these species were known to be widespread, 48 were either likely or potential SREs and one confirmed SRE, *Karaops banyjima*. Of these SRE category taxa, 32 were identified to the level of species or morphospecies:

- seven spiders: *Karaops banyjima*, *Karaops* 'ARA001', *Aurecocrypta* 'MYG315', *Aurecocrypta* 'HD1', *Synothele* 'MYG309', *Synothele* 'MYG311' and *Yilgarnia* 'MYG197';
- nine pseudoscorpions: *Tyrannochthonius* 'HD1', *Tyrannochthonius* 'HD2', *Austrohorus* 'HD5', *Beierolpium* 'HD1', *Beierolpium* 'HD2', *Euryolpium* 'HD6', *Euryolpium* 'HD7', 'Genus 7/4 PSE118', 'PSEAAA HD4';
- four scorpions; *Lychas* 'bituberculatus complex', *Lychas* 'hairy tail complex', *Lychas* 'multipunctatus complex', *Urodacus* 'HD1';
- seven centipedes: *Sepedonophilus* 'HD1', *Sepedonophilus* 'HD2', *Mecistocephalus* 'HD1', *Mecistocephalus* 'HD2', *Mecistocephalus* 'HD3', *Orphnaeus* 'HD1', *Cryptops* 'HD1',
- three millipedes: *Antichiropus* 'wonmunna', *Austrostrophus* 'Clade A', *Austrostrophus* 'Clade E', and
- two isopods: *Buddelundia* '10ma', *Buddelundia* '77'.

Seventeen (17) SRE taxa sampled represent ambiguously identified groups:

- three spiders: *Synothele* sp., *Aname* sp., Nemesiidae sp.;
- five pseudoscorpions: *Anatemnus* sp., *Sundochernes* sp., *Indolpium* sp., *Euryolpium* sp., Olpiidae sp.;
- two centipedes: *Sepedonophilus* sp., Geophilomorpha sp.;

- two millipedes: *Antichiropus* sp. and *Austrostrophus* sp., and
- five isopods: *Buddelundia* sp., Buddelundiinae sp., *Pseudodiploexochus* sp., *Troglarmadillo* sp., Philosciidae sp.

Habitat mapping was undertaken by Astron and five habitats stand out as being conducive to relictual SREs: Breakaways, Mulga Woodland, Minor Drainage lines, Gorges and Gullies, and Rocky Hills. Most of these latter habitats are associated with an isolated ridge running in an east-west direction, so most of the breakaways and rocky slopes are south-facing and therefore conducive to SREs.

Several SRE category invertebrates were found in multiple habitat types, suggesting that they may be less specialised with respect to their habitat preferences:

- *Lychas* 'bituberculatus complex', from stony hills and eucalypt woodland;
- *Sepedenophilus* 'HD1', from rocky slopes and gullies, and mulga woodland;
- *Mecistocephalus* 'HD1', from rocky slopes and gullies, and mulga woodland;
- *Austrostrophus* 'Clade E', from mulga woodland and open eucalypt woodland;
- *Antichiropus* 'wonmunna', from mulga woodland in this study area, but from gully slopes and riparian vegetation outside of this study area.

These species are likely to be found outside of the limits of the study area.

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1 INTRODUCTION

1.1 SCOPE

In March 2019, Rio Tinto (Rio) commissioned Astron and Alacran Environmental Science (Alacran) to undertake a second (wet-season) short-range endemic invertebrate (SRE) survey within the Hope Downs 2 Level 2 Survey Area (10,817.7 ha) located approximately 75 km WNW of Newman (the Study Area), Figure 2.1. These areas form part of the larger Hope Downs 1 Development Envelope.

This survey followed from an initial Level 2 survey undertaken in May 2018 (Here after referred to as "T1") which yielded a modest collection (110 specimens) comprising 11 SREs and potential SREs:

- two trapdoor spiders: *Gaius* sp. and *Nemesiidae* sp.;
- four pseudoscorpion taxa: *Austrohorus* sp., *Indolpium* sp., Olpiide sp. and *Tyrannochthonius aridus*.
- three scorpion taxa*: Lychas* 'bituberculatus complex', *Lychas* 'multipunctatus complex' and *Lychas* 'hope downs';
- one earth centipede (Geophilomorpha): *Sepedenophilus* sp.; and
- one isopod: *Buddelundia* sp.

In the time since that survey, two species can be removed from the list:

- the genus *Gaius* (Rix et al. 2018c) was revised subsequent to the report and *Gaius* sp. is now known to represent the species *Gaius tealei* which is widespread in the Pilbara;
- *Lychas* 'hope downs' is the same as *Lychas* 'harveyi complex' following examination of additional specimens of *Lychas* 'harveyi complex' obtained from the T2 survey. *Lychas* 'harveyi complex' is a widespread species in the Pilbara.

One of the primary limiting factors for that survey was the dry conditions during and preceding the survey, reflecting the suboptimal season for undertaking SRE surveys.

The present survey aimed to bolster the survey effort for SREs in the study area by surveying in March, in the latter half of the Pilbara wet season (EPA 2016). The present report combined the results from both surveys and therefore supersedes report No. 1807 (Alacran 2018).

The overall purpose of the survey was to gather additional biological information through a desktop study and intensive field surveys to enhance and contextualise the level of knowledge at the locality scale.

Alacran provided specialist support for the short-range endemic component of the survey by way of:

- recommending likely field locations within the Study Area to undertake SRE sampling (T1 and T2),
- guided SRE field survey (T2),
- undertaking a desktop assessment including area searches of relevant W. A. Museum databases,
- identification and SRE assessment of field samples (T1 and T2),
- coordinating DNA sequencing and analyses of target samples.

OVERVIEW

1.1.1 Short-range endemism

Short-range endemics are organisms with small geographic distributions (Harvey 2002b; Ponder and Colgan 2002), nominally less than 10,000 km^2(Harvey 2002b). These organisms are typically characterised by one or more of the following characteristics:

- limited dispersal capabilities,
- seasonal activity (cooler or wetter periods),
- slow growth, and
- low levels of fecundity.

Their limited dispersal capabilities result in small populations being isolated from each other by inhospitable geographic features such as rivers, rocky ridges or plains. Prolonged isolation between populations eventually results in speciation, with each population becoming genetically and morphologically distinct. Two types of short-range endemism have been recognised: Relictual Endemism and Habitat Specialist Endemism (Harvey 2002b; Ponder and Colgan 2002).

Relictual SREs result when speciation occurs following the fragmentation of continuous habitat into two or more refugia. In Australia, the primary driver of this over the last 65 million years has been aridification, which acted to isolate formerly widespread species living in mesic forests to small patches of mesic refugia. Relictual SREs include scorpions in the genus *Aops* (Volschenk and Prendini 2008), pseudoscorpions in the genera *Tyrannochthonius* (Harvey 1991; Edward and Harvey 2008), *Indohya* (Harvey 1993b; Harvey and Volschenk 2007) and *Idioblothrus* (Muchmore 1982; Harvey 1993a; Harvey and Leng 2008b) and millipedes in the genus *Antichiropus* (Car et al. 2013; Car and Harvey 2014). Troglobites (obligate subterranean species) are thought to be extreme examples of relictual SREs; most troglobites from the Pilbara have surface dwelling relatives living in the more mesic forests of northern Australia (Harvey 2002b; Ponder and Colgan 2002).

Habitat specialist SREs are species that have adapted to very specific environment types, including those found in arid environments (e.g. rocky outcrops or isolated dune systems). These habitats are often relatively young (<10 million years) and therefore are not refugial. Examples of habitat specialist SREs include spiders in the family Selenopidae and pseudoscorpions in the genera *Synsphyronus* (Harvey 2011b, 2012) and *Feaella* (Harvey 1989; Harvey and Volschenk 2007), and scorpions in the genera *Lychas* and *Urodacus*.

2 METHODS

2.1 DEFINING SHORT-RANGE ENDEMISM

Assessment of short-range endemism can be challenging when data for evaluation are absent or limited. Limitations may include any of the following:

- **Poor survey coverage,** e.g. the fauna of an area has not been sampled extensively enough to enable assessment of species distributions. The absence of a species from survey records may not mean that it is absent from the area.
- **Poor taxonomic resolution,** e.g. a species has not been subject to systematic investigation, and/or the identity is either difficult or impossible to determine. Good taxonomic resolution does not necessarily need to be in the form of published revisions, as it can be facilitated by any of the following:
  - a researcher actively working on the group who can authorise identifications,
  - a publicly accessible reference collection, and/or;
  - assessment of species boundaries using genomic methods such as DNA barcoding (Hebert et al. 2003a; Hebert et al. 2003b).
- **Identification issues**, e.g. surveys sampled life stages of SREs that are impossible to identify based on morphological characters. Examples of relevant taxa include juvenile or female millipedes, mygalomorph spiders and *Urodacus* scorpions. Genomic methods have great potential to overcome this type of limitation.

There are no published systems for assessing the SRE potential for a species. The W. A. Museum previously employed the following system to assess SRE-status of invertebrates:

- **Confirmed SRE:** This category applies when the identity of the taxon is unambiguous, and its distribution is less than 10 000km^2 based on publicly available vouchered records. Supporting data can be either genomic (from DNA sequences) or morphological, ideally both.
- **Potential SRE:** This category applies to situations where there are knowledge gaps for the taxon. The following sub-categories further elucidate this status:
  - **Data Deficiency (DD):** This category covers taxa for which there is insufficient data available to determine SRE status. Factors that fall under this category include:
    - insufficient geographic information,
    - insufficient taxonomic information, and/or
    - inappropriate life stages prevent identification to species level.
  - **Habitat Indicators (H):** This category employs habitat characteristics to evaluate SRE status when habitats are known to support SRE taxa. For example, many species sampled from subterranean habitats are known to be range restricted; a new species discovered from such habitat therefore has greater potential to be range restricted (i.e. an SRE) than widespread.
  - **Morphological Evidence (M):** This category uses one or more morphological characters that are characteristic of SRE taxa inhabiting restricted environments, e.g. the specialised morphological features of animals adapted to subterranean habitats, including body markings that are absent or significantly paler than surface dwelling relatives, eyes that are absent or significantly reduced, and/or longer appendages (legs and antennae) than surface relatives.
  - **Unpublished Research & Expertise (U):** This category relies on unpublished research or expertise to develop SRE status.

These categories of potential SRE may be helpful in developing conservation priorities; however, each taxon should be assessed on its merit and in accordance with the *Precautionary Principle* (EPA 2002):

> "*where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation*".

— **Widespread (not an SRE)**: This category applies when vouchered evidence demonstrates a distribution greater than 10,000 km^2.

2.2 TAXONOMY

The taxonomic nomenclature of invertebrates follows the references detailed in Table 2.1. Morphospecies designations follow the parataxonomy of the scientist(s) working on the group; these informal names are written between single quotation marks rather than being italicised as they are not valid under the International Code of Zoological Nomenclature (1999).

Alacran follows the "Phylogenetic Species Concept" (Cracraft 1983) when delineating species or morphospecies:

> "A species is the smallest diagnosable cluster of individual organisms within which there is a parental pattern of ancestry and descent."

2.2.1 Identification

For this report, Dr Simon Judd contributed information about isopod distributions, SRE assessment and specimen identification. The remaining identifications (spiders, pseudoscorpions, scorpions, millipedes, centipedes, silverfish and snails) were carried out by the Dr Erich Volschenk. The references used for species determination are summarised in Table 2.1.

Where morphological identification was not possible, attempts were made to assess the identity of the specimen using DNA Barcoding of the gene COI (Cytochrome C oxidase subunit I). The DNA barcoding study for this survey is detailed in Appendix 3.

Table 2.1. The following 'general' references and collections were used to assist with morphospecies designations

Order	Taxonomic reference	Morphospecies and reference collection
Araneae	(Raven et al. 2002; Crews and Harvey 2011; Harvey et al. 2012; Crews 2013; World Spider Catalog 2014; Castalanelli et al. 2017; Rix et al. 2017a; Rix et al. 2017b; Harrison et al. 2018; Harvey et al. 2018; Rix et al. 2018a; Rix et al. 2018b; Rix et al. 2018c)	Reference collection at the W. A. Museum
Pseudoscorpiones	(Harvey 1992; Harvey and Volschenk 2007; Edward and Harvey 2008; Harvey and Leng 2008a; Murienne et al. 2008; Harvey 2011a, 2012, 2013b; Alexander et al. 2014; Harrison et al. 2014; Harvey et al. 2016)	Reference collection at the W. A. Museum
Scorpiones	(Glauert 1925b, a; Acosta 1990; Kovařík 1997; Fet et al. 2000; Volschenk et al. 2000; Volschenk and Prendini 2008; Volschenk et al. 2010)	Morphospecies designation by Dr Erich S Volschenk. Reference collection at the W. A. Museum and with Dr Erich S. Volschenk.
Chilopoda	(Colloff et al. 2005)	Reference collection at the W. A. Museum
Diplopoda	(Car and Harvey 2013; Car et al. 2013; Car and Harvey 2014)	Reference collection at the W. A. Museum
Isopoda	(Judd and Horwitz 2003; Schmalfuss 2003; Judd 2004; Schmidt and Leistikow 2004; Schotte et al. 2008; Judd and Perina 2013)	Morphospecies designation by Dr Simon Judd. Reference collection at the W. A. Museum and with Dr Simon Judd.
Gastropoda	(Solem 1985, 1997; Johnson et al. 2004; Johnson et al. 2012; Whisson and Köhler 2012; Johnson et al. 2013; Whisson and Kirkendale 2014; Stanasic et al. 2017)	Reference collection at the W. A. Museum

2.2.2 Specimen Lodgement and Data Access

In accordance with *EPA Guidance Statement 20* (2009), specimens submitted to Alacran for taxonomic identification will be offered to the W. A. Museum for inclusion in their biological collections.

Supporting data are attached as appendices:

Appendix 1. Short-range endemic records from an area search by the W. A. Museum.
Appendix 2. Short-range endemic and target group records from the field survey.
Appendix 3. Targeted DNA barcoding of Invertebrates from the Hope Downs 2 Project Area.

2.3 DESKTOP ASSESSMENT

2.3.1 Database search

2.3.1.1 Search area

For this report, the Search Area is defined as the area investigated for SREs surrounding the Study Area. Based on the nominal area threshold for SRE distributions, <10,000 km^2 (Harvey 2002b), a square area was generated using "Google™ Earth Pro", centring on the Study Area and extended approximately 100 km north, south east and west from it. The following corner coordinates of the Search Area was used when undertaking searches from within the W. A. Museum's databases: Top left corner (North West): -22.175902°, 118.070211°; Bottom right corner (South East): -23.956909°, 120.008080°. The total area searched was approximately 40,000 km^2 (a square with 200 km sides) (Figure 2.1).

2.3.1.2 Search area data edits and filtering

At the time when the area searches were requested from the W. A. Museum, limited taxonomic support was provided for database searches with **limited** screening for SREs or subterranean fauna from the department of Arachnids and Myriapods. Database search results constituted data 'dumps' of ALL records from within the Search Area requested. Database search results were edited prior to screening for SREs to enforce consistency between the different departmental databases. The following edits and filtering were applied to the combined data:

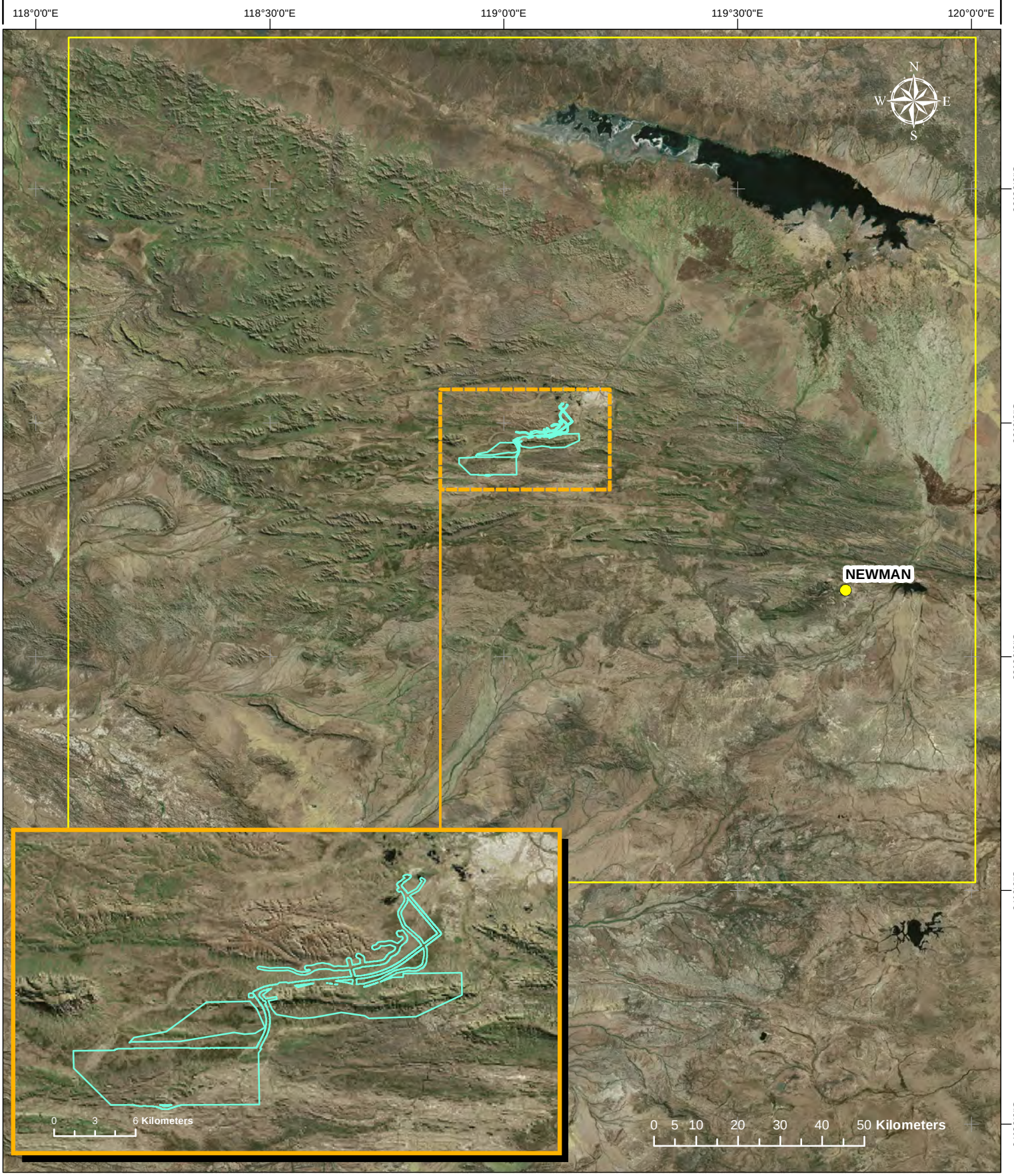
1. A new field "Binomial" was created, into which the Genus and Species field values were concatenated, *e.g.* Genus [Lychas] + Species [`gracilimanus`] → Binomial [Lychas 'gracilimanus']
    a. Where the genus field was empty or contained the values "Unknown" or "gen. nov.", the family rank name was used instead of genus.
    b. Where both family and genus fields were empty, unknown, the order rank was used in place of the genus.
    c. all unidentified 'species' in the 'Binomial' field (*e.g.* "sp. indet.", "sp. indet. (juvenile)", "sp?", "unknown") were renamed to "sp."
    d. All Binomial morphospecies names ending in "sp. n." were renamed without that suffix, *e.g.* "*Rhagada* 'pannawonica' sp. n." was renamed to *Rhagada* 'pannawonica'.

2. Another field was created called "Ecotype", into which the ecotype of the species was manually recorded, based on taxon and/or sampling methods:
    a. **Epigean**: all species obtained through terrestrial survey methods or belonging to taxa only known to be epigean in W. A., *e.g.* trapdoor spiders.
    b. **Subterranean, Troglobite** or **stygobite**: 'named' species or morphospecies obtained using subterranean sampling methods or from taxa known predominantly from subterranean habitats, *e.g.* schizomids.
    c. **?Epigean**: unidentified species from subterranean survey methods of groups known to contain epigean SREs in the Pilbara, *e.g.* Centipedes from the order Geophilomorpha or family Cryptopidae.

d. **?troglobite**: Unidentified species obtained from subterranean fauna survey methods of orders or families rarely sampled in SRE surveys in the Pilbara, *e.g.* Millipede families Haplodesmidae and Dalodesmidae.
e. **Marine** and **Aquatic**: marine and freshwater species respectively.

3 The data were filtered for records with ecotypes of either “epigean” or “?epigean”.
4 The SRE status of each species present in the filtered data was assessed according to the SRE categories previously used by the W. A. Museum Taxonomic Service and described in **2.1**.

Figure 2.1 Eastern and central Pilbara showing the location of the Study Area (inset) and the Search Area used to interrogate the Western Australian Museum's Terrestrial Invertebrates, Crustaceans and Molluscs databases



Project: Short-range Endemic Invertebrate asessment for the Hope Downs 2 Level 2 Survey Area
Client: Astron (Rio Tinto)

Coordinate System: GCS WGS 1984
Projection: Transverse Mercator

Author: E.S. Volschenk
Date: 1 Oct 2019

Alacran Environmental Science
www.alacranenvironmental.com

Towns
Study Area
Database Search Area



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3 RESULTS

3.1 LITERATURE REVIEW

This review focusses on the data obtained from the W. A. Museum invertebrate departments as these are based on vouchered reference specimens. Numerous invertebrate surveys have been undertaken in (or partly in) the Search Area and many of these are not publicly available. The specimen records from all these surveys are however accessible from the W. A. Museum. Species referred to in reports that were not lodged in the W. A. Museum are of questionable value since their relevance to any subsequently collected specimens cannot be assessed. References to informative literature are made in the "Justification" column of the taxon summary tables.

3.2 W. A. MUSEUM DATABASE SEARCH

The Area Searches yielded a total of 12,376 records. After applying the SRE data edits and filters (**2.3.1.2 search area data edits and filtering**), that number was reduced to 4,335 records of SRE and Potential SRE species. These were represented by 282 taxa of which eight (2.8%) were named species, 182 (64.5%) were morphospecies and 92 (32.6%) were undetermined taxa, e.g. *Tyrannochthonius* sp. and Chthoniidae sp. The majority (260) of these taxa were potential SRE and 24 were confirmed SRE.

These results are summarised by Order in Table 3.1. The corresponding data file is embedded within this file as Appendix 1.

Table 3.1. Summary of W. A. Museum database search results for SRE and potential SRE taxa.

Order	Named species	Morphospecies	Un-named taxa ("sp.")	Totals
Araneae: Araneomorphae (modern spiders)	2	5	3	**10**
Araneae: Mygalomorphae (trapdoor spiders)	2	78	21	**101**
Opiliones (harvestmen)	0	0	2	**2**
Pseudoscorpiones (pseudoscorpions)	3	31	18	**52**
Schizomida (short-tailed whip scorpions)	0	1	0	**1**
Scorpiones (scorpions)	0	19	6	**25**
Geophilomorpha (earth centipedes)	0	1	9	**10**
Scolopendromorpha (centipedes)	0	0	3	**3**
Polydesmida (flat-back millipedes	0	18	4	**22**
Polyzoniida (sucking millipedes)	0	0	1	**1**
Spirobolida (millipedes)	1	2	5	**8**
Symphyla	0	0	1	**1**
Isopoda (Slaters)	0	25	9	**34**
Eupulmonata (land snails)	0	2	10	**12**
Totals	**8**	**182**	**92**	**282**

3.3 FIELD SURVEY

The field survey yielded a total of 202 samples, representing 66 taxa belonged to SRE groups. Of those 67 taxa, one was an SRE, 48 were either likely SRE or potential SRE and 18 were widespread; Table 3.2, Figure 3.1, Figure 3.2 and Figure 3.3. The summary of SRE species records per site is given in Table 3.3.

Table 3.2. Taxonomy and SRE status of field survey records with SRE category taxa shaded green.

Class	Order	Family	Species	SRE status
Arachnida	Araneae	Selenopidae	*Karaops banyjima* DNA	SRE
Arachnida	Araneae	Selenopidae	*Karaops* 'AEA001'	Potential SRE: DD
Arachnida	Araneae	Actinopodidae	*Missulena rutraspina*	Widespread
Arachnida	Araneae	Barychelidae	*Aurecocrypta* 'MYG315' DNA	Potential SRE: DD
Arachnida	Araneae	Barychelidae	*Aurecocrypta* 'HD1' DNA	Potential SRE: DD
Arachnida	Araneae	Barychelidae	*Synothele* 'MYG309' DNA	Potential SRE: DD
Arachnida	Araneae	Barychelidae	*Synothele* 'MYG311' DNA	Potential SRE: DD
Arachnida	Araneae	Barychelidae	*Synothele* sp.	Potential SRE: DD
Arachnida	Araneae	Barychelidae	*Synothele* 'xkarara'	Widespread
Arachnida	Araneae	Idiopidae	*Gaius tealei*	Widespread
Arachnida	Araneae	Nemesiidae	*Aname mellosa*	Widespread
Arachnida	Araneae	Nemesiidae	*Aname* 'MYG004'	Widespread
Arachnida	Araneae	Nemesiidae	*Aname* sp.	Potential SRE: DD
Arachnida	Araneae	Nemesiidae	*Yilgarnia* 'MYG197'	Potential SRE: DD
Arachnida	Araneae	Nemesiidae	Nemesiidae sp.	Potential SRE: DD
Arachnida	Pseudoscorpiones	Atemnidae	*Anatemnus* sp.	Potential SRE: DD
Arachnida	Pseudoscorpiones	Atemnidae	*Oratemnus* sp.	Widespread
Arachnida	Pseudoscorpiones	Chernetidae	*Sundochernes* sp.	Potential SRE: DD
Arachnida	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius* 'HD1' DNA	Potential SRE: DD
Arachnida	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius* 'HD2' DNA	Potential SRE: DD
Arachnida	Pseudoscorpiones	Olpiidae	*Austrohorus* 'HD5' DNA	Potential SRE: DD
Arachnida	Pseudoscorpiones	Olpiidae	*Beierolpium* '8/4 small'	Widespread
Arachnida	Pseudoscorpiones	Olpiidae	*Beierolpium* 'HD1' DNA	Potential SRE: DD
Arachnida	Pseudoscorpiones	Olpiidae	*Beierolpium* 'HD2' DNA	Potential SRE: DD
Arachnida	Pseudoscorpiones	Olpiidae	Beierolpium '8/4' DNA	Widespread
Arachnida	Pseudoscorpiones	Olpiidae	*Euryolpium* 'HD6' DNA	Potential SRE: DD
Arachnida	Pseudoscorpiones	Olpiidae	*Euryolpium* 'HD7' DNA	Potential SRE: DD
Arachnida	Pseudoscorpiones	Olpiidae	*Euryolpium* sp.	Potential SRE: DD
Arachnida	Pseudoscorpiones	Olpiidae	'Genus 7/4 PSE118' DNA	Potential SRE: DD
Arachnida	Pseudoscorpiones	Olpiidae	'PSEAAA HD4' DNA	Potential SRE: DD
Arachnida	Pseudoscorpiones	Olpiidae	*Indolpium* sp.	Potential SRE: DD
Arachnida	Pseudoscorpiones	Olpiidae	Olpiidae sp.	Potential SRE: DD
Arachnida	Scorpiones	Buthidae	*Isometroides* 'pilbara 1'	Widespread

Class	Order	Family	Species	SRE status
Arachnida	Scorpiones	Buthidae	*Lychas* 'bituberculatus complex'	Potential SRE: DD
Arachnida	Scorpiones	Buthidae	*Lychas* 'hairy tail complex'	Potential SRE: DD
Arachnida	Scorpiones	Buthidae	*Lychas* 'harveyi complex'	Widespread
Arachnida	Scorpiones	Buthidae	*Lychas* 'multipunctatus complex'	Potential SRE: DD
Arachnida	Scorpiones	Buthidae	*Lychas* 'pilbara 1'	Widespread
Arachnida	Scorpiones	Urodacidae	*Urodacus* 'pilbara 12'	Widespread
Arachnida	Scorpiones	Urodacidae	*Urodacus* 'HD1' DNA	Potential SRE: DD
Chilopoda	Geophilomorpha	Chilenophilidae	*Sepedonophilus* 'HD1' DNA	Potential SRE: DD
Chilopoda	Geophilomorpha	Chilenophilidae	*Sepedonophilus* 'HD2' DNA	Potential SRE: DD
Chilopoda	Geophilomorpha	Chilenophilidae	*Sepedonophilus* sp.	Potential SRE: DD
Chilopoda	Geophilomorpha	Geophilomorpha^	Geophilomorpha sp.	Potential SRE: DD
Chilopoda	Geophilomorpha	Mecistocephalidae	*Mecistocephalus* 'HD1' DNA	Potential SRE: DD
Chilopoda	Geophilomorpha	Mecistocephalidae	*Mecistocephalus* 'HD2' DNA	Potential SRE: DD
Chilopoda	Geophilomorpha	Mecistocephalidae	*Mecistocephalus* 'HD3' DNA	Potential SRE: DD
Chilopoda	Geophilomorpha	Oryidae	*Orphnaeus* 'HD1' DNA	Potential SRE: DD
Chilopoda	Scolopendromorpha	Cryptopidae	*Cryptops* 'HD1'DNA.	Potential SRE: DD
Diplopoda	Polydesmida	Paradoxosomatidae	*Antichiropus* sp.	Potential SRE: DD
Diplopoda	Polydesmida	Paradoxosomatidae	*Antichiropus* 'wonmunna' DNA	Potential SRE: DD
Diplopoda	Spirobolida	Trigoniulidae	*Austrostrophus* 'Clade A' DNA	Potential SRE: DD
Diplopoda	Spirobolida	Trigoniulidae	*Austrostrophus* 'Clade E' DNA	Potential SRE: DD
Diplopoda	Spirobolida	Trigoniulidae	*Austrostrophus* sp.	Potential SRE: DD
Gastropoda	Eupulmonata	Pupillidae	*Gastrocopta* sp.	Widespread
Gastropoda	Eupulmonata	Pupillidae	*Pupoides* sp.	Widespread
Gastropoda	Eupulmonata	Subulinidae	*Eremopeas interioris*	Widespread
Gastropoda	Eupulmonata	Subulinidae	Subulinidae sp.	Widespread
Malacostraca	Isopoda	Armadillidae	*Buddelundia* '10ma'	Potential SRE: DD
Malacostraca	Isopoda	Armadillidae	*Buddelundia* '15'	Widespread
Malacostraca	Isopoda	Armadillidae	*Buddelundia* '16'	Widespread
Malacostraca	Isopoda	Armadillidae	*Buddelundia* '77'	Potential SRE: DD
Malacostraca	Isopoda	Armadillidae	*Buddelundia* sp.	Potential SRE: DD
Malacostraca	Isopoda	Armadillidae	Buddelundiinae sp.	Potential SRE: DD
Malacostraca	Isopoda	Armadillidae	*Pseudodiploexochus* sp.	Potential SRE: DD
Malacostraca	Isopoda	Armadillidae	*Troglarmadillo* sp.	Likely SRE
Malacostraca	Isopoda	Philosciidae	Philosciidae sp.	Potential SRE: DD

DNA putative species recognised with DNA barcoding.

Table 3.3. Number of specimens of SRE category invertebrates from each site.

Species	Bl01	Op01	SRE01	SRE02	SRE04	SRE08	SRE09	SRE10	SRE11	SRE12	SRE13	SRE14	SRE15	SRE16	SRE17	SRE18	SRE19	SRE20	SRE21	SRE22	SRE23	TS04	TS05	TS14	TS15	TS16	TS17	TS18	**Total No. specimens**	**Total No. Sites count**
Aurecocrypta 'HD1'															1														**1**	**1**
Aurecocrypta 'MYG315'																				1									**1**	**1**
Synothele 'MYG309'																												1	**1**	**1**
Synothele 'MYG311'																												1	**1**	**1**
Synothele sp.										1																			**1**	**1**
Aname sp.														1											1				**2**	**2**
Yilgarnia 'MYG197'																								1					**1**	**1**
Nemesiidae sp.									1																				**1**	**1**
Karaops banyjima																2	1		1										**4**	**3**
Karaops 'ARA001'																1													**1**	**1**
Anatemnus sp.												1																	**1**	**1**
Sundochernes sp.																					1								**1**	**1**
Tyrannochthonius 'HD1'												1																	**1**	**1**
Tyrannochthonius 'HD2'				1																									**1**	**1**
Austrohorus 'HD5'			1																										**1**	**1**
Beierolpium 'HD1'												1																	**1**	**1**
Beierolpium 'HD2'																								1					**1**	**1**
Euryolpium 'HD6'									2																				**2**	**1**
Euryolpium 'HD7'							1																						**1**	**1**
Euryolpium sp.								1										1											**2**	**2**
'Genus 7/4 PSE118'				4	1			2											2										**9**	**4**
'PSEAAA HD4'														1															**1**	**1**
Indolpium sp.			5																										**5**	**1**

Olpiidae sp.			1																									**1**	**1**
Lychas 'bituberculatus complex'	1																				1		1		2	1		**6**	**5**
Lychas 'hairy tail complex'																										1		**1**	**1**
Lychas 'multipunctatus complex'	3					1																	4			3		**11**	**4**
Urodacus 'HD1'											1																	**1**	**1**
Sepedonophilus 'HD1'		1													2		3											**6**	**3**
Sepedonophilus 'HD2'																				1								**1**	**1**
Sepedonophilus sp.			1														1											**2**	**2**
Geophilomorpha sp.														1														**1**	**1**
Mecistocephalus 'HD1'											1								1	2								**4**	**3**
Mecistocephalus 'HD2'																				1								**1**	**1**
Mecistocephalus 'HD3'													2															**2**	**1**
Orphnaeus 'HD1'																				1								**1**	**1**
Cryptops 'HD1'													3															**3**	**1**
Antichiropus sp.													1							2								**3**	**2**
Antichiropus 'wonmunna'													2							12								**14**	**2**
Austrostrophus 'Clade A'																		2										**2**	**1**
Austrostrophus 'Clade E'													1							1			4				1	**7**	**4**
Austrostrophus sp.											1		5	1	1	1	1											**10**	**6**
Buddelundia '10ma'									1												2	6						**9**	**3**
Buddelundia '77'													2		1		4			1	2							**10**	**5**
Buddelundia sp.																					1							**1**	**1**
Buddelundiinae sp.																					1		2					**3**	**2**
Pseudodiploexochus sp.															1													**1**	**1**
Troglarmadillo sp.											1																	**1**	**1**
Philosciidae sp.																	5						1					**6**	**2**
Total No. taxa per site	**2**	**1**	**4**	**2**	**1**	**1**	**1**	**2**	**3**	**1**	**5**	**3**	**7**	**4**	**5**	**2**	**6**	**2**	**3**	**3**	**10**	**2**	**1**	**7**	**1**	**1**	**3**	**3**	

Araneae

Araneomorphae

- *Karaops banyjima* (3)
- *Karaops* 'ARA001' (1)

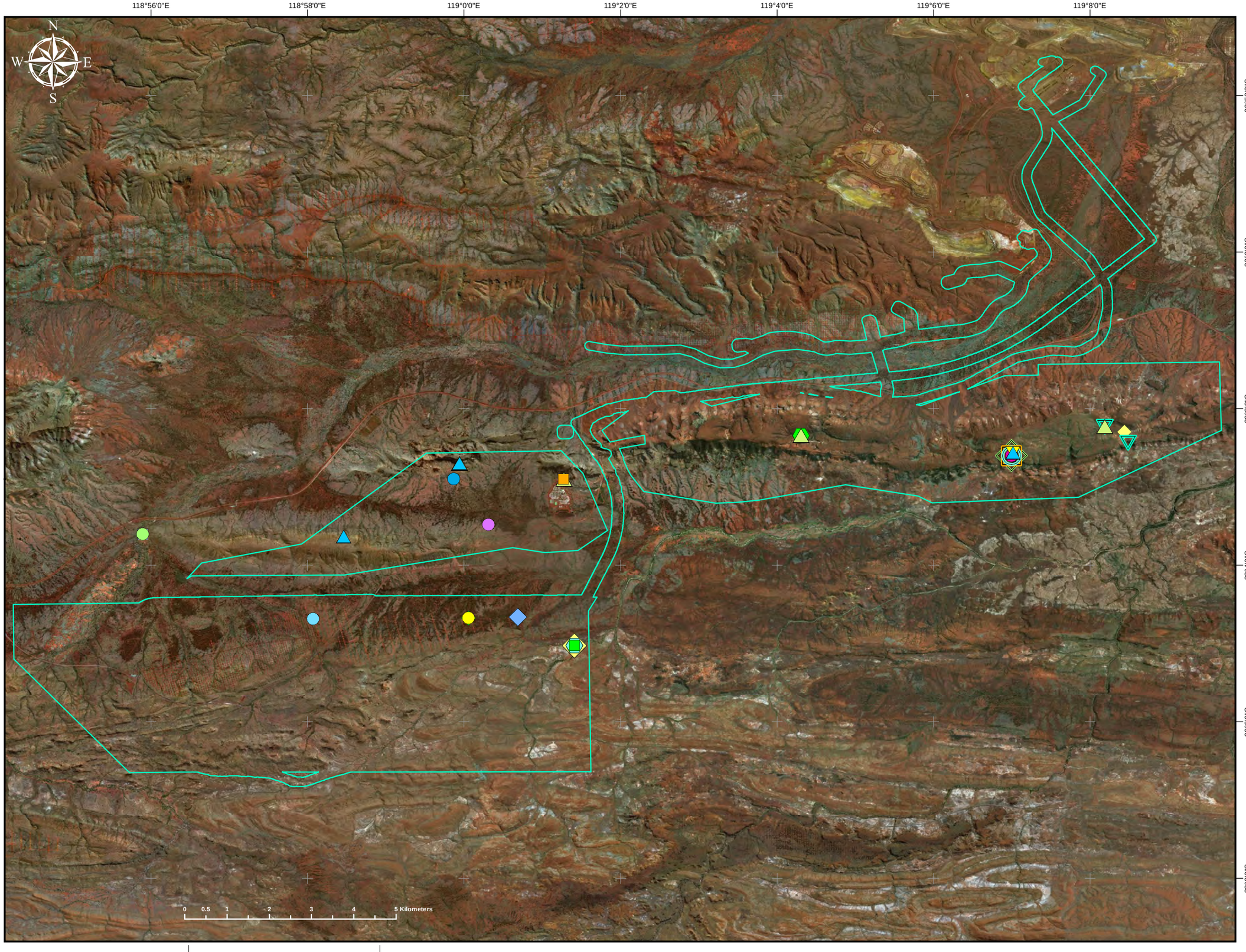
Mygalomorphae

- Nemesiidae sp. (1)
- *Aurecocrypta* 'MYG315' (1)
- *Austrohorus* 'HD5' (1)
- *Synothele* 'MYG309' (1)
- *Synothele* 'MYG311' (1)
- *Synothele* sp. (1)
- *Yilgarnia* 'MYG197' (1)

Pseudoscorpiones

- *Anatemnus* sp. (1)
- *Austrohorus* 'HD5' (1)
- Olpiidae sp. (1)
- *Beierolpium* 'HD1' (1)
- *Beierolpium* 'HD2' (1)
- *Euryolpium* 'HD6' (1)
- *Euryolpium* 'HD7' (1)
- *Euryolpium* sp. (2)
- 'PSEAAA HD4' (1)
- *Indolpium* sp. (2)
- 'Genus 7/4 PSE118' (4)
- *Sundochernes* sp. (1)
- *Tyrannochthonius* 'HD1' (1)
- *Tyrannochthonius* 'HD2' (1)

Study Area





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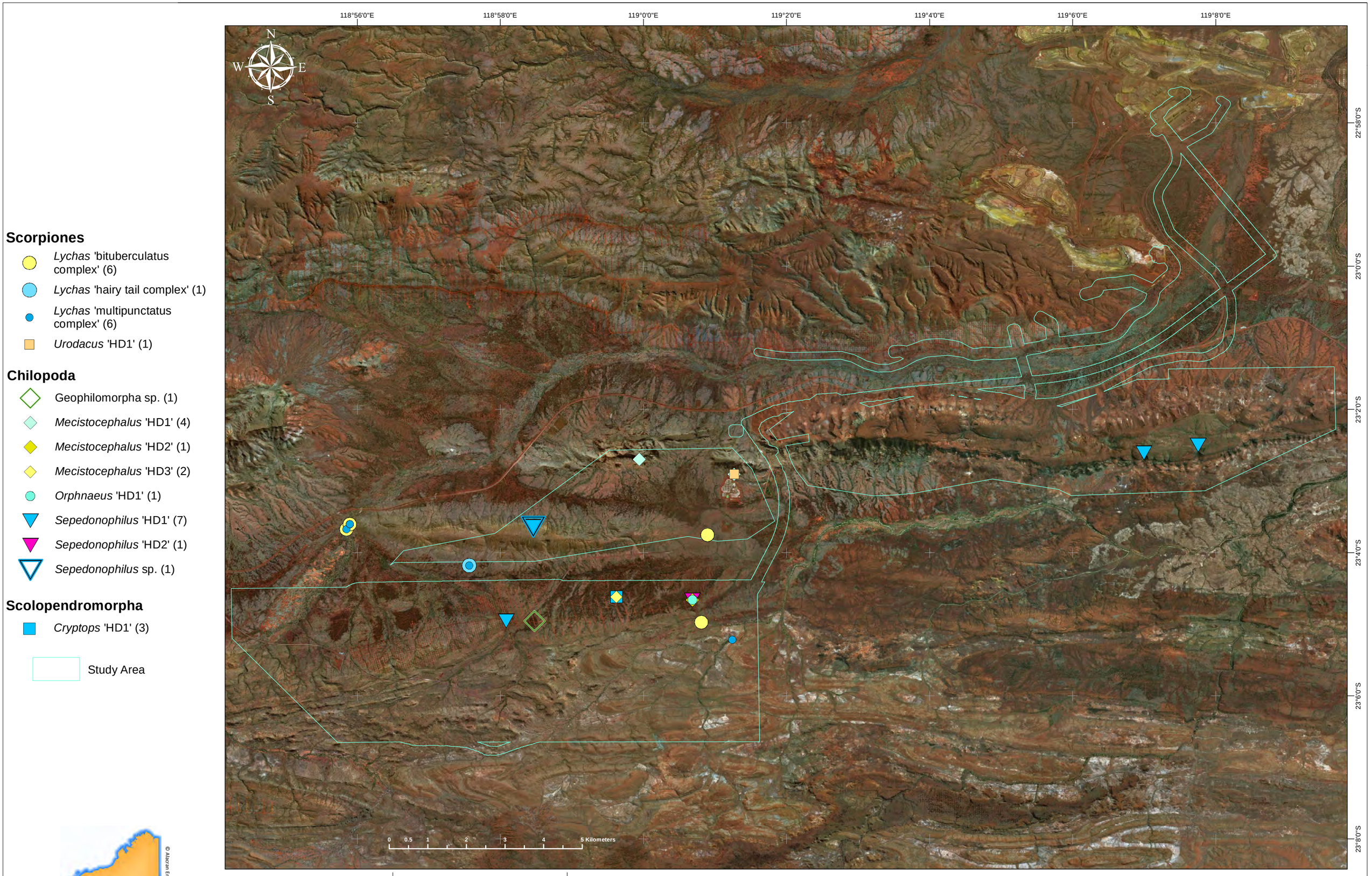
Coordinate System: GCS WGS 1984
Projection: Transverse Mercator
Author: E.S. Volschenk
Date: 5 Dec 2019

Figure 3.1. Distribution of SRE and potential SRE spider and pseudoscorpion records from the field surveys.



Scorpiones

- *Lychas* 'bituberculatus complex' (6)
- *Lychas* 'hairy tail complex' (1)
- *Lychas* 'multipunctatus complex' (6)
- *Urodacus* 'HD1' (1)

Chilopoda

- Geophilomorpha sp. (1)
- *Mecistocephalus* 'HD1' (4)
- *Mecistocephalus* 'HD2' (1)
- *Mecistocephalus* 'HD3' (2)
- *Orphnaeus* 'HD1' (1)
- *Sepedonophilus* 'HD1' (7)
- *Sepedonophilus* 'HD2' (1)
- *Sepedonophilus* sp. (1)

Scolopendromorpha

- *Cryptops* 'HD1' (3)

Study Area



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Projection: Transverse Mercator
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Date: 5 Dec 2019

Figure 3.2. Distribution of SRE and potential SRE scorpion and centipede records from the field surveys.

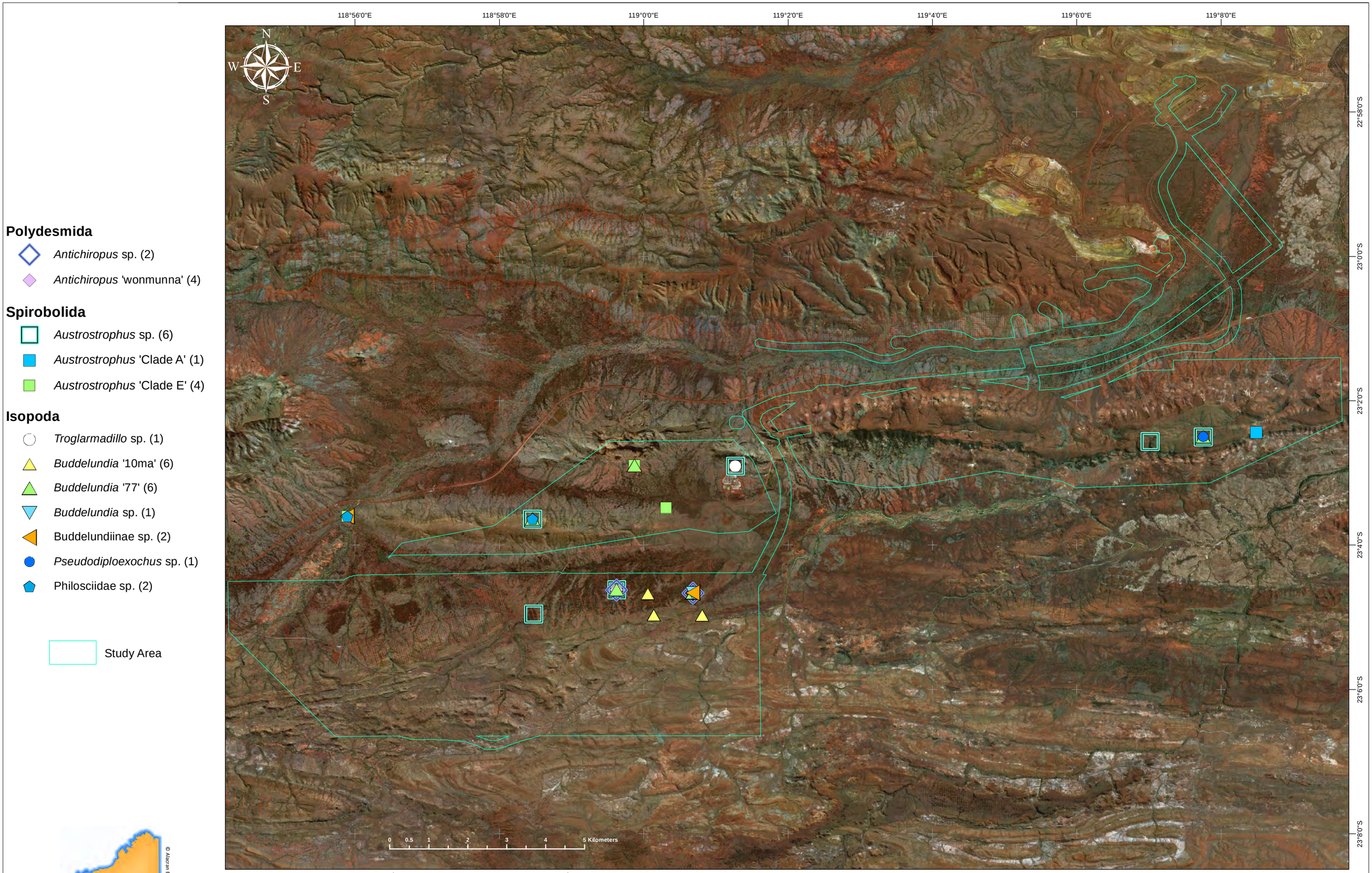

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Figure 3.3. Distribution of SRE and potential SRE millipede and slater records from the field surveys.

4 DISCUSSION

4.1 ARACHNIDA

Among the classes containing SREs, the arachnids stand out with the number of orders and families that contain SREs. With the exception of most modern spiders, and some pseudoscorpions and mites, most arachnids have relatively poor dispersal capabilities and are therefore significant candidates for exhibiting short-range endemism (Harvey 2002a; Harvey et al. 2011).

4.1.1 Araneae (spiders)

Spiders are instantly recognisable arachnids. In Australia, there are thought to be between 15,000 and 20,000 species, although only approximately 4,000 are currently named (White and Anderson 2017). Australia's spiders are broadly divided into two groups, the Araneomorphae (modern spiders) and the Mygalomorphae (trapdoor spiders). Most modern spiders are widely distributed and achieve this through 'ballooning'; a process where a spiderling creates and releases a long strand of silk into the wind. The silk strand eventually becomes long enough to 'catch the wind' like a kite and lift the spiderling into the wind to be deposited elsewhere, potentially many kilometres from its 'take-off' site. In the Pilbara, the modern spiders currently considered to contain SREs are members of the family *Selenopidae* (wall crab spiders) (Crews and Harvey 2011; Crews 2013).

Most of W.A's SRE spiders are trapdoor spiders. In W. A., nine trapdoor spider species are currently listed in the *Wildlife Conservation* (Specially Protected Fauna) *Notice* 2016 (Western Australian Government 2017); however, none of these are known from the Pilbara region. In the Pilbara, trapdoor spiders are represented by seven families: Actinopodidae, Barychelidae, Halonoproctidae, Dipluridae, Idiopidae, Nemesiidae and Theraphosidae, of which all except Theraphosidae are known to contain representatives with confirmed or potential short-range distributions (Harvey et al. 2012; Castalanelli et al. 2014; Rix et al. 2017b; Rix et al. 2018c).

The Search Area contained 111 SRE category spider taxa, of which four were named species, 83 were morphospecies and 24 were unidentified taxa (Table 4.1 and Figure 4.2-Figure 4.5). Four of these taxa are SREs and the remainder are potential SRE (DD) (Table 4.1).

The Search Area included several potential SRE (DD) spider taxa from within the Study Area:

- *Synothele* sp. (Figure 4.2): T116849, T116852; Mudlark, 87 km WNW. of Newman
- *Idiosoma* sp. (Figure 4.4): T116854, T116851; Mudlark, 87 km WNW. of Newman;
- *Aname* sp. (Figure 4.5): T116850; Mudlark, 87 km WNW. of Newman;
- *Kwonkan* 'MYG339' (Figure 4.5): T116853; Mudlark, 87 km WNW. of Newman.

Additional species were also revealed to the north and south of the Study Area, suggesting that a greater diversity of trapdoor spiders might be expected than the survey yielded. It is likely that survey conditions or methods were not optimal for sampling the broader diversity of trapdoor spiders in the area. Morphological identification of trapdoor spiders relies on characteristics of the adult male morphology and male trapdoor spiders are generally most active shortly after good summer or winter rains, when they leave their burrows and search for mates. Pitfall trapping (wet or dry) appears to be the most efficient way to sample these

spiders; however, since the males are wandering from their burrows, the specific microhabitat supporting these spiders may be difficult to determine. Wet pitfall traps are generally active for longer periods and have the greatest chance of being active during rainfall events.

Table 4.1. Table of SRE category Araneae identified from the area search of the W. A. Museum's Terrestrial Invertebrates Database

Infraorder	Family	Binomial	SRE Category	Justification
Araneomorphae	Selenopidae	*Karaops* 'ARA001'	Potential SRE: DD	W. A. Museum data
Araneomorphae	Selenopidae	*Karaops* 'ARA002'	Potential SRE: DD	W. A. Museum data
Araneomorphae	Selenopidae	*Karaops* 'ARA003'	Potential SRE: DD	W. A. Museum data
Araneomorphae	Selenopidae	*Karaops* 'ARA005'	Potential SRE: DD	W. A. Museum data
Araneomorphae	Selenopidae	*Karaops banyjima*	SRE	(Crews 2013)
Araneomorphae	Selenopidae	*Karaops* 'BD1'	Potential SRE: DD	(Phoenix 2011)
Araneomorphae	Selenopidae	*Karaops feedtime*	SRE	(Crews 2013)
Araneomorphae	Selenopidae	*Karaops* sp.	Potential SRE: DD	Genus contains SREs and potential SREs
Araneomorphae	Selenopidae	Selenopidae sp.	Potential SRE: DD	Family contain SREs and potential SREs
Mygalomorphae		Mygalomorphae sp.	Potential SRE: DD	Infraorder contains SREs and potential SREs
Mygalomorphae	Actinopodidae	*Missulena faulderi*	SRE	(Harms and Framenau 2013)
Mygalomorphae	Actinopodidae	*Missulena langlandsi*	SRE	(Harms and Framenau 2013)
Mygalomorphae	Actinopodidae	*Missulena* 'marillana'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Actinopodidae	*Missulena* 'MYG252'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Actinopodidae	*Missulena* sp.	Potential SRE: DD	Genus contains SREs and potential SREs
Mygalomorphae	Barychelidae	*Aurecocrypta* 'MYG057'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Barychelidae	*Aurecocrypta* 'MYG246'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Barychelidae	*Aurecocrypta* 'MYG315'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Barychelidae	*Aurecocrypta* 'MYG316'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Barychelidae	*Aurecocrypta* 'MYG317'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Barychelidae	*Aurecocrypta* sp.	Potential SRE: DD	Genus known to contain SREs and or potential SREs
Mygalomorphae	Barychelidae	*Barychelidae* 'bark door bary'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Barychelidae	*Barychelidae* sp.	Potential SRE: DD	Family contains SREs and potential SREs
Mygalomorphae	Barychelidae	*Idiommata* 'MYG128'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Barychelidae	*Idiommata* 'MYG247'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Barychelidae	*Idiommata* sp.	Potential SRE: DD	Genus contains SREs and

Infraorder	Family	Binomial	SRE Category	Justification
				potential SREs
Mygalomorphae	Barychelidae	*Synothele* 'MYG055'	potential SRE: DD	W. A. Museum data
Mygalomorphae	Barychelidae	*Synothele* 'MYG309'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Barychelidae	*Synothele* 'MYG311'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Barychelidae	*Synothele* 'MYG334'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Barychelidae	*Synothele* sp.	Potential SRE: DD	Genus contains SREs or potential SREs
Mygalomorphae	Dipluridae	*Cethegus* 'Cloudbreak sp. 1'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Dipluridae	*Cethegus* 'MYG299'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Dipluridae	*Cethegus* sp.	Potential SRE: DD	Genus contains SREs and potential SREs
Mygalomorphae	Halonoproctidae	*Conothele* 'MYG002'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Halonoproctidae	*Conothele* 'MYG279'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Halonoproctidae	*Conothele* 'MYG281'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Halonoproctidae	*Conothele* 'MYG282'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Halonoproctidae	*Conothele* 'MYG293'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Halonoproctidae	*Conothele* 'MYG333'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Halonoproctidae	*Conothele* 'MYG385'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Halonoproctidae	*Conothele* 'MYG525'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Halonoproctidae	*Conothele* 'MYG526'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Halonoproctidae	*Conothele* 'MYG527'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Halonoproctidae	*Conothele* 'MYG528'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Halonoproctidae	*Conothele* 'MYG533'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Halonoproctidae	*Conothele* 'MYG534'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Halonoproctidae	*Conothele* 'MYG537'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Halonoproctidae	*Conothele* 'MYG538'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Halonoproctidae	*Conothele* 'MYG539'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Halonoproctidae	*Conothele* 'MYG558'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Halonoproctidae	*Conothele* 'MYG574'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Halonoproctidae	*Conothele* sp.	Potential SRE: DD	Genus contains SREs and potential SREs
Mygalomorphae	Idiopidae	*Eucyrtops* 'B04'	Potential SRE: DD	Genus contains SREs and potential SREs
Mygalomorphae	Idiopidae	*Eucyrtops* sp.	Potential SRE: DD	Genus contains SREs and potential SREs
Mygalomorphae	Idiopidae	Idiopidae sp.	Potential SRE: DD	Family contains SREs and potential SREs
Mygalomorphae	Idiopidae	*Idiosoma* 'Cloudbreak sp. 1'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Idiopidae	*Idiosoma* 'MYG083'	Potential SRE: DD	W. A. Museum data

Infraorder	Family	Binomial	SRE Category	Justification
Mygalomorphae	Idiopidae	*Idiosoma* 'MYG085'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Idiopidae	*Idiosoma* 'MYG086'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Idiopidae	*Idiosoma* 'MYG126'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Idiopidae	*Idiosoma* 'MYG233'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Idiopidae	*Idiosoma* 'MYG300'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Idiopidae	*Idiosoma* 'MYG303'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Idiopidae	*Idiosoma* 'MYG305'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Idiopidae	*Idiosoma* 'MYG306'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Idiopidae	*Idiosoma* 'MYG384'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Idiopidae	*Idiosoma* sp.	Potential SRE: DD	Genus contains SREs and potential SREs
Mygalomorphae	Nemesiidae	*Aname* 'marillana group'	potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Aname* 'MYG035'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Aname* 'MYG104'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Aname* 'MYG321'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Aname* 'MYG340'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Aname* 'MYG341'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Aname* 'MYG377'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Aname* 'MYG378'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Aname* sp.	Potential SRE: DD	Genus contains SREs and potential SREs
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG006'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG033'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG088'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG098'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG101'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG195'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG197'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG323'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG324'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG325'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG336'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG337'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG338'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG339'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG340'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG379'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG380'	Potential SRE: DD	W. A. Museum data

Infraorder	Family	Binomial	SRE Category	Justification
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG433'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG484'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Kwonkan* 'MYG524'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Kwonkan* sp.	Potential SRE: DD	Genus contains SREs and potential SREs
Mygalomorphae	Nemesiidae	Nemesiidae 'N140'	potential SRE: DD	W. A. Museum Data
Mygalomorphae	Nemesiidae	Nemesiidae 'N43'	Potential SRE: DD	W. A. Museum Data
Mygalomorphae	Nemesiidae	Nemesiidae sp.	Potential SRE: DD	Family contains SREs and potential SREs
Mygalomorphae	Nemesiidae	*Swolnpes* 'MYG234'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Teyl* 'MYG027'	Potential SRE: DD	W. A. Museum data
Mygalomorphae	Nemesiidae	*Teyl* sp.	Potential SRE: DD	Genus contains SREs or potential SREs
Mygalomorphae	Nemesiidae	*Yilgarnia* sp.	Potential SRE: DD	Genus contains SREs and potential SREs

Fourteen spider taxa were collected during these surveys, representing the families Selenopidae, Actinopodidae, Barychelidae, Idiopidae and Nemesiidae. Five of these represented widespread taxa, eight species were potential SRE owing to data deficiency (*Aurecocrypta* 'HD1', *Aurecocrypta* 'MYG315', *Synothele* 'MYG309', *Synothele* 'MYG311', *Synothele* sp., *Aname* sp., *Yilgarnia* 'MYG197', Nemesiidae sp.) and one species was a known SRE (*Karaops banyjima*). The identity of *Karaops banyjima, Aurecocrypta* 'HD1', *Aurecocrypta* 'MYG315', *Synothele* 'MYG309' and *Synothele* 'MYG311' were verified with DNA barcoding (Appendix 3).

4.1.1.1 Selenopidae (wall crab spiders or flatties)

Karaops banyjima. Four samples of *Karaops* were obtained, of which three were identified as *Karaops banyjima* using Crews (2013). This species is an SRE and the type locality is 19.2 km north of the centre of the study area (Figure 4.2). *Karaops banyjima* was sampled from sites SRE18, SRE19 and SRE21 (Figure 3.1).

A COI sequence from this species (AES190099) was obtained to confirm its relationship with this species. The barcoding study undertaken by Alacran (Appendix 3) found this sample to be most similar to the Genbank sequence of *Karaops banyjima*. Assessment by the W.A. Museum (Appendix 4); however, assigned *Karaops nyangumarta* to this sequence, not *Karaops banyjima*. In order to resolve the issue of species identity, a third opinion was requested from Dr Sarah Crews, who is an authority on the global systematics of Selenopidae and the author of both *Karaops banyjima* and *Karaops nyangumarta* (Crews 2013). On the basis of the photographs provided (Figure 4.1) Dr Crews identified this species as *Karaops banyjima* and this identification is followed here.

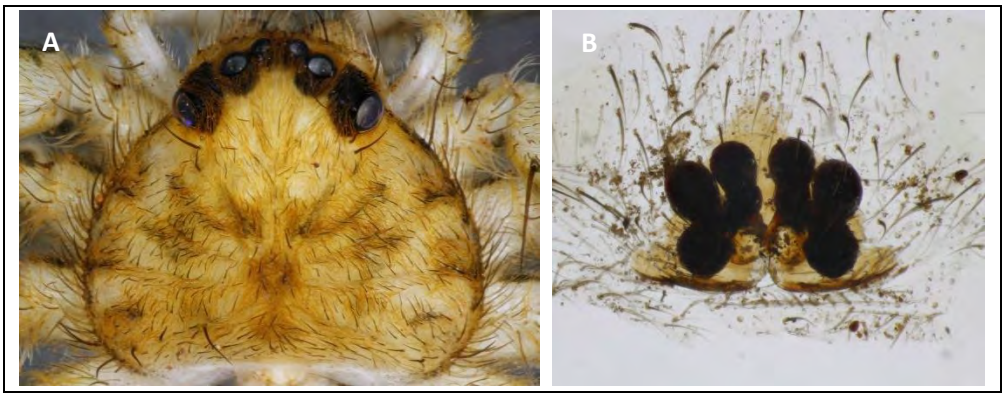

Figure 4.1 Photographs used to confirm the identity of *Karaops banyjima* (AES190099): A, carapace; B, epigynum morphology.

***Karaops* 'ARA001'.** This species was represented by a juvenile specimen and identified using DNA barcoding of COI. The W. A. Museum identified this sample as *Karaops* 'ARA001', a potential SRE species owing to data deficiency concerning its taxonomy and distribution limits.

4.1.1.2 Actinopodidae (mouse spiders)

***Missulena rutraspina*.** Two samples of *Missulena rutraspina* were obtained from site TS18. This species is widespread in the Pilbara (DBCA 2019).

4.1.1.3 Barychelidae (brush footed trapdoor spiders)

***Aurecocrypta* 'MYG315'**. This species was identified from a single juvenile specimen from site SRE22. This specimen was identified with DNA barcoding (Appendix 3). *Aurecocrypta* 'MYG315' was also recorded from the Search Area (Figure 4.2) and is a potential SRE owing to data deficiency regarding its distribution limits. The species appears to have a relatively wide distribution, within the constraints of an SRE, with records occurring from the north west of the Search Area to just north of Newman (Figure 4.2). This project is therefore unlikely to present a significant threat to this species.

***Aurecocrypta* 'HD1'**. This species was represented by a single female specimen from site SRE17. While DNA sequences were obtained from this specimen, no matches could be found by either Alacran or W. A. Museum barcoding studies (Appendix 3 and Appendix 4). *Aurecocrypta* 'HD1' is a potential SRE owing to data deficiency regarding its distribution limits.

***Synothele* 'xkarara'**. Four samples of this species were tentatively identified to *Synothele* 'xkarara', from sites TS07 and TS18. This morpho-species is extremely similar to *Synothele karara* and both have widespread distributions.

***Synothele* 'MYG309'.** A single sample of this species was represented by a juvenile specimen from site TS18 (Table 3.3 and Figure 3.1). The identity of the species was confirmed with DNA barcoding, Appendix 3. This species was represented by 25 samples at 10 different localities within the Search Area. The distribution of this species suggests that it is restricted to the Eastern Hammersley range, but that its distribution extends outside of the project area, Table 4.1 and Figure 4.2. This project is therefore unlikely to significantly threaten this species.

***Synothele* 'MYG311'**. A single sample of this species was represented by a female from site TS18 (Table 3.3 and Figure 3.1). The identity of the species was confirmed with DNA barcoding, Appendix 3. This species was represented by seven samples at six different localities within the Search Area. This species also appears to be restricted to the Eastern Hamersley range, but its distribution extends outside of the Study Area, Table 4.1 and Figure 4.2. This project is therefore unlikely to significantly threaten this species.

***Synothele* sp.** This taxon was represented by three samples, obtained from sites SRE12, SRE17 and SRE22 (Table 3.3 and Figure 3.1). These samples were either female or juvenile, so species level identification was not possible using morphology. Attempts to amplify COI sequences from these samples were unsuccessful. These samples are potential SREs owing to data deficiency concerning their species identity. The genus *Synothele* contains many SRE morphospecies and four are known from the search area (Table 4.1).

4.1.1.4 Idiopidae (spiny trapdoor spiders)

Gaius tealei. This species was represented by females and juveniles, from five sites SRE03, SRE16, SRE23, TS14 and TS18. During the T1 survey, this species was identified as *Gaius* sp.; however, since that survey, the genus was revised and *Gaius tealei* described (Rix et al. 2018c). *Gaius tealei* is the only known representative of this genus in the Pilbara where it is widespread (Rix et al. 2018c).

4.1.1.5 Nemesiidae (open-holed trapdoor spiders)

***Aname mellosa*.** *Aname mellosa* was represented by 27 samples from sites TS14, TS16-18, SRE16, SRE18, Bl01 and Hope Downs Village (camp). This species is widespread in the Pilbara (DBCA 2019).

***Aname* 'MYG004'.** A single sample of this morphospecies was collected from site TS17. This species is widespread in the Pilbara (Table 4.1).

***Yilgarnia* 'MYG197'.** Despite being an adult male, this specimen could not be clearly matched with any of the W. A. Museum voucher morphospecies. The identity if this species was confirmed using DNA sequences (Appendix 3). This species is a potential SRE since *Yilgarnia* contains potential SRE species (Table 4.1 and Figure 4.2).

Nemesiidae sp. This taxon was represented by a single female sample from site SRE11. This specimen could not be identified to genus or species as adult males are needed to do this (Harvey et al. 2018). Attempts to amplify COI sequences from this specimen were unsuccessful. The family Nemesiidae contains numerous potential SRE morphospecies and while the identity of this specimen is ambiguous it is a potential SRE owing to taxonomic data deficiency.

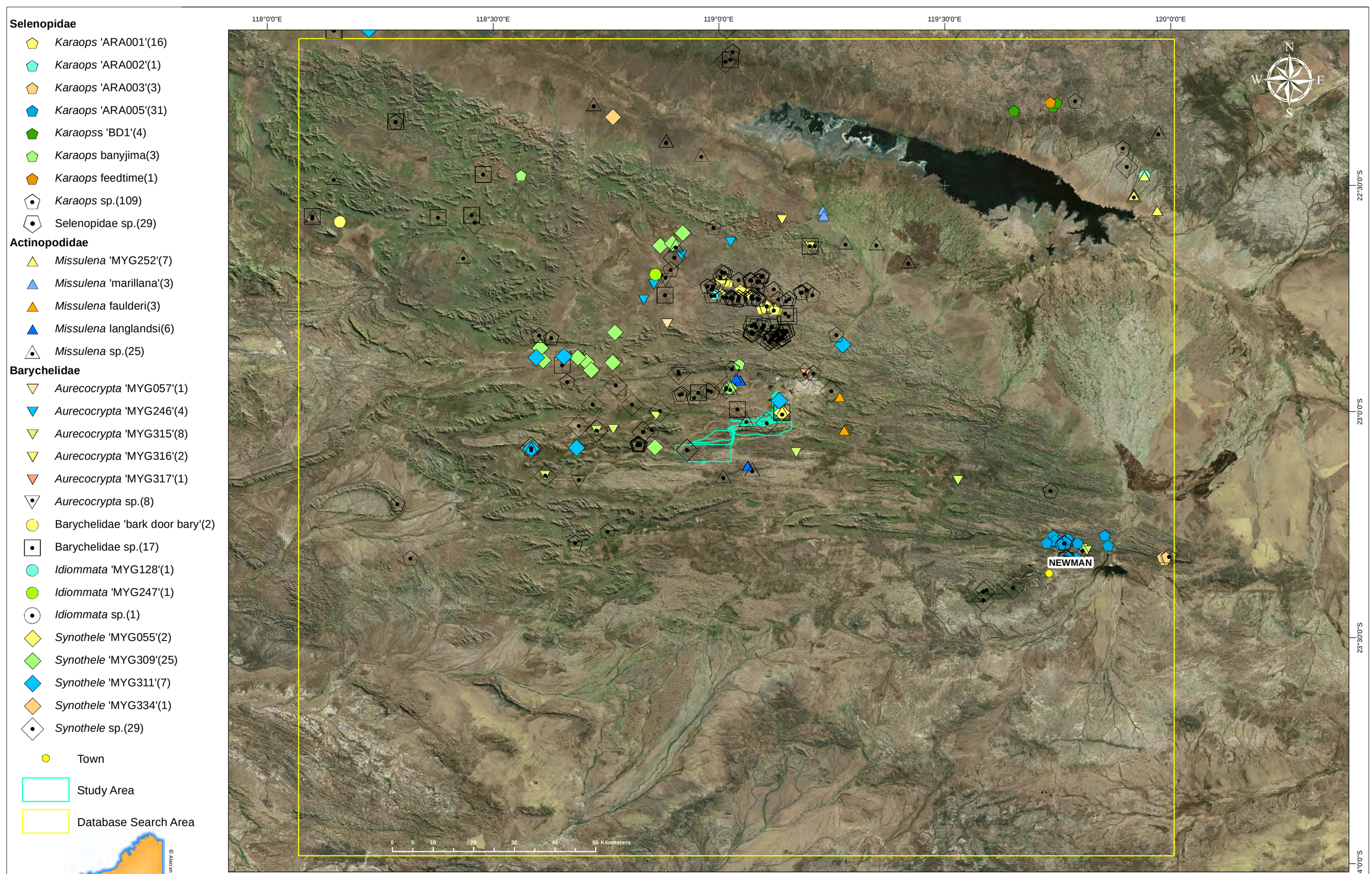

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Figure 4.2. Central and eastern Pilbara showing the distribution of SRE category spider records from the database Search Area: families Selenopidae, Actinopodidae and Barychelidae. Number of records in Parentheses.

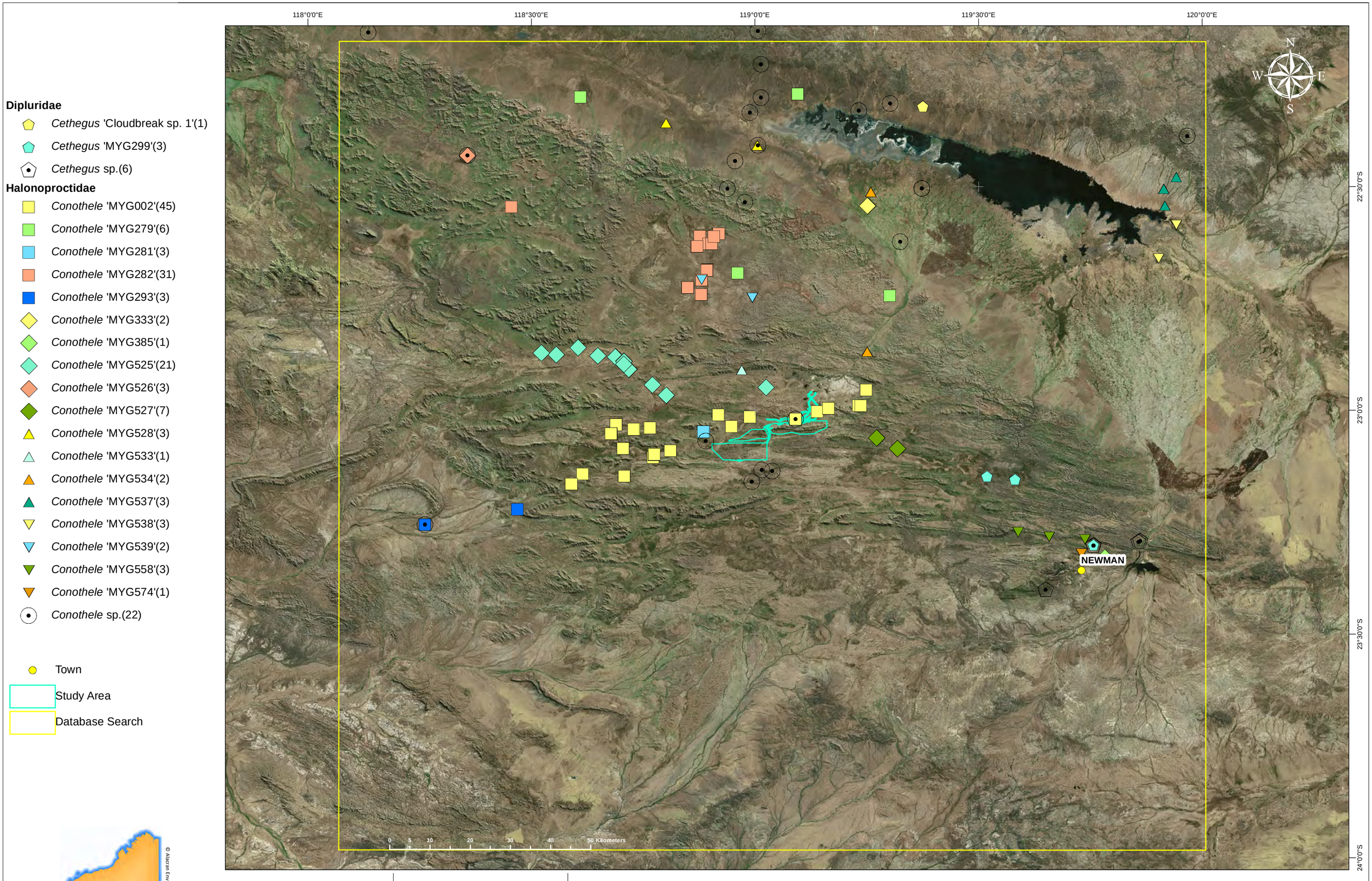

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Figure 4.3. Central and eastern Pilbara showing the distribution of SRE category spider records from the database Search Area: families Dipluridae and Halonoproctidae. Number of records in Parentheses.

Idiopidae

- *Eucyrtops* 'B04'(1)
- *Eucyrtops* sp.(26)
- *Gaius* 'MYG286'(7)
- *Gaius* sp.(5)
- Idiopidae sp.(14)
- *Idiosoma* 'Cloudbreak sp.
- *Idiosoma* 'MYG083'(24)
- *Idiosoma* 'MYG085'(9)
- *Idiosoma* 'MYG086'(6)
- *Idiosoma* 'MYG126'(4)
- *Idiosoma* 'MYG233'(3)
- *Idiosoma* 'MYG300'(6)
- *Idiosoma* 'MYG303'(4)
- *Idiosoma* 'MYG305'(2)
- *Idiosoma* 'MYG306'(3)
- *Idiosoma* 'MYG384'(12)
- *Idiosoma* sp.(124)

Nemesiidae

- Nemesiidae 'N140'(3)
- Nemesiidae 'N43'(5)
- Nemesiidae sp.(67)
- *Swolnpes* 'MYG234'(3)
- *Teyl* 'MYG027'(4)
- *Teyl* sp.(6)
- *Yilgarnia* 'MYG197'(3)
- *Yilgarnia* sp.(8)

Town

Study Area

Database Search Area

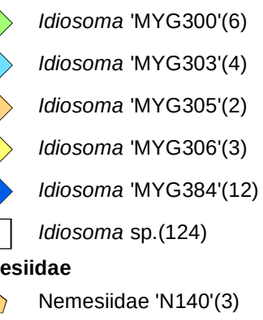

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Figure 4.4. Central and eastern Pilbara showing the distribution of SRE category spider records from the database Search Area: families Idiopidae and Nemesiidae (part 1). Number of records in Parentheses.

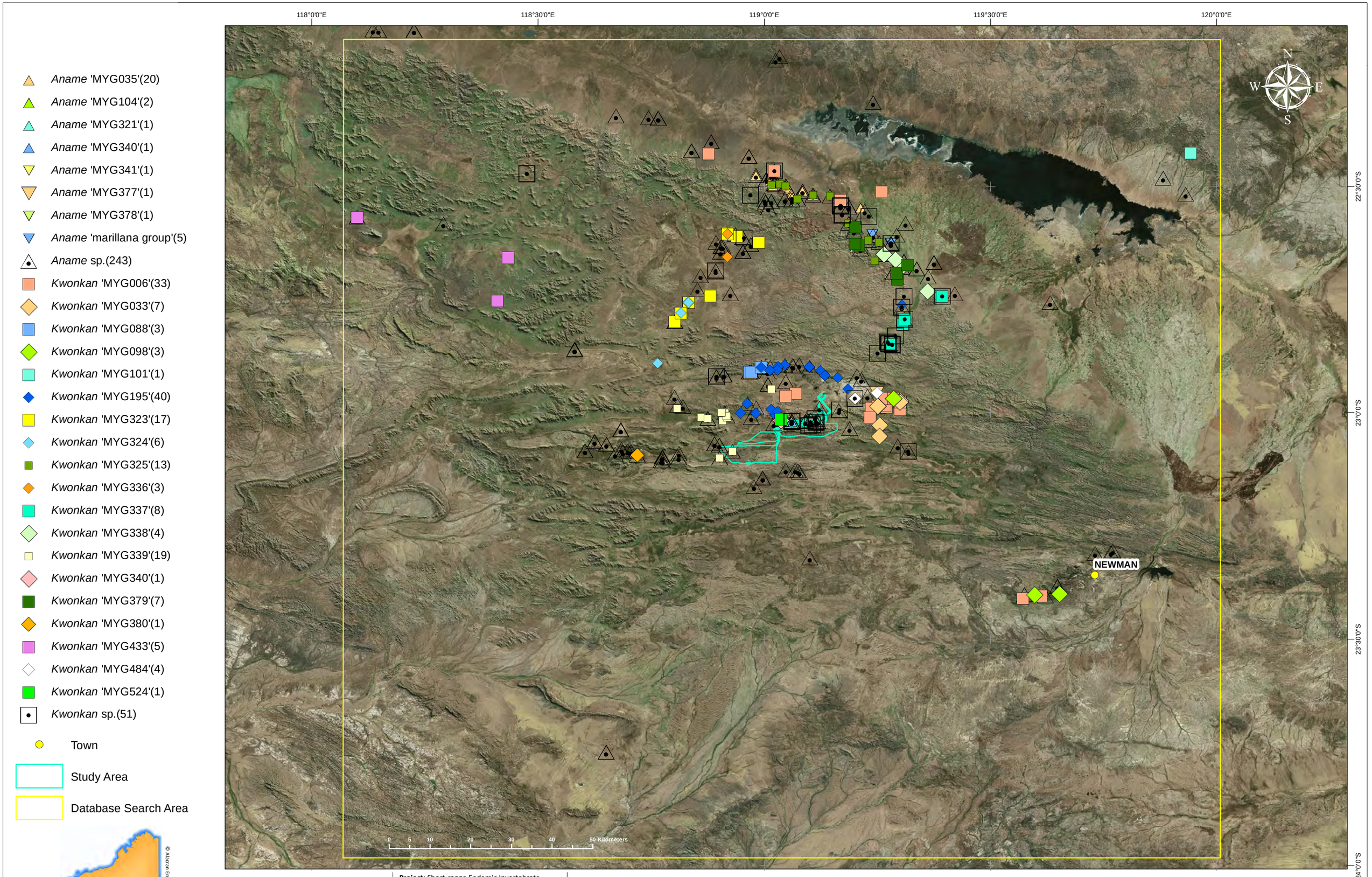


Figure 4.p0 Central and eastern Pilbara showing the distribution of SRE category spider records from the database Search Area: family Nemesiidae (part 2). Number of records in Parentheses.

4.1.2 Opiliones (harvestmen)

Opiliones appear superficially similar to small spiders, but differ from them by lacking a clearly defined division (constriction) between the cephalothorax and abdomen, as well as in numerous other aspects (Pinto-da-Rocha et al. 2007). In Australia, 11 families are recorded (ALA 2017). Some members of this order are SREs while others have wider distribution patterns (Harvey 2002b). The Pilbara diversity of Opiliones is poorly known but appears to be dominated by the genus *Dampetrus* (Assamiidae) (DPaW 2017), a diverse but poorly resolved genus confined to northern Australia (Shear 2001).

The Search Area contained two Opiliones taxa: Opiliones sp. and Assamiidae sp. (Figure 4.6). Both were considered Potential SRE: DD owing to their need for more mesic microhabitats. The field survey yielded no Opiliones and none of the Search Area records were within the Study Area. The absence of Opiliones was difficult to interpret as conditions leading up to both surveys was quite dry and if they are present, the rain experienced during the T2 survey may not have been sufficient to bring them out from their retreats. If present, they are likely to be in the rocky gorges and gullies in Bedded Hilltop and Wonmunna areas.

4.1.3 Pseudoscorpions (pseudoscorpions)

Pseudoscorpions superficially resemble scorpions, but they are not closely related to them. They are generally much smaller than most scorpions and lack the distinctive tail-like abdomen and stinging telson for which scorpions are infamous. In W. A. pseudoscorpions are represented by 19 families (Harvey 2013a). They occur on most undisturbed terrestrial habitats but are seldom noticed owing to their small size and cryptic behaviour (Harvey 1992). The Pilbara pseudoscorpion fauna is generally poorly known with only a few groups receiving taxonomic attention over the last decade and these are primarily focussed on troglobites (Harvey and Edwards 2007; Harvey and Volschenk 2007; Edward and Harvey 2008; Harvey and Leng 2008c). The epigean taxa flagged as SREs or Potential SREs are largely undescribed.

The Search Area contained 52 SRE category pseudoscorpion taxa, of which three are named species, 31 were morphospecies and 18 were unidentified taxa (Table 4.2, Figure 4.6 and Figure 4.7). Two species are SREs and the remaining taxa are Potential SRE (DD) (Table 4.2).

Table 4.2. Table of SRE category Pseudoscorpiones identified from the area search of the W. A. Museum's Terrestrial Invertebrates Database

Family	Binomial	SRE-Category	Justification
	Panctenata sp.	Potential SRE: DD	Infraorder contains SREs and potential SREs
	Pseudoscorpiones sp.	Potential SRE: DD	Order contains SREs and potential SREs
Atemnidae	*Paratemnoides* sp.	Potential SRE: DD	Genus likely to contain SREs and potential SREs
Chernetidae	Chernetidae sp.	Potential SRE: DD	Family contains SREs and potential SREs
Chernetidae	*Cordylochernes* 'cf. dingo'	Potential SRE: DD	W. A. Museum data
Chernetidae	*Haplochernes* '1'	Potential SRE: DD	Genus contains SREs and potential SREs

Family	Binomial	SRE-Category	Justification
Chernetidae	*Haplochernes* '2'	Potential SRE: DD	Genus contains SREs and potential SREs
Chernetidae	*Haplochernes* sp.	Potential SRE: DD	Genus contains SREs and potential SREs
Chernetidae	*Nesidiochernes* sp.	Potential SRE: DD	Genus likely to contain SREs and potential SREs
Chernetidae	*Sundochernes* 'PSE090'	Potential SRE: DD	W. A. Museum data
Chernetidae	*Troglochernes* 'PSE072'	Potential SRE: DD	
Chernetidae	*Troglochernes* sp.	Potential SRE: DD	Presence of SRE or potential SRE species in this genus
Chthoniidae	*Austrochthonius* sp.	Potential SRE: DD	Genus likely to contain SREs and potential SREs
Chthoniidae	Chthoniidae sp.	Potential SRE: DD	Family contains SREs and potential SREs
Chthoniidae	*Tyrannochthonius aridus*	Potential SRE: DD	See discussion
Chthoniidae	*Tyrannochthonius* 'aridus?'	Potential SRE: DD	See discussion
Chthoniidae	*Tyrannochthonius* sp.	Potential SRE: DD	Presence of SRE species in this genus (Edward and Harvey 2008)
Feaellidae	*Feaella callani*	SRE	(Harvey et al. 2016)
Garypidae	*Synsphyronus gracilis*	SRE	W. A. Museum data
Garypidae	*Synsphyronus* 'PSE006'	Potential SRE: DD	W. A. Museum data
Garypidae	*Synsphyronus* 'PSE014'	Potential SRE: DD	W. A. Museum data
Garypidae	*Synsphyronus* 'PSE085'	Potential SRE: DD	W. A. Museum data
Garypidae	*Synsphyronus* 'PSE086'	Potential SRE: DD	W. A. Museum data
Garypidae	*Synsphyronus* sp.	Potential SRE: DD	Genus contains SREs or potential SREs
Garypinidae	*Solinus* sp.	Potential SRE: DD	Genus contains SREs and potential SREs
Hyidae	*Indohya* 'Mt Meharry'	Potential SRE: DD	W. A. Museum data
Olpiidae	*Austrohorus* '1 (big)'	Potential SRE: DD	W. A. Museum data
Olpiidae	*Austrohorus* 'M1'	Potential SRE: DD	W. A. Museum data
Olpiidae	*Austrohorus* 'M2'	Potential SRE: DD	W. A. Museum data
Olpiidae	*Austrohorus* 'PSE119'	Potential SRE: DD	W. A. Museum data
Olpiidae	*Austrohorus* 'PSE120'	Potential SRE: DD	W. A. Museum data
Olpiidae	*Austrohorus* 'PSE121'	Potential SRE: DD	W. A. Museum data
Olpiidae	*Austrohorus* 'PSE122'	Potential SRE: DD	W. A. Museum data
Olpiidae	*Austrohorus* sp.	Potential SRE: DD	Genus likely to contain SREs and potential SREs
	Beierolpium 'PSE126'	Potential SRE: DD	W. A. Museum data
	Genus 7/4 *'PSE118'*	Potential SRE: DD	W. A. Museum data
Olpiidae	*Indolpium* '1'	Potential SRE: DD	W. A. Museum data
Olpiidae	*Indolpium* '2'	Potential SRE: DD	W. A. Museum data
Olpiidae	*Indolpium* 'PSE123'	Potential SRE: DD	W. A. Museum data

Family	Binomial	SRE-Category	Justification
Olpiidae	*Indolpium* 'PSE124'	Potential SRE: DD	W. A. Museum data
Olpiidae	*Indolpium* 'PSE125'	Potential SRE: DD	W. A. Museum data
Olpiidae	*Indolpium* 'long chelal hand'	Potential SRE: DD	W. A. Museum data
Olpiidae	*Indolpium* sp.	Potential SRE: DD	Genus contains SREs and potential SREs
Olpiidae	*Linnaeolpium* sp.	Potential SRE: DD	Genus contains SREs and Potential SREs
Olpiidae	Olpiidae sp.	Potential SRE: DD	Family contains SREs and potential SREs
Olpiidae	'PSEAAA' sp.	Potential SRE: DD	W. A. Museum data
Olpiidae	*Xenolpium* '1'	Potential SRE: DD	W. A. Museum data
Olpiidae	*Xenolpium* '2'	Potential SRE: DD	W. A. Museum data
Olpiidae	*Xenolpium* 'PSE033'	Potential SRE: DD	W. A. Museum data
Olpiidae	*Xenolpium* sp.	Potential SRE: DD	Genus contains SREs and potential SREs

The field survey sampled eight pseudoscorpion taxa from four families: Atemidae, Chernetidae, Chthoniidae and Olpiidae (Table 3.2).

4.1.3.1 Atemidae

***Anatemnus* sp.** A single adult female specimen of *Anatemnus* sp. was obtained from site SRE10. This species is very unusual by being eyeless and having relatively pale body colour colouration. These features closely resemble those seen in the troglobitic *Anatemnus subvastus*, the only described species in this genus from the Pilbara (Alexander et al. 2014). The placement of this species into *Anatemnus* is also tentative owing to the uncertain relationship between this genus and several other genera in Atemnidae (Alexander et al. 2014). This sample represents the first epigean representative of *Anatemnus* from the Pilbara. This species is a potential SRE owing to data deficiency regarding its taxonomy and distribution limits.

***Oratemnus* sp.** Specimens of *Oratemnus* sp. were sampled from three sites: SRE03 SRE11, SRE13 and SRE23. This taxon has been collected widely throughout the Pilbara and is not an SRE.

4.1.3.2 Chernetidae

***Sundochernes* sp.** A single sample of this species was collected from site SRE23. Species in this genus are occasionally sampled in Pilbara surveys; however, they are seldom collected in large numbers or from more than two or three sites. They are potential SREs owing to data deficiency regarding their distribution and taxonomy.

4.1.3.3 Chthoniidae

Tyrannochthonius aridus is the only named epigean species in this genus from the Pilbara where it has been recorded across a wide distribution. The distribution of *Tyrannochthonius aridus* is inconsistent with that of the subterranean species, which are all SREs. The type locality for *Tyrannochthonius aridus* is Barrow Island

(Edward and Harvey 2008). Preliminary investigation into this species indicates the presence of more than one species in the Pilbara. The only two COI sequences for *Tyrannochthonius aridus* in GenBank (Benson et al. 2012) are KJ659959 from Wodgina Mine, 21.1790°S 118.6463°E and KJ659960 from Boodarie Stockyard, 20.4752°S 118.5071°E. The genetic divergence between these samples is 11.1%, suggesting that they represent different species. For this reason, the identity of all epigean *Tyrannochthonius* should be verified using molecular data.

This survey obtained two samples of *Tyrannochthonius*. The barcoding study undertaken by Alacran (Appendix 3) regarded these as different species owing to them being 13.13% divergent from one another. While confirming a similar genetic divergence (13%) the study undertaken by W. A. Museum did not consider these as clearly different species, but rather took the position that based on this genetic divergence "does not allow a conclusion about whether the two are conspecific or not" (Appendix 4). In this instance the more definitive and defensible approach of Alacran's report (Appendix 3) is adopted and the two species recognised are: ***Tyrannochthonius* 'HD1'** from site SRE14 and ***Tyrannochthonius* 'HD2'** from site SRE02 (Appendix 3). Both species represent potential SRE's owing to data deficiency regarding their distribution limits.

4.1.3.4 Olpiidae

In the Pilbara, epigean Olpiidae constitute species of *Austrohorus*, *Beierolpium*, *Euryolpium*, *Indolpium*, *Xenolpium* and 'Genus 7/4'. The constituent species of these genera have been problematic to assess using morphology alone. *Austrohorus* and *Indolpium* are suspected to contain numerous species; however, there is no morphological framework for identifying Pilbara species. *Beierolpium* has a basic taxonomic framework; however, it has not been tested with either robust morphological assessment or with DNA based species delimitation. A recent molecular investigation (Alacran, unpublished data) into the diversity of a small group of Pilbara Olpiidae revealed the presence of nine putative species from four genera. Independent assessment of those sequences by the W. A. Museum confirmed these identifications and all are potential SREs. That study was not exhaustive, either by way of sample intensity or survey area, and it seems likely that many more species of Olpiidae are present in the in the Pilbara.

In this study, representatives of unresolved (using morphology) putative olpiid taxa from each sample sites were assessed using DNA barcoding.

***Austrohorus* 'HD5'.** A single record of this species was sampled from site SRE01. While this species was distinct, its generic placement was ambiguous with an unresolved polytomy of *Austrohorus*, 'Genus 7/4' and *Nanolpium* (Appendix 3). The study undertaken by the W. A. Museum placed this species in *Austrohorus* but did not recognise this as a novel species, despite being 14.46% divergent from the most similar species in that analysis. The species delimitation presented by Alacran (Appendix 3) is followed here owing to the clear and testable framework for species delimitation.

***Beierolpium* '8/4 small'.** This survey recorded one sample of *Beierolpium* '8/4 small' from site SRE19. Attempts to sequence this sample were unsuccessful. *Beierolpium* '8/4 small' is thought to be widespread in the Pilbara.

Three putative species of *Beierolpium* were recognised by Alacran (Appendix 3) using DNA barcoding. The W. A. Museum indicated the presence of two species (Appendix 4). Where Alacran recognised two different species, based on 11% sequence divergence between samples AES190331 and AES190341, the W. A. Museum, based on similar sequence divergence, recognised one species and neither analyses could apply a name to these samples. For the purpose of this report, Alacran's analysis is followed as it offers a clear and published rationale for delimitation between species using sequences of COI: >8% COI sequence divergence based (Hebert et al. 2003b). The study undertaken by the W. A. Museum offered no rationale for species delimitation.

The three species of *Beierolpium* identified here are ***Beierolpium* 'HD1'** from site SRE14, potential SRE owing to data deficiency; ***Beierolpium* 'HD2'** from site TS14, a potential SRE owing to data deficiency, and ***Beierolpium* '8/4'** from site SRE13, a widespread species in the Pilbara.

Both barcoding studies (Appendix 3 and Appendix 4) recognised two putative species of *Euryolpium*: ***Euryolpium* 'HD6'** was identified from site SRE6 and ***Euryolpium* 'HD7'** from site SRE09. Representatives of both species are juveniles and were initially thought to be species of *Beierolpium*; however, the phylogenetic analyses used to assess relationships between these sequences placed both samples in monophyletic *Euryolpium* clade.

Prior to this study, the genus *Euryolpium* was thought to be represented by a single widespread species (undescribed) in the Pilbara and was not identified to a morphospecies. *Euryolpium* can be difficult to diagnose with morphology since the distinguishing characteristics are only distinctive in adult females.

Two samples were identified to ***Euryolpium* sp.** for sites SRE10 and SRE20. The relationship of these with the two genetic species is not known. With the discovery *Euryolpium* 'HD6' and *Euryolpium* 'HD7', both potential SREs, unresolved *Euryolpium* sp. can no longer be regarded as widespread and are here considered to be potential SRE owing to taxonomic data deficiency.

'Genus 7/4 PSE118'. Four specimens belonging to this species were identified from sites SRE02, SRE04 and SRE10. The identity of all four specimens was confirmed with DNA barcoding (Appendix 3). This species is currently regarded as a potential SRE owing to limited knowledge about its distribution. Area Search records included a single representative of this species in the northern portion of the Search Area (Figure 4.7).

'PSEAAA HD4'. This species was sampled from site SRE16 and was identified using DNA barcoding (Appendix 3 and Appendix 4). The study undertaken by the W. A. Museum assigned this sample to an undescribed species and genus of Olpiidae: 'PSEAAA' sp.; however, that relationship was based on a 13.61% sequence divergence with a voucher sequence of 'PSEAAA' sp.. Alacran (Appendix 3) identified this species as belonging to *Indolpium*; however, that study did not include representative sequences of the genus 'PSEAAA'. The species identity of 'PSEAAA HD4' follows the findings of the W. A. Museum and uses the species delimiting threshold >8% sequence divergence to recognise this as a novel species.

***Indolpium* sp.** was recorded from site SRE01 and represents an ambiguous identification. Recent DNA barcoding studies (Alacran, unpublished) identified three undescribed species (*Indolpium* 'PSE123',

Indolpium 'PSE124' and *Indolpium* 'PSE125') from this region of the Pilbara (Figure 4.7). All three are potential SREs and because of this, unresolved *Indolpium* species identifications are potential SRE.

Olpiidae sp. was represented by a single sample from site SRE01. Attempts to obtain DNA sequences from this specimen were unsuccessful. In the absence of a species level identification, Olpiidae sp is a potential SRE because the family contains numerous potential SRE species.

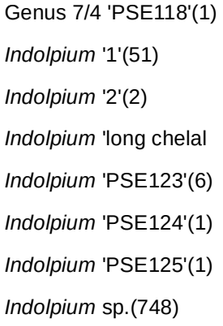
Opiliones

- Assamiidae sp.(8)
- Opiliones sp.(1)

Pseudoscorpiones

- *Austrohorus* 'M1'(2)
- *Austrohorus* 'M2'(1)
- *Austrohorus* 'PSE119'(9)
- *Austrohorus* 'PSE120'(1)
- *Austrohorus* 'PSE121'(1)
- *Austrohorus* 'PSE122'(2)
- *Austrohorus* '1 (big)'(1)
- *Austrohorus* sp.(128)
- Genus 7/4 'PSE118'(1)
- *Indolpium* '1'(51)
- *Indolpium* '2'(2)
- *Indolpium* 'long chelal
- *Indolpium* 'PSE123'(6)
- *Indolpium* 'PSE124'(1)
- *Indolpium* 'PSE125'(1)
- *Indolpium* sp.(748)
- *Linnaeolpium* sp.(7)
- 'PSEAAA' sp.(38)
- *Xenolpium* '1'(4)
- *Xenolpium* '2'(1)
- *Xenolpium* 'PSE033'(5)
- *Xenolpium* sp.(67)
- Olpiidae sp.(129)

- Town
- Study Area
- Database Search Area



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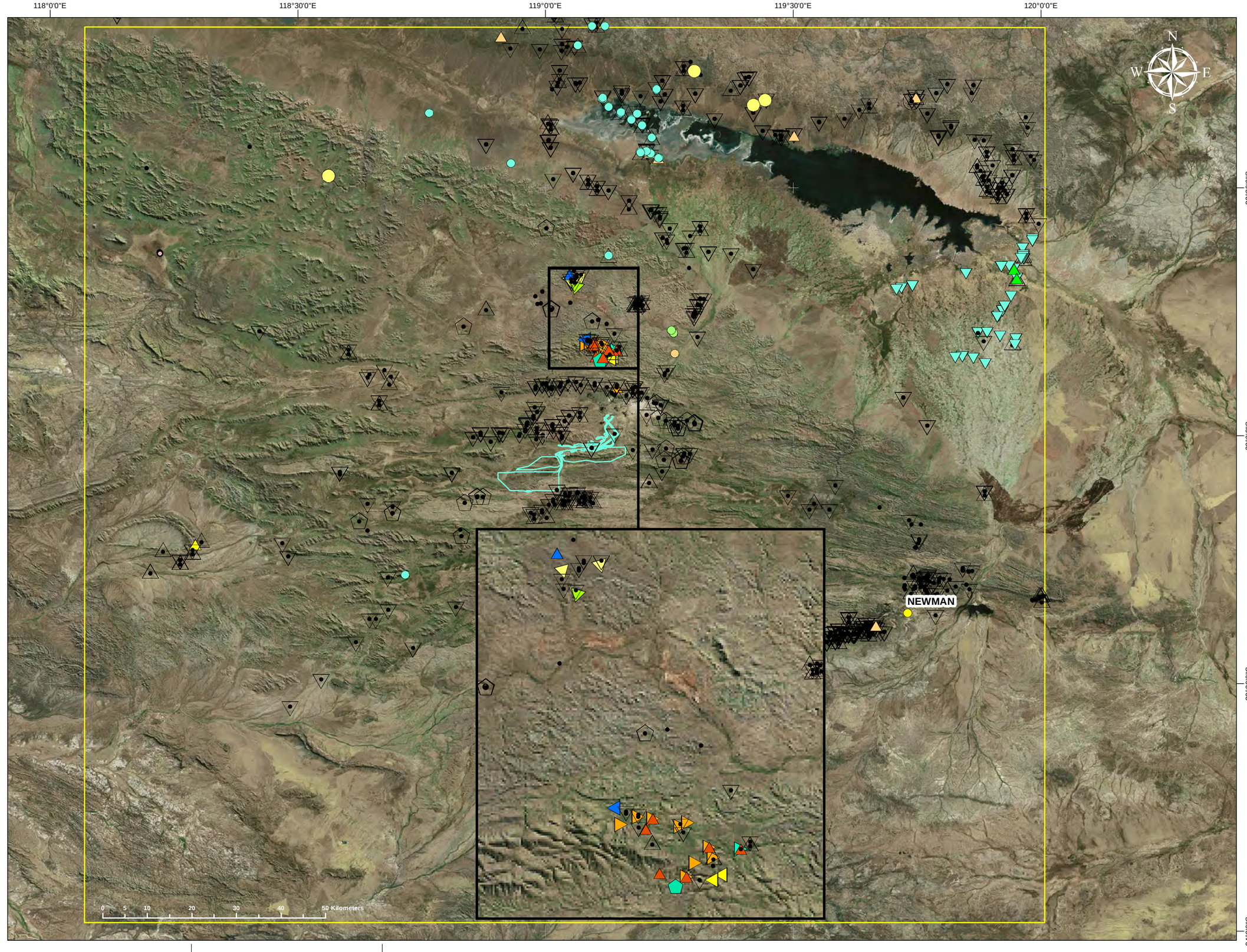

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Figure 4.c. Central and eastern Pilbara showing the distribution of SRE category Opiliones and Pseudoscorpiones (part 1: Olpiidae) records from the database Search Area. Number of records in Parentheses.

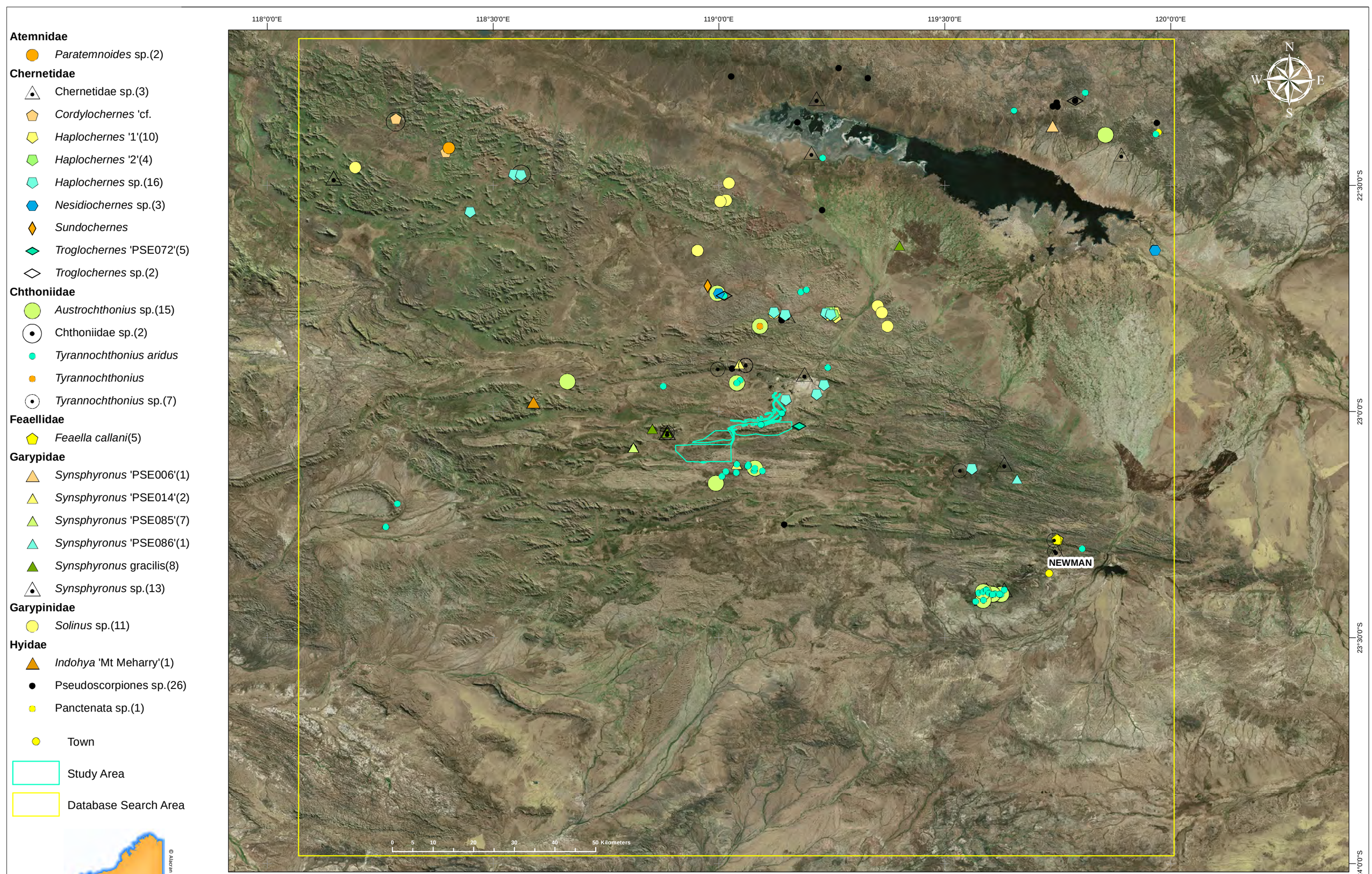

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Figure 4.T. Central and eastern Pilbara showing the distribution of SRE category Pseudoscorpiones (part 2) records from the database Search Area: families Atemnidae, Chthoniidae, Chernetidae, Feaellidae, Garypidae, Garypinidae and Hyidae. Number of records in Parentheses

4.1.4 Schizomida (short-tailed whip scorpions)

Schizomida is an order of Arachnida that vaguely resemble small spiders, but are not related to them. They are more closely related to Uropygi (Wheeler and Hayashi 1998) which are not known from Australia. Australian schizomids are relatively well studied taxonomically (Harvey 2002b; Harvey et al. 2008; Abrams and Harvey 2015); however, numerous undescribed species are known. All Pilbara schizomids show very high levels of endemism and are all considered SREs.

The only known epigean schizomid from the Pilbara is an undescribed species: *Draculoides* 'SCH053' and is only known from deep shaded gorges of Karijini National Park (Figure 4.8). None of the survey samples contained schizomids. It is also unlikely for epigean schizomids to occur within the Study Area because the study area lacks very deep shaded gorges such as those that support this species in Karijini National Park.

4.1.5 Scorpiones (scorpions)

Scorpions are instantly recognisable arachnids and are represented by four families in W. A. Short-range endemic species are known from the families Buthidae, Urodacidae and Hormuridae. The Australian scorpion fauna is very poorly described with as much as 85% suspected of being undescribed (Volschenk et al. 2000; Volschenk 2008; Volschenk et al. 2010; Volschenk et al. 2012; Harvey 2014).

Species delineation in scorpions varies in complexity: species from the family Buthidae can be identified from all but 1st and 2nd instars; however, species identification of Bothriuridae, Urodacidae and Hormuridae is usually heavily dependent on characteristics only present in adult males. The families Buthidae and Urodacidae also contain several species complexes containing cryptic species, which can only be currently identified using DNA barcoding methods.

In W. A., the family Buthidae is represented by three genera, *Lychas*, *Isometroides* and *Isometrus*. Representatives of *Lychas* are frequently collected in surveys of W. A. and current investigations on the genus *Lychas* (W. A. Museum) indicates the presence of several species complexes, some of which appear to contain SREs.

The family Urodacidae is represented by two genera, *Urodacus* and *Aops*, the latter *Aops oncodactylus* is only known from a single specimen from Barrow Island (Volschenk and Prendini 2008). Most species of *Urodacus* appear to be relatively widespread but are often patchily distributed (Volschenk et al. 2010), meaning that their "distribution does not equate to their area of occupation". Several *Urodacus* species are also known to be SREs including the described species *Urodacus planimanus* and *Urodacus koolanensis* as well as several undescribed species from the Pilbara.

The Search Area contained 25 scorpion taxa, of which none were named, 21 were morphospecies and four were unidentified taxa (Table 4.3 and Figure 4.6). One species is an SRE and the remaining 24 taxa are Potential SRE (DD) (Table 4.3).

Table 4.3. Table of SRE category Scorpiones identified from the area search of the W. A. Museum's Terrestrial Invertebrates Database

Family	Binomial	SRE-Category	Justification
	Scorpiones sp.	Potential SRE: DD	Order contains SREs and potential SREs
Buthidae	Buthidae sp.	Potential SRE: DD	Family contains SREs and potential SREs
Buthidae	*Isometroides* sp.	Potential SRE: DD	Genus contains SREs and potential SREs
Buthidae	*Lychas* 'aitkeni complex'	Potential SRE: DD	rare scorpions, unresolved species complex likely to contain SREs
Buthidae	*Lychas* 'annulatus complex'	Potential SRE: DD	molecular evidence indicates several cryptic species involved, some of which appear to be SRE
Buthidae	*Lychas* 'bituberculatus complex'	Potential SRE: DD	molecular evidence indicates several cryptic species involved, some of which appear to be SRE
Buthidae	*Lychas* 'gracilimanus'	Potential SRE: DD	rare species with very disjunct distribution pattern, may contain cryptic species
Buthidae	*Lychas* 'hairy tail complex'	Potential SRE: DD	molecular evidence indicates several cryptic species involved, some of which appear to be SRE
Buthidae	*Lychas* 'Iron Valley'	Potential SRE: DD	W. A. Museum data
Buthidae	*Lychas* 'marandoo 1'	Potential SRE: DD	W. A. Museum data
Buthidae	*Lychas* 'mjobergi?'	Potential SRE: DD	W. A. Museum data
Buthidae	*Lychas* 'paraburdoo'	Potential SRE: DD	W. A. Museum data
Buthidae	*Lychas* 'Pilbara sp. 2'	Potential SRE: DD	W. A. Museum data
Buthidae	*Lychas* 'racing stripe'	Potential SRE: DD	W. A. Museum data
Buthidae	*Lychas* sp.	Potential SRE: DD	Genus contains SREs and potential SREs
Urodacidae	*Urodacus* 'cloudbreak'	Potential SRE: DD	W. A. Museum data
Urodacidae	*Urodacus* 'fat hands'	Potential SRE: DD	W. A. Museum data
Urodacidae	*Urodacus* 'firetail'	Potential SRE: DD	W. A. Museum data
Urodacidae	*Urodacus* 'megamastigus complex'	Potential SRE: DD	W. A. Museum data
Urodacidae	*Urodacus* 'micros'	SRE	W. A. Museum data
Urodacidae	*Urodacus* 'pale complex'	Potential	W. A. Museum data

Family	Binomial	SRE-Category	Justification
		SRE: DD	
Urodacidae	*Urodacus* 'Pilbara 5'	Potential SRE: DD	W. A. Museum data
Urodacidae	*Urodacus* 'SCO022'	Potential SRE: DD	W. A. Museum data
Urodacidae	*Urodacus* sp.	Potential SRE: DD	Genus contains SREs and potential SREs

The field survey yielded eight species of scorpions from the families Buthidae and Urodacidae, of which four are potential SREs.

4.1.5.1 Buthidae (narrow handed scorpions)

***Isometroides* 'pilbara 1'.** This species was recorded from sites TS14, TS16, TS17 and TS18. This species is rarely sampled during invertebrate fauna surveys but is occasionally sampled in the dry pitfall traps of vertebrate fauna surveys. This species is widespread in the Pilbara.

***Lychas* 'pilbara 1'.** This widespread species was recorded from site TS04. It is not an SRE.

***Lychas* 'bituberculatus complex'.** This scorpion was sampled from sites TS04, TS14, TS16, TS17 and Bl01. This taxon represents an unresolved species complex involving several cryptic species, some of which are suspected to be SREs. Until this group is resolved this taxon is a potential SRE owing to taxonomic data deficiency.

***Lychas* 'hairy tail complex'.** This species was sampled from site TS17. This taxon is similar in many ways to *Lychas* 'bituberculatus complex' in that it represents an unresolved species complex, suspected of containing SRE species. Until this group is resolved this taxon is a potential SRE owing to taxonomic data deficiency. Further resolution to the identity of this species may be possible using DNA barcoding methods.

***Lychas* 'harveyi complex'.** This species was sampled from sites TS14 and TS18. This taxon represents an unresolved species complex involving several cryptic species, however in this case they appear to be widespread.

Lychas 'Hope Downs' was identified by Alacran (2018); however, following examination of additional samples obtained during the second survey, that identification appears to have been erroneous and that specimen is here regarded as *Lychas* 'harveyi complex'.

***Lychas* 'multipunctatus complex'.** *Lychas* 'multipunctatus complex' was sampled from sites SRE08, TS14, TS17 and BL01. Like *Lychas* 'bituberculatus complex', this taxon represents an unresolved species complex and appears to contain SRE species. Until this group is resolved this taxon is a potential SRE owing to taxonomic data deficiency.

Assessment of *Lychas* 'bituberculatus complex' and *Lychas* 'multipunctatus complex' was undertaken by both Alacran and W. A. Museum; however, no additional information could be obtained from these studies to assist placing these samples within their respective species complexes.

4.1.5.2 Urodacidae (burrowing scorpions)

***Urodacus* 'pilbara 12'.** This scorpion was sampled from site SRE12. This is a widespread species in the Pilbara.

***Urodacus* 'HD1'.** This scorpion was represented by a juvenile from site SRE13. Since adult males are usually required for morphological identification, DNA barcoding was used to try and place this sample. Patterning on the body of this specimen, suggests that it may represent a different species to *Urodacus* 'Pilbara 12', with the latter species being generally devoid of darker patterns. Barcoding analyses by both Alacran and W. A. Museum could not match this species to any sequenced species (Appendix 3 and Appendix 4).

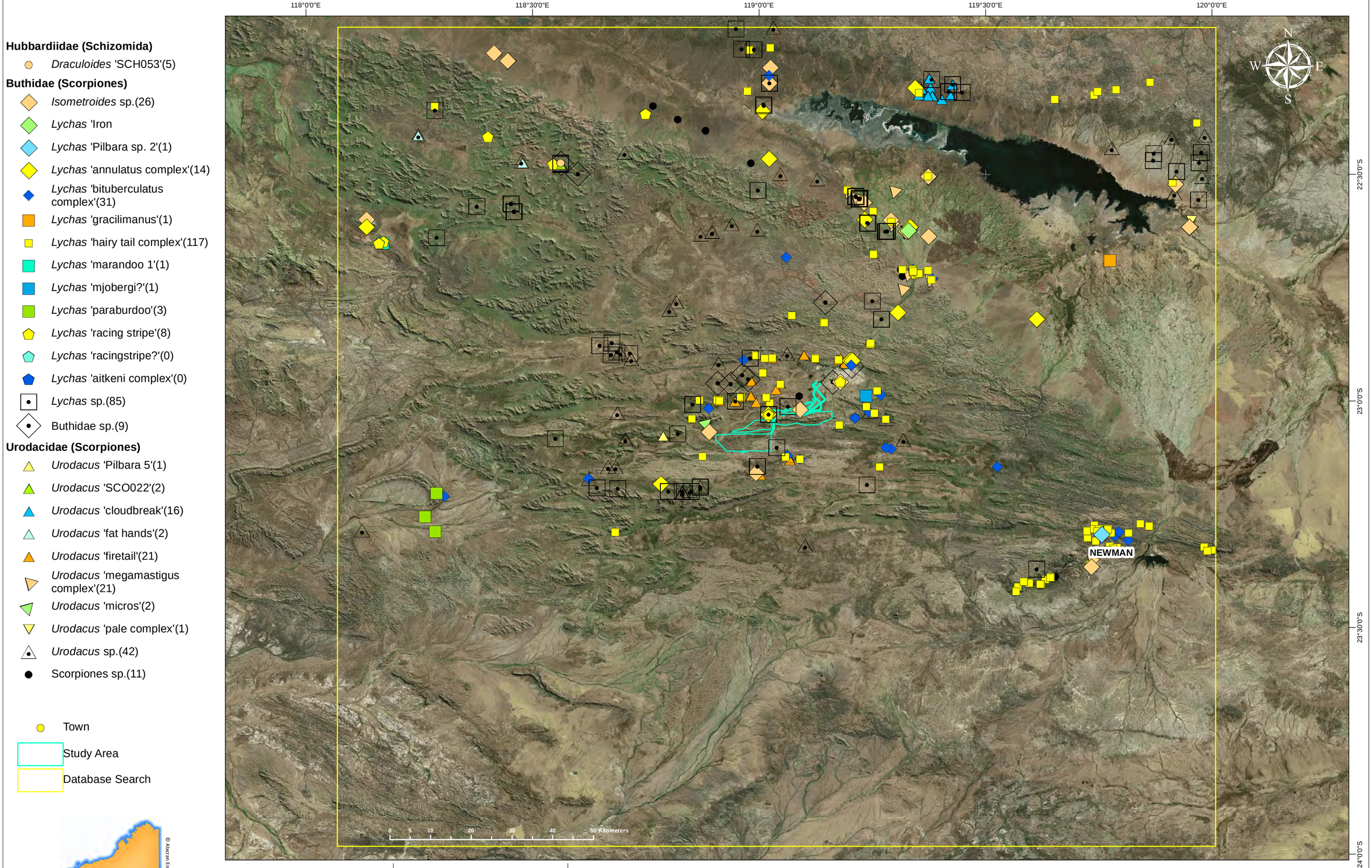

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Figure 4.y. Central and eastern Pilbara showing the distribution of SRE category Schizomida and Scorpiones records from the database Search Area. Number of records in Parentheses.

4.2 CHILOPODA (CENTIPEDES)

Two orders of centipedes from the Pilbara are known to contain SREs: Geophilomorpha (Soil Centipedes) and members of the order Scolopendromorpha, mostly from the family Cryptopidae. Both geophilomorphs and cryptopids are blind and strongly associated with rocky environments, surface soil and deep leaf litter microhabitats. They are usually encountered when turning over rocks or larger pieces of fallen wood/logs and from leaf litter sifting samples. Members of both groups are also frequently collected in subterranean fauna surveys where their presence as troglofauna or soil fauna is often debated. Regardless of their specific ecophysiological requirements, preliminary genetic studies indicate high incidence of local endemism (Phoenix 2014a, b).

The Search Area contained 13 centipede taxa, of which none were named species, two were morphospecies and 11 were unidentified taxa (Table 4.4 and Figure 4.9). All were considered Potential SRE (DD) (Table 4.4). None of the Search Area records fell within the Study Area; however, a large cluster of records of Mecistocephalidae sp. and *Sepedenophilus* sp. records were recorded from the area immediately south east of the Study Area (Figure 4.9).

Table 4.4. Table of SRE category Chilopoda identified from the area search of the W. A. Museum's Terrestrial Invertebrates Database

Order	Family	Binomial	Justification
Geophilomorpha		Geophilomorpha sp.	Order contains SREs and potential SREs
Geophilomorpha	Ballophilidae	Ballophilidae sp.	Family contains SREs and potential SREs
Geophilomorpha	Chilenophilidae	Chilenophilidae sp.	Family contains SREs and potential SREs
Geophilomorpha	Chilenophilidae	*Sepedenophilus* sp.	Genus likely to contain SREs and potential SREs
Geophilomorpha	Geophilidae	Geophilidae sp.	Family may contain SREs and potential SREs
Geophilomorpha	Mecistocephalidae	Mecistocephalidae sp.	Family contains SREs and potential SREs
Geophilomorpha	Mecistocephalidae	*Mecistocephalus* sp.	Genus contains SREs and potential SREs
Geophilomorpha	Oryidae	Oryidae sp.	Family likely to contain SREs and potential SREs
Geophilomorpha	Schendylidae	*Australoschendyla* 'cf. capensis'	ALA, W. A. Museum Data
Geophilomorpha	Schendylidae	*Schendylidae* sp.	Family likely to contain SREs and potential SREs
Scolopendromorpha	Cryptopidae	Cryptopidae sp.	Family contains SREs and potential SREs
Scolopendromorpha	Cryptopidae	*Cryptops* sp.	Genus contains SREs and potential SREs
Scolopendromorpha	Scolopendridae	*Cormocephalus* 'long anal legs'	W. A. Museum data

The field surveys yielded 21 Centipede samples representing the orders Scolopendromorpha (Family Cryptopidae) and Geophilomorpha (families Chilenophilidae, Mecistocephalidae and Oryidae). All Geophilomorpha and Cryptopidae are very poorly known in W. A. While keys to genera and families of Geopholomorpha are available (Colloff et al. 2005), there is no workable morphological framework for

species level identifications. For this reason, all identifications used in this report are based on DNA barcoding.

4.2.1 Geophilomorpha

Members of this order of centipedes are commonly referred to as Soil Centipedes. Unlike most centipedes, they have short legs and cannot move fast. They are adapted for burrowing through soil and leaf litter rather than rapid movement over the soil surface. Geophilomorpha is the most speciose of centipede orders with an estimated 8000 species (Adis and Harvey 2000). The combination of high species diversity and low vagility suggests that this order may support SREs. There are no specialists working on W. A. Soil Centipedes and none have been described from the Pilbara. For this reason, the entire taxonomic framework for W. A. Geophilomorpha used by Alacran relies on DNA barcoding of COI sequences.

Geophilomorpha sp. A single tiny specimen could not be identified using morphology and attempts to obtain COI sequences from this specimen were unsuccessful. Owing to the presence of numerous potential SREs within the Order Geophilomorpha, this taxon is a potential SRE owing to uncertainty about its identity.

4.2.1.1 Chilenophilidae

Two species were identified belonging to the family Chilenophilidae: ***Sepedonophilus* 'HD1'** from sites Op01, SRE01, SRE17 and SRE19, and ***Sepedonophilus* 'HD2'** from site SRE23. Both of these species are new and are potential SREs owing to uncertainty about their distribution limits.

***Sepedenophilus* sp.** represents a specimen for which COI sequences were unsuccessful. This sample was from site SRE19. This specimen may be conspecific with *Sepedenophilus* 'HD1', which was also found at this site. As an ambiguous identification, *Sepedenophilus* sp. is a potential SRE since the genus contains numerous suspected SREs.

Mecistocephalidae

Three species were identified from the family Mecistocephalidae: ***Mecistocephalus* 'HD1'** from sites SRE13, SRE21 and SRE23, ***Mecistocephalus* 'HD2'** from site SRE23 and ***Mecistocephalus* 'HD3'** from site SRE15. All three species are new and are potential SREs owing to uncertainty about their distribution limits.

4.2.1.2 Oryidae

One species was identified from the family Oryidae: ***Orphnaeus* 'HD1'** from site SRE23.This is a new species and is a potential SRE owing to limited data about its distribution limits.

4.2.2 Scolopendromorpha

This order of centipedes contains the families Scolopendridae and Cryptopidae. Species in the family Scolopendridae have been relatively well studied taxonomically in Australia (Koch 1982b; Koch 1982a; Koch 1982c; Koch 1983c, b, a); however, the taxonomy of the family Cryptopidae is largely unstudied.

4.2.2.1 Cryptopidae

This family of centipedes is very poorly known in Australia and in the Pilbara, most species appear to be SREs. Most Pilbara Cryptopidae are represented by troglobites, and epigean records are uncommon. Species delimitation studies of epigean (surface dwelling) cryptopids suggests a significant diversity is present and most appear to be SREs. There is no taxonomic framework for Pilbara cryptopids, and all species assessments are currently based on comparisons using DNA sequences.

***Cryptops* 'HD1'.** This taxon was sampled from site SRE11 and was represented by three specimens. Alacran undertook DNA Barcoding of these samples (Appendix 3); however, this species could not be placed among those within Alacran's database of DNA sequences. This taxon is a potential SRE owing to uncertainty about its identity.

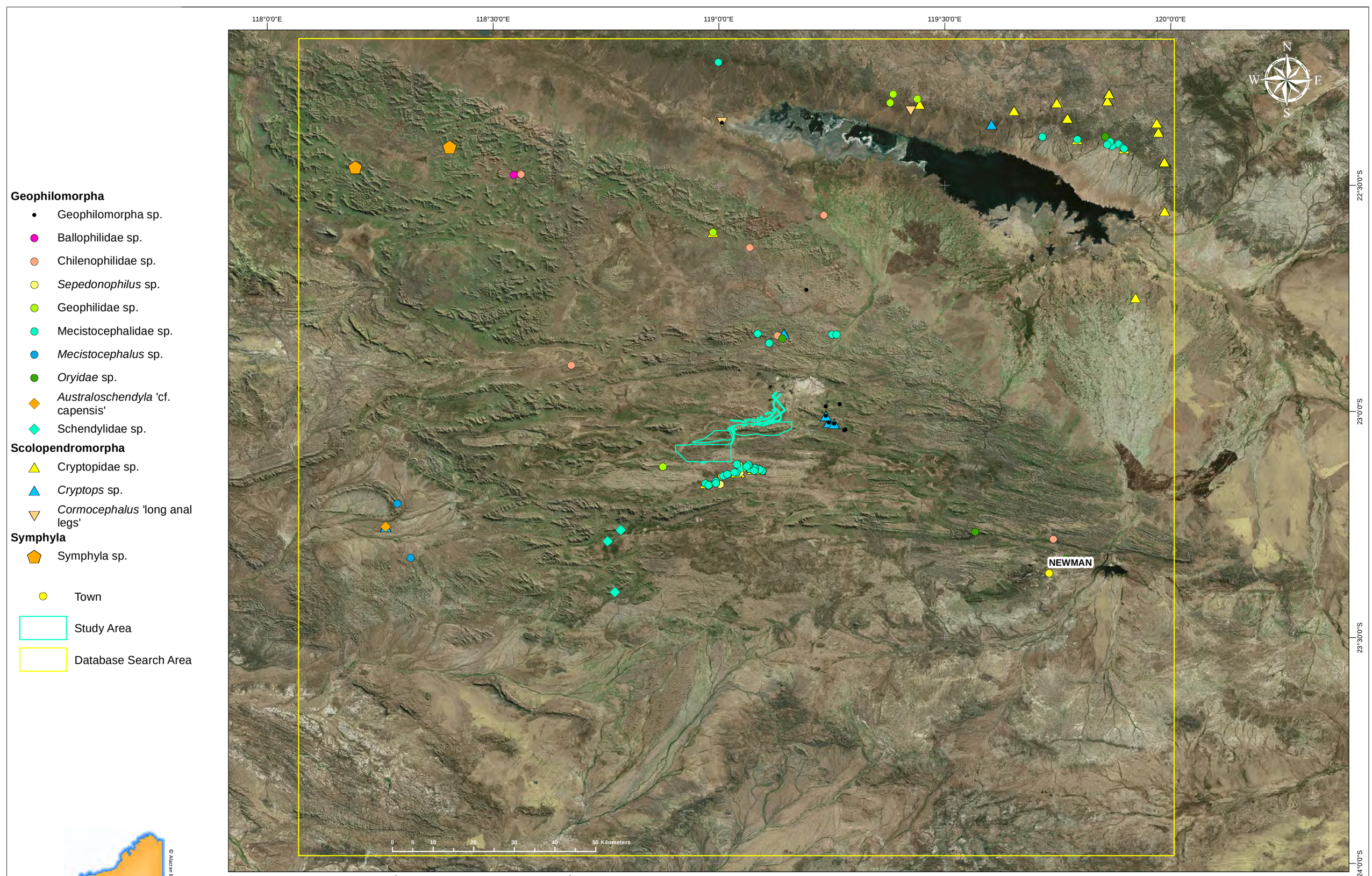

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Figure 4.ϕ. Central and eastern Pilbara showing the distribution of SRE category Chilopoda and Symphyla records from the database Search Area. Number of records in parentheses.

4.3 DIPLOPODA (MILLIPEDES)

Diplopoda is a diverse class and in the Pilbara, it is represented by five orders: Polydesmida, Polyxenida, Polyzoniida, Spirobolida and Spirostreptida. Of these, only the order Polyxenida (pincushion millipedes) has mostly widespread epigean species (Short and Huynh 2011, 2013); however, molecular data (unpublished) indicates several troglobitic species are SREs. The orders Polyzoniida (sucking millipedes) and Spirostreptida are very poorly known from the Pilbara; however, based on investigations of the fauna of SW Australia (Harvey 2002b; Moir et al. 2009; Edward and Harvey 2010; Harvey et al. 2011), it seems likely that most Pilbara representatives will be SREs.

The Search Area contained 30 millipede taxa, of which one was a named species, 20 were morphospecies and nine were unidentified taxa (Table 4.5 and Figure 4.11). Seventeen of these species were SREs and the remainder were potential SRE (DD) (Table 4.5).

Table 4.5. Table of SRE category Diplopoda identified from the area search of the W. A. Museum's Terrestrial Invertebrates Database

Order	Family	Binomial	SRE-Category	Justification
		Diplopoda sp.	Potential SRE: DD	Class contains SREs and potential SREs
Polydesmida		Polydesmida sp.	Potential SRE: DD	Order contains SREs and potential SREs
Polydesmida	Dalodesmidae	Dalodesmidae sp.	Potential SRE: DD	Genus contains SREs and potential SREs
Polydesmida	Paradoxosomatidae	*Antichiropus* 'DIP004'	SRE	W. A. Museum data
Polydesmida	Paradoxosomatidae	*Antichiropus* 'DIP006'	SRE	W. A. Museum data
Polydesmida	Paradoxosomatidae	*Antichiropus* 'DIP007'	SRE	W. A. Museum data
Polydesmida	Paradoxosomatidae	*Antichiropus* 'DIP013'	SRE	W. A. Museum data
Polydesmida	Paradoxosomatidae	*Antichiropus* 'DIP014'	SRE	W. A. Museum data
Polydesmida	Paradoxosomatidae	*Antichiropus* 'DIP015'	SRE	W. A. Museum data
Polydesmida	Paradoxosomatidae	*Antichiropus* 'DIP028'	SRE	W. A. Museum data
Polydesmida	Paradoxosomatidae	*Antichiropus* 'DIP029'	SRE	W. A. Museum data
Polydesmida	Paradoxosomatidae	*Antichiropus* 'DIP031'	SRE	W. A. Museum data
Polydesmida	Paradoxosomatidae	*Antichiropus* 'DIP032'	SRE	W. A. Museum data
Polydesmida	Paradoxosomatidae	*Antichiropus* 'DIP035'	SRE	W. A. Museum data
Polydesmida	Paradoxosomatidae	*Antichiropus* 'DIP036'	SRE	W. A. Museum data
Polydesmida	Paradoxosomatidae	*Antichiropus* 'DIP047'	SRE	W. A. Museum data
Polydesmida	Paradoxosomatidae	*Antichiropus* 'DIP048'	SRE	W. A. Museum data
Polydesmida	Paradoxosomatidae	*Antichiropus* 'DIP075'	SRE	W. A. Museum data
Polydesmida	Paradoxosomatidae	*Antichiropus* 'DIP173'	SRE	W. A. Museum data
Polydesmida	Paradoxosomatidae	*Antichiropus* 'DNA06'	SRE	W. A. Museum data
Polydesmida	Paradoxosomatidae	*Antichiropus* sp.	Potential SRE: DD	Genus contains numerous SRE taxa: (Harvey 2002b; Car and

Order	Family	Binomial	SRE-Category	Justification
				Harvey 2013; Car et al. 2013; Car and Harvey 2014)
Polydesmida	Paradoxosomatidae	*Antichiropus* 'Wonmunna'	SRE	W. A. Museum data
Polydesmida	Paradoxosomatidae	Paradoxosomatidae sp.	Potential SRE: DD	Family contains numerous SRE taxa: (Harvey 2002b; Car and Harvey 2013; Car et al. 2013; Car and Harvey 2014)
Polyzoniida		Polyzoniida sp.	Potential SRE: DD	Order contains SREs and potential SREs
Spirobolida	`Family indet.`	Spirobolida sp.	Potential SRE: DD	Order contains SREs and potential SREs
Spirobolida	Trigoniulidae	*Austrostrophus* 'DIP018'	Potential SRE: DD	W. A. Museum data
Spirobolida	Trigoniulidae	*Austrostrophus* 'DIP053'	Potential SRE: DD	W. A. Museum data
Spirobolida	Trigoniulidae	*Austrostrophus* sp.	Potential SRE: DD	Genus likely to contain SREs and potential SREs
Spirobolida	Trigoniulidae	*Austrostrophus stictopygus*	Potential SRE: DD	Species currently under investigation with molecular data, likely to contain one or more SREs
Spirobolida	Trigoniulidae	Trigoniulidae sp.	Potential SRE: DD	Presence of SRE or potential SRE species in this family

The field survey yielded numerous millipede samples belonging to the orders Spirobolida (family Trigoniulidae) and Polydesmida (family Paradoxosomatidae).

4.3.1 Polydesmida

The order Polydesmida (flatback millipedes) has received significant attention over recent years, particularly the family Paradoxosomatidae (Car and Harvey 2013; Car et al. 2013; Car and Harvey 2014). In the Pilbara, Paradoxosomatidae are represented by two described genera *Antichiropus* and *Boreohesperus*, both of which contain SRE representatives.

4.3.1.1 Paradoxosomatidae

A single species was identified from the family Paradoxosomatidae: *Antichiropus* 'wonmunna' from sites SRE15 (three samples) and SRE23 (one sample). These samples were matched with tissue obtained from a sample of *Antichiropus* 'wonmunna' (T118101) from the W. A. Museum. *Antichiropus* 'wonmunna' was represented by five samples (three different locations) in the Search Area and all are within 10 km of sites SRE15 and SRE23 (Figure 4.10). This species is a potential SRE owing to limited information about its distribution.

***Antichiropus* sp.** was also recorded from sites SRE11 and SRE23. These samples are likely to represent *Antichiropus* 'wonmunna'; however, there is also a chance that one or more may represent different species since multiple species of Paradoxosomatidae have been collected from the same locality (Car and Harvey 2013).

4.3.2 Spirobolida

4.3.2.1 Trigoniulidae

In the Pilbara, Spirobolida is represented by the family Trigoniulidae and the genera *Austrostrophus* and *Speleostrophus*. All epigean species belong to *Austrostrophus* which is represented by a single described species, *Austrostrophus stictopygus*. Molecular studies of this species at the W. A. Museum indicate significant variation between some Pilbara populations that are consistent with species level differences (W. A. Museum, unpublished data). *Austrostrophus stictopygus* therefore appears to represent a complex of species, some of which may be SREs.

Species delimitation by Alacran and the W. A. Museum indicated the presence of two putative species (Appendix 3 and Appendix 4) and the designations applied by the W. A. Museum are adopted here: ***Austrostrophus* 'Clade A'** from site SRE20 and ***Austrostrophus* 'Clade E'** from sites SRE15, SRE22, TS14 and TS18. Both are regarded as potential SREs owing to uncertainty about their distribution limits.

***Austrostrophus* sp.** represents specimens that were not sequenced and were found at sites SRE13, SRE15, SRE16, SRE17, SRE18 and SRE19. In the absence of clear unambiguous identification, this taxon is regarded as a potential SRE owing to data limitation regarding species identity.

4.4 SYMPHYLA (GARDEN CENTIPEDES)

Symphylans are tiny, less than 1 cm, centipede-like arthropods. Like centipedes, they have a multi-segmented body with one pair of legs per segment. They differ from centipedes in several ways, but most notably by the absence of the modified first pair of legs into poison claws, which is characteristic of all true centipedes. This group is poorly known and literature on the Australian species is very limited.

In the Pilbara, nearly all symphylans are recorded from subterranean habitats, where they are frequently SREs. In the absence of a workable taxonomy for Pilbara symphylans, species identification is heavily dependent on DNA sequencing methods. While epigean records of symphylans from the Pilbara are very scarce, it is plausible for them to be present in deep gorges that retain moist soil and leaf litter throughout most of the year.

The database search identified one Symphyla record which was not identified beyond the rank of Class: Symphyla sp. Insufficient data were available to assess whether these were sampled from subterranean habitats or not, therefore they are tentatively considered to be epigean and potential SRE: DD (Figure 4.11).

No symphylans were sampled during this survey; however, they may be present in south-facing gullies and scree slopes in the north west of the Study Area.

Polydesmida

- Dalodesmidae sp.(1)
- *Antichiropus* 'DIP004'(1)
- *Antichiropus* 'DIP006'(20)
- *Antichiropus* 'DIP007'(25)
- *Antichiropus* 'DIP013'(6)
- *Antichiropus* 'DIP014'(15)
- *Antichiropus* 'DIP015'(2)
- *Antichiropus* 'DIP028'(1)
- *Antichiropus* 'DIP029'(2)
- *Antichiropus* 'DIP031'(5)
- *Antichiropus* 'DIP032'(1)
- *Antichiropus* 'DIP035'(1)
- *Antichiropus* 'DIP036'(1)
- *Antichiropus* 'DIP047'(5)
- *Antichiropus* 'DIP048'(3)
- *Antichiropus* 'DIP075'(1)
- *Antichiropus* 'DIP173'(1)
- *Antichiropus* 'DNA06'(1)
- *Antichiropus* 'Wonmunna'(5)
- *Antichiropus* sp.(34)
- Paradoxosomatidae sp.(19)
- Polydesmida sp.(3)

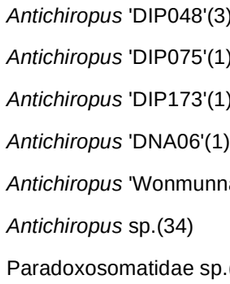
Polyzoniida

- Polyzoniida sp.(1)

Spirobolida

- Spirobolida sp.(1)
- Trigoniulidae sp.(10)
- *Austrostrophus*
- *Austrostrophus* sp.(103)
- *Austrostrophus* 'DIP053'(4)
- *Austrostrophus* 'DIP018'(4)
- Diplopoda sp.(3)

- Townc
- Study Area
- Database Search Area



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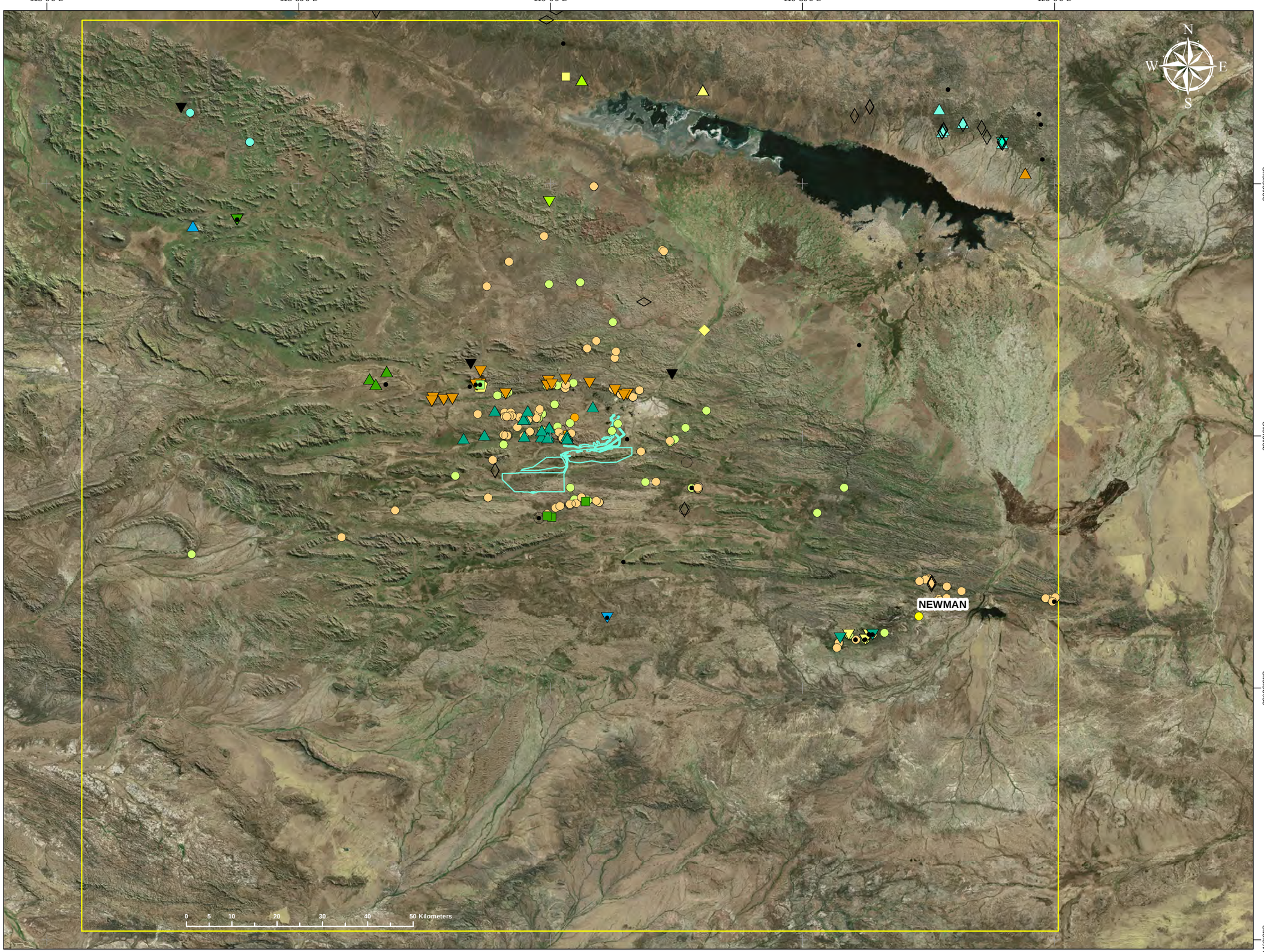

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Figure 4.мл. Central and eastern Pilbara showing the distribution of SRE category Diplopoda records from the database Search Area. Number of records in Parentheses.

4.5 ISOPODA (SLATERS OR WOOD LICE)

Isopoda represent the only order of epigean crustaceans known to contain SREs. The suborder Oniscidae represents terrestrial and secondarily aquatic isopods with approximately 190 species described in Australia (Martin et al. 2011). The W. A. terrestrial isopod fauna is largely undescribed and is diverse (Judd and Horwitz 2003; Judd and Perina 2013). Isopods have poor dispersal capabilities and often have specific habitat preferences, making them target SRE taxa in W. A.

The Search Area contained 34 isopod taxa, of which none were named species, 25 were morphospecies and nine were unidentified taxa (Table 4.6 and Figure 4.9). These taxa were potential SRE (DD) (Table 4.6).

Table 4.6. Table of SRE category terrestrial Isopoda from the area search of the W. A. Museum's Crustacea Database

Family	Binomial	SRE-Category	Justification
	Isopoda sp.	Potential SRE: DD	Order contains SREs and potential SREs
Armadillidae	*Acanthodillo* '6'	Potential SRE: DD	assessment by Dr Simon Judd
Armadillidae	*Acanthodillo* sp.	Potential SRE: DD	Genus contains SREs and potential SREs
Armadillidae	*Armadillidae* 'ISO001'	Potential SRE: DD	W. A. Museum assessment
Armadillidae	*Armadillidae* sp.	Potential SRE: DD	Family contains SREs and potential SREs
Armadillidae	*Barrowdillo* '1'	Potential SRE: DD	W. A. Museum Data and assessment by Dr Simon Judd assessment
Armadillidae	*Buddelundia* '10'	Potential SRE: DD	assessment by Dr Simon Judd
Armadillidae	*Buddelundia* '12'	Potential SRE: DD	assessment by Dr Simon Judd
Armadillidae	*Buddelundia* '13'	Potential SRE: DD	assessment by Dr Simon Judd
Armadillidae	*Buddelundia* '14'	Potential SRE: DD	assessment by Dr Simon Judd
Armadillidae	*Buddelundia* '14cr'	Potential SRE: DD	assessment by Dr Simon Judd
Armadillidae	*Buddelundia* '14fm'	Potential SRE: DD	assessment by Dr Simon Judd
Armadillidae	*Buddelundia* '20'	Potential SRE: DD	assessment by Dr Simon Judd
Armadillidae	*Buddelundia* '26'	Potential SRE: DD	assessment by Dr Simon Judd
Armadillidae	*Buddelundia* '47'	Potential SRE: DD	assessment by Dr Simon Judd
Armadillidae	*Buddelundia* '48'	Potential SRE: DD	assessment by Dr Simon Judd
Armadillidae	*Buddelundia* '49'	Potential SRE: DD	assessment by Dr Simon Judd
Armadillidae	*Buddelundia* '54'	Potential SRE: DD	assessment by Dr Simon Judd
Armadillidae	*Buddelundia* 'B47'	Potential SRE: DD	(Ecologia 2014)
Armadillidae	*Buddelundia* 'B49'	Potential SRE: DD	(Ecologia 2014)
Armadillidae	*Buddelundia* 'B50'	Potential SRE: DD	(Ecologia 2014)
Armadillidae	*Buddelundia* 'B52'	Potential SRE: DD	(Ecologia 2014)
Armadillidae	*Buddelundia* 'B53'	Potential SRE: DD	(Ecologia 2014)
Armadillidae	*Buddelundia* 'B54'	Potential SRE: DD	(Ecologia 2014)
Armadillidae	*Buddelundia* 'ISO002'	Potential SRE: DD	W. A. Museum assessment
Armadillidae	*Buddelundia* sp.	Potential SRE: DD	Genus contains SREs and potential SREs
Armadillidae	Buddelundiinae sp.	Potential SRE: DD	Tribe contains SREs and potential SREs, previously *Buddelundia* '19', Assessment by

Family	Binomial	SRE-Category	Justification
			Dr Simon Judd
Armadillidae	*Spherillo* sp.	Potential SRE: DD	Genus contains SREs and potential SREs
Philosciidae	*Laevophiloscia* 'PES4394'	Potential SRE: DD	assessment by Dr Simon Judd
Philosciidae	*Laevophiloscia* sp.	Potential SRE: DD	assessment by Dr Simon Judd
Philosciidae	*Laevophiloscia* 'Wonmunna A'	Potential SRE: DD	assessment by Dr Simon Judd
Philosciidae	*Laevophiloscia* 'Wonmunna B'	Potential SRE: DD	assessment by Dr Simon Judd
Philosciidae	Philosciidae sp.	Potential SRE: DD	All Philosciidae in the Pilbara are considered potential SREs.

4.5.1.1 Armadillidae

***Buddelundia* '10ma'.** This species was sampled from sites SRE11, TS4 and TS5. This species was only sampled during the T1 survey. The *Buddelundia* '10' species group contains several species, including this one. This taxon has been previously collected from the Marillana and West Angelas areas and is regarded as an SRE. The records of the W. A. Museum have not been updated to distinguish *Buddelundia* '10' from Buddelundia '10ma'; therefore, the latter species is not specifically represented in Figure 4.11. The distribution of *Buddelundia* '10' is mapped and some of these will be representatives of *Buddelundia* '10ma'.

***Buddelundia* '15'.** This isopod was sampled from sites SRE14, SRE15, SRE19 and SRE23. This is a relatively widespread Pilbara species.

***Buddelundia* '16'.** This species was sampled from sites SRE17 and SRE19. This is a relatively widespread Pilbara species complex.

***Buddelundia* '77'.** This species was sampled from five sites: SRE15, SRE17, SRE19, SRE22 and SRE23. This species has a distinct disjunct distribution. It's is a small, likely cryptic species of *Buddelundia* and the isolated populations may be different species. This species is a potential SRE owing to taxonomic uncertainty and highly disjunct populations.

Buddelundiinae sp. This taxon was sampled from sites SRE23 and TS14. It belongs to an undescribed genus closely related to *Buddelundia*. This genus is mostly found in the Pilbara region and lacks the morphological characters used to determine *Buddelundia*. Morphospecies are difficult to define in this group and there is a general lack of sequences with which to make comparisons. They are all potential SRE species.

***Pseudodiploexochus* sp.** This unusual isopod was sampled from SRE17. This is the second record of this genus from the Pilbara. The only other record of this genus in the Pilbara is from the West Angelas area (23°07'26.83"S 118°53'09.08"E), approximately 25 km SW of the locality where it was sampled in this survey. That sample is part of the S. Judd Isopod collections and is therefore not present in the W. A. Museum data records. Further comparisons between these samples should be undertaken using DNA barcoding methods since the taxonomy of this group is also very poor in W. A.

Members of this genus do not have the well-developed lungs present in most terrestrial Armadillidae. For this reason, they are far more susceptible to desiccation and are nearly always considered to be SRE in arid or semi-arid environments. *Pseudodiploexochus* is therefore likely to represent an SRE but in the absence of additional taxonomic or distributional data, it is a potential SRE.

***Troglarmadillo* sp.** This unusual isopod was sampled from site SRE13. This tiny specimen could not be unambiguously identified; however, it showed closest affinity to *Troglarmadillo*, a genus almost entirely represented by troglobites in the Pilbara. Despite the genus name, the species sampled possesses well developed eyes and has faint body patterning, suggesting that it is not a troglobite. Subterranean *Troglarmadillo* species are nearly always SRE and it is likely that this species will be as well. In the absence of more resolved taxonomic and distributional data, this species is a Potential SRE. While there are a number of sources for sequences for Pilbara *Troglarmadillo* species, all of them are from troglobites; therefore, sequencing this specimen is unlikely to be of much use until more specimens are obtained.

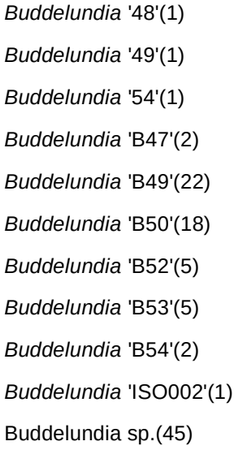
4.5.1.2 Family Philosciidae

The taxonomy of the Philosciidae is unknown in W. A. They are rarely collected in the Pilbara and are generally considered to be potential SREs.

Philosciidae sp. This taxon was collected at SRE19 and TS14. Several attempts were made to amplify COI sequences from these samples; however, all samples failed to yield useful sequences. In the absence of unambiguous species identification, this taxon is a potential SRE owing to data deficiency about its identity.

- *Acanthodillo* '6'(4)
- *Acanthodillo* sp.(6)
- Armadillidae sp.(1)
- *Barrowdillo* '1'(1)
- *Buddelundia* '10'(101)
- *Buddelundia* '12'(11)
- *Buddelundia* '13'(36)
- *Buddelundia* '14'(58)
- *Buddelundia* '14cr'(8)
- *Buddelundia* '14fm'(3)
- *Buddelundia* '20'(2)
- *Buddelundia* '26'(3)
- *Buddelundia* '47'(1)
- *Buddelundia* '48'(1)
- *Buddelundia* '49'(1)
- *Buddelundia* '54'(1)
- *Buddelundia* 'B47'(2)
- *Buddelundia* 'B49'(22)
- *Buddelundia* 'B50'(18)
- *Buddelundia* 'B52'(5)
- *Buddelundia* 'B53'(5)
- *Buddelundia* 'B54'(2)
- *Buddelundia* 'ISO002'(1)
- Buddelundia sp.(45)
- Buddelundiinae sp.(90)
- Isopoda sp.(49)
- *Spherillo* sp.(3)
- *Laevophiloscia* 'Wonmunna
- *Laevophiloscia* 'Wonmunna
- *Laevophiloscia*
- *Laevophiloscia* sp.(2)
- Philosciidae sp.(2)

- Town
- Study Area
- Database Search Area



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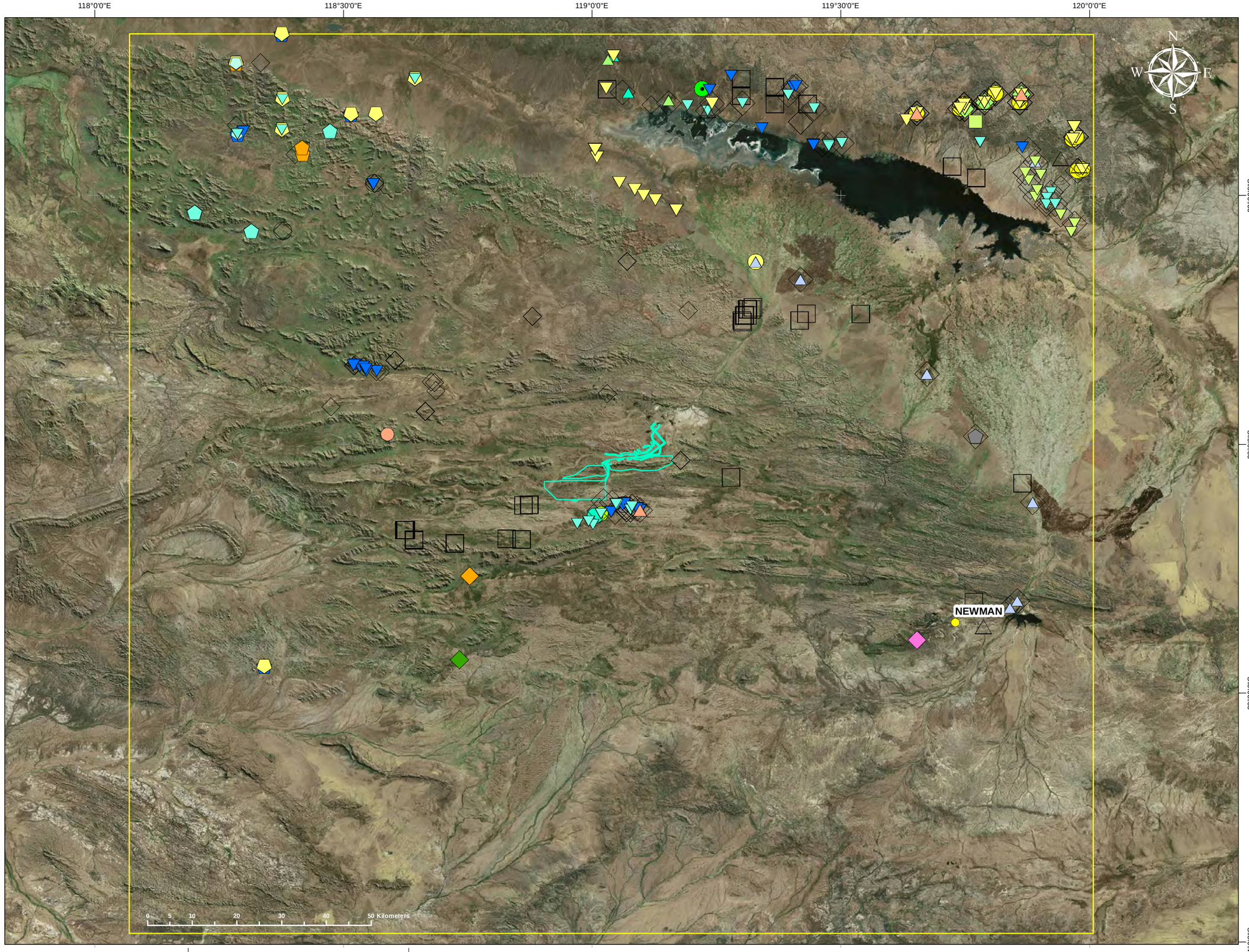

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Date: 2 Oct 2019

Figure 4.1M. Central and eastern Pilbara showing the distribution of SRE category Isopoda records from the database Search Area. Number of records in Parentheses.

4.6 EUPULMONATA, MOLLUSCA (LAND SNAILS)

Land snails are a diverse group of invertebrates and most of Australia's snail fauna is endemic (Beesley et al. 1998). Their limited dispersal capabilities, often combined with specific habitat requirements, makes them one of the SRE target groups in W. A. (Harvey 2002b; EPA 2009). In the Pilbara region of W. A., the families Camaenidae, Bothriembryonitidae and Succineidae are significant in containing SREs and potential SREs; however, much of the diversity is cryptic and dependent on molecular investigations to verify species boundaries (Johnson et al. 2012; Johnson et al. 2013; Whisson and Kirkendale 2014).

The Search Area contained 12 SRE category snail taxa, of which one was a named species, four were morphospecies and seven were unidentified taxa (Table 4.7 and Figure 4.12). All were considered potential SRE (DD) (Table 4.7).

Table 4.7. Table of SRE category Eupulmonata from the area search of the W. A. Museum's Mollusca Database

Family	Binomial	SRE-Category	Justification
Camaenidae	Camaenidae 'Mount Robinson'	Potential SRE: DD	W. A. Museum data
Camaenidae	Camaenidae sp.	Potential SRE: DD	(Whisson and Kirkendale 2014)
Camaenidae	cf. *Quistrachia* sp.	Potential SRE: DD	Genus contains SREs and potential SREs
Camaenidae	*Quistrachia* cf. turneri	Potential SRE: DD	W. A. Museum data
Camaenidae	*Quistrachia* 'Marandoo'	Potential SRE: DD	W. A. Museum data
Camaenidae	Quistrachia sp.	Potential SRE: DD	Genus contains SREs and potential SREs (Whisson and Kirkendale 2014)
Camaenidae	*Rhagada* sp.	Potential SRE: DD	Genus contains SREs and potential SREs (Whisson and Kirkendale 2014)
Charopidae	*Discocharopa* sp.	Potential SRE: DD	W. A. Museum data
Planorbidae	*Bayardella* sp.	Potential SRE: DD	W. A. Museum data
Planorbidae	*Leichhardtia sisurnius*	Potential SRE: DD	W. A. Museum data
Planorbidae	*Leichhardtia* cf. sisurnius	Potential SRE: DD	W. A. Museum data
Punctidae	*Paralaoma* sp.	Potential SRE: DD	W. A. Museum data

The field survey yielded three species of land snails: *Gastrocopta* sp., *Pupoides* sp. and *Eremopeas interioris*, all of which are widespread in the Pilbara (Table 3.2). The absence of SRE snails from the Study Area is difficult to assess. Among SRE groups, snails can be extremely difficult to find, making their absence in surveys difficult to interpret. Optimal conditions for surveying SRE snails (rainy nights) are often logistically

challenging for surveys in the Pilbara. When inactive, most species burrow into the ground or seal themselves against rocks deep in rock piles and remain inactive until rains return.

4.7 HABITAT ASSESSMENT

The Mulga Woodlands in the study area supported eight of the nine centipede taxa and both millipede taxa. Of note in these groups is the presence of the millipede genus *Antichiropus* and the centipede genus *Cryptops*. All Pilbara morphospecies and species of *Antichiropus* are SREs and all epigean *Cryptops* are potential SRE.

Hill slope gullies supported Philosciidae sp, *Troglarmadillo* sp. and *Pseudodiploexochus* sp. which, while being ambiguously defined, represent likely SREs. The latter two taxa represent forms that are very rarely sampled from epigean habitats in the Pilbara and are not arid adapted. The presence of arid sensitive taxa in these habitats indicates that SRE habitats are present. Additional SRE species are likely to occur in these habitats.

The pseudoscorpion *Anatemnus* sp. is enigmatic in that it has all of the features of a troglobite (blind and pale) and the only other Pilbara record of this genus is troglobitic. One specimen was sampled from riparian leaf litter of a dry creek line (SRE10). There is a small chance that this species is troglobitic and in rare cases, troglobites have been observed at the entrance of caves during very humid conditions. In the Pilbara, troglobitic *Nocticola* have been sampled from creak gravels (Volschenk personal observations) indicating that this is potential habitat for troglobitic taxa. The presence of this species from the subterranean fauna surveys of this area may offer evidence that this is a troglobite.

Several SRE category invertebrates sampled during this study were found in multiple habitat types, suggesting that they may be less specialised with respect to their habitat preferences:

- *Lychas* 'bituberculatus complex', from stony hills and eucalypt woodland;
- *Sepedenophilous* 'HD1', from rocky slopes and gullies, and mulga woodland;
- *Mecistocephalus* 'HD1', from rocky slopes and gullies, and mulga woodland;
- *Austrostrophus* 'HD2', from mulga woodland and open eucalypt woodland;
- *Antichiropus* 'wonmunna', from mulga woodland in this study area, but from gully slopes and riparian vegetation outside of this study area.

Habitat mapping was undertaken by Astron and while all of the habitats have the potential to support SREs, five habitats stand out as being conducive to relictual SREs: Breakaways, Mulga Woodland, Minor Drainage lines, Gorges and Gullies, and Rocky Hills. Most of these latter habitats are associated with an isolated ridge running in an east-west direction, so most of the breakaways and rocky slopes are south-facing and therefore conducive to SREs (Harvey 2002b).

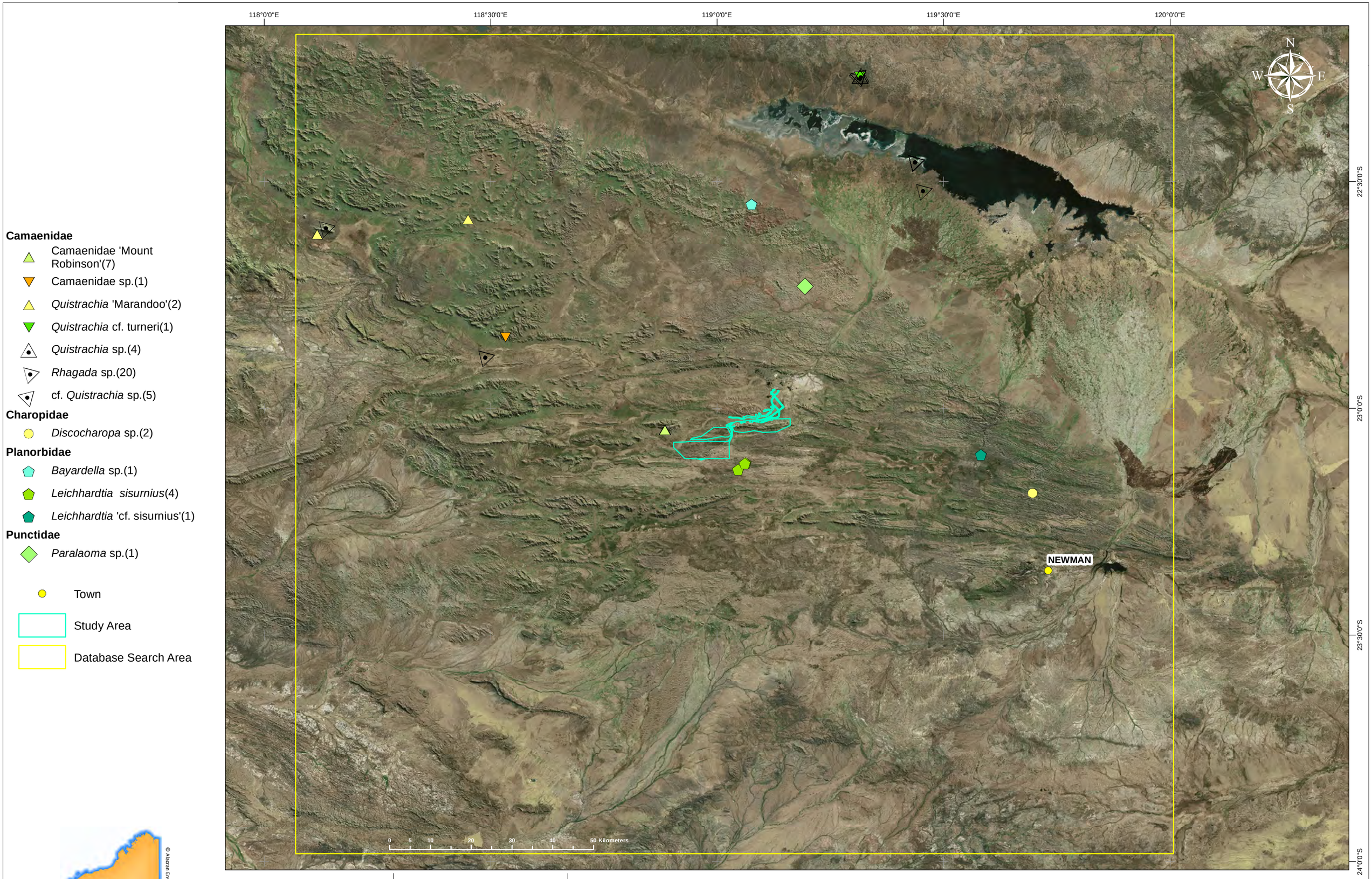

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Figure 4.1H. Central and eastern Pilbara showing the distribution of SRE category Eupulmonata records from the database Search Area. Number of records in Parentheses.

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APPENDICES

The following appendices are embedded within this document:

Appendix 1. Short-range endemic records from an area search by the W. A. Museum.
Appendix 2. Short-range endemic and target group records from the field survey.
Appendix 3. Targeted DNA barcoding of Invertebrates from the Hope Downs 2 Project Area.
Appendix 4. WAM-MSU-476: Molecular identification of terrestrial arthropods from north west of Newman, Western Australia (project 1912).



Alacran Environmental Science

Report 1912

DNA-Barcoding report for invertebrates from Hope Downs



Prepared for **Astron**

Stylised DNA sequence of *Aname mellosa*

ABN 33577027061
www.alacranenvironmental.com

SUMMARY

This study aimed to verify the identity of 60 samples of invertebrates from an invertebrate survey undertaken at Hope Downs using molecular barcoding techniques. Standard sanger sequencing methods were employed to amplify a DNA fragment of the gene Cytochrome C oxidase subunit I (COI).

Of the 60 samples assessed, 53 yielded useable DNA sequences, which were analysed using Bayesian phylogenetic reconstruction methods. Thirty (30) species and morphospecies were identified from the study. Ten (10) of these taxa represent species or morphospecies previously known from the Pilbara:

- *Karaops banyjima*: (AES190099, AES190069), a potential SRE: DD;
- *Aurecocrypta* 'MYG315' (AES190347), a potential SRE: DD;
- *Synothele* 'MYG311' (AES190039), a potential SRE: DD;
- *Synothele* 'MYG309' (AES190063), a potential SRE: DD;
- *Gaius tealei* (AES190072, AES190101), a widespread species;
- *Yilgarnia* 'MYG197' (AES190050), potential SRE: DD;
- 'Genus 7/4 PSE118' (T146562, T146561, T146559, AES190079), potential SRE: DD;
- *Lychas* 'bituberculatus cmplx' (AES190065), potential SRE: DD;
- *Lychas* 'multipunctatus cmplx' (AES190080), potential SRE: DD, and
- *Antichiropus* 'wonmunna' (AES190321, AES190104, AES190067, AES190040), potential SRE: DD.

Twenty-two (20) taxa could not be matched with available sequences:

- *Aurecocrypta* 'HD1' (AES190082), a brush-footed trapdoor spider (Barychelidae);
- *Beierolpium* 'HD1' (AES190331), a pseudoscorpion (Olpiidae);
- *Beierolpium* 'HD2' (AES190341), a pseudoscorpion (Olpiidae);
- *Beierolpium* 'HD3' (AES190012), a pseudoscorpion (Olpiidae);
- *Indolpium* 'HD4'(AES190014), a pseudoscorpion (Olpiidae);
- *Austrohorus* 'HD5' (T146556), a pseudoscorpion (Olpiidae);
- *Euryolpium* 'HD6' (T146557), a pseudoscorpion (Olpiidae);
- *Euryolpium* 'HD7' (T146564), a pseudoscorpion (Olpiidae);
- *Tyrannochthonius* 'HD1' (T146555), a pseudoscorpion (Chthoniidae);
- *Tyrannochthonius* 'HD2' (AES190330), a pseudoscorpion (Chthoniidae);
- *Urodacus* 'HD1' (AES190076), a burrowing scorpion (Urodacidae);
- *Mecistocephalus* 'HD1' (AES190336, AES190335, AES190308, AES190338), an earth centipede (Mecistocephalidae);
- *Mecistocephalus* 'HD2' (AES190337), an earth centipede (Mecistocephalidae);
- *Mecistocephalus* 'HD3' (AES190313, AES190322), an earth centipede (Mecistocephalidae);
- *Sepedenophilous* 'HD1' (AES190305, AES190306, AES190077, AES190006, T146570, AES190007, AES190106), an earth centipede (Chilenophilidae);
- *Sepedenophilus* 'HD2' (AES190061), an earth centipede (Chilenophilidae);
- *Orphnaeus* 'HD1' (AES190103), an earth centipede (Oryidae);
- *Cryptops* 'HD1' (AES190315, AES190318, AES190319),
- *Austrostrophus* 'HD1' (AES190092), a millipede (Trigoniulidae), and

- *Austrostrophus* 'HD2' (AES190028, AES190344, AES190074, AES190083), a millipede (Trigoniulidae).

These 19 taxa all have distribution and taxonomic characteristics that make them potential SREs.

1 AIMS

The aim of this study was to assess the species boundaries of eight groups of invertebrates from the Hope Downs area and surrounds, in the Pilbara region of Western Australia:

- spiders from the genus *Karaops* (family Selenopidae)
- brush-footed trapdoor spiders (Barychelidae)
- spiny trapdoor spiders (Idiopidae)
- pseudoscorpions (Olpiidae and Chthoniidae);
- *Lychas* scorpions;
- *Urodacus* scorpions;
- Earth centipedes (Chilenophilidae, Mecistocephalidae and Oryidae);
- Cryptic centipedes (Cryptopidae)
- millipedes in the genus *Austrostrophus* (family Trigoniulidae).
- wood lice (isopods from the family Philosciidae);

These samples were obtained during invertebrate surveys by Astron and Alacran Environmental Science (Alacran) and reported on in Alacran (2019). This report is intended as a supplement to Alacran (2019).

2 METHODS

Sequences and tissue samples were obtained from the following sources:

- Western Australian Museum (tissues and comparative sequences): codes beginning with “T” and followed by a string of numbers
- Alacran Environmental Science (comparative sequences and tissues): samples predating 2019 begin with “ESV” and later samples beginning with “AES”
- Genbank (comparative sequences): codes beginning with two letters and followed by six numbers.
- Erich Volschenk scorpion research (comparative sequences): codes beginning with “EVR”.

All of the target samples were sourced from field collected specimens detailed in a report provided to Astron by Alacran Environmental Science (Alacran), (Alacran 2019).

Sequences of the gene COI were amplified from muscle tissues obtained from specimens preserved in >95% (WA Museum tissue collection) or *ca.* 70%->95% ethanol (wet collections of WA Museum and Simon Judd). Sequence generation from tissues was undertaken by Xytogen Pty Ltd (https://xytogen.com.au/) and AGRF Perth (http://www.agrf.org.au).

Sequence contigs were assembled from forward and reverse amplicons using Geneious R7 version 7.1.9 and were subsequently edited and pruned by eye, prior to consensus sequences being created. Primers were removed from the consensus sequences which were then assessed for contamination using the NCBI Nucleotide Blast tool (https://blast.ncbi.nlm.nih.gov).

For analyses and alignment, additional sequences of species were obtained from Genbank or from Alacran (unpublished sequences) to better guide alignments and assessment of species boundaries. Species pairs were

selected from taxa within the same genus or family of the taxa under investigation and more than 400 bases long.

Phylogenetic analyses and Sequence alignments were performed with Geneious R7. For each analysis sequences were assembled and aligned using ClausalW or the Geneious alignment tool, implementing the following variable settings: Global alignment with free ends; Cost matrix, 70% similarity (IUB); Open gap penalty, 70; Gap extension penalty, 10; refinement iterations, 4.

Phylogenetic analyses were implemented using Geneious R7 and MrBayes (Huelsenbeck and Ronquist 2001; Ronquist et al. 2012). Outgroups were selected from (in order of preference): sister genus-, sister family- or sister order- to the group under investigation. Species delimitation was based on an 8% sequence divergence threshold (Hebert et al. 2003a; Hebert et al. 2003b; Barrett and Hebert 2005; Robinson et al. 2009) unless otherwise stated. Most of the analyses undertaken here were comprised of representatives of the same family; however, sequences were grouped at the Class level for Diplopoda, and order for Geophilomorpha and Pseudoscorpiones.

2.1 ANALYSES

Eight separate analyses were undertaken here, with each analysis aiming to assess the identification of the target taxa for the respective group.

Composition of the analyses are listed for each analysis as follows:

- Selenopidae - Table 1,
- Barychelidae - Table 2,
- Idopidae - Table 3,
- Nemesiidae - Table 4
- Pseudoscorpiones - Table 5,
- *Lychas* (Scorpiones, Buthidae) - Table 6,
- *Urodacus* (Scorpiones, Urodacidae) - Table 7,
- Geophilomorpha - Table 8,
- Cryptopidae - Table 9,
- Diplopoda - Table 10.

Table 1. Sample composition for the Selenopidae analysis

Sample type	Samples
Target samples	*Karaops* sp., AES190069; *Karaops banyjima* AES190099
Reference samples	*Karaops martamarta* (T124805, T124806) and four additional *Karaops* haplotypes: *Karaops* 'DNA01' (T124901, T128055), *Karaops* 'DNA02' (T124815, T124818), *Karaops* 'DNA03' (T124816, T124817), *Karaops* 'DNA04' (T124792) *Karaops* 'DNA05' (T128008, T128011, T128002) and *Karaops* sp. (T134092, T134104, T139710, T139711, T139718, T139720, T139722, T139723, T139724, T139730).
Outgroup	*Liphistius laoticus* (KP229896), *Anyphops barnardi* (HM575911, HM575912), *Garcorops* 'madagascar' (HM575917) and *Selenops submaculosus* (HM575844)

Table 2. Sample composition for the Barychelidae analysis

Sample type	Samples
Target samples	*Synothele* sp.: AES190063, AES190039, AES190082, AES190347
Reference samples	*Aurecocrypta* 'MYG246' (KJ744784, KJ744805), *Aurecocrypta* 'MYG314' (KJ744682), *Aurecocrypta* 'MYG315' (KJ744636, KJ744575), *Aurecocrypta* 'MYG316' (KJ744667, KJ745033), *Aurecocrypta* 'MYG317' (KJ744547), *Aurecocrypta* 'MYG318' (KJ744660), *Aurecocrypta* 'MYG319' (KJ745481), *Idiommata blackwalli* (KJ745197), *Idiommata* 'MYG247' (KJ745462, KJ745116), *Idiommata* 'MYG254' (KJ745103), *Idiommata* 'MYG320' (KJ745100, KJ745205), *Synothele arrakis* (KY017602), *Synothele* 'xkarara' (KJ744439, KJ745125, KJ745214, KJ745438), *Synothele* '01' (T128031, T128171, T128044), *Synothele* '02' (T118332), *Synothele* '03' (T124724), *Synothele* '04' (T124722), *Synothele* '05' (T126826, T128057), *Synothele* 'WM1' (ESV18:0841), *Synothele* 'WM2' (ESV18:0933), *Synothele* 'MYG127' (KJ745104, KJ745113), *Synothele* 'MYG179' (KJ744405), *Synothele* 'MYG309' (KJ744894, KJ744794 KJ745344), *Synothele* 'MYG310' (KJ744594, KJ744595), *Synothele* 'MYG311' (KJ744654, KJ745445, KJ744869, KJ745034), *Synothele* 'MYG312' (KJ745212) and *Synothele* 'MYG313' (KJ745433).
Outgroup	*Liphistius laoticus* (KP229896).

Table 3. Sample composition for the Idiopidae analysis

Sample type	Samples
Target samples	Idiopidae sp. (AES190072, AES190101)
Reference samples	*Arbanitis longipes* (KY295347), *Arbanitis robertcollinsi* (KY295308), *Blakistonia aurea* (KY295304), *Blakistonia bassi* (MH491250), *Blakistonia birksi* (MH491279), *Blakistonia mainae* (MH491281), *Blakistonia maryae* (MH491199), *Blakistonia nullarborensis* (MH491284), *Bungulla bella* (MG516838), *Bungulla bertmaini* (MG516831), *Bungulla biotai* (MG516828), *Bungulla disrupta* (MG516840), *Bungulla gibba* (MG516839), *Bungulla yeni* (MG516835), *Cataxia barrettae* (KY485320), *Cataxia bolganupensis* (KY295345), *Cataxia colesi* (KY485343), *Cataxia maculata* (KY295235), *Cataxia melindae* (KY485348), *Cataxia pallida* (KY295300), *Cataxia pulleinei* (KY295295), *Cataxia sandsorum* (KY485338), *Cataxia spinipectoris* (KY295296), *Cataxia* sp. (KY295229, KY295294, KY295297, KY295299), *Cataxia stirlingi* (KY485328, KY485332), *Cataxia victoriae* (KY295302), *Eucyrtops eremaeus* (KY295252), *Eucyrtops latior* (KY295256), *Euoplos annulipes* (KY295283), *Euoplos inornatus* (KT598258), *Euoplos mcmillani* (KY295245, KY295273), *Euoplos* 'MYG307' (KJ745207), *Euoplos ornatus* (KY295342), *Euoplos similaris* (KY295263), *Euoplos spinnipes* (KY295237), *Euoplos tasmanicus* (KY295267), *Euoplos variabilis* (KY295341), *Gaius austini* (MG652494), *Gaius cooperi* (MG652496), *Gaius humphreysi* (MG652497), *Gaius mainae* (KY295313), *Gaius tealei* (KJ745055), *Gaius villosus* (KJ745514), *Idiopidae* sp. (KY295250, KY295306), *Idiosoma arenaceum* (MH144662, MH144666), *Idiosoma castellum* (KY295247), *Idiosoma clypeatum* (MH144640), *Idiosoma cupulifex* (KY295337), *Idiosoma dandaragan* (MH144626), *Idiosoma formosum* (MH144628), *Idiosoma intermedium* (MH144611), *Idiosoma jarrah* (MH144614), *Idiosoma kopejtkaorum* (MH144654), *Idiosoma kwongan* (MH144660), *Idiosoma mcclementsorum* (MH144624), *Idiosoma mcnamarai* (MH144631), *Idiosoma* 'MYG014' (KJ745420), *Idiosoma* 'MYG015' (KJ745427), Idiosoma 'MYG019' (KJ745428), *Idiosoma* 'MYG085' (KJ745369), *Idiosoma* 'MYG256' (KJ745099), *Idiosoma* 'MYG260' (KJ745101), *Idiosoma* 'MYG300' (KJ745123), *Idiosoma* 'MYG303' (KJ745062), *Idiosoma* 'MYG304' (KJ745109), *Idiosoma* 'MYG305' (KJ745148), *Idiosoma nigrum* (KY295317, MH144634), *Idiosoma schoknechtorum* (MH144638), *Idiosoma sigillatum* (KJ745098), *Idiosoma smeatoni* (KY295348), *Idiosoma* sp. (KY295228, KY295233, KY295240, KY295244, KY295246, KY295249, KY295262, KY295271, KY295274, KY295291, KY295292, KY295307, KY295310, KY295312, KY295314, KY295315, KY295316, KY295318, KY295319, KY295320, KY295321, KY295322, KY295323, KY295326, KY295327, KY295328, KY295329, KY295330, KY295332, KY295338, KY295349, MH144664)), *Idiosoma subtristis* (KY295282), *Idiosoma subtristis* (KY295334), *Misgolas gracilis* (KY295281), *Misgolas hubbardi* (KY017758), Misgolas rapax (KY295239), *Misgolas robertsi* (KY295286), *Misgolas villosus* (KY295339).
Outgroup	*Liphistius laoticus* (KP229896)

Table 4. Sample composition for the Nemesiidae analysis

Sample type	Samples
Target samples	*Kwonkan* sp. (AES190050)
Reference samples	*Aname aragog* (JQ772136), *Aname ellenae* (JQ772137), *Aname mainae* (KJ745198), *Aname mellosa* (JQ772125), *Aname* 'MYG001' (KJ744409), *Aname* 'MYG004 (KJ744436), *Aname* 'MYG034' (KJ745375), *Aname* 'MYG067' (KJ745435), *Aname* 'MYG079' (KJ744406), *Kwonkan* 'MYG006' (KJ744608), *Kwonkan* 'MYG006' (KJ744607), *Kwonkan* 'MYG088' (KJ745206), *Kwonkan* 'MYG172' (KJ744388), *Kwonkan* 'MYG175' (KJ744403), *Kwonkan* 'MYG195' (MG800177), *Kwonkan* 'MYG325' (KJ744834, KJ744665), *Kwonkan* 'MYG337' (KJ744962, KJ744959), *Kwonkan* 'MYG338' (KJ744840, KJ744666), *Kwonkan* 'MYG341' (KJ745190, KJ745188), *Kwonkan* 'MYG343' (KJ745210), *Kwonkan* 'MYG352' (KJ745255, KJ745238), *Kwonkan* 'MYG361' (KJ745281), *Kwonkan* 'MYG378' (KJ744782), *Kwonkan* 'MYG379' (KJ744832, KJ744831), *Kwonkan* 'MYG390' (MG800173), *Kwonkan* 'MYG392' (MG800175), *Kwonkan* 'MYG394' (MG800176), *Kwonkan* 'MYG599' (MH932614), *Pseudoteyl* 'MYG353' (KJ745272, KJ745278, KJ745277), *Teyl* 'MYG021' (KJ745381, KJ745380), *Teyl* 'MYG027' (KJ744759), *Teyl* 'MYG412' (MG800164), *Teyl* 'MYG455' (MG800147), *Yilgarnia* 'MYG164' (KJ745511), *Yilgarnia* 'MYG165' (KJ745513, KJ745512), *Yilgarnia* 'MYG197' (MG800166), *Yilgarnia* 'MYG324' (KJ744777, KJ744773), *Yilgarnia* 'MYG327' (KJ745015, KJ745013), *Yilgarnia* 'MYG374' (KJ744695), *Yilgarnia* 'MYG375' (KJ744709), *Yilgarnia* 'MYG376' (KJ744725), *Yilgarnia* 'MYG458' (MG800155)
Outgroup	*Liphistius laoticus* (KP229896)

Table 5. Sample composition for the Pseudoscorpiones analysis

Sample type	Samples
Target samples	**Olpiidae**: *Austrohorus* sp. (T146556), *Beierolpium* sp. (AES190012, AES190341, AES190331, T146557, AES190090), *Indolpium* sp. (T146562, T146561, T146559, T146563, AES190014, AES190079); **Unresolved samples**: Olpiidae sp. (1T146564, T146565); **Chthoniidae**: Tyrannochthonius sp. (T146555, AES190330).
Reference samples	**Olpiidae:** *Austrohorus* 'PSE119' (T139670, T139676, T139680, T139687, T139697, T139700, T139702, T139703); *Austrohorus* 'PSE121' (T139681); *Austrohorus* 'PSE122' (T139706, T139707); *Beierolpium* 'PSE126' (T139688); *Indolpium* 'PSE123' (T139678, T139683, T139705 , T139675, T139696, T139701); *Indolpium* 'PSE124' (T136334); 'Genus 7/4 PSE118' (T139690). **Additional Olpiid Genera:** *Xenolpium* 'JM (2008' (EU559539), *Apolpium parvum* (EU559541), *Pachyolpium* 'JM (2008' (EU559542), *Nanolpium* 'JM (2008' (EU559543), *Beierolpium bornemisszai*, (EU559545) and *Euryolpium* 'JM (2008' (EU559546); **Chthoniidae**: *Tyrannochthonius aridus* (KJ659960, KJ659959), sequence of *Tyrannochthonius garthhumphreysi* (KJ659948)
Outgroup	*Siro exilis* (AY639579), *Buthus occitanus* (GQ168524)

Table 6. Sample composition for the *Lychas* analysis

Sample type	Samples
Target samples	*Lychas* 'bituberculatus cmplx' (AES190065), *Lychas* 'multipunctatus cmplx' (AES190080).
Reference samples	*Lychas* 'adonis' (T101228, T85763), *Lychas* 'annulatus cmplx' (T114330, T124554, T99992), *Lychas* 'bituberculatus cmplx' (EVR7959, T101960, T91706, T97380), *Lychas* 'pilbara 1' (T126898, T126932), *Lychas* 'hairy tail cmplx' (T92146, T97507, T97518, T97522, T98280, T99692), *Lychas jonesae* (T101224, T118598, T94832, T99995), *Lychas* 'LC' (ESV18:0359), *Lychas* 'cf mjobergi' (T94832), *Lychas* 'multipunctatus cmplx' (EVR7974), *Lychas* 'nigrescens' (T83597), *Lychas* 'splendens' (T94760, T97774), *Lychas* sp. (T126899).
Outgroup	Siro exilis (AY639579), *Buthus occitanus* (GQ168524), *Cercophonius sulcatus* (KT447038), *Heterometrus laoticus* (JN018160), *Orthochirus innesi* (JQ514244) and *Parabuthus transvaalicus* (JQ514247).

Table 7. Sample composition for the *Urodacus* analysis

Sample type	Samples
Target samples	*Urodacus* sp., AES190076
Reference samples	*Urodacus* 'Biota 2' (EVR6974, EVR6985), *Urodacus* 'bullsbrook' (EVR8013), *Urodacus butleri* (T123092, T85115), *Urodacus* cf.hartmeyeri (EVR2122), *Urodacus* 'eddiei' (EVR2342), *Urodacus* 'gibson 2' (EVR7981), *Urodacus* 'gibson 4' (EVR7999), *Urodacus* 'gibson 5' (EVR8011), *Urodacus* 'glauerti' (T79950, *Urodacus* 'granifrons' (EVR9141), *Urodacus hoplurus* (T75099), *Urodacus* 'karara' (T77953), *Urodacus koolanensis* (T101952), *Urodacus* 'laverton 2' (EVR7979), *Urodacus* 'laverton 3' (EVR7976), *Urodacus* 'laverton 5' (EVR7994), *Urodacus* 'majerorum' (EVR2878), *Urodacus* 'maret' (EVR6988), *Urodacus mckenziei* (EVR2689), *Urodacus* 'megamastigus cmplx' (T100386, T100390), *Urodacus* 'mingenew' (T53929), *Urodacus novaehollandiae* (EVR1540, EVR7993), *Urodacus* 'pale cmplx' (EVR1553, EVR529, EVR6978, EVR1552, EVR527), *Urodacus planimanus* (EVR1661), *Urodacus similis* (T85018), *Urodacus* sp. (ESV18:0205, ESV18:0578, ESV18:0587), *Urodacus* 'telfer' (T114318, T114321), *Urodacus varians* (T37723), *Urodacus* 'woodwardii' (EVR1664), *Urodacus* 'yaschenkoi cmplx' (EVR6984, EVR8007), *Urodacus* 'yeelirrie' (T101241, T101243)
Outgroup	*Siro exilis* (AY639579) was used as the outgroup for this analysis, along with the following scorpions: *Buthus occitanus* (GQ168524), *Centruroides exilicauda* (AY649858), *Cercophonius michaelseni* (T41784) and *Cercophonius sulcatus* (T81521).

Table 8. Sample composition for the Geophilomorpha analysis

Sample type	Samples
Target samples	**Chilenophilidae:** *Sepedenophilus* sp. (AES190305, AES146570, AES190306, AES190006, AES190077, AES190007, AES190106, AES190061); **Mecistocephalidae**: Mecistocephalus sp. (AES190335, AES190336); **Oryidae**: *Orphnaeus sp.* (AES190103 and AES190322); **Unresolved Geophilomorpha**: Geophilomorpha sp. (AES190313, AES190308, AES190337)
Reference samples	**Chilenophilidae**: *Sepedenophilous*, representing eight species, were included in the analysis: *Sepedonophilus* '01' (T126608, T126604), *Sepedonophilus* '02' (T126607, T126772), *Sepedonophilus* '03' (T126781, T126778, T128035), *Sepedonophilus* '04' (T128075, T128080), *Sepedonophilus* '05' (T136340), *Sepedonophilus* 'G1' (ESV18:1010), *Sepedonophilus* 'G2' (ESV18:1050), *Sepedonophilus* 'G3' (ESV18:0519); **Mecistocephalidae**: *Mecistocephalus* '02' (T126693), *Mecistocephalus* '03' (T126697, T128034), *Mecistocephalus* '04' (T128174), *Mecistocephalus* '05' (T128180), *Mecistocephalus* '06' (T126739, T128041), *Mecistocephalus* '07' (T126733), *Mecistocephalus* '08' (T128073, T128076), *Mecistocephalus* '09' (T128060, T136342, T136341), *Mecistocephalus* '10' (T128063, T128077), *Mecistocephalus* '11' (T126845); **Oryidae**: *Orphnaeus* 'WM1' (ESV18:0997), *Orphnaeus brevilabiatus* (T128175, T128176, AB608780).
Outgroup	*Lamyctes africanus* (KC688312)

Table 9. Sample composition for the Cryptopidae analysis

Sample type	Samples
Target samples	*Cryptops* sp. (AES190315, AES190318, AES190319)
Reference samples	*Cryptops anomalans* (KU497151, JN266283), *Cryptops doriae* (KF676500), *Cryptops hortensis* (KU497145, KU497144), *Cryptops indicus* (KF676505), *Cryptops japonicus* (AB610777), *Cryptops lamprethus* (JX422663, JF273305), *Cryptops parisi* (KU497140, KF676502), *Cryptops japonicus* (AB610778), *Cryptops niuensis* (JF273296, JF273294), *Cryptops pictus* (JF273264, JF273262), *Cryptops punicus* (KF676503), *Cryptops sarasini* (JF273306), *Cryptops trisulcatus* (KF676504), *Cryptops* sp. (T128039, T126647), *Cryptops* '06' (T136352, T136353, T128042, T128032, T128069), *Cryptops* '07' (T126644, T126674), *Cryptops* '13' (T112190), *Cryptops* '15' (T124753, T124750), *Cryptops* '16' (T124748, T126657), *Cryptops* '17' (T118071, T126662), *Cryptops* '18' (T136354), *Cryptops* 'K1' (ESV181007), *Cryptops* 'G1' (T149105, T149106)
Outgroup	*Lithobius agilis* (JN306649)

Table 10. Sample composition for the Diplopoda analysis

Sample type	Samples
Target samples	**Trigoniulidae** (**Spirobolida**)**:** *Austrostrophus* sp. (AES190083, AES190344, AES190028, AES190074, AES190092); **Paradoxosomatidae** (**Polydesmida**)**:** *Antichiropus* sp. (AES190104, AES190040, AES190321, AES190067).
Reference samples	**Trigoniulidae** (**Spirobolida**)**:** *Austrostrophus* sp. (T101121, T101128); **Paradoxosomatidae** (**Polydesmida**)**:** *Antichiropus anguinus* (MK735847), *Antichiropus apricus* (MK735886, MK735892), *Antichiropus cirratus* (MK735904, MK735906, MK735861), *Antichiropus cunicularis* (MK735862, MK735889), *Antichiropus* DIP019 (T128169), *Antichiropus* DIP174 (MH932612), *Antichiropus forcipatus* (MK735872, MK735882), *Antichiropus* G1 (ESV18:0003), *Antichiropus* 'G2' (ESV18:0434), *Antichiropus nimbus* (MK735887), *Antichiropus pendiculus* (MK735849, MK735923), *Antichiropus simmonsi* (MK735891), *Antichiropus sloanae* (MK735877, MK735888), *Antichiropus* sp. (ESV18:0440, ESV18:0449), *Antichiropus uvulus* (MK735848, MK735893), *Antichiropus variabilis* (JN637337, JN637362), *Antichiropus verutus* (MK735851, MK735860), *Antichiropus* 'wonmunna' (T118101), *Antichiropus whistleri* (JN637364, JN637365).
Outgroup	*Polyzonium germanicum* (JQ350463), order Polyzoniida

3 RESULTS

3.1 SELENOPIDAE (ARANEOMORPHAE)

Karaops banyjima (Figure 1)**.** The two target samples of *Karaops* differed from each other by 4.6% sequence divergence, indicating that they are likely to be conspecific Figure 1. These samples grouped with other samples also likely to represent *Karaops banyjima* but not previously identified (T134092, T134104, T139710, T139711, T139718, T139720, T139722, T139723, T139724, T139730). These samples differed from each other by 2.3% - 7.59%. These sampled differed from all other samples in the analysis by 7.56% or more sequence divergence.

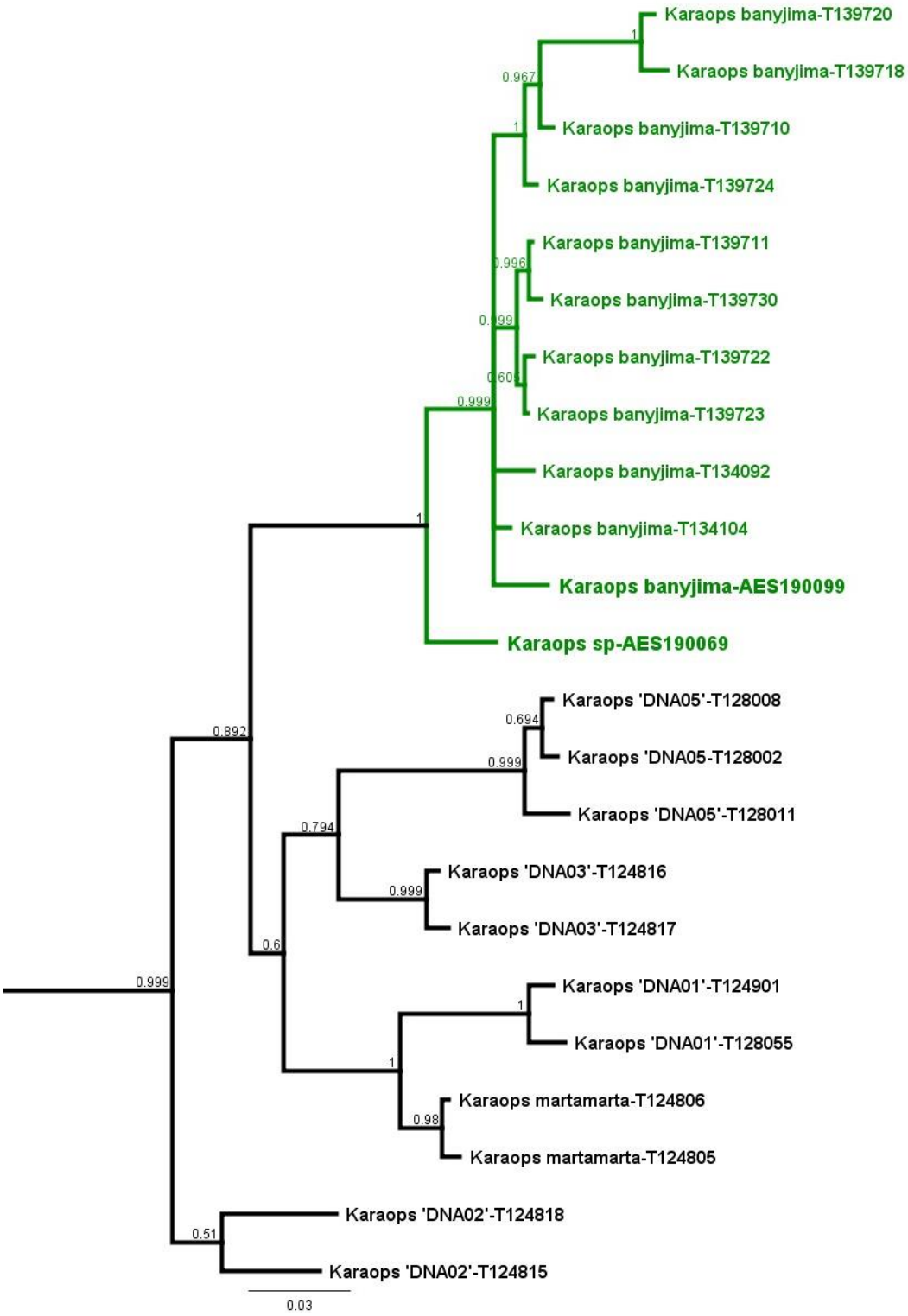

Figure 1 Phylogenetic relationships between *Karaops* samples analysed based on COI DNA sequences: *Karaops banyjima* clade in green, branch labels represent posterior probabilities; scale bar represents substitutions per site.

3.2 BARYCHELIDAE (MYGALOMORPHAE)

The analysis yielded a poorly resolved phylogeny with none of the ingroup genera being monophyletic (Figure 2)

Synothele **'MYG309'** (Figure 2)**.** Sample AES190063 was most similar to *Synothele* 'MYG309' (KJ744894, KJ744794) and differed from these samples by 2.66% and 9.19% sequence divergence respectively, indicating that they are likely to represent the same species. These three samples differed from all others included in this study by 9.57% or more sequence divergence.

Synothele **'MYG311'** (Figure 2)**.** Sample AES190039, grouped with four samples of *Synothele* 'MYG311' (KJ744654, KJ745445, KJ744869, KJ745034) and differed from these samples by 1.37% - 2.79% sequence divergence, indicating that they are conspecific. These five samples differed from all other samples in the analysis by 12.46% or more sequence divergence.

Aurecocrypta **'HD1'** (Figure 2)**.** Sample AES190082 differed from all other samples in the analysis by 9.75% or more sequence divergence indicating that it may not be conspecific with any of the species included in the analysis. The phylogenetic analysis placed this species as a sister to *Aurecocrypta* 'MYG317' (KJ744547) from which it differed by 11.03% sequence divergence. Sample AES190082 was placed in a clade comprising nine other samples of *Aurecocrypta* therefore it is cautiously regarded as a representative of this genus and is here referred to as *Aurecocrypta* 'HD1'.

Aurecocrypta **'MYG315'** (Figure 2)**.** Sample AES190347 grouped with two samples of *Aurecocrypta* 'MYG315' (KJ744636, KJ744575) and differed from these samples by 0.46% and 7.29% sequence divergence respectively. This sample therefore represents *Aurecocrypta* 'MYG315' and these three samples differed from all others in the analysis by 11.09% or more sequence divergence.

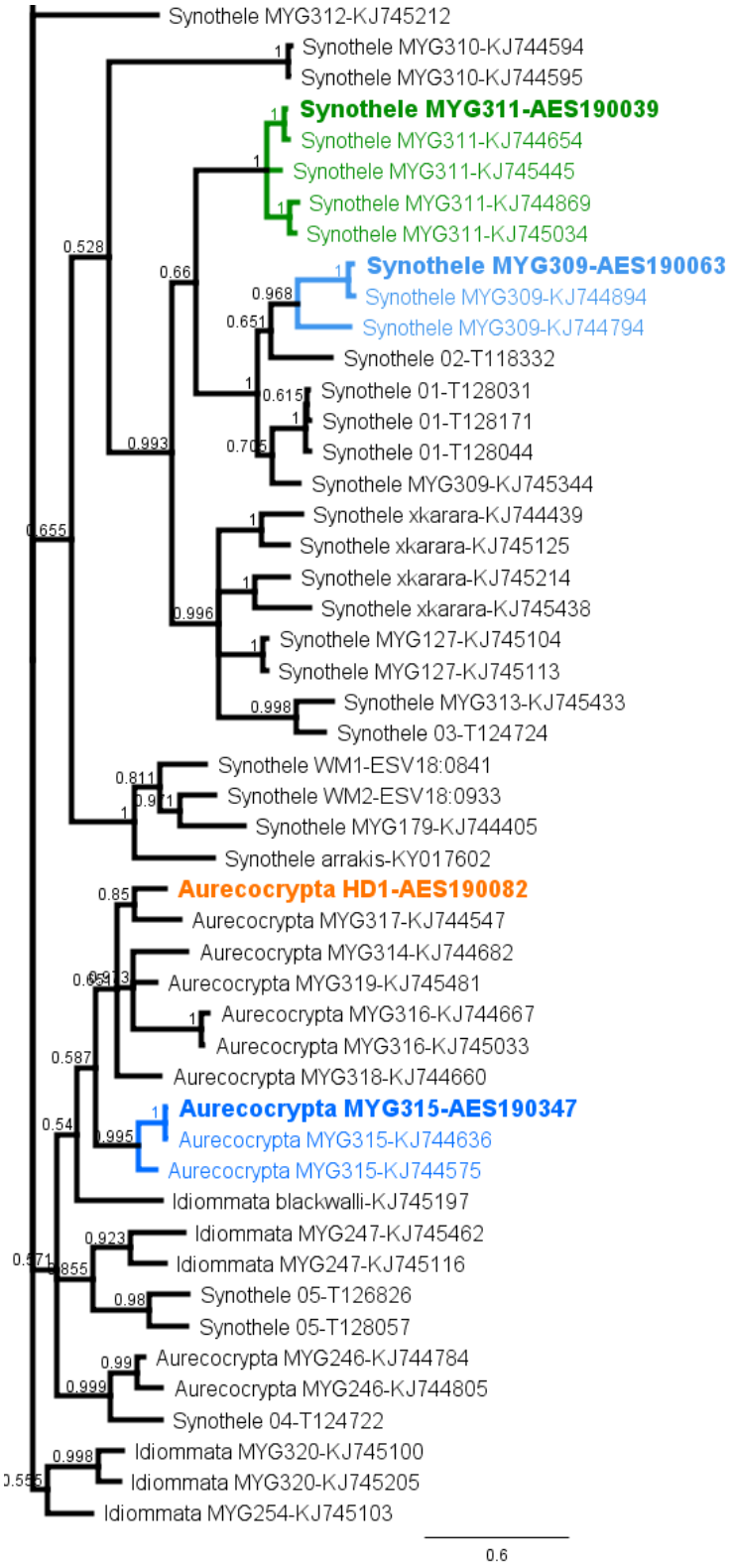

Figure 2 Phylogenetic relationships between samples of Barychelidae based on the analysis of COI DNA sequences: shaded clades represent target taxa and conspecific samples; taxa in bold text; branch labels represent posterior probabilities; scale bar represents substitutions per site.

3.3 IDIOPIDAE (MYGALOMORPHAE)

Gaius tealei (Figure 3)**.** The target samples AES190072 and AES190101 differed from one another by 0.15% sequence divergence, indicating that they are representatives of the same species. The phylogenetic analysis grouped them with *Gaius tealei* (KJ745055), from which they differed by 3.05% sequence divergence, indicating that they are likely to belong to this species (Figure 3). These samples differed from all others in the analysis by more than 15.42% sequence divergence or more.

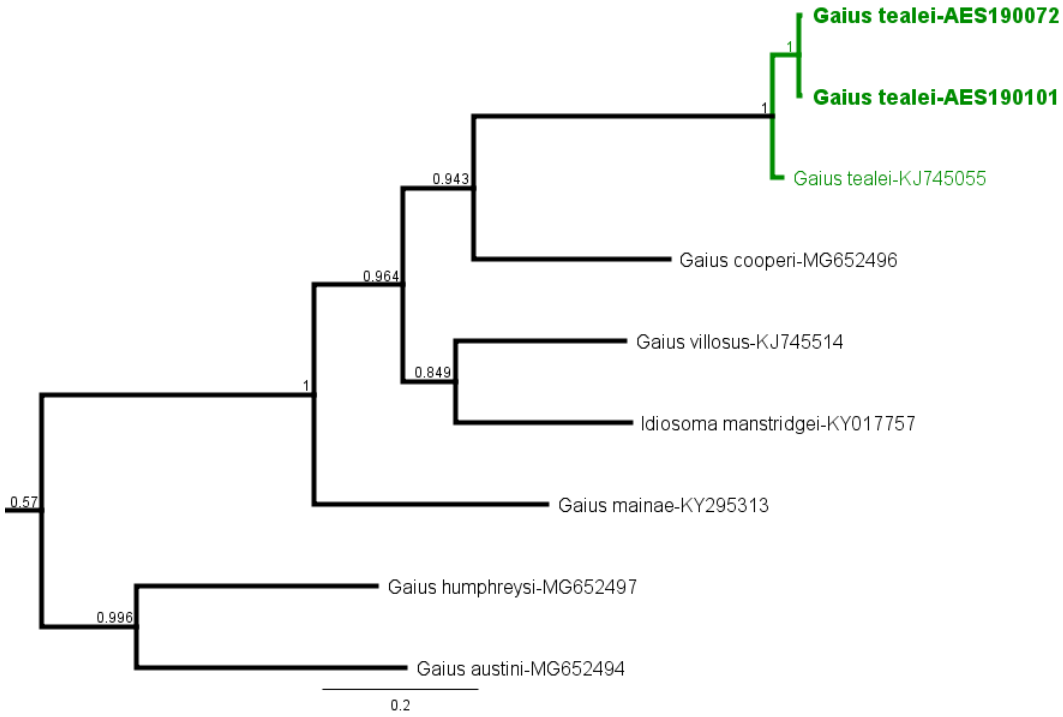

Figure 3 Subclade from the phylogeny of Idiopidae showing relationships between the targeted samples: target taxa in bold text; green clade, *Gaius tealei* branch labels represent posterior probabilities; scale bar represents substitutions per site.

3.4 NEMESIIDAE (MYGALOMORPHAE)

***Yilgarnia* 'MYG197'.** Sample AES190050 matched with a sample of *Yilgarnia* 'MYG197' and differed from it by 4.86% COI sequence divergence, indicating that they are conspecific. *Yilgarnia* 'MYG197' was placed in a clade dominated by other *Yilgarnia* sequences (Figure 4) indicating that the original placement of this sample into *Kwonkan* was incorrect and that *Yilgarnia* is the correct genus.

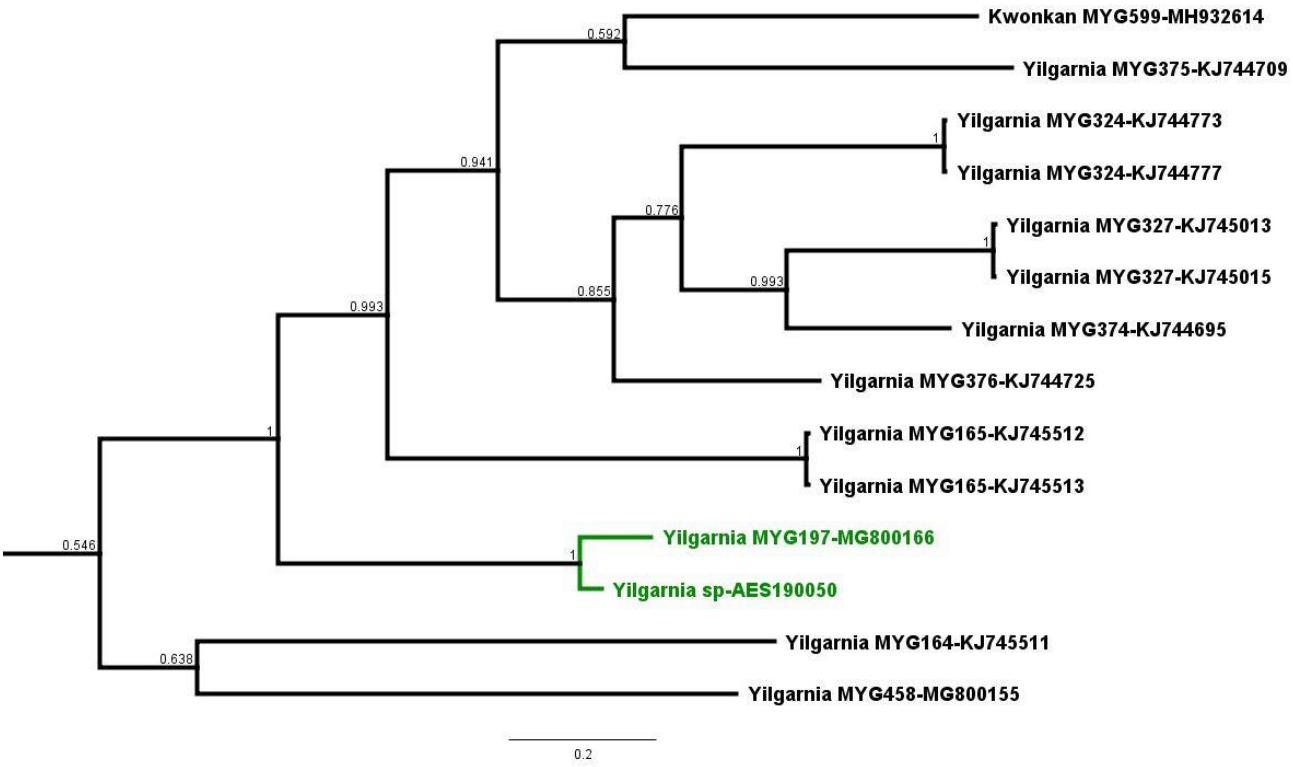

Figure 4. Clade of mostly *Yilgarnia* from the analysis of target Nemesiidae: branch labels represent posterior probabilities; scale bar represents substitutions per site.

3.5 OLPIIDAE AND CHTHONIIDAE (PSEUDOSCORPIONES)

***Beierolpium* 'HD1'** (Figure 5)**.** Sample AES190331 differed from all other samples in the analysis by 11% or more sequence divergence, indicating that is unlikely to be conspecific with any of the species included in this study. The most similar species was represented by sample AES190341.

***Beierolpium* 'HD2'** (Figure 5)**.** Sample AES190341 differed from all other samples in the analysis by 11% or more sequence divergence, indicating that is unlikely to be conspecific with any of the species included in this study.

***Beierolpium* 'HD3'** (Figure 5)**.** Sample AES190012 differed from all other samples in the analysis by 19.92% or more sequence divergence, indicating that is unlikely to be conspecific with any of the species included in this study.

In this analysis, *Beierolpium* was monophyletic, supporting the placement of these samples in this genus.

***Indolpium* 'HD4'** (Figure 5)**.** Sample AES190014 differed from all other samples in the analysis by 15.29% or more sequence divergence, indicating that it is unlikely to be conspecific with any of the species included in this study. This sample was placed basely on a monophyletic *Indolpium* clade confirming its placement within this genus.

***Austrohorus* 'HD5'** (Figure 5)**.** Sample T146556 differed from all other samples in the analysis by 15.29% or more sequence divergence, indicating that is unlikely to be conspecific with any of the species included in this

study. This sample was not monophyletic with the remaining *Austrohorus* samples in the analysis. This taxon is grouped in a polytomy with *Apolpium*, *Austrohorus* and (*Xenolpium* + 'Genus 7/4') making assignment to genus problematic. For the purpose of this study, the sample is regarded as a representative of *Austrohorus* and additional data will need to be included to resolve the placement of this taxon.

'Genus 7/4 PSE118' (Figure 5)**.** Four samples (T146559, T146561, AES190079 and T146562) differed from one another by 1.18% (6.63% sequence divergence indicating that they are likely to represent a single taxon. These samples differed from 'Genus 7/4 PSE118' (T139690) by 7.04% (7.44% sequence divergence, indicating that they are conspecific with this taxon. These samples of 'Genus 7/4 PSE118' differed from all other samples in the analysis by 15.65% or more sequence divergence. Samples AES146559, AES146561, AES190079 and AES146562 were previous incorrectly regarded as species of *Indolpium* (Alacran 2019).

***Euryolpium* 'HD6'** (Figure 5). Sample AES146557 differed from all other samples in the analysis by 15.04% or more sequence divergence, indicating that is unlikely to be conspecific with any of the species included in this study. This sample was previously not assigned to *Beierolpium* (Alacran 2019); however this study placed the sample in a clade containing a species of *Euryolpium*. This taxon is therefore regarded as a representative of the genus *Euryolpium*.

***Euryolpium* 'HD7'** (Figure 5). Sample AES146564 differed from all other samples in the analysis by 15.04% or more sequence divergence, indicating that is unlikely to be conspecific with any of the species included in this study. This sample was previously not assigned to any genus (Alacran 2019); however this study placed the sample in a clade containing a species of *Euryolpium*. This taxon is therefore regarded as a representative of the genus *Euryolpium*.

***Tyrannochthonius* 'HD1'**, AES146555) and ***Tyrannochthonius* 'HD2'**, AES190330 (Figure 5). The two target samples differed from one another by 13.13% sequence divergence, indicating that they are unlikely to be conspecific. These samples also differed from all other samples in the analysis by 17% or more sequence divergence, indicating that they are not conspecific with the two samples of *Tyrannochthonius aridus* from Genbank.

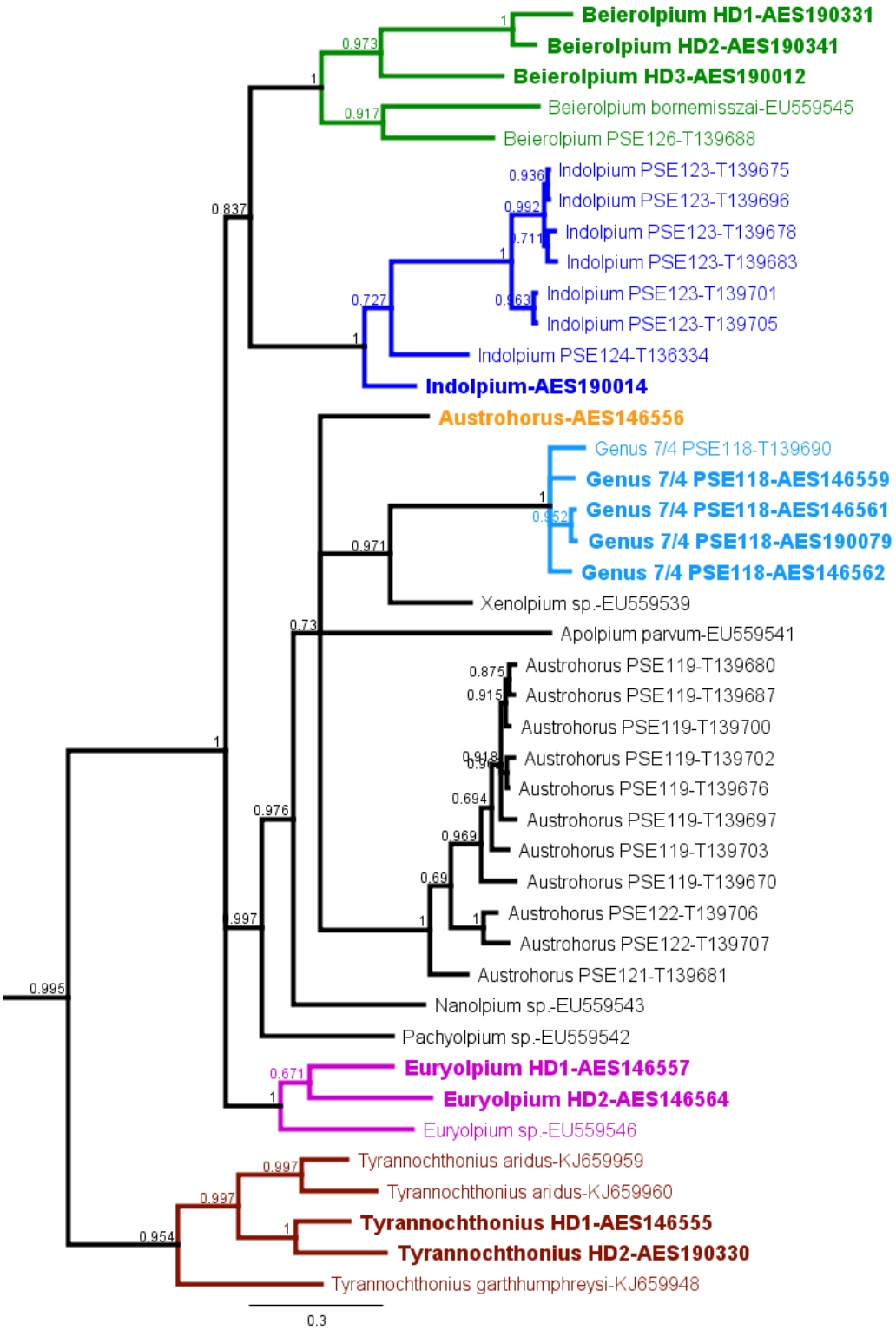

Figure 5. Phylogeny of pseudoscorpions included in this study with monophyletic clades shaded, target samples in bold; branch labels represent posterior probabilities; scale bar represents substitutions per site.

3.6 BUTHIDAE (SCORPIONES)

The phylogenetic analysis of these species produced a very poorly structured phylogeny (Figure 6).

***Lychas* 'bituberculatus cmplx'** (Figure 6)**.** Sample AES190065 was most similar to T91706 and differed from it by 0.94% sequence divergence, confirming that these belonging to the same species, thus supporting the placement of this species within this species complex. These two samples differed from other species in this complex (EVR7959, T97380, T91706) by between 10.03% and 10.53% sequence divergence. These five samples differed from all others in the analysis by 8.81% or more sequence divergence, further highlighting the confusing relationships between species in this genus.

***Lychas* 'multipunctatus cmplx'** (Figure 6)**.** Sample AES190080 was most similar to EVR7974 and differed from it by 1.82% sequence divergence, confirming that these belonging to the same species, thus supporting the placement of this species within this species complex. These two samples differed from all others in the analysis by 8.81% or more sequence divergence.

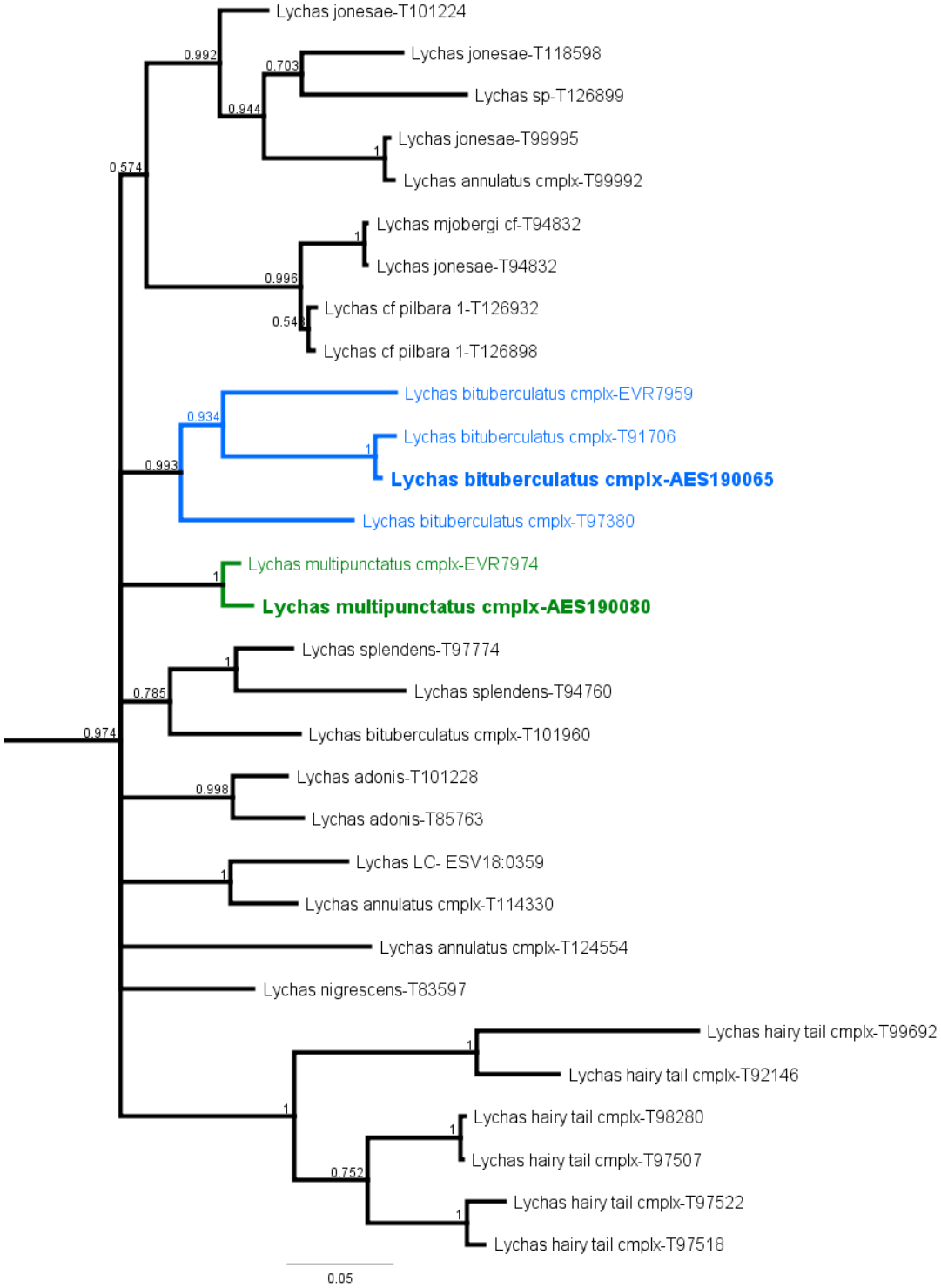

Figure 6. Phylogeny of *Lychas* species included in this study with monophyletic clades shaded, target samples in bold; branch labels represent posterior probabilities; scale bar represents substitutions per site.

3.7 URODACIDAE (SCORPIONES)

***Urodacus* 'HD1'** (Figure 7). Sample AES190076 showed no clear relationship with any of the samples included in the analysis Figure 7 and differed from all of them by 8.05% or more sequence divergence. The average divergence between this species and all other *Urodacus* samples in this study was 9.9% suggesting that the species delimiting threshold is likely to be less than 9% sequence divergence. Of the unambiguous species pairs analyses in this study, *Urodacus novaehollandiae* (EVR1540, EVR7993) showed the greatest divergence between specimens at 7.48% sequence divergence, suggesting that this may represent a more appropriate delimiting threshold for species of *Urodacus*. Sample AES190076 is here referred to as *Urodacus* 'HD1'.

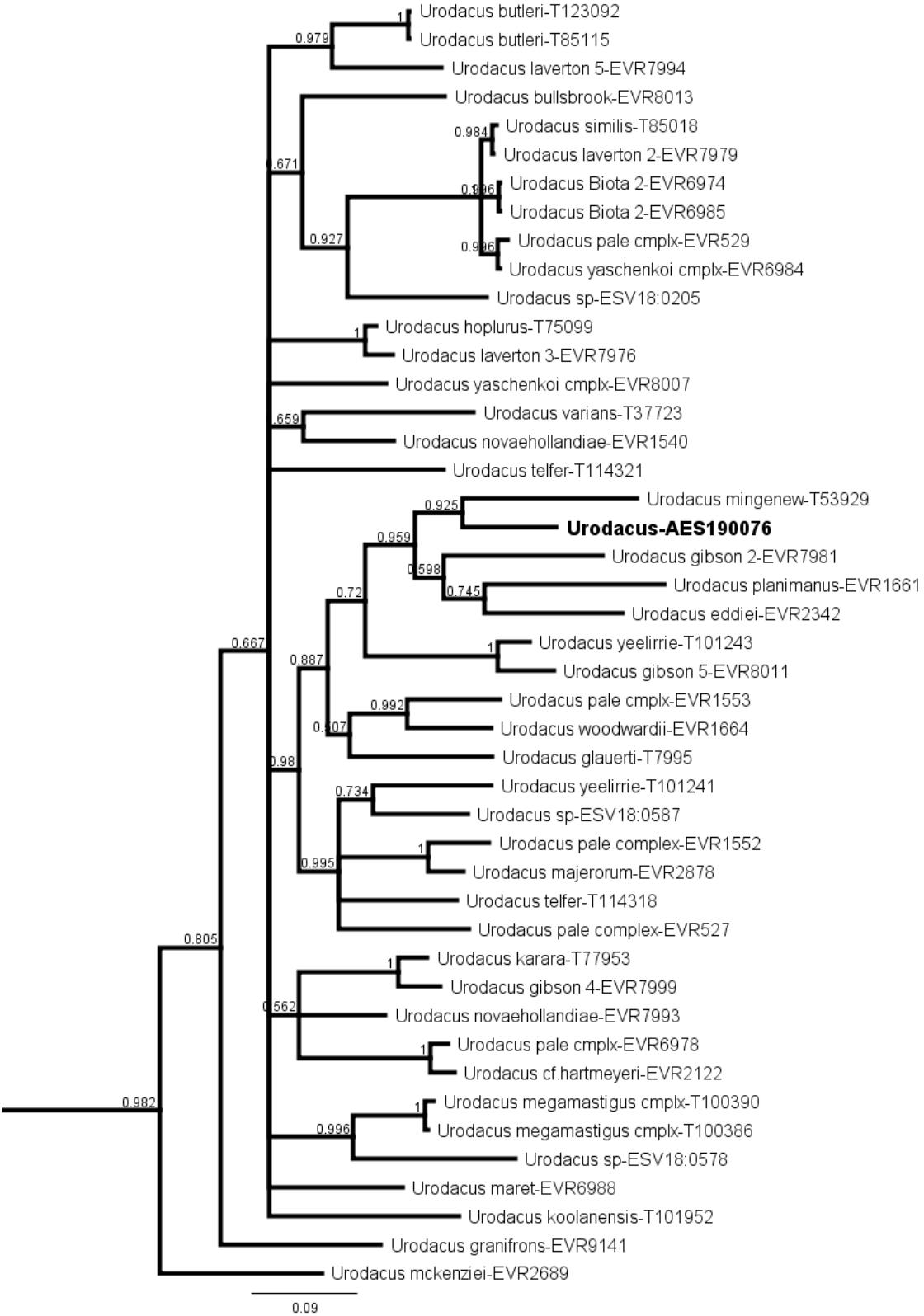

Figure 7. Phylogeny of *Urodacus* species and morphospecies included in this study: target sample in bold; branch labels represent posterior probabilities; scale bar represents substitutions per site.

3.8 CHILENOPHILIDAE, MECISTOCEPHALIDAE AND ORYIDAE (GEOPHILOMORPHA)

***Sepedenophilous* 'HD1'** (Figure 9)**.** Seven target taxa grouped together (AES190305, T146570, AES190306, AES190006, AES190077, AES190007, AES190106) with 0% - 7.34% sequence divergences. These samples differed from all others in the analysis by 12.23% or more sequence divergence.

***Sepedenophilus* 'HD2'** (Figure 9)**.** Sample AES190061 differed from all other samples in the analysis by 19.44% sequence divergence, therefore this species is not conspecific with any in the analysis. The sample was placed within a monophyletic clade of *Sepedenophilous* samples and is here referred to ad *Sepedenophilous* 'HD2'.

***Mecistocephalus* 'HD1'** (Figure 9)**.** Four samples (AES190338, AES190335, AES190336, AES190308) grouped together and differed from one another by 0.16% - 1.1% sequence divergence, indicating that they are conspecific. These samples differed from all other samples in the analysis by 10.97% or more sequence divergence. This species is here referred to as *Mecistocephalus* 'HD1'. Among the samples identified to this taxon, was one that was previously misidentified as a species of *Sepedenophilous* (AES190338) and one sample that could not be identified, Geophilomorpha sp. (AES190308) (Alacran 2019)

***Mecistocephalus* 'HD2'** (Figure 9). Sample (AES190337) differed from all others in the analysis by 10.97% or more sequence divergence. This sample could originally not be placed in a family or genus but was here placed in a monophyletic clade of *Mecistocephalus*. This species is here referred to as *Mecistocephalus* 'HD2'.

***Mecistocephalus* 'HD3'** (Figure 9)**.** Sample AES190322 grouped closely with AES190313 0.31% sequence divergence indicating that they are conspecific. These samples differed from all other sin the analysis by 18.03% or more sequence divergence. These samples were placed in a monophyletic clade of *Mecistocephalus*. These two samples are here referred to as *Mecistocephalus* 'HD3'. Sample AES190322 was originally misidentified as a species of *Orphnaeus* and sample AES190313 could not be identified to family or genus (Alacran 2019).

***Orphnaeus* 'HD1'** (Figure 9)**.** Sample AES190103 differed from all samples in the analysis by 15.09% or more sequence divergence, indicating that it is not conspecific with any of those species. This species was placed in a clade containing was placed in monophyletic clade of *Orphnaeus*, thus supporting its placement in this genus. This species is here referred to as *Orphnaeus* 'HD1'.

3.9 CRYPTOPIDAE (SCOLOPENDROMORPHA)

***Cryptops* 'HD1'** (**Figure 8**)**.** The three target taxa grouped together (AES190315, AES190318, AES190319) with 2.81% - 3.5% sequence divergences between them. These samples differed from all others in the analysis by 19.04% or more sequence divergence, indicating that they represent a unique taxon relative to those included in this study. This species is here referred to as *Cryptops* 'HD1'.

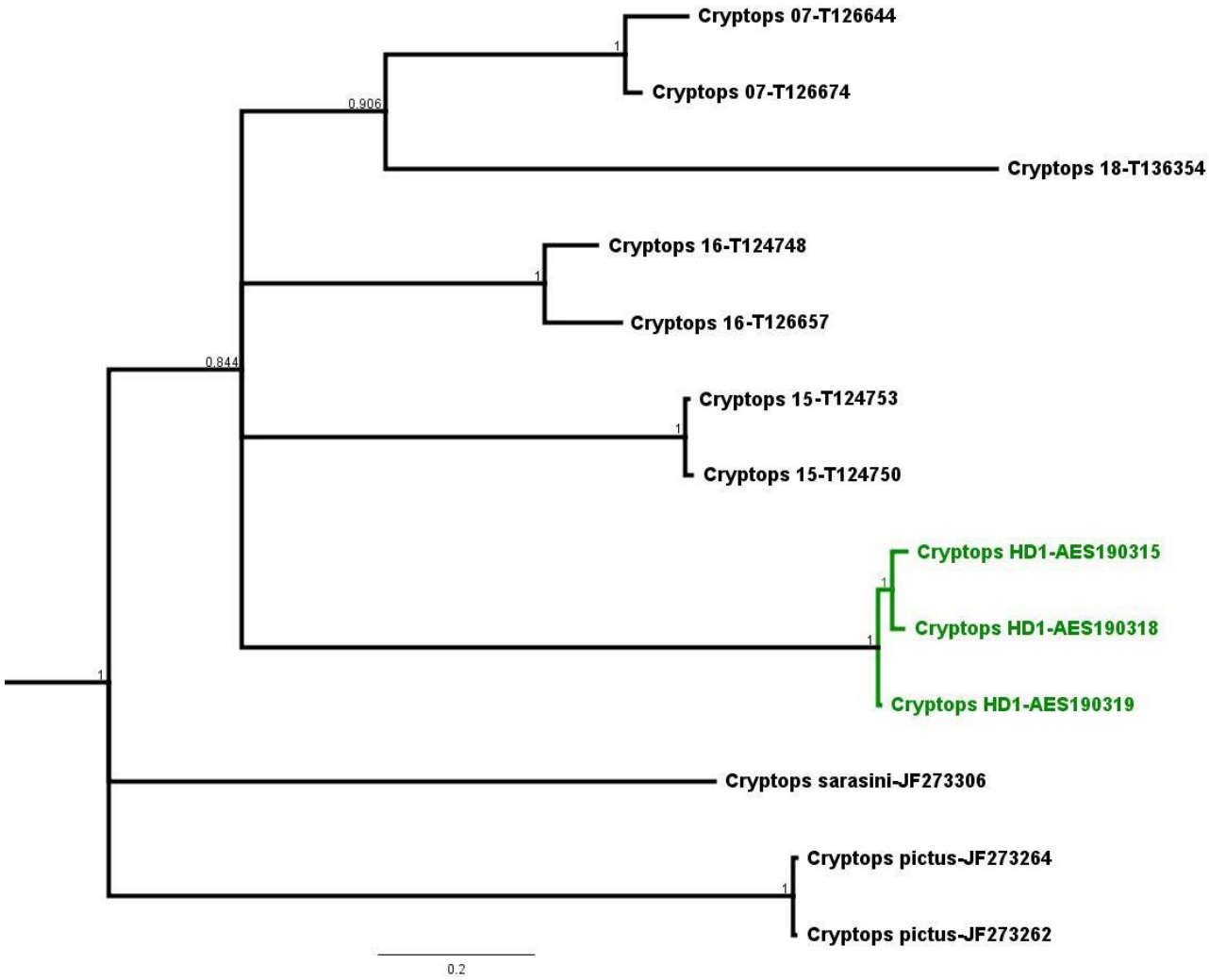

Figure 8. Sub-clade of the Cryptopidae phylogeny: target sample in green; branch labels represent posterior probabilities; scale bar represents substitutions per site.

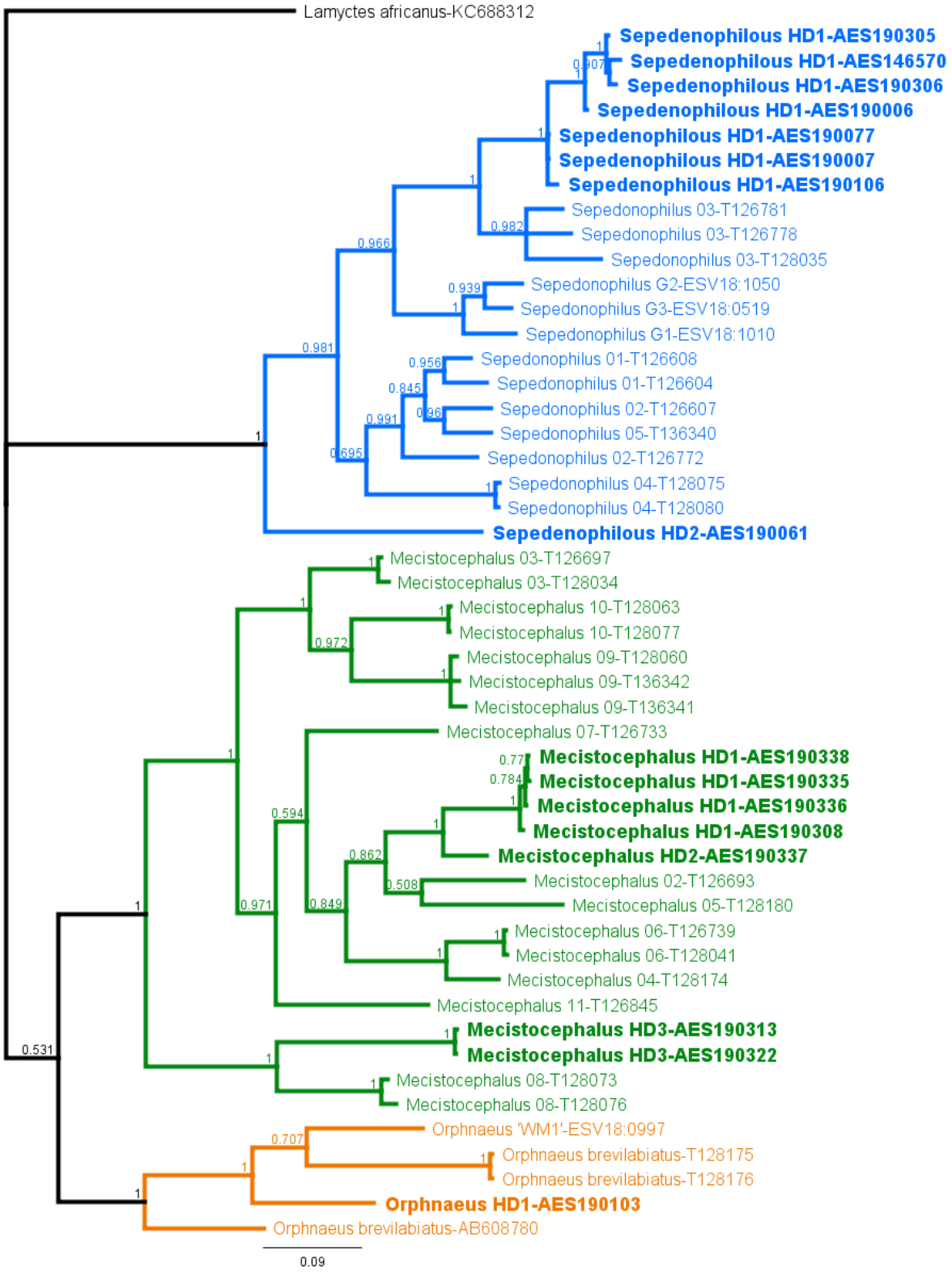

Figure 9. Phylogeny of Geophilomorpha: blue, *Sepedenophilus* clade; green, *Mecistocephalus* clade; orange, *Orphnaeus* clade; target samples in bold; branch labels represent posterior probabilities; scale bar represents substitutions per site.

3.10 TRIGONIULIDAE (SPIROBOLLIDA)

***Austrostrophus* 'HD1'** (Figure 10), was represented by three samples (T101128, T101121, AES190092) which differed from each other by 0.76% - 3.81% sequence divergence.

***Austrostrophus* 'HD2'** (Figure 10), was represented by four samples (AES190083, AES190028, AES190344, AES190074) which differed from each other by 0% - 0.46% sequence divergence.

Austrostrophus 'HD1' and *Austrostrophus* 'HD2' differed from each other by 7.7% - 8.38% sequence divergence with an average of 8.04% sequence divergence. The level of sequence divergence within the two groups was substantially less than the variation between these groups, indicating the likely hood that two lineages are present.

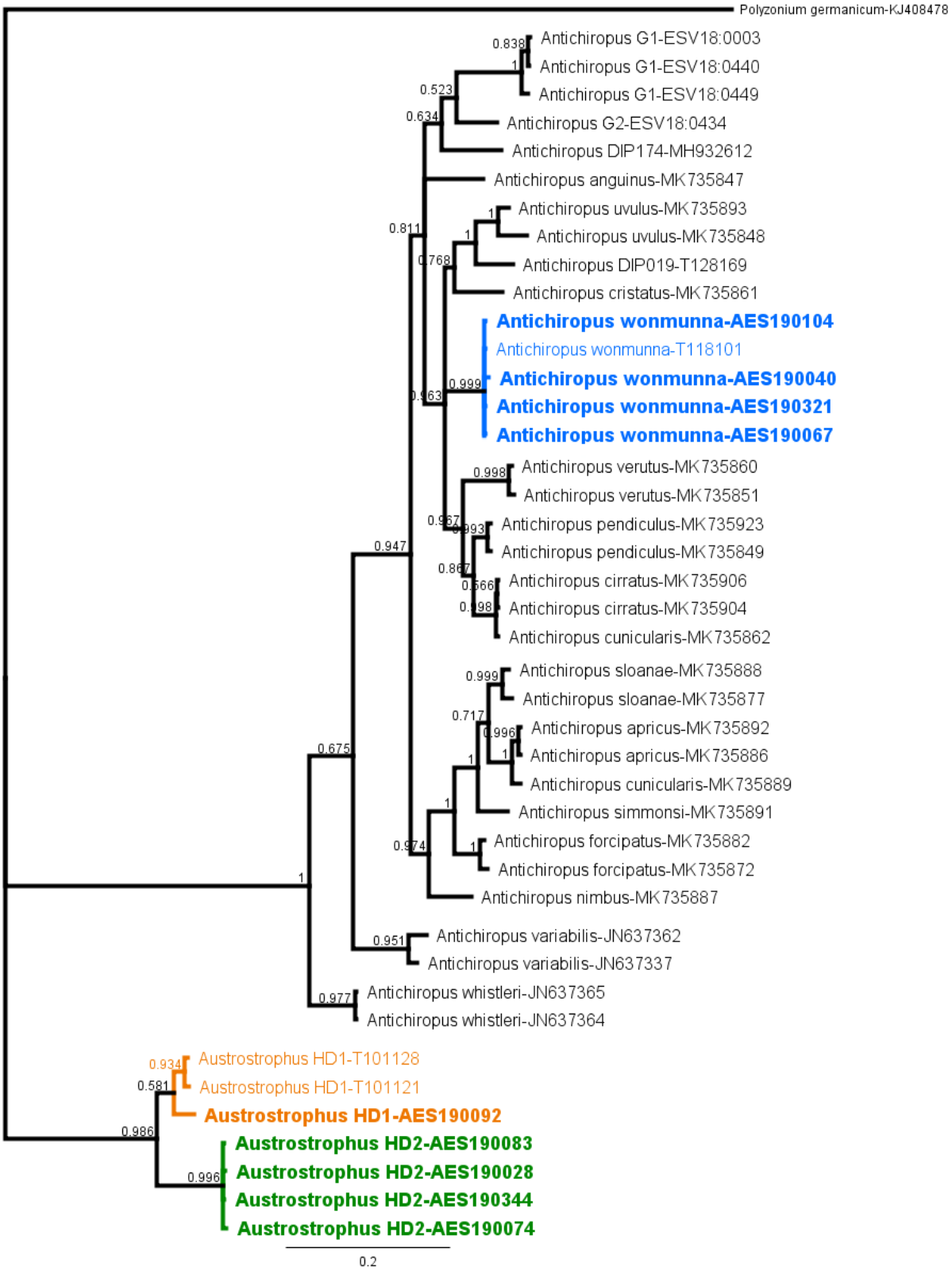

Figure 10. Phylogeny of millipedes included in this study with monophyletic clades shaded: target samples in bold; branch labels represent posterior probabilities; scale bar represents substitutions per site.

3.11 PARADOXOSOMATIDAE (POLYDESMIDA)

***Antichiropus* 'wonmunna'** (Figure 10)**.** The target samples differed from one another by 0% - 0.46% sequence divergence. These samples grouped with the sample of *Antichiropus* 'wonmunna' (T118101) and differed from it by between 0% - 0.45% sequence divergence, indicating that they are conspecific. These samples differed from all other *Antichiropus* samples in the analysis by 6.5% or more sequence divergence.

4 DISCUSSION

This study identified 30 species form 53 samples, of which 10 taxa represent species or morphospecies previously known from the Pilbara:

- *Karaops banyjima*: (AES190069, AES190099), a potential SRE: DD;
- *Aurecocrypta* 'MYG315' (AES190347), a potential SRE: DD;
- *Synothele* 'MYG311' (AES190039), a potential SRE: DD;
- *Synothele* 'MYG309' (AES190063), a potential SRE: DD;
- *Gaius tealei* (AES190072, AES190101), widespread;
- *Yilgarnia* 'MYG197' (AES190050), potential SRE: DD;
- 'Genus 7/4 PSE118' (T146562, T146561, T146559, AES190079), potential SRE: DD;
- *Lychas* 'bituberculatus cmplx' (AES190065), potential SRE: DD;
- *Lychas* 'multipunctatus cmplx' (AES190080), potential SRE: DD;
- *Antichiropus* 'wonmunna' (AES190321, AES190104, AES190067, AES190040), potential SRE: DD.

Twenty-two taxa identified here could not be matched with available sequences:

- *Aurecocrypta* 'HD1' (AES190082),
- *Beierolpium* 'HD1' (AES190331),
- *Beierolpium* 'HD2' (AES190341),
- *Beierolpium* 'HD3' (AES190012),
- *Indolpium* 'HD4'(AES190014),
- *Austrohorus* 'HD5' (T146556),
- *Euryolpium* 'HD6' (T146557),
- *Euryolpium* 'HD7' (T146564),
- *Tyrannochthonius* 'HD1' (T146555),
- *Tyrannochthonius* 'HD2'(AES190330),
- *Urodacus* 'HD1' (AES190076),
- *Mecistocephalus* 'HD1' (AES190336, AES190335, AES190308, AES190338),
- *Mecistocephalus* 'HD2' (AES190337),
- *Mecistocephalus* 'HD3' (AES190313, AES190322),
- *Sepedenophilous* 'HD1' (AES190305, AES190306, AES190077, AES190006, T146570, AES190007, AES190106),
- *Sepedenophilus* 'HD2' (AES190061),
- *Orphnaeus* 'HD1' (AES190103),
- *Cryptops* 'HD1' (AES190315, AES190318, AES190319),

- *Austrostrophus* 'HD1' (AES190092),
- *Austrostrophus* 'HD2' (AES190028, AES190344, AES190074, AES190083).

These taxa all have distribution and taxonomic characteristics that make them potential SREs. There is potential for the WA Museum to have sequences that could provide additional information regarding the relationships of the following taxa: *Aurecocrypta* 'HD1', *Beierolpium* 'HD1' (AES190331), *Beierolpium* 'HD2', *Beierolpium* 'HD3', *Indolpium* 'HD4', *Austrohorus* 'HD5', *Euryolpium* 'HD6', *Euryolpium* 'HD7', *Tyrannochthonius* 'HD1', and *Tyrannochthonius* 'HD2'.

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APPENDICES

Appendix 1 - DNA sequences generated 1912.

Attached as “Appendix 1 - DNA sequences generated 1912.txt”

Molecular identification of terrestrial arthropods from north west of Newman, Western Australia (project 1912)

Report to *Alacran Environmental Science*

11 October 2019

Nerida Wilson, Joel Huey, Mark Harvey

Molecular Systematics Unit & Department of Terrestrial Zoology,
Western Australian Museum,
Locked Bag 49, Welshpool DC, Western Australia 6986, Australia

Although identifications in this report were consistent with the best available information and current scientific thinking at the time of identification the use of this report is at the risk of the user. Any liability to users of this report for loss of any kind arising out of the use of this report or the information and identifications it contains is expressly disclaimed.

Summary

Alacran Environmental Science requested identification of mitochondrial COI sequences from specimens of terrestrial invertebrates from the Pilbara region of Western Australia. This comprised of 19 sequences from Barychelidae, Buthidae, Chthoniidae, Olpiidae, Selenopidae, Trigoniulidae and Urodacidae (see Table 1 and Appendix 1 for sequence and specimen details). The main objectives of the WA Museum's Molecular Systematics Unit (MSU) were to use these sequences to determine the taxonomic identity of the specimens.

Provided DNA sequences were each BLASTED against publically accessible sequences in GenBank and with data sets derived from current research projects at WA Museum. The top 20 blast hits for each major taxon were gathered, duplicates removed, and analysed with a Maximum Likelihood phylogenetic analysis using a GTR+G model of evolution and 100 bootstraps (RAxML). Distances were calculated via tree-based estimates of identical bases in Geneious Prime 2019.2.1.

A summary of sequences queried is in Table 1.

Table 1. Summary of queried sequences supplied to WA Museum.

FAMILY	Total no. sequences
Barychelidae	1
Buthidae	2
Chthoniidae	2
Olpiidae	7
Selenopidae	2
Trigoniulidae	4
Urodacidae	1

Results

The sequencing was undertaken by Xytogen at the request of Alacran and reconciled sequences were passed on to WAM for analysis. COI DNA barcodes were compared to existing data held by the Western Australian Museum, and the publically accessible GenBank database. A summary of the comparison (BLAST results) is provided in Table 2. Excised relevant parts of the resulting Maximum Likelihood trees are provided in Appendix 2 for visualisation of genetic relationships. The raw sequence data is supplied for reference in Appendix 3.

Table 2. Summary of identifications of queried specimens.

REGNO (FIELD NO)	FAMILY	SPECIES DESIGNATION	SUMMARY OF RESULTS
AES190082	Barychelidae	*Aurecocrypta* sp. indet.	This specimen forms a basal grade to many other *Aurecocrypta* species. It shares 89.60% genetic pairwise similarity with *Aurecocrypta* MYG317. It either represents a newly discovered species or a not-yet-sequenced species. It can be given a MYG code once registered at WAM
AES190065	Buthidae	*Lychas* `bituberculatus' complex	This specimen falls into a well-supported clade known as the *L. 'bituberculatus*' complex, which has not yet been resolved taxonomically. It shares 99.85% genetic pairwise similarity with WAMT91703.
AES190080	Buthidae	*Lychas* `multipunctatus' complex	This specimen falls into a well-supported clade known as the *L. 'multipunctatus*' complex, which has not yet been resolved taxonomically. It shares 99.70% genetic pairwise similarity with WAMT97367.

AES190330	Chthoniidae	*Tyrannochthonius* sp. indet.	This specimen forms a sister relationship with T146555. The pair share 87.00% genetic pairwise similarity, which does not allow a conclusion about whether the two are conspecific or not. Further work on the group is needed to establish even a code-based system of names. It either represents a newly discovered taxon or a not-yet-sequenced taxon.
T146555	Chthoniidae	*Tyrannochthonius* sp. indet.	This specimen forms a well-supported sister relationship with AES190330. The pair share 87.00% genetic pairwise similarity, which does not allow a conclusion about whether the two are conspecific or not. Further work on the group is needed to establish even a code-based system of names. It either represents a newly discovered taxon or a not-yet-sequenced taxon.
T146556	Olpiidae	*Austrohorus* sp. indet.	This specimen's nearest relative in the tree is WAMT132648. The pair share 85.54% genetic pairwise similarity, which does not allow a conclusion about whether the two are conspecific or not. The identity of WAMT132648 is PSE099.
AES190012	Olpiidae	*Beierolpium* sp. 8/4	This specimen is highly supported as conspecific with WAMT132648. The pair share 99.79% genetic pairwise similarity. The identity of WAMT122168 is sp. 8/4.

AES190331 AES190341	Olpiidae	*Beierolpium sp. indet.*	These two specimens are highly supported as sister taxa. They share 88.57% genetic pairwise similarity and are likely conspecific. These either represent a newly discovered species or a not-yet-sequenced species.
T146557	Olpiidae	*Euryolpium* sp. indet.	This specimen is highly supported as conspecific with WAMT127762. The pair share 96.86% genetic pairwise similarity. The identity of WAMT127762 is unknown, as it represents a juvenile from West Angelas.
T146564	Olpiidae	*Euryolpium* sp. indet.	This specimen's nearest relative in the tree is WAMT135503. The pair share 84.40% genetic pairwise similarity. It either represents a newly discovered taxon or a not-yet-sequenced taxon.
AES190014	Olpiidae	*Genus PSEAAA* sp. indet.	This specimen is poorly supported as sister to WAMT113765. The pair share 86.39% genetic pairwise similarity, which does not allow a conclusion about whether the two are conspecific or not. The identity of WAMT113765 is an undescribed genus *PSEAAA* sp. indet.
AES190099	Selenopidae	*Karaops nyangumarta*	This specimen is highly supported as conspecific with WAMT134063 (and others). The pair share 98.88% genetic pairwise similarity. The identity of WAMT134063 is *Karaops nyangumarta.*

AES190069	Selenopidae	*Karaops* sp 'ARA001'	This specimen is highly supported as conspecific with WAMT130402 (and others). The pair share 97.29% genetic pairwise similarity. The identity of WAMT130402 is *Karaops 'ARA001'.*
AES190074 AES190028 AES190083	Trigoniulidae	*Austrostrophus* clade E	This specimen is highly supported as conspecific with WAMT100768 (and others). The pair share 99.54% genetic pairwise similarity. The identity of WAMT100768 is *Austrostrophus* clade E.
AES190092	Trigoniulidae	*Austrostrophus* clade A	This specimen is supported as conspecific with WAMT122166 (and others). The pair share 99.09% genetic pairwise similarity. The identity of WAMT122166 is *Austrostrophus* clade A.
AES190076	Urodacidae	*Urodacus* sp. indet.	This specimen is highly supported as sister taxon to WAMT91922 (and others). The pair share 93.49% genetic pairwise similarity, which does not yet allow a conclusion about whether they are conspecific or not. The closely related specimens are also unidentified at present.

Conclusions

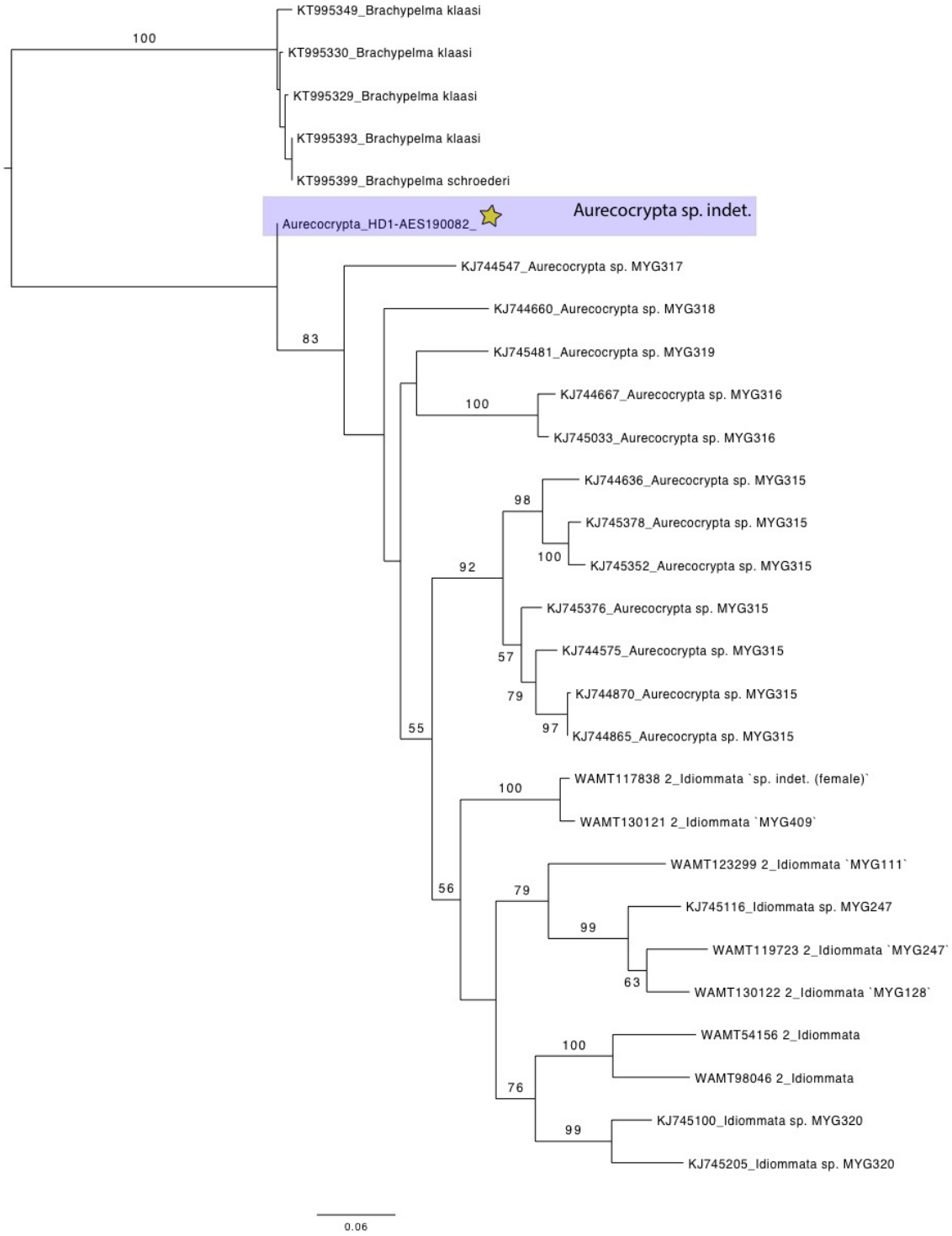
The 19 sequences supplied represent sixteen different taxa, from ten different genera. Fifteen of those species are currently undescribed. Only one specimen can be identified to a valid species name. Many others belong to known but unnamed taxa, and many remain to be clarified at the species-level, which would rely on further research in the respective taxonomic groups.

Appendix 1. Specimen data for all specimens.

FIELD NO (WAM NUMBER)	FAMILY	GENUS	SPECIES (ALACRAN)	SPECIES (NEW ID)	SITE	LATITUDE	LONGITUDE
AES190082	Barychelidae	Aurecocrypta	`HD1`	sp. indet.	70.8 km NW of Newman	23°02'30.05"S	119°07'45.24"E
AES190065	Buthidae	Lychas	`bituberculatus complex`	`bituberculatus complex`	85.2 km NW of Newman	23°04'10.94"S	118°57'33.81"E
AES190080	Buthidae	Lychas	`multipunctatus complex`	`multipunctatus complex`	88.2 km NW of Newman	23°03'36.24"S	118°55'53.61"E
AES190330	Chthoniidae	Tyrannochthonius	`HD2`	sp. indet.	78.5 km NW of Newman	23°05'01.74"S	119°01'24.61"E
T146555	Chthoniidae	Tyrannochthonius	`HD1`	sp. indet.	Hope Downs 1 mine, 76.2 km NW of Newman	23°02'20.77"S	119°04'18.43"E
T146556	Olpiidae	Austrohorus	`HD5`	sp. indet.	Hope Downs 1 mine, 81.8 km NW of Newman	23°02'36.48"S	119°06'59.89"E
AES190012	Olpiidae	Beierolpium	`HD3`	sp. 8/4	80.3 km NW of Newman	23°02'54.36"S	119°01'16.11"E
AES190331	Olpiidae	Beierolpium	`HD1`	sp. indet.	78.5 km NW of Newman	23°05'01.74"S	119°01'24.61"E
AES190341	Olpiidae	Beierolpium	`HD2`	sp. indet.	88.2 km NW of Newman	23°03'36.24"S	118°55'53.61"E
T146557	Olpiidae	Euryolpium	`HD6`	sp. indet.	Hope Downs 1 mine, 80.9 km NW of Newman	23°04'40.65"S	119°00'03.37"E
T146564	Olpiidae	Euryolpium	`HD7`	sp. indet.	Hope Downs 1 mine, 70 km NW of Newman	23°02'18.05"S	119°08'26.42"E

AES190014	Olpiidae	Indolpium	`HD4`	Genus = *PSEAAA* sp. indet.	83.2 km NW of Newman	23°04'57.16"S	118°58'28.48"E
AES190099	Selenopidae	Karaops	banyijama	nyangumarta	82.5 km NW of Newman	23°02'42.13"S	118°59'56.60"E
AES190069	Selenopidae	Karaops	sp.	sp. 'ARA001'	71.9 km NW of Newman	23°02'33.97"S	119°07'00.94"E
AES190074	Trigoniulidae	Austrostrophus	`HD2`	Clade E	82.5 km NW of Newman	23°02'53.96"S	118°59'52.21"E
AES190092	Trigoniulidae	Austrostrophus	`HD1`	Clade A	69.8 km NW of Newman	23°02'26.57"S	119°08'28.01"E
AES190028	Trigoniulidae	Austrostrophus	`HD2`	Clade E	81.6 km NW of Newman	23°04'37.22"S	118°59'37.32"E
AES190083	Trigoniulidae	Austrostrophus	`HD2`	Clade E	18.4 km NW of Newman	23°03'29.00"S	119°00'18.75"E
AES190076	Urodacidae	Urodacus	HD1`	sp. indet.	80.3 km NW of Newman	23°02'54.36"S	119°01'16.11"E

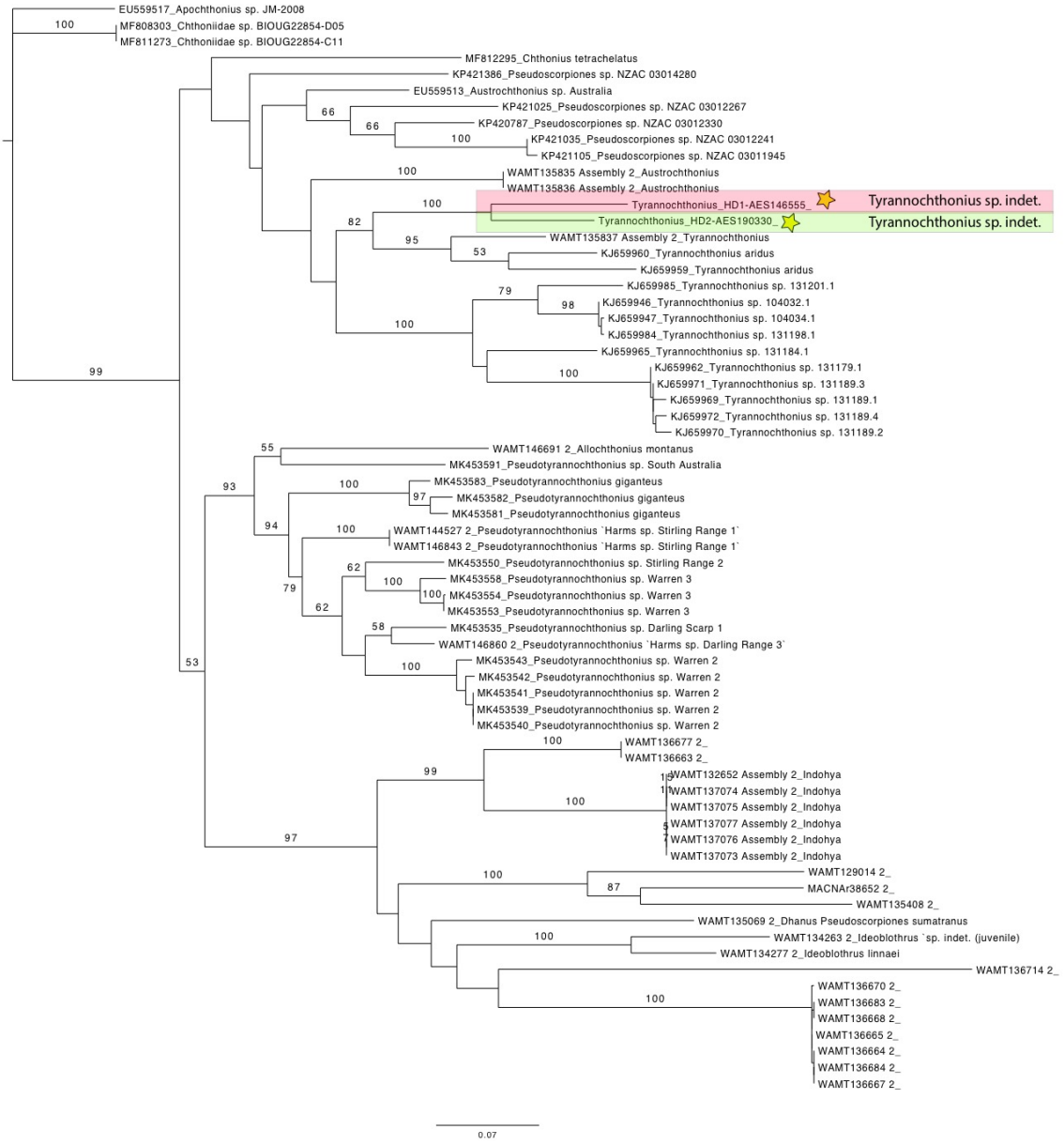
Appendix 2a. Excerpt from Maximum Likelihood tree of Barychelidae COI, to be used *ONLY* for visualisation of relationships. Bootstrap values less than 50 and some interior node support were removed.



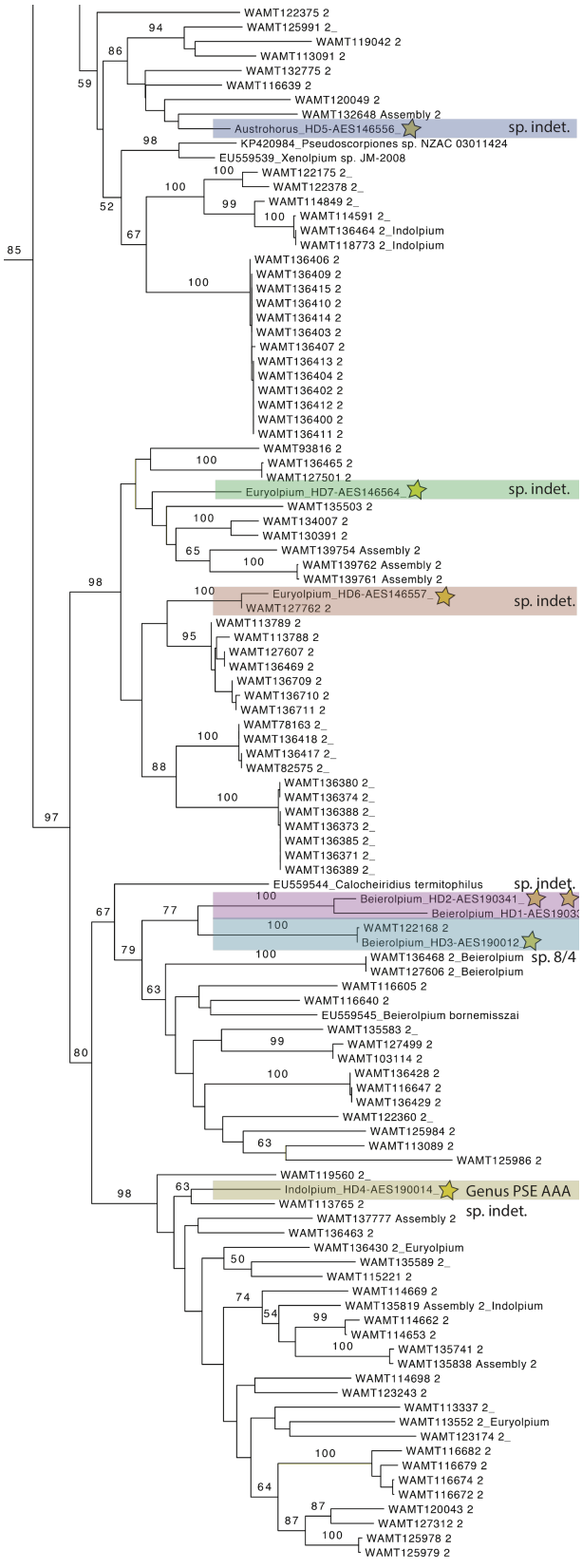
Appendix 2b. Excerpt from Maximum Likelihood tree of Buthidae COI, to be used *ONLY* for visualisation of relationships. Bootstrap values less than 50 and some interior node support were removed.



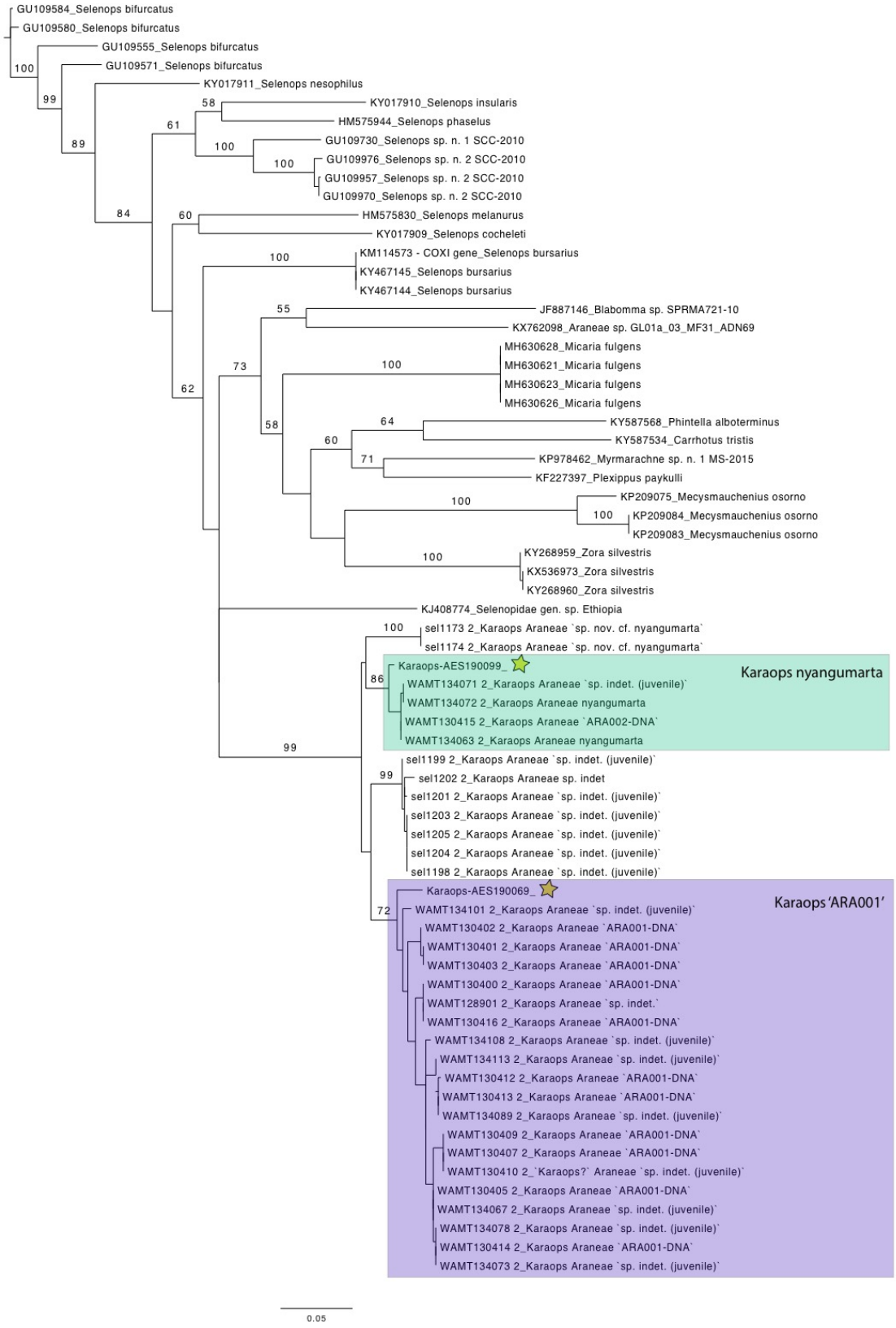
Appendix 2c. Excerpt from Maximum Likelihood tree of Chthoniidae COI, to be used *ONLY* for visualisation of relationships. Bootstrap values less than 50 and some interior node support were removed.



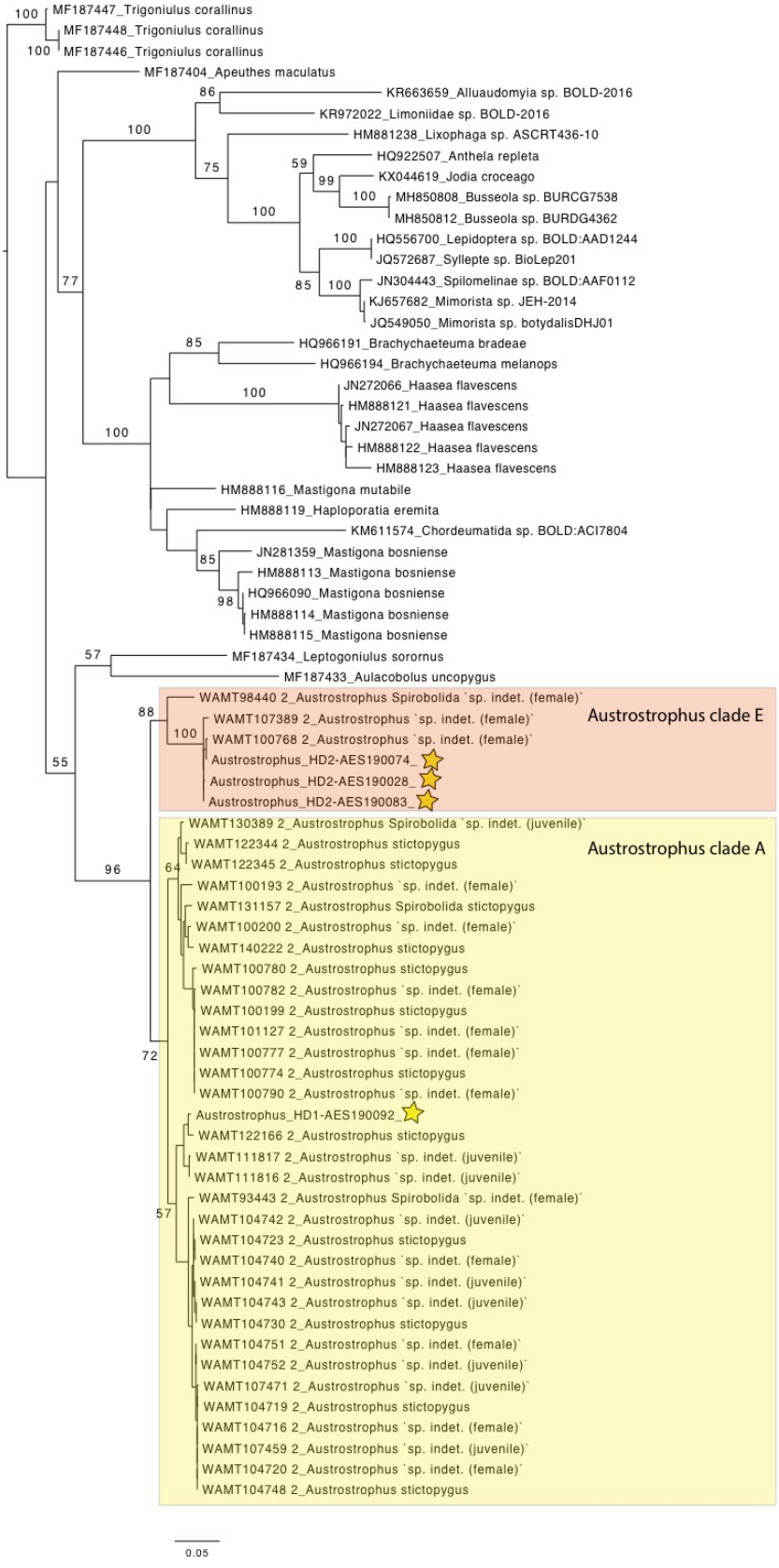
Appendix 2d. Excerpt from Maximum Likelihood tree of Olpiidae COI, to be used *ONLY* for visualisation of relationships. Bootstrap values less than 50 and some interior node support was removed.



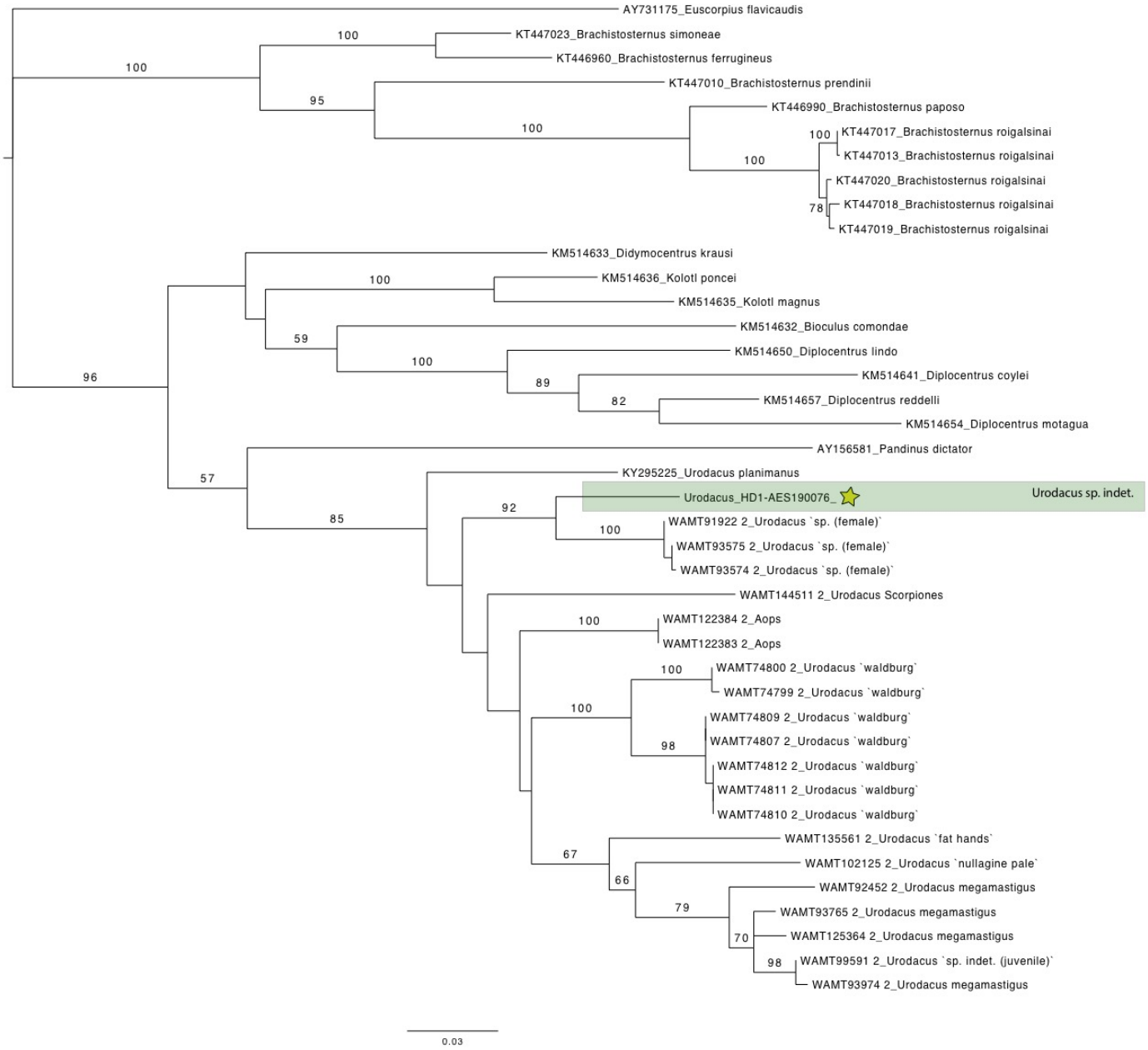
Appendix 2e. Excerpt from Maximum Likelihood tree of Selenopidae COI, to be used *ONLY* for visualisation of relationships. Bootstrap values less than 50 and some interior node support were removed.



Appendix 2f. Excerpt from Maximum Likelihood tree of Trigoniulidae COI, to be used *ONLY* for visualisation of relationships. Bootstrap values less than 50 and some interior node support were removed.



Appendix 2g. Excerpt from Maximum Likelihood tree of Urodacidae COI, to be used *ONLY* for visualisation of relationships. Bootstrap values less than 50 and some interior node support were removed.



Appendix 3. COI DNA sequence data queried in this report

>Aurecocrypta_HD1-AES190082

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>Austrohorus_HD5-AES146556

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>Austrostrophus_HD1-AES190092

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>Austrostrophus_HD2-AES190028

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>Austrostrophus_HD2-AES190074

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>Austrostrophus_HD2-AES190083

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>Beierolpium_HD1-AES190331

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>Beierolpium_HD2-AES190341

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>Karaops-AES190069

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>Lychas_bituberculatus_cmplx-AES190065

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>Urodacus_HD1-AES190076

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Appendix E: Fauna Species Lists

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Table E.1: Amphibian species list – results of database searches, literature reviews and Astron survey results.

Scientific name	Common name	Introduced	Conservation codes			NatureMap / DBCA	EPBC PMST	Previous surveys	Phase 1 survey	Phase 2 survey	Phase 3 survey
			EPBC Act	BC Act	DBCA						
HYLIDAE											
Cyclorana maini	Sheep Frog					X		X			X
Cyclorana platycephala	Water-holding Frog					X					
Litoria rubella	Little Red Tree Frog					X			X	X	X
LIMNODYNASTIDAE											
Neobatrachus aquilonius	Northern Burrowing Frog					X					
Neobatrachus sutor	Shoemaker Frog					X					
MYOBATRACHIDAE											
Pseudophryne douglasi	Gorge Toadlet					X					
Uperoleia russelli	Northwest Toadlet					X					
Uperoleia saxatilis	Pilbara Toadlet					X					

Table E.2: Reptile species list – results of database searches, literature reviews and Astron survey results.

Scientific name	Common name	Introduced	Conservation codes			Nature Map / DBCA	EPBC PMST	Previous surveys	Phase 1 survey	Phase 2 survey	Phase 3 survey
			EPBC Act	BC Act	DBCA						
CHELUIDAE											
Chelodina steindachneri	Flat-shelled Turtle					X					
AGAMIDAE											
Gowidon longirostris						X		X	X	X	X
Ctenophorus caudicinctus	Ring-tailed Dragon					X		X	X	X	X
Ctenophorus isolepis	Military Dragon					X				X	
Ctenophorus nuchalis	Central Netted Dragon					X					
Ctenophorus reticulatus	Western Netted Dragon					X		X			
Diporiphora amphiboluroides	Mulga Dragon							X			
Diporiphora valens	Southern Pilbara Tree Dragon					X		X			
Pogona minor						X		X	X	X	
Tympanocryptis cephalus	Pebble Dragon					X		X			
DIPLODACTYLIDAE											
Crenadactylus ocellatus	Clawless Gecko					X					
Diplodactylus conspicillatus	Fat-tailed Gecko					X					
Diplodactylus granariensis rex						X					
Diplodactylus pulcher						X		X	X		
Diplodactylus savagei	Southern Pilbara Beak-faced Gecko					X		X			
Lucasium stenodactylum						X		X	X		X
Lucasium wombeyi						X		X	X		
Oedura fimbria	Marbled Velvet Gecko					X		X	X	X	X
Rhynchoedura ornata	Western Beaked Gecko					X		X	X		X
Strophurus elderi						X		X	X		
Strophurus jeanae						X					
Strophurus wellingtonae						X		X	X	X	X
CARPHODACTYLIDAE											
Nephrurus wheeleri cinctus						X		X		X	X

Scientific name	Common name	Introduced	Conservation codes			Nature Map / DBCA	EPBC PMST	Previous surveys	Phase 1 survey	Phase 2 survey	Phase 3 survey
			EPBC Act	BC Act	DBCA						
Underwoodisaurus seorsus	Pilbara Barking Gecko				P2	X		X			
GEKKONIDAE											
Gehyra pilbara						X					
Gehyra punctata						X		X	X	X	X
Gehyra purpurascens						X					
Gehyra variegata						X		X	X	X	X
Heteronotia binoei	Bynoe's Gecko					X		X		X	X
Heteronotia spelea	Desert Cave Gecko					X		X	X	X	
PYGOPODIDAE											
Delma butleri											X
Delma elegans						X		X			
Delma haroldi						X					
Delma nasuta						X		X	X		X
Delma pax						X		X	X	X	X
Delma tincta						X		X			
Lialis burtonis						X		X	X		X
Pygopus nigriceps						X		X			X
SCINCIDAE											
Carlia munda						X		X	X	X	X
Carlia triacantha						X		X			
Cryptoblepharus buchananii						X		X			
Cryptoblepharus plagiocephalus						X					
Cryptoblepharus ustulatus						X		X	X	X	
Ctenotus duricola						X		X			
Ctenotus grandis						X			X		X
Ctenotus hanloni						X					
Ctenotus helenae						X		X	X		
Ctenotus leonhardii						X					
Ctenotus pallasotus	Western Pilbara Lined Ctenotus								X		X

Scientific name	Common name	Introduced	Conservation codes			Nature Map / DBCA	EPBC PMST	Previous surveys	Phase 1 survey	Phase 2 survey	Phase 3 survey
			EPBC Act	BC Act	DBCA						
Ctenotus pantherinus	Leopard Ctenotus					X		X	X	X	X
Ctenotus robustus						X		X			
Ctenotus rubicundus						X					
Ctenotus rutilans						X		X	X		
Ctenotus saxatilis	Rock Ctenotus					X		X	X	X	X
Ctenotus schomburgkii						X		X	X	X	
Ctenotus serventyi						X					
Ctenotus uber						X		X			X
Cyclodomorphus melanops	Slender Blue-tongue					X		X			
Egernia cygnitos	Western Pilbara Spiny-tailed Skink					X					
Egernia depressa	Southern Pygmy Spiny-tailed Skink					X					
Egernia formosa						X			X	X	X
Eremiascincus pallidus	Western Narrow-banded Skink					X					
Eremiascincus richardsonii	Broad-banded Sand Swimmer					X					
Lerista bipes						X					
Lerista labialis						X					
Lerista macropisthopus remota					P2	X					X
Lerista muelleri						X		X	X		
Lerista neander						X		X	X		
Lerista timida						X		X			
Lerista verhmens						X		X			
Lerista zietzi						X		X			
Menetia greyii						X		X		X	X
Menetia surda						X		X			
Morethia ruficauda exquisita						X		X		X	X
Proablepharus reginae						X					

Scientific name	Common name	Introduced	Conservation codes			Nature Map / DBCA	EPBC PMST	Previous surveys	Phase 1 survey	Phase 2 survey	Phase 3 survey
			EPBC Act	BC Act	DBCA						
Tiliqua multifasciata	Central Blue-tongue					X		X	X		X
VARANIDAE											
Varanus acanthurus	Spiny-tailed Monitor					X		X	X	X	X
Varanus brevicauda	Short-tailed Pygmy Monitor					X		X	X		
Varanus bushi	Pilbara Mulga Monitor					X		X	X		
Varanus caudolineatus						X			X		
Varanus eremius	Pygmy Desert Monitor					X					
Varanus gouldii	Bungarra or Sand Monitor					X			X		
Varanus giganteus	Perentie					X		X			X
Varanus hamersleyensis	Southern Pilbara Rock Goanna					X					
Varanus panoptes	Yellow-spotted Monitor					X		X	X	X	X
Varanus pilbarensis	Pilbara Rock Monitor					X					
Varanus tristis tristis	Racehorse Monitor					X		X	X		X
TYPHLOPIDAE											
Anilios ammodytes									X		
Anilios ganei					P1	X					
Anilios grypus								X	X		
Anilios hamatus								X	X		X
Anilios waitii								X			
BOIDAE											
Antaresia perthensis	Pygmy Python					X		X			
Antaresia stimsoni	Stimson's Python					X					
Aspidites melanocephalus	Black-headed Python					X					
Liasis olivaceus barroni	Pilbara Olive Python		VU	VU		X	X				
ELAPIDAE											
Acanthophis wellsi	Pilbara Death Adder					X		X	X		
Brachyurophis approximans						X		X	X		

Scientific name	Common name	Introduced	Conservation codes			Nature Map / DBCA	EPBC PMST	Previous surveys	Phase 1 survey	Phase 2 survey	Phase 3 survey
			EPBC Act	BC Act	DBCA						
Demansia psammophis cupreiceps	Yellow-faced Whipsnake					X		X			X
Demansia rufescens	Rufous Whipsnake					X		X			
Furina ornata	Moon Snake					X		X		X	
Parasuta monachus						X		X			
Pseudechis australis	Mulga Snake					X		X		X	X
Pseudonaja mengdeni	Western Brown Snake					X		X			
Pseudonaja modesta	Ringed Brown Snake					X		X			
Pseudonaja nuchalis	Gwardar; Northern Brown Snake					X				X	
Suta fasciata	Rosen's Snake					X		X			
Suta punctata	Spotted Snake					X					
Vermicelli snelli	Pilbara Bandy Bandy					X		X			

Table E.3: Bird species list – results of database searches, literature reviews and Astron survey results.

Scientific name	Common name	Introduced	Conservation codes			Nature Map / DBCA	EPBC PMST	Birdata	Previous surveys	Phase 1 survey	Phase 2 survey	Phase 3 survey
			EPBC Act	BC Act	DBCA							
CASUARIIDAE												
Dromaius novaehollandiae	Emu					X		X	X		X	
PHASIANIDAE												
Coturnix ypsilophora	Brown Quail					X		X	X	X	X	
ANATIDAE												
Dendrocygna eytoni	Plumed Whistling-Duck					X		X				
Cygnus atratus	Black Swan							X				
Anas gracilis	Grey Teal							X				
Anas superciliosa	Pacific Black Duck					X		X				
Chenonetta jubata	Australian Wood Duck							X				
COLUMBIDAE												
Phaps chalcoptera	Common Bronzewing					X		X	X		X	X
Ocyphaps lophotes	Crested Pigeon					X		X	X	X	X	X
Geophaps plumifera	Spinifex Pigeon					X		X	X	X	X	X
Geopelia cuneata	Diamond Dove					X		X	X	X	X	X
Geopelia striata	Peaceful Dove					X		X				
PODARGIDAE												
Podargus strigoides	Tawny Frogmouth					X		X	X			X
EUROSTOPODIDAE												
Eurostopodus argus	Spotted Nightjar					X		X	X		X	X
AEGOTHELIDAE												
Aegotheles cristatus	Australian Owlet-nightjar					X		X	X	X		
APODIDAE												
Apus pacificus	Fork-tailed Swift		IA	IA		X			X			
ANHINGIDAE												
Anhinga novaehollandiae	Australasian Darter					X		X				
PHALACROCORACIDAE												
Microcarbo melanoleucos	Little Pied Cormorant							X				

Scientific name	Common name	Introduced	Conservation codes			Nature Map / DBCA	EPBC PMST	Birdata	Previous surveys	Phase 1 survey	Phase 2 survey	Phase 3 survey
			EPBC Act	BC Act	DBCA							
Phalacrocorax varius	Pied Cormorant					X						
Phalacrocorax sulcirostris	Little Black Cormorant					X		X				
PELECANIDAE												
Pelecanus conspicillatus	Australian Pelican					X		X				
ARDEIDAE												
Ardea pacifica	White-necked Heron							X				
Ardea modesta	Eastern Great Egret						X	X				
Ardea ibis	Cattle Egret						X					
Egretta novaehollandiae	White-faced Heron					X		X	X			
THRESKIORNITHIDAE												
Threskiornis spinicollis	Straw-necked Ibis					X		X	X		X	
ACCIPITRIDAE												
Elanus axillaris	Black-shouldered Kite					X			X	X	X	
Elanus scriptus	Letter-winged Kite				P4						X	
Haliastur sphenurus	Whistling Kite					X		X	X	X	X	X
Lophoictinia isura	Square-tailed Kite					X		X	X			
Milvus migrans	Black Kite					X		X				
Accipiter fasciatus	Brown Goshawk					X		X	X	X		X
Accipiter cirrocephalus	Collared Sparrowhawk					X		X	X			
Circus assimilis	Spotted Harrier					X		X	X	X	X	X
Hamirostra melanosternon	Black-breasted Buzzard					X		X	X		X	
Aquila audax	Wedge-tailed Eagle					X		X	X		X	
Hieraaetus morphnoides	Little Eagle					X		X	X	X		
FALCONIDAE												
Falco cenchroides	Nankeen Kestrel					X		X	X	X	X	
Falco berigora	Brown Falcon					X		X	X	X	X	X
Falco subniger	Black Falcon							X				
Falco longipennis	Australian Hobby					X		X	X		X	
Falco hypoleucos	Grey Falcon			VU		X						

Scientific name	Common name	Introduced	Conservation codes			Nature Map / DBCA	EPBC PMST	Birdata	Previous surveys	Phase 1 survey	Phase 2 survey	Phase 3 survey
			EPBC Act	BC Act	DBCA							
Falco peregrinus	Peregrine Falcon			OS		X		X				
RALLIDAE												
Gallirallus philippensis	Buff-banded Rail							X				
Porzana tabuensis	Spotless Crake					X						
OTIDIDAE												
Ardeotis australis	Australian Bustard					X		X	X	X	X	
BURHINIDAE												
Burhinus grallarius	Bush Stone-curlew					X		X	X			
RECURVIROSTRIDAE												
Himantopus himantopus	Black-winged Stilt					X		X				
CHARADRIIDAE												
Charadrius veredus	Oriental Plover		IA	IA			X					X
Elseyornis melanops	Black-fronted Dotterel					X		X				
Erythrogonys cinctus	Red-kneed Dotterel					X		X				
ROSTRATULIDAE												
Rostratula australis	Australian Painted Snipe		EN	EN			X					
SCOLOPACIDAE												
Tringa hypoleucos	Common Sandpiper		IA	IA			X					
Tringa nebularia	Common Greenshank		IA	IA		X						
Calidris melanotos	Pectoral Sandpiper		IA	IA			X					
Calidris acuminata	Sharp-tailed Sandpiper		IA	IA			X					
Calidris ferruginea	Curlew Sandpiper		CR	VU/ IA			X					
TURNICIDAE												
Turnix velox	Little Button-quail					X		X	X	X	X	X
CACATUIDAE												
Cacatua roseicapilla	Galah					X		X	X	X		
Cacatua sanguinea	Little Corella					X		X	X	X		X
Nymphicus hollandicus	Cockatiel					X		X	X	X		
PSITTACIDAE												

Scientific name	Common name	Introduced	Conservation codes			Nature Map / DBCA	EPBC PMST	Birdata	Previous surveys	Phase 1 survey	Phase 2 survey	Phase 3 survey
			EPBC Act	BC Act	DBCA							
Platycercus zonarius	Australian Ringneck					X		X	X	X	X	X
Melopsittacus undulatus	Budgerigar					X		X	X	X	X	X
Neophema bourkii	Bourke's Parrot					X		X		X		
Platycercus varius	Mulga Parrot					X		X	X	X		
Pezoporus occidentalis	Night Parrot		EN	CR			X					
CUCULIDAE												
Centropus phasianinus	Pheasant Coucal							X				
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo					X		X	X		X	X
Chrysococcyx osculans	Black-eared Cuckoo							X	X			
Cacomantis pallidus	Pallid Cuckoo					X		X	X		X	X
STRIGIDAE												
Ninox connivens	Barking Owl					X			X			
Ninox boobook boobook	Southern Boobook							X	X	X		
TYTONIDAE												
Tyto javanica	Eastern Barn Owl					X		X	X			
HALCYONIDAE												
Dacelo leachii	Blue-winged Kookaburra					X		X		X	X	
Todiramphus pyrrhopygius	Red-backed Kingfisher					X		X	X	X	X	X
Todiramphus sanctus	Sacred Kingfisher					X		X	X	X	X	
MEROPIDAE												
Merops ornatus	Rainbow Bee-eater					X	X	X		X	X	X
PTILONORHYNCHIDAE												
Ptilonorhynchus maculatus guttatus	Western Bowerbird					X		X	X	X	X	X
MALURIDAE												
Malurus leucopterus	White-winged Fairy-wren					X		X	X		X	X
Malurus lamberti assimilis	Variegated Fairy-wren					X		X	X	X	X	X
Stipiturus ruficeps	Rufous-crowned Emu-wren					X		X	X	X	X	X
Malurus splendens	Splendid Fairy-wren					X		X	X			
Amytornis striatus whitei	Striated Grasswren					X		X	X	X	X	X

Scientific name	Common name	Introduced	Conservation codes			Nature Map / DBCA	EPBC PMST	Birdata	Previous surveys	Phase 1 survey	Phase 2 survey	Phase 3 survey
			EPBC Act	BC Act	DBCA							
ACANTHIZIDAE												
Pyrrholaemus brunneus	Redthroat					X		X	X			
Smicrornis brevirostris	Weebill					X		X	X	X	X	X
Gerygone fusca	Western Gerygone					X		X	X	X	X	X
Acanthiza robustirostris	Slaty-backed Thornbill					X		X	X	X		
Acanthiza chrysorrhoa	Yellow-rumped Thornbill					X		X	X			
Acanthiza uropygialis	Chestnut-rumped Thornbill					X		X	X		X	X
Acanthiza apicalis	Inland Thornbill					X		X	X	X	X	X
Aphelocephala nigricincta	Banded Whiteface							X				
Aphelocephala leucopsis	Southern Whiteface					X		X				
PARDALOTIDAE												
Pardalotus rubricatus	Red-browed Pardalote					X		X			X	
Pardalotus striatus	Striated Pardalote					X		X	X		X	
MELIPHAGIDAE												
Gavicalis virescens	Singing Honeyeater					X		X	X	X	X	X
Ptilotula keartlandi	Grey-headed Honeyeater					X		X	X	X	X	X
Ptilotula penicillata	White-plumed Honeyeater							X	X		X	X
Purnella albifrons	White-fronted Honeyeater					X			X			
Manorina flavigula	Yellow-throated Miner					X		X	X	X	X	X
Melithreptus gularis	Black-chinned Honeyeater					X		X	X			
Acanthagenys rufogularis	Spiny-cheeked Honeyeater					X		X	X	X	X	X
Conopophila whitei	Grey Honeyeater					X		X	X			
Epthianura tricolor	Crimson Chat					X		X	X			
Certhionyx variegatus	Pied Honeyeater					X		X				
Sugomel niger	Black Honeyeater							X				
Lichmera indistincta	Brown Honeyeater					X		X	X		X	X
POMATOSTOMIDAE												
Pomatostomus temporalis	Grey-crowned Babbler					X		X	X	X	X	X
Pomatostomus superciliosus	White-browed Babbler					X		X	X			

Scientific name	Common name	Introduced	Conservation codes			Nature Map / DBCA	EPBC PMST	Birdata	Previous surveys	Phase 1 survey	Phase 2 survey	Phase 3 survey
			EPBC Act	BC Act	DBCA							
EUPATRIDAE												
Cinclosoma castaneothorax	Chestnut-breasted Quail-thrush					X		X				
Psophodes occidentalis	Chiming Wedgebill							X			X	
NEOSITTIDAE												
Daphoenositta chrysoptera	Varied Sittella					X		X				
CAMPEPHAGIDAE												
Coracina novaehollandiae	Black-faced Cuckoo-shrike					X		X	X	X	X	X
Coracina maxima	Ground Cuckoo-shrike					X		X	X			
Lalage tricolor	White-winged Triller					X		X	X	X	X	X
PACHYCEPHALIDAE												
Pachycephala rufiventris	Rufous Whistler					X		X	X	X		X
Colluricincla harmonica	Grey Shrike-thrush					X		X	X	X	X	X
Oreoica gutturalis	Crested Bellbird					X		X	X	X	X	X
ARTAMIDAE												
Artamus personatus	Masked Woodswallow					X		X	X			X
Artamus cinereus	Black-faced Woodswallow					X		X	X	X	X	X
Artamus minor	Little Woodswallow					X		X	X	X	X	
Cracticus torquatus	Grey Butcherbird					X		X	X	X	X	X
Cracticus tibicen	Australian Magpie					X		X	X	X	X	X
Cracticus nigrogularis	Pied Butcherbird					X		X	X	X	X	X
RHIPIDURIDAE												
Rhipidura albiscapa	Grey Fantail					X		X	X	X	X	X
Rhipidura leucophrys	Willie Wagtail					X		X	X	X	X	X
CORVIDAE												
Corvus bennetti	Little Crow					X		X	X		X	
Corvus orru	Torresian Crow					X		X	X	X	X	X
MONARCHIDAE												
Grallina cyanoleuca	Magpie-lark					X		X	X	X	X	X

Scientific name	Common name	Introduced	Conservation codes			Nature Map / DBCA	EPBC PMST	Birdata	Previous surveys	Phase 1 survey	Phase 2 survey	Phase 3 survey
			EPBC Act	BC Act	DBCA							
PETROICIDAE												
Petroica goodenovii	Red-capped Robin					X		X	X		X	
Melanodryas cucullata	Hooded Robin					X		X	X		X	X
ALAUDIDAE												
Mirafra javanica	Horsfield's Bushlark					X		X	X		X	
ACROCEPHALIDAE												
Acrocephalus australis	Australian Reed-Warbler					X		X				
MEGALURIDAE												
Cincloramphus mathewsi	Rufous Songlark							X	X	X		X
Cincloramphus cruralis	Brown Songlark							X	X			
Eremiornis carteri	Spinifexbird					X		X	X	X		X
HIRUNDINIDAE												
Cheramoeca leucosterna	White-backed Swallow							X				
Hirundo rustica	Barn Swallow		IA	IA			X					
Hirundo neoxena	Welcome Swallow					X		X				
Petrochelidon ariel	Fairy Martin					X		X		X		
Petrochelidon nigricans	Tree Martin					X		X	X	X		
NECTARINIIDAE												
Dicaeum hirundinaceum	Mistletoebird					X		X	X			
ESTRILDIDAE												
Taeniopygia guttata	Zebra Finch					X		X	X	X	X	X
Neochmia ruficauda	Star Finch					X		X				
Emblema pictum	Painted Finch					X		X	X	X	X	X
MOTACILLIDAE												
Anthus novaeseelandiae	Australasian Pipit					X		X	X		X	
Motacilla flava	Yellow Wagtail		IA	IA			X					
Motacilla cinerea	Grey Wagtail		IA	IA			X					

Table E.4: Mammal species list – results of database searches, literature reviews and Astron survey results.

Scientific name	Common name	Introduced	Conservation codes			NatureMap / DBCA	EPBC PMST	Previous surveys	Phase 1 survey	Phase 2 survey	Phase 3 survey
			EPBC Act	BC Act	DBCA						
TACHYGLOSSIDAE											
Tachyglossus aculeatus	Short-beaked Echidna								X	X	
DASYURIDAE											
Dasycercus blythi	Brush-tailed Mulgara				P4	X					
Dasykaluta rosamondae	Little Red Kaluta					X		X		X	X
Dasyurus hallucatus	Northern Quoll		EN	EN		X	X	X	X	X	X
Ningaui timealeyi	Pilbara Ningaui					X		X	X	X	X
Planigale ingrami	Long-tailed Planigale					X					
Planigale sp. 1'	Pilbara Planigale								X		X
Pseudantechinus roryi	Rory's Pseudantechinus					X					
Pseudantechinus woolleyae	Woolley's Pseudantechinus					X		X			
Sminthopsis macroura	Stripe-faced Dunnart					X		X	X	X	
Sminthopsis ooldea	Ooldea Dunnart					X		X			X
Sminthopsis youngsoni	Lesser Hairy-footed Dunnart					X					
THYLACOMYIDAE											
Macrotis lagotis	Bilby, Dalgyte		VU	VU		X	X				
MACROPODIDAE											
Macropus robustus erubescens	Euro, Biggada					X		X	X	X	X
Macropus rufus	Red Kangaroo, Marlu					X		X	X		X
Petrogale rothschildi	Rothschild's Rock-wallaby					X		X	X	X	X
MEGADERMATIDAE											
Macroderma gigas	Ghost Bat		VU	VU		X	X	X	X	X	X
HIPPOSIDERIDAE											
Rhinonicteris aurantia (Pilbara form)	Pilbara Leaf-nosed Bat		VU	VU		X	X	X		X	
EMBALLONURIDAE											

Scientific name	Common name	Introduced	Conservation codes			NatureMap / DBCA	EPBC PMST	Previous surveys	Phase 1 survey	Phase 2 survey	Phase 3 survey
			EPBC Act	BC Act	DBCA						
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat					X		X	X	X	X
Taphozous georgianus	Common Sheathtail-bat					X		X	X	X	X
Taphozous hilli	Hill's Sheathtail-bat					X		X	X	X	
VESPERTILIONIDAE											
Chalinolobus gouldii	Gould's Wattled Bat					X		X	X	X	X
Chalinolobus morio	Chocolate Wattled Bat					X					
Nyctophilus daedalus	Northwestern Long-eared Bat					X					
Nyctophilus geoffroyi	Lesser Long-eared Bat					X		X	X	X	
Scotorepens greyii	Little Broad-nosed Bat					X		X	X	X	X
Vespadelus finlaysoni	Finlayson's Cave Bat					X		X	X	X	X
MOLOSSIDAE											
Chaerephon jobensis	Northern Freetail-bat					X		X	X	X	X
Mormopterus beccarii	Beccari's Freetail-bat							X			
Ozimops lumsdenae	Northern Freetail-bat					X		X	X	X	X
Austronomus australis	White-striped Freetail-bat							X		X	
MURIDAE											
Leggadina lakedownensis	Short-tailed Mouse				P4	X					
Mus musculus	House Mouse	*				X	X	X		X	
Notomys alexis	Spinifex Hopping-mouse					X					
Pseudomys chapmani	Western Pebble-mound Mouse				P4	X		X	X		X
Pseudomys delicatulus	Delicate Mouse					X		X			
Pseudomys desertor	Desert Mouse					X		X	X	X	
Pseudomys hermannsburgensis	Sandy Inland Mouse					X		X	X	X	
Pseudomys nanus	Western Chestnut Mouse					X					
Zyzomys argurus	Common Rock-rat					X		X	X	X	
LEPORIDAE											

Scientific name	Common name	Introduced	Conservation codes			NatureMap / DBCA	EPBC PMST	Previous surveys	Phase 1 survey	Phase 2 survey	Phase 3 survey
			EPBC Act	BC Act	DBCA						
Oryctolagus cuniculus	Rabbit	*				X	X	X	X	X	X
CANIDAE											
Canis familiaris dingo	Dingo, Dog	*				X	X	X	X	X	X
Vulpes vulpes	Red Fox	*					X				
FELIDAE											
Felis catus	Cat	*				X	X	X	X	X	X
EQUIDAE											
Equus asinus	Donkey	*				X	X			X	
Equus caballus	Horse	*				X	X				
CAMELIDAE											
Camelus dromedarius	Dromedary, Camel	*				X	X		X	X	
BOVIDAE											
Bos taurus	European Cattle	*				X			X	X	X

Previous surveys

Biota Environmental Sciences (2006) Hope Downs Rail Corridor (Juna Downs Section) Fauna Survey

Biota Environmental Sciences (2009) Hope Downs Section 45C Targeted Fauna Review

Biota Environmental Sciences (2011) Hope Downs Project Life of Mine Targeted Fauna Survey

Biota Environmental Sciences (2014) Hope Downs South West Marra Mamba Development Targeted Fauna Survey

Ecologia Environment (2014) Greater West Angelas Terrestrial Fauna Assessment

Ninox Wildlife Consulting (2009a) A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Infrastructure Corridor Option 1 Near Newman Western Australia

Ninox Wildlife Consulting (2009b) A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Infrastructure Corridor Option 1 Near Newman Western Australia

Table E.5: Amphibian species recorded during the current surveys. Numbers are those recorded in Phase 1, Phase 2 and Phase 3. X = the trap sites were not opened during that particular phase of fauna surveying.

Species name	TS01	TS02	TS03	TS04	TS05	TS06	TS07	TS08	TS09	TS10	TS11	TS12	TS13	TS14	TS15	TS16	TS17	TS18	TS19	Other
HYLIDAE																				
Cyclorana maini														x, x, 4						
Litoria rubella						1, 0, x	0, 2, x							x, x, 1						0, 11, 4

Table E.6: Reptile species recorded during the current surveys. Numbers are those recorded in Phase 1, Phase 2 and Phase 3. X = the trap sites were not opened during that particular phase of fauna surveying.

Species name	TS01	TS02	TS03	TS04	TS05	TS06	TS07	TS08	TS09	TS10	TS11	TS12	TS13	TS14	TS15	TS16	TS17	TS18	TS19	Other
AGAMIDAE																				
Gowidon longirostris						0, 1, x	0, 1, x													2, 0, 1
Ctenophorus caudicinctus	0, 1, x			3, 2, x	0, 3, x							0, 1, x			x, x, 1					2, 2, 0
Ctenophorus isolepis					0, 2, x															
Pogona minor			1, 0, x	0, 1, x																1, 0, 0
CARPHODACTYLIDAE																				
Nephrurus wheeleri cinctus	0, 1, x													x, x, 4						0, 0, 1
DIPLODACTYLIDAE																				
Diplodactylus pulcher	5, 0, x		5, 0, x																	
Lucasium stenodactylum				5, 0, x		3, 0, x										x, x, 1	x, x, 3			0, 0, 1
Lucasium wombeyi				1, 0, x		2, 0, x	1, 0, x													1, 0, 0
Oedura fimbria																				13, 3, 1
Rhynchoedura ornata				1, 0, x		2, 0, x										x, x, 3				
GEKKONIDAE																				
Gehyra punctata																				6, 2, 1
Gehyra variegata			1, 0, x			1, 0, x								x, x, 1						3, 2, 1
Heteronotia binoei																				0, 1, 1
Heteronotia spelea																				1, 1, 0
Strophurus elderi				1, 0, x																
Strophurus wellingtonae					1, 0, x															0, 1, 2
PYGOPODIDAE																				
Delma butleri															x, x, 1					
Delma nasuta							1, 0, x							x, x, 1						0, 0, 1
Delma pax						1, 0, x	0, 1, x									x, x, 1				
Lialis burtonis				2, 0, x			1, 0, x													1, 0, 1
Pygopus nigriceps														x, x, 1						
SCINCIDAE																				
Carlia munda	1, 0, x	5, 0, x			0, 1, x	6, 1, x	3, 5, x				1, 1, x			x, x, 3			x, x, 2	x, x, 1		
Cryptoblepharus ustulatus									1, 0, x											1, 1, 0
Ctenotus grandis	1, 0, x													x, x, 1		x, x, 1				
Ctenotus helenae				1, 0, x		3, 0, x														
Ctenotus pallasotus				2, 0, x													x, x, 1	x, x, 1		
Ctenotus pantherinus		2, 1, x		4, 0, x	6, 0, x	2, 0, x						0, 1, x			x, x, 2	x, x, 2				
Ctenotus rutilans					2, 0, x															
Ctenotus saxatilis							0, 1, x				1, 0, x		0, 2, x	x, x, 2	x, x, 3	x, x, 2	x, x, 3	x, x, 2		
Ctenotus schomburgkii	1, 0, x		1, 1, x																	0, 1, 0

Species name	TS01	TS02	TS03	TS04	TS05	TS06	TS07	TS08	TS09	TS10	TS11	TS12	TS13	TS14	TS15	TS16	TS17	TS18	TS19	Other
Ctenotus uber															x, x, 1	x, x, 1		x, x, 1		
Egernia formosa										1, 0, x	2, 1, x								x, x, 1	
Lerista macropisthopus remota																		x, x, 1		
Lerista muelleri	1, 0, x																			
Lerista neander	1, 0, x		1, 0, x																	
Menetia greyii							0, 3, x							x, x, 1			x, x, 1			
Morethia ruficauda exquisita					0, 1, x											x, x, 1				0, 0, 1
Tiliqua multifasciata				1, 0, x	1, 0, x											x, x, 3	x, x, 1	x, x, 2		
VARANIDAE																				
Varanus acanthurus				1, 0, x									0, 1, x		x, x, 2	x, x, 1				1, 0, 0
Varanus brevicauda					3, 0, x															
Varanus bushi																				1, 0, 0
Varanus caudolineatus																				1, 0, 0
Varanus giganteus																				0, 0, 1
Varanus gouldii																				1, 0, 0
Varanus panoptes	1, 0, x																			0, 1, 1
Varanus tristis tristis																				1, 0, 1
TYPHLOPIDAE																				
Anilios ammodytes					2, 0, x															
Anilios grypus				1, 0, x	1, 0, x															
Anilios hamatus				1, 0, x										x, x, 1						
ELAPIDAE																				
Acanthophis wellsi				1, 0, x																
Brachyurophis approximans						1, 0, x	1, 0, x													
Demansia psammophis																x, x, 1				
Furina ornata													0, 1, x							
Pseudechis australis																x, x, 1				0, 1, 0
Pseudonaja nuchalis												0, 1, x								

Table E.7: Bird species recorded during the current surveys. Numbers are those recorded in Phase 1, Phase 2 and Phase 3. X = the trap sites were not opened during that particular phase of fauna surveying.

Species name	TS01	TS02	TS03	TS04	TS05	TS06	TS07	TS08	TS09	TS10	TS11	TS12	TS13	TS14	TS15	TS16	TS17	TS18	TS19	Other
DROMAIIDAE																				
Dromaius novaehollandiae				0, 1, x																
PHASIANIDAE																				
Coturnix ypsilophora				1, 0, x		4, 0, x	1, 1, x													
COLUMBIDAE																				
Geopelia cuneata				3, 0, x								0, 1, x		x, x, 1						1, 1, 0
Geophaps plumifera										0, 1, x										1, 1, 2
Ocyphaps lophotes			0, 1, x	2, 3, x	1, 1, x	1, 0, x													x, x, 2	1, 1, 1
Phaps chalcoptera																			x, x, 1	0, 1, 2
CAPRIMULGIDAE																				
Eurostopodus argus																				0, 2, 3
AEGOTHELIDAE																				
Aegotheles cristatus											1, 0, x									4, 0, 0
THRESKIORNITHIDAE																				
Threskiornis spinicollis																				0, 1, 0
ACCIPITRIDAE																				
Elanus caeruleus axillaris																				1, 1, 0
Elanus scriptus																				0, 1, 0
Haliastur sphenurus						2, 0, x									x, x, 1					2, 4, 0
Accipiter fasciatus																				1, 0, 1
Circus assimilis	1, 0, x																			1, 2, 2
Aquila audax																				0, 2, 0
Hamirostra melanosternon																				0, 4, 0
Hieraaetus morphnoides																				1, 0, 0
FALCONIDAE																				
Falco cenchroides				1, 0, x		1, 0, x														0, 2, 0
Falco berigora				1, 0, x																0, 1, 1
Falco longipennis							0, 1, x													
OTIDIDAE																				
Ardeotis australis																				1, 1, 0
CHARADRIIDAE																				
Charadrius veredus																				0, 0, 1
TURNICIDAE																				
Turnix velox				1, 0, x		1, 1, x	1, 0, x						0, 2, x			x, x, 1				
CACATUIDAE																				
Cacatua roseicapillus				1, 0, x		1, 0, x														

Species name	TS01	TS02	TS03	TS04	TS05	TS06	TS07	TS08	TS09	TS10	TS11	TS12	TS13	TS14	TS15	TS16	TS17	TS18	TS19	Other
Cacatua sanguinea		1, 0, x					1, 0, x												x, x, 1	
Nymphicus hollandicus						1, 0, x														
PSITTACIDAE																				
Melopsittacus undulatus								2, 0, x												0, 1, 1
Neophema bourkii																				11, 0, 0
Platycercus varius																				2, 0, 0
Platycercus zonarius	1, 0, x		3, 0, x		1, 1, x	2, 0, x	1, 2, x		0, 1, x							x, x, 3	x, x, 1		x, x, 2	1, 4, 1
CUCULIDAE																				
Chrysococcyx basalis							0, 1, x		0, 2, x		0, 1, x					x, x, 1	x, x, 1	x, x, 1		
Cacomantis pallidus			0, 2, x						0, 1, x					x, x, 1			x, x, 1			0, 1, 0
STRIGIDAE																				
Ninox boobook boobook										1, 0, x	1, 0, x									2, 0, 0
Podargus strigoides																				0, 0, 1
ALCEDINIDAE																				
Dacelo leachii						2, 1, x														
Todiramphus pyrrhopygius																				1, 2, 1
Todiramphus sanctus		1, 0, x				4, 1, x														1, 0, 0
MEROPIDAE																				
Merops ornatus				1, 2, x	0, 1, x	0, 1, x								x, x, 1		x, x, 1		x, x, 1		1, 4, 2
PTILONORHYNCHIDAE																				
Ptilonorhynchus guttatus										1, 0, x										2, 3, 3
MALURIDAE																				
Amytornis striatus				0, 1, x						0, 2, x	0, 1, x									1, 2, 1
Malurus lamberti assimilis		2, 2, x		0, 2, x		1, 0, x	0, 3, x	0, 1, x						x, x, 2		x, x, 1				0, 0, 1
Malurus leucopterus		0, 1, x														x, x, 1		x, x, 1		0, 1, 1
Stipiturus ruficeps					2, 1, x								0, 1, x		x, x, 3	x, x, 3	x, x, 1			
ACANTHIZIDAE																				
Acanthiza apicalis	1, 0, x	1, 0, x						0, 2, x										x, x, 1		0, 0, 1
Acanthiza robustirostris	2, 0, x		1, 0, x																	
Acanthiza uropygialis									0, 1, x											0, 1, 1
Gerygone fusca	4, 0, x		1, 0, x															x, x, 1		0, 1, 1
Smicrornis brevirostris	1, 2, x	0, 2, x		2, 2, x	1, 2, x	1, 3, x	1, 4, x	1, 2, x	2, 6, x	1, 0, x	1, 1, x			x, x, 1		x, x, 1			x, x, 1	2, 7, 3
PARDALOTIDAE																				
Pardalotus rubricatus										0, 2, x										0, 1, 0
Pardalotus striatus								0, 1, x												
MELIPHAGIDAE																				
Acanthagenys rufogularis			1, 0, x	0, 4, x			0, 1, x				0, 1, x			x, x, 1		x, x, 2		x, x, 1		1, 3, 1

Species name	TS01	TS02	TS03	TS04	TS05	TS06	TS07	TS08	TS09	TS10	TS11	TS12	TS13	TS14	TS15	TS16	TS17	TS18	TS19	Other
Gavicalis virescens	2, 2, x	1, 2, x		3, 1, x	0, 1, x		4, 1, x	0, 2, x	0, 3, x	0, 3, x	0, 1, x			x, x, 2	x, x, 1	x, x, 2	x, x, 1	x, x, 3	x, x, 2	2, 1, 3
Lichmera indistincta							0, 1, x	0, 1, x										x, x, 2		0, 1, 1
Manorina flavigula					1, 0, x	2, 0, x		1, 0, x										x, x, 1	x, x, 2	2, 7, 3
Ptilotula keartlandi						1, 1, x	6, 0, x		0, 1, x	1, 4, x	5, 2, x									0, 1, 2
Ptilotula penicillata						0, 5, x	0, 2, x											x, x, 1		0, 3, 1
POMATOSTOMIDAE																				
Pomatostomus temporalis	1, 1, x	1, 2, x	5, 0, x		4, 0, x	1, 1, x	0, 4, x	1, 0, x	0, 2, x	1, 0, x				x, x, 2				x, x, 1		0, 4, 4
PSOPHODIDAE																				
Psophodes occidentalis																				0, 1, 0
CAMPEPHAGIDAE																				
Coracina novaehollandiae		0, 1, x		2, 0, x		1, 0, x	0, 1, x								x, x, 1	x, x, 4		x, x, 1		2, 1, 0
Lalage tricolor	1, 0, x	1, 0, x	1, 0, x	2, 0, x		0, 1, x								x, x, 2	x, x, 2	x, x, 1	x, x, 2			0, 1, 1
OREOICIDAE																				
Oreoica gutturalis	1, 1, x	1, 0, x		1, 0, x	2, 0, x															0, 1, 1
PACHYCEPHALIDAE																				
Cincloramphus mathewsi	1, 0, x	1, 0, x		2, 0, x		2, 0, x	1, 0, x													2, 0, 1
Colluricincla harmonica				1, 0, x		0, 1, x		0, 2, x	2, 0, x	1, 0, x	1, 1, x							x, x, 2		1, 4, 0
Pachycephala rufiventris	1, 0, x		2, 0, x	1, 0, x		1, 0, x		2, 0, x	1, 0, x								x, x, 1	x, x, 4	x, x, 1	0, 0, 1
ARTAMIDAE																				
Artamus cinereus		1, 0, x						1, 0, x				0, 3, x								1, 4, 1
Artamus minor											1, 0, x									2, 2, 0
Artamus personatus																		x, x, 1		
CRACTICIDAE																				
Cracticus nigrogularis				2, 0, x	2, 0, x	2, 0, x		1, 0, x			1, 0, x			x, x, 1			x, x, 2		x, x, 2	0, 3, 2
Cracticus tibicen		1, 0, x		1, 0, x	1, 0, x				0, 1, x								x, x, 1		x, x, 2	1, 2, 0
Cracticus torquatus	0, 1, x				2, 1, x	0, 1, x	0, 1, x	0, 1, x									x, x, 1			1, 4, 1
RHIPIDURIDAE																				
Rhipidura albiscapa	3, 0, x								0, 1, x		0, 1, x							x, x, 2	x, x, 1	
Rhipidura leucophrys	3, 0, x	2, 0, x	1, 0, x	2, 1, x	2, 0, x	2, 0, x	0, 2, x		1, 1, x	0, 1, x	1, 1, x					x, x, 3	x, x, 2	x, x, 1		2, 6, 4
CORVIDAE																				
Corvus bennetti								0, 1, x												
Corvus orru	1, 1, x			1, 0, x			0, 1, x	0, 1, x	1, 0, x	0, 1, x	0, 1, x		0, 1, x		x, x, 1	x, x, 3			x, x, 1	3, 4, 1
MONARCHIDAE																				
Grallina cyanoleuca						2, 0, x													x, x, 2	0, 3, 0
PETROICIDAE																				
Melanodryas cucullata	0, 1, x																			0, 1, 1
Petroica goodenovii				0, 1, x																

Species name	TS01	TS02	TS03	TS04	TS05	TS06	TS07	TS08	TS09	TS10	TS11	TS12	TS13	TS14	TS15	TS16	TS17	TS18	TS19	Other
ALAUDIDAE																				
Mirafra javanica																				0, 1, 0
LOCUSTELLIDAE																				
Eremiornis carteri														x, x, 1		x, x, 2	x, x, 1			1, 0, 0
HIRUNDINIDAE																				
Petrochelidon ariel																				1, 0, 0
Petrochelidon nigricans																				1, 0, 0
ESTRILDIDAE																				
Emblema pictum				0, 1, x		0, 1, x		1, 0, x	0, 1, x	2, 2, x	3, 1, x	0, 1, x								1, 4, 1
Taeniopygia guttata	0, 1, x			12, 3, x	10, 0, x	5, 4, x	1, 1, x		0, 1, x			0, 1, x		x, x, 2		x, x, 1				0, 1, 1
MOTACILLIDAE																				
Anthus australis																				0, 1, 0

Table E.8: Non-volant mammal species recorded during the current survey. Numbers are those recorded in Phase 1, Phase 2 and Phase 3. X = the trap sites were not opened during that particular phase of fauna surveying.

Species name	TS01	TS02	TS03	TS04	TS05	TS06	TS07	TS08	TS09	TS10	TS11	TS12	TS13	TS14	TS15	TS16	TS17	TS18	TS19	Other
TACHYGLOSSIDAE																				
Tachyglossus aculeatus acanthion																				1, 1, 0
DASYURIDAE																				
Dasykaluta rosamondae					0, 1, x	0, 1, x								x, x, 3	x, x, 4	x, x, 4	x, x, 16	x, x, 3		
Dasyurus hallucatus																				1, 12, 1
Ningaui timealeyi				2, 1, x	0, 3, x											x, x, 1	x, x, 1			
Planigale sp. 1'		1, 0, x					1, 0, x							x, x, 1						
Sminthopsis macroura		0, 2, x		1, 0, x		1, 0, x														
Sminthopsis ooldea																x, x, 1		x, x, 1		
MACROPODIDAE																				
Macropus robustus erubescens						1, 0, x														5, 3, 1
Macropus rufus																				2, 0, 1
Petrogale rothschildi																				11, 5, 1
MURIDAE																				
Mus musculus		0, 1, x				0, 1, x	0, 2, x													
Pseudomys chapmani															x, x, 2		x, x, 1			1, 0, 5
Pseudomys desertor		0, 1, x		2, 0, x	0, 2, x		4, 0, x						0, 2, x							
Pseudomys hermannsburgensis	6, 0, x		2, 1, x		1, 1, x															
Zyzomys argurus					0, 2, x			2, 2, x	1, 2, x	2, 2, x	1, 3, x	0, 2, x	0, 13, x							2, 3, 0
LEPORIDAE																				
Oryctolagus cuniculus				1, 0, x		0, 1, x														2, 2, 1
CANIDAE																				
Canis familiaris dingo						0, 3, x					1, 0, x								x, x, 1	3, 9, 0
FELIDAE																				
Felis catus																				3, 1, 1
EQUIDAE																				
Equus asinus																				0,1, 0
CAMELIDAE																				
Camelus dromedarius				0, 1, x																1, 0, 0
BOVIDAE																				
Bos taurus																				1, 1, 2

Table E.9: Volant mammal (bat) species recorded during the current surveys. BAT 1 – 12 (Phase 1); BAT 13 – 21 (Phase 2); Bat 23 – 26 (Phase 3).

Species name (Common name)	BAT01	BAT02	BAT03	BAT04	BAT05	BAT06	BAT07	BAT08	BAT09	BAT10	BAT12	BAT13	BAT14	BAT15	BAT16	BAT17	BAT19	BAT21	BAT23	BAT24	BAT25	BAT26	Other
MEGADERMATIDAE																							
Macroderma gigas				Low (2 calls)														Low (1 call)			Low (1 call)		Phase 3 (scat)
HIPPOSIDERIDAE																							
Rhinonicteris aurantia (Pilbara form)												Low (10 calls)				Low (2 calls)		Low (1 call)					
EMBALLONURIDAE																							
Saccolaimus flaviventris											x		x	x					x	x			
Taphozous georgianus		x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Taphozous hilli												x											
VESPERTILIONIDAE																							
Chalinolobus gouldii			x	x					x		x	x	x	x	x	x		x	x	x	x	x	
Nyctophilus geoffroyi											x		x										
Scotorepens greyii			x	x					x		x	x	x	x				x	x	x	x	x	
Vespadelus finlaysoni			x	x					x	x	x	x	x	x	x	x	x	x	x	x	x	x	
MOLOSSIDAE																							
Chaerephon jobensis	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	
Ozimops lumsdenae			x	x					x		x				x	x			x	x		x	
Austronomus australis												x	x	x	x	x	x	x					

Table E.10: Collected species in SRE target groups. SRE and potential SRE species are shaded grey.

SPECIES	SRE1	SRE2	SRE3	SRE4	SRE5	SRE6	SRE7	SRE8	SRE9	SRE10	SRE11	SRE12	SRE13	SRE14	SRE15	SRE16	SRE17	SRE18	SRE19	SRE20	SRE21	SRE22	SRE23	TS01	TS02	TS03	TS04	TS05	TS06	TS07	TS08	TS09	TS10	TS11	TS12	TS13	TS14	TS15	TS16	TS17	TS18	TS19	Other	Total
Araneae																																												
Aname mellosa																1		2																			4		10	8	9		2	**36**
Aname 'MYG004'																																								1				**1**
Aname sp.																1																						1						**2**
Aurecocrypta 'sp. indet. (AESHD1)'																	1																											**1**
Aurecocrypta 'MYG315'																						1																						**1**
Gaius tealei			1													1							1													1				3			**7**
Karaops banyjima																		1	1		1																						**3**
Karaops sp. 'ARA001'																		1																										**1**
Yilgarnia 'MYG197'																																					1						**1**
Missulena rutraspina																																									2			**2**
Nemesiidae sp.											1																																	**1**
Synothele sp.												1																																	**1**
Synothele 'MYG309'																																									1			**1**
Synothele 'MYG311'																																									1			**1**
Synothele xkarara																														1											3			**4**
Scorpiones																																												
Isometroides 'pilbara 1'																																					2		1	2	3			**8**
Lychas 'bituberculatus complex'																											1										1			1			1	**6**
Lychas 'hairy tail complex'																																								1				**1**
Lychas 'harveyi complex'																														1							2				1			**4**
Lychas 'multipunctatus complex'								1																													4			3			3	**11**
Lychas 'pilbara 1'																											1																	**1**
Urodacus 'pilbara 12'												1																																**1**
Urodacus 'HD1'													1																															**1**
Pseudoscorpiones																																												
Anatemnus sp.														1																															**1**
Austrohorus 'sp. indet. (AESHD5)'	1																																											**1**
Beierolpium '8/4 small'																			2																										**2**
Beierolpium '8/4'													1																															**1**
Beierolpium 'sp. indet. (AESHD1)'														1																															**1**
Beierolpium 'sp. indet. (AESHD2)'																																					1							**1**
Euryolpium 'sp. indet. (AESHD6)'										2																																		**2**
Euryolpium 'sp. indet. (AESHD7)'									1																																			**1**
Euryolpium sp.										1										1																									**2**
'Genus 7/4 PSE118'		4		1						2											2																								**9**
'*PSEAAA* sp. indet. (AESHD4)'																1																													**1**
Indolpium sp.	5																																												**5**
Olpiidae sp.	1																																												**1**

SPECIES	SRE1	SRE2	SRE3	SRE4	SRE5	SRE6	SRE7	SRE8	SRE9	SRE10	SRE11	SRE12	SRE13	SRE14	SRE15	SRE16	SRE17	SRE18	SRE19	SRE20	SRE21	SRE22	SRE23	TS01	TS02	TS03	TS04	TS05	TS06	TS07	TS08	TS09	TS10	TS11	TS12	TS13	TS14	TS15	TS16	TS17	TS18	TS19	Other	Total
Oratemnus sp.			1										2		8								4																					**15**
Sundochernes sp.																							1																					**1**
Tyrannochthonius 'sp. indet. (AESHD)1'														1																														**1**
Tyrannochthonius 'sp. indet. (AESHD2)'		1																																									**1**
Geophilomorpha																																												
Geophilomorpha sp.																1																													**1**
Mecistocephalus 'HD1'													1								1		2																					**4**
Mecistocephalus 'HD2'																							1																					**1**
Mecistocephalus 'HD3'															2																													**2**
Orphnaeus sp.																							1																					**1**
Sepedonophilus 'HD1'	1																2		3																								1	**7**
Sepedonophilus 'HD2'																							1																					**1**
Sepedonophilus sp.																			1																									**1**
Scolopendromorpha																																											
Cryptops 'HD1'															3																													**3**
Polydesmida																																												
Antichiropus sp.															1								2																					**3**
Antichiropus 'wonmunna'															2								12																					**14**
Spirobolida																																											
Austrostrophus 'Clade A'																				2																									**2**
Austrostrophus 'Clade E'															1							1																				4			1			**7**
Austrostrophus sp.													1		5	1	1	1	1																										**10**
Eupulmonata																																												
Gastrocopta sp.	30		1	1			2		2		3			2	2						6																				2					**51**
Pupoides sp.	3			1			1				1			4							1		1																		2					**14**
Eremopeas interioris														5	2		4		2																					5					**18**
Subulinidae sp.	20	1	1	1						1																																			**24**
Isopoda																																												
Buddelundia '10ma'											1																2	6																		**9**
Buddelundia '15'														2	2				1				5																						**10**
Buddelundia '16'																	3		8																										**11**
Buddelundia '77'															2		1		4			1	2																						**10**
Buddelundia sp.																							1																						**1**
Buddelundiinae sp.																							1																		2					**3**
Pseudodiploexochus sp.																	1																												**1**
Troglarmadillo sp.													1																																**1**
Philosciidae sp.																			5																					1						**6**
Total	**61**	**6**	**4**	**4**	**0**	**0**	**3**	**1**	**3**	**4**	**8**	**2**	**7**	**16**	**30**	**6**	**13**	**5**	**28**	**3**	**11**	**3**	**34**	**0**	**0**	**0**	**4**	**6**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**32**	**1**	**13**	**16**	**24**	**0**	**7**	**358**

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Appendix F: Threatened and Priority Fauna Species Likelihood of Occurrence within the Survey Area

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Table F.1: Likelihood of occurrence of conservation listed vertebrate fauna species listed as potentially occurring in the vicinity of the survey area.

Scientific name (common name)	Conservation codes			Preferred habitat	Likelihood of occurrence	
	EPBC Act	BC Act	DBCA		Pre-survey	Post-survey
Reptiles						
Underwoodisaurus seorsus (Pilbara Barking Gecko)			P2	Confined in the Pilbara to the Hamersley Ranges from Tom Price to Newman. Occurs in rocky areas with spinifex and low tree cover.	High	High
Lerista macropisthopus remota			P2	This subspecies occurs in woodlands and semi-arid shrublands where animals shelter under leaf litter. This species is generally found in the central interior particularly the Ashburton region.	High	**Recorded**
Anilios ganei			P1	Little information is available on this species but it is believed to be associated with moist gorges and gullies.	High	High
Liasis olivaceus barroni (Pilbara Olive Python)	VU	VU		Generally rocky habitats in close association to permanent and semi-permanent water sources.	High	High
Birds						
Apus pacificus (Fork-tailed Swift)	IA	IA		Largely aerial species independent of the terrestrial environment.	Moderate	Moderate
Elanus scriptus (Letter-winged Kite)			P4	The Letter-winged Kite is a bird of open country and grasslands in arid and semi-arid Australia, where there are tree-lined streams or water courses.	Low	**Recorded**
Falco hypoleucos (Grey Falcon)		VU		Open habitats: semi-deserts, grassy inland plains, timbered watercourses, pastoral lands.	Moderate	Moderate
Falco peregrinus (Peregrine Falcon)		OS		Cosmopolitan, will hunt in any habitat, soaring at height or from a perch; often near cliffs. Nests on rocky ledges in tall, vertical cliff faces and tall trees associated with drainage lines.	Moderate	Moderate
Charadrius veredus (Oriental Plover)	IA	IA		Breeding habitat includes arid grasslands, saltpans; non-breeding habitat includes grasslands, salt-fields, and coastal regions.	Moderate	**Recorded**

Scientific name (common name)	Conservation codes			Preferred habitat	Likelihood of occurrence	
	EPBC Act	BC Act	DBCA		Pre-survey	Post-survey
Rostratula australis (Australian Painted Snipe)	EN	EN		Inhabits shallow terrestrial freshwater wetlands, lakes, swamps and claypans. Also found in waterlogged grassland and saltmarsh. Typical sites include areas with emergent tussocks of grass, sedges or samphire; often scattered with clumps of lignum *Muehlenbeckia*, or canegrass or sometimes with tea-tree (*Melaleuca*).	Low	Low
Actitis hypoleucos (Common Sandpiper)	IA	IA		Non-breeding migrant to a wide variety of habitats, such as riverbanks, estuaries, freshwater seeps on coastal shores, tidal creeks, mangrove swamps and saltmarshes.	Low	Low
Tringa nebularia (Common Greenshank)	IA	IA		A variety of freshwater, marine and artificial wetlands, including swamps, open muddy or rocky shores of lakes and large rivers, sewerage farms, saltworks, muddy coastal flats, mangroves and estuaries.	Low	Low
Calidris melanotos (Pectoral Sandpiper)	IA	IA		Mainly swamps, lagoons, river pools, irrigation channels and sewerage ponds. Also in samphire flats around estuaries and salt lakes.	Low	Low
Calidris acuminata (Sharp-tailed Sandpiper)	IA	IA		Muddy edges of shallow fresh/brackish wetlands with emergent sedges, saltmarsh, grass and low vegetation.	Low	Low
Calidris ferruginea (Curlew Sandpiper)	CR/IA	VU/IA		This species mainly occurs on intertidal mudflats in sheltered coastal areas and also around non-tidal swamps, lakes and lagoons near the coast. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand.	Low	Low

Scientific name (common name)	Conservation codes			Preferred habitat	Likelihood of occurrence	
	EPBC Act	BC Act	DBCA		Pre-survey	Post-survey
Pezoporus occidentalis (Night Parrot)	EN	CR		Most habitat records are from *Triodia* grasslands and/or chenopod shrublands in the arid and semi-arid zones. *Astrebla* spp. (Mitchell grass), shrubby samphire and chenopod associations, scattered trees and shrubs, *Acacia aneura* (Mulga) woodland, treeless areas and bare gibber as associated with sightings of the species.	Low	Low
Hirundo rustica (Barn Swallow)	IA	IA		Coastal open country generally, especially near surface water and man-made structures such as bridges and power wires.	Low	Low
Motacilla cinerea (Grey Wagtail)	IA	IA		Damp short-grass flats, rice stubbles and edge of swamps, sewage ponds, bore overflows, grazed or mowed grass and irrigated areas.	Low	Low
Motacilla flava (Yellow Wagtail)	IA	IA		Mainly banks and rocks in fast-running freshwater habitats such as rivers, creeks, streams and around waterfalls.	Low	Low
Mammals						
Dasycercus blythi (Brush-tailed Mulgara)			P4	Common in a range of habitats – tussock/hummock grasslands and sparse shrubs and low open woodlands on ridge tops, cliffs, scree slopes, hills and valley floors.	Moderate	Low
Dasyurus hallucatus (Northern Quoll)	EN	EN		Northern Quoll habitat generally encompasses some form of rocky area for denning purposes with surrounding vegetated habitats used for foraging and dispersal.	High	**Recorded**
Macrotis lagotis (Greater Bilby, Dalgyte)	VU	VU		Sand or sandy-loam in hummock grassland (*Triodia* species) and or *Acacia* shrublands.	Low	Low

Scientific name (common name)	Conservation codes			Preferred habitat	Likelihood of occurrence	
	EPBC Act	BC Act	DBCA		Pre-survey	Post-survey
Macroderma gigas (Ghost Bat)	VU	VU		A wide range from rainforest, monsoon and vine scrub in the tropics to open woodlands and arid areas.	High	**Recorded**
Rhinonicteris aurantia (Pilbara form) (Pilbara Leaf-nosed Bat)	VU	VU		Roosts in deep warm, humid caves or rock cracks, especially in proximity to water pools. Forages while flying low along watercourses and gorges and over *Triodia* grassland.	High	**Recorded**
Leggadina lakedownensis (Short-tailed Mouse, Karekanga)			P4	Open tussock and hummock grassland, *Acacia* shrubland and savannah woodland on alluvial clay/sandy soils.	Moderate	Moderate
Pseudomys chapmani (Western Pebble-mound Mouse)			P4	Gentle rocky slopes, hills and spurs with small pebble surface cover and sparse vegetation.	High – previously recorded within survey area	**Recorded**

Appendix G: Fauna Habitat Mapping and Significant Areas

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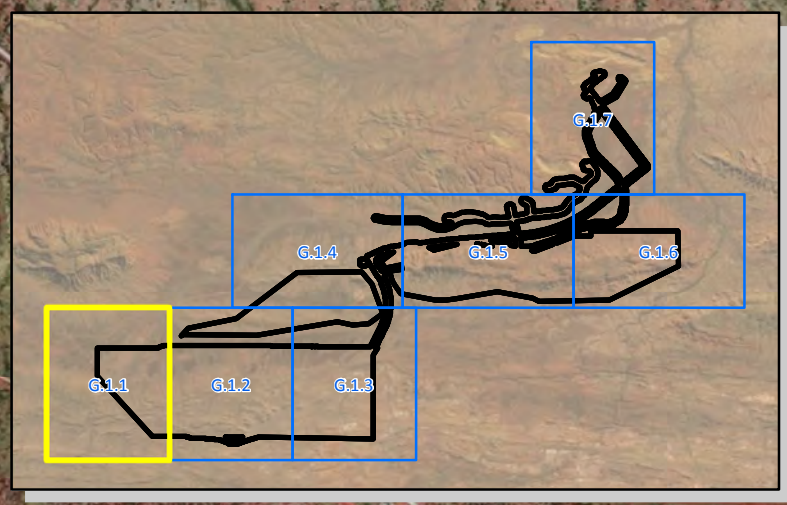
694000 696000 698000

7448000 7446000 7444000 7442000



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Survey Area

Significant Areas

Cave

Fauna Habitat

Breakaway
Mulga Woodland
Low Hills and Slopes
Stony Plain
Alluvial Plain
Minor Drainage
Cleared

Cave 7

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Hope Downs 2 Proposal Fauna Survey

Figure G.1.1: Vertebrate fauna habitat mapping and significant areas

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Author: J. Johnston	Date: 31-01-2020
Drawn: C. Dyde	Figure Ref: 14292B-19-BIDR-3Rev2_200131_P_FigG1

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

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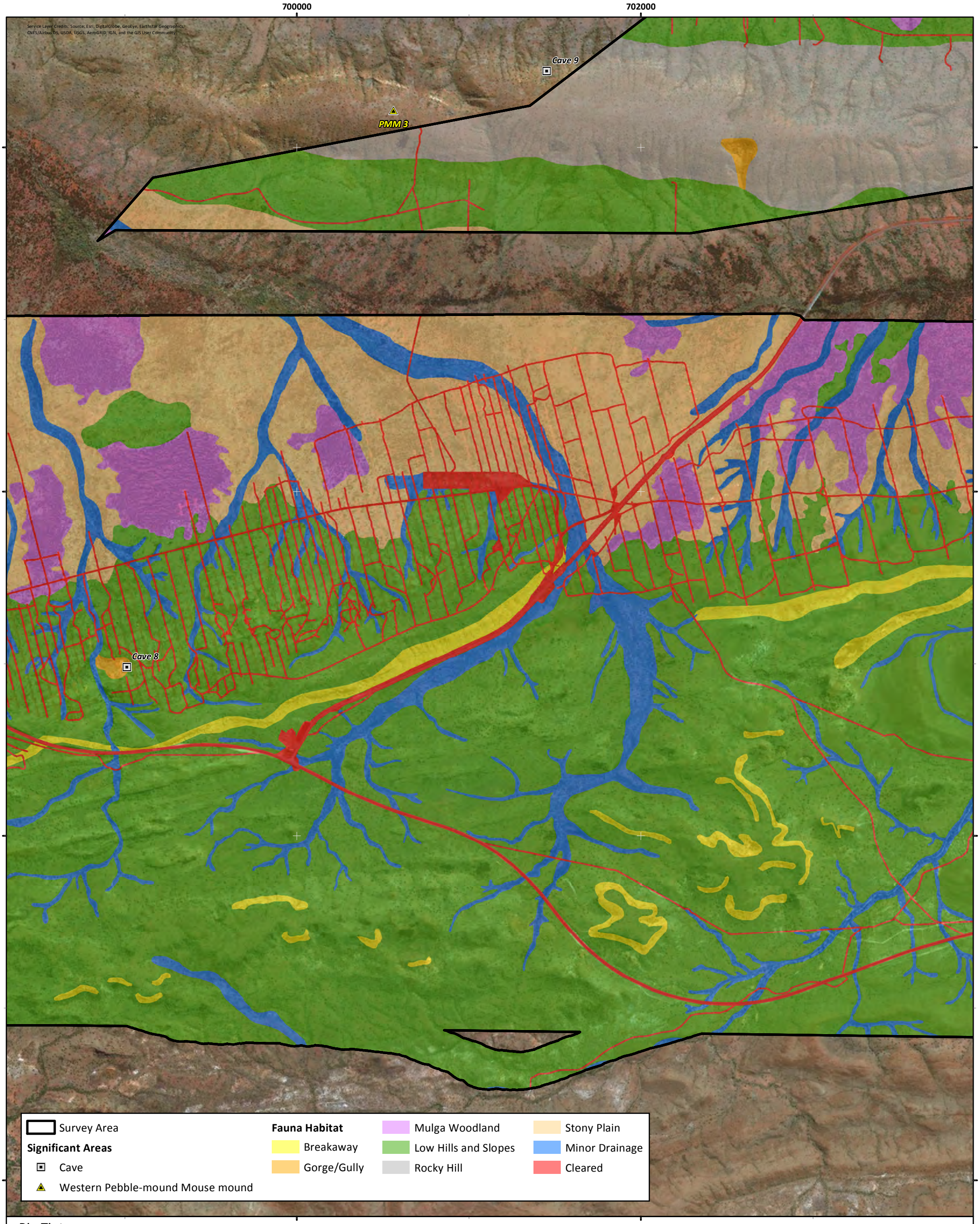

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Figure G.1.2: Vertebrate fauna habitat mapping and significant areas

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Author: J. Johnston	Date: 31-01-2020	Coordinate System: GDA 1994 MGA Zone 50
Drawn: C. Dyde	Figure Ref: 14292B-19-BIDR-3Rev2_200131_P_FigG1	Metres 0 200 400 600 800 1,000 N

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706000
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Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Survey Area

Fauna Habitat

- Breakaway
- Mulga Woodland
- Low Hills and Slopes
- Rocky Hill
- Stony Plain
- Alluvial Plain
- Minor Drainage
- Cleared

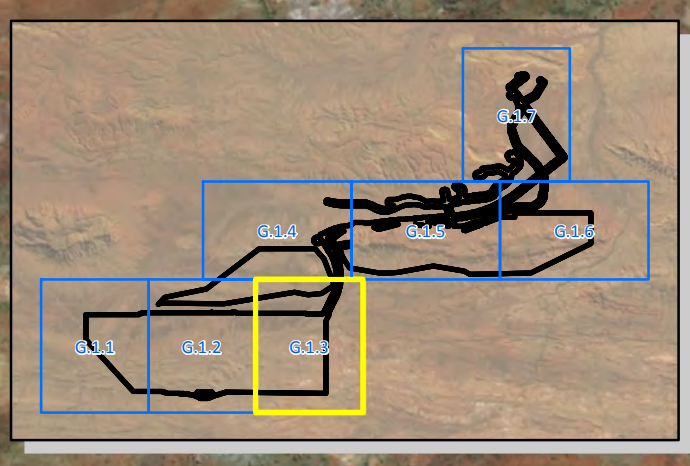

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Figure G.1.3: Vertebrate fauna habitat mapping

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Author: J. Johnston	Date: 31-01-2020	Coordinate System: GDA 1994 MGA Zone 50
Drawn: C. Dyde	Figure Ref: 14292B-19-BIDR-3Rev2_200131_P_FigG1	Metres 0 200 400 600 800 1,000

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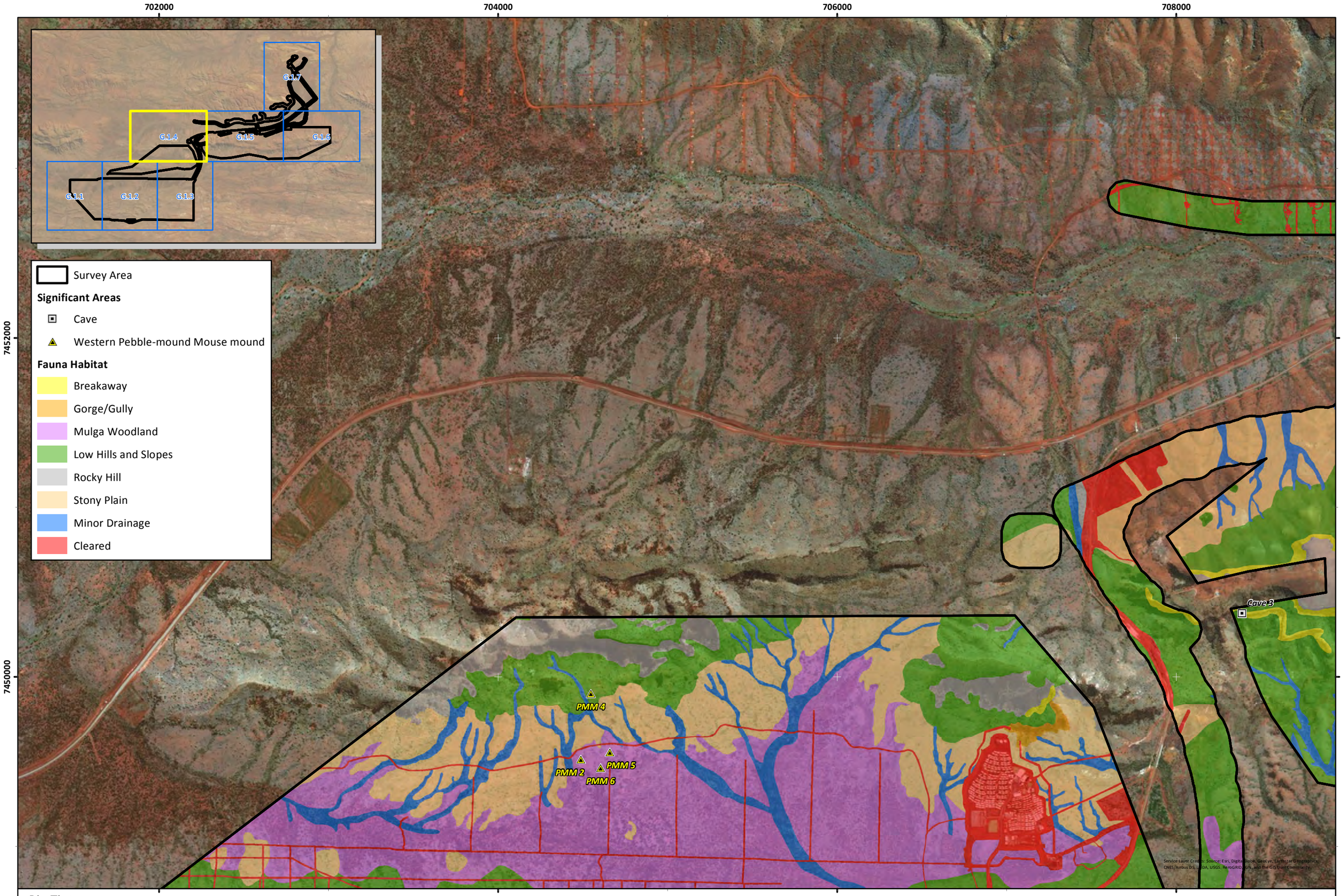

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Figure G.1.4: Vertebrate fauna habitat mapping and significant areas

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

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Author: J. Johnston | Drawn: C. Dyde | Date: 31-01-2020 | Figure Ref: 14292B-19-BIDR-3Rev2_200131_LS_FigG1

710000 712000 714000 716000

7452000

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Survey Area

Significant Areas

Cave

Western Pebble-mound Mouse mound

Fauna Habitat

Breakaway

Gorge/Gully

Mulga Woodland

Low Hills and Slopes

Rocky Hill

Stony Plain

Alluvial Plain

Minor Drainage

Cleared

Cave 4

Cave 6

Cave 5

Cave 1

PMM1

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure G.1.5: Vertebrate fauna habitat mapping and significant areas

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: J. Johnston | Drawn: C. Dyde | Date: 31-01-2020 | Figure Ref: 14292B-19-BIDR-3Rev2_200131_LS_FigG1

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G.1.1
G.1.2
G.1.3
G.1.4
G.1.5
G.1.6
G.1.7

Cave 2

Survey Area

Significant Areas

Cave

Fauna Habitat

Breakaway
Gorge/Gully
Mulga Woodland
Low Hills and Slopes
Rocky Hill
Stony Plain
Alluvial Plain
Minor Drainage
Cleared

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure G.1.6: Vertebrate fauna habitat mapping and significant areas

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

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Author: J. Johnston | Drawn: C. Dyde | Date: 31-01-2020 | Figure Ref: 14292B-19-BIDR-3Rev2_200131_LS_FigG1

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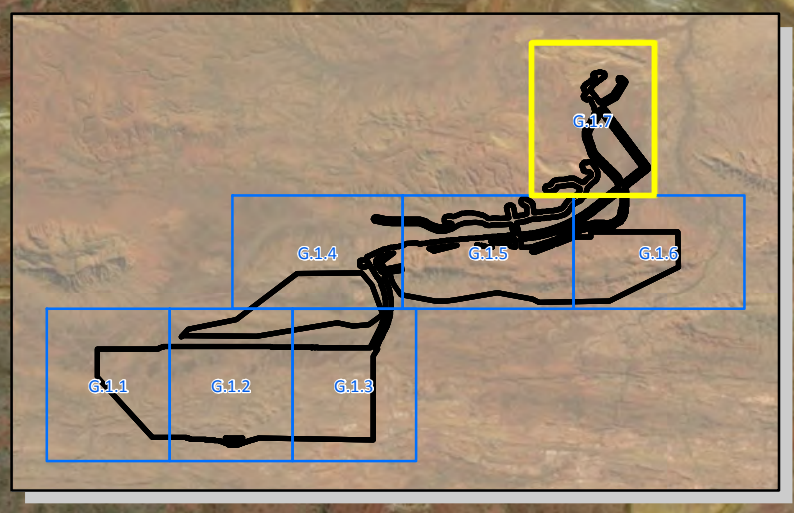

Survey Area

Fauna Habitat

- Mulga Woodland
- Low Hills and Slopes
- Rocky Hill
- Alluvial Plain
- Minor Drainage
- Cleared

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure G.1.7: Vertebrate fauna habitat mapping

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Author: J. Johnston	Date: 31-01-2020	Coordinate System: GDA 1994 MGA Zone 50
Drawn: C. Dyde	Figure Ref: 14292B-19-BIDR-3Rev2_200131_P_FigG1	0 200 400 600 800 1,000 Metres; N

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Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Survey Area

Northern Quoll Habitat Suitability

- Probable shelter and foraging habitat
- Potential shelter and foraging habitat
- Suitable foraging and dispersal habitat
- Limited foraging and dispersal habitat

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Figure G.2: Northern Quoll habitat suitability mapping

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Author: J. Johnston | Drawn: C. Dyde | Date: 31-01-2020 | Figure Ref: 14292B-19-BIDR-3Rev2_200131_FigG2_NQ

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Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Survey Area

Pilbara Leaf-nosed Bat Habitat Suitability

Potential shelter and foraging habitat

Suitable foraging and dispersal habitat

Limited foraging and dispersal habitat

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Figure G.3: Pilbara Leaf-nosed Bat habitat suitability mapping

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Author: J. Johnston | Drawn: C. Dyde | Date: 31-01-2020 | Figure Ref: 14292B-19-BIDR-3Rev2_200131_FigG3_PLNB

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Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Survey Area

Ghost Bat Habitat Suitability

Potential shelter and foraging habitat

Suitable foraging and dispersal habitat

Limited foraging and dispersal habitat

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Figure G.4: Ghost Bat habitat suitability mapping

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Survey Area

Night Parrot Habitat Suitability

Suitable foraging and dispersal habitat

Limited foraging and dispersal habitat

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Figure G.5: Night Parrot habitat suitability mapping

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Author: J. Johnston | Drawn: C. Dyde | Date: 31-01-2020 | Figure Ref: 14292B-19-BIDR-3Rev2_200131_FigG5_NP

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710000

720000

7460000

7450000

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Survey Area

Pilbara Olive Python Habitat Suitability

Potential shelter and foraging habitat

Suitable foraging and dispersal habitat

Limited foraging and dispersal habitat

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Figure G.6: Pilbara Olive Python habitat suitability mapping

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Author: J. Johnston | Drawn: C. Dyde | Date: 31-01-2020 | Figure Ref: 14292B-19-BIDR-3Rev2_200131_FigG6_POP

Table G.1: Location of significant areas recorded during the Astron surveys.

Site ID	MGA Zone 50 K		Reason	Photograph
	Easting (mE)	Northing (mE)		
Cave 1	712281	7450651	Cave that is likely to support Matters of National Environmental Significance (MNES) bat species and other conservation significant fauna species. Confirmed Ghost Bat nocturnal roost (possible diurnal roost).	
Cave 2	716905	7450075	Cave that is likely to support MNES bat species and other conservation significant fauna species.	
Cave 4	712487	7451071	Cave that is likely to support MNES bat species and other conservation significant fauna species. Confirmed Ghost Bat nocturnal roost (feed cave, five scats found).	No photo available

Site ID	MGA Zone 50 K		Reason	Photograph
	Easting (mE)	Northing (mE)		
Cave 5	710766	7450668	Cave that is likely to support MNES bat species and other conservation significant fauna species. Confirmed Ghost Bat nocturnal roost (possible diurnal roost).	
Cave 6	710715	7450850	Cave that is likely to support MNES bat species and other conservation significant fauna species.	No photo available
Cave 7	697235	7444586	Cave that is likely to support MNES bat species and other conservation significant fauna species. Confirmed Ghost Bat nocturnal roost (scats recorded)	

Site ID	MGA Zone 50 K		Reason	Photograph
	Easting (mE)	Northing (mE)		
Cave 8	699012	7444982	Cave that is likely to support MNES bat species and other conservation significant fauna species.	
PMM 1	713863	7450216	Active pebble mound that provides refuge for the Western Pebble-mound Mouse.	
PMM 2	704489	7449512	Inactive pebble mound that may provide refuge for the Western Pebble-mound Mouse.	

Site ID	MGA Zone 50 K		Reason	Photograph
	Easting (mE)	Northing (mE)		
PMM 4	704548	7449901	Active pebble mound that provides refuge for the Western Pebble-mound Mouse.	
PMM 5	704660	7449555	Active pebble mound that provides refuge for the Western Pebble-mound Mouse.	
PMM 6	704605	7449461	Recently inactive pebble mound that provides refuge for the Western Pebble-mound Mouse.	

Site ID	MGA Zone 50 K		Reason	Photograph
	Easting (mE)	Northing (mE)		
Cave 3*	708388	7450375	Cave that is likely to support MNES bat species and other conservation significant fauna species.	
Cave 9*	701453	7448445	Cave that is likely to support MNES bat species and other conservation significant fauna species. Confirmed Ghost feed cave (scats recorded)	
PMM 3*	700562	7448214	Recently inactive/active pebble mound that provides refuge for the Western Pebble-mound Mouse.	

*Recorded just outside the survey area due to post-survey boundary changes.

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Appendix H: Conservation Listed and SRE Fauna Locations

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7445000

Conservation Significant Fauna - DBCA Database

Survey Area

Conservation Significant Fauna

- Ghost Bat *(Macroderma gigas)*
- Pilbara Leaf-nosed Bat *(Rhinonicteris aurantia)*
- *Lerista macropisthopus remota*
- Northern Quoll *(Dasyurus hallucatus)*
- Oriental Plover *(Charadrius veredus)*
- Western Pebble-mound Mouse *(Pseudomys chapmani)*

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 2 Proposal Fauna Survey

Figure H.1: Previous and current conservation significant vertebrate fauna locations

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Author: J. Johnston | Drawn: C. Dyde | Date: 31-01-2020 | Figure Ref: 14292B-19-BIDR-3Rev2_200131_FigH1_CSF

Table H.1 Locations of vertebrate conservation listed species recorded during the Astron surveys.

Species name (common name)	Status	Site ID	MGA Zone 50 K		Date	Observation type (number of records)	Habitat	Photograph
			Easting (mE)	Northing (mN)				
Reptiles								
Lerista macropisthopus remota	P2	TS18	705435	7448646	12/03/19	Individual caught in a pitfall trap	Mulga Woodland	
Birds								
Charadrius veredus (Oriental Plover)	IA/IA	Opp	706994	7449115	11/03/19	Individual sighting	Disturbed (Camp soccer pitch)	No photo available
Elanus scriptus (Letter-winged Kite)	P4	Opp	696225	7445906	20/05/18	Individual sighting	Drainage	No photo available
Mammals								
Dasyurus hallucatus (Northern Quoll)	EN/EN	CAM14	710747	7450853	25/11/17	Camera record	Breakaway	
		Q1	707086	7449680	26/05/18	Individual male caught in cage trap	Gorge/Gully	
		Opp	707084	7449675	23/05/18	Scat	Gorge/Gully	
		Opp	707107	7449900	25/05/18	Scat	Rocky Hill	

Species name (common name)	Status	Site ID	MGA Zone 50 K		Date	Observation type (number of records)	Habitat	Photograph
			Easting (mE)	Northing (mN)				
Dasyurus hallucatus (Northern Quoll)	EN/EN	Opp	710723	7450660	27/05/18	Scat	Breakaway	
		CAM25	710744	7450871	24/05/18	Camera record	Rocky Hill	
		CAM25	710744	7450871	25/05/18	Camera record	Rocky Hill	
		CAM17	716057	7450006	22/05/18	Camera record	Breakaway	
		CAM27	711120	7450982	23/05/18	Camera record	Gorge/Gully	
		CAM27	711120	7450982	24/05/18	Camera record	Gorge/Gully	
		CAM28	712309	7450614	22/05/18	Camera record	Gorge/Gully	
		CAM20	717463	7449927	20/05/18	Camera record	Gorge/Gully	
		CAM23	707082	7449669	23/05/18	Camera record	Gorge/Gully	
		CAM35	716150	7449991	14/03/19	Camera record	Breakaway	
Pseudomys chapmani (Western Pebble-mound Mouse)	P4	PMM 1	713863	7450216	27/11/17	Active pebble mound.	Rocky Hill	
		PMM 2	704489	7449512	18/03/19	Inactive pebble mound.	Stony Plain	

Species name (common name)	Status	Site ID	MGA Zone 50 K		Date	Observation type (number of records)	Habitat	Photograph
			Easting (mE)	Northing (mN)				
Pseudomys chapmani (Western Pebble-mound Mouse)	P4	PMM 4	704548	7449901	13/03/19	Active pebble mound.	Stony Plain	
		PMM 5	704660	7449555	14/03/19	Active pebble mound.	Stony Plain	
		PMM 6	704605	7449461	14/03/19	Recently inactive pebble mound.	Mulga Woodland	

Species name (common name)	Status	Site ID	MGA Zone 50 K		Date	Observation type (number of records)	Habitat	Photograph
			Easting (mE)	Northing (mN)				
Pseudomys chapmani (Western Pebble-mound Mouse)	P4	PMM 3*	700562	7448214	10/03/19	Recently inactive/active pebble mound.	Rocky Hill	
		TS15*	700605	7448201	12/03/19	Individual caught in an Elliot trap	Rocky Hill	
		TS15*	700605	7448201	13/03/19	Individual caught in an Elliot trap	Rocky Hill	No photo available

Species name (common name)	Status	Site ID	MGA Zone 50 K		Date	Observation type (number of records)	Habitat	Photograph
			Easting (mE)	Northing (mN)				
Pseudomys chapmani (Western Pebble-mound Mouse)	P4	TS17*	700743	7447421	16/03/19	Individual caught in a pitfall trap	Stony Plain	No photo available
Rhinonicteris aurantia (Pilbara Leaf-nosed Bat)	VU/VU	BAT13	710050	7450766	22/05/18	10 calls	Breakaway	No photo available
		BAT17	712383	7450606	23/05/18	2 calls	Gorge/Gully	
		BAT21	700067	7444800	21/05/18	1 call	Breakaway	
Macroderma gigas (Ghost Bat)	VU/VU	Opp	695856	7445499	25/11/17	Scats	Drainage	No photo available
		Opp (Cave 4)	712487	7451071	25/11/17	Scats	Breakaway	
		BAT4	712483	7451071	28/11/17	2 calls	Breakaway	
		Opp	700299	7444846	19/05/18	Individual sighting	Breakaway	
		Opp (Cave 5)	710755	7450673	18/05/18	Scats	Breakaway	
		Opp (Cave 1)	712281	7450651	22/05/18	Scats	Rocky Hill	
		Opp (Cave 7)	697235	7444586	26/11/17	Scats	Breakaway	
		BAT21	700067	7444800	21/05/18	1 call	Breakaway	
		BAT25	702192	7448397	15/03/19	1 call	Gorge/Gully	
		Opp (Cave 9)*	701453	7448445	11/03/19	Scats	Gorge/Gully	No photo available

*Recorded outside survey area due to post survey boundary changes.

695000 700000 705000 710000 715000 720000

7460000 7455000 7450000 7445000

Previously Recorded SRE Species - WAM database

Survey Area

SRE Order

- Araneae
- Geophilomorpha
- Isopoda
- Polydesmida
- Pseudoscorpiones
- Scolopendromorpha
- Scorpiones
- Spirobolida

Genus 7/4 PSE118'
Karoops banyjama
Mecistocephalus 'HD1'
Buddelundia '77'
Urodacus 'HD1'
Genus 7/4 PSE118'
Troglarmadillo sp.
Aurecocrypta 'MYG315'
Austrostrophus sp.
Austrostrophus Clade E
Buddelundiinae sp.
Philosciidae sp.
Beierolpium 'sp. indet. (AESHD2)'
Austrostrophus Clade E
Lychas 'bituberculatus complex'
Lychas 'multipunctatus complex'
Yilgarnia 'MYG197'
Lychas 'bituberculatus complex'
Lychas 'multipunctatus complex'
Austrostrophus sp.
Sepedenophilus 'HD1'
Sepedenophilus sp.
Karoops banyjama
Philosciidae sp.
Buddelundia '77'
Nemesiidae sp.
Synothele 'MYG309'
Synothele 'MYG311'
Austrostrophus Clade E
Lychas 'bituberculatus complex'
Lychas 'bituberculatus complex'
Lychas 'hairy tail complex'
Lychas 'multipunctatus complex'
Cryptops 'HD1'
Austrostrophus sp.
Antichiropus sp.
Buddelundia '77'
Mecistocephalus 'HD3'
Austrostrophus Clade E
Buddelundiinae sp.
Orphnaeus 'HD1'
Antichiropus sp.
Mecistocephalus 'HD1'
Mecistocephalus 'HD2'
Antichiropus 'wonmunna'
Buddelundia sp.
Sepedenophilus 'HD2'
Sundochernes sp.
Buddelundia '77'
Synothele sp.
Lychas 'hairy tail complex'
Sepedenophilus 'HD1'
Geophilomorpha sp.
Antichiropus 'wonmunna'
Mecistocephalus 'HD3'
Cryptops 'HD1'
Antichiropus 'wonmunna'
Euryolpium 'sp. indet. (AESHD6)'
PSEAAA sp. indet. (AESHD4)
Nemesiidae sp.
Buddelundia '10ma'
Nemesiidae sp.
Buddelundia '10ma'
Buddelundia '10ma'
Lychas 'bituberculatus complex'
Beierolpium 'sp. indet. (AESHD1)'
Tyrannochthonius 'sp. indet. (AESHD2)'
Anatemnus sp.
Lychas 'multipunctatus complex'
Tyrannochthonius 'sp. indet. (AESHD1)'
Genus 7/4 PSE118'
Austrostrophus sp.
Karoops sp. 'ARA001'
Karoops banyjama
Indolpium sp.
Austrohorus 'sp. indet. (AESHD5)'
Sepedenophilus 'HD1'
Olpiidae sp.
Genus 7/4 PSE118'
Euryolpium 'sp. indet. (AESHD7)'
Austrostrophus Clade A
Sepedenophilus 'HD1'
Aurecocrypta 'sp. indet. AESHD1'
Austrostrophus sp.
Buddelundia '77'
Pseudodiploexochus sp.

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Hope Downs 2 Proposal Fauna Survey

Figure H.2: Previous and current potential Short Range Endemic invertebrate fauna locations

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Author: J. Johnston | Drawn: C. Dyde | Date: 31-01-2020 | Figure Ref: 14292B-19-BIDR-3Rev2_200131_FigH2_SRE

Table H.2: Locations of Potential SRE species recorded during the Astron surveys.

SPECIES	SRE1	SRE2	SRE3	SRE4	SRE5	SRE6	SRE7	SRE8	SRE9	SRE10	SRE11	SRE12	SRE13	SRE14	SRE15	SRE16	SRE17	SRE18	SRE19	SRE20	SRE21	SRE22	SRE23	TS01	TS02	TS03	TS04	TS05	TS06	TS07	TS08	TS09	TS10	TS11	TS12	TS13	TS14	TS15	TS16	TS17	TS18	TS19	Other	Total
Araneae																																											
Aname sp.																1																						1						**2**
Aurecocrypta 'sp. indet. (AESHD1)'																	1																											**1**
Aurecocrypta 'MYG315'																					1																								**1**
Karaops banyjima																		1	1		1																								**3**
Karaops sp. 'ARA001'																		1																												**1**
Yilgarnia 'MYG197'																																					1								**1**
Nemesiidae sp.											1																																		**1**
Synothele sp.												1																																	**1**
Synothele 'MYG309'																																										1			**1**
Synothele 'MYG311'																																										1			**1**
Scorpiones																																												
Lychas 'bituberculatus complex'																											1										1		2	1			1	**6**
Lychas 'hairy tail complex'																																								1				**1**
Lychas 'multipunctatus complex'								1																													4			3			3	**11**
Urodacus 'HD1'													1																															**1**
Pseudoscorpiones																																												
Anatemnus sp.														1																															**1**
Austrohorus 'sp. indet. (AESHD5)'	1																																											**1**
Beierolpium 'sp. indet. (AESHD1)'														1																														**1**
Beierolpium 'sp. indet. (AESHD2)'																																					1							**1**
Euryolpium 'sp. indet. (AESHD6)'											2																																	**2**
Euryolpium 'sp. indet. (AESHD7)'									1																																			**1**
Euryolpium sp.										1											1																								**2**
'Genus 7/4 PSE118'		4		1						2											2																								**9**
'*PSEAAA* sp. indet. (AESHD4)'																1																													**1**
Indolpium sp.	5																																												**5**
Olpiidae sp.	1																																												**1**
Sundochernes sp.																							1																						**1**
Tyrannochthonius 'sp. indet. (AESHD1)'														1																														**1**
Tyrannochthonius 'sp. indet. (AESHD2)'		1																																										**1**
Geophilomorpha																																												
Geophilomorpha sp.																1																													**1**
Mecistocephalus 'HD1'													1								1		2																						**4**
Mecistocephalus 'HD2'																							1																						**1**
Mecistocephalus 'HD3'															2																														**2**
Orphnaeus sp.																							1																						**1**

SPECIES	SRE1	SRE2	SRE3	SRE4	SRE5	SRE6	SRE7	SRE8	SRE9	SRE10	SRE11	SRE12	SRE13	SRE14	SRE15	SRE16	SRE17	SRE18	SRE19	SRE20	SRE21	SRE22	SRE23	TS01	TS02	TS03	TS04	TS05	TS06	TS07	TS08	TS09	TS10	TS11	TS12	TS13	TS14	TS15	TS16	TS17	TS18	TS19	Other	Total
Sepedonophilus 'HD1'	1																2		3																								1	**7**
Sepedonophilus 'HD2'																							1																						**1**
Sepedonophilus sp.																			1																										**1**
Scolopendromorpha																																												
Cryptops 'HD1'															3																														**3**
Polydesmida																																												
Antichiropus sp.															1								2																						**3**
Antichiropus 'wonmunna'															2								12																						**14**
Spirobolida																																												
Austrostrophus 'Clade A'																				2																									**2**
Austrostrophus 'Clade E'															1							1																4				1			**7**
Austrostrophus sp.													1		5	1	1	1	1																									**10**
Isopoda																																												
Buddelundia '10ma'											1																2	6																	**9**
Buddelundia '77'															2		1		4			1	2																					**10**
Buddelundia sp.																							1																					**1**
Buddelundiinae sp.																							1															2						**3**
Pseudodiploexochus sp.																	1																											**1**
Troglarmadillo sp.													1																															**1**
Philosciidae sp.																			5																			1							**6**
Total	**8**	**5**	**0**	**1**	**0**	**0**	**0**	**1**	**1**	**3**	**4**	**1**	**4**	**3**	**16**	**4**	**6**	**3**	**15**	**3**	**4**	**3**	**24**	**0**	**0**	**0**	**3**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**14**	**1**	**2**	**5**	**3**	**0**	**5**	**148**

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Appendix I: Bat Call WA Pty Ltd Report

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Rio Tinto,
Hope Downs 2 and Bedded Hilltop,
Pilbara WA,

Acoustic Survey of Bat and Night Parrot Activity, phases 1 (November 2017), 2 (May 2018) and 3 (March 2019).

Prepared for Astron Environmental Services

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Document Revision History

Issue	Date	Revision History
A	8 June 2018	Initial draft of Phase 1 and 2 prepared for Astron review
1	14 June 2018	First formal issue incorporating clients comments
2	15 June 2018	Second issue incorporating clients comments
3	27 March 2019	Third issue incorporating Phase 3 data

Summary
Bat and Night Parrot (*Pezoporus occidentalis*) presence is reported for 28 sites in the Hope Down 2 and Bedded Hilltop areas, in the Pilbara, WA. Astron Environmental Services (Astron) carried out an echolocation based survey in three phases in November 2017, May 2018 and March 2019. 24 sites were surveyed for all bats present including Ghost bat social and ultrasonic calls. Four were surveyed using acoustic detectors set to record Night Parrot and Ghost bat social calls. Bat Call WA has reviewed the recordings made and provided species lists and activity levels for the bats present.

Twelve species of echolocating bats were confirmed present including both EPBC Act listed species in the Pilbara, the Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) (PLNb) and the Ghost bat (*Macroderma gigas*) (PGb). PLNb calls were detected in low numbers at three sites in May 2018. PGb were detected ultrasonically at three sites and their presence was confirmed by observation by Astron ecologists of either bats or middens in caves at a further seven.

PLNb calls were detected at three sites during May 2018 but were not detected in November 2017 or March 2019. The calls at all three sites were at least three hours after dusk and are not consistent with the presence of a permanent roost cave nearby.

PGb presence during all three phases is consistent with the known population and dispersal of PGb in the district. The number of observations recorded indicates that additional targeted survey work is required to fully define the usage and categorisation of caves in the area by this species.

No Night Parrot calls were detected.

Habitats
The sites for the survey were chosen by Astron. Details of the sites are presented in table 1. The bat sites included each type of habitat present in the study area including gorges, breakaways. drainage lines and stony plains. All the Night Parrot sites are on stony plains. The locations are shown in relation to local features in figures 1 and 2.

Timing, Moon Phase and Weather
The echolocation survey was conducted between 24th to 30th November 2017, 18th to 26th May 2018 and 11th to 17th March 2019.

The November sampling evenings were hot with minimum overnight temperatures between 20 and 25°C. The moon in this period was first quarter to full. The May sampling evenings were cool to cold with minimum overnight temperatures between 5 and 15°C. The moon in this period was first quarter. No rain fell during these survey periods. The March sampling evenings were hot and humid with minimum overnight temperatures between 25 and 30°C typical of northern wet season. Some seasonal rain fell during this period. The moon was at first quarter.

Survey Team
Sites were chosen and detectors placed by Astron ecologists. Bob Bullen of Bat Call WA completed analysis of audio and echolocation recordings.

Sampling
The survey consisted of completing a total of forty overnight ultrasonic bat sound recordings in November, thirty seven in May and twenty four in March, beginning at twilight, at twenty four locations within the survey area. A total of eleven acoustic survey nights were completed at two sites for Night Parrot in May and a further twelve in March. The recordings were "continuous"

(Hyder *et al.* 2010) made using ultrasonic SM2BAT+ SongMeter and acoustic SM4A SongMeter (both by Wildlife Acoustics Inc., USA) detectors. The audio settings used followed the manufacturer's recommendations contained in the user manuals.

For the ultrasonic recordings, once reformatted as .wav files, COOL EDIT 2000 (now available as AUDITION from Adobe Systems Inc.) was used to display each sequence for identification. Calls were identified manually. Only good quality call sequences were used. Details of calls analysed are provided in Table 2 as recommended by Australasian Bat Society (ABS 2006). Reference data for the species identified are available in Bullen and McKenzie 2002, McKenzie and Bullen 2003 and McKenzie and Bullen 2009.

For the acoustic recordings, each was reviewed both manually and using an automatic scan technique for Night Parrot calls. Candidate calls were compared with the author's confirmed reference calls from two Western Australian arid zone locations.

Survey Limitations

The sites surveyed were accessible on foot and the detectors, using omnidirectional microphones, were set on the ground with the microphone horizontal. Species are unlikely to be under-represented as a result.

Bat species density away from cave or adit entrances is impossible to estimate from echolocation records. Bat activity is therefore substituted as an approximate guide to the relative numbers of each species using the study area.

Results of bat fauna survey

An assemblage of twelve echolocating bat species was confirmed as present at the study sites including both the PLNb and PGb, table 4. Species activity levels were low to very high, which is expected for the study area habitat and the times of year.

PLNb detections

PLNb were detected at three widespread locations, two breakaway sites and a gorges site, table 4 and figure 3. Call numbers at all three were low with the maximum number of calls being eight at BAT 13 on the 22nd May, figure 4. The temporal pattern of calls at all three sites, figure 4, is consistent with PLNb foraging away from their roost with timing gaps from civil twilight of approximately three hours and being wide spread. This result is consistent with author's unpublished data that indicates that PLNb are only active across the study area in autumn. The closest confirmed permanent diurnal roosts are over 55 km to the north, west and south and over 80 km to the east (author's unpublished data). These distances suggest that the PLNb are possibly using temporary or satellite roosts in the district, as their usual foraging range is under 30 km (Bullen 2013). However the pattern of the data, the three hour time gap together with the low number of calls, is inadequate to indicate whether any potential satellite is within or outside the study area boundary. A more probable suggestion is that bats from existing permanent colonies take advantage of the benign conditions in autumn and spread across the country temporarily in search of additional foraging and roosting opportunities.

PGb detections

Ghost bats were detected ultrasonically at three sites, Bat 4 in November, BAT 21 in May and BAT 25 in March, table 4, figure 5. Additional observations were made by the field survey team, Table 5. Five caves containing PGb middens were located and a foraging PGb was seen at an opportunistic site, Table 5. Also a scat pile was observed under a highway bridge at site BAT 9. Two caves were assessed by the team as potential diurnal roosts and the other three caves and the

bridge as nocturnal feeding sites. These records are consistent with the PGB being present on both the Hope Down 2 and Bedded Hilltops study area ridges year round. This result is consistent with the known presence of the PGb across the central Pilbara in general and on the major ridges immediately to the north of the study area and west of the Hope Downs 1 mining area.

Common bat species detections
Four common species, *Austronomus australis*, *Chaerephon jobensis*, *Chalinolobus gouldii*, *Taphozous georgianus* and *Vespadelus finlaysoni* dominated bat presence in the area. Both Taphozous species were detected

Taxonomy presented herein is after Reardon *et al.* (2014) and Jackson and Groves (2015).

Results of Night Parrot survey.

No Night Parrot calls were detected.

Recommendations.

PLNb
The results of the survey are consistent with the author's existing data on the autumn dispersal of this species from its permanent roosts. No further specific targeted survey effort is indicated by these results.

PGb
The results of the survey are consistent with the use of the ridge lines within the study areas by PGb on a year round basis. Additional targeted survey effort is recommended to confirm potential maternity roost caves, groupings of caves that are important for the persistence of PGb, and other important diurnal roosting sites.

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Table 1 Microbat site specific details. Coordinates are Zone 50K

	Date	Recording Time & SM2 unit	Habitat	Easting	Northing
Phase 1 Nov 2017					
BAT 1	24-27 Nov	Four overnight recordings using SM2 SN 4684 recording at 44.1 kbps	Gorge	718218	7450208
BAT 2	28-30 Nov	Three overnight recordings using SM2 SN 4684 recording at 44.1 kbps	Gorge	716514	7450015
BAT 3	24-27 Nov	Four overnight recordings using SM2 SN 4685 recording at 384 kbps	Gorge	713964	7450155
BAT 4	28-30 Nov	Three overnight recordings using SM2 SN 4685 recording at 384 kbps	Breakaway	712483	7451071
BAT 5	24-27 Nov	Four overnight recordings using SM2 SN 4698 recording at 44.1 kbps	Foot of slope	715766	7450509
BAT 6	28-30 Nov	Three overnight recordings using SM2 SN 4698 recording at 44.1 kbps	Gorge	719087	7450901
BAT 7	24-27 Nov	Four overnight recordings using SM2 SN 7982 recording at 44.1 kbps	Cave entrance	712290	7450636
BAT 8	28-30 Nov	Three overnight recordings using SM2 SN 7982 recording at 44.1 kbps	Gorge	710766	7450668
BAT 9	25-28 Nov	Four overnight recordings using SM2 SN 4685 recording at 384 kbps	Highway culvert	695851	74455001
BAT 10	29-30 Nov	Two overnight recordings using SM2 SN 4685 recording at 384 kbps	Cave entrance	599015	7444976
BAT 11	24-27 Nov	Four overnight recordings using SM2 SN 7634 recording at 384 kbps	Breakaway	708261	7446389
BAT 12	29-30 Nov	Two overnight recordings using SM2 SN 7634 recording at 384 kbps	Mulga woodland	699301	7446157
Phase 2 May 2018					
BAT 13	18-22 May	Five overnight recordings using SM2 SN 7634 recording at 384 kbps	Breakaway	710050	7450766
BAT 14	21-25 May	Five overnight recordings using SM2 SN 8027 recording at 384 kbps	Major drainage line	707275	7445721
BAT 15	21-24 May	Four overnight recordings using SM2 SN 11040 recording at 384 kbps	Breakaway	707097	7449888
BAT 16	18-26 May	Nine overnight recordings using SM4U04031 recording at 384 kbps	Gorge with caves present	710759	7450661
BAT 17	23-26 May	Four overnight recordings using SM2 SN 7634 recording at 384 kbps	Gorge	712383	7450606
BAT 19	20-24 May	Five overnight recordings using SM2 SN 11793 recording at 384 kbps	Gorge	711117	7450976
BAT 21	21-25 May	Five overnight recordings using SM2 SN 7768 recording at 384 kbps	Breakaway	700067	7444800

	Date	Recording Time & SM2 unit	Habitat	Easting	Northing
Phase 3 March 2019					
BAT 22	11-17 Mar	SM2 SN 7634 failed to operate	Gorge/gully	700620	7448043
BAT 23	13-17 Mar	Five overnight recordings using SM4U05349 recording at 384 kbps	Breakaway with overhangs	716260	7449988
BAT 24	11-17 Mar	Seven overnight recordings using SM4U05956 recording at 384 kbps	Gorge/gully	700803	7448400
BAT 25	11-17 Mar	Seven overnight recordings using SM4U05978 recording at 384 kbps	Gorge with caves present	702192	7448397
BAT 26	13-17 Mar	Five overnight recordings using SM4U04031 recording at 384 kbps	Breakaway with overhangs	704510	7450188

Table 2 Night Parrot site specific details.

	Date	Recording Time & SM2 unit	Habitat	Easting	Northing
Phase 2 May 2018					
AU 1	21-24 May	Four overnight recordings using SM4A04717	Stony plain	706071	7449544
AU 2	20-26 May	Seven overnight recordings using SM4A05295	Stony plain	717660	7449529
Phase 3 March 2019					
AU 3	11-17 Mar	Seven overnight recordings using SM4A08538	Stony plain	701069	7447576
AU 4	13-17 Mar	Five overnight recordings using SM4A08576	Stony plain	704512	7449271

Note 1: Coordinates are Zone 50K

Table 3: Summary of Echolocation call characteristics for microbat species present.

Genus species Authority	Common name	Typical F_{peak} kHz Note 1	Ave. Q Note 1	Typical Duration msec	Typical Call Shape
Austronomus australis (Gray 1838) Note 2	White-striped free-tailed bat	12	7	12 - 23	CF– shallow FM
Chaerephon jobensis (Miller 1902)	Northern free-tailed bat	22	5	8 - 15	Shallow FM
Chalinolobus gouldii (Grey 1841)	Gould's wattled bat	32	10	7 - 11	FM
Macroderma gigas (Dobson 1880)	Ghost bat	20 – 52 variable	2 – 20 variable	variable	Complex FM
Nyctophilus geoffroyi Leach 1821	Lesser long-eared bat	48	3	5	Steep FM
Ozimops lumsdenae Reardon *et al*.2014	Northern free-tailed bat	26	10	8 - 13	Shallow FM
Rhinonicteris aurantia (Gray 1845)	Pilbara leaf-nosed bat	120	30	5 - 8	CF
Saccolaimus flaviventris (Peters 1867)	Yellow-bellied sheath-tailed bat	18	9	12 - 21	CF - FM
Scotorepens greyii (Gray 1843)	Little broad-nosed bat	38	10	7 - 13	FM
Taphozous georgianus Thomas 1915	Common sheath-tailed bat	24.5	14	9 - 18	CF– shallow FM
Taphozous hilli Thomas 1915	Hills sheath-tailed bat	26	14	9 - 18	CF– shallow FM
Vespadelus finlaysoni (Kitchener, Jones and Caputi 1987)	Inland cave bat	55	14	4 - 8	FM

Note 1: Fpeak and Q are defined in McKenzie and Bullen 2003, 2009.
Note 2: Taxonomy follows Jackson and Groves (2015). *A. australis* was recently *Tadarida australis*. *O. lumsdenae* was recently *Mormopterus beccarii*.

Table 4. Survey microbat lists presented by site.

Site	*Austronomus australis*	*Chaerephon jobensis*	*Chalinolobus gouldii*	*Macroderma gigas*	*Nyctophilus geoffroyi*	*Ozimops lumsdenae*	*Rhinonicteris aurantia*	*Saccolaimus flaviventris*	*Scotorepens greyii*	*Taphozous spp.*	*Taphozous hilli*	*Vespadelus finlaysoni*
Phase 1 Nov 17												
BAT 1		Yes										
BAT 2		Yes								Yes		
BAT 3		Yes	Yes			Yes			Yes	Yes		Yes
BAT 4		Yes	Yes	Low (2 calls)		Yes			Yes	Yes		Yes
BAT 5		Yes										
BAT 6		Yes										
BAT 7		Yes								Yes		
BAT 8		Yes								Yes		
BAT 9			Yes			Yes			Yes	Yes		Yes
BAT 10										Yes		Yes
BAT 11		Yes	Yes					Yes	Yes	Yes	Yes	Yes
BAT 12		Yes	Yes		Yes	Yes		Yes	Yes	Yes		Yes
Phase 2 May 18												
BAT 13	Yes	Yes	Yes				Low (10 calls)		Yes	Yes	Yes	Yes
BAT 14	Yes	Yes	Yes		Yes			Yes	Yes	Yes		Yes
BAT 15	Yes	Yes	Yes					Yes	Yes	Yes		Yes
BAT 16	Yes	Yes	Yes			Yes				Yes		Yes
BAT 17	Yes	Yes	Yes			Yes	Low (2 calls)			Yes		Yes
BAT 19	Yes	Yes								Yes		Yes
BAT 21	Yes	Yes	Yes	Low (1 call)			Low (1 call)		Yes	Yes		Yes

Site	*Austronomus australis*	*Chaerephon jobensis*	*Chalinolobus gouldii*	*Macroderma gigas*	*Nyctophilus geoffroyi*	*Ozimops lumsdenae*	*Rhinonicteris aurantia*	*Saccolaimus flaviventris*	*Scotorepens greyii*	*Taphozous spp.*	*Taphozous hilli*	*Vespadelus finlaysoni*
Phase 3 March 19												
BAT 23		Yes	Yes			Yes		Yes	Yes	Yes		Yes
BAT 24		Yes	Yes			Yes		Yes	Yes	Yes		Yes
BAT 25		Yes	Yes	Low (1 call)					Yes	Yes		Yes
BAT 26		Yes	Yes			Yes			Yes	Yes		Yes

Note: Both *Taphozous* species were detected. The majority of calls were *T. georgianus. T hilli* calls were identified at sites BAT 11 and ‘13

Table 5 Ghost bat opportunistic observations.

	Observation	Easting	Northing
Cave 1	Cave assessed as a potential PGb diurnal roost	712281	7450651
Cave 4	Cave assessed as a nocturnal roost containing PGb scats	742487	7451071
Cave 5	Cave assessed as a potential PGb diurnal roost	710766	7450668
Cave 7	Cave assessed as a nocturnal roost containing PGb scats	697235	7444586
Cave 9	Cave assessed as a nocturnal roost containing PGb scats	701453	7448445
Opp1	PGb sighted foraging	700299	7444845

Note 1: Coordinates are Zone 50K

Figure 1. Western survey sites in relation to features in the study area. The orange pins denote sites where PLNb were detected. PLNb call numbers and timing of the closest calls to civil twilight are also noted. Pink pins denote sites where PGb ultrasonic calls and opportunistic observations were recorded. Yellow pins denote sites where microbat calls were recorded but no PLNb or PGb were detected. Green pins denote sites where acoustic detectors were placed to record Night Parrot and Ghost bat social calls.

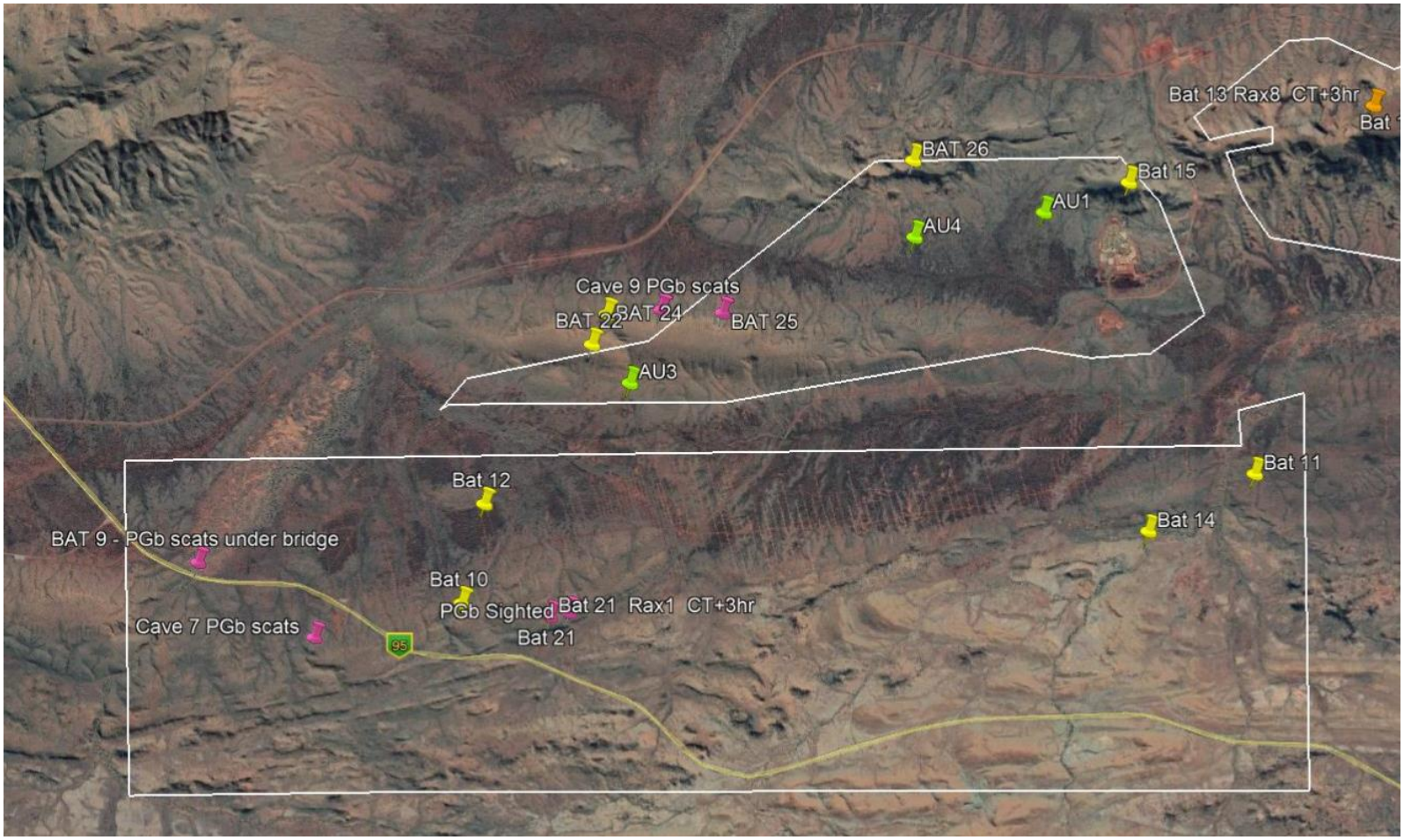


Figure 2. Eastern survey sites in relation to features in the study area. Pin colours are from figure 1.

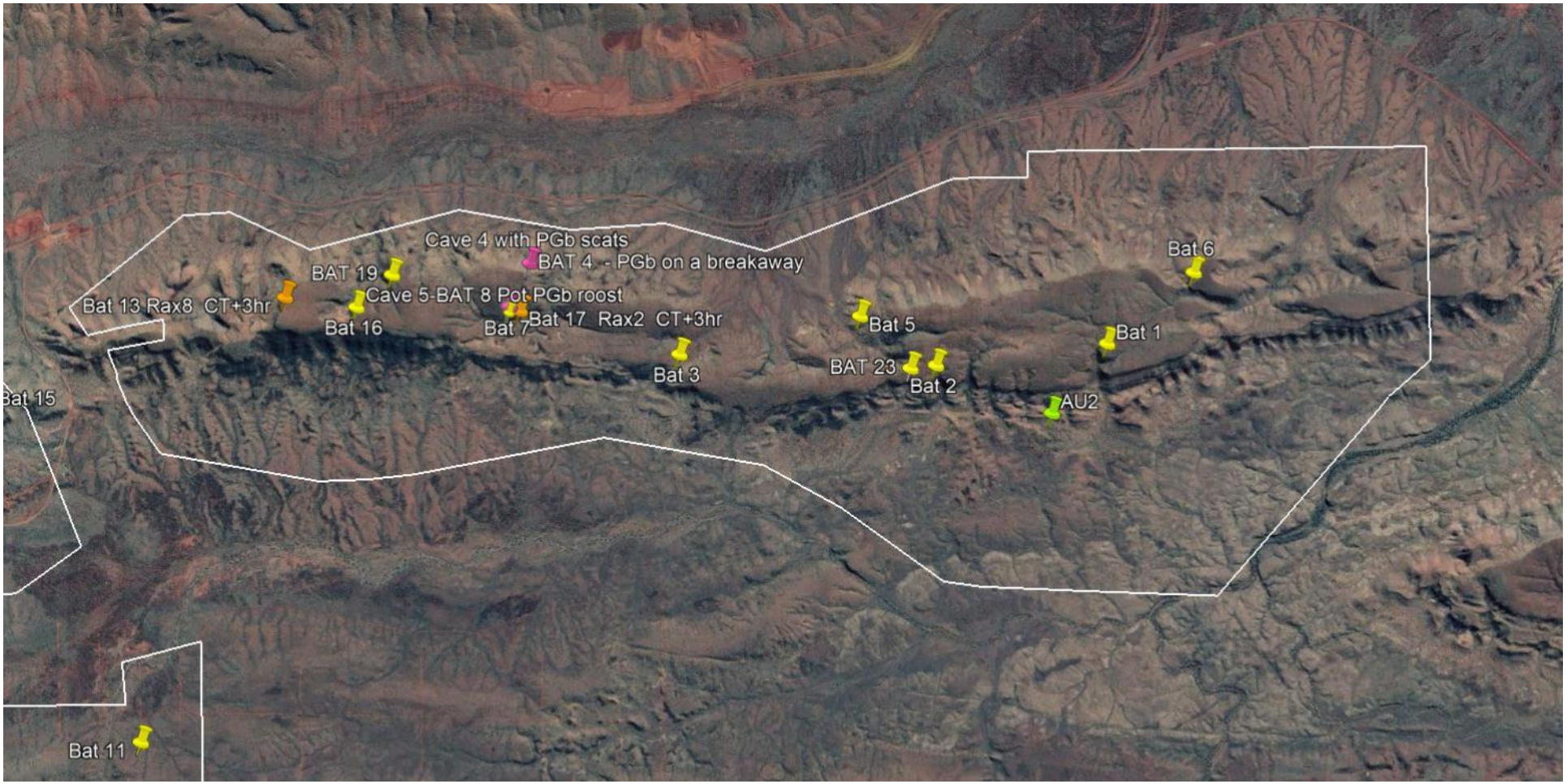


Figure 3. Survey sites where PLNb were detected in May 2018.



Figure 4. Temporal patterns of PLNb calls detected

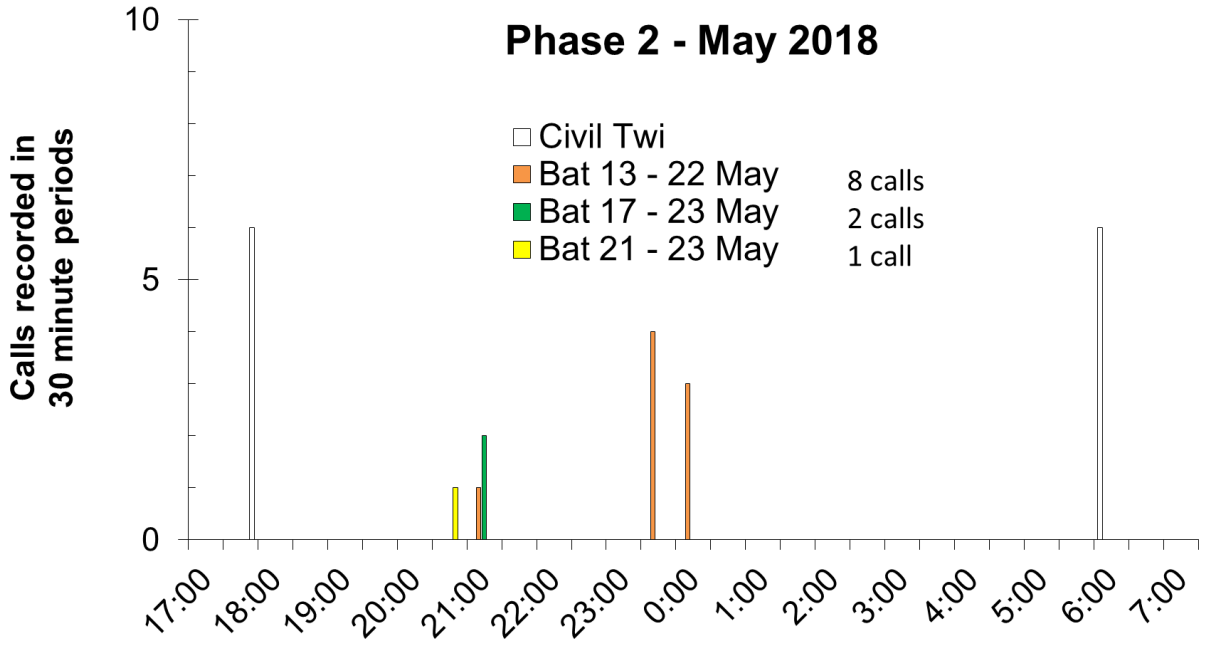
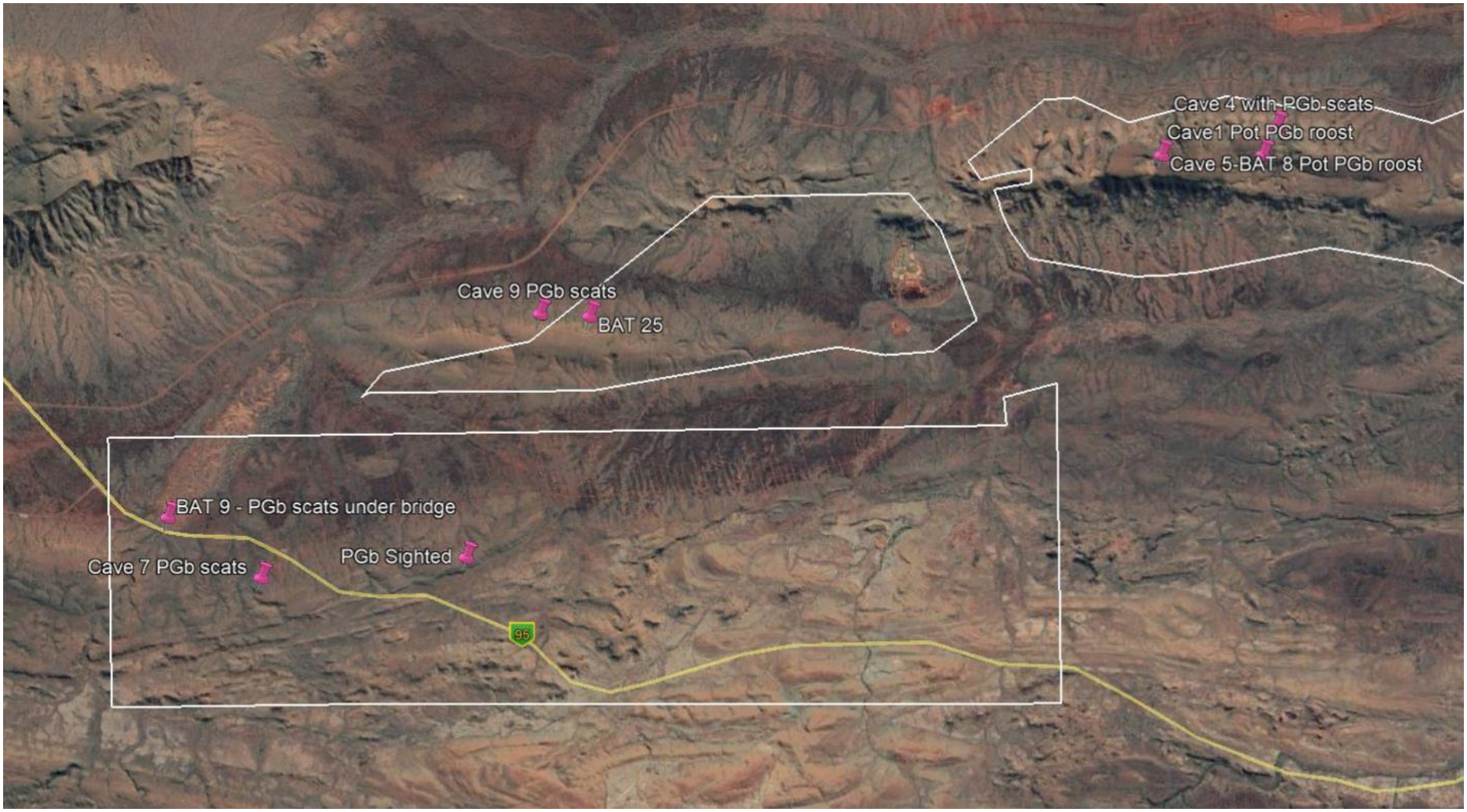


Figure 5. Survey sites where PGb were detected



Appendix J: List of Specimens Lodged with the Western Australian Museum

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Table J.1: List of specimens submitted to the Western Australian Museum.

Species	Site	Coordinates (Zone 50K)		Number of specimens	Collecting date	WAM registration number
		Easting (mE)	Northing (mN)			
Lerista macropisthopus remota	TS18	705435	7448646	1	12/03/2019	R179612
Synothele 'xkarara'	TS07	696251	7445929	1	19/05/2018	T146551
Gaius tealei	SRE03	704413	7446421	1	25/05/2018	T146552
Nemesiidae sp.	SRE11	704970	7446447	1	25/05/2018	T146553
Oratemnus sp.	SRE03	704413	7446421	1	25/05/2018	T146554
Tyrannochthonius 'HD2'	SRE02	712291	7450649	1	22/05/2018	T146555
Austrohorus 'HD5'	SRE01	716881	7450100	1	22/05/2018	T146556
Euryolpium 'HD6'	SRE11	704970	7446447	2	25/05/2018	T146557
Euryolpium 'HD7'	SRE09	719353	7450631	1	24/05/2018	T146564
Euryolpium sp.	SRE10	718923	7450760	1	24/05/2018	T146558
Indolpium sp.	SRE01	716881	7450100	2	22/05/2018	T146560
Indolpium sp.	SRE01	716881	7450100	3	22/05/2018	T146563
Olpiidae 'PSE118'	SRE02	712291	7450649	4	22/05/2018	T146559
Olpiidae 'PSE118'	SRE04	707098	7449693	1	25/05/2018	T146561
Olpiidae 'PSE118'	SRE10	718923	7450760	2	24/05/2018	T146562
Olpiidae sp.	SRE01	716881	7450100	1	22/05/2018	T146565
Lychas 'bituberculatus complex'	TS04	706249	7445883	1	19/05/2018	T146566
Lychas 'harveyi complex'	TS07	696251	7445929	1	19/05/2018	T146567
Lychas 'multipunctatus complex'	SRE08	706977	7445419	1	23/05/2018	T146568
Lychas 'pilbara 1'	TS04	706249	7445883	1	19/05/2018	T146569
Sepedonophilus 'HD1'	SRE01	716881	7450100	1	22/05/2018	T146570
Gastrocopta sp.	SRE01	716881	7450100	7	22/05/2018	S111506
Gastrocopta sp.	SRE03	704413	7446421	1	25/05/2018	S111511

Species	Site	Coordinates (Zone 50K)		Number of specimens	Collecting date	WAM registration number
		Easting (mE)	Northing (mN)			
Gastrocopta sp.	SRE04	707098	7449693	1	25/05/2018	S111507
Gastrocopta sp.	SRE07	699385	7445954	2	23/05/2018	S111510
Gastrocopta sp.	SRE09	719353	7450631	2	24/05/2018	S111512
Gastrocopta sp.	SRE11	704970	7446447	3	25/05/2018	S111509
Pupoides sp.	SRE01	716881	7450100	3	22/05/2018	S111515
Pupoides sp.	SRE04	707098	7449693	1	25/05/2018	S111513
Pupoides sp.	SRE07	699385	7445954	1	23/05/2018	S111514
Pupoides sp.	SRE11	704970	7446447	1	25/05/2018	S111516
Subulinidae sp.	SRE01	716881	7450100	15	22/05/2018	S111520
Subulinidae sp.	SRE01	716881	7450100	5	22/05/2018	S111518
Subulinidae sp.	SRE02	712291	7450649	1	22/05/2018	S111522
Subulinidae sp.	SRE03	704413	7446421	1	25/05/2018	S111519
Subulinidae sp.	SRE04	707098	7449693	1	25/05/2018	S111517
Subulinidae sp.	SRE10	718923	7450760	1	24/05/2018	S111521
Buddelundia '10ma'	SRE11	704970	7446447	1	25/05/2018	C73873
Buddelundia '10ma'	TS04	706249	7445883	1	19/05/2018	C73876
Buddelundia '10ma'	TS04	706249	7445883	1	19/05/2018	C73872
Buddelundia '10ma'	TS05	705107	7445902	1	19/05/2018	C73871
Buddelundia '10ma'	TS05	705107	7445902	4	19/05/2018	C73874
Buddelundia '10ma'	TS05	705107	7445902	1	19/05/2018	C73875
Karaops banyjima	SRE19	702270	7448404	1	12/03/2019	T149457
Karaops banyjima	SRE21	704827	7450096	1	14/03/2019	T149408
Karaops banyjima	SRE18	716912	7450177	1	11/03/2019	T149484
Karaops 'ARA001'	SRE18	716912	7450177	1	11/03/2019	T149465

Species	Site	Coordinates (Zone 50K)		Number of specimens	Collecting date	WAM registration number
		Easting (mE)	Northing (mN)			
Missulena rutraspina	TS18	705437	7448645	1	10/03/2019	T149449
Missulena rutraspina	TS18	705437	7448645	1	10/03/2019	T149409
Aurecocrypta 'HD1'	SRE17	718175	7450279	1	11/03/2019	T149411
Aurecocrypta 'MYG315'	SRE22	704697	7449733	1	14/03/2019	T149466
Synothele 'MYG309'	TS18	705437	7448645	1	10/03/2019	T149467
Synothele 'MYG311'	TS18	705437	7448645	1	10/03/2019	T149425
Synothele sp.	SRE12	701579	7446476	1	14/03/2019	T149438
Synothele 'xkarara'	TS18	705437	7448645	1	10/03/2019	T149414
Synothele 'xkarara'	TS18	705437	7448645	1	10/03/2019	T149415
Synothele 'xkarara'	TS18	705437	7448645	1	10/03/2019	T149413
Gaius tealei	TS18	705437	7448645	1	10/03/2019	T149486
Gaius tealei	TS18	705437	7448645	1	10/03/2019	T149470
Gaius tealei	TS18	705437	7448645	1	10/03/2019	T149469
Gaius tealei	TS14	697889	7448523	1	9/03/2019	T149417
Gaius tealei	SRE16	702263	7445976	1	10/03/2019	T149418
Gaius tealei	SRE23	706043	7446455	1	16/03/2019	T149416
Aname mellosa	TS16	706428	7448136	1	10/03/2019	T149423
Aname mellosa	Bl01	697807	7448393	1	3/09/2019	T149437
Aname mellosa	TS17	700725	7447419	1	11/03/2019	T149424
Aname mellosa	TS14	697889	7448523	1	9/03/2019	T149464
Aname mellosa	TS17	700725	7447419	1	11/03/2019	T149429
Aname mellosa	TS14	697889	7448523	1	9/03/2019	T149488
Aname mellosa	TS17	700725	7447419	1	11/03/2019	T149443
Aname mellosa	SRE18	716912	7450177	1	11/03/2019	T149420

Species	Site	Coordinates (Zone 50K)		Number of specimens	Collecting date	WAM registration number
		Easting (mE)	Northing (mN)			
Aname mellosa	TS17	700725	7447419	2	11/03/2019	T149421
Aname mellosa	TS16	706428	7448136	1	10/03/2019	T149446
Aname mellosa	TS17	700725	7447419	1	11/03/2019	T149444
Aname mellosa	TS18	705437	7448645	1	10/03/2019	T149435
Aname mellosa	TS17	700725	7447419	1	11/03/2019	T149471
Aname mellosa	TS16	706428	7448136	5	10/03/2019	T149463
Aname mellosa	TS18	705437	7448645	1	10/03/2019	T149494
Aname mellosa	SRE18	716912	7450177	1	11/03/2019	T149432
Aname 'MYG004'	TS17	700725	7447419	1	11/03/2019	T149419
Aname sp.	SRE16	702263	7445976	1	10/03/2019	T149448
Aname sp.	TS15	700594	7448201	1	17/03/2019	T149459
Yilgarnia 'MYG197'	TS14	697889	7448523	1	9/03/2019	T149527
Anatemnus sp.	SRE14	707274	7445766	1	17/03/2019	T149450
Oratemnus sp.	SRE13	707086	7449689	2	9/03/2019	T149472
Oratemnus sp.	SRE15	704230	7446563	8	17/03/2019	T149473
Oratemnus sp.	SRE23	706043	7446455	1	16/03/2019	T149474
Oratemnus sp.	SRE23	706043	7446455	3	16/03/2019	T149475
Sundochernes sp.	SRE23	706043	7446455	1	16/03/2019	T149476
Tyrannochthonius 'HD1'	SRE14	707274	7445766	1	17/03/2019	T149477
Beierolpium '8/4 small'	SRE19	702270	7448404	2	12/03/2019	T149481
Beierolpium 'HD1'	SRE14	707274	7445766	1	17/03/2019	T149478
Beierolpium 'HD2'	TS14	697889	7448523	1	9/03/2019	T149479
Beierolpium '8/4'	SRE13	707086	7449689	1	9/03/2019	T149410
Euryolpium sp.	SRE20	719431	7450376	1	13/03/2019	T149482

Species	Site	Coordinates (Zone 50K)		Number of specimens	Collecting date	WAM registration number
		Easting (mE)	Northing (mN)			
'PSEAAA HD4'	SRE16	702263	7445976	1	10/03/2019	T149480
Olpiidae 'PSE118'	SRE21	704827	7450096	2	14/03/2019	T149483
Isometroides 'pilbara 1'	TS14	697889	7448523	1	9/03/2019	T149406
Isometroides 'pilbara 1'	TS18	705437	7448645	1	10/03/2019	T149487
Isometroides 'pilbara 1'	TS16	706428	7448136	1	10/03/2019	T149468
Isometroides 'pilbara 1'	TS17	700725	7447419	2	11/03/2019	T149453
Isometroides 'pilbara 1'	TS18	705437	7448645	1	10/03/2019	T149485
Isometroides 'pilbara 1'	TS14	697889	7448523	1	9/03/2019	T149452
Isometroides 'pilbara 1'	TS18	705437	7448645	1	10/03/2019	T149441
Lychas 'bituberculatus complex'	Bl01	697807	7448393	1	3/09/2019	T149491
Aname mellosa	TS14	697889	7448523	1	9/03/2019	T149433
Aname mellosa	TS18	705437	7448645	3	10/03/2019	T149426
Aname mellosa	Camp	706880	7449184	1	15/03/2019	T149434
Aname mellosa	TS18	705437	7448645	1	10/03/2019	T149430
Aname mellosa	SRE16	702263	7445976	1	10/03/2019	T149447
Aname mellosa	TS14	697889	7448523	1	9/03/2019	T149454
Aname mellosa	TS17	700725	7447419	1	11/03/2019	T149440
Aname mellosa	TS18	705437	7448645	3	10/03/2019	T149407
Aname mellosa	TS16	706428	7448136	1	10/03/2019	T149445
Aname mellosa	TS16	706428	7448136	1	10/03/2019	T149439
Aname mellosa	TS16	706428	7448136	1	10/03/2019	T149422
Lychas 'bituberculatus complex'	TS14	697889	7448523	1	9/03/2019	T149427
Lychas 'bituberculatus complex'	TS16	706428	7448136	1	10/03/2019	T149490
Lychas 'bituberculatus complex'	TS17	700725	7447419	1	11/03/2019	T149489

Species	Site	Coordinates (Zone 50K)		Number of specimens	Collecting date	WAM registration number
		Easting (mE)	Northing (mN)			
Lychas 'bituberculatus complex'	TS16	706428	7448136	1	10/03/2019	T149460
Lychas 'hairy tail complex'	TS17	700725	7447419	1	11/03/2019	T149493
Lychas 'harveyi complex'	TS18	705437	7448645	1	10/03/2019	T149495
Lychas 'harveyi complex'	TS14	697889	7448523	2	9/03/2019	T149436
Lychas 'multipunctatus complex'	TS14	697889	7448523	1	9/03/2019	T149496
Lychas 'multipunctatus complex'	TS17	700725	7447419	3	11/03/2019	T149455
Lychas 'multipunctatus complex'	Bl01	697807	7448393	3	3/09/2019	T149456
Lychas 'multipunctatus complex'	TS14	697889	7448523	2	9/03/2019	T149497
Lychas 'multipunctatus complex'	TS14	697889	7448523	1	9/03/2019	T149442
Urodacus 'HD1'	SRE13	707086	7449689	1	9/03/2019	T149458
Urodacus 'pilbara 12'	SRE12	701579	7446476	1	14/03/2019	T149431
Sepedonophilus 'HD1'	Op01	701589	7445986	1	15/03/2019	T149502
Sepedonophilus 'HD1'	SRE19	702270	7448404	1	12/03/2019	T149499
Sepedonophilus 'HD1'	SRE17	718175	7450279	1	11/03/2019	T149501
Sepedonophilus 'HD1'	SRE19	702270	7448404	1	12/03/2019	T149498
Sepedonophilus 'HD1'	SRE19	702270	7448404	1	12/03/2019	T149500
Sepedonophilus 'HD1'	SRE17	718175	7450279	1	11/03/2019	T149503
Sepedonophilus 'HD2'	SRE23	706043	7446455	1	16/03/2019	T149504
Sepedonophilus sp.	SRE19	702270	7448404	1	12/03/2019	T149505
Geophilomorpha sp.	SRE16	702263	7445976	1	10/03/2019	T149506
Mecistocephalus 'HD1'	SRE13	707086	7449689	1	9/03/2019	T149507
Mecistocephalus 'HD1'	SRE21	704827	7450096	1	14/03/2019	T149508
Mecistocephalus 'HD1'	SRE23	706043	7446455	1	16/03/2019	T149509
Mecistocephalus 'HD1'	SRE23	706043	7446455	1	16/03/2019	T149510

Species	Site	Coordinates (Zone 50K)		Number of specimens	Collecting date	WAM registration number
		Easting (mE)	Northing (mN)			
Mecistocephalus 'HD2'	SRE23	706043	7446455	1	16/03/2019	T149511
Mecistocephalus 'HD3'	SRE15	704230	7446563	1	17/03/2019	T149512
Mecistocephalus 'HD3'	SRE15	704230	7446563	1	17/03/2019	T149513
Orphnaeus 'HD1'	SRE23	706043	7446455	1	16/03/2019	T149514
Cryptops 'HD1'	SRE15	704230	7446563	1	17/03/2019	T149517
Cryptops 'HD1'	SRE15	704230	7446563	1	17/03/2019	T149515
Cryptops 'HD1'	SRE15	704230	7446563	1	17/03/2019	T149516
Antichiropus sp.	SRE15	704230	7446563	1	17/03/2019	T149461
Antichiropus sp.	SRE23	706043	7446455	2	16/03/2019	T149521
Antichiropus 'wonmunna'	SRE15	704230	7446563	2	17/03/2019	T149519
Antichiropus 'wonmunna'	SRE23	706043	7446455	1	16/03/2019	T149518
Antichiropus 'wonmunna'	SRE23	706043	7446455	1	16/03/2019	T149520
Antichiropus 'wonmunna'	SRE23	706043	7446455	10	16/03/2019	T149412
Austrostrophus 'Clade A'	SRE20	719431	7450376	2	13/03/2019	T149522
Austrostrophus 'Clade E'	TS18	705437	7448645	1	10/03/2019	T149462
Austrostrophus 'Clade E'	TS14	697889	7448523	4	9/03/2019	T149524
Austrostrophus 'Clade E'	SRE22	704697	7449733	1	14/03/2019	T149523
Austrostrophus 'Clade E'	SRE15	704230	7446563	1	17/03/2019	T149451
Austrostrophus sp.	SRE19	702270	7448404	1	12/03/2019	T149526
Austrostrophus sp.	SRE13	707086	7449689	1	9/03/2019	T149529
Austrostrophus sp.	SRE18	716912	7450177	1	11/03/2019	T149492
Austrostrophus sp.	SRE17	718175	7450279	1	11/03/2019	T149525
Austrostrophus sp.	SRE16	702263	7445976	1	10/03/2019	T149428
Austrostrophus sp.	SRE15	704230	7446563	5	17/03/2019	T149528

Species	Site	Coordinates (Zone 50K)		Number of specimens	Collecting date	WAM registration number
		Easting (mE)	Northing (mN)			
Gastrocopta sp.	TS14	697889	7448523	2	9/03/2019	S29639
Gastrocopta sp.	SRE21	704827	7450096	3	14/03/2019	S29643
Gastrocopta sp.	SRE21	704827	7450096	3	14/03/2019	S29642
Gastrocopta sp.	SRE15	704230	7446563	2	17/03/2019	S29640
Gastrocopta sp.	SRE14	707274	7445766	2	17/03/2019	S29641
Pupoides sp.	SRE14	707274	7445766	4	17/03/2019	S29645
Pupoides sp.	SRE21	704827	7450096	1	14/03/2019	S29647
Pupoides sp.	SRE23	706043	7446455	1	16/03/2019	S29646
Pupoides sp.	TS14	697889	7448523	2	9/03/2019	S29644
Eremopeas interioris	SRE17	718175	7450279	4	11/03/2019	S29649
Eremopeas interioris	SRE19	702270	7448404	2	12/03/2019	S29653
Eremopeas interioris	SRE14	707274	7445766	5	17/03/2019	S29652
Eremopeas interioris	TS14	697889	7448523	4	9/03/2019	S29650
Eremopeas interioris	TS14	697889	7448523	1	9/03/2019	S29648
Eremopeas interioris	SRE15	704230	7446563	2	17/03/2019	S29651
Buddelundia '15'	SRE15	704230	7446563	2	17/03/2019	C75033
Buddelundia '15'	SRE19	702270	7448404	1	12/03/2019	C75030
Buddelundia '15'	SRE23	706043	7446455	4	16/03/2019	C75031
Buddelundia '15'	SRE14	707274	7445766	2	17/03/2019	C75032
Buddelundia '15'	SRE23	706043	7446455	1	16/03/2019	C75034
Buddelundia '16'	SRE17	718175	7450279	3	11/03/2019	C75035
Buddelundia '16'	SRE19	702270	7448404	8	12/03/2019	C75036
Buddelundia '77'	SRE19	702270	7448404	4	12/03/2019	C75040
Buddelundia '77'	SRE17	718175	7450279	1	11/03/2019	C75042

Species	Site	Coordinates (Zone 50K)		Number of specimens	Collecting date	WAM registration number
		Easting (mE)	Northing (mN)			
Buddelundia '77'	SRE23	706043	7446455	1	16/03/2019	C75039
Buddelundia '77'	SRE23	706043	7446455	1	16/03/2019	C75041
Buddelundia '77'	SRE15	704230	7446563	2	17/03/2019	C75038
Buddelundia '77'	SRE22	704697	7449733	1	14/03/2019	C75037
Buddelundia sp.	SRE23	706043	7446455	1	16/03/2019	C75043
Buddelundiinae sp.	TS14	697889	7448523	2	9/03/2019	C75044
Buddelundiinae sp.	SRE23	706043	7446455	1	16/03/2019	C75045
Pseudodiploexochus sp.	SRE17	718175	7450279	1	11/03/2019	C75046
Troglarmadillo sp.	SRE13	707086	7449689	1	9/03/2019	C75047
Philosciidae sp.	SRE19	702270	7448404	5	12/03/2019	C75048
Philosciidae sp.	TS14	697889	7448523	1	9/03/2019	C75049

C.2: Hope Downs Development Envelope Consolidated Fauna Habitat Mapping Report

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6 February 2020

Our Reference: 14292-19-BILE-4Rev1_200206

Michelle Doak
Senior Advisor - Environmental Approvals
Rio Tinto
Central Park
152-158 St Georges Terrace
Perth WA 6000

Dear Michelle,

Re: Hope Downs Development Envelope – Fauna Habitat Mapping

1 Introduction

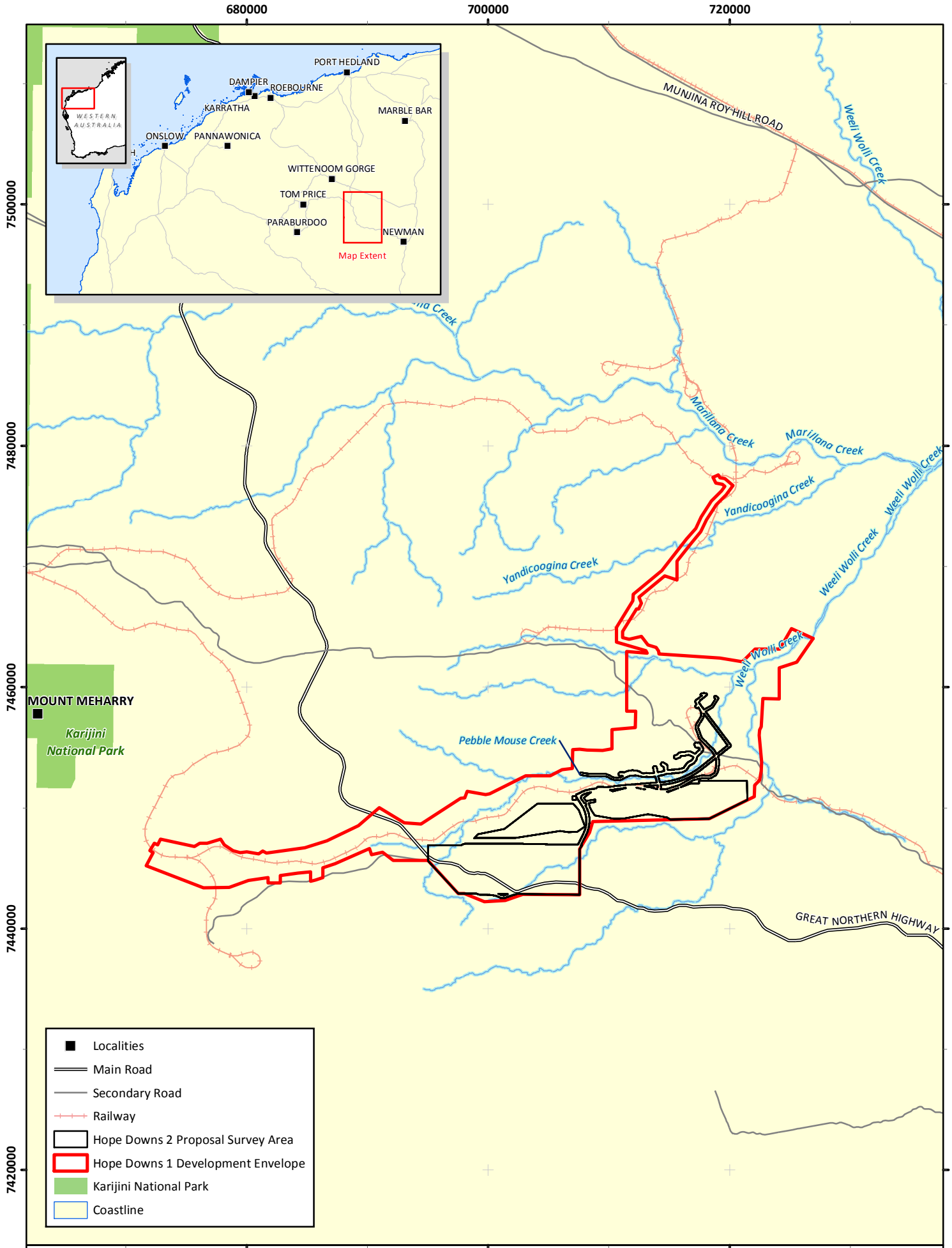
Early in 2019 Rio Tinto commissioned a consolidation of all previous fauna habitat mapping across the Hope Downs 1 (HD1) Development Envelope. The HD1 Development Envelope encompasses the Hope Downs 2 Proposal area and the existing approved and operational Hope Downs 1 and Baby Hope mine sites, and corridors linking the West Angelas and Yandicoogina operations (36,944 ha) (Figure 1). A single, consolidated fauna habitat mapping GIS layer for the HD1 Development Envelope is presented in this letter.

2 Methods

Any previous fauna habitat mapping across the HD1 Development Envelope was consulted and incorporated into the final fauna habitat mapping layer ensuring fauna habitats aligned with those reported by Astron Environmental Services (2019a) as part of the Level 2 fauna surveys for the Hope Downs 2 proposal.

Forty-two fauna habitat assessments were conducted within the HD1 Development Envelope to consolidate or sample previously un-surveyed areas (Table A.1, Attachment A). A small area in the northern portion (319 ha) of the HD1 Development Envelope under Fortescue Metals Group (FMG) tenure was not able to be ground-truthed. Habitat mapping of this area was extrapolated using aerial imagery and available vegetation mapping (Astron Environmental Services 2019b). The locations of all the fauna habitat assessments within the HD1 Development Envelope are shown in Figure B.1 (Attachment B) and the following information was collected at each site:

- location – coordinates measured using a handheld GPS (GDA94)
- recorder and date – personnel involved in undertaking the fauna habitat assessment and the survey date



Rio Tinto

Hope Downs 1 Development Envelope

Figure 1: Survey area location

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Author: J. Johnston	Date: 05-02-2020
Drawn: C. Dyde	Figure Ref: 14292B-19-BIDR-3Rev1_200205_HD1_Fig01_Locn

Datum: GDA 1994 - Projection: MGA Zone 50

0 5 10 15 20 Km

N

- habitat/landform – position in the landscape - major fauna habitat types were described based on the landform and vegetation
- vegetation type – a broad description of vegetation type and structure
- soils – a brief description of soil type
- microhabitat – presence of specific microhabitat features, for example, leaf litter, logs, burrows, rocky outcrops, rock crevices, hollows, permanent or semi-permanent water
- condition – habitat condition was assessed based on the presence of anthropogenic (human-induced) disturbances, and using the condition ratings suggested by Thompson and Thompson (2010)
- disturbance – any disturbance such as clearing, fire, weeds, flooding, vehicular, machinery, tracks or grazing
- photographs – a representative photograph was taken of each habitat assessment site.

The information derived from the fauna habitat assessments was used to delineate fauna habitats throughout the HD1 Development Envelope, which were then mapped accordingly. The potential for the mapped habitats to provide suitable habitat for MNES species Northern Quoll (*Dasyurus hallucatus*) (EN, EN), Ghost Bat (*Macroderma gigas*) (VU, VU), Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) (VU, VU), Night Parrot (*Pezoporus occidentalis*) (EN, CR) and Pilbara Olive Python (*Liasis olivaceus barroni*) (VU, VU) were ranked according to the criteria listed in Table 1.

Table 1: Suitability/significance of habitat ranking criteria for the target Matters of National Environmental Significance (MNES) species.

Species	Probable shelter and foraging habitat	Potential shelter and foraging habitat	Suitable foraging and dispersal habitat	Limited foraging and dispersal habitat
Pilbara Olive Python (*Liasis olivaceus barroni*)	N/A	Rocky habitat such as gorges, escarpments and breakaways along with drainage lines including or near permanent or semi-permanent water holes.	Drainage lines with dense vegetation enabling transitory behaviours and/or providing foraging potential. Rocky habitats that are not near water.	Habitat that has limited sheltering and foraging capacity with no permanent or semi-permanent water.
Northern Quoll *(Dasyurus hallucatus)*	Habitat as described in potential shelter and foraging habitat but is considered core habitat critical to the Northern Quoll. This was determined by proximity to known records and microhabitat features, such as south-facing, extent of habitat and whether it was in close association with a gorge or gully.	Rocky habitats such as ranges, escarpments, mesas, gorges, breakaways and boulder fields. Also major drainage lines or tree-lined drainage systems that are structurally diverse and contain large diameter trees, termite mounds or hollow logs.	Habitat important for foraging, dispersal and buffering of the species including moderate to small sized drainage lines and native vegetation in proximity (within 2 km) denning or shelter habitat.	Habitat that has limited sheltering and foraging capacity and not connected to potential denning/shelter and foraging habitat.
Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) and Ghost Bat (*Macroderma gigas*)	N/A	Rocky habitat that contains caves suitable as diurnal or maternity roosts sites, or potentially contains these caves and has not been adequately surveyed OR Areas highly suitable for foraging that are likely to be used on a regular basis.	Habitat important for foraging including diverse rocky terrain, moderately sized drainage lines and dense complex vegetation stands.	Habitat that has limited ecological value but may provide capacity for transitory movement across the landscape and/or limited foraging potential.

Species	Probable shelter and foraging habitat	Potential shelter and foraging habitat	Suitable foraging and dispersal habitat	Limited foraging and dispersal habitat
Night Parrot (*Pezoporus occidentalis*)	N/A	Isolated habitat not subjected to predation pressure, fire pressure, and altered habitat from pastoralism and mining activities. Generally roosting habitat that contains old and large spinifex clumps (>50 years unburnt), particularly ring-forming hummocks. OR Areas highly suitable for foraging in close association (<10 km) to potential roosting habitat, including *Triodia* (particularly at times of mass flowering and seeding) and chenopod communities dominated by *Sclerolaena*.	Very little is known on the foraging requirements of the Night Parrot. Habitat within 40 km of potential roosting and nesting sites, potentially important for foraging, including chenopod communities (particularly those dominated by *Sclerolaena*), *Triodia* and areas rich in herbs, including forbs, grasses and grass-like plants.	Habitat that has limited roosting and foraging potential for the Night Parrot.

3 Results and Discussion

3.1 Fauna Habitats

Nine broad fauna habitat types were recorded in the HD1 Development Envelope including: Major Drainage, Minor Drainage, Gorge/Gully, Breakaway, Rocky Hill, Low Hill and Slopes, Alluvial Plain, Mulga Woodland and Stony Plain (Table 2 and Figure B.1, Attachment B).

Areas of cleared habitat were prevalent throughout the operational mining areas within the HD1 mine site and Baby Hope deposit. These areas were associated with active mining and infrastructure and nearby mineral drilling programs such as drill pads and drill access tracks. These areas totalled 4,891.1 ha (13.2%) and were considered in 'disturbed' condition (Table 2). The fauna habitats surrounding these areas have been impacted by edge effects, lack of connectivity, grazing and the vegetation is often covered in dust. Most of the habitats away from the mining operations were considered 'very good' to 'high quality' condition owing to the lack of disturbances from fire, weeds and grazing. The Minor and Major Drainage habitats were heavily impacted by weed species such as **Cenchrus ciliaris* (Buffel Grass) and **Malvastrum americanum* (American Malvastrum), as well as impacts through extensive grazing and erosion from livestock. The Gorge and Breakaway habitats generally had the highest quality fauna habitat condition due to isolation from these threatening processes.

Major Drainage habitat is of high importance to fauna species providing a range of ecological values to a wide suite of species. This habitat type was often narrow linear isolated pockets of riparian vegetation, which is usually denser, taller and more diverse than the adjacent Minor Drainage habitat. The vegetation was complex and provided a range of micro niches for fauna species to exploit, such as for shelter and foraging. There were also a significant number of permanent and semi-permanent water bodies that provide drinking opportunities for a range of species and attract prey for predators. This habitat potentially supports conservation listed fauna species such as Northern Quoll and provides foraging sites for Ghost Bats and Pilbara Leaf-nosed Bats.

Minor Drainage habitat is a commonly recorded habitat for the Pilbara region and considered to be of moderate value to a wide spectrum of fauna species. The Minor Drainage habitat comprised a reduced diversity and density in vegetation species and communities, particularly when in the creek bed, and particularly when compared to riparian habitats, such as Weeli Wolli Creek located to the east of the survey area. When present, vegetation typically exhibited a moderate diversity of microhabitats, with some tree hollows and woody debris such as logs and leaf litter. The woody debris provides foraging and sheltering potential to ground dwelling reptiles and mammals. There were limited locations in this habitat that supported the potential for semi-permanent water bodies to form. Ground dwelling fauna are likely to utilise the linear nature of this habitat to traverse between habitats.

Gorge/Gully habitat is one of the more restricted habitats in the survey area. Gorges are a common feature of the Pilbara; however, as they tend to be narrow, linear features, gorges represent a small proportion of the total land area. In addition, they represent important shelter or roosting habitat for a number of MNES species, including the Pilbara Olive Python, Ghost Bat, Pilbara Leaf-nosed Bat and Northern Quoll. They may also support Priority listed species such as the blind snake *Anilios ganei* (P1). Occasional deep caves and semi-permanent rock pools are features within this habitat that can provide refuge and foraging opportunities for fauna during harsher drier seasonal conditions. There was one permanent/semi-permanent pool present during the survey at HA40. In addition, there are a number of locations where water could potentially pool after significant rain events, particularly within the Bedded Hilltop (BHT) area. This habitat was considered of high value

as it contains a complexity of microhabitats and potentially supports conservation significant fauna species.

Breakaway habitat is a common feature of the Pilbara; however, they tend to be narrow, linear features that represent a small proportion of the total land area. The breakaways of the survey area were often associated with the drop off areas of the Rocky Hill habitat and were specifically pertinent to BHT. Breakaway habitat contained microhabitats such as crevices, overhangs and shallow caves that provide shelter opportunities for MNES species. The caves have the potential to be used as diurnal roosts and nocturnal feeding roosts for the Ghost Bat, potential den sites for the Northern Quoll and Pilbara Olive Python. The Breakaway habitat provides important habitat values to a number of conservation listed species including MNES; therefore, it was considered of high importance for fauna.

Rocky Hill habitat is common and widespread throughout the Pilbara. This habitat generally has low vegetation complexity and low diversity of microhabitats; however, MNES species (such as the Northern Quoll) are likely to traverse and forage within these habitats. Other conservation significant species such as the Western Pebble-mound Mouse, *Anilios ganei* and the Pilbara Barking Gecko may also utilise this habitat. The soils are generally stony and compact, reducing the potential opportunities for burrowing species. Therefore, this habitat was considered of moderate value for fauna.

Low Hill and Slopes habitat is widespread and common throughout the Pilbara region and although there are a few conservation listed species that may utilise this habitat, they are unlikely to be restricted to it, except for the Western Pebble-mound Mouse. This habitat generally has low vegetation complexity and low diversity of microhabitats available for fauna species to exploit. The soils were generally stony and compact, reducing potential opportunities for burrowing species. This habitat was of low value to a broad spectrum of fauna species.

Alluvial Plain habitat is associated closely with drainage landforms of the Pilbara as it is often formed from the sediment overflow from drainage systems during flooding events. The Alluvial Plain habitat was of moderate value to a wide spectrum of fauna species as this habitat typically exhibited a moderate diversity of microhabitats, with some tree hollows and logs, and some areas of sandy soils suitable for burrowing. At the time of the survey, the tree hollows of this habitat supported nesting potential for small passerines such as pardalotes, thornbills and multiple species of honeyeaters. Within the survey area the vegetation of this habitat was generally less complex when compared to Minor Drainage habitat, with an absence of large eucalypts. This habitat may provide some limited foraging opportunities for Ghost Bats and Pilbara Leaf-nosed Bats.

Mulga Woodland habitat is characterised by vegetation communities dominated by Mulga (*Acacia aneura*) on a stony mantle. The open to moderately dense woodlands consisted of an understorey composed of sparse tussock or hummock grasses. The woodlands provide nesting and shelter habitats for birds and reptiles and the tussocks and hummocks provide habitat for small birds, reptiles and mammals. Mulga Woodlands are also subject to sheet water flow after rainfall and vegetation is often densely clumped or banded due to the sheet flow, often forming large groves. However due to a low diversity of microhabitats present (generally the understorey and leaf litter were considered sparse), this habitat type was considered of low value to a wide spectrum of fauna species.

Stony Plain habitat is widespread and common throughout the Pilbara region and although there are a few species of conservation significance that may utilise it, they are not restricted to this habitat type. Conservation significant fauna likely to occur in this habitat type include the Western

Pebble-mound Mouse. This habitat generally had low vegetation complexity and microhabitat diversity and was of low value for fauna.

3.2 Habitat Suitability for MNES Species

3.2.1 Northern Quoll

Approximately 665.4 ha (2%) of the HD1 Development Envelope, comprising Gorge/Gully and some Breakaway habitats, was considered probably shelter and foraging habitat (or core habitat as per the referral guidelines (Department of the Environment and Energy 2016)), based on proximity to known quoll records, microhabitat features and orientation aspect (Figure B.2, Attachment B). Approximately 255 ha (1%) of the survey area was considered potential shelter and foraging habitat, comprising mainly smaller Breakaway habitat (Figure B.2, Attachment B). The Gorge/Gully and Breakaway habitats contain rocky environments of high relief that are particularly important for Northern Quolls in the Pilbara as they provide potential denning sites for breeding and shelter and diverse microhabitats for foraging.

Approximately 4,814.2 ha (13%) of the HD1 Development Envelope was considered suitable foraging and dispersal habitat (Major and Minor Drainage, and Rocky Hill habitats), particularly where these habitats were in close association with the Gorge/Gully and Breakaway habitats as they provided microhabitats such as crevices and cracks for foraging (Figure B.2, Attachment B). The remaining 31,209 ha (84%) of the HD1 Development Envelope was considered to provide limited foraging and dispersal habitat, consisting of Alluvial Plain, Low Hills and Slopes, Mulga Woodland, Stony Plain and Disturbed habitats (Figure B.2, Attachment B).

3.2.2 Pilbara Leaf-nosed Bat

Approximately 920.4 ha (3%) of the HD1 Development Envelope, comprising the Gorge/Gully and Breakaway habitat, was considered potential shelter and foraging habitat for this species due to the presence of nocturnal refuge caves (Figure B.3, Attachment B). Approximately 31,132 ha (84%) of the HD1 Development Envelope, which consisted of Alluvial Plain, Major and Minor Drainage, Low Hills and Slopes, Mulga Woodland, Rocky Hill and Stony Plain habitats was considered suitable foraging and dispersal habitat (Figure B.3, Attachment B). The remaining 4,891.1 ha (13%) of the HD1 Development Envelope, comprising Disturbed areas, was considered to provide limited foraging and dispersal habitat (Figure B.3, Attachment B).

3.2.3 Ghost Bat

Approximately 920.4 ha (3%) of the HD1 Development Envelope, comprising the Gorge/Gully and Breakaway habitat, was considered potential shelter and foraging habitat (Figure B.4, Attachment B), due to the presence of caves that potentially support roost sites. Often Gorge/Gully and Breakaway habitats contain caves and deep shelters that are used as nocturnal feeding roosts by Ghost Bats.

Approximately 4,814.2 ha (13%) of the HD1 Development Envelope, which consisted of Major and Minor Drainage, and Rocky Hill habitats, was considered suitable foraging and dispersal habitat (Figure B.4, Attachment B). The taller trees provide ideal foraging/hunting perches particularly in areas that have, or have the potential for, semi-permanent surface water and contain thick vegetation. The Rocky Hill habitat contains microhabitats such as boulder piles, cracks and crevices that support a wide range of prey species for the Ghost Bat. The remaining 31,209 ha (84%) of the HD1 Development Envelope, comprising the Alluvial Plain, Low Hills and Slopes, Mulga Woodland,

Stony Plain and Disturbed habitats, was considered to provide limited foraging and dispersal habitat (Figure B.4, Attachment B).

3.2.4 Night Parrot

None of the habitats of the HD1 Development Envelope supported old, large and unburnt *Triodia* clumps that are considered the primary habitat requirement for the Night Parrot (Department of Parks and Wildlife 2017). The Alluvial Plain, Major and Minor Drainage, Mulga Woodland and Stony Plain habitats (11,738.2 ha, 32%) within the HD1 Development Envelope were mapped as suitable foraging and dispersal habitat (Figure B.5, Attachment B). However, most of these habitats have been impacted by recent fires (less than 10 years old), pastoral and mining impacts over a long duration, very sparse ground cover vegetation and a lack of chenopod communities or suitable size/age *Triodia* hummocks and are unlikely to support the Night Parrot. The remaining 25,205.4 ha (68%) was considered to provide limited foraging and dispersal habitat (Figure B.5, Attachment B).

3.2.5 Pilbara Olive Python

Approximately 920.4 ha (3%) of the HD1 Development Envelope, comprising the Gorge/Gully and Breakaway habitats, was considered as potential shelter and foraging habitat for the Pilbara Olive Python (Figure B.6, Attachment B). The caves and overhangs of the Gorge and Breakaway habitats are likely to provide denning sites and ambush locations frequented by this species.

Approximately 1,893 ha (5%) of the HD1 Development Envelope was considered suitable foraging and dispersal habitat, which consisted of Major and Minor Drainage habitats (Figure B.6, Attachment B). The remaining 34,130.2 ha (92%) of the HD1 Development Envelope was considered to provide limited foraging and dispersal habitat, consisting of Alluvial Plain, Low Hills and Slopes, Mulga Woodland, Rocky Hill, Stony Plain and Disturbed habitats (Figure B.6, Attachment B).

Table 2: Fauna habitat types recorded in the Hope Downs 1 Development Envelope.

Habitat type	Extent in HD1 Development Envelope (proportion)	Broad habitat description	Vegetation description	Microhabitats	Sites	Habitat condition	Value (broad faunal assemblage and MNES species)	Representative photo
Major Drainage	244.2 ha (0.7%)	Closed drainage areas on stony soils. Water bodies only present during times of heavy inundation	*Eucalyptus victrix* (*Eucalyptus camaldulensis*) woodland over *Melaleuca argentea* tall shrubland over *Petalostylis labicheoides* and *Acacia* spp. tall open shrubland over tussock grassland	Water bodies, hollow bearing trees and logs, thick ground cover/ vegetation, deep leaf litter	HA21, HA23, HA26	Very Good	Primary high value habitat for target MNES species. Provides significant shelter sites and supports a diversity of fauna species.	
Minor Drainage	1,648.9 ha (4.5%)	Open drainage areas on stony soils. Water bodies only present during times of heavy inundation	Scattered *Eucalyptus victrix* woodland over *Petalostylis labicheoides* and *Acacia* spp. tall open shrubland over tussock grassland	Hollow bearing trees and logs, thick ground cover/ vegetation, deep leaf litter	HA14, HA20, HA31	Good to High Quality	Moderate value to a wide spectrum of fauna species that are likely to reside in Minor Drainage habitats. Low value to target MNES species as they do not provide significant shelter.	
Gorge/ Gully	622 ha (1.7%)	Deep often rocky gorges, sometimes with ephemeral or semi-permanent pools	*Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia ferriticola* scattered low trees or *Eucalyptus repullulans* scattered low mallee over *Triodia pungens*, *T. vanleeuwenii* very open hummock grassland and scattered tussock grasses	Overhangs, crevices, caves, tree hollows, ephemeral, semi-permanent water	HA1, HA8, HA33, HA35, HA40	Very Good to High Quality	Primary high value habitat for target MNES species. Provides significant shelter sites and supports a diversity of fauna species.	
Breakaway	298.5 ha (0.8%)	Breakaway or ridge line, falling away to steep scree slope or drainage	*Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia* spp. tall shrubs over *Triodia pungens* very open hummock grassland, sometimes with scattered tussock grasses	Caves (roost/feed caves), cracks and crevices, sheltered leaf litter	HA4, HA5, HA9, HA24, HA38	Very Good to High Quality	High value to a low diversity of fauna species that are likely to reside in Breakaway habitats. High value to target MNES species as they are likely to roost and den within this habitat type.	

Habitat type	Extent in HD1 Development Envelope (proportion)	Broad habitat description	Vegetation description	Microhabitats	Sites	Habitat condition	Value (broad faunal assemblage and MNES species)	Representative photo
Rocky Hill	2,921.2 ha (7.9%)	Stony hills on high ranges with dissected valleys and gorges	*Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* scattered low trees to low open woodland over mixed open shrubland over open *Triodia wiseana, T. pungens, T. vanleeuwenii* hummock grassland	Shallow overhangs, boulders and crevices	HA3, HA7, HA10, HA11, HA12, HA13, HA34, HA39	Good to High Quality	Moderate value for target MNES species as they are likely to traverse and forage within these habitats. Moderate value to a low diversity of fauna species that are rocky habitat specialists.	
Low Hills and Slopes	16,472.6 ha (44.6%)	Low stony hills and slopes with dissected valleys and drainage on stony soils	*Eucalyptus leucophloia* subsp. *leucophloia* and/or *Corymbia hamersleyana* scattered low trees over mixed *Acacia* spp. open shrubland over open *Triodia pungens, T. vanleeuwenii* hummock grassland	Termite mounds, *Triodia* hummocks, minimal leaf litter	HA2, HA17, HA19, HA22, HA25, HA36, HA37, HA41, HA42	Very Good to High Quality	Low value to a wide spectrum of fauna species that are likely to reside within these habitats. Low value to target MNES species as this habitat type offers minimal ecological value to these species.	
Alluvial Plain	1,332.7 ha (3.6%)	Flood plain surrounding drainage areas	*Acacia pruinocarpa, A. aptaneura, Eremophila longifolia* tall open shrubland over tussock grassland	Dense leaf litter, termite mounds and spinifex clumps, cracking clays	None	Very Good	Low value to a wide spectrum of fauna species that are likely to reside within these habitats. Low value to target MNES species as this habitat type offers minimal ecological value to these species.	
Mulga Woodland	5,818.8 ha (15.7%)	Stands of Mulga groves on clay based stony plains	*Acacia catenulata*, (*A. pruinocarpa*) tall shrubland over *Eremophila fraseri* scattered tall shrubs over *Triodia pungens* very open hummock grassland	Limited microhabitats, termite mounds, minimal leaf litter	HA6, HA18, HA28, HA29, HA30, HA32	Disturbed to High Quality	Low value to a wide spectrum of fauna species that are likely to reside within these habitats. Low value to target MNES species as this habitat type offers minimal ecological value to these species.	

Habitat type	Extent in HD1 Development Envelope (proportion)	Broad habitat description	Vegetation description	Microhabitats	Sites	Habitat condition	Value (broad faunal assemblage and MNES species)	Representative photo
Stony Plain	2,693.8 ha (7.3%)	Broad flat low-lying plains to undulating plains on soft loamy soils	*Acacia aptaneura, A. pruinocarpa, A. catenulata* tall shrubland over *Triodia pungens* (and sometimes *T. vanleeuwenii)* hummock grassland or tussock grassland	Limited leaf litter, termite mounds and spinifex clumps	HA15, HA16, HA27	Very Good	Low value to a wide spectrum of fauna species that are likely to reside within these habitats. Low value to target MNES species as this habitat type offers minimal ecological value to these species.	
Disturbed	4,891.1 ha (13.2%)	Cleared areas from mining and pastoralism activities	Vegetation structure disturbed or absent.	None	None	Highly Degraded	Little value as fauna habitat.	

This letter was prepared by Principal Environmental Scientist Dr Jessica Johnston and was technically reviewed by Senior Environmental Scientist Matthew Love. If you would like to discuss this further, please feel free to contact me on 9421 9600.

Yours sincerely
ASTRON ENVIRONMENTAL SERVICES



Dr Stuart Pearse
General Manager

Attachments

Attachment A: Fauna Habitat Assessment Sites

Attachment B: Fauna Habitat Mapping

References

Astron Environmental Services. 2019a. Hope Downs 2 Proposal Fauna Survey, March 2019. unpublished report prepared for Rio Tinto, Perth, WA.

Astron Environmental Services. 2019b. Hope Downs 1 Development Envelope - Vegetation Mapping. Unpublished letter report prepared for Rio Tinto, Perth, WA.

Attachment A: Fauna Habitat Assessment Sites

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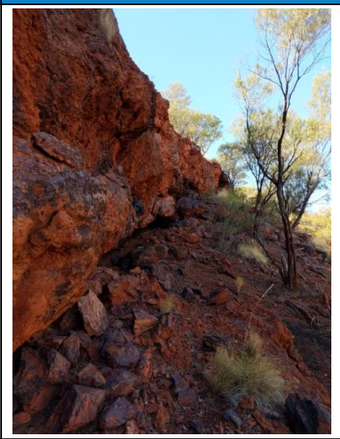
Table A.1: Fauna habitat assessment sites conducted within the Hope Downs 1 Development Envelope.

Site ID	MGA Zone 50 K		Phase	Sampling method	Sample start date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)								
HA1	712426	7450668	1	Other	24/11/17	Gorge/Gully	1	None	Cracks and crevices; leaf litter; tree hollows	
HA2	697800	7444359	1	Other	24/11/17	Low Hills and Slopes	0.8	Drill lines	Spinifex hummocks and dead stags	
HA3	712444	7450310	1	Other	25/11/17	Rocky Hill	0.8	Tracks, drill lines	Tree hollows; rocky outcropping; spinifex hummocks	No photo available
HA4	712497	7450930	1	Other	25/11/17	Breakaway	0.8	Tracks, drill lines	Rock cracks and crevices; overhangs; deep leaf litter and logs; cracks in logs	No photo available
HA5	706586	7445460	1	Other	25/11/17	Breakaway	1	None	Rocky breakaway with shallow caves (day shelter)	No photo available

Site ID	MGA Zone 50 K		Phase	Sampling method	Sample start date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)								
HA6	706063	7449531	2	Other	21/05/18	Mulga Woodland	1	None	Thick undergrowth, old *Triodia*, leaf litter	
HA7	706761	7449949	2	Other	21/05/18	Rocky Hill	1	None	Rocky outcrop, logs, crevices	
HA8	718838	7450779	2	Other	22/05/18	Gorge/Gully	1	None	Rocky outcrop, caves, overhangs, thick undergrowth, old *Triodia*, leaf litter	

Site ID	MGA Zone 50 K		Phase	Sampling method	Sample start date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)								
HA9	720309	7450652	2	Other	24/05/18	Breakaway	1	None	South facing, rocky outcrop, caves, overhangs, crevices	
HA10	721334	7450737	2	Other	24/05/18	Rocky Hill	1	None	Old *Triodia*, leaf litter	
HA11	721637	7450813	2	Other	24/05/18	Rocky Hill	1	None	Rock pile, leaf litter	

Site ID	MGA Zone 50 K		Phase	Sampling method	Sample start date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)								
HA12	712682	7450284	2	Other	25/05/18	Rocky Hill	0.8	Drill lines, roads	Leaf litter	
HA13	719511	7477110	3	Other	12/03/19	Rocky Hill	0.8	Drill lines	Old *Triodia*, leaf litter, termite mounds	
HA14	711907	7466444	3	Other	12/03/19	Minor Drainage	0.8	Drill lines	Tree hollows, thick undergrowth, old *Triodia*, leaf litter	
HA15	710786	7465101	3	Other	12/03/19	Stony Plain	1	Drill lines	Leaf litter, termite mounds	

Site ID	MGA Zone 50 K		Phase	Sampling method	Sample start date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)								
HA16	711944	7462616	3	Other	12/03/19	Stony Plain	1	Drill lines	Soft soil (burrows), old *Triodia*, leaf litter, termite mounds	
HA17	713032	7463435	3	Other	12/03/19	Low Hills and Slopes	1	Drill lines	Leaf litter, termite mounds	
HA18	713508	7461542	3	Other	12/03/19	Mulga Woodland	1	None	Logs, leaf litter, termite mounds	
HA19	717139	7461847	3	Other	12/03/19	Low Hills and Slopes	0.8	Drill lines	Rock piles, old *Triodia*, leaf litter	

Site ID	MGA Zone 50 K		Phase	Sampling method	Sample start date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)								
HA20	719000	7461603	3	Other	12/03/19	Minor Drainage	0.8	Grazing, weeds	Tree hollows, thick undergrowth, rock piles, old *Triodia*, leaf litter	
HA21	726758	7464043	3	Other	14/03/19	Major Drainage	0.8	None	Moist, tree hollows, thick undergrowth, pools, semi-permanent water, old *Triodia*, leaf litter	
HA22	725888	7463376	3	Other	14/03/19	Low Hills and Slopes	0.8	Drill lines	Termite mounds	
HA23	725556	7463539	3	Other	14/03/19	Major Drainage	0.8	Grazing, drill lines, weeds	Moist, logs, tree hollows, crevices, thick undergrowth, soft soil (burrows), semi-permanent water, old *Triodia*, leaf litter	

Site ID	MGA Zone 50 K		Phase	Sampling method	Sample start date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)								
HA24	719501	7477015	3	Other	12/03/19	Breakaway	1	None	Caves, overhangs, rock piles, leaf litter	
HA25	721374	7461739	3	Other	14/03/19	Low Hills and Slopes	0.8	Grazing, drill lines	Leaf litter, termite mounds	
HA26	721923	7457681	3	Other	14/03/19	Major Drainage	0.8	Grazing, drill lines, weeds	Logs, tree hollows, semi-permanent water, leaf litter	
HA27	722558	7457114	3	Other	14/03/19	Stony Plain	0.8	Grazing, drill lines	Leaf litter, termite mounds	

Site ID	MGA Zone 50 K		Phase	Sampling method	Sample start date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)								
HA28	719267	7454360	3	Other	14/03/19	Mulga Woodland	0.8	Drill lines, weeds	Tree hollows, thick undergrowth, leaf litter, termite mounds	
HA29	706822	7447252	3	Other	14/03/19	Mulga Woodland	1	Drill lines	Logs, tree hollows, thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	
HA30	685609	7444152	3	Other	14/03/19	Mulga Woodland	1	Drill lines	Tree hollows, thick undergrowth, soft soil (burrows), old *Triodia*, leaf litter	
HA31	711281	7452235	3	Other	16/03/19	Minor Drainage	0.8	Grazing, drill lines	Logs, thick undergrowth, soft soil (burrows), leaf litter, termite mounds	

Site ID	MGA Zone 50 K		Phase	Sampling method	Sample start date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)								
HA32	681855	7444406	3	Other	14/03/19	Mulga Woodland	0.8	Drill lines, weeds	Thick undergrowth, soft soil (burrows), leaf litter, termite mounds	
HA33	709023	7453727	3	Other	16/03/19	Gorge/Gully	1	None	South facing, rocky outcrop, caves, overhangs, thick undergrowth, rock piles	
HA34	708277	7454504	3	Other	16/03/19	Rocky Hill	0.8	Drill lines	Rocky outcrops, rock piles, termite mounds	
HA35	707524	7454417	3	Other	16/03/19	Gorge/Gully	1	Drill lines	South facing, rocky outcrops, caves, overhangs, logs, rock piles	

Site ID	MGA Zone 50 K		Phase	Sampling method	Sample start date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)								
HA36	717714	7473956	3	Other	12/03/19	Low Hills and Slopes	0.8	Drill lines	Leaf litter, termite mounds	
HA37	718941	7475358	3	Other	12/03/19	Low Hills and Slopes	0.8	Drill lines	Leaf litter, termite mounds	
HA38	717368	7473240	3	Other	12/03/19	Breakaway	1	None	Rocky outcrops, caves, overhangs, crevices, thick undergrowth, rock piles, old *Triodia*, leaf litter	
HA39	717217	7473028	3	Other	12/03/19	Rocky Hill	0.8	Drill lines	Leaf litter, termite mounds	

Site ID	MGA Zone 50 K		Phase	Sampling method	Sample start date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)								
HA40	716614	7471693	3	Other	12/03/19	Gorge/Gully	0.8	Grazing, weeds	Caves, overhangs, logs, tree hollows, soft soil (burrows), pools, semi-permanent water, rock piles, old *Triodia*, leaf litter	
HA41	713605	7467911	3	Other	12/03/19	Low Hills and Slopes	1	Drill lines	Leaf litter, termite mounds	
HA42	712478	7466807	3	Other	12/03/19	Low Hills and Slopes	0.8	Drill lines	Leaf litter, termite mounds	

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Attachment B: Fauna Habitat Mapping

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674000
676000
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7446000
7444000

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B.1.12
B.1.13
B.1.14
B.1.15
B.1.16
B.1.17

HD1 Development Envelope

Fauna Habitat

- Gorge/Gully
- Mulga Woodland
- Low Hills and Slopes
- Rocky Hill
- Stony Plain
- Alluvial Plain
- Cleared

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope

Figure B.1.1: Vertebrate fauna habitat mapping and significant areas

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: J. Johnston | Drawn: C. Dyde | Date: 05-02-2020 | Figure Ref: 14292B-19-BIDR-3Rev1_200205_HD1_FigB1

680000
682000
684000
686000
7448000
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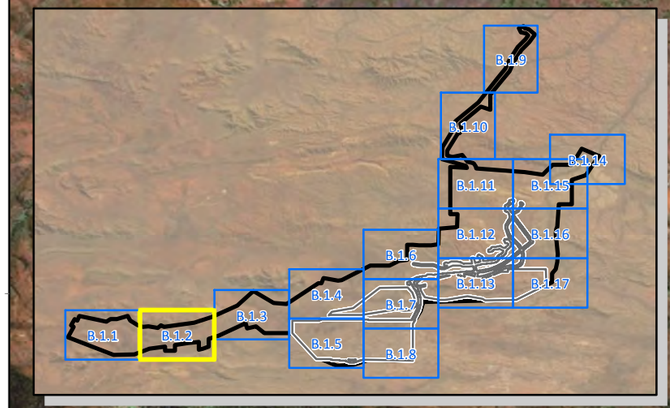
7444000



- Habitat Assessment
- HD1 Development Envelope

Fauna Habitat

- Breakaway
- Gorge/Gully
- Mulga Woodland
- Low Hills and Slopes
- Rocky Hill
- Stony Plain
- Alluvial Plain
- Cleared

HA32

HA30

Source: Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope

Figure B.1.2: Vertebrate fauna habitat mapping and significant areas

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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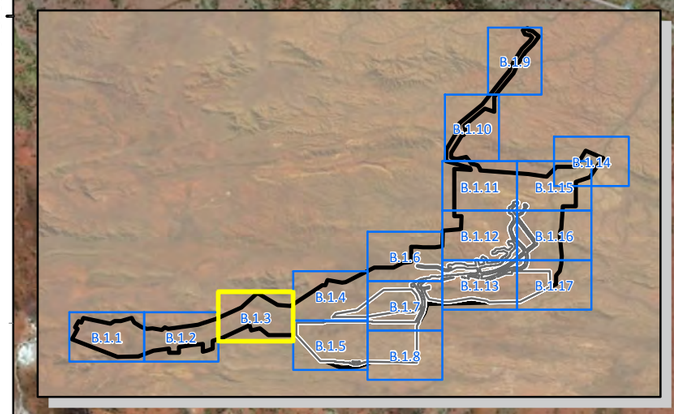
688000 690000 692000 694000

7450000 7448000 7446000



HD1 Development Envelope

Fauna Habitat

- Gorge/Gully
- Mulga Woodland
- Low Hills and Slopes
- Rocky Hill
- Stony Plain
- Minor Drainage
- Cleared

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope

Figure B.1.3: Vertebrate fauna habitat mapping and significant areas

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

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696000 698000 700000 702000

7452000

7450000

7448000

HD2 Proposal Survey Area

HD1 Development Envelope

Significant Areas

Cave

Western Pebble-mound Mouse mound

Fauna Habitat

Gorge/Gully

Mulga Woodland

Low Hills and Slopes

Rocky Hill

Stony Plain

Alluvial Plain

Minor Drainage

Cleared

Cave 9

PMM 3

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope

Figure B.1.4: Vertebrate fauna habitat mapping and significant areas

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

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696000
698000
700000
702000
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Cave 8
Cave 7
HA2
Habitat Assessment
HD2 Proposal Survey Area
HD1 Development Envelope
Significant Areas
Cave
Fauna Habitat
Breakaway
Gorge/Gully
Mulga Woodland
Low Hills and Slopes
Stony Plain
Alluvial Plain
Minor Drainage
Cleared
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Rio Tinto
Hope Downs 1 Development Envelope
Figure B.1.5: Vertebrate fauna habitat mapping and significant areas
Coordinate System: GDA 1994 MGA Zone 50
0 200 400 600 800 1,000 Metres
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Author: J. Johnston
Drawn: C. Dyde
Date: 05-02-2020
Figure Ref: 14292B-19-BIDR-3Rev1_200205_HD1_FigB1

704000 706000 708000 710000

7456000

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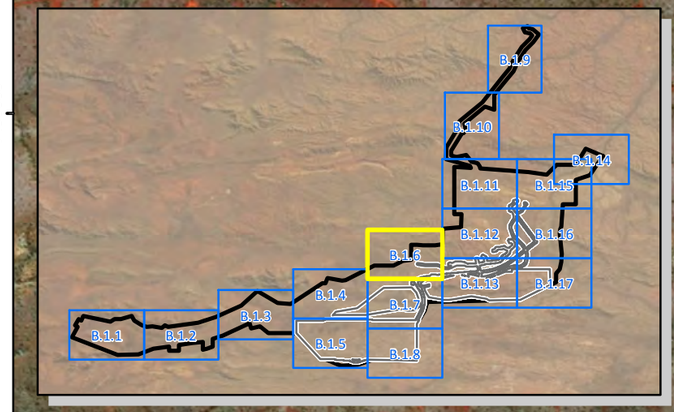

Habitat Assessment

HD2 Proposal Survey Area

HD1 Development Envelope

Fauna Habitat

Breakaway

Gorge/Gully

Mulga Woodland

Low Hills and Slopes

Rocky Hill

Stony Plain

Minor Drainage

Cleared



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope

Figure B.1.6: Vertebrate fauna habitat mapping and significant areas

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

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704000
706000
708000
710000
7450000
7448000
PMM 4
PMM 2
PMM 5
PMM 6
HA6
HA7
Cave 3
HA29
Habitat Assessment
HD2 Proposal Survey Area
HD1 Development Envelope
Significant Areas
Cave
Western Pebble-mound Mouse mound
Fauna Habitat
Breakaway
Gorge/Gully
Mulga Woodland
Low Hills and Slopes
Rocky Hill
Stony Plain
Alluvial Plain
Minor Drainage
Cleared
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Rio Tinto
Hope Downs 1 Development Envelope
Figure B.1.7: Vertebrate fauna habitat mapping and significant areas
Coordinate System: GDA 1994 MGA Zone 50
0 200 400 600 800 1,000 Metres
N
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delivering environmental intelligence™
Author: J. Johnston
Drawn: C. Dyde
Date: 05-02-2020
Figure Ref: 14292B-19-BIDR-3Rev1_200205_HD1_FigB1

704000 706000 708000 710000

7446000

7444000

7442000

HA5

B.1.1 B.1.2 B.1.3 B.1.4 B.1.5 B.1.6 B.1.7 B.1.8 B.1.9 B.1.10 B.1.11 B.1.12 B.1.13 B.1.14 B.1.15 B.1.16 B.1.17

Habitat Assessment
HD2 Proposal Survey Area
HD1 Development Envelope

Fauna Habitat

Breakaway
Mulga Woodland
Low Hills and Slopes
Stony Plain
Alluvial Plain
Minor Drainage
Cleared

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope

Figure B.1.8: Vertebrate fauna habitat mapping and significant areas

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: J. Johnston | Drawn: C. Dyde | Date: 05-02-2020 | Figure Ref: 14292B-19-BIDR-3Rev1_200205_HD1_FigB1

716000

718000

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7472000

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

B.1.19
B.1.10
B.1.14
B.1.11
B.1.15
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B.1.16
B.1.6
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B.1.17
B.1.7
B.1.3
B.1.1
B.1.2
B.1.5
B.1.8

HA13
HA24
HA37
HA36
HA38
HA39
HA40

Habitat Assessment
HD1 Development Envelope

Fauna Habitat

Breakaway
Gorge/Gully
Low Hills and Slopes
Rocky Hill
Minor Drainage
Cleared

Rio Tinto

Hope Downs 1 Development Envelope

Figure B.1.9: Vertebrate fauna habitat mapping and significant areas

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Author: J. Johnston	Date: 05-02-2020	Coordinate System: GDA 1994 MGA Zone 50
Drawn: C. Dyde	Figure Ref: 14292B-19-BIDR-3Rev1_200205_HD1_FigB1_9_10	0 200 400 600 800 1,000 Metres

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714000
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B.1.9
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B.1.11
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B.1.14
B.1.15
B.1.16
B.1.17
B.1.6
B.1.4
B.1.7
B.1.3
B.1.1
B.1.2
B.1.5
B.1.8

HA41
HA42
HA14
HA15

Habitat Assessment
HD1 Development Envelope
Fauna Habitat
Breakaway
Gorge/Gully
Low Hills and Slopes
Minor Drainage
Cleared

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope

Figure B.1.10: Vertebrate fauna habitat mapping and significant areas

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Author: J. Johnston	Date: 05-02-2020	Coordinate System: GDA 1994 MGA Zone 50
Drawn: C. Dyde	Figure Ref: 14292B-19-BIDR-3Rev1_200205_HD1_FigB1_9_10	0 200 400 600 800 1,000 Metres; N

712000
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716000
7462000
7460000
HA16
HA17
HA18
HA19
Habitat Assessment
HD2 Proposal Survey Area
HD1 Development Envelope
Fauna Habitat
Gorge/Gully
Mulga Woodland
Low Hills and Slopes
Stony Plain
Alluvial Plain
Minor Drainage
Cleared
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Rio Tinto
Hope Downs 1 Development Envelope
Figure B.1.11: Vertebrate fauna habitat mapping and significant areas
Coordinate System: GDA 1994 MGA Zone 50
0 200 400 600 800 1,000 Metres
N
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Author: J. Johnston
Drawn: C. Dyde
Date: 05-02-2020
Figure Ref: 14292B-19-BIDR-3Rev1_200205_HD1_FigB1

712000
714000
716000
7458000
7456000
7454000

HD2 Proposal Survey Area
HD1 Development Envelope

Fauna Habitat

- Breakaway
- Gorge/Gully
- Mulga Woodland
- Low Hills and Slopes
- Rocky Hill
- Alluvial Plain
- Minor Drainage
- Cleared

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope

Figure B.1.12: Vertebrate fauna habitat mapping and significant areas

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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712000
714000
716000
7452000
7450000
HA31
Cave 4
HA4
Cave 6
Cave 5
Cave 1
HA1
HA3
HA12
PMM1
Cave 2
Habitat Assessment
HD2 Proposal Survey Area
HD1 Development Envelope
Significant Areas
Cave
Western Pebble-mound Mouse mound
Fauna Habitat
Breakaway
Gorge/Gully
Mulga Woodland
Low Hills and Slopes
Rocky Hill
Stony Plain
Alluvial Plain
Minor Drainage
Cleared
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Rio Tinto
Hope Downs 1 Development Envelope
Figure B.1.13: Vertebrate fauna habitat mapping and significant areas
Coordinate System: GDA 1994 MGA Zone 50
0 200 400 600 800 1,000 Metres
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delivering environmental intelligence™
Author: J. Johnston
Drawn: C. Dyde
Date: 05-02-2020
Figure Ref: 14292B-19-BIDR-3Rev1_200205_HD1_FigB1

722000 724000 726000 728000

7466000 7464000 7462000

Habitat Assessment

HD1 Development Envelope

Fauna Habitat

- Breakaway
- Low Hills and Slopes
- Rocky Hill
- Stony Plain
- Alluvial Plain
- Minor Drainage
- Major Drainage
- Cleared

B.1.1 B.1.2 B.1.3 B.1.4 B.1.5 B.1.6 B.1.7 B.1.8 B.1.9 B.1.10 B.1.11 B.1.12 B.1.13 B.1.14 B.1.15 B.1.16 B.1.17

HA21 HA23 HA22

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope

Figure B.1.14: Vertebrate fauna habitat mapping and significant areas

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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718000
720000
722000
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7460000
HA23
HA25
HA20
Habitat Assessment
HD2 Proposal Survey Area
HD1 Development Envelope
Fauna Habitat
Breakaway
Mulga Woodland
Low Hills and Slopes
Rocky Hill
Stony Plain
Alluvial Plain
Minor Drainage
Major Drainage
Cleared
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Rio Tinto
Hope Downs 1 Development Envelope
Figure B.1.15: Vertebrate fauna habitat mapping and significant areas
Coordinate System: GDA 1994 MGA Zone 50
0 200 400 600 800 1,000 Metres
N
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Author: J. Johnston
Drawn: C. Dyde
Date: 05-02-2020
Figure Ref: 14292B-19-BIDR-3Rev1_200205_HD1_FigB1

718000
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7456000
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HA26
HA27
HA28

B.1.1
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B.1.5
B.1.6
B.1.7
B.1.8
B.1.9
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B.1.11
B.1.12
B.1.13
B.1.14
B.1.15
B.1.16
B.1.17

Habitat Assessment
HD2 Proposal Survey Area
HD1 Development Envelope

Fauna Habitat

Mulga Woodland
Low Hills and Slopes
Stony Plain
Alluvial Plain
Minor Drainage
Major Drainage
Cleared

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope

Figure B.1.16: Vertebrate fauna habitat mapping and significant areas

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

N

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Author: J. Johnston | Drawn: C. Dyde | Date: 05-02-2020 | Figure Ref: 14292B-19-BIDR-3Rev1_200205_HD1_FigB1

718000 720000 722000 724000

7452000

7450000

HA8 HA9 HA10 HA11

B.1.1 B.1.2 B.1.3 B.1.4 B.1.5 B.1.6 B.1.7 B.1.8 B.1.9 B.1.10 B.1.11 B.1.12 B.1.13 B.1.14 B.1.15 B.1.16 B.1.17

Habitat Assessment
HD2 Proposal Survey Area
HD1 Development Envelope

Fauna Habitat

Breakaway
Gorge/Gully
Mulga Woodland
Low Hills and Slopes
Rocky Hill
Stony Plain
Minor Drainage
Cleared

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope

Figure B.1.17: Vertebrate fauna habitat mapping and significant areas

Coordinate System: GDA 1994 MGA Zone 50

0 200 400 600 800 1,000 Metres

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670000 680000 690000 700000 710000 720000

7480000 7470000 7460000 7450000 7440000

HD2 Proposal Survey Area

HD1 Development Envelope

Northern Quoll Habitat Suitability

Probable shelter and foraging habitat

Potential shelter and foraging habitat

Suitable foraging and dispersal habitat

Limited foraging and dispersal habitat

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope

Figure B.2: Habitat suitability mapping - Northern Quoll

Coordinate System: GDA 1994 MGA Zone 50

0 2 4 6 8 10 Kilometres

N

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Author: J. Johnston | Drawn: C. Dyde | Date: 05-02-2020 | Figure Ref: 14292B-19-BIDR-3Rev1_200205_HD1_FigB2_NQ

670000 680000 690000 700000 710000 720000

7480000 7470000 7460000 7450000 7440000

HD2 Proposal Survey Area

HD1 Development Envelope

Pilbara Leaf-nosed Bat Habitat Suitability

Potential shelter and foraging habitat

Suitable foraging and dispersal habitat

Limited foraging and dispersal habitat

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 1 Development Envelope

Figure B.3: Habitat suitability mapping - Pilbara Leaf-nosed Bat

Coordinate System: GDA 1994 MGA Zone 50

0 2 4 6 8 10 Kilometres

N

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Author: J. Johnston | Drawn: C. Dyde | Date: 05-02-2020 | Figure Ref: 14292B-19-BIDR-3Rev1_200205_HD1_FigB3_PLNB

670000 680000 690000 700000 710000 720000

7480000 7470000 7460000 7450000 7440000

HD2 Proposal Survey Area

HD1 Development Envelope

Ghost Bat Habitat Suitability

Potential shelter and foraging habitat

Suitable foraging and dispersal habitat

Limited foraging and dispersal habitat

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope

Figure B.4: Habitat suitability mapping - Ghost Bat

Coordinate System: GDA 1994 MGA Zone 50

0 2 4 6 8 10 Kilometres

N

astron delivering environmental intelligence™

Author: J. Johnston | Drawn: C. Dyde | Date: 05-02-2020 | Figure Ref: 14292B-19-BIDR-3Rev1_200205_HD1_FigB4_GB

670000 680000 690000 700000 710000 720000

7480000 7470000 7460000 7450000 7440000

HD2 Proposal Survey Area

HD1 Development Envelope

Night Parrot Habitat Suitability

Suitable foraging and dispersal habitat

Limited foraging and dispersal habitat

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope

Figure B.5: Habitat suitability mapping - Night Parrot

Coordinate System: GDA 1994 MGA Zone 50

0 2 4 6 8 10 Kilometres

N

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Author: J. Johnston | Drawn: C. Dyde | Date: 05-02-2020 | Figure Ref: 14292B-19-BIDR-3Rev1_200205_HD1_FigB5_NP

670000 680000 690000 700000 710000 720000

7480000 7470000 7460000 7450000 7440000

HD2 Proposal Survey Area

HD1 Development Envelope

Pilbara Olive Python Habitat Suitability

Potential shelter and foraging habitat

Suitable foraging and dispersal habitat

Limited foraging and dispersal habitat

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 1 Development Envelope

Figure B.6: Habitat suitability mapping - Pilbara Olive Python

Coordinate System: GDA 1994 MGA Zone 50

0 2 4 6 8 10 Kilometres

N

astron delivering environmental intelligence™

Author: J. Johnston | Drawn: C. Dyde | Date: 05-02-2020 | Figure Ref: 14292B-19-BIDR-3Rev1_200205_HD1_FigB6_POP

C.3: Hope Downs 2 Proposal – Ghost Bat Cave Characteristics Report

19 May 2020

Our Reference: 14292B-20-BILR-1Rev0_200519

Michelle Doak
Senior Advisor Environmental Approvals
Rio Tinto
Central Park
152-158 St Georges Terrace
Perth WA 6000

Dear Michelle,

Re: Hope Downs 2 Proposal – Ghost Bat Cave Characteristics, February/March 2020

1 Introduction

Rio Tinto required additional assessment to be made of previously recorded caves by Astron Environmental Services (Astron) within the Hope Downs 2 (HD2) Proposal survey area. Astron was commissioned to confirm the GPS coordinates and record cave characteristics, including estimated number of Ghost Bat (*Macroderma gigas*) (VU; VU) scats, external and internal dimensions, entrance orientation and any other annotations, of the previously recorded Ghost Bat caves 1, 2, 4, 5, 6 and 8.

2 Methods

Astron previously recorded six Ghost Bat caves (Cave 1, 2, 4, 5, 6 and 8) within the HD2 Proposal survey area in 2017 (Astron Environmental Services 2020), prior to being permitted to enter caves to record internal dimensions. Astron zoologists Matthew Love and Lucy Dadour revisited the six Ghost Bat caves between 25 February and 2 March 2020 to confirm the GPS coordinates and record the following:

- external and internal dimensions of the cave, including annotations
- cave entrance orientation
- the number of Ghost Bat scats present and any other evidence of Ghost Bats
- photographs.

3 Results

The GPS coordinates and physical characteristics of the six previously recorded Ghost Bat caves are provided in Table 1. In addition to the six previously recorded caves, Astron zoologists located an additional Ghost Bat cave within the HD2 Proposal survey area that had not previously been recorded. The location and characteristics of this cave (Cave 10) are also provided in Table 1.

Table 1: Location of caves within Hope Downs 2 Proposal Survey Area.

Site ID	MGA Zone 50 K		Category rating for Ghost Bat usage according to Bat Call WA (2019)	Reason	Description	Photographs
	Easting (mE)	Northing (mE)				
Cave 1	712290	7450626	3	Ghost Bat nocturnal roost. Occasional diurnal roost possible due to size and depth.	**Entrance:** Large open overhang (4.5 m high x 16.7 m wide x 8.7 m deep) **Orientation:** East **Internal:** One internal dome (7.5 m high x 8.7 m wide) **Conditions:** Bat smell; bat scats present; raised humidity/temperature. Northern Quoll scats recorded.	
Cave 2	716871	7450090	4	Potential Ghost Bat nocturnal roost.	**Entrance:** Wide open entrance (3 m high x 3 m wide) **Orientation:** South-east **Internal:** Slanted slated Rock (0.5 m high x 2 m wide x 14.4 m deep) **Conditions:** No raised humidity/temperature; microbats present.	
Cave 4	712491	7451075	4	Confirmed Ghost Bat nocturnal roost	**Entrance:** Open exposed overhang (10 m wide x 3 m high) **Orientation:** North **Internal:** Shallow **Conditions:** Ghost Bat scats present (x5 scats) in November 2017 but not in February/March 2020; no raised humidity/temperature; microbats present in November 2017 but not in February/March 2020.	

Site ID	MGA Zone 50 K		Category rating for Ghost Bat usage according to Bat Call WA (2019)	Reason	Description	Photographs
	Easting (mE)	Northing (mE)				
Cave 5	710765	7450679	3	Ghost Bat nocturnal roost. Occasional diurnal roost possible due to depth and presence of rear chamber.	**Entrance:** Small narrow opening (3 m wide x 1.9 m high) **Orientation:** West **Internal:** One long tunnel 22.5 m deep, average 1 m high average width 3 m **Conditions:** Ghost Bat scats present (approximately 1,000).	
Cave 6	710740	7450865	4	Potential Ghost Bat nocturnal roost	**Entrance:** Narrow (1 m wide x 5 m high) **Orientation:** East **Internal:** One long flat tunnel (0.5 m high x 2.7 m wide) **Conditions:** Bat smell; bat scats present; raised humidity/temperature.	
Cave 8	699014	7444987	4	Potential Ghost Bat nocturnal roost	**Entrance:** Small entrance (3 m wide x 0.9 m high) **Orientation:** North-west **Internal:** Two main domes each with side or rear caverns. Solitary Ghost Bat present (flushed). East dome 1.4 m high x 5.4 m wide x 8.3 m deep. Rear chamber off east dome 0.5 m high x 5 m deep x 2 m wide. West dome (high ceiling) 3.6 m high x 4 m wide x 5.2 m deep. Side bubble off west dome 2 m high x 1.6 m wide x 1.7 m deep.Behind rock pile to entrance 4.7 m. **Conditions:** Bats present; Ghost Bat (x1) present in February/March 2020; raised humidity/temperature.	

Site ID	MGA Zone 50 K		Category rating for Ghost Bat usage according to Bat Call WA (2019)	Reason	Description	Photographs
	Easting (mE)	Northing (mE)				
Cave 10	715713	7450542	2	Ghost Bat diurnal roost with regular occupancy	**Entrance:** Open/wide (4.7 m wide x 4.2 m high x 23.5 m deep) **Orientation:** West **Internal:** One long cave tapering upwards. First dome 2.7 m high x 8.5 m wide Second dome (rear) 2.1 m high x 5.3 m wide Side north chamber 1.6 m high x 2.5 m wide **Conditions:** First dome ~ 5,500 Ghost Bat scats, midden and feeding debris. Second dome 120 Ghost Bat scats, midden and feed debris. Side north chamber 20 Ghost Bat scats. Bats present; bat scats, Ghost Bat scats; raised humidity/temperature. Northern Quoll scats recorded.	

During the survey Northern Quoll (*Dasyurus hallucatus*) (EN; EN) scats were also recorded within Cave 1 (Plate 1) and Cave 10 (Plate 2).



Plate 1: Northern Quoll scat recorded within Cave 1.



Plate 2: Northern Quoll scats recorded within Cave 10.

This letter was prepared by Environmental Scientist Brittany Osborn and Senior Environmental Scientist Matthew Love, and was technically reviewed by Principal Environmental Scientist Dr Jessica Johnston. If you would like to discuss this further, please feel free to contact me on 9421 9600.

Yours sincerely

ASTRON ENVIRONMENTAL SERVICES

Brett Lucas
Manager - Biodiversity

References

Astron Environmental Services. 2020. Hope Downs 2 Proposal Fauna Survey, March 2019. Unpublished report prepared for Rio Tinto, Perth, WA.

Bat Call WA. 2019. Rio Tinto Hope Downs 2 and Bedded Hilltop, Pilbara WA, Acoustic Survey of Bat and Night Parrot Activity - Phases 1 (November 2017), 2 (May 2018), 3 (March 2019) and 4 (September 2019). Unpublished report for Astron Environmental Services.

C.4: Hope Downs 2 Proposal – Ghost Bat Memo

9 August 2023

Our Reference: 14200-009-22-BILR-2Rev0_220809

Sally Pickard
Senior Environmental Approvals Advisor
Rio Tinto
Central Park
158 St Georges Terrace
Perth WA 6000

Dear Sally,

Re: Hope Downs 2 Proposal – Ghost Bat Memo, August 2023

1 Introduction

Rio Tinto has referred to the Environmental Protection Authority (EPA) the potential development of two above water table iron ore deposits, Hope Downs (HD) 2 and Bedded Hilltop (together referred to as the 'HD2 Survey Area'), located within the Greater Hope Downs area in the Pilbara region of Western Australia. A Preliminary Feasibility Study (PFS) has commenced. Based on the outcome of the PFS, the Project is expected to progress into a Feasibility Study in late 2022/23. The environmental approvals process commenced in 2021 with referral under both the State *Environmental Protection Act 1986* and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) being undertaken. The EPA set a Public Environmental Review level of assessment.

The Banjima Native Title Aboriginal Corporation commissioned Strategen JBS&G (Strategen) (2021) to undertake a peer review of the baseline survey reports that had been undertaken to date to support the previous environmental review document. Rio Tinto is committed to providing a response to the peer review conclusions and recommendations.

The Scope of Work was to provide a letter summarising the work undertaken to date on the Ghost Bat (*Macroderma gigas;* Vulnerable) within the HD2 Survey Area in response to the recommendations provided by Strategen's (2021) review of the following reports:

- Hope Downs 2 Proposal Fauna Survey (Astron Environmental Services 2020a)
- Hope Downs 2 Proposal Matters of National Environmental Significance Fauna Assessment (Astron Environmental Services 2020b)
- Hope Downs 2 Proposal – Ghost Bat Cave Characteristics, February/March 2020 (Astron Environmental Services 2020c)

With respect to Ghost Bats, Strategen (2021) made the following recommendations:

Survey Effort

- Clearly demonstrate that all potential roost caves have been adequately surveyed. Demonstrate survey effort overlain with habitat mapping.
- The report (Astron Environmental Services 2020b) states that "areas not traversed were assessed visually from a distance where possible and considered a low probability of containing caves". Give further consideration to undertaking additional targeted survey effort to demonstrate suitable roost caves are unlikely to occur in areas not traversed in the targeted Matters of National Environmental Significance survey. Consider the benefit of adopting techniques such as drones to adequately cover the development envelope and determine if any potential roost caves occur which may require additional survey.

Ghost Bat Records within the Survey Area

- Show category of Ghost Bat roost on the figure displaying locations of Ghost Bat roost caves.

Regional Context of Ghost Bat Records

- Provide greater detail as to the regional context/ importance of the development envelope with respect to the Ghost Bat, i.e. proximity and location of nearest known significant roosts.

2 Survey Effort

There were no specific instructions for survey effort within relevant guidelines at the time of the surveys (Department of the Environment, Water, Heritage and the Arts 2010), except to focus selective searches and sampling procedures within large survey areas. The most recent publication on Ghost Bats (Bat Call WA 2021), which was published following completion of surveys within the HD2 Survey Area, states that surveys should focus on the most likely areas within a study area; that is, in gorges, deep gullies flanked by rocky outcrop and beneath ephemeral waterfalls, focusing on landscapes composed primarily of Brockman and Marra Mamba banded iron formation.

Searches were focused within the Brockman Iron Formation and Marra Mamba Iron Formation geological units of the HD2 Survey Area that were mapped as Breakaway and Gorge/Gully habitats. Astron considers that suitable habitat within the HD2 Survey Area has been adequately surveyed to record potential roost caves and that there are no areas considered to require further search effort. Echolocation recording sites were sampled across four phases – November 2017, May 2018, March 2019 and September 2019. When all survey effort (Astron Environmental Services 2020c, 2020b, 2020a) is combined, including track logs and 27 echolocation bat recording sites, Astron considers that the HD2 Survey Area has been adequately surveyed. Other targeted assessments for the Northern Quoll (*Dasyurus halluctus*; Endangered) (Astron Environmental Services 2023a, 2023b, 2023c) have also been undertaken since Strategen's (2021) review, which covered similar habitats to those that support Ghost Bat roosts and would classify as additional search effort. Figure 1 shows survey effort to date overlain with fauna habitat mapping to demonstrate that the Gorge/Gully and Breakaway habitats have been thoroughly surveyed throughout the Survey Area. It was concluded by Bat Call WA (2019) that targeted survey effort for groupings of caves important for the persistence of Ghost Bat had been carried out at both the eastern and western ends of the HD2 Proposal Survey Area.

There are some areas of Gorge/Gully and Breakaway habitats deemed to be less suitable roosting habitat (did not contain overhangs or shallow caves) and not to contain roost caves suitable for Ghost Bats. These areas were not ground-truthed, as they were visually assessed as not suitable roosting habitat in the field by highly experienced personnel with over 10 years of experience.

695000 700000 705000 710000 715000 720000

7455000

7450000

7445000

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

BAT28 BAT26 BAT15 BAT25 BAT22 BAT12 BAT9 BAT10 BAT21 BAT31 BAT14 BAT27 BAT19 BAT4 BAT13 BAT8 BAT7 BAT29 BAT16 BAT17 BAT3 BAT6 BAT5 BAT30 BAT23 BAT2 BAT1

Echolocation Sites
GPS Tracklogs
Hope Downs 2 Survey Area

Fauna Habitat

- Breakaway
- Gorge/Gully
- Mulga Woodland
- Low Hills and Slopes
- Rocky Hill
- Stony Plain
- Alluvial Plain
- Minor Drainage
- Major Drainage
- Cleared

Rio Tinto
Hope Downs 2 Proposal Ghost Bat Memo

Figure 1: Summary of survey effort for the Ghost Bat within the Hope Downs 2 Survey Area

Scale: 1:70,000 at A3
Coordinate System: GDA 1994 MGA Zone 50
0 1 2 3 4 5 Kilometres

N

astron
delivering environmental intelligence™

Author: J. Johnston | Drawn: C. Dyde | Date: 24-05-2022 | Figure Ref: 14200-009-22-BIDR1-RevA_220524_Fig1_Effort

3 Ghost Bat Records within the Survey Area

The Ghost Bat has been recorded on 12 occasions within the HD2 Survey Area during previous Astron surveys, through acoustic recordings/calls (BAT4, BAT21 and BAT25), scats (seven records) and sighting of two individuals (one during spotlighting and one within Cave 8 during a cave assessment) (Astron Environmental Services 2020c, 2020b, 2020a) (Figure 2 and Table 1.1, Attachment 1).

Nine Ghost Bat caves have been recorded within the Survey Area (Figure 2 and Table 1.2, Attachment 1). One cave (Cave 10) was deemed to be a Category 2 maternity/diurnal roost cave with regular occupancy according to Bat Call WA (2021). Because of current insufficient data to identify any trends, any cave that has regular occupancy must be assumed to be capable of supporting one or more reproducing females and their offspring, and is therefore considered critical habitat (Bat Call WA 2021).

Two caves (Caves 1 and 5) were deemed to be Category 3 roost caves with occasional occupancy. When adjacent to Category 2 caves, these are considered to be a part of an 'apartment block' and are therefore critical habitat important for the ongoing presence of the species in the area (Bat Call WA 2021). In contrast, isolated Category 3 caves are not considered critical habitat essential to the long-term viability of a local population (Bat Call WA 2021). However, these caves may enable the long-distance movement of individuals across a landscape, and therefore contribute to genetic exchange between neighbouring colonies (Bat Call WA 2021).

The remaining six caves (Caves 2, 3, 4, 6, 7 and 8) were deemed to be Category 4 nocturnal roost caves (opportunistic usage) and are not considered significant (Bat Call WA 2021). These Category 4 caves are common in the landscape and numerous observations suggest that the majority of caves and adits in the Pilbara are used in at least an opportunistic manner by itinerant Ghost Bats (Bat Call WA 2019).

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7455000

7450000

7445000

Hope Downs 2 Survey Area

Ghost Bat Records

- Calls
- Scat
- Sighted (individual)

Roost Caves

- Category 2 Ghost Bat roost
- Category 3 Ghost Bat roost
- Category 4 Ghost Bat roost

Ghost Bat Habitat Suitability

- Potential shelter and foraging habitat (a)
- Suitable foraging and dispersal habitat (b)
- Limited foraging and dispersal habitat (c)

Cave 3
Cave 6
Cave 5
Cave 1
Cave 4
Cave 10
Cave 2
Cave 7
Cave 8



Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 2 Proposal Ghost Bat Memo

Figure 2: Summary of Ghost Bat records within the Hope Downs 2 Survey Area

Scale: 1:60,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

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astron delivering environmental intelligence™

Author: J. Johnston | Drawn: C. Dyde | Date: 25-05-2022 | Figure Ref: 14200-009-22-BIDR1-RevA_220524_Fig2_GB

4 Regional Context of Ghost Bat Records

The number of Ghost Bats within the Hamersley Range of the Pilbara region has been estimated at 350 individuals, with Ghost Bats mostly being encountered as groups of one to 15 individuals roosting in caves in ironstone strata (Bat Call WA 2021). In the wet season, these groups have been observed to include reproducing females (Bat Call WA 2021). The records of Ghost Bats within the HD2 Proposal Survey Area indicate that the Ghost Bat forages in low numbers on the HD2 and Bedded Hilltop ridges, with only one to two calls recorded across four phases of survey (November 2017, May 2018, March and September 2019) (Bat Call WA 2019). No evidence of activity consistent with reproducing bats was detected (Bat Call WA 2019). The records are consistent with the known regional presence of the Ghost Bat across the central Pilbara region (Hamersley subregion), as well as locally on the major ridges immediately to the north of the survey area and west of the HD1 mining area (Bat Call WA 2019).

There are a number of Pilbara caves and adits that are considered Category 2 roosts, where Ghost Bats have regular, but not continuous, presence over long periods (Bat Call WA 2021). The longest continuous monitoring programs have been at Rio Tinto's West Angelas project, just west of the HD2 Survey Area, and at BHP's Mining Area C and South Flank projects, immediately to the north of the HD2 Survey Area (Bat Call WA 2021). At all three locations there are several caves with roosting Ghost Bat records but none of these have had either permanent presence or consistently high numbers present (Bat Call WA 2021). Numbers have varied between zero and five individuals, with very occasional counts of 20 or more (Bat Call WA 2021). Based on recent monitoring of several Hamersley Range caves using ultrasonic call detectors, Ghost Bats may be present for 25% to 75% of nights over periods of up to several months, but then may abandon the caves for weeks or even months at a time (Bat Call WA 2021). At present, there is insufficient data to determine if there are any seasonal trends in these occupancy rates (Bat Call WA 2021). These caves typically have several other caves, shelters, and overhangs within a few hundred metres and together they make up an 'apartment block' grouping (Threatened Species Scientific Committee 2016) that supports the ongoing presence of the bats.

Other caves and/or shelters have not been recorded within proximity to the Category 2 Ghost Bat roost cave (Cave 10) within the HD2 Survey Area, and all suitable Gorge/Gully habitat within a 500 m radius of Cave 10 has been searched. The nearest caves are approximately 1.25 km (Cave 2 – Category 4), 3.26 km (Cave 4 – Category 4) and 3.43km (Cave 1 – Category 3) from Cave 10. No groupings of caves with regular calls, suggesting a more heavily used 'apartment block', have been identified to date within the HD2 Survey Area. However, ultrasonic detector units have not been placed within Cave 10, so the number of Ghost Bats utilising the cave and the frequency of usage is currently unknown.

This letter was prepared by Principal Zoologist Dr Jessica Johnston and technically reviewed by Principal Environmental Scientist Janelle Atkinson. If you have any queries please contact Senior Project Coordinator, Melissa Ford on (08) 9421 9600.

Yours sincerely
ASTRON ENVIRONMENTAL SERVICES



Brett Lucas
Manager – Biodiversity

Attachments

Attachment 1: Ghost Bat Records and Roost Caves

References

Astron Environmental Services. 2020a. Hope Downs 2 Proposal Fauna Survey, March 2019. Unpublished report prepared for Rio Tinto, Perth, WA.

Astron Environmental Services. 2020b. Hope Downs 2 Proposal Matters of National Environmental Significance Fauna Assessment, September 2019. Unpublished report prepared for Rio Tinto, Perth, WA.

Astron Environmental Services. 2020c. Hope Downs 2 Proposal Ghost Bat Cave Characteristics, February/March 2020. Unpublished report prepared for Rio Tinto, Perth, WA.

Astron Environmental Services. 2023a. Hope Downs 2 Proposal Matters of National Environmental Significance Northern Quoll Monitoring - Phase 3 of 3 Results (July-October 2022) and Phases 1 to 3 Summary Report. Unpublished Report Prepared for Rio Tinto, Rev 0, Perth, WA.

Astron Environmental Services. 2023b. Hope Downs 2 Proposal Matters of National Environmental Significance Northern Quoll Monitoring - Phase 1 of 3 (September-November 2020). Unpublished Report Prepared for Rio Tinto, Rev 1, Perth, WA.

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Department of the Environment, Water, Heritage and the Arts. 2010. Survey guidelines for Australia's threatened bats: Guidelines for detecting bats listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*.

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Threatened Species Scientific Committee. 2016. Conservation Advice for *Macroderma gigas* (ghost bat). Canberra.

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Attachment 1: Ghost Bat Records and Roost Caves

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Table 1.1: Location of Ghost Bat records within the Hope Downs 2 Proposal Survey Area.

Common name (species name)	Status	Site ID	MGA Zone 50 K		Date	Observation type (number of records)	Habitat
			Easting (mE)	Northing (mN)			
Ghost Bat (*Macroderma gigas*)	VU/VU	Opp	695856	7445499	25/11/2017	Scats	Drainage
		Cave 4	712487	7451071	25/11/2017	Scats	Breakaway
		BAT4	712483	7451071	28/11/2017	2 calls	Breakaway
		Opp	700299	7444846	19/05/2018	Individual sighting	Breakaway
		Cave 5	710755	7450673	18/05/2018	Scats	Breakaway
		Cave 1	712281	7450651	22/05/2018	Scats	Rocky Hill
		Cave 7	697235	7444586	26/11/2017	Scats	Breakaway
		BAT21	700067	7444800	21/05/2018	1 call	Breakaway
		BAT25	702192	7448397	15/03/2019	1 call	Gorge/Gully
		Cave 8	699016	7444981	29/02/2020	Individual sighting	Breakaway
		Cave 10	715708	7450541	27/02/2020	Scats (5,640)	Gorge/Gully
		Cave 5	710765	7450679	28/02/2020	(1,000)	Gorge/Gully

Table 1.2: Location of Ghost Bat roost caves within Hope Downs 2 Proposal Survey Area.

Site ID	MGA Zone 50 K		Ghost Bat category	Reason	Description	Photograph
	Easting (mE)	Northing (mE)				
Cave 1	712290	7450626	3	Ghost Bat nocturnal roost. Occasional diurnal roost possible due to size and depth.	**Entrance:** Large open overhang (4.5 m high x 16.7 m wide x 8.7 m deep) **Orientation:** East **Internal:** One internal dome (7.5 m high x 8.7 m wide) **Conditions:** Bat smell; bat scats present; raised humidity/temperature.	
Cave 2	716871	7450090	4	Potential Ghost Bat nocturnal roost.	**Entrance:** Wide open entrance (3 m high x 3 m wide) **Orientation:** South-east **Internal:** Slanted slated Rock (0.5 m high x 2 m wide x 14.4 m deep) **Conditions:** No raised humidity/temperature; microbats present.	
Cave 3	708388	7450375	4	Potential Ghost Bat nocturnal roost	**Entrance:** Small narrow entrance (2 m wide x 0.5 m high) **Orientation:** South **Internal:** Not recorded; shallow depth through visual assessment **Conditions:** No raised humidity/temperature; microbats present.	
Cave 4	712491	7451075	4	Confirmed Ghost Bat nocturnal roost	**Entrance:** Open exposed overhang (10 m wide x 3 m high) **Orientation:** North **Internal:** Shallow **Conditions:** Ghost Bat scats present (x5 scats) in November 2017 but not in February/March 2020; no raised humidity/temperature; microbats present in November 2017 but not in February/March 2020.	

Site ID	MGA Zone 50 K		Ghost Bat category	Reason	Description	Photograph
	Easting (mE)	Northing (mE)				
Cave 5	710765	7450679	3	Ghost Bat nocturnal roost. Occasional diurnal roost possible due to depth and presence of rear chamber.	**Entrance:** Small narrow opening (3 m wide x 1.9 m high) **Orientation:** West **Internal:** One long tunnel 22.5 m deep, average 1 m high average width 3 m **Conditions:** Ghost Bat scats present (approximately 1,000).	 
Cave 6	710740	7450865	4	Potential Ghost Bat nocturnal roost	**Entrance:** Narrow (1 m wide x 5 m high) **Orientation:** East **Internal:** One long flat tunnel (0.5 m high x 2.7 m wide) **Conditions:** Bat smell; bat scats present; raised humidity/temperature.	 
Cave 7	697235	7444586	4	Confirmed Ghost Bat nocturnal roost	**Entrance:** Open/wide (5 m wide x 2 m high) **Orientation:** South **Internal:** One dome 2 m high with several side pockets **Conditions:** Ghost Bat scats present.	
Cave 8	699014	7444987	4	Potential Ghost Bat nocturnal roost	**Entrance:** Small entrance (3 m wide x 0.9 m high) **Orientation:** North-west **Internal:** Two main domes each with side or rear caverns. Solitary Ghost Bat present (flushed). East dome 1.4 m high x 5.4 m wide x 8.3 m deep. Rear chamber off east dome 0.5 m high x 5 m deep x 2 m wide. West dome (high ceiling) 3.6 m high x 4 m wide x 5.2 m deep. Side bubble off west dome 2 m high x 1.6 m wide x 1.7 m deep.Behind rock pile to entrance 4.7 m. **Conditions:** Bats present; Ghost Bat (x1) present in February/March 2020; raised humidity/temperature.	 

Site ID	MGA Zone 50 K		Ghost Bat category	Reason	Description	Photograph
	Easting (mE)	Northing (mE)				
Cave 10	715713	7450542	2	Ghost Bat diurnal roost with regular occupancy	**Entrance:** Open/wide (4.7 m wide x 4.2 m high x 23.5 m deep) **Orientation:** West **Internal:** One long cave tapering upwards. First dome 2.7 m high x 8.5 m wide Second dome (rear) 2.1 m high x 5.3 m wide Side north chamber 1.6 m high x 2.5 m wide **Conditions:** First dome ~ 5,500 Ghost Bat scats, midden and feeding debris. Second dome 120 Ghost Bat scats, midden and feed debris. Side north chamber 20 Ghost Bat scats. Bats present; bat scats, Ghost Bat scats; raised humidity/temperature.	

C.5: Hope Downs 2 Proposal Grey Falcon Assessment Report

9 August 2023

Our Reference: 14000-009-22-BILR-1Rev0_230809

Sally Pickard
Senior Environmental Approvals Advisor
Rio Tinto
Central Park
158 St Georges Terrace
Perth WA 6000

Dear Sally,

Re: Hope Downs 2 Proposal – Grey Falcon Environmental Impact Assessment, August 2023

1 Introduction

1.1 Background

Rio Tinto has referred to the Environmental Protection Authority (EPA) the potential development of two above water table iron ore deposits, Hope Downs 2 (HD2) and Bedded Hilltop (referred to as the 'HD2 survey area'), located within the Greater Hope Downs area, in the Pilbara region of Western Australia. A Preliminary Feasibility Study (PFS) Study has commenced. Based on the outcome of the PFS, the Project is expected to progress into Feasibility Study in late 2022/23. The environmental approvals process commenced in 2021 with referral under both the State *Environmental Protection Act 1986* and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) being undertaken. The EPA set a Public Environmental Review level of assessment.

The Department of Agriculture, Water and the Environment (DAWE) determined the project a controlled action under the EPBC Act, with an accredited assessment pathway. DAWE identified that the proposed action is likely to have a significant impact on Matters of National Environmental Significance species, including the Grey Falcon (*Falco hypoleucos*), which has been listed as Vulnerable since the baseline surveys were undertaken (Astron Environmental Services 2020).

1.2 Scope of Work

The Scope of Work was to undertake a review of the Grey Falcon's occurrence within the HD2 survey area based on the records captured during the baseline survey and any local surveys that have been completed in adjacent areas, to inform environmental impact assessment.

2 Grey Falcon

The Grey Falcon (*Falco hypoleucos*) is specially protected under both State and Federal legislation. The species is listed as Criterion 4 ('Vulnerable') under the Western Australian *Biodiversity Conservation Act 2016* and as 'Vulnerable' under the Commonwealth EPBC Act.

The Grey Falcon is an elusive species endemic to mainland Australia. It is the rarest of six Australian falcons and one of the least common raptors (Olsen and Olsen 1986; Marchant and Higgins 1993). The Grey Falcon is a medium-sized raptor (400 g – 500 g) with females weighing on average about 30% more than males (Schoenjahn 2011). The Grey Falcon is a compact, pale grey falcon with a heavy thick chest, long wings and dark wing tips (Debus 2019; Schoenjahn 2010).

The species occurs in arid and semi-arid Australia, including the Murray-Darling Basin, Eyre Basin, central Australia and Western Australia (Marchant and Higgins 1993). The species is mainly found where annual rainfall is less than 500 mm, except when wet years are followed by drought when the species might become marginally more widespread, although it is essentially confined to the arid and semi-arid zones at all times (Schoenjahn 2018). The species appears to be absent from Cape York Peninsula, areas east of the Great Dividing Range in Queensland and New South Wales, south of the Great Dividing Range in Victoria, and south of latitude 26°S in Western Australia (Barrett et al. 2003; Schoenjahn 2018).

The Grey Falcon occurs at low densities across inland Australia (Birdlife Australia 2019). The species frequents timbered lowland plains, particularly *Acacia* shrublands that are crossed by tree-lined water courses (Garnett et al. 2011, Watson 2011, Janse et al. 2015, Ley and Tynan 2016, Schoenjahn 2018). The species has been observed hunting in treeless areas and frequents tussock grassland and open woodland, especially in winter (Janse et al. 2015, Schoenjahn 2018). While breeding, Grey Falcons feed almost exclusively on birds (Cupper and Cupper 1980, 1981, Schoenjahn 2013, Janse et al. 2015, Ley and Tynan 2016). Prey species include doves, pigeons, small parrots and cockatoos, and finches, but a variety of other bird prey species has been recorded (Marchant and Higgins 1993, Deebus and Rose 2000, Hollands 2003, Schoenjahn 2013). Grey Falcons have also been observed predating small mammals and lizards (Czechura 1981, Moore 2016).

Breeding occurs from June to November. Clutch size can vary from one to four eggs (Olsen and Olsen 1986, Garnett et al. 2011, Schoenjahn 2013). Data on laying dates and breeding events suggests that above average rainfall in the first half of the year may encourage breeding (Sutton 2010). Eggs are laid in the old nests of other birds, particularly those of other raptors or corvids. The nests chosen are usually in the tallest trees along watercourses, particularly River Red Gum (*Eucalyptus camaldulensis*) and Coolibah (*E. coolabah*), but falcons also nest in telecommunication towers (Marchant and Higgins 1993, Schoenjahn 2013, Schoenjahn 2018). Therefore, the critical breeding habitat for this species includes major drainage lines with established tall trees. The incubation period is 34 to 35 days (Cupper and Cupper 1980, Hollands 2003, Sutton 2010, Ley and Tynan 2016), with the nesting period between 40 to 50 days (Hollands 2003). Young falcons typically remain with their parents up to at least 12 months after fledging (Schoenjahn 2018).

Schoenjahn (2018) identified 10 plausible threats to the Grey Falcon and ranked them according to severity. These threats were extrapolated from closely related species since there is little data on specific threats to the Grey Falcon. The main threats (threat status equal to high or very high) identified were predation by cats, increased temperatures due to climate change, grazing by exotic herbivores, small population size and nest shortage (Garnett et al. 2011, Schoenjahn 2013).

3 Methods

The primary method of recording Grey Falcon is via opportunistic sightings. Targeted searches for this species are difficult due to their rarity, nomadic nature, and potential to range across a variety of habitats. Historical surveys within and surrounding the project area relied mainly on opportunistic sightings to detect this species. This species could have also been detected during targeted searches for other conservation significant species such as the Northern Quoll (*Dasyurus hallucatus*) and Pilbara

Olive Python (*Liasis olivaceus barroni*). Targeted searching for Grey Falcon involves intensive area searches on foot, involving detection by sight, call and signs of occupancy, especially nests.

Astron completed a Department of Biodiversity, Conservation and Attractions (DBCA) threatened and priority fauna search to identify any new records of this species within 75 km of the HD2 survey area (Department of Biodiversity, Conservation and Attractions 2022) and reviewed known information on this species, the survey effort completed in previous surveys and sightings recorded to date within the vicinity of the survey area.

The likelihood of the species being present within the survey area and the likely impacts to this species from the Project in accordance with the Commonwealth significant impact guidelines (Department of Environment 2013) were assessed.

4 Results

A DBCA database search returned four Grey Falcon records within 50 km of the HD2 survey area. Three of these records were from Area C South Flank deposit in 2008 within approximately 8 km from the HD2 survey area. The three records were of one individual each, all within 5 km of each other and four days apart, suggesting it was likely the same individual on all three occasions. The fourth record was from West Angelas in June 1997, within 22 km of the HD2 survey area. The record was of two individuals and given the record was from June and breeding occurs from June to November, it is possible that this was a record of a breeding pair.

Nine previous fauna surveys within 50 km of the HD2 survey area returned only one (1 record from 1,239 person days) Grey Falcon record (Table 1). During detailed fauna surveys at Rhodes Ridge, two adults were sighted opportunistically together on powerlines leading from Hope Downs 4 camp within Low Hills and Slopes habitat, approximately 45 km south-east from the HD2 survey area (Astron Environmental Services 2020). The record was from August and since breeding occurs from June to November, it is possible that this was a record of a breeding pair.

All habitats previously identified within the HD2 survey area (Astron Environmental Services 2020) could be utilised by the Grey Falcon for foraging, particularly areas where prey bird species are found. However, no Major Drainage Line habitat (preferred breeding habitat) is present within the HD2 survey area. Minor Drainage Line habitat is not considered suitable breeding habitat due to the lack of mature trees within this habitat. The closest potential breeding habitat for the Grey Falcon is the sections of Weeli Wolli Creek near discharge points that support riparian vegetation with larger trees, approximately 5 km north-east of the HD2 survey area, since it provides tall, established trees for breeding.

Table 1: Summary of literature review results from surveys conducted within the vicinity of the survey area.

Author (year)	Survey area; size (ha)	Survey level	Survey timing	Survey effort	Grey Falcon records
Astron (unpublished)	Rhodes Ridge survey area 110,745 ha	Level 2 (2 phases)	June 2019 -present (ongoing)	Baseline fauna assessment of terrestrial vertebrate fauna and short-range endemic (SRE) invertebrate fauna species within the survey area. Habitat assessments, 60 trapping sites, avifauna censuses at each trapping site, foot traverses, nocturnal searches, targeted searches for both vertebrates and SRE invertebrates, and the use of SM2 acoustic bat echolocation recorders and motion sensor cameras.	12 fauna sampling surveys 4 people per survey. Trip length from 7 to 11 days. 1 record of 2 individuals together. **1 record (2 individuals)/ 700 person days.**
Astron (2020)	Hope Downs 2 survey area 10,817.7 ha	Level 2 (3 phases)	November 2017 May 2018 March 2019	Baseline fauna assessment of terrestrial vertebrate fauna and SRE invertebrate fauna species within the survey area. Habitat assessments, 19 trapping sites, avifauna censuses at each trapping site, foot traverses, nocturnal searches, targeted searches for both vertebrates and SRE invertebrates, and the use of SM2 acoustic bat echolocation recorders and motion sensor cameras.	12 days 6 people, 10 days 5 people and 11 days 4 people. 166 person hours. Considered to have moderate potential to occur. Not recorded during survey. **0 records/ 166 person days.**
Biota Environmental Sciences (2006)	Hope Downs Rail Corridor (Juna Downs) Size not stated	Level 2 (1 phase)	September 2005	The survey focused on areas and habitat, which may not have been sampled in previous assessments. Sampling methods included the use of Elliott traps, avifauna surveys, harp nets, and opportunistic methods.	5 days 11 people. 55 person days. Not recorded during survey. **0 records/ 55 person days.**
Biota Environmental Sciences (2009)	Hope Downs 1 Iron Ore mine Size not stated	Desktop Review	N/A	To provide a desktop and habitat-based review of potential SREs and troglobitic fauna values and habitats within the expanded project footprint for the Hope Downs Iron Ore mine project.	3 reports with potential for Grey Falcon records reviewed. No records. Unclear how many person days/hours spent searching. **0 records/ unknown number of person days.**
Biota Environmental Sciences (2011b)	Hope Downs 1 Size not stated	Targeted/ Level 1	June 2010	Five Elliott trapping transects located within potential Northern Quoll habitat. Camera trapping and opportunistic searches.	4 people 7 days. 28 person days. Not recorded during survey. **0 records/ 28 person days.**
Biota Environmental Sciences (2014a)	Hope Downs South West Marra Mamba deposit 2,758 ha	Targeted/ Level 1	September 2013	Four cage and large Elliott trapping transects located within potential Northern Quoll habitat and opportunistic searches. Motion sensor cameras and SM2 acoustic bat echolocation recorders were used to detect the presence of conservation significant fauna species.	8 days 3 people. 24 person days. 21 hours of avifauna survey. Not recorded during survey. **0 records/ 24 person days.**
Ecologia Environment (2014)	Greater West Angelas 17,565 ha	Level 2 (2 phases)	September – October 2012 March 2013	Habitat assessments, 12 trapping sites, avifauna censuses at each trapping site, foot traverses, nocturnal searches, targeted searches for both vertebrates and SRE invertebrates, and the use of SM2 acoustic bat echolocation recorders and motion sensor cameras.	Two phases, 21 days total. 134 person days. 46 hours of searching with the potential to encounter this species. Considered to have moderate potential to occur. Not recorded during survey. **0 records/ 134 person days.**
Ninox Wildlife Consulting (2009a)	Hope Downs 4 Option 1 Infrastructure Corridor Size not stated	Level 2 (1 phase)	May 2008	Four trapping sites, Anabat ultrasonic call detector, avifauna census, SRE sampling and opportunistic searches.	8 days 6 people. 48 person days. 10.5 hours of survey. Considered to have moderate potential to occur. Not recorded during survey. **0 records/ 48 person days.**
Ninox Wildlife Consulting (2009b)	Hope Downs 4 Option 6 Infrastructure Corridor Size not stated	Level 2 (2 phases)	September 2008 April 2009	Six trapping sites, Anabat ultrasonic call detector, avifauna census, SRE sampling and opportunistic searches.	14 days 6 people. 84 person days. 21 hours of avifauna survey. Considered to have moderate potential to occur. Not recorded during survey. **0 records/ 84 person days.**

5 Discussion

Major Drainage Line habitats represent the most suitable breeding and foraging habitat for Grey Falcons since they provide large trees for nesting and waterbodies which act as attractants for prey.

The closest major drainage line is the sections of Weeli Wolli Creek near discharge points that support riparian vegetation with larger trees, approximately 5 km north-east of the HD2 survey area. Since Major Drainage Line habitat does not lie within the HD2 survey area, it is unlikely that the Project will have significant impacts on breeding/nesting success.

The sighting of two individuals near HD4 camp (approximately 45 km from HD2 survey area) shows the species occurs in the general vicinity of the survey area. Given the time of year (August) and the maturity of the individuals, they were likely to be a breeding pair. Since the individuals were observed away from nesting habitat (within Low Hills and Slopes habitat), it is likely that they were foraging at the time of observation.

Grey Falcons forage across a variety of habitats. While suitable foraging habitat exists within the HD2 survey area and the Grey Falcon is likely to utilise the survey area for foraging, they are unlikely to rely solely on habitat within the survey area. Given the nomadic nature of the Grey Falcon, they tend not to be reliant on a specific habitat or area. The lack of fidelity to a set home range means that the species is less likely to be reliant on the habitats of the HD2 survey area and less likely to be impacted by the Project. The fauna habitats within the HD2 survey area are also not considered unique, and similar habitat is found in the surrounding area. Consequently, the HD2 survey area does not represent critical foraging or breeding habitat for this species.

The records of potential breeding pairs and individual records within 50 km of the HD2 survey area suggests a population of Grey Falcons exist in the surrounding area and may utilise the HD2 survey area for foraging.

6 Conclusions

Based on few previous records within 50 km of the HD2 survey area, the lack of historical records within the HD2 survey area despite a large amount of survey effort (1 record from 1,239 person days), lack of preferred breeding habitat within the survey area, and the nature of Grey Falcons to forage across a variety of habitats, it is unlikely that the Project will have a significant impact on this species.

This letter was prepared by Zoologist Brittany Osborn and technically reviewed by Principal Zoologist Dr Jessica Johnston. If you have any queries please contact Senior Project Coordinator, Melissa Ford on (08) 9421 9600.

Yours sincerely
ASTRON ENVIRONMENTAL SERVICES



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Manager - Biodiversity

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C.6: Hope Downs 2 Proposal Matters of National Environmental Significance Fauna Assessment Report

Hope Downs 2 Proposal
Matters of National Environmental Significance Fauna Assessment

September 2019

Prepared for
Rio Tinto



astron

Report Reference: 14292-19-BISR-2Rev1_200130

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Matters of National Environmental Significance Fauna Assessment

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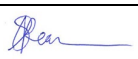
1	30/01/2020	T. Savage	S. Pearse	

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Abbreviations

Abbreviation	Definition
ARU	Autonomous Recording Unit
Astron	Astron Environmental Services
BHT	Bedded Hilltop
BoM	Bureau of Meteorology
CR	Critically Endangered
DBCA	Department of Biodiversity, Conservation and Attractions
DotEE	Department of the Environment and Energy
EN	Endangered
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ha	Hectares
HD1	Hope Downs 1
HD2	Hope Downs 2
IA	International Agreement (Migratory under the EPBC Act and Schedule 5 under the *Biodiversity Conservation Act 2016*)
IBRA	Interim Biogeographic Regionalisation for Australia
km	Kilometres
m	Metres
mm	Millimetres
MNES	Matters of National Environmental Significance
The 'survey area'	Hope Downs 2 Development Envelope, which includes two deposits: Hope Downs 2 and Bedded Hilltop (10,817.7 ha)
TEC	Threatened ecological community
VU	Vulnerable
WM	Wonmunna

Executive Summary

Rio Tinto is evaluating the potential development of additional iron ore deposits at Hope Downs 2 (HD2) in the Pilbara region of Western Australia. Astron Environmental Services was commissioned to undertake an assessment of Matters of National Environmental Significance (MNES) fauna species within the Hope Downs 2 Development Envelope (the survey area, which is 10,817.7 hectares). This MNES assessment was completed by undertaking:

- a review of a previously completed three phase Level 2 vertebrate fauna assessment of the survey area
- a targeted MNES field survey to better understand the distribution of MNES species within the survey area and to address the gaps in effort and coverage of the previously completed surveys.

Eight broad fauna habitat types have been recorded in the survey area: Minor Drainage; Gorge/Gully; Breakaway; Rocky Hill; Low Hill and Slopes; Alluvial Plain; Mulga Woodland; and Stony Plain. Areas of cleared habitat were present within the HD2 and Bedded Hilltop areas where exploration drilling had occurred in the form of drill pads and drill access tracks. The Gorge/Gully and Breakaway habitats in the survey area were considered important habitat for the MNES fauna species: Northern Quoll; Ghost Bat; Pilbara Leaf-nosed Bat; and Pilbara Olive Python. This is due to the microhabitats they provide such as caves and semi-permanent water pools that can exist in these refuge type areas and are important for species foraging and sheltering requirements.

Four MNES fauna species have been recorded within the survey area: Northern Quoll (*Dasyurus hallucatus*) (Endangered; Endangered); Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) (Vulnerable; Vulnerable); Ghost Bat (*Macroderma gigas*) (Vulnerable; Vulnerable); and Oriental Plover (*Charadrius veredus*) (Migratory; Migratory). No further records of any MNES fauna species were obtained during the targeted MNES survey.

The recent Northern Quoll records previously documented within the survey area are significant given that the survey area is at the edge of this species' regional distribution and there has been a paucity of previous local and regional records. These recent quoll records suggested that a resident population may exist in the survey area. No Northern Quolls were recorded during the targeted MNES survey, despite utilising sampling methods specifically designed to target this species. The conditions were considered poor due to dry conditions preceding the survey. The seasonal conditions, along with a high feral cat (*Felis catus*) activity recorded within the survey area, may have contributed to the lack of Northern Quoll records during the targeted MNES survey.

The nine previous records of Ghost Bats within the survey area, as well as two Category 3 roost caves with occasional occupancy and five Category 4 nocturnal roost caves, are consistent with the Ghost Bat foraging in low numbers on the HD2 and Bedded Hilltop. It is consistent with the known regional presence of the Ghost Bat across the central Pilbara region as well as locally on the major ridges immediately to the north of the survey area and west of the Hope Downs 1 mining area.

The Pilbara Leaf-nosed Bat has only been detected by calls at three locations during one previous field survey in May 2018 within the survey area and recordings were deemed to indicate low activity levels. The Pilbara Leaf-nosed Bat records were from foraging individuals in Gorge/Gully and Breakaway fauna habitats with all calls at least three hours after dusk and not consistent with presence of a permanent roost cave nearby.

One Oriental Plover individual was opportunistically sighted during the recent Level 2 surveys (Astron Environmental Services 2019) at the Hope Downs 1 village camp, likely due to the presence

of water at the camp. This species is unlikely to occur on a permanent basis within the unaltered habitats of the survey area.

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1 Introduction

1.1 Project Background

Rio Tinto is evaluating the potential development of additional iron ore deposits at Hope Downs 2 (HD2) in the Pilbara region of Western Australia, approximately 68 km north-west of Newman. Astron Environmental Services (Astron) was commissioned to undertake an assessment of Matters of National Environmental Significance (MNES) fauna species within the 10,817.7 ha HD2 Development Envelope (which includes two deposits: HD2 and Bedded Hilltop) and herein is referred to as the survey area (Figure 1).

1.2 Scope and Objectives

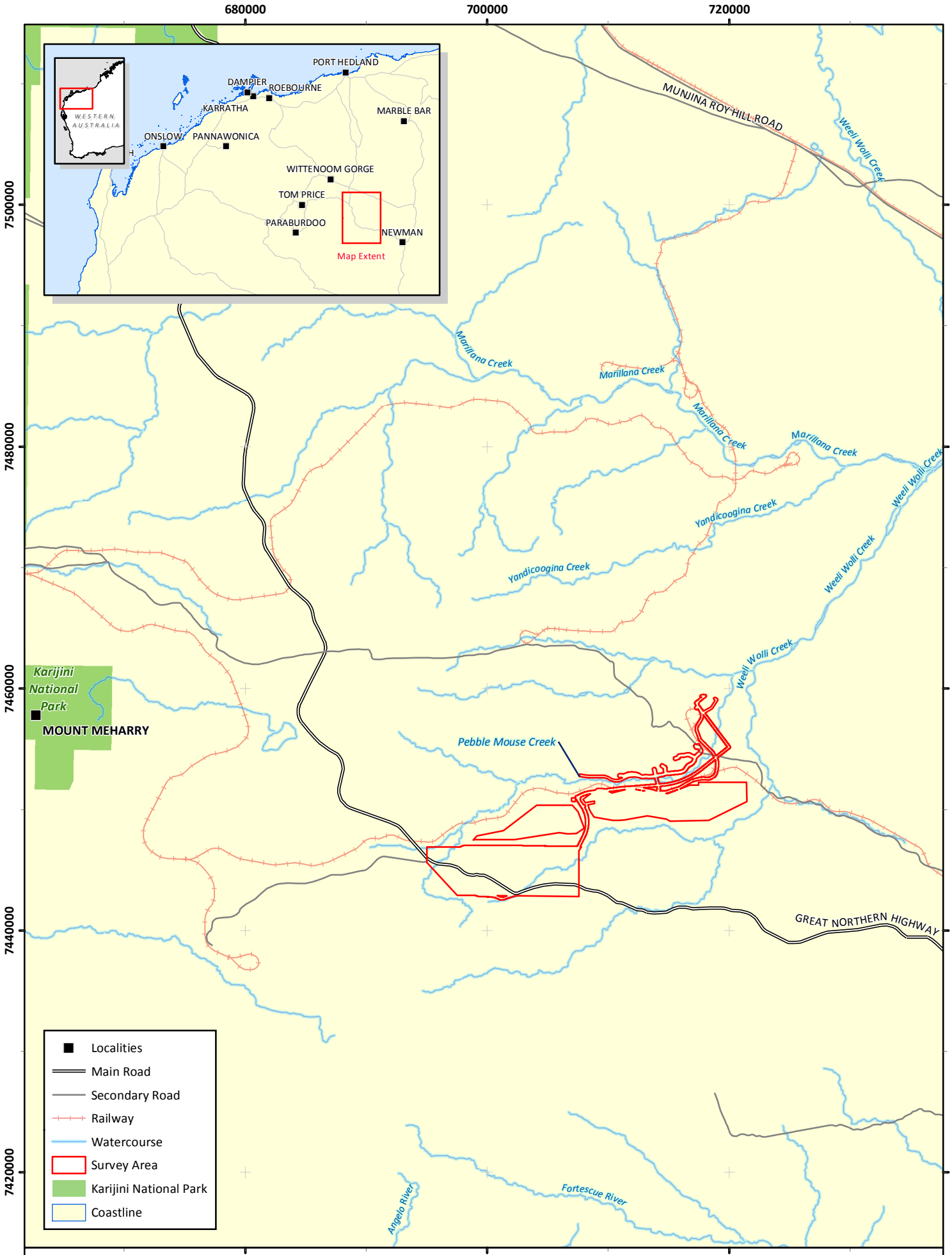
Astron previously completed a three phase Level 2 vertebrate fauna assessment of the survey area, in which four species of MNES were recorded (Astron Environmental Services 2019). These species included: Northern Quoll (*Dasyurus hallucatus*) (EN; EN); Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) (VU; VU); Ghost Bat (*Macroderma gigas*) (VU; VU); and Oriental Plover (*Charadrius veredus*) (IA; IA). Rio Tinto commissioned a targeted MNES survey to better understand the distribution of MNES species within the survey area that was required from the previous surveys conducted and to address the gaps in survey effort and coverage from the previous surveys conducted (Astron Environmental Services 2019).

The objective was to undertake a targeted MNES fauna assessment through a desktop assessment and field survey, and to incorporate data from previous biological surveys conducted in the vicinity of the survey area. The resultant data have been utilised to produce this report, which is intended to support and inform the environmental assessment process in accordance with the requirements of the *Environmental Protection and Biodiversity Act 1999* (EPBC Act). Astron conducted the targeted MNES survey in accordance with the regulatory guidance detailed in Table 1.

The scope and key limitations of the targeted MNES survey are outlined in Table 1 and further detail is provided in Section 3.3 of this report.

Table 1: Summary of Astron's vertebrate MNES fauna assessment.

Level of survey	Survey area size	Survey timing	Relevant regulatory guidance documents	Key survey limitations
Targeted terrestrial MNES vertebrate fauna survey	10,817.7 ha (survey area)	17 – 27 September 2019	• EPBC Act referral guideline for the Endangered Northern Quoll *Dasyurus hallucatus* (Department of the Environment and Energy 2016) • Survey Guidelines for Australia's Threatened Reptiles, Birds, Mammals and Bats Technical Guidance - Sampling Methods for Terrestrial Fauna (Department of the Environment, Water, Heritage and the Arts 2010a, 2010b, Department of Sustainability Environment Water Population and Communities 2011a, 2011b) **Other supporting guidance documents:** • Position Statement No. 3 (Environmental Protection Authority 2002) • Technical Guidance - Terrestrial Fauna Surveys (Environmental Protection Authority 2016a) • Technical Guidance - Sampling Methods for Terrestrial Fauna (Environmental Protection Authority 2016b) • Pilbara Northern Quoll Project: Surveying and Monitoring *Dasyurus hallucatus* in the Pilbara, Western Australia (Dunlop et al. 2014) • Interim Guidelines for Preliminary Surveys of the Night Parrot (*Pezoporus occidentalis*) in Western Australia (Department of Parks and Wildlife 2017)	• Rainfall in the three months preceding the targeted MNES survey was 52% below average. • Feral cat (*Felis catus*) activity appeared to be high in the area at the time of survey. • This is classified as a potentially major limitation for the lack of detection of any MNES species, particularly the Northern Quoll that had previously been recorded.



Rio Tinto

Hope Downs 2 Proposal Matters of National Environmental Significance Fauna Assessment

Figure 1: Survey area location

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Author: J. Johnston	Date: 13-11-2019	Datum: GDA 1994 - Projection: MGA Zone 50
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2 Environmental Context

2.1 Physical Environment

2.1.1 Climate

The climate of the Pilbara region of Western Australia is classified as arid tropical with two distinct seasons: a hot, wet summer (October – April) and a mild, dry winter (May – September) (Bureau of Meteorology 2019)

Based on long-term climatic data from the nearest Bureau of Meteorology weather station at Newman Aero (Station 007176) (approximately 90 km south-east of the survey area) the mean annual rainfall since 1971 is 329.5 mm. The mean maximum daily temperatures since 1996 range between 23.0°C and 39.2°C, and range above 30°C for much of the year (Figure 2) (Bureau of Meteorology 2019).

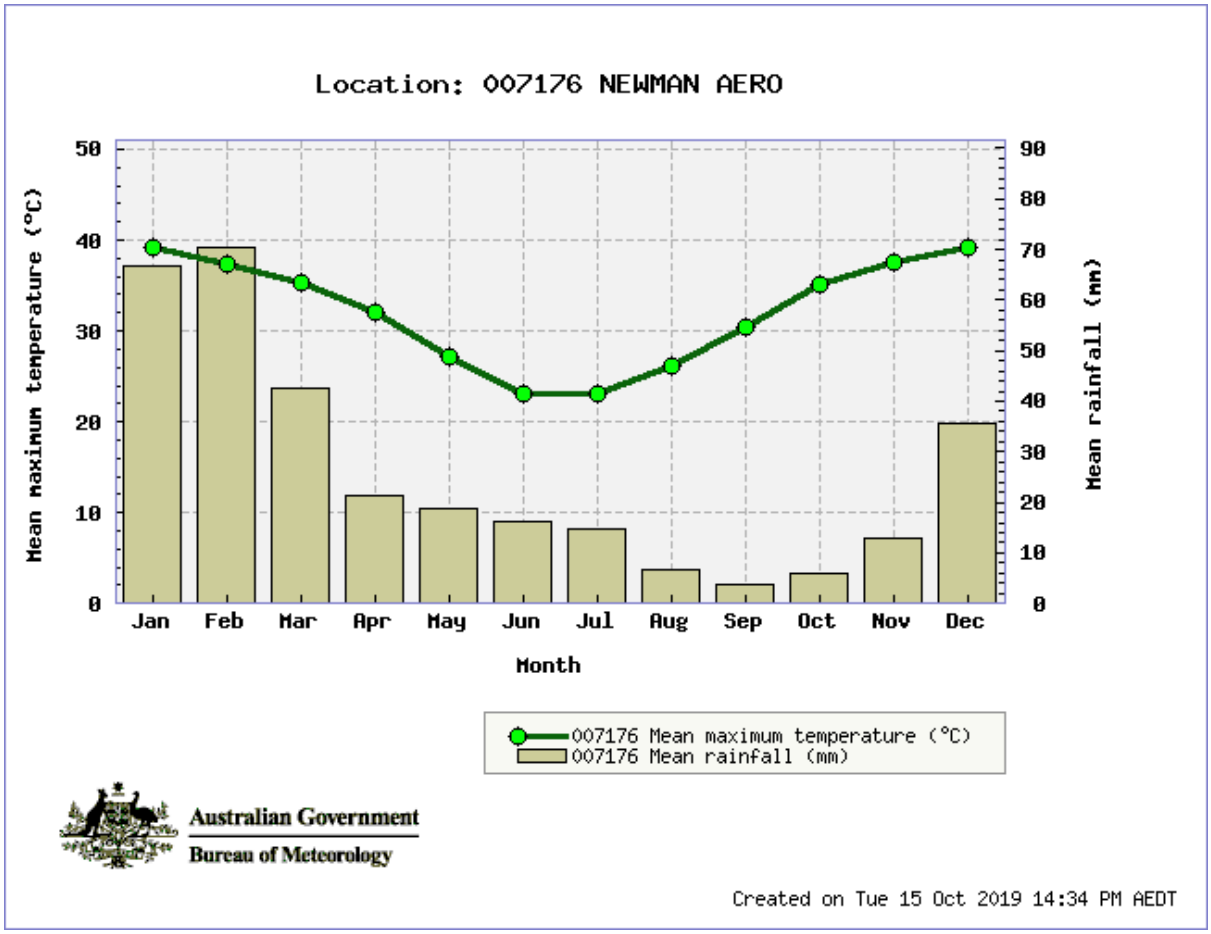

Figure 2: Climate data for Newman Aero Station (Station 007176). Mean annual rainfall data has been calculated from 1971 – 2019 and mean maximum temperature has been calculated from 1996 – 2019 (Bureau of Meteorology 2019).

2.1.2 Geology and Soils

The surface geology of the survey area is comprised of 10 units (Stewart et al. 2008), with Colluvium 3841 being the most dominant (Table 2). Geological mapping of the survey area and surrounds is presented in Figure A.1 (Appendix A).

Table 2: Geological units of the survey area (Stewart et al. 2008).

Geological name	Label	Area (ha)
Alluvium 38485: Channel and flood plain alluvium; gravel, sand, silt, clay, locally calcreted.	Qa	431.4
Brockman Iron Formation: banded iron-formation, chert, mudstone and siltstone.	Lchk	681.7
calcrete 38497 - Pisolitic, nodular or massive calcrete; ferruginous inclusions; calcareous cementing of bedrock and transported materials; locally with intercalated chalcedony; as low mounds, in playa lakes, or as valley calcrete; locally dissected and karstified	Czk	18.1
Colluvium 38491: Colluvium, sheetwash, talus; gravel piedmonts and aprons over and around bedrock; clay-silt-sand with sheet and nodular kankar; alluvial and aeolian sand-silt-gravel in depressions and broad valleys in Canning Basin; local calcrete, reworked laterite.	Qrc	2,587.8
Fortescue Group: Metadolerite, dolerite, gabbro; medium to coarse grained, massive grey-green rock, usually foliated.	Adf	763.6
Jeerinah Formation: Shale, sandstone, siltstone, mudstone, dolomite, local microbanded chert, jaspilite, conglomerate; fine-grained massive rhyolite; mafic tuff with local accretionary lapilli and agglomerate; thin basalt/dolerite and andesitic basalt flows.	Awfj	1,443.9
Marra Mamba Iron Formation: Chert, ferruginous chert, jaspilite, banded iron-formation, minor shale, siltstone, mudstone.	Achm	2,328.3
Mount McRae Shale and Mount Sylvia Formation: Interbedded shale, chert, banded iron-formation.	Ashm	1,212.5
Weeli Wolli Formation: Banded iron-formation (commonly jaspilitic), mudstone, siltstone; common interlayered metadoleritic sills.	Lchw	1,036.1
Wittenoom Formation: Calcitic dolomite, interbedded chert and shale in upper and lower parts, volcaniclastic sandstone.	Alhw	314.3

2.1.3 Surface Water and Hydrology

No Wetlands of International Importance (i.e. Ramsar wetlands) or Nationally Important Wetlands occur within the survey area (Department of the Environment and Energy 2019a). The nearest Nationally Important Wetland is Fortescue Marshes, located 40 km north of the survey area, which has been nominated as a proposed Ramsar site. Pebble Mouse Creek passes through a large proportion of the survey area. One of the upper tributaries of Weeli Wolli Creek passes through the survey area.

2.2 Biological Environment

2.2.1 Interim Biogeographic Regionalisation of Australia

The Interim Biogeographic Regionalisation for Australia (IBRA version 7) divides the Australian continent into 89 bioregions and 419 subregions (Department of the Environment and Energy 2019b). The IBRA regions represent a landscape-based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and fauna. The survey area occurs in the Pilbara bioregion, of which 8.4% is represented in the national reserve system (Department of the Environment 2018).

The biodiversity of the 53 subregions recognised in Western Australia was documented as part of a national audit to provide priorities for conservation action (Department of Conservation and Land Management 2002). The survey area occurs within the Hamersley subregion of the Pilbara region and is described in the audit as:

- Hamersley PIL3 – dissected bold plateaux and ranges of flat lying, moderately folded sandstone and quartzite with vegetation described as Mulga low woodland over tussock grasses occurring on fine textured soils in valley floors, with scattered Snappy gum (*Eucalyptus leucophloia*) over *Triodia brizoides* on skeletal soils of the ranges (Kendrick 2001).

2.2.2 Land Systems

Land systems of the Western Australian rangelands have been mapped and described by the Department of Primary Industries and Regional Development (formerly the Department of Agriculture and Food WA) outlining the distributions and providing comprehensive descriptions of biophysical resources, including soil and vegetation condition. A total of 102 land systems occur in the Pilbara bioregion covering 181,723 km^2. Nine land systems occur in the survey area (Table 3). The layout of these land systems within the survey area is shown in Figure A.2 (Appendix A).

Table 3: Distribution of land systems within the survey area.

Land system	Total area within bioregion (ha)	Total area (ha) (proportion of survey area (%))
Boolgeeda - stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands.	961,847	1,486.0 (13.7)
Calcrete - low calcrete platforms and plains supporting shrubby hard spinifex grasslands.	134,834	4.9 (<0.1)
Egerton - highly dissected plains and slopes with sparse mulga shrublands or shrubby hard spinifex grasslands.	66,849	1.4 (<0.1)
McKay - hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands with acacias and occasional eucalypts.	426,124	326.7 (3.0)
Newman - rugged jaspilite plateaux, ridges and mountains with hard spinifex.	1,994,339	4,647.2 (43.0)
Pindering - gravelly hardpan plains supporting groved mulga shrublands with hard and soft spinifex.	38,738	410.5 (3.8)
Platform - dissected slopes and raised plains supporting shrubby hard spinifex grasslands.	236,390	2,522.2 (23.3)
Rocklea - basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.	2,880,288	1,314.1 (12.1)
Wannamunna - hardpan plains and internal drainage tracts supporting mulga shrublands and woodlands and occasionally eucalypt woodlands.	63,004	104.5 (1.0)

2.2.3 Pre-European Vegetation

Beard (1975) completed broad-scale (1:1,000,000) pre-European vegetation mapping at an association level. The Beard mapping was later used by the Department of Agriculture and Food WA (Shepherd et al. 2002) to compile vegetation units that assisted with identifying pre-European and current extents of vegetation throughout Western Australia.

Three pre-European vegetation units, 82, 18 and 29 (Shepherd et al. 2002), are associated with the survey area (Figure A.3, Appendix A). Table 4 summarises the current and pre-European extent of these three vegetation units in the Pilbara bioregion and the survey area.

2.3 Commonwealth Conservation Categories

The EPBC Act provides a legal framework to protect and manage MNES including listed flora, fauna and ecological communities. These listed flora, fauna and ecological communities are allocated a conservation category, which are outlined in Tables B.1 and B.2 (Appendix B).

Ecological communities may be subject to processes that threaten to destroy or significantly modify it across much of its range. These communities are identified as threatened ecological communities (TECs) that are listed at both Commonwealth level under the EPBC Act (Table B.1, Appendix B).

2.4 Land Use and Tenure

The survey area is located within the Shire of East Pilbara. The local area is mainly used for mineral exploration and mining activity. Karijini National Park is the nearest conservation reserve, located approximately 35 km to the west of the survey area (Figure 1).

Table 4: Extent of pre-European vegetation within the survey area (Department of Biodiversity, Conservation and Attractions 2018a).

Vegetation association	Mapping unit (Beard 1975)	Description	Total area (ha) (proportion of survey area (%))	Pre-European extent (ha)	Current extent in bioregion (ha)	Proportion of pre-European extent remaining (%)	Pre-European extent with formal protection (%)
82	e16Lr t3Hi	Hummock grasslands, low tree steppe; snappy gum over *Triodia wiseana*	5,452.2 (50.4)	2,168,702	2,156,558	99.4	13.7
18	a1Li	Low woodland, open low woodland or sparse woodland; mulga (*Acacia aneura*)	5,339.0 (49.4)	580,512	576,389	99.3	29.6
29	a1Lp	Mulga (*Acacia aneura*) and associated species.	26.5 (0.2)	172,083	171,975	99.9	12.8

3 Methods

3.1 Desktop Assessment

3.1.1 Database Searches

A desktop assessment was previously undertaken as part of the Level 2 survey report (Astron Environmental Services 2019) to assess whether any conservation listed vertebrate and invertebrate species, Short Range Endemic (SRE) invertebrate species or communities were likely to occur within the survey area. The review focused on key habitats for conservation listed fauna and MNES species; the targeted MNES assessment was specific to federal referral under the EPBC Act and so an updated Protected Matters database search was also undertaken (Table 5).

Table 5: Database searches requested.

Database name	Date search results received	Search focus	Search area
Protected Matters Search Tool (Department of the Environment and Energy 2019c)	04/09/2019	Matters of National Environmental Significance	40 km radius from a central point defined by the coordinates: 23°04'04" S, 119°01'56" E

3.1.2 Literature Review

Fauna surveys that have been previously commissioned by Rio Tinto within the vicinity of the survey area and supplied to Astron were incorporated within the desktop assessment. Astron (2019) completed the only baseline systematic fauna survey that have been conducted within the survey area. Other survey areas in relation to the current survey area are shown in Figure 3 and include:

- Biota Environmental Sciences (2006) Hope Downs Rail Corridor (Juna Downs Section) Fauna Survey
- Biota Environmental Sciences (2009) Hope Downs Section 45C Targeted Fauna Review
- Biota Environmental Sciences (2011) Hope Downs Project Life of Mine Targeted Fauna Survey
- Biota Environmental Sciences (2014) Hope Downs South West Marra Mamba Development Targeted Fauna Survey
- Ecologia Environment (2014) Greater West Angelas Terrestrial Fauna Assessment
- Ninox Wildlife Consulting (2009a) A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Infrastructure Corridor Option 1 Near Newman Western Australia
- Ninox Wildlife Consulting (2009b) A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Infrastructure Corridor Option 6 Near Newman Western Australia

3.1.3 Conservation Assessment

Threatened and Migratory MNES listed vertebrate fauna species that were returned from the database searches were categorised for likelihood of occurrence within the survey area according to the criteria listed in Table B.3 (Appendix B). Post survey, the likelihood table was re-assessed utilising the information obtained during the field survey. The additional criteria used for the assessment are

outlined in Table B.3 (Appendix B). The likelihood table was then updated to reflect an improved understanding of the likelihood that a species would actually occur in the survey area.

The potential for the habitats to provide suitable habitat for MNES species Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*), Night Parrot (*Pezoporus occidentalis*) and Pilbara Olive Python (*Liasis olivaceus barroni*) were ranked according to the criteria listed in Table B.4 (Appendix B). The shelter and foraging habitat suitability category for the Northern Quoll was further refined and split into 'probable shelter and foraging habitat' (or core habitat as per the referral guidelines (Department of the Environment and Energy 2016)) and 'potential shelter and foraging habitat'. The criteria for these categories are also listed in Table B.4 (Appendix B).

Given the presence of Ghost Bats within the region and survey area, each cave assessed was categorised as:

- Category 1 – diurnal roost caves with permanent occupancy
- Category 2 – diurnal roost caves with regular occupancy
- Category 3 – roost caves with occasional occupancy
- Category 4 – nocturnal roost caves (opportunistic usage).

These categories are based on definitions for Ghost Bat usage according to Bat Call WA (2019) (Appendix G).

690000 700000 710000 720000 730000

7460000

7450000

Survey Area

Previous Surveys

Hope Downs Project Life of Mine Targeted Fauna Survey (Biota 2011)

Hope Downs Rail Corridor (Juna Downs Section) Fauna Survey (Biota 2006)

Hope Downs 2 Proposal Fauna Survey (Astron 2019)

Hope Downs South West Marra Mamba Development Targeted Fauna Survey (Biota 2014)

Greater West Angelas Terrestrial Fauna Assessment (Ecologia 2014)

A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Infrastructure Corridor Option 1 Near Newman Western Australia (Ninox 2009a)

Hope Downs Section 45C Targeted Fauna Review (Biota 2009)

A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Infrastructure Corridor Option 6 Near Newman Western Australia (Ninox 2009b)

Biota 2011

Biota 2009

Biota 2014

Biota 2006

Ninox 2009b

Astron 2019

Ninox 2009a

Ecologia 2014

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Rio Tinto

Hope Downs 2 Proposal Matters of National Environmental Significance Fauna Assessment

Figure 3: Previous fauna surveys conducted in the vicinity of the Survey Area

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

astron delivering environmental intelligence™

Author: J. Johnston | Drawn: C. Dyde | Date: 20-11-2019 | Figure Ref: 14292B-19-BIDR-2RevA_191120_MNES_Fig03_PrevSurveys

3.2 Field Survey

3.2.1 Survey Timing and Personnel

The MNES fauna assessment was undertaken by Matthew Love, David Keirle, Brittany Osborn and Sean Smithies. The fauna team leader (Matthew Love) has over 10 years of experience conducting vertebrate fauna surveys within the Pilbara region of Western Australia.

The targeted MNES field survey was conducted from 17 to 27 September 2019 under "Fauna Taking (Biological Assessment) Licence" No. BA27000015-2 and "Authorisation to Take or Disturb Threatened Species" No. TFA 2019-0006.

3.2.2 Weather

Daily observations for rainfall and temperature were recorded by Rio Tinto at the Hope Downs 1 (HD1) Weather Station, with long term rainfall and temperature observations being sourced from the Newman Aero BoM station (number 007176), approximately 87 km south-east of the HD1 Weather Station. Local rainfall and temperatures preceding the survey are presented in Figure 4.

The daily maximum temperatures during the targeted MNES survey averaged 28.4°C ± 4°C and daily minimum temperatures averaged 16.1°C ± 4°C. Mean maximum daily temperatures during the targeted MNES survey were approximately 2°C warmer than the long-term mean for September and the mean minimum daily temperatures were approximately 2°C cooler than the long-term mean for September. Rainfall in the 12 months preceding the targeted MNES survey was 204.7 mm (38%) below the long-term mean of 329.5 mm. Rainfall in the 12 weeks preceding the targeted MNES survey was 18 mm (52%) below the mean rainfall for the same period.

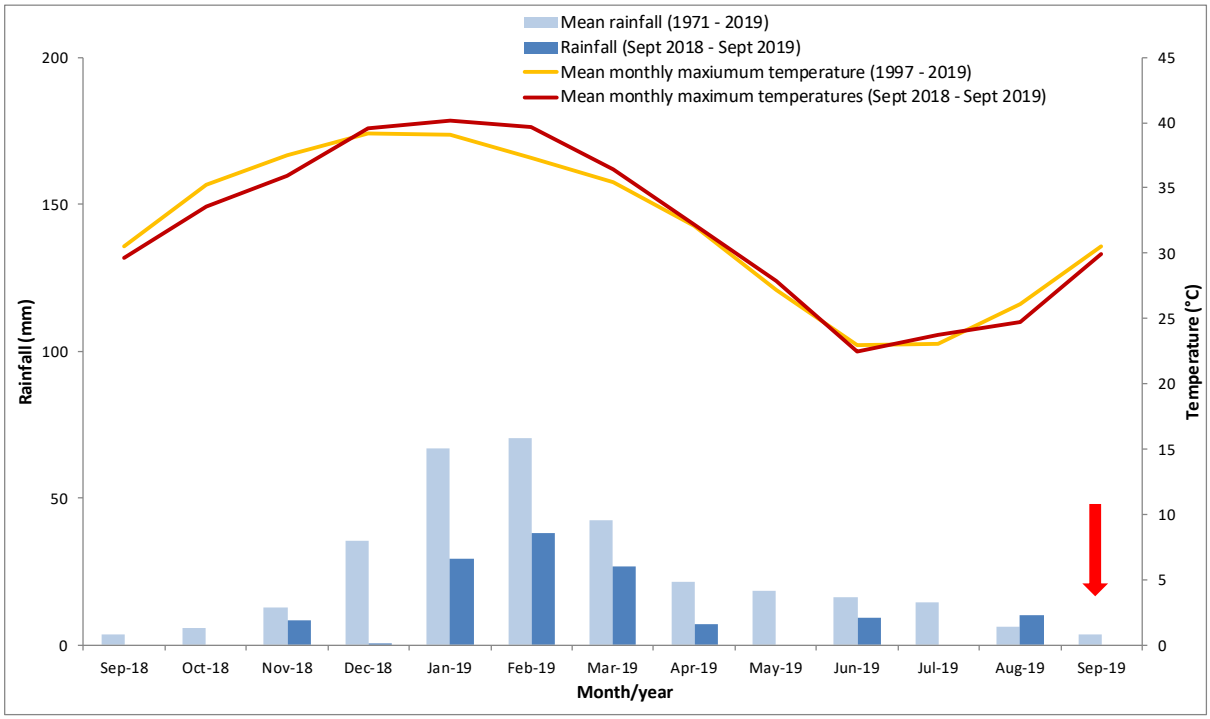

Figure 4: Mean monthly and recorded monthly rainfall (mm) and mean monthly and recorded monthly maximum temperatures (°C). Daily records supplied by Rio Tinto and long term records supplied by the Bureau of Meteorology from the Newman Aero station (number 007176). The red arrow displays the timing for the targeted MNES survey.

3.2.3 Vertebrate Fauna

3.2.3.1 Northern Quoll Trapping

A trapping program, designed to detect the presence of the Northern Quoll was implemented within the survey area. Four sites, each with 50 wire cage traps spaced at approximately 50 m intervals, were set within the survey area in line with the standardised regional monitoring protocol. This methodology is designed by the Department of Biodiversity, Conservation and Attractions (DBCA) and referral guidelines (Dunlop et al. 2014, Department of the Environment and Energy 2016). The cage traps were set for seven nights, covered with hessian for shade and protection, and baited with peanut butter, oats and sardines (Dunlop et al. 2014). The locations of the cage traps are shown in Figure C.1 and detailed in Table C.1 (Appendix C).

3.2.3.2 Motion Sensitive Cameras

Motion sensitive cameras (Moultrie and Reconyx HC600 HyperFire) were set at three locations as per methods set out in the referral guidelines (Department of the Environment and Energy 2016). Three targeted camera transects each consisting of 10 motion sensitive cameras spaced at approximately 100 m intervals, were set for between four and six nights with a combined trapping effort of 140 camera trap nights. The cameras were baited and placed in prospective/suitable habitat such as cave entrances aimed at targeting MNES species, specifically the Northern Quoll. Camera locations are shown in Figure C.1 and detailed in Table C.1 (Appendix C).

3.2.3.3 Acoustic Bat Surveys

Acoustic ultrahigh frequency equipment was used to record the presence of bats, in particular the Pilbara Leaf-nosed Bat and Ghost Bat. Acoustic recording devices (Song Meter (SM) 2 SM2BAT+ and SM4) were positioned in a total of five locations to achieve a broad coverage of the survey area, and to target potential flyways for the Pilbara Leaf-nosed Bat. The detectors were set for between four and five nights, resulting in a total of 17 recording nights. One unit failed to operate (BAT32). The locations are depicted in Figure C.1 and detailed in Table C.1 (Appendix C). The bat echolocation data collected in the field was analysed by Robert Bullen (Bat Call WA 2019).

3.2.3.4 Audio Night Parrot Survey

Due to the recent discovery of Night Parrot populations in Western Australia, DBCA have published Interim Guidelines for Preliminary Surveys of Night Parrots in Western Australia (Environmental Protection Authority 2016a, 2016b). The survey area location is mapped as 'high priority for survey' for this species so passive acoustic surveys were undertaken and Autonomous Recording Units (ARUs) used in the most prospective habitats (Stony Plain habitat containing *Triodia*).

The ARUs were set at two locations for five and six nights each and recorded from 1 hour pre-sunset to 1 hour post-dawn. The audio data was recorded at 44.1 k bits and covered the frequency range 100 kHz to 21,000 kHz, which brackets the Night Parrot call frequency range of 1,500 kHz to 3,500 kHz. The audio data collected in the field was analysed by Robert Bullen (Bat Call WA 2019). The ARU locations are depicted in Figure C.1 and detailed in Table C.1 (Appendix C).

3.2.3.5 Targeted Searches

The aim of the targeted searches was to identify areas of potentially suitable habitat for conservation significant fauna, such as caves, and secondary signs including tracks, scats, diggings and burrows. Visual observation for conservation significant fauna habitat was ongoing whilst moving through the survey area. Track logs were recorded using a handheld GPS and are shown in

Figure C.1 (Appendix C). Any opportunistic sightings of fauna species were recorded whilst traversing the survey area.

3.3 Limitations

Following completion of the desktop assessment and targeted MNES survey, a review of any limitations that may affect a complete assessment of the data collected was conducted. The limitations listed in Table 6 are based on those suggested as considerations in Technical Guidance - Terrestrial Fauna Surveys (Environmental Protection Authority 2016b, 2016a); however, still have relevance for this targeted MNES fauna assessment. Due to the number of fauna surveys conducted in the survey area, the populations of conservation significant fauna are considered to be relatively well documented.

Table 6: Statement of limitations for the targeted vertebrate fauna assessment.

Potential limitation	Degree of limitation	Statement regarding potential limitations
(i) Competency/experience	No limitation	The two senior zoologists leading the survey teams have over 10 years' experience conducting fauna surveys in the Pilbara.
(ii) Scope What faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions.	No limitation	The survey scope was able to be completed and all sampling methods were adequately employed. The fauna observed and identified are likely to represent a portion of the suite of species that utilise the survey area.
(iii) Proportion of fauna identified, recorded and/or collected	Minor limitation	Ghost Bats are notoriously difficult to detect as their echolocation calls show wide variation and they do not always call (utilising ultrasonic calls) when exiting and entering caves (McKenzie and Bullen 2009). In addition acoustic recording devices are not always successful in picking up the vocal calls (audible sound) when Ghost Bats utilise certain feeding strategies. However, searches of fauna habitat with the potential to support roost caves were also undertaken to record feeding evidence or individuals roosting in caves.
(iv) Sources of information Previously available information (whether historic or recent) as distinct from new data.	No limitation	Adequate information was available from database searches and previous studies in the survey area and region.
(v) Proportion of task achieved. Further work which might be needed?	No limitation	The survey scope was able to be completed and all sampling methods were adequately employed.
(vi) Timing/weather/season/cycle	Minor limitation	Rainfall in the three months preceding the targeted MNES survey was 18 mm (52%) below the mean rainfall for the same period; therefore, the seasonal conditions were considered to be dry. This may have contributed to the lack of MNES species, particularly the Northern Quoll, detected during the survey. However, a three-phase Level 2 survey has recently been completed within the survey area, with Phase 3 experiencing good seasonal conditions. Therefore, this limitation is considered minor when these surveys are also considered.
(vii) Disturbances For example fire, flood, accidental human intervention which affected results of survey	Potentially major limitation	Large areas of the Bedded Hilltop area were affected by recent fires and therefore were not suitable for sampling. Feral cat activity appeared to be high in the area at the time of survey and may have contributed to the lack of MNES species, particularly the Northern Quoll, detected during the survey.
(viii) Intensity In retrospect, was the intensity adequate?	No limitation	The intensity of the surveys was considered adequate for a targeted MNES fauna survey.

Potential limitation	Degree of limitation	Statement regarding potential limitations
(ix) Completeness Was the relevant area fully surveyed?	No limitation	All target habitats considered suitable for MNES species within the survey area were adequately surveyed.
(x) Resources Degree of expertise available in animal identification to taxon level.	No limitation	Adequate resources were available to identify fauna species. All technical personnel involved in identification have extensive experience in conducting vertebrate fauna surveys in the Pilbara.
(xi) Remoteness and/or access problems	No limitation	No access constraints affected the survey outcomes.
(xii) Availability of contextual information For example biogeographic information on the region.	No limitation	Database searches and previous vertebrate fauna surveys in the vicinity of the survey area provided contextual information.

4 Results

4.1 Desktop Assessment

A Protected Matters database search revealed 17 MNES species, specifically listed Threatened and Migratory species. Fauna species listed as Marine and Invasive were not considered in this assessment. These 17 species comprised of one reptile species, 12 bird species and four mammal species (Table D.1 Appendix D). Of these, four species were considered to have a 'high' likelihood (inclusive of those recorded within the survey area), two species were considered to have a 'moderate' likelihood and 11 were considered to have a 'low' likelihood of occurrence within the survey area (Table D.1, Appendix D). This is based on their respective ecology, habitats considered likely to be present and any previous records from historic survey and database records.

Previous surveys undertaken for Rio Tinto in the vicinity of the survey area recorded five MNES fauna species: Fork-tailed Swift (*Apus pacificus*) (IA; IA); Oriental Plover; Northern Quoll*;* Pilbara Leaf-nosed Bat; and Ghost Bat (Table 7). Astron (2019) completed a three phase Level 2 vertebrate fauna assessment of the survey area, in which four MNES species were recorded: Northern Quoll; Pilbara Leaf-nosed Bat; Ghost Bat; and Oriental Plover.

Table 7: Summary of literature review results from surveys conducted within the vicinity of the survey area.

Author (year)	Survey area; size (ha)	Survey level	Survey timing	Survey effort	MNES vertebrate fauna recorded
Astron (2019)	Hope Downs 2 survey area 10,817.7 ha	Level 2 (3 phases)	November 2017 May 2018 March 2019	Baseline fauna assessment of terrestrial vertebrate fauna and SRE invertebrate fauna species within the survey area. Habitat assessments, 19 trapping sites, avifauna censuses at each trapping site, foot traverses, nocturnal searches, targeted searches for both vertebrates and SRE invertebrates, and the use of SM2 acoustic bat echolocation recorders and motion sensor cameras.	• Northern Quoll (*Dasyurus hallucatus*) • Ghost Bat (*Macroderma gigas*) • Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) • Oriental Plover (Charadrius veredus)
Biota Environmental Sciences (2006)	Hope Downs Rail Corridor (Juna Downs) Size not stated	Level 2 (1 phase)	September 2005	The survey focused on areas and habitat, which may not have been sampled in previous assessments. Sampling methods included the use of Elliott traps, avifauna surveys, harp nets, and opportunistic methods.	Ghost Bat (*Macroderma gigas*)
Biota Environmental Sciences (2009)	Hope Downs 1 Iron Ore mine Size not stated	Desktop Review	N/A	To provide a desktop and habitat-based review of potential SREs and troglobitic fauna values and habitats within the expanded project footprint for the Hope Downs Iron Ore mine project.	N/A
Biota Environmental Sciences (2011)	Hope Downs 1 Life of Mine Size not stated	Targeted/ Level 1	June 2010	Five Elliott trapping transects located within potential Northern Quoll habitat and opportunistic searches.	Northern Quoll (*Dasyurus hallucatus*)
Biota Environmental Sciences (2014)	Hope Downs South West Marra Mamba deposit 2,758 ha	Targeted/ Level 1	September 2013	Four cage and large Elliott trapping transects located within potential Northern Quoll habitat and opportunistic searches. Motion sensor cameras and SM2 acoustic bat echolocation recorders were used to detect the presence of conservation significant fauna species.	Nil

Author (year)	Survey area; size (ha)	Survey level	Survey timing	Survey effort	MNES vertebrate fauna recorded
Ecologia Environment (2014)	Greater West Angelas 17,565 ha	Level 2 (2 phases)	September – October 2012 March 2013	Habitat assessments, 12 trapping sites, avifauna censuses at each trapping site, foot traverses, nocturnal searches, targeted searches for both vertebrates and SRE invertebrates, and the use of SM2 acoustic bat echolocation recorders and motion sensor cameras.	• Fork-tailed Swift (*Apus pacificus*) • Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)
Ninox Wildlife Consulting (2009a)	Hope Downs 4 Option 1 Infrastructure Corridor Size not stated	Level 2 (1 phase)	May 2008	Four trapping sites, Anabat ultrasonic call detector, avifauna census, SRE sampling and opportunistic searches.	Nil
Ninox Wildlife Consulting (2009b)	Hope Downs 4 Option 6 Infrastructure Corridor Size not stated	Level 2 (2 phases)	September 2008 April 2009	Six trapping sites, Anabat ultrasonic call detector, avifauna census, SRE sampling and opportunistic searches.	Nil

4.2 Field Survey

4.2.1 Fauna Habitat

Eight broad fauna habitat types have been previously detailed within the survey area: Minor Drainage; Gorge/Gully; Breakaway; Rocky Hill; Low Hill and Slopes; Alluvial Plain; Mulga Woodland; and Stony Plain (Astron Environmental Services 2019).

4.2.2 Habitat Suitability for MNES Species

Northern Quoll

Approximately 107 ha (1%) of the survey area, comprising Gorge/Gully and some Breakaway habitats, was considered 'probable shelter and foraging habitat' (or core habitat as per the referral guidelines (Department of the Environment and Energy 2016)), based on proximity to known quoll records, microhabitat features and orientation aspect (Figure E.1, Appendix E). Approximately 200 ha (2%) of the survey area was considered 'potential shelter and foraging habitat', comprising mainly smaller Breakaway habitats (Figure E.1, Appendix E). The Gorge/Gully and Breakaway habitats contain rocky environments of high relief that are particularly important for Northern Quolls in the Pilbara as they provide denning sites for breeding and shelter and diverse microhabitats for foraging.

Approximately 1,858 ha (17%) of the survey area was considered suitable foraging and dispersal habitat (Minor Drainage and Rocky Hill habitats), particularly where these habitats were in close association with the Gorge/Gully and Breakaway habitats as they provided microhabitats such as crevices and cracks for foraging (Figure E.1, Appendix E).

The remaining 8,653 ha (80%) of the survey area was considered to provide limited foraging and dispersal habitat, consisting of Alluvial Plain, Low Hills and Slopes, Mulga Woodland, Stony Plain and Disturbed habitats (Figure E.1, Appendix E).

Pilbara Leaf-nosed Bat

Approximately 307 ha (3%) of the survey area, comprising the Gorge/Gully and Breakaway habitat, was considered potential shelter and foraging habitat for this species due to the presence of nocturnal refuge caves (Figure E.2, Appendix E). No permanent roosts for this species have been recorded in the survey area.

Approximately 9,678 ha (89%) of the survey area, which consisted of Alluvial Plain, Minor Drainage, Low Hills and Slopes, Mulga Woodland, Rocky Hill and Stony Plain habitats was considered suitable foraging and dispersal habitat (Figure E.2, Appendix E). This species is likely to forage only occasionally within the survey area based on recorded calls, taking advantage of benign conditions and dispersing temporarily in search of additional foraging and roosting opportunities (Bat Call WA 2019).

The remaining 833 ha (8%) of the survey area, comprising Disturbed areas, was considered to provide limited foraging and dispersal habitat (Figure E.2, Appendix E).

Ghost Bat

Approximately 307 ha (3%) of the survey area, comprising the Gorge/Gully and Breakaway habitat, was considered potential shelter and foraging habitat (Figure E.3, Appendix E), due to the presence

of caves that potentially support roost sites. Often Gorge/Gully and Breakaway habitats contain caves and deep shelters that are used as nocturnal feeding roosts by Ghost Bats.

Previously, seven caves have been recorded within the survey area (Table F.1, Appendix F) (Astron Environmental Services 2019). Two caves (Caves 1 and 5) were categorised as Category 3 roost caves with occasional occupancy due to the presence of Ghost Bat feeding evidence (scats) and/or the physical properties of the caves were conducive to diurnal roosting (Astron Environmental Services 2019).

The remaining five caves (Cave 2, 4, 6, 7 and 8) were categorised as Category 4 nocturnal roost caves (opportunistic usage) given the physical properties of the caves (Table F.1, Appendix F). Ghost Bat feeding evidence was recorded in Caves 4 and 7; however, these sites were more overhangs rather than caves and not conducive to diurnal roosting for this species (Astron Environmental Services 2019).

No additional caves were recorded during the targeted MNES survey. It is considered unlikely that additional significant caves exist within the survey area; however, the possibility cannot be discounted as the survey area was not searched in its entirety. If present, they are likely to be found within the Gorge/Gully and Breakaway habitats only. Both habitats also contain complex vegetation structures and microhabitats that support prey species and foraging sites for the Ghost Bat.

Approximately 1,858 ha (17%) of the survey area, which consisted of Minor Drainage and Rocky Hill habitats, was considered suitable foraging and dispersal habitat (Figure E.3, Appendix E). The taller trees found in the Minor Drainage habitats provide ideal foraging/hunting perches particularly in areas that have the potential for semi-permanent surface water and contain thick vegetation. The Rocky Hill habitat contains microhabitats such as boulder piles, cracks and crevices that support a wide range of prey species for the Ghost Bat.

The remaining 8,653 ha (80%) of the survey area, comprising the Alluvial Plain, Low Hills and Slopes, Mulga Woodland, Stony Plain and Disturbed habitats, was considered to provide limited foraging and dispersal habitat (Figure E.3, Appendix E).

Night Parrot

None of the habitats of the survey area supported old, large and unburnt *Triodia* clumps that are considered the primary habitat requirement for the Night Parrot (Department of Parks and Wildlife 2017). The Alluvial Plain, Minor Drainage, Mulga Woodland and Stony Plain habitats (3,230 ha, 30%) within the survey area were mapped as suitable foraging and dispersal habitat but the Night Parrot is unlikely to occur within the survey area (Figure E.4, Appendix E). Most of these habitats (particularly within the Bedded Hilltop (BHT) and HD2 areas) were impacted by recent fires (less than 10 years old), pastoral and mining impacts over a long duration, very sparse ground cover vegetation and a lack of chenopod communities or suitable size/age *Triodia* hummocks and are unlikely to support the Night Parrot.

The remaining 7,587 ha (70%) was considered to provide limited foraging and dispersal habitat (Figure E.4, Appendix E).

Pilbara Olive Python

Approximately 307 ha (3%) of the survey area, comprising the Gorge/Gully and Breakaway and habitats, was considered as potential shelter and foraging habitat for the Pilbara Olive Python

(Figure E.5, Appendix E). The caves and overhangs of the Gorge and Breakaway habitats are likely to provide denning sites and ambush locations frequented by this species.

Approximately 870 ha (8%) of the survey area was considered suitable foraging and dispersal habitat, which consisted of Minor Drainage habitats (Figure E.5, Appendix E).

The remaining 9,641 ha (89%) of the survey area was considered to provide limited foraging and dispersal habitat, consisting of Alluvial Plain, Low Hills and Slopes, Mulga Woodland, Rocky Hill, Stony Plain and Disturbed habitats (Figure E.5, Appendix E).

4.2.3 Fauna Species

4.2.3.1 MNES Species Recorded

Four MNES fauna species have been recorded within the survey area. The locations of these species records are shown in Figure F.1 (Appendix F).

Northern Quoll (*Dasyurus hallucatus*) (EN; EN)

The Northern Quoll occurs in a variety of habitats (Oakwood 2008) but is commonly found in open lowland savannah forest and rocky escarpments. Rocky areas are a particularly important zone for Northern Quolls in the Pilbara as these areas retain water and provide a diversity of microhabitats. These areas also tend to have greater floristic diversity and productivity resulting in greater prey density compared to non-rocky areas. These rocky areas also provide refuge from feral cats, fire and livestock (Hill and Ward 2010) and provide breeding potential (Department of the Environment and Energy 2016).

The Northern Quoll was recorded 14 times during the previous Astron surveys (Astron Environmental Services 2019) (Appendix F.1, Appendix F). The majority of the records were made within Gorge/Gully and Breakaway habitats via motion camera detection (10 records), followed by scat recordings (three records) and a solitary male individual was captured. Most of the records were made at BHT (10 recordings), followed by four records at the Wonmunna (WM) area. No records of the Northern Quoll were made within the HD2 deposit. The capture of an individual sub-adult male as well as multiple motion camera recordings at separate locations suggested that a resident population may exist in the survey area, particularly within the BHT area. However, no Northern Quolls were recorded during the current targeted MNES survey, despite utilising sampling methods such as cage traps and motion sensitive cameras, specifically designed to target this species.

Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) (VU; VU)

Pilbara Leaf-nosed Bats are known to require deep caves characterised by high levels of humidity and stable temperatures (Churchill 2008). This is a result of their limited ability to conserve heat and water (Armstrong 2001, Churchill 2008). Caves deep enough to create this environment are relatively uncommon in the Pilbara, with only 20 to 25 roost sites being known (R. Bullen 2014, pers. comm. 20 Oct 2014). Foraging habitat for the Pilbara Leaf-nosed Bat is diverse and includes riparian vegetation, hummock grassland, and sparse tree and shrub savannah (Duncan et al. 1999). Roost sites for the Pilbara Leaf-nosed Bat can be classified (Department of the Environment 2017) based on the following criteria:

- Permanent diurnal roosts—occupied year-round and likely the focus for some part of the nine-month breeding cycle; considered as critical habitat that is essential for daily survival.

- Non-permanent breeding (maternal) roosts—evidence of usage during some part of the nine-month breeding cycle (July to March), but not occupied year-round; considered as critical habitat that is essential for both daily and long-term survival.
- Transitory diurnal roosts—occupied for part of the year only, outside the breeding season (i.e. April to June), and which could facilitate long distance dispersal in the region; considered as critical habitat that is essential for both daily and long-term survival.
- Nocturnal refuge—occupied or entered at night for resting, feeding or other purposes, with perching not a requirement. Excludes overhangs. Not considered critical habitat but are important for persistence in a local area.

Pilbara Leaf-nosed Bats have also been recorded flying over small watercourses amongst granite boulder terrain, over pools and low shrubs in ironstone gorges, and above low shrubs and around pools in gravelly watercourses with *Melaleuca leucadendron*, such as in Barlee Range Nature Reserve (Armstrong 2001). In the Pilbara, the species has been observed in *Triodia* hummock grasslands covering low rolling hills and shallow gullies, with scattered *Eucalyptus camaldulensis* along the creeks (Armstrong 2001, Churchill 2008).

The Pilbara Leaf-nosed Bat was not recorded during the current survey but was recorded at three locations at low activity levels within the survey area during previous Astron surveys (Astron Environmental Services 2019) (Table F.1, Appendix F). The Pilbara Leaf-nosed Bat records were from foraging individuals in Gorge/Gully and Breakaway fauna habitats, as the calls at all three sites were at least three hours after dusk and are not consistent with the presence of a permanent roost cave nearby (Astron Environmental Services 2019). This species is likely to forage only occasionally within the survey area taking advantage of benign conditions and dispersing temporarily in search of additional foraging and roosting opportunities (Bat Call WA 2019).

Ghost Bat (*Macroderma gigas*) (VU; VU)

The preferred habitat of Ghost Bats is considered to be rocky gorges and breakaways that support caves and crevices used as maternity roosts. The Ghost Bat uses different natural formations for various purposes and for groups to persist they generally require habitats that provide:

- a selection of roosting opportunities with night roosts or feeding sites, day roosts and at least one deep cave with characteristics of a maternity roost
- nearby gullies and gorges with vegetation of vertical complexity (diverse vegetation heights and density) and presence of water that would attract prey species
- a productive foraging area within a 5 km to 10 km radius, usually including a good quality riparian drainage line.

Transient roosts and feeding sites are used by small numbers of Ghost Bats, whereas maternity roosts are used by larger colonies (Armstrong and Anstee 2000). Night feeding roosts (feed caves) are typically shallow caves and shelters/overhangs high in the strata and poorly insulated from the elements (Armstrong and Anstee 2000). Transient day roosts are deeper and more complex, have more insulation providing a more stable temperature and typically have one or more large chambers high enough to avoid predators. Maternity roosts provide additional features to support a reproducing population including high temperature (27°C to 33°C) and humidity (>85%) (Armstrong and Anstee 2000). The Ghost Bat can have a relatively small nightly foraging range (up to 2 km from the roost where it has been studied in Queensland) (Tidemann et al. 1985, Pettigrew et al. 1986), but has the flight capability to range widely (Bullen and McKenzie 2002) perhaps tens of kilometres

in a night. This is evident from genetic markers, which suggest that males are particularly likely to disperse long distances throughout the landscape (Worthington Wilmer et al. 1994, 1999).

Ghost Bats require caves of varying shapes and sizes to fulfil each of its ecological requirements. Cave usage can be classified into three categories: feed caves, day roosts and maternal roosts.

- Feed caves are typically shallow caves or overhangs high in the strata that are poorly insulated from the elements (Armstrong and Anstee 2000). Ghost Bats hunt at night and use feed caves to consume prey they have captured in the surrounding area. Feed caves often contain Ghost Bat scats and/or feeding remnants (typically feathers and small animal bones).
- Day roosts are generally deep, complex caves or disused mines that contain domed ceilings, fissures or passages which create a stable microclimate. These caves are usually lower in the strata making them well insulated. The stable temperature and elevated humidity of these caves relative to the ambient conditions create physiologically benign conditions (Leitner and Nelson 1967, Hall et al. 1997, Armstrong and Anstee 2000, McKenzie and Bullen 2009).
- Maternal roosts like day roosts are generally deep, complex caves or disused mines that contain domed ceilings, fissures or passages which create a stable microclimate and often contain multiple entrances (McKenzie and Hall 2008). Maternal roosts have a stable temperature of 23°C to 28°C and moderate to high relative humidity of 50% to 100% (Pettigrew et al. 1986, Churchill and Helman 1990, Armstrong and Anstee 2000, Churchill 2008).

The Ghost Bat was recorded on nine occasions within the survey area during the previous Astron surveys, through acoustic recordings (calls), scats recorded in nocturnal feed caves and an individual sighted during spotlighting within the HD2 area (Astron Environmental Services 2019) (Table F.1, Appendix F). Two of seven caves previously recorded within the survey area (Caves 1 and 5) were deemed to be Category 3 roost caves with occasional occupancy. These caves are not considered significant to the long-term presence of the species (Bat Call WA 2019). The other five previously recorded caves were deemed to be Category 4 nocturnal roost caves (opportunistic usage) and are not considered significant. These Category 4 caves are common in the landscape as numerous observations suggest that the majority of caves and adits in the Pilbara are used in at least an opportunistic manner by itinerant Ghost Bats (Bat Call WA 2019). No further observations of the Ghost Bat or additional caves were recorded during the targeted MNES survey. It is considered unlikely that additional significant caves exist within the survey area; however, the possibility cannot be discounted as the survey area was not searched in its entirety. The areas not traversed were assessed visually from a distance where possible and considered a low probability of containing caves. If present, they are likely to be found within the Gorge/Gully and Breakaway habitats only.

Oriental Plover (*Charadrius veredus*) (IA; IA)

The Oriental Plover is a non-breeding visitor to Australia, where the species occurs in both coastal and inland areas, mostly in northern Australia. Most records are along the north-western coast, between the Exmouth Gulf and Derby in Western Australia (Department of the Environment and Energy 2019d). This species occupies sparsely vegetated plains, beaches and tidal flats, saltworks and sometimes sewage ponds.

One individual was opportunistically sighted during a previous survey at the HD1 village camp, likely due to the presence of water at the camp (Astron Environmental Services 2019) (Table F.1, Appendix F). It was not recorded during the targeted MNES survey.

4.2.3.1 MNES Species Potentially Occurring

Pilbara Olive Python (*Liasis olivaceus barroni*) (VU; VU)

The Pilbara Olive Python prefers escarpments, deep gorges, water holes and rock piles associated with permanent pools in rocky areas in the ranges of the Pilbara region (Pearson 1993, Wilson and Swan 2010). Microhabitat preferences of the Pilbara Olive Python are under rock piles, on top of rocks or under spinifex (Tutt et al. 2004). Individuals spend the cooler winter months within caves and rock crevices away from water sources. In the warmer summer months, the pythons are found to move around widely, usually in close proximity to water and rock outcrops (Wilson and Swan 2010).

This species was not recorded during the targeted MNES survey or during previous surveys (Astron Environmental Services 2019). Despite this it is still considered likely to be found within the Gorge/Gully, Breakaway and Minor Drainage habitats given there are 14 previous records of this species in the vicinity of the survey area (Department of Biodiversity, Conservation and Attractions 2018b) and suitable habitat exists within the survey area.

5 Discussion

5.1 MNES Habitat

Habitats within the survey area were not restricted at the local or subregional scale and no uncommon geological units or land systems occurred within the survey area. In a regional context, the Gorge and Breakaway habitats in the Pilbara are restricted to the Chichester and Hamersley Ranges, but they are well represented in these areas. The Gorge/Gully and Breakaway habitats in the survey area were considered important habitat for MNES fauna species. This is due to the microhabitats they provide such as caves and semi-permanent water pools that can exist in these refuge type areas and are important for species foraging and sheltering requirements. Gorge/Gully and Breakaway habitats were considered suitable for the MNES species Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat and Pilbara Olive Python. With respect to the Northern Quoll, these habitats were divided into 'probable shelter and foraging habitat' (or core habitat), which comprised most of the Gorge/Gully habitat within the survey area and Breakaway habitats within the BHT area; and 'potential shelter and foraging habitat', comprising the smaller Breakaway habitats, particularly within the HD2 area.

The Rocky Hill habitat within the survey area has been impacted by fire. It is widespread and common throughout the Pilbara bioregion and is not restricted to the Chichester and Hamersley Ranges. This habitat generally had low vegetation complexity and low diversity of microhabitats; however, the MNES species Northern Quoll, Pilbara Leaf-nosed Bat and Ghost Bat are likely to traverse and forage within these habitats.

The Minor Drainage habitats within the survey area were generally devoid of vegetation and impacted from pastoral activities, and are unlikely to provide significant refuge for species, but may provide dispersal and/or foraging habitat for MNES species Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat and Pilbara Olive Python. Minor drainage line habitats, although not necessarily large in terms of area, are also common and well-represented habitats within the immediate vicinity of the survey area and the wider Pilbara region.

The Low Hills and Slopes, Alluvial Plain, Mulga Woodland and Stony Plain habitat in the survey area provide fewer microhabitat opportunities for MNES fauna species and are also more widespread in the immediate vicinity as well as the Hamersley subregion and wider bioregion.

5.2 MNES Species

Four MNES fauna species have previously been recorded within the survey area. No further records of any MNES fauna species were obtained during the targeted MNES survey.

The recent Northern Quoll records documented within the survey area (Astron Environmental Services 2019) are significant given that the survey area is at the edge of this species' regional distribution and there has been a paucity of previous local and regional records. The records, which included capture of an individual sub-adult male and multiple motion camera recordings at separate locations suggest that a resident population may exist in the survey area, particularly within the BHT area (Astron Environmental Services 2019). However, no Northern Quolls were recorded during the targeted MNES survey, despite utilising sampling methods specifically designed to target this species in accordance with Commonwealth referral guidelines (Department of the Environment and Energy 2016) and standardised regional monitoring protocols (Dunlop et al. 2014). The conditions preceding the targeted MNES survey were considered poor due to dry conditions. The seasonal conditions, along with a high feral cat (*Felis catus*) activity recorded within the survey area, may have contributed to the lack of Northern Quoll records during the targeted MNES survey. Three individual

cats were captured at three different cage trapping sites across the survey area. Another individual cat was observed on a motion sensitive camera within the HD2 area and the field team observed cat sightings in and around both the HD1 and Hope Downs 4 villages during the survey (Matthew Love, pers. obs.), indicating a potentially high level of cat activity within the survey area at the time of the survey.

The Ghost Bat was previously recorded on nine occasions within the survey area through acoustic recordings (calls), scats recorded in nocturnal feed caves and an individual sighted during spotlighting within the HD2 area (Astron Environmental Services 2019). Two of seven caves previously recorded within the survey area (Caves 1 and 5) were deemed to be Category 3 roost caves with occasional occupancy based on their size and depth; however, no ultrasonic detections were recorded. The other five previously recorded caves were deemed to be Category 4 nocturnal roost caves (opportunistic usage). These Category 4 caves are common in the landscape as numerous observations suggest that the majority of caves and adits in the Pilbara are used in at least an opportunistic manner by itinerant Ghost Bats (Bat Call WA 2019). The caves recorded within the survey area are not considered significant to the long-term presence of the species (Bat Call WA 2019). The records are consistent with the Ghost Bat foraging in low numbers on the HD2 and BHT ridges (Bat Call WA 2019). It is also consistent with the known regional presence of the Ghost Bat across the central Pilbara region as well as locally on the major ridges immediately to the north of the survey area and west of the HD1 mining area (Bat Call WA 2019). The targeted MNES survey failed to further record the Ghost Bat or additional caves within the survey area. It is highly unlikely that additional significant caves (Category 1 or 2) exist within the survey area.

The Pilbara Leaf-nosed Bat has been detected by calls at three locations during one previous field survey in May 2018 (Astron Environmental Services 2019), but were not detected in November 2017, March 2019 (Astron Environmental Services 2019) or the targeted MNES survey. The calls recorded were at least three hours after dusk and are not consistent with the presence of a permanent roost cave nearby (Bat Call WA 2019). This species is likely to forage only occasionally within the survey area taking advantage of benign conditions and dispersing temporarily in search of additional foraging and roosting opportunities (Bat Call WA 2019).

One Oriental Plover individual was opportunistically sighted during a previous survey at the HD1 village camp (Astron Environmental Services 2019), likely due to the presence of water at the camp. This species is unlikely to occur on a permanent basis within the unaltered habitats of the survey area.

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Appendix A: Background Information Figures

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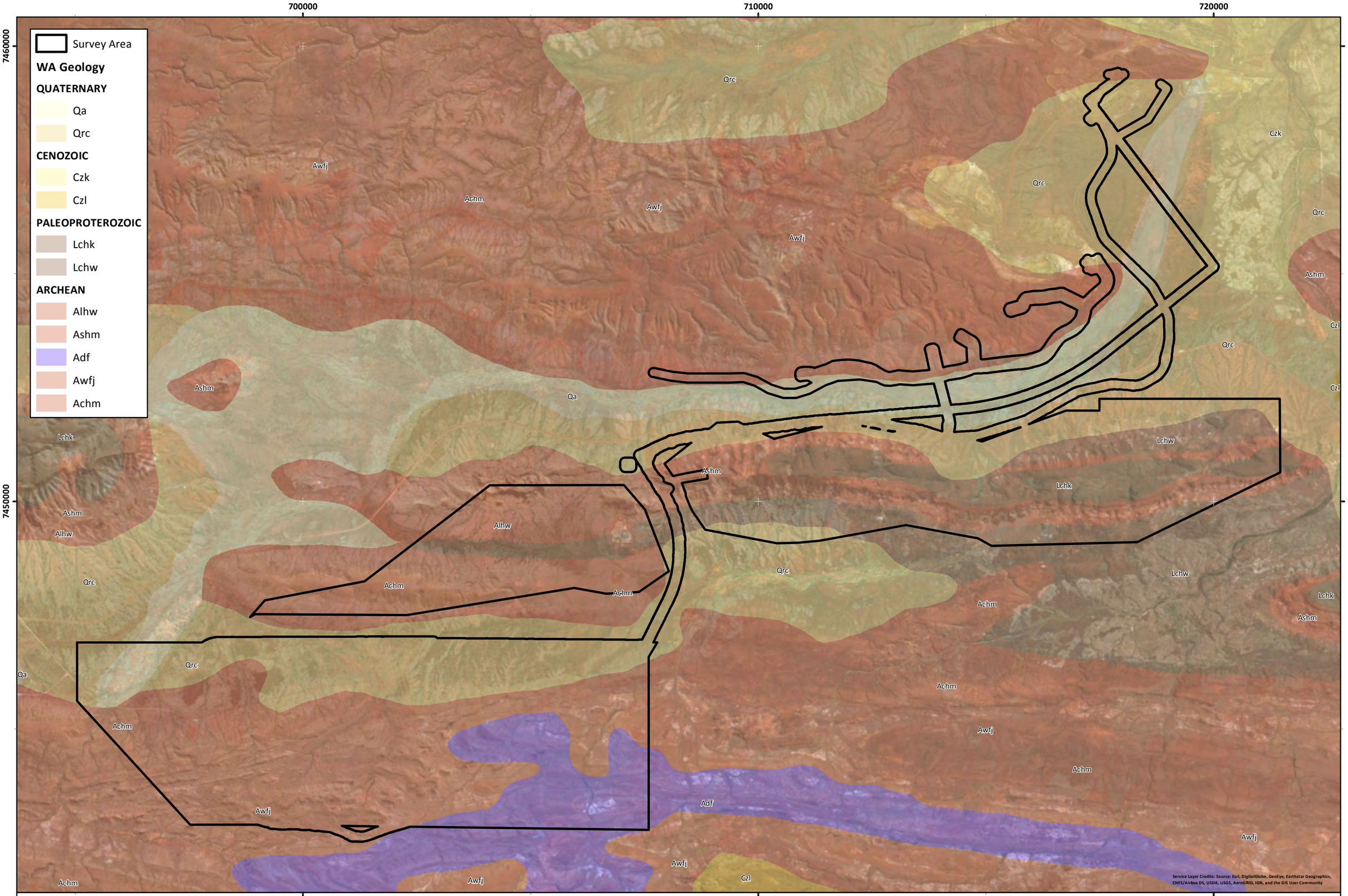

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Hope Downs 2 Proposal Matters of National Environmental Significance Fauna Assessment

Figure A.1: Geology of the Survey Area

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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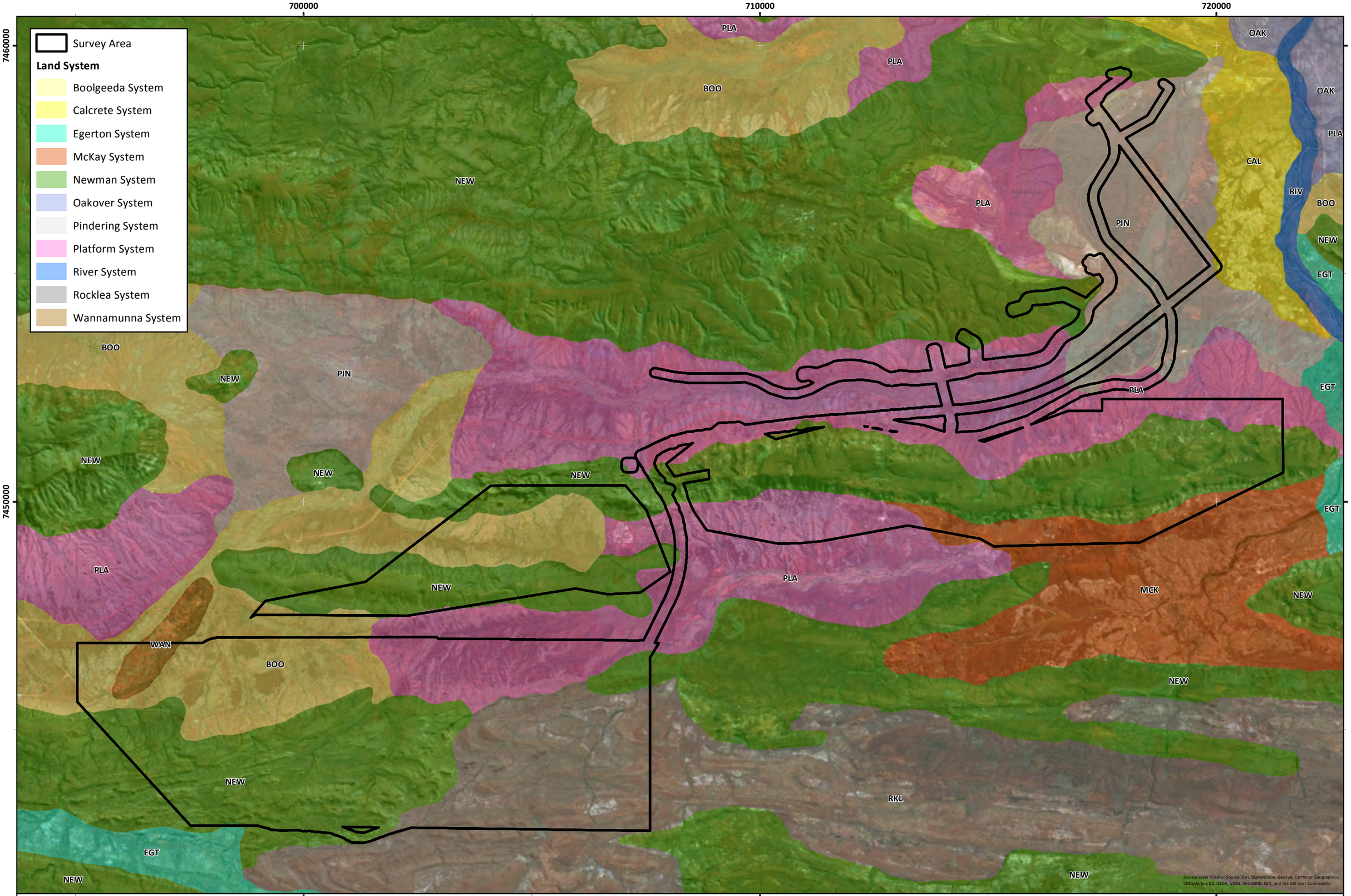

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Hope Downs 2 Proposal Matters of National Environmental Significance Fauna Assessment

Figure A.2: Land systems of the Survey Area

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

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710000

720000

7460000

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Survey Area

System Association

HAMERSLEY_18

HAMERSLEY_29

HAMERSLEY_82

HAMMERSLEY_18

HAMMERSLEY_82

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HAMMERSLEY_82

HAMMERSLEY_18

HAMMERSLEY_82

HAMMERSLEY_29

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 2 Proposal Matters of National Environmental Significance Fauna Assessment

Figure A.3: Pre-European vegetation of the Survey Area

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

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Appendix B: Conservation Categories, Habitat Suitability and Likelihood Criteria

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Table B.1: Definitions and criteria for Threatened Ecological Communities (Department of Environment and Conservation 2013).

Three categories exist for listing Threatened Ecological Communities under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). An ecological community may be categorised as:

Categories of ecological communities	
Critically endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

Reference: Department of Environment and Conservation 2013, Definitions, Categories and Criteria for Threatened and Priority Ecological Communities DEC (Parks and Wildlife), <https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf.>

Table B.2: Categories and definitions for EPBC Act listed fauna species.

Conservation category	Definition
Extinct	Taxa with no reasonable doubt that the last member of the species has died.
Extinct in the wild	Taxa known to survive only in cultivation, in captivity or as a naturalized population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriated seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (EN)	Taxa are not critically endangered; and are facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	Taxa are not critically endangered or endangered; and are facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation dependent (CD)	Taxa are the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or the following subparagraphs are satisfied: i) the taxa is a species of fish; ii) the taxa is the focus of a management plan that provides management actions necessary to stop the decline of, and support the recovery of, the taxa so that its chances of long term survival in nature are maximized; iii) the management plan is in force under a law of the Commonwealth or of a State or Territory; iv) Cessation of the management plan would adversely affect the conservation status of the taxa Fish includes all taxa of bony fish, sharks, rays, crustaceans, molluscs and other marine organisms, but does not include marine mammals/reptiles.
Migratory (IA)	Taxa are considered migratory species on International Agreements; i) if they are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II); ii) all migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA); and iii) Are native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Note: CD and IA are only related to conservation significant fauna

Table B.3: Criteria used to define likelihood occurrence of conservation significant fauna species.

Likelihood of occurrence	Pre-survey	Post-survey
Recorded	N/A	Species or evidence of species recorded during survey.
High	Species has been recorded within the survey area or within 20 km of the survey area and preferred habitat appears to be present.	Core or preferred habitats present in the survey area which are abundant and/or high quality condition. OR Species is known to be cryptic and may not have been detected despite adequate survey effort and suitable habitat present within the survey area. OR Species or evidence of species recorded within the survey area however doubt remains over the taxonomic identification, validity of record.
Moderate	Species has not been recorded from within the survey area, however species has been recorded within the prescribed database search area and suitable habitat appears to be present.	Core or highly suitable habitats present in the survey area, however non-cryptic species that was not detected despite adequate survey effort. OR Core or preferred habitats present in the survey area are mainly in poor or modified condition.
Low	Species recorded from within the prescribed database search area but suitable habitat does not appear to be present.	Species has not been recorded in the survey area despite adequate survey effort. OR Species dependent on specific habitats that do not occur in the survey area. OR Species considered locally extinct.

Table B.4: Suitability/significance of habitat ranking criteria for the target Matters of National Environmental Significance (MNES) species.

Species	Probable shelter and foraging habitat	Potential shelter and foraging habitat	Suitable foraging and dispersal habitat	Limited foraging and dispersal habitat
Pilbara Olive Python (*Liasis olivaceus barroni*)	N/A	Rocky habitat such as gorges, escarpments and breakaways along with drainage lines including or in close proximity to permanent or semi-permanent water holes.	Drainage lines with dense vegetation enabling transitory behaviours and/or providing foraging potential. Rocky habitats that are not in close proximity to water.	Habitat that has limited sheltering and foraging capacity with no permanent or semi-permanent water.
Northern Quoll *(Dasyurus hallucatus)*	Habitat as described in potential shelter and foraging habitat but is considered core habitat critical to the Northern Quoll. This was determined by proximity to known records and microhabitat features, such as south-facing, extent of habitat and whether it was in close association with a gorge or gully.	Rocky habitats such as ranges, escarpments, mesas, ranges, gorges, breakaways and boulder fields. Also major drainage lines or tree-lined drainage systems that are structurally diverse and contain large diameter trees, termite mounds or hollow logs.	Habitat important for foraging, dispersal and buffering of the species including moderate to small sized drainage lines and native vegetation in close proximity (within 2 km) denning or shelter habitat.	Habitat that has limited sheltering and foraging capacity and not connected to potential denning/shelter and foraging habitat.
Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) and Ghost Bat (*Macroderma gigas*)	N/A	Rocky habitat that contains caves suitable as diurnal or maternity roosts sites, or potentially contains these caves and has not adequately surveyed OR Areas highly suitable for foraging that are likely to be used on a regular basis.	Habitat important for foraging including diverse rocky terrain, moderately sized drainage lines and dense complex vegetation stands.	Habitat that has limited ecological value but may provide capacity for transitory movement across the landscape and/or limited foraging potential.

Species	Probable shelter and foraging habitat	Potential shelter and foraging habitat	Suitable foraging and dispersal habitat	Limited foraging and dispersal habitat
Night Parrot (*Pezoporus occidentalis*)	N/A	Isolated habitat not subjected to predation pressure, fire pressure, and altered habitat from pastoralism and mining activities. Generally roosting habitat that contains old and large spinifex clumps (>50 years unburnt), particularly ring-forming hummocks. OR Areas highly suitable for foraging in close association (<10 km) to potential roosting habitat, including *Triodia* (particularly at times of mass flowering and seeding) and chenopod communities dominated by *Sclerolaena*.	Very little is known on the foraging requirements of the Night Parrot. Habitat within 40 km of potential roosting and nesting sites, potentially important for foraging, including chenopod communities (particularly those dominated by *Sclerolaena*), *Triodia* and areas rich in herbs, including forbs, grasses and grass-like plants.	Habitat that has limited roosting and foraging potential for the Night Parrot.

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Appendix C: Survey Sampling Locations

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7460000 7455000 7450000 7445000

PEBBLE MOUSE CREEK

West Angelas Rd

Great Northern Hwy

White Spring Rd

BAT28 BAT29 BAT30 BAT31 BAT27

NQ1 NQ2 NQ3 NQ4

NQc01 NQc02 NQc03

AU5 AU6

GPS Tracklogs
River/Creek
Survey Area

Fauna Sampling Sites

Acoustic recording
Echolocation recording
Northern Quoll cage transect
Northern Quoll camera transect

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 2 Proposal Matters of National Environmental Significance Fauna Assessment

Figure C.1: Current fauna sampling locations within the Survey Area

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Author: J. Johnston | Drawn: C. Dyde | Date: 28-11-2019 | Figure Ref: 14292B-19-BIDR-2RevB_191128_MNES_FigC1

Table C.1: Astron fauna sampling locations.

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
Northern Quoll trapping sites												
NQ1	707120	7449697	Wonmunna	Targeted MNES	Cage trap transect	19/09/2019	26/09/2019	Gorge/Gully	1.0	Drill lines, rubbish	South facing, caves, overhangs, logs, crevices, thick undergrowth, rock piles, old *Triodia* hummocks	
NQ2	710745	7450743	Bedded Hilltop	Targeted MNES	Cage trap transect	19/09/2019	26/09/2019	Breakaway	1.0	Drill lines	South facing, rocky outcrops, caves, overhangs, crevices, thick undergrowth, leaf litter	
NQ3	716386	7449914	Bedded Hilltop	Targeted MNES	Cage trap transect	18/09/2019	25/09/2019	Breakaway	1.0	None	South facing, moist, rocky outcrops, caves, overhangs, logs, crevices	
NQ4	697228	7444452	Hope Downs 2	Targeted MNES	Cage trap transect	19/09/2019	26/09/2019	Breakaway	1.0	None	South-facing, rocky outcrops, caves, overhangs, logs, tree hollows, crevices, thick undergrowth, old *Triodia* hummocks, leaf litter	

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
Motion sensitive camera sites												
NQc01	712971	7450610	Bedded Hilltop	Targeted MNES	Camera (active) transect	20/09/2019	24/09/2019	Gorge	1.0	None	South facing, rocky outcrops, caves, overhangs, tree hollows, crevices, old *Triodia* hummocks, leaf litter	
NQc02	717562	7449888	Bedded Hilltop	Targeted MNES	Camera (active) transect	18/09/2019	24/09/2019	Breakaway	1.0	None	South facing, moist, rocky outcrops, caves, overhangs, logs, tree hollows, crevices, thick undergrowth, rock piles, leaf litter	
NQc03	704546	7445701	Hope Downs 2	Targeted MNES	Camera (active) transect	20/09/2019	24/09/2019	Breakaway	1.0	Drill lines	Overhangs, leaf litter	
Acoustic/echolocation recording sites												
AU5	709429	7449116	Bedded Hilltop	Targeted MNES	Acoustic recording	20/09/2019	25/09/2019	Minor Drainage Line	0.8	None	Old *Triodia* hummocks	

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
AU6	697739	7446526	Hope Downs 2	Targeted MNES	Acoustic recording	20/09/2019	26/09/2019	Stony Plain	1.0	None	Thick undergrowth, old *Triodia* hummocks, leaf litter	
BAT27	702566	7443529	Hope Downs 2	Targeted MNES	Echolocation recording	23/09/2019	27/09/2019	Low Hill	1.0	None	Overhangs, leaf litter	
BAT28	707688	7450582	Bedded Hilltop	Targeted MNES	Echolocation recording	20/09/2019	25/09/2019	Low Hill	1.0	Drill lines	Crevices, old *Triodia* hummocks, leaf litter	
BAT29	712841	7450682	Bedded Hilltop	Targeted MNES	Echolocation recording	20/09/2019	24/09/2019	Gorge	1.0	None	South facing, moist, rocky outcrops, caves, overhangs, logs, tree hollows, old *Triodia* hummocks, leaf litter	
BAT30	719155	7450357	Bedded Hilltop	Targeted MNES	Echolocation recording	20/09/2019	24/09/2019	Breakaway	1.0	Drill lines	Rocky outcrops, overhangs, leaf litter	

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
BAT31*	702693	7444968	Hope Downs 2	Targeted MNES	Echolocation recording	20/09/2019	25/09/2019	Breakaway	0.8	Drill lines	Rocky outcrops, overhangs, rock piles	

Habitat Condition: 1.0 (Excellent); 0.8 (Very Good); 0.6 (Good); 0.4 (Poor); 0.2 (Very Poor); 0.1 (Completely Degraded)

*Failed to operate

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Appendix D: MNES Species Likelihood of Occurrence within the Survey Area

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Table D.1: Likelihood of occurrence of conservation listed vertebrate fauna species listed as potentially occurring in the vicinity of the survey area.

Scientific name (common name)	Conservation codes		Preferred habitat	Likelihood of occurrence	
	EPBC Act	BC Act		Pre-survey	Post-survey
Reptiles					
Liasis olivaceus barroni (Pilbara Olive Python)	VU	VU	Generally rocky habitats in close association to permanent and semi-permanent water sources.	High	High
Birds					
Apus pacificus (Fork-tailed Swift)	IA	IA	Largely aerial species independent of the terrestrial environment.	Moderate	Moderate
Charadrius veredus (Oriental Plover)	IA	IA	Breeding habitat includes arid grasslands, saltpans; non-breeding habitat includes grasslands, salt-fields, and coastal regions.	Moderate	High - previously recorded
Rostratula australis (Australian Painted Snipe)	EN	EN	Inhabits shallow terrestrial freshwater wetlands, lakes, swamps and claypans. Also found in waterlogged grassland and saltmarsh. Typical sites include areas with emergent tussocks of grass, sedges or samphire; often scattered with clumps of lignum *Muehlenbeckia*, or canegrass or sometimes with tea-tree (*Melaleuca*).	Low	Low
Actitis hypoleucos (Common Sandpiper)	IA	IA	Non-breeding migrant to a wide variety of habitats, such as riverbanks, estuaries, freshwater seeps on coastal shores, tidal creeks, mangrove swamps and saltmarshes.	Low	Low
Tringa nebularia (Common Greenshank)	IA	IA	A variety of freshwater, marine and artificial wetlands, including swamps, open muddy or rocky shores of lakes and large rivers, sewerage farms, saltworks, muddy coastal flats, mangroves and estuaries.	Low	Low
Calidris melanotos (Pectoral Sandpiper)	IA	IA	Mainly swamps, lagoons, river pools, irrigation channels and sewerage ponds. Also in samphire flats around estuaries and salt lakes.	Low	Low
Calidris acuminata (Sharp-tailed Sandpiper)	IA	IA	Muddy edges of shallow fresh/brackish wetlands with emergent sedges, saltmarsh, grass and low vegetation.	Low	Low

Scientific name (common name)	Conservation codes		Preferred habitat	Likelihood of occurrence	
	EPBC Act	BC Act		Pre-survey	Post-survey
Calidris ferruginea (Curlew Sandpiper)	CR/IA	VU/IA	This species mainly occurs on intertidal mudflats in sheltered coastal areas and also around non-tidal swamps, lakes and lagoons near the coast. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand.	Low	Low
Pezoporus occidentalis (Night Parrot)	EN	CR	Most habitat records are from *Triodia* grasslands and/or chenopod shrublands in the arid and semi-arid zones. *Astrebla* spp. (Mitchell grass), shrubby samphire and chenopod associations, scattered trees and shrubs, *Acacia aneura* (Mulga) woodland, treeless areas and bare gibber as associated with sightings of the species.	Low	Low
Hirundo rustica (Barn Swallow)	IA	IA	Coastal open country generally, especially near surface water and man-made structures such as bridges and power wires.	Low	Low
Motacilla cinerea (Grey Wagtail)	IA	IA	Damp short-grass flats, rice stubbles and edge of swamps, sewage ponds, bore overflows, grazed or mowed grass and irrigated areas.	Low	Low
Motacilla flava (Yellow Wagtail)	IA	IA	Mainly banks and rocks in fast-running freshwater habitats such as rivers, creeks, streams and around waterfalls.	Low	Low
Mammals					
Dasyurus hallucatus (Northern Quoll)	EN	EN	Northern Quoll habitat generally encompasses some form of rocky area for denning purposes with surrounding vegetated habitats used for foraging and dispersal.	High	High - previously recorded
Macrotis lagotis (Greater Bilby, Dalgyte)	VU	VU	Sand or sandy-loam in hummock grassland (*Triodia* species) and or *Acacia* shrublands.	Low	Low

Scientific name (common name)	Conservation codes		Preferred habitat	Likelihood of occurrence	
	EPBC Act	BC Act		Pre-survey	Post-survey
Macroderma gigas (Ghost Bat)	VU	VU	A wide range from rainforest, monsoon and vine scrub in the tropics to open woodlands and arid areas.	High	High - previously recorded
Rhinonicteris aurantia (Pilbara form) (Pilbara Leaf-nosed Bat)	VU	VU	Roosts in deep warm, humid caves or rock cracks, especially in proximity to water pools. Forages while flying low along watercourses and gorges and over *Triodia* grassland.	High	High - previously recorded

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Appendix E: MNES Habitat Suitability Mapping

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Survey Area

Northern Quoll Habitat Suitability

- Probable shelter and foraging habitat
- Potential shelter and foraging habitat
- Suitable foraging and dispersal habitat
- Limited foraging and dispersal habitat

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Hope Downs 2 Proposal Matters of National Environmental Significance Fauna Assessment

Figure E.1: Northern Quoll habitat suitability mapping

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

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Author: J. Johnston | Drawn: C. Dyde | Date: 29-01-2020 | Figure Ref: 14292B-19-BIDR-2Rev1_200129_MNES_FigE1_NQ

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Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Survey Area

Pilbara Leaf-nosed Bat Habitat Suitability

Potential shelter and foraging habitat

Suitable foraging and dispersal habitat

Limited foraging and dispersal habitat

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Figure E.2: Pilbara Leaf-nosed Bat habitat suitability mapping

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

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Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Cave 4

Cave 6

Cave 5

Cave 1

Cave 2

Cave 8

Cave 7

Survey Area

Ghost Bat Caves

Nocturnal feed roost

Potential diurnal roost

Potential roost cave

Ghost Bat Habitat Suitability

Potential shelter and foraging habitat

Suitable foraging and dispersal habitat

Limited foraging and dispersal habitat

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Hope Downs 2 Proposal Matters of National Environmental Significance Fauna Assessment

Figure E.3: Ghost Bat habitat suitability mapping

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Survey Area

Night Parrot Habitat Suitability

Suitable foraging and dispersal habitat

Limited foraging and dispersal habitat

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Hope Downs 2 Proposal Matters of National Environmental Significance Fauna Assessment

Figure E.4: Night Parrot habitat suitability mapping

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Survey Area

Pilbara Olive Python Habitat Suitability

Potential shelter and foraging habitat

Suitable foraging and dispersal habitat

Limited foraging and dispersal habitat

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Hope Downs 2 Proposal Matters of National Environmental Significance Fauna Assessment

Figure E.5: Pilbara Olive Python habitat suitability mapping

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

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Author: J. Johnston | Drawn: C. Dyde | Date: 29-01-2020 | Figure Ref: 14292B-19-BIDR-2Rev1_200129_MNES_FigE5_POP

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Appendix F: MNES Fauna Species and Cave Locations

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Northern Quoll
Northern Quoll (x3)
Ghost Bat
Pilbara Leaf-nosed Bat

Northern Quoll (x3)
Ghost Bat (x2)
Ghost Bat
Northern Quoll
Northern Quoll
Pilbara Leaf-nosed Bat
Ghost Bat
Northern Quoll (x2)
Northern Quoll (x2)

Northern Quoll (x2)
Northern Quoll (x2)
Ghost Bat (x2)
Pilbara Leaf-nosed Bat
Northern Quoll
Ghost Bat
Northern Quoll
Ghost Bat
Northern Quoll
Pilbara Leaf-nosed Bat

Survey Area

Conservation Significant Fauna - Astron (2019)

- Ghost Bat *(Macroderma gigas)*
- Northern Quoll *(Dasyurus hallucatus)*
- Oriental Plover *(Charadrius veredus)*
- Pilbara Leaf-nosed Bat *(Rhinonicteris aurantia)*

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Hope Downs 2 Proposal Matters of National Environmental Significance Fauna Assessment

Figure F.1: Previous conservation significant vertebrate fauna locations

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

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Author: J. Johnston | Drawn: C. Dyde | Date: 19-11-2019 | Figure Ref: 14292B-19-BIDR-2RevA_191119_MNES_FigF1_CSF

Table F.1: Location of caves within Hope Downs 2 Proposal Survey Area.

Site ID	MGA Zone 50 K		Survey Area	Category rating for Ghost Bat usage	Reason	Description	Photograph
	Easting (mE)	Northing (mE)					
Cave 1	712281	7450651	HD2 Proposal Survey Area	3	Ghost Bat nocturnal roost. Occasional diurnal roost possible due to size and depth.	**Entrance:** Large open wide entrance (7 m high x 5 m wide) **Orientation:** South **Internal:** Not recorded; depth >5 m, visual assessment inconclusive **Conditions:** Not recorded	
Cave 2	716905	7450075	HD2 Proposal Survey Area	4	Potential Ghost Bat nocturnal roost.	**Entrance:** Wide open entrance (2 m high x 4 m wide) **Orientation:** South-east **Internal:** Not recorded; shallow depth through visual assessment **Conditions:** No raised humidity/temperature; microbats present	

Site ID	MGA Zone 50 K		Survey Area	Category rating for Ghost Bat usage	Reason	Description	Photograph
	Easting (mE)	Northing (mE)					
Cave 3	708388	7450375	Greater HD1 Development Envelope	4	Potential Ghost Bat nocturnal roost	**Entrance:** Small narrow entrance (2 m wide x 0.5 m high) **Orientation:** South **Internal:** Not recorded; shallow depth through visual assessment **Conditions:** No raised humidity/temperature; microbats present	
Cave 4	712487	7451071	HD2 Proposal Survey Area	4	Confirmed Ghost Bat nocturnal roost	**Entrance:** Open exposed **Orientation:** North north-east **Internal:** Shallow **Conditions:** Ghost Bat scats present (x5 scats), no raised humidity/temperature; microbats present	No photo available
Cave 5	710766	7450668	HD2 Proposal Survey Area	3	Ghost Bat nocturnal roost. Occasional diurnal roost possible due to depth and presence of rear chamber.	**Entrance:** Small opening (1 m wide x 1 m high) **Orientation:** Not recorded **Internal:** Narrow passage leading to one rear chamber (10 m to 15 m deep) **Conditions:** Ghost Bat scats present	

Site ID	MGA Zone 50 K		Survey Area	Category rating for Ghost Bat usage	Reason	Description	Photograph
	Easting (mE)	Northing (mE)					
Cave 6	710715	7450850	HD2 Proposal Survey Area	4	Potential Ghost Bat nocturnal roost	**Entrance:** Low open wide opening (7 m wide x 4 m high) **Orientation:** South-east **Internal:** Tappering passage to rear chamber (7 m to 9 m deep), rear chamber 2 m wide x 1 m high **Conditions:** No raised humidity/temperature; microbats present	No photo available
Cave 7	697235	7444586	HD2 Proposal Survey Area	4	Confirmed Ghost Bat nocturnal roost	**Entrance:** Open/wide (5 m wide x 2 m high) **Orientation:** South **Internal:** One dome 2 m high with several side pockets **Conditions:** Ghost Bat scats present	
Cave 8	699012	7444982	HD2 Proposal Survey Area	4	Potential Ghost Bat nocturnal roost	**Entrance:** Small entrance (2 m wide x 0.5 m high) **Orientation:** Not recorded **Internal:** Two internal chambers (8 m x 1 m high) **Conditions:** Microbats present	

Site ID	MGA Zone 50 K		Survey Area	Category rating for Ghost Bat usage	Reason	Description	Photograph
	Easting (mE)	Northing (mE)					
Cave 9	701453	7448445	Greater HD1 Development Envelope	4	Confirmed Ghost Bat nocturnal roost	**Entrance:** Shallow overhang (3 m x 4 m) **Orientation:** West **Internal:** Shallow overhang 6 m deep **Conditions:** Ghost Bat scats present	

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Appendix G: Bat Call WA Pty Ltd Report

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Rio Tinto,
Hope Downs 2 and Bedded Hilltop,
Pilbara WA,

Acoustic Survey of Bat and Night Parrot Activity, phases 1 (November 2017), 2 (May 2018), 3 (March 2019) and 4 (September 2019).

Prepared for Astron Environmental Services

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Issue 5
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Document Revision History

Issue	Date	Revision History
A	8 June 2018	Initial draft of Phase 1 and 2 prepared for Astron review
1	14 June 2018	First formal issue incorporating client's comments
2	15 June 2018	Second issue incorporating client's comments
3	27 March 2019	Third issue incorporating Phase 3 data
4	21 Oct 2019	Fourth Issue incorporating Phase 4 data.
5	28 Nov 2019	Fifth issue incorporating client's comments

Summary
Bat and Night Parrot (*Pezoporus occidentalis*) presence is reported for thirty-three sites in the Hope Down 2 and Bedded Hilltop areas, in the Pilbara, WA. Astron Environmental Services (Astron) carried out an acoustic survey in four phases in November 2017, May 2018, March and September 2019. Twenty-seven sites were surveyed ultrasonically for all bats present including Ghost bat social and ultrasonic calls. Six sites were surveyed using acoustic detectors set to record Night Parrot and Ghost bat social calls. Bat Call WA has reviewed the recordings made and provided species lists and activity levels for the bats present.

Twelve species of echolocating bats were confirmed present including both EPBC Act listed species in the Pilbara, the Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) (PLNb) and the Ghost bat (*Macroderma gigas*) (PGb). PLNb calls were detected in low numbers at three sites in May 2018. PGb were detected ultrasonically at three sites and their presence was confirmed by observation by Astron ecologists of either bats or middens at a further six.

PLNb calls were detected at three sites during May 2018 but were not detected in November 2017 or in 2019. The calls at all three sites were at least three hours after dusk, were well scattered, and are not consistent with the presence of a permanent roost cave nearby.

PGb presence, detected in very low numbers in phases 1, 2 and 3 (November 2017, May 2018 and March 2019, but not in September 2019), is consistent with the known regional population and dispersal for foraging of PGb in the district. No evidence of activity consistent with reproducing bats was detected.

No Night Parrot calls were detected.

Habitats
The sites for the survey were chosen by Astron. Details of the sites are presented in table 1. The bat sites included each type of habitat present in the study area including cave entrances, gorges, breakaways. drainage lines and stony plains. All the Night Parrot sites are on stony plains. The locations are shown in relation to local features in figures 1 and 2.

Given the presence of PGb in the district, each cave assessed during the survey has been categorised according to the following definitions based on PGb usage:

Category 1 diurnal roost caves with permanent occupancy.
There are several documented permanent roost caves and underground mines in northern Australia, e.g. Tunnel Creek in the Kimberley and Kohinoor Adit in the NT. These tend to have large but variable populations, e.g. Kohinoor's colony has grown from 300+ in 1981 to ~1,500 in 1990 and then reduced to 550 in 2013 (Woinarski *et al*. 2014). In the Pilbara, other than a few historical underground mines e.g. Klondyke Queen, Lalla Rookh and Bamboo Creek which do have large populations of over 100 PGb, very few such roosts in natural caves are documented. Those that may be permanently occupied have been observed with variable populations present.

Where permanent presence at these sites is proven, they must all be assumed to be maternity caves. There are no previously documented Cat 1 caves in the central Hamersley Ranges.

Category 2 diurnal roost caves with regular occupancy.
There are a number of Pilbara caves and adits where PGb have regular, but not continuous, presence over long periods. The longest continuous monitoring programs have been at Rio Tinto's West Angelas project and at BHPs MAC and South Flank projects. At all three locations there are several caves with roosting PGb records but none of these have had either permanent presence or consistently high numbers present. Numbers have varied between zero and five with very occasional counts of 20 or more. Based on recent monitoring of caves using ultrasonic call detectors, these caves have PGb present for 25% to 75% of nights for mid to long periods but then may be abandoned for periods. There is insufficient data at present to see if there are any seasonal trends in these occupancy rates. These caves typically have a number of other caves, shelters and overhangs within a few hundred meters. Together they make up an "apartment block" grouping (TSSC 2016, Bat Call 2017, Bat Call 2019) that supports the ongoing presence of the bats.

Recent analysis at West Angelas based on genetic sampling at five monitored caves in 2015 and 2017 (Ottwell *et al*. 2018) suggests that some PGb tend to use particular caves regularly over a season or year but others move between caves in the same period. Their analysis identifies 34 unique individuals at caves over those two years and indicated that the "genetic effective population size" was 12 individuals. Two of the five caves have been shown by the long-term observations to have regular occupancy (Biologic 2016). These are AA1 and A1. In all surveys undertaken, PGb have been either roosting in low numbers or there was evidence of recent roosting at the former and, with the exception of one survey, at the latter. The genetic analysis also supports this conclusion with presence of multiple bats over the two years of that study at these caves. Similar occupancy patterns have been recorded at several caves at the BHP projects. There are an increasing number of observations becoming available of pregnant PGb or PGb carrying pups at some of these caves although again there is insufficient data to identify any trends other than to say that any cave that has regular occupancy must be assumed to be capable of supporting one or more reproducing females and their offspring. There are no caves at HD2/Bedded Hilltops (see below) that the data indicates fall into this category.

Category 3 roost caves with occasional occupancy.
There are many caves and adits where PGb occasionally or rarely roost diurnally in small numbers of one to a few. Surveys in recent years have identified numerous caves that have PGb scats or small food middens present but either no evidence of roosting bats or with rarely repeated presence observations, e.g. five of the seven monitored caves at West Angelas (Biologic 2016) show such a pattern with occasional PGb present and/or intermittent evidence of recent occupancy. Reproducing females have been reported from at least two caves that ongoing observations indicate fall into this category. However, the ongoing observations show opportunistic occupation only. These caves are therefore not considered significant to the long-term presence of the species.

Category 4 nocturnal roost caves, opportunistic usage.
Numerous observations suggest that the majority of caves and adits in the Pilbara are used in at least an opportunistic manner by itinerant Ghost bats. This may be anything from a single foraging visit to a longer visit with a resting period or possibly a feeding session. Evidence of such visits is the widespread presence of small numbers of scats or occasionally recorded echolocation calls during surveys. These visits may or may not be repeated depending whether the bat is passing through a district or is a more permanent resident nearby.

Timing, Moon Phase and Weather
The echolocation survey was conducted between 24th to 30th November 2017, 18th to 26th May 2018, 11th to 17th March 2019 and 20th to 26th September 2019.

The November 2017 sampling evenings were hot with minimum overnight temperatures between 20 and 25°C. The moon in this period was first quarter to full. The May 2018 sampling evenings were cool to cold with minimum overnight temperatures between 5 and 15°C. The moon in this period was first quarter. No rain fell during these survey periods. The March 2019 sampling evenings were hot and humid with minimum overnight temperatures between 25 and 30°C typical of northern wet season. Some seasonal rain fell during this period. The moon was at first quarter. The September 2019 sampling evenings were warm and dry with minimum overnight temperatures between 10 and 15°C. The moon was at third quarter.

Survey Team
Sites were chosen and detectors placed by Astron ecologists. Bob Bullen of Bat Call WA completed analysis of audio and echolocation recordings.

Sampling
The survey consisted of completing a total of forty overnight ultrasonic bat sound recordings in November 2017, thirty-seven in May 2018, twenty-four in March and twenty-two in September 2019, beginning at twilight, at twenty-seven locations within the survey area. A total of eleven acoustic survey nights were completed at two sites for Night Parrot in May 2018, twelve in March and eleven in September 2019. The recordings were “continuous” (Hyder *et al.* 2010) made using ultrasonic SM2BAT+ SongMeter and acoustic SM4A SongMeter (both by Wildlife Acoustics Inc., USA) detectors. The audio settings used followed the manufacturer’s recommendations contained in the user manuals.

For the ultrasonic recordings, once reformatted as .wav files, COOL EDIT 2000 (now available as AUDITION from Adobe Systems Inc.) was used to display each sequence for identification. Calls were identified manually. Only good quality call sequences were used. Details of calls analysed are provided in Table 2 as recommended by Australasian Bat Society (ABS 2006). Reference data for the species identified are available in Bullen and McKenzie 2002, McKenzie and Bullen 2003 and McKenzie and Bullen 2009.

For the acoustic recordings, each was reviewed both manually and using an automatic scan technique for Night Parrot calls. Candidate calls were compared with the author's confirmed reference calls from two Western Australian arid zone locations.

Survey Limitations

The sites surveyed were accessible on foot and the detectors, using omnidirectional microphones, were set on the ground with the microphone horizontal. Species are unlikely to be under-represented as a result.

Bat species density away from cave or adit entrances is impossible to estimate from echolocation records. Bat activity is therefore substituted as an approximate guide to the relative numbers of each species using the study area.

Results of bat fauna survey

An assemblage of twelve echolocating bat species was confirmed as present at the study sites including both the PLNb and PGb, table 4. Species activity levels were low to very high, which is expected for the study area habitat and the times of year.

PLNb detections

PLNb were detected at three widespread locations, two breakaway sites and a gorges site, table 4 and figure 3. Call numbers at all three were low with the maximum number of calls being eight at BAT 13 on the 22nd May 2018, figure 4. The temporal pattern of calls at all three sites, figure 4, is consistent with PLNb foraging away from their roost with timing gaps from civil twilight of approximately three hours and being widespread. This result is consistent with author's unpublished data that indicates that PLNb are only active across the study area in autumn. The closest confirmed permanent diurnal roosts are over 55 km to the north, west and south and over 80 km to the east (author's unpublished data). These distances suggest that the PLNb are possibly using temporary or satellite roosts in the district, as their usual foraging range is under 30 km (Bullen 2013). However, the pattern of the data, the three-hour time gap together with the low number of calls, is inadequate to indicate whether any potential satellite is within or outside the study area boundary. A more probable suggestion is that bats from existing permanent colonies take advantage of the benign conditions in autumn and spread across the country temporarily in search of additional foraging and roosting opportunities.

PGb detections

Ghost bats were detected ultrasonically at three, widely spaced sites, Bat 4 in November 2017, BAT 21 in May 2018 and BAT 25 in March 2019, table 4, figure 5. Additional observations were made by the field survey team, Table 5. Four caves ('4, '5, '7 and '9) containing PGb middens or scats were located and a foraging PGb was seen at an opportunistic site, Table 5. Also, a scat pile was observed under a highway bridge at site BAT 9. There were no category 1 or 2 caves identified. Two caves, Cave 1 and 5, were assessed as category 3 "occasional diurnal roosts" based on their size and depth (see Appendix 1), however no ultrasonic detections were recorded at these sites. The other caves and the highway bridge were assessed as category 4 nocturnal sites. These records are consistent with the PGB foraging in low numbers on both the Hope Down 2 and

Bedded Hilltops study area ridges year-round. This result is consistent with the known presence of the PGb across the central Pilbara in general and on the major ridges immediately to the north of the study area and west of the Hope Downs 1 mining area. No groupings of caves or sites with regular calls were identified suggesting a more heavily used "apartment block".

Common bat species detections
Five common species, *Austronomus australis*, *Chaerephon jobensis*, *Chalinolobus gouldii*, *Taphozous georgianus* and *Vespadelus finlaysoni* dominated bat presence in the area. Both *Taphozous* species were detected

Taxonomy presented herein is after Reardon *et al.* (2014) and Jackson and Groves (2015).

Results of Night Parrot survey.

No Night Parrot calls were detected.

Recommendations.

PLNb
The results of the survey are consistent with the author's existing data on the autumn dispersal of this species from its permanent roosts. No further specific targeted survey effort is indicated by these results.

PGb
The results of the survey are consistent with the use of the ridge lines within the north-central and western ends of the study area by foraging PGb on a year-round basis. Targeted survey effort for groupings of caves that are important for the persistence of PGb has been carried out at both the eastern and western ends of the study area, without locating significant diurnal roosting sites.

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Table 1: Microbat site specific details. Coordinates are Zone 50K

	Date	Recording Time & SM2 unit	Habitat	Easting	Northing
Phase 1 Nov 2017					
BAT 1	24-27 Nov	Four overnight recordings using SM2 SN 4684 recording at 44.1 kbps	Gorge	718218	7450208
BAT 2	28-30 Nov	Three overnight recordings using SM2 SN 4684 recording at 44.1 kbps	Gorge	716514	7450015
BAT 3	24-27 Nov	Four overnight recordings using SM2 SN 4685 recording at 384 kbps	Gorge	713964	7450155
BAT 4	28-30 Nov	Three overnight recordings using SM2 SN 4685 recording at 384 kbps	Breakaway	712483	7451071
BAT 5	24-27 Nov	Four overnight recordings using SM2 SN 4698 recording at 44.1 kbps	Foot of slope	715766	7450509
BAT 6	28-30 Nov	Three overnight recordings using SM2 SN 4698 recording at 44.1 kbps	Gorge	719087	7450901
BAT 7	24-27 Nov	Four overnight recordings using SM2 SN 7982 recording at 44.1 kbps	Cave entrance	712290	7450636
BAT 8	28-30 Nov	Three overnight recordings using SM2 SN 7982 recording at 44.1 kbps	Gorge	710766	7450668
BAT 9	25-28 Nov	Four overnight recordings using SM2 SN 4685 recording at 384 kbps	Highway culvert	695851	74455001
BAT 10	29-30 Nov	Two overnight recordings using SM2 SN 4685 recording at 384 kbps	Cave entrance	599015	7444976
BAT 11	24-27 Nov	Four overnight recordings using SM2 SN 7634 recording at 384 kbps	Breakaway	708261	7446389
BAT 12	29-30 Nov	Two overnight recordings using SM2 SN 7634 recording at 384 kbps	Mulga woodland	699301	7446157
Phase 2 May 2018					
BAT 13	18-22 May	Five overnight recordings using SM2 SN 7634 recording at 384 kbps	Breakaway	710050	7450766
BAT 14	21-25 May	Five overnight recordings using SM2 SN 8027 recording at 384 kbps	Major drainage line	707275	7445721
BAT 15	21-24 May	Four overnight recordings using SM2 SN 11040 recording at 384 kbps	Breakaway	707097	7449888
BAT 16	18-26 May	Nine overnight recordings using SM4U04031 recording at 384 kbps	Gorge with caves present	710759	7450661
BAT 17	23-26 May	Four overnight recordings using SM2 SN 7634 recording at 384 kbps	Gorge	712383	7450606
BAT 19	20-24 May	Five overnight recordings using SM2 SN 11793 recording at 384 kbps	Gorge	711117	7450976
BAT 21	21-25 May	Five overnight recordings using SM2 SN 7768 recording at 384 kbps	Breakaway	700067	7444800

	Date	Recording Time & SM2 unit	Habitat	Easting	Northing
Phase 3 March 2019					
BAT 22	11-17 Mar	SM2 SN 7634 failed to operate	Gorge/gully	700620	7448043
BAT 23	13-17 Mar	Five overnight recordings using SM4U05349 recording at 384 kbps	Breakaway with overhangs	716260	7449988
BAT 24	11-17 Mar	Seven overnight recordings using SM4U05956 recording at 384 kbps	Gorge/gully	700803	7448400
BAT 25	11-17 Mar	Seven overnight recordings using SM4U05978 recording at 384 kbps	Gorge with caves present	702192	7448397
BAT 26	13-17 Mar	Five overnight recordings using SM4U04031 recording at 384 kbps	Breakaway with overhangs	704510	7450188
Phase 4 Sept 2019					
BAT 27	23 to 26 Sept	Four overnight recordings using SM2-7634 recording at 384 kbps	Low Hill	702566	7443529
BAT 28	20 to 24 Sept	Five overnight recordings using SM4U-5956 recording at 384 kbps	Low Hill	707688	7450582
BAT 29	23 to 26 Sept	Four overnight recordings using SM4U-6479 recording at 384 kbps	Gorge	712841	7450682
BAT 30	23 to 26 Sept	Four overnight recordings using SM4U-6488 recording at 384 kbps	Breakaway	719155	7450357

Table 2: Night Parrot site specific details.

	Date	Recording Time & SM2 unit	Habitat	Easting	Northing
Phase 2 May 2018					
AU 1	21-24 May	Four overnight recordings using SM4A04717	Stony plain	706071	7449544
AU 2	20-26 May	Seven overnight recordings using SM4A05295	Stony plain	717660	7449529
Phase 3 March 2019					
AU 3	11-17 Mar	Seven overnight recordings using SM4A08538	Stony plain	701069	7447576
AU 4	13-17 Mar	Five overnight recordings using SM4A08576	Stony plain	704512	7449271
Phase 4 Sept 2019					
AU 5	20 to 24 Sept	Five overnight recordings using SM4A-4818	Minor Drainage Line	709429	7449116
AU 6	20 to 25 Sept	Six overnight recordings using SM4A-11075	Stony Plain	697739	7446526

Note 1: Coordinates are Zone 50K

Table 3: Summary of Echolocation call characteristics for microbat species present.

Genus species Authority	Common name	Typical F_{peak} kHz Note 1	Ave. Q Note 1	Typical Duration msec	Typical Call Shape
Austronomus australis (Gray 1838) Note 2	White-striped free-tailed bat	12	7	12 - 23	CF– shallow FM
Chaerephon jobensis (Miller 1902)	Northern free-tailed bat	22	5	8 - 15	Shallow FM
Chalinolobus gouldii (Grey 1841)	Gould's wattled bat	32	10	7 - 11	FM
Macroderma gigas (Dobson 1880)	Ghost bat	20 – 52 variable	2 – 20 variable	variable	Complex FM
Nyctophilus geoffroyi Leach 1821	Lesser long-eared bat	48	3	5	Steep FM
Ozimops lumsdenae Reardon *et al*.2014	Northern free-tailed bat	26	10	8 - 13	Shallow FM
Rhinonicteris aurantia (Gray 1845)	Pilbara leaf-nosed bat	120	30	5 - 8	CF
Saccolaimus flaviventris (Peters 1867)	Yellow-bellied sheath-tailed bat	18	9	12 - 21	CF - FM
Scotorepens greyii (Gray 1843)	Little broad-nosed bat	38	10	7 - 13	FM
Taphozous georgianus Thomas 1915	Common sheath-tailed bat	24.5	14	9 - 18	CF– shallow FM
Taphozous hilli Thomas 1915	Hills sheath-tailed bat	26	14	9 - 18	CF– shallow FM
Vespadelus finlaysoni (Kitchener, Jones and Caputi 1987)	Inland cave bat	55	14	4 - 8	FM

Note 1: Fpeak and Q are defined in McKenzie and Bullen 2003, 2009.
Note 2: Taxonomy follows Jackson and Groves (2015). *A. australis* was recently *Tadarida australis*. *O. lumsdenae* was recently *Mormopterus beccarii*.

Table 4: Survey microbat lists presented by site.

Site	*Austronomus australis*	*Chaerephon iobensis*	*Chalinolobus gouldii*	*Macroderma gigas*	*Nyctophilus geoffrovi*	*Ozimops lumsdenae*	*Rhinonicteris aurantia*	*Saccolaimus flaviventris*	*Scotorepens greyii*	*Taphozous spp.*	*Taphozous hilli*	*Vespadelus finlaysoni*
Phase 1 Nov 17												
BAT 1		Yes										
BAT 2		Yes								Yes		
BAT 3		Yes	Yes			Yes			Yes	Yes		Yes
BAT 4		Yes	Yes	Low (2 calls)		Yes			Yes	Yes		Yes
BAT 5		Yes										
BAT 6		Yes										
BAT 7		Yes								Yes		
BAT 8		Yes								Yes		
BAT 9			Yes			Yes			Yes	Yes		Yes
BAT 10										Yes		Yes
BAT 11		Yes	Yes					Yes	Yes	Yes	Yes	Yes
BAT 12		Yes	Yes		Yes	Yes		Yes	Yes	Yes		Yes
Phase 2 May 18												
BAT 13	Yes	Yes	Yes				Low (10 calls)		Yes	Yes	Yes	Yes
BAT 14	Yes	Yes	Yes		Yes			Yes	Yes	Yes		Yes
BAT 15	Yes	Yes	Yes					Yes	Yes	Yes		Yes
BAT 16	Yes	Yes	Yes			Yes				Yes		Yes
BAT 17	Yes	Yes	Yes			Yes	Low (2 calls)			Yes		Yes
BAT 19	Yes	Yes								Yes		Yes

Site	*Austronomus australis*	*Chaerephon iobensis*	*Chalinolobus gouldii*	*Macroderma gigas*	*Nyctophilus geoffroyi*	*Ozimops lumsdenae*	*Rhinonicteris aurantia*	*Saccolaimus flaviventris*	*Scotorepens greyii*	*Taphozous spp.*	*Taphozous hilli*	*Vespadelus finlaysoni*
BAT 21	Yes	Yes	Yes	Low (1 call)			Low (1 call)		Yes	Yes		Yes
Phase 3 March 19												
BAT 23		Yes	Yes			Yes		Yes	Yes	Yes		Yes
BAT 24		Yes	Yes			Yes		Yes	Yes	Yes		Yes
BAT 25		Yes	Yes	Low (1 call)					Yes	Yes		Yes
BAT 26		Yes	Yes			Yes			Yes	Yes		Yes
Phase 4 Sept 2019												
BAT 27			Yes						Yes	Yes		Yes
BAT 28		Yes	Yes							Yes	Yes	Yes
BAT 29		Yes	Yes							Yes	Yes	Yes
BAT 30		Yes	Yes							Yes		Yes

Note: Both *Taphozous* species were detected. The majority of calls were *T. georgianus. T hilli* calls were also present at some sites

Table 5: Ghost bat caves and opportunistic observations. (Ref: Astron 2019)

	Observation	Easting	Northing
Cave 1	Cave assessed as CAT 3 due to its size and depth. No PGb presence recorded.	712281	7450651
Cave 2	Shallow cave assessed as CAT 4. No PGb presence recorded.	716905	7450075
Cave 4	Cave assessed as a CAT 4 roost containing PGb scats	742487	7451071
Cave 5	Cave assessed as CAT 3 due to its size and depth. Scats but no other PGb presence recorded.	710766	7450668
Cave 6	Cave assessed as a CAT 4 roost. No PGb presence recorded.	710715	7450850
Cave 7	Cave assessed as a CAT 4 roost containing PGb scats	697235	7444586
Cave 8	Cave assessed as a CAT 4 roost. No PGb presence recorded.	699012	7444982
Opp Cave 3	Cave assessed as a CAT 4 roost. No PGb presence recorded.	708388	7450375
Opp Cave 9	Cave assessed as a CAT 4 roost containing PGb scats	701453	7448445
Opp1	PGb sighted foraging	700299	7444845

Note 1: Coordinates are Zone 50K

Figure 1. Western survey sites in relation to features in the study area. The orange pins denote sites where PLNb were detected. PLNb call numbers and timing of the closest calls to civil twilight are also noted. Pink pins denote sites where PGb ultrasonic calls and opportunistic observations were recorded. Yellow pins denote sites where microbat calls were recorded but no PLNb or PGb were detected. Green pins denote sites where acoustic detectors were placed to record Night Parrot and Ghost bat social calls.

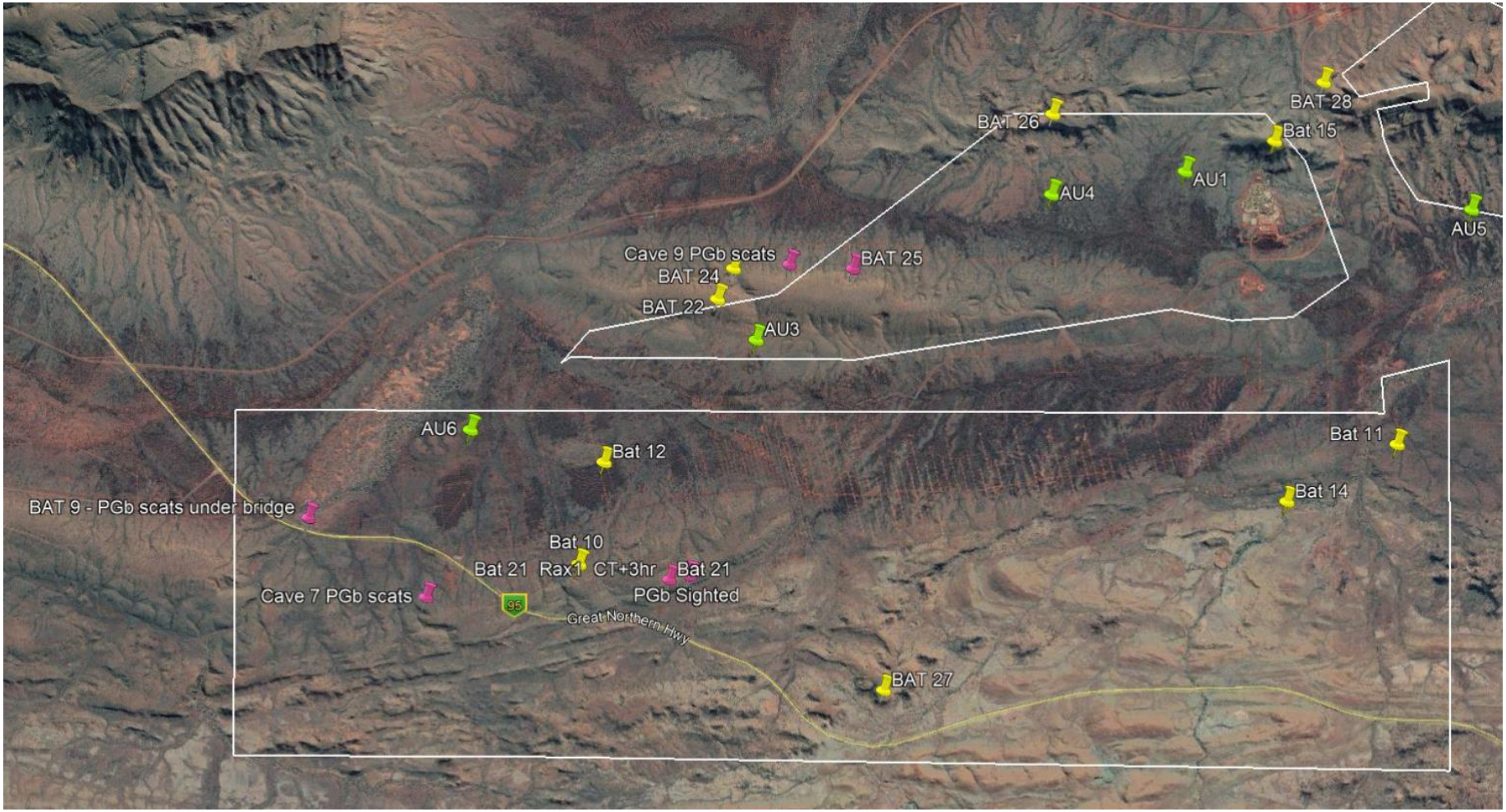


Figure 2. Eastern survey sites in relation to features in the study area. Pin colours are from figure 1. BAT 7 (near BAT 17) is not shown for clarity.

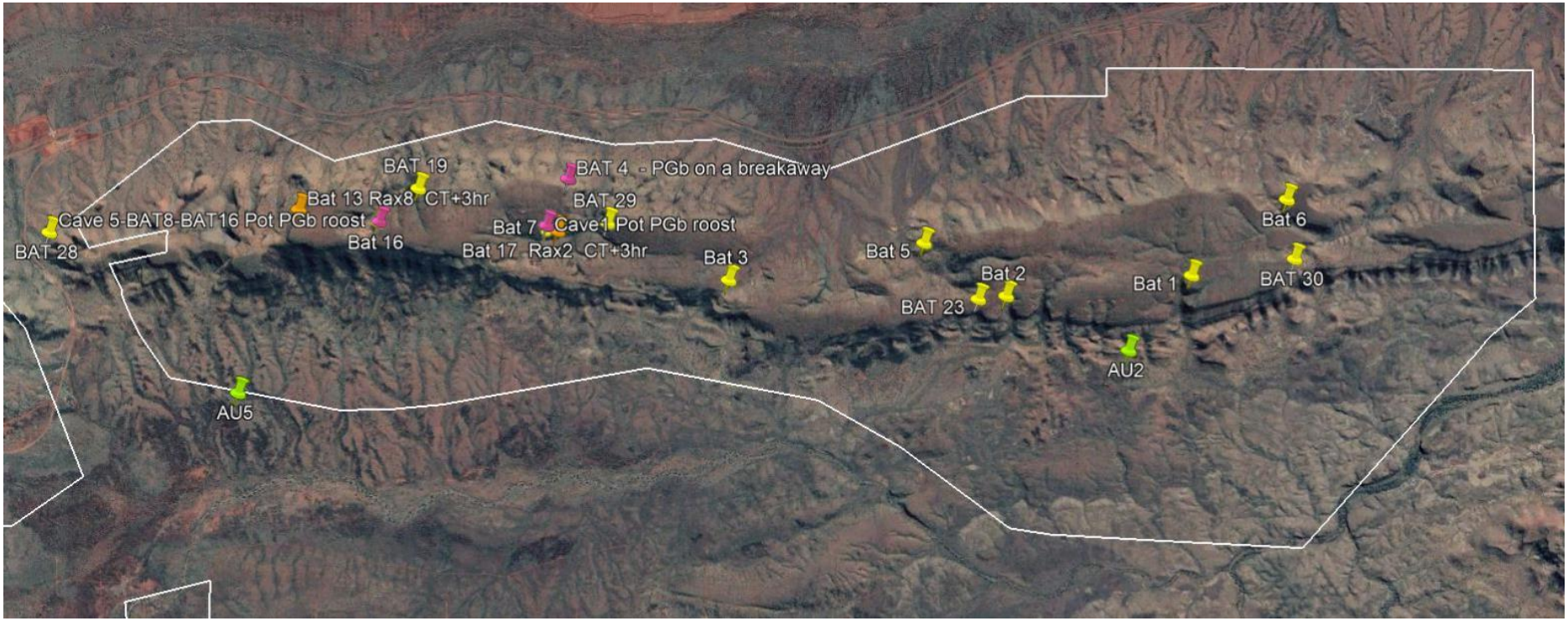


Figure 3. Survey sites where PLNb were detected in May 2018.



Figure 4. Temporal patterns of PLNb calls detected

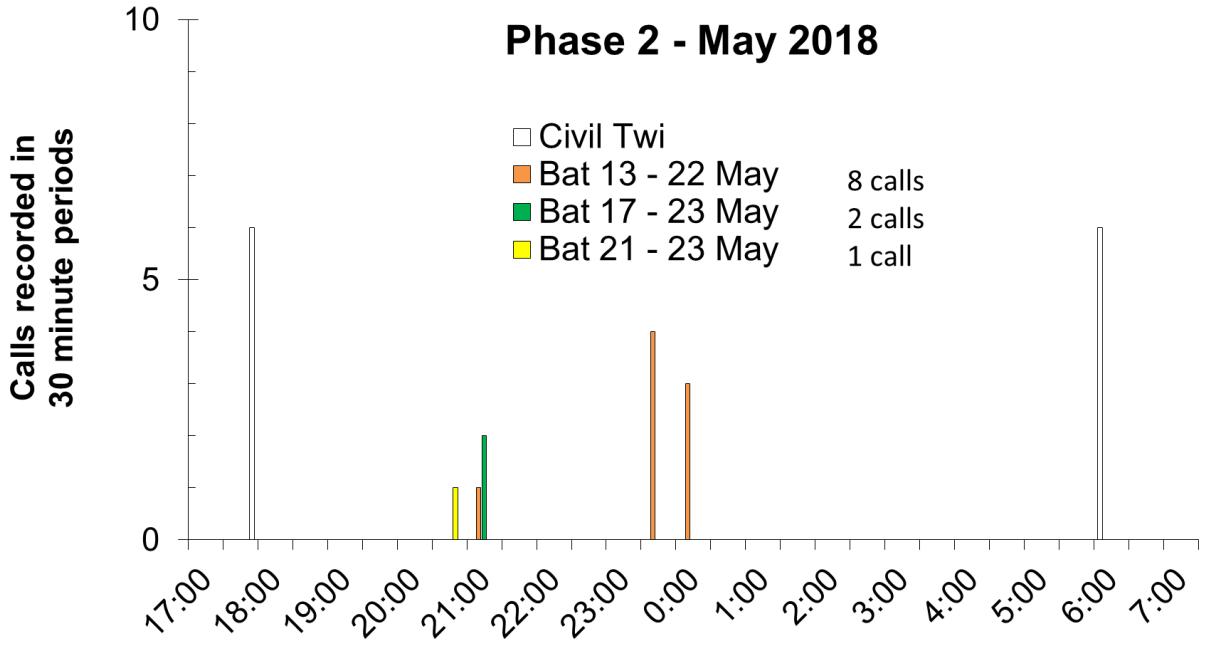
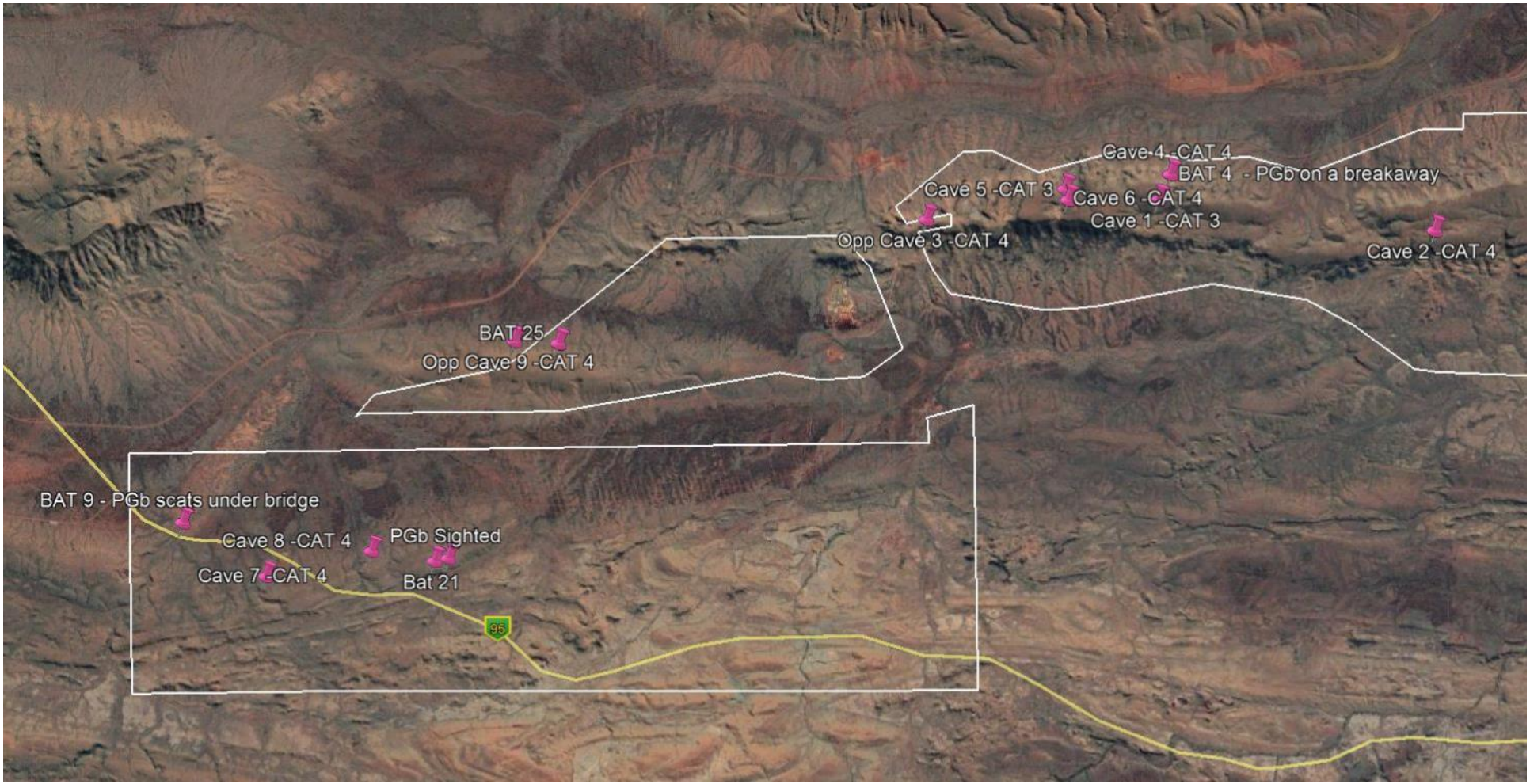


Figure 5. Caves and survey sites where PGb were detected



Appendix 1. Cave Descriptions (Ref: Astron 2019)

Site ID	MGA Zone 50 K		Survey Area	Category rating for PGb usage	Reason	Description	Photograph
	Easting (mE)	Northing (mE)					
Cave 1	712281	7450651	HD2 Proposal Survey Area	3	Ghost Bat nocturnal roost. Occasional diurnal roost possible due to size and depth.	**Entrance:** Large open wide entrance (7 m high x 5 m wide) **Orientation:** South **Internal:** Not recorded; depth >5 m, visual assessment inconclusive **Conditions:** Not recorded	
Cave 2	716905	7450075	HD2 Proposal Survey Area	4	Potential Ghost Bat nocturnal roost	**Entrance:** Wide open entrance (2 m high x 4 m wide) **Orientation:** South-east **Internal:** Not recorded; shallow depth through visual assessment **Conditions:** No raised humidity / temperature; microbats present	

Site ID	MGA Zone 50 K		Survey Area	Category rating for PGb usage	Reason	Description	Photograph
	Easting (mE)	Northing (mE)					
Cave 3	708388	7450375	Greater HD1 Development Envelope	4	Potential Ghost Bat nocturnal roost	**Entrance:** Small narrow entrance (2 m wide x 0.5 m high) **Orientation:** South **Internal:** Not recorded; shallow depth through visual assessment **Conditions:** No raised humidity / temperature; microbats present	
Cave 4	712487	7451071	HD2 Proposal Survey Area	4	Confirmed Ghost Bat nocturnal roost	**Entrance:** Open exposed **Orientation:** North north-east **Internal:** Shallow **Conditions:** Ghost Bat scats present (x5 scats), no raised humidity / temperature; microbats present	No photo available
Cave 5	710766	7450668	HD2 Proposal Survey Area	3	Ghost Bat nocturnal roost. Occasional diurnal roost possible due to depth and presence of rear chamber.	**Entrance:** Small opening (1 m wide x 1 m high) **Orientation:** Not recorded **Internal:** Narrow passage leading to one rear chamber (10-15 m deep) **Conditions:** Ghost Bat scats present	

Site ID	MGA Zone 50 K		Survey Area	Category rating for PGb usage	Reason	Description	Photograph
	Easting (mE)	Northing (mE)					
Cave 6	710715	7450850	HD2 Proposal Survey Area	4	Potential Ghost Bat nocturnal roost	**Entrance:** Low open wide opening (7m wide x 4 m high) **Orientation:** South-east **Internal:** Tappering passage to rear chamber (7 - 9 m deep), rear chamber 2 m wide x 1 m high **Conditions:** No raised humidity / temperature; microbats present	No photo available
Cave 7	697235	7444586	HD2 Proposal Survey Area	4	Confirmed Ghost Bat nocturnal roost	**Entrance:** Open/wide (5 m wide x 2 m high) **Orientation:** South **Internal:** One dome 2 m high with several side pockets **Conditions:** Ghost Bat scats present	
Cave 8	699012	7444982	HD2 Proposal Survey Area	4	Potential Ghost Bat nocturnal roost	**Entrance:** Small entrance (2 m wide x 0.5 m high) **Orientation:** Not recorded **Internal:** Two internal chambers (8 m x 1 m high) **Conditions:** Microbats present	

Site ID	MGA Zone 50 K		Survey Area	Category rating for PGb usage	Reason	Description	Photograph
	Easting (mE)	Northing (mE)					
Cave 9	701453	7448445	Greater HD1 Development Envelope	4	Confirmed Ghost Bat nocturnal roost	**Entrance:** Shallow overhang (3 m x 4 m) **Orientation:** West **Internal:** Shallow overhang 6 m deep **Conditions:** Ghost Bat scats present	

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C.7: Hope Downs 2 Proposal Matters of National Environmental Significance Northern Quoll Monitoring – Phase 3 of 3 Results (July – October 2022) and Phases 1 to 3 Summary Report

Hope Downs 2 Proposal
Matters of National Environmental Significance Northern Quoll Monitoring Phase 3 of 3 Results (July - October 2022) and Phases 1 to 3 Summary Report

Prepared for
Rio Tinto



astron
an ecocene company

Report Reference: 14324-22-BISR-1Rev0_230809

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Hope Downs 2 Proposal
Matters of National Environmental Significance Northern Quoll Monitoring Phase 3 of 3 Results (July - October 2022) and Phases 1 to 3 Summary Report

Prepared for
Rio Tinto

Job Number: 14324-22

Reference: 14324-22-BISR-1Rev0_230809

Revision Status

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Abbreviations

Abbreviation	Definition
°C	Degrees Celsius
Astron	Astron Environmental Sciences
BC Act	*Biodiversity Conservation Act 2016*
BHT	Bedded Hilltop - deposit within the Hope Downs 2 Development Envelope
BoM	Bureau of Meteorology
DBCA	Department of Biodiversity, Conservation and Attractions
EMP	Environmental Management Plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
g	Grams
ha	Hectares
HD1	Hope Downs 1
HD2	Hope Downs 2 - deposit within the Hope Downs 2 Development Envelope
IBRA	Interim Biogeographic Regionalisation for Australia
km	Kilometres
m	Metres
MEZ	Mining Exclusion Zones
mm	Millimetres
MNES	Matters of National Environmental Significance
PNQRP	Pilbara Northern Quoll Research Program (DBCA)
SRE	Short Range Endemic
Survey area	Hope Downs 2 Development Envelope, which includes two deposits: Hope Downs 2 and Bedded Hilltop (10,817.7 ha)

Executive Summary

Rio Tinto is evaluating the potential development of additional iron ore deposits at Hope Downs 2 in the Pilbara region of Western Australia. Astron Environmental Services was commissioned by Rio Tinto to assist with development and establishment of a Northern Quoll, *Dasyurus hallucatus* (Endangered) baseline monitoring program within the Hope Downs 2 Proposal area (the survey area, 10,817.7 ha) as part of the Environmental Management Plan. This was achieved through undertaking:

- desktop review and analysis of Northern Quoll monitoring programs and previous biological surveys relevant to the survey area
- field surveys including the deployment and retrieval of Northern Quoll long-term monitoring cameras at five monitoring localities - 35 cameras; Phase 1 (2,128 trap nights) between September and November 2020, Phase 2 (4,151 trap nights) between October 2021 and February 2022, and Phase 3 (2,221 trap nights) between July and October 2022.
- data analysis determining the presence and where possible, the abundance of Northern Quolls
- interpretation of results and reporting on the data capture from the long-term camera monitoring sites and comparable studies within the Pilbara region.

The overall distribution of records surrounding the survey area suggests that the Northern Quoll is likely to be patchily distributed at low density. Other targeted surveys for Northern Quoll in the surrounding locality and broader south-east Pilbara region reported low capture rates, variable capture rates, or the apparent absence of the species. Available data and occupancy modelling from regional studies suggest that Northern Quoll are largely absent or at very low density in the south-eastern portion of the Pilbara.

There are several Northern Quoll records documented in Detailed surveys and a Targeted survey within the Bedded Hilltop (BHT) area prior to the establishment of the monitoring program, with few records since. The records from Detailed surveys were initially considered to be of significance given that the survey area is at the edge of the species' regional distribution, and there has been a paucity of previous local and regional records. Since the Detailed (formerly Level 2) surveys (2017 to 2019) few records of Northern Quoll have been documented, including two motion-camera records from the Targeted survey (2020) prior to the monitoring program and one opportunistic scat record during Phase 1 (2020) of the program. No Northern Quolls have been recorded on the long-term cameras during the baseline monitoring program (8,500 camera trap nights in total), despite utilising a survey designed to target the species within suitable habitat.

Northern Quoll populations are highly variable in both temporal and spatial scales and experience natural fluctuations due to the species life history and other stochastic factors. Fluctuations may also be a function of additional (and linked) factors such as fire history, and predator and prey densities. Fire events in 2019 affected large areas of BHT and may have contributed to the lack of Northern Quoll records since 2019 by limiting resource availability during the earlier phases of monitoring. High Feral Cat (**Felis catus*) activity has also consistently been recorded since the establishment of the monitoring program in 2020.

Given the extensive survey effort now completed (8,500 camera trap nights), and the overall distribution pattern of records surrounding the HD2 area, it is concluded that currently, the Northern Quoll is patchily distributed and at a low density within the HD2 area and surrounding locality. It is not clear why the number of Northern Quoll records has decreased from 12 records in May 2018 to only

four records subsequently, but the presence of feral predators and recent fire may be explanatory variables.

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1 Introduction

1.1 Project Background

Rio Tinto is evaluating the potential development of additional iron ore deposits at Hope Downs 2 (HD2) in the Pilbara region of Western Australia, approximately 68 km north-west of Newman (Figure 1). To support assessment of the HD2 Proposal under the Western Australian *Environmental Protection Act 1986* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), an Environmental Management Plan (EMP) has been developed by Rio Tinto on behalf of Hamersley HMS Pty Limited (the Proponent). The EMP specifically addresses the following environmental factor associated with the HD2 Proposal:

- Terrestrial fauna – Matters of National Environmental Significance (MNES) fauna species and their high value habitat: Northern Quoll (*Dasyurus hallucatus*), Ghost Bat (*Macroderma gigas*), Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) and Pilbara Olive Python (*Liasis olivaceus barroni*).

The overall management strategy for MNES fauna is to maintain the integrity of the high value habitat mapped within the HD2 Proposal area (the survey area), mainly comprising Gorge/Gully and Breakaway habitats. These habitats are known to contain core foraging, denning and roosting habitats for species of elevated conservation significance. Given the presence of Northern Quolls, albeit at low numbers, additional management-based provisions are proposed for this species.

This report considers aspects relating to the development and implementation of the Northern Quoll monitoring program by Astron Environmental Services (Astron) using long-term motion sensitive cameras. This program began with the establishment and monitoring of five sites between September and November 2020 (Phase 1; 2,128 trap nights) which were then re-monitored between October 2021 and February 2022 (Phase 2; 4,151 trap nights), and between July and October 2022 (Phase 3; 2,221 trap nights). The monitoring program aims to establish a baseline for species' presence and use of high value habitats to further inform management practices and procedures.

1.2 Scope and Objectives

Astron was commissioned by Rio Tinto to assist with development and establishment of a Northern Quoll baseline monitoring program within the survey area (Figure 1). The specific aspects considered in this report relate to the implementation of long-term camera trap monitoring for Northern Quolls and include:

- desktop review and data analysis of Northern Quoll monitoring programs and previous biological surveys relevant to the survey area
- field survey including:
    - re-deployment and retrieval of 35 cameras set across five existing monitoring sites (three impact and two reference sites)
- data analysis determining the presence and if possible, the abundance of Northern Quolls
- interpreting the results and reporting on the data capture from the long-term camera monitoring sites.

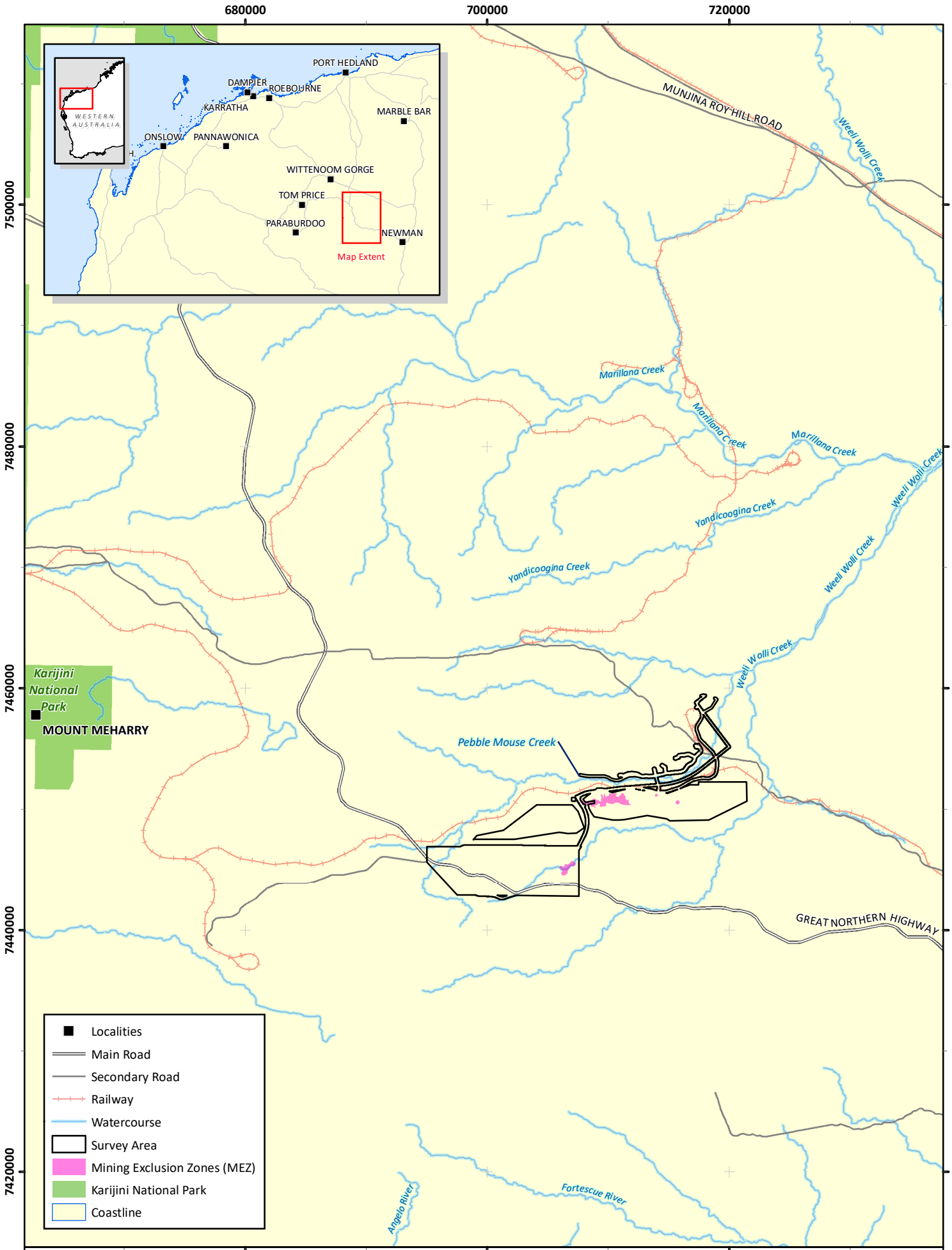
The resultant data have been incorporated to produce this report, which is intended to support and inform the environmental assessment and monitoring process in accordance with the requirements of the EPBC Act. Astron conducted the Northern Quoll monitoring survey in accordance with the regulatory guidance detailed in Table 1.

The scope and key limitations of the Northern Quoll monitoring survey are outlined in Table 1 and further detail is provided in Section 4.3 of this report.

Table 1: Summary of Astron's Northern Quoll desktop assessment and long-term monitoring program.

Level of survey	Survey area and size	Survey timing	Relevant regulatory and technical guidance documents	Compliance with survey guidelines	Key survey limitations
Northern Quoll desktop assessment and targeted monitoring	Hope Downs 2 (HD2) Proposal 10,817.7 ha (survey area)	Phase 1: September – November 2020 (Astron Environmental Services 2023a) Phase 2: October 2021 – February 2022 (Astron Environmental Services 2023b)	• EPBC Act referral guideline for the Endangered Northern Quoll *Dasyurus hallucatus* (Department of the Environment and Energy 2016) • Survey Guidelines for Australia's Threatened Mammals Technical Guidance - Sampling Methods for Terrestrial Fauna (Department of Sustainability Environment Water Population and Communities 2011) **Other supporting guidance documents:** • Environmental Factor Guideline – Terrestrial Fauna (Environmental Protection Authority 2016)	• Surveys conducted by suitably qualified and experienced zoologists. • Cameras were deployed for more than the minimum number of nights recommended.	• Rainfall in the three months preceding and during Phase 1 and 2 was below average but annual rainfall was on average, with good summer rainfall. In Phase 3, annual rainfall was below average but rainfall in the three months preceding was higher than average. • Historically high Feral Cat (**Felis catus*) activity in the area, prior to Phase 1, with records on 40% of deployed cameras. This is classified as a potential

Level of survey	Survey area and size	Survey timing	Relevant regulatory and technical guidance documents	Compliance with survey guidelines	Key survey limitations
		Phase 3: July – October 2022 (current survey)	• Technical Guidance - Terrestrial Fauna Surveys for Environmental Impact Assessment (Environmental Protection Authority 2020) • Pilbara Northern Quoll Project: Surveying and Monitoring *Dasyurus hallucatus* in the Pilbara, Western Australia (Dunlop et al. 2014 p. 2014).		explanatory variable for the low detection of Northern Quoll compared to previous records (14). • Deployment of camera traps without an attractant in Phase 1 due to ethics requirements. This was classified as a potential limitation for the low detection of Northern Quoll compared to previous records. However, Phases 2 and 3 were conducted with attractant. • Survey timing of Phase 1 and Phase 2 was suboptimal regarding Northern Quoll activity. This was classified as a potential limitation for the low detection of Northern Quoll compared to previous records. However, Phase 3 was conducted at an optimal time.



Rio Tinto

Hope Downs 2 Proposal Matters of National Environmental Significance Northern Quoll Monitoring Phase 3 of 3 Results (July – October 2022) and Phases 1 to 3 Summary Report

Figure 1: Survey area location

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Author: D. Keirle	Date: 09-08-2023
Drawn: C. Dyde	Figure Ref: 14324-22-BIDR-1Rev0_230809_Fig01_Locn

Datum: GDA 1994 - Projection: MGA Zone 50

0 5 10 15 20 Km

N

2 Environmental Context

2.1 Physical Environment

2.1.1 Climate

The climate of the Pilbara region of Western Australia is classified as arid tropical with two distinct seasons: a hot, wet summer (October – April) and a mild, dry winter (May – September) (Bureau of Meteorology 2022).

Based on long-term climatic data from the nearest Bureau of Meteorology (BoM) weather station at Newman Aero (Station 007176) (approximately 90 km south-east of the survey area) the mean annual rainfall since 1971 is 317 mm. The mean maximum daily temperatures since 1996 range between 23.1°C and 39.3°C, and range above 30°C for much of the year (Figure 2) (Bureau of Meteorology 2022).

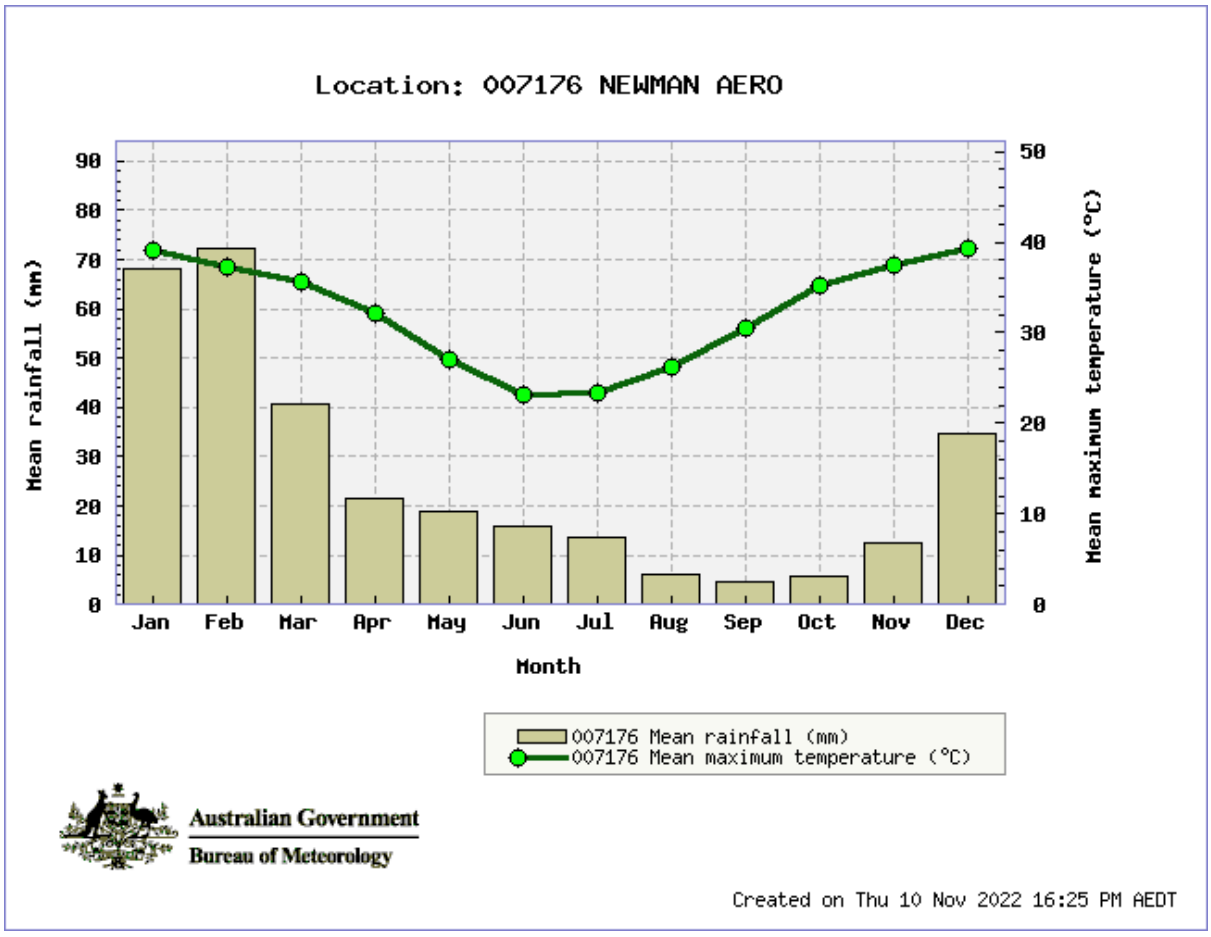

Figure 2: Climate data for Newman Aero Station (Station 007176). Mean annual rainfall data has been calculated from 1971 – 2022 and mean maximum temperature has been calculated from 1996 – 2022 (Bureau of Meteorology 2022).

2.1.2 Geology and Soils

The surface geology of the survey area is comprised of 10 units (Stewart et al. 2008), with Colluvium 3841 as the most dominant (Table 2). Geological mapping of the survey area and surrounds is presented in Figure A.1 (Appendix A).

Table 2: Geological units of the survey area (Stewart et al. 2008).

Geological name	Label	Area (ha)
Alluvium 38485: Channel and flood plain alluvium; gravel, sand, silt, clay, locally calcreted.	Qa	431.4
Brockman Iron Formation: banded iron-formation, chert, mudstone and siltstone.	Lchk	681.7
Calcrete 38497 - Pisolitic, nodular or massive calcrete; ferruginous inclusions; calcareous cementing of bedrock and transported materials; locally with intercalated chalcedony; as low mounds, in playa lakes, or as valley calcrete; locally dissected and karstified	Czk	18.1
Colluvium 38491: Colluvium, sheetwash, talus; gravel piedmonts and aprons over and around bedrock; clay-silt-sand with sheet and nodular kankar; alluvial and aeolian sand-silt-gravel in depressions and broad valleys in Canning Basin; local calcrete, reworked laterite.	Qrc	2,587.8
Fortescue Group: Metadolerite, dolerite, gabbro; medium to coarse grained, massive grey-green rock, usually foliated.	Adf	763.6
Jeerinah Formation: Shale, sandstone, siltstone, mudstone, dolomite, local microbanded chert, jaspilite, conglomerate; fine-grained massive rhyolite; mafic tuff with local accretionary lapilli and agglomerate; thin basalt/dolerite and andesitic basalt flows.	Awfj	1,443.9
Marra Mamba Iron Formation: Chert, ferruginous chert, jaspilite, banded iron-formation, minor shale, siltstone, mudstone.	Achm	2,328.3
Mount McRae Shale and Mount Sylvia Formation: Interbedded shale, chert, banded iron-formation.	Ashm	1,212.5
Weeli Wolli Formation: Banded iron-formation (commonly jaspilitic), mudstone, siltstone; common interlayered metadoleritic sills.	Lchw	1,036.1
Wittenoom Formation: Calcitic dolomite, interbedded chert and shale in upper and lower parts, volcaniclastic sandstone.	Alhw	314.3

2.1.3 Surface Water and Hydrology

No Wetlands of International Importance (i.e. Ramsar wetlands) or Nationally Important Wetlands occur within the survey area (Department of the Environment and Energy 2020). The nearest Nationally Important Wetland is Fortescue Marshes, located 40 km north of the survey area, which has been nominated as a proposed Ramsar site. One of the upper tributaries of Weeli Wolli Creek and Pebble Mouse Creek pass through the survey area.

2.2 Biological Environment

2.2.1 Interim Biogeographic Regionalisation of Australia

The Interim Biogeographic Regionalisation for Australia (IBRA version 7) divides the Australian continent into 89 bioregions and 419 subregions (Department of Agriculture, Water and the Environment 2020). The IBRA regions represent a landscape-based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and fauna. The survey area occurs in the Pilbara bioregion, of which 8.4% is represented in the national reserve system (Department of the Environment and Energy 2018).

The biodiversity of the 53 subregions recognised in Western Australia was documented as part of a national audit to provide priorities for conservation action (Department of Conservation and Land Management 2002). The survey area occurs within the Hamersley subregion of the Pilbara region and is described in the audit as:

- Hamersley PIL3 – dissected bold plateaux and ranges of flat lying, moderately folded sandstone and quartzite with vegetation described as Mulga low woodland over tussock grasses occurring on fine textured soils in valley floors, with scattered snappy gum (*Eucalyptus leucophloia*) over *Triodia brizoides* on skeletal soils of the ranges (Kendrick 2001).

2.2.2 Land Systems

Land systems of the Western Australian rangelands have been mapped and described by the Department of Primary Industries and Regional Development (formerly the Department of Agriculture and Food WA) outlining the distributions and providing comprehensive descriptions of biophysical resources, including soil and vegetation condition. A total of 102 land systems occur in the Pilbara bioregion covering 181,723 km^2. Nine land systems occur in the survey area (Table 3). The layout of these land systems within the survey area is shown in Figure A.2 (Appendix A).

Table 3: Distribution of land systems within the survey area.

Land system	Total area within bioregion (ha)	Total area (ha) (proportion of survey area (%))
Boolgeeda - stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands.	961,847	1,486.0 (13.7)
Calcrete - low calcrete platforms and plains supporting shrubby hard spinifex grasslands.	134,834	4.9 (<0.1)
Egerton - highly dissected plains and slopes with sparse mulga shrublands or shrubby hard spinifex grasslands.	66,849	1.4 (<0.1)
McKay - hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands with acacias and occasional eucalypts.	426,124	326.7 (3.0)
Newman - rugged jaspilite plateaux, ridges and mountains with hard spinifex.	1,994,339	4,647.2 (43.0)
Pindering - gravelly hardpan plains supporting groved mulga shrublands with hard and soft spinifex.	38,738	410.5 (3.8)
Platform - dissected slopes and raised plains supporting shrubby hard spinifex grasslands.	236,390	2,522.2 (23.3)
Rocklea - basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.	2,880,288	1,314.2 (12.1)
Wannamunna - hardpan plains and internal drainage tracts supporting mulga shrublands and woodlands and occasionally eucalypt woodlands.	63,004	104.6 (1.0)

2.2.3 Pre-European Vegetation

Beard (1975) completed broad-scale (1:1,000,000) pre-European vegetation mapping at an association level. The Beard mapping was later used by the Department of Agriculture and Food WA (Shepherd et al. 2002) to compile vegetation units that assisted with identifying pre-European and current extents of vegetation throughout Western Australia.

Three pre-European vegetation units, 82, 18 and 29 (Shepherd et al. 2002), are associated with the survey area (Figure A.3, Appendix A). Table 4 summarises the current and pre-European extent of these three vegetation units in the Pilbara bioregion and the survey area.

Table 4: Extent of pre-European vegetation within the survey area (Department of Biodiversity, Conservation and Attractions 2018).

Vegetation association	Mapping unit (Beard 1975)	Description	Total area (ha) (proportion of survey area (%))	Pre-European extent (ha)	Current extent in bioregion (ha)	Proportion of pre-European extent remaining (%)	Pre-European extent with formal protection (%)
82	e16Lr t3Hi	Hummock grasslands, low tree steppe; snappy gum over *Triodia wiseana*	5,452.2 (50.4)	2,168,702	2,156,558	99.4	13.7
18	a1Li	Low woodland, open low woodland or sparse woodland; mulga (*Acacia aneura*)	5,339.0 (49.4)	580,512	576,389	99.3	29.6
29	a1Lp	Mulga (*Acacia aneura*) and associated species.	26.5 (0.2)	172,083	171,975	99.9	12.8

2.3 Commonwealth Conservation Categories and Management

The EPBC Act provides a legal framework to protect and manage MNES including listed flora, fauna and ecological communities. Listed flora, fauna and ecological communities are allocated a conservation category, which are outlined in Tables B.1 and B.2 (Appendix B).

2.4 Land Use and Tenure

The survey area is located within the Shire of East Pilbara. The local area is mainly used for mineral exploration and mining activity. Karijini National Park is the nearest conservation reserve, located approximately 35 km to the west of the survey area (Figure 1).

3 Background on the Northern Quoll

3.1 Distribution

The Northern Quoll occurs in a variety of habitats (Oakwood 2008) but is commonly found in open lowland savannah forest and rocky escarpments. Northern Quolls were once common across the majority of northern Australia but have suffered significant range contractions and population fragmentation since European settlement (Braithwaite and Griffiths 1994, Hill and Ward 2010).

Rocky areas are a particularly important habitat type for Northern Quolls in the Pilbara as these areas retain water and provide a diversity of microhabitats. Rocky areas also tend to have greater floristic diversity and productivity resulting in greater prey density compared to non-rocky areas. Importantly, these areas provide refuge from Feral Cats, fire and livestock (Hill and Ward 2010), and provide breeding potential and denning options (Department of the Environment and Energy 2016).

Northern Quolls are more common in the northern parts than the southern and south-eastern parts of the Pilbara region, particularly within 150 km of the coast (Cramer et al. 2016, Dunlop et al. 2019; Figure 3 and Figure 4).

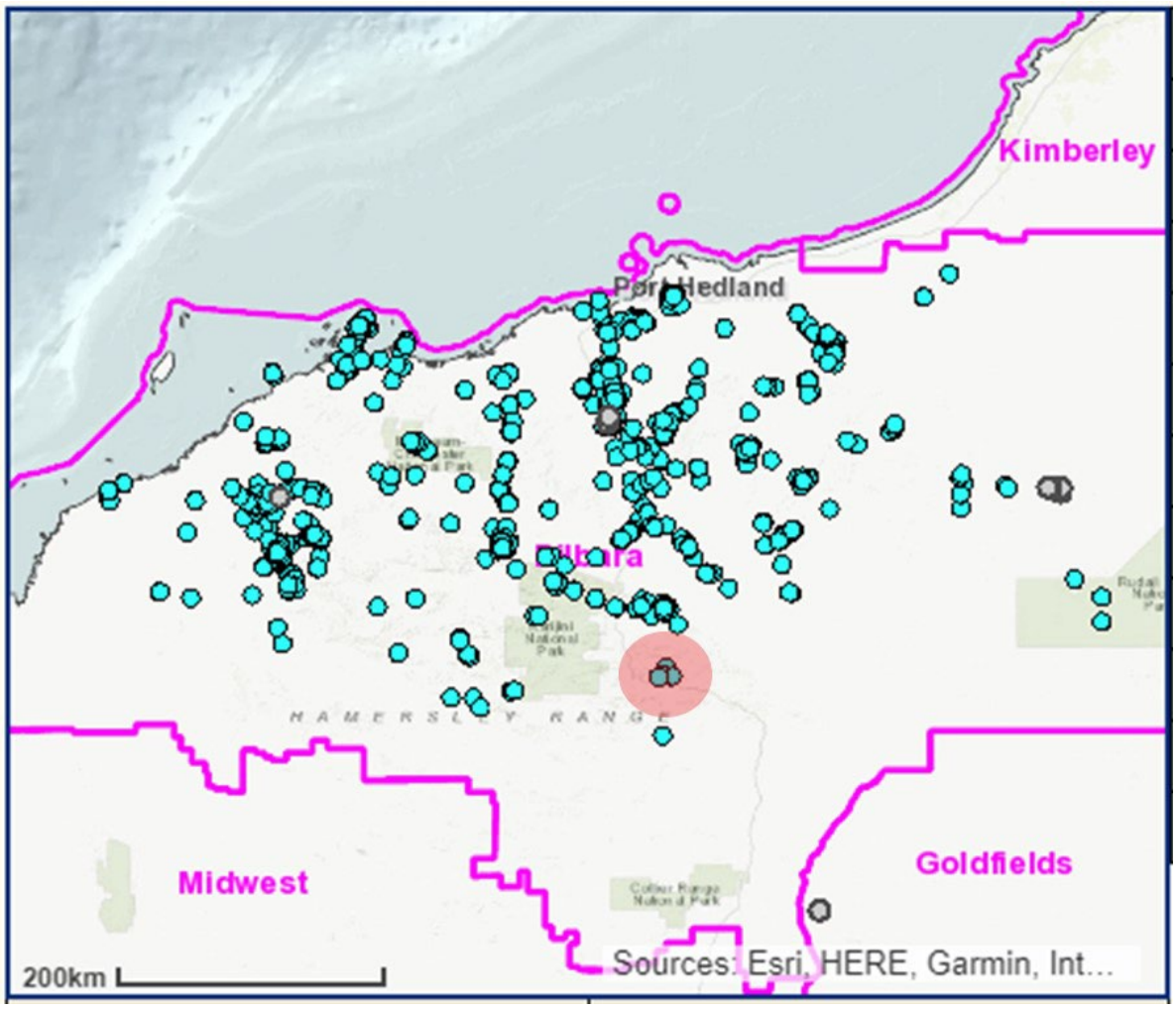

Figure 3: Northern Quoll records from the Pilbara region, available on NatureMap (Department of Biodiversity, Conservation and Attractions 2021). Current survey area with a 40 km buffer is indicated by the red circle.

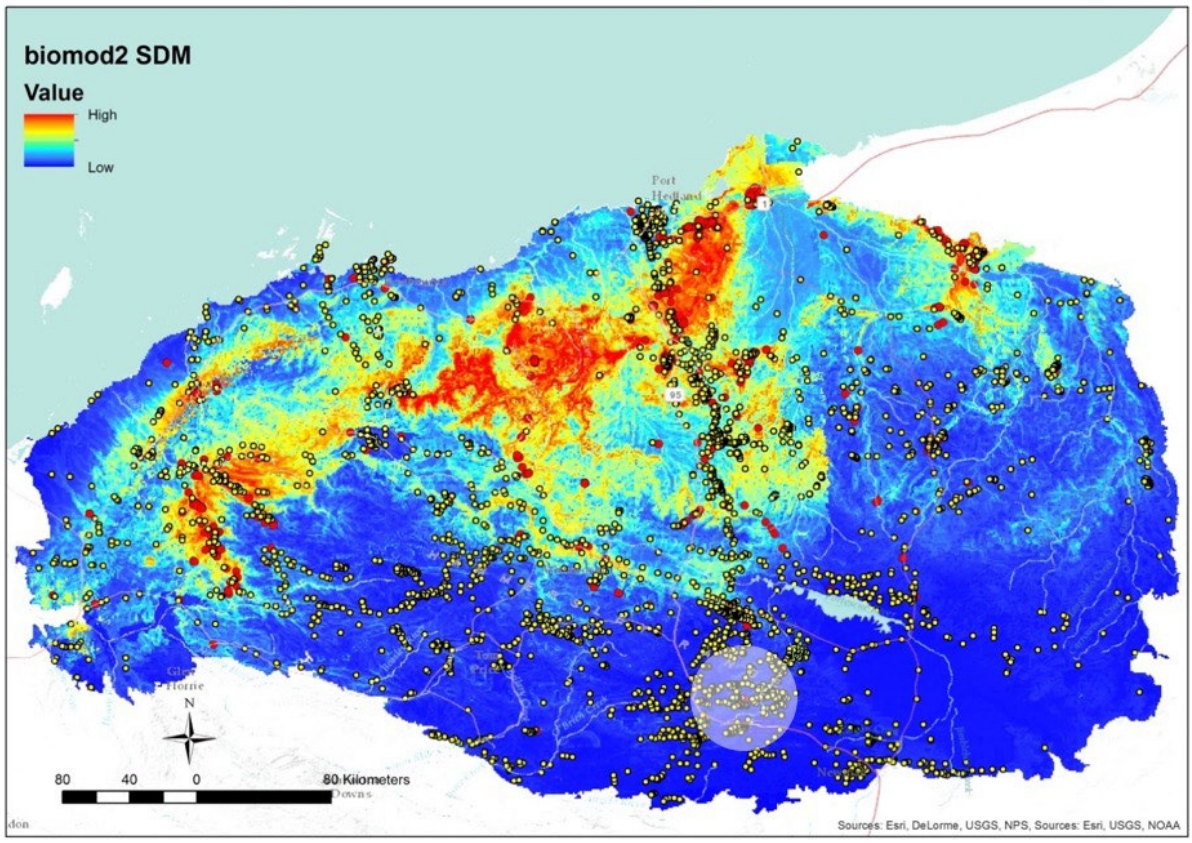

Figure 4: Likelihood of Northern Quoll presence in the Pilbara bioregion, ranging from red (highest likelihood) to blue (lowest likelihood) to a 1 km² resolution. The points indicate past fauna surveys that either detected (red) or did not detect (yellow) Northern Quolls. Current survey area with a 40 km buffer indicated by a white circle. Reproduced with permission from Molloy et al. (2017).

3.2 Biology

The Northern Quoll is a small (240 g to 1,120 g; Oakwood 2008), omnivorous dasyurid marsupial that is partially arboreal and mostly nocturnal (Dunlop et al. 2019 p. 2019). Northern Quolls are short-lived with both sexes maturing at 11 months and display a partly semelparous reproductive strategy, whereby many females and almost all males die following reproduction in their first year (Oakwood 2008, Fisher et al. 2013).

3.3 Conservation Status

The Northern Quoll is protected under both State and Federal legislation. The species is listed as Schedule 1 ('Endangered') under the Western Australian *Biodiversity Conservation Act 2016* (BC Act) and as 'Endangered' under the Federal EPBC Act.

Northern Quolls in the Pilbara have high conservation priority due to their separation from other northern populations, distinct genetics, occupancy of a unique habitat niche and exposure to different threatening processes (Dunlop et al. 2019).

3.4 Hope Downs 2 Northern Quoll Monitoring Program

Northern Quolls were recorded during baseline surveys at HD2 within Gorge/Gully and Breakaway habitats present on the Bedded Hilltop (BHT) deposit (Astron Environmental Services 2020a). Mining Exclusion Zones (MEZ) have been delineated on the western end of the BHT deposit to preserve this habitat within the survey area as part of the EMP (Figure 1). An additional monitoring program for Northern Quolls was proposed to employ a Before-After-Control-Impact survey design approach, including potential impact sites within the MEZ and on the BHT deposit, and reference sites on the range/s to the east of the development area for comparison. It was intended that the monitoring program would be implemented over two to three annual surveys prior to proposed activities at HD2 to account for any variability in the baseline data and satisfy the 'Before' element in planned monitoring. The field component of this survey involved the re-deployment of cameras at fixed sites (three impact sites and two reference sites) between July and October 2022 as part of this monitoring program (Phase 3 of 3).

The motion camera data captured is intended to be used to inform the data requirements under the EMP by establishing baselines for species' presence and use of high value habitats, and to further inform management practices and procedures. Data are to be specifically compared and contrasted against the Department of Biodiversity, Conservation and Attractions (DBCA) regional survey and monitoring work for the Northern Quoll for context (e.g. Dunlop et al. 2019; see Section 4.1.1).

4 Methods

4.1 Desktop Assessment

A desktop assessment including database searches and literature review with a specific focus on Northern Quolls was undertaken previously to assess records within the vicinity of the survey area (Astron Environmental Services 2023b, 2023a). The assessment provides context to the field results generated to date, the habitat requirements and presence of Northern Quolls within the survey area, and to place these results in a broader regional context.

Fauna surveys have been previously commissioned by Rio Tinto within the vicinity of the survey area (Figure 5) and the results supplied to Astron for the desktop assessment in the Phase 1 and Phase 2 monitoring reports (Astron Environmental Services 2023b, 2023a). No new survey reports or annual reports from the DBCA regional monitoring project were found since the initial desktop assessment.

4.1.1 Northern Quoll Regional Survey

In 2011 DBCA embarked on a 10 year Northern Quoll regional monitoring project within the Pilbara (Cook and Morris 2013) with the aim of improving understanding of Northern Quoll population distribution, ecology, abundance and demographics in the region. The project aims to provide contextual information to environmental regulators, consultants and resource development companies that will allow appropriate management to ensure the persistence of resident Northern Quoll populations in the Pilbara region.

The results provide a basis for comparison of abundance estimates between potential impact and reference sites for the current HD2 monitoring program. Following future monitoring surveys, temporal analyses can be conducted over the multiple phases of 'baseline' monitoring to determine inter-annual variability and compare this variability with regional trends. The latest publicly available report is the 2018 annual report (Dunlop et al. 2019).

690000 700000 710000 720000 730000

7460000

7450000

Survey Area

Previous Surveys

- Hope Downs Project Life of Mine Targeted Fauna Survey (Biota 2011a)
- Hope Downs Rail Corridor (Juna Downs Section) Fauna Survey (Biota 2006)
- Hope Downs South West Marra Mamba Development Targeted Fauna Survey (Biota 2014a)
- Greater West Angelas Terrestrial Fauna Assessment (Ecologia 2014)
- A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Infrastructure Corridor Option 1 Near Newman Western Australia (Ninox 2009a)
- A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Infrastructure Corridor Option 6 Near Newman Western Australia (Ninox 2009b)
- Hope Downs 2 Proposal Fauna Survey (Astron 2020a)
- Hope Downs 2 Proposal MNES Fauna Assessment (Astron 2020b)
- Hope Downs 2 Proposal MNES Northern Quoll Monitoring - Phase 1 (Astron 2023a)
- Hope Downs 2 Proposal MNES Northern Quoll Monitoring - Phase 2 (Astron 2023b)
- Hope Downs 2 Proposal Motion Camera Memo February to September 2020 (Astron 2023c)

Biota 2011a

Biota 2014a

Biota 2006

Ninox 2009b

Astron 2020a, 2020b, 2023a, 2023b, 2023c

Ninox 2009a

Ecologia 2014

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Rio Tinto

Hope Downs 2 Proposal Matters of National Environmental Significance Northern Quoll Monitoring Phase 3 of 3 Results (July – October 2022) and Phases 1 to 3 Summary Report

Figure 5: Previous fauna surveys conducted in the vicinity of the Survey Area

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

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Author: A. Catterick-Stoll | Drawn: C. Dyde | Date: 09-08-2023 | Figure Ref: 14324-22-BIDR-1Rev0_230809_Fig05_PrevSurveys

4.2 Field Survey

4.2.1 Survey Timing and Personnel

Astron zoologists Brittany Osborn and Sean Smithies established 35 long-term monitoring cameras for Phase 1 between 8 and 14 September 2020. The 35 cameras were collected between 10 and 12 November 2020 by Astron zoologist Matthew Love.

Astron zoologists David Keirle and Brittany Osborn re-deployed 35 long-term monitoring cameras at the established monitoring sites for Phase 2 between 25 and 29 October 2021. The 35 cameras were collected between 22 and 24 February 2022 by Astron zoologists Kady Grosser and Sean Smithies.

Astron zoologists Lucy Dadour and Amelia Catterick-Stoll re-deployed 35 long-term monitoring cameras at established monitoring sites for Phase 3 between 28 July and 2 August 2022. The 35 cameras were collected between 3 and 6 October 2022 by Amelia Catterick-Stoll and Brett Jorgensen.

Opportunistic observations of fauna, including secondary signs (tracks and scats) were undertaken while traversing the survey area and during deployment and collection of cameras.

4.2.2 Weather

Daily weather observations recorded from Newman Aero (station 007176) were used to describe local rainfall and temperature preceding the surveys.

4.2.2.1 Phase 1

Rainfall in the 12 months preceding Phase 1 was 349 mm (8% more than the long-term mean of 324.3 mm). Rainfall in the 12 weeks preceding the commencement of the monitoring survey was 68% (25 mm) below the mean rainfall for the same period but followed an above average wet season with 43% (79 mm) more rainfall received between January and March than the long-term mean.

4.2.2.2 Phase 2

Rainfall in the 12 months preceding Phase 2 was 354 mm (10% more than the long-term mean of 317.8 mm). Rainfall in the 12 weeks preceding the commencement of the monitoring survey was 100% (8 mm) below the mean rainfall for the same period (no rainfall recorded in the 12 weeks prior to survey) but followed an above average wet season with 18% (12 mm) more rainfall received between January and March than the long-term mean.

4.2.2.3 Phase 3

The annual rainfall recorded preceding the Phase 3 survey (226.8 mm) was 28.0% below the long-term mean (315.2 mm) recorded at Newman (Figure 6). Rainfall in the three months preceding the field survey (86.4 mm) was 52.9% above the long-term mean (56.5 mm) (Figure 6). The maximum daily temperatures during the field survey ranged between 28.7°C and 38.2°C (Bureau of Meteorology 2022).

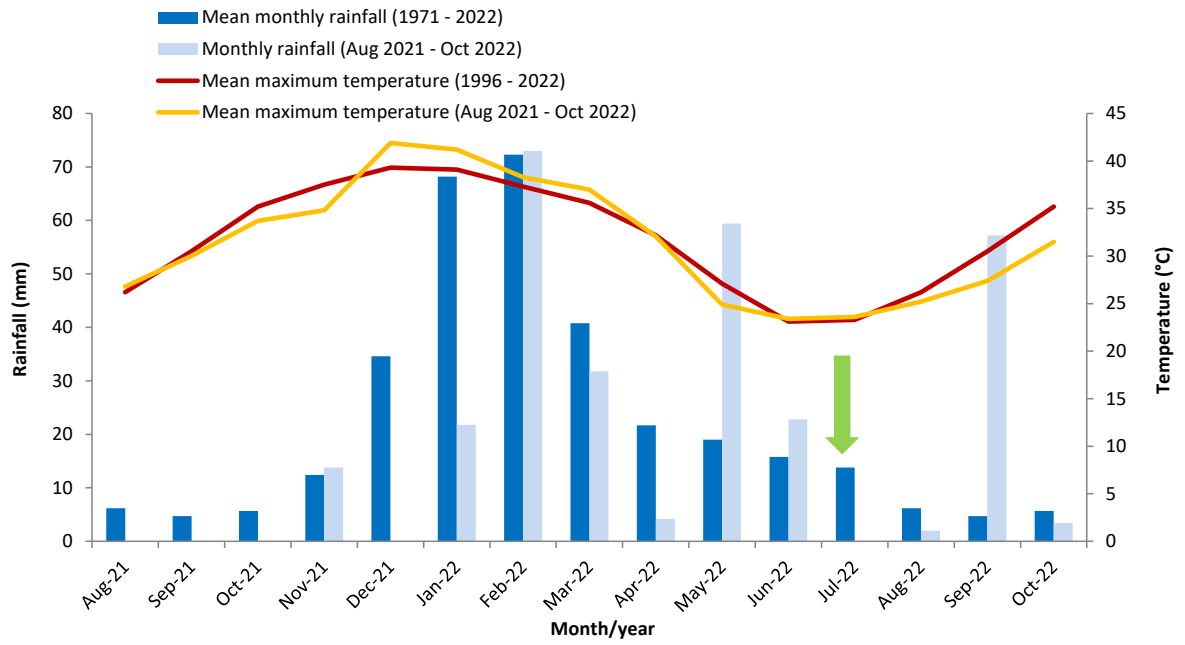

Figure 6: Newman Aero (station 007176) mean monthly rainfall (1971 - 2022), total recorded rainfall (August 2021 - October 2022), long-term mean monthly maximum temperatures (1996-2022) and mean monthly maximum temperatures (August 2021 - October 2022). The green arrow indicates the current Northern Quoll monitoring survey commencement (Phase 3).

4.2.3 Long-term Monitoring Motion Sensitive Cameras

The motion-sensitive cameras (Reconyx® HyperFire 2) set up in July/August 2022 (Phase 3) are part of a long-term monitoring program established in September 2020 (Table C.1 and Figure C.1, Appendix C).

The monitoring program consists of seven cameras set at five sites (35 cameras in total; sites NQ1-5) within Northern Quoll habitat; three sites within 'potential impact' areas (two within the MEZ, one on BHT) and two within 'reference' areas to the east of the MEZ, initially established in September 2020 (Phase 1). In October 2021 (Phase 2) the cameras were redeployed at four of the five previously established sites. One of the reference sites from Phase 1 was moved behind Hope Downs 1 (HD1) camp as the habitat is more suitable and was known to provide refuge to Northern Quolls based on the capture of an individual during the Hope Downs 2 Fauna survey in May 2018 (Astron Environmental Services 2023a). For the current survey (Phase 3), the cameras were re-deployed at the five sites, with minor adjustments to site NQ1. Five cameras within site NQ1 were moved from previous locations to avoid heritage sites and buffer boundaries. The new locations are still within moderate habitat suitability for Northern Quoll, which is in line with work undertaken in Phases 1 and 2.

Each of the five sites consist of five downward-facing cameras and two horizontally orientated cameras set approximately 50 m and 100 m apart. The cameras were fixed to star pickets using tie down straps or brackets and were set with non-reward scent lures inside bait cannisters that were secured to rocks. The downward-facing cameras (Figure 7) had a reduced focal length and were fixed approximately 1 m above the ground, whereas the horizontal cameras (Figure 8) had an opened focal range and the scent lure was placed 1 m in front of the camera. The downward-facing placement allows for Northern Quoll spot recognition to differentiate between individuals (e.g. Hohnen et al. 2013, Dunlop et al. 2019), whilst the horizontal placement with a wider field of view allows for the

capture of other animals of interest such as feral predators (Dunlop et al. 2019). All equipment was removed from site during the camera collection in October 2022, and the cameras were analysed following a combined trapping effort of 2,221 trap nights (Phase 3).



Plate 1: Downward-facing camera setup.



Plate 2: Horizontally orientated camera setup.

4.2.4 Data Analysis

Motion camera images were analysed by experienced Astron personnel to identify any Northern Quoll image captures, as well as any other conservation significant species or non-indigenous species. Field guides and accepted scientific peer reviewed references were used to assist with fauna identification. All false triggers (i.e. non-target photos, malfunctions etc) were eliminated from the data set.

The following minimum analyses (ongoing) are required to assess management targets for Northern Quoll as part of the monitoring program and were undertaken where possible:

- Determine presence – presence is deduced through camera monitoring, trap site recording and opportunistic identification of scats, tracks and traces during the camera trapping program.
- Calculate abundance from:
    - Camera images - where possible, individual quolls were identified through spot pattern recognition (Hohnen et al. 2013, Dunlop et al. 2019) and the number of individual Northern Quolls calculated. If not possible, an 'activity' index was instead calculated based on the proportion of records across all camera trap nights. An 'activity' index was also calculated for any feral species recorded on cameras in a similar manner.
    - Trapping records - abundance will be measured using the trap success rate (standardised by 100-trap nights) for the monitoring period. Trap success was used as a directly proportional indicator of population abundance to monitor fluctuations and impacts on the Northern Quoll population.
- Compare and contrast – comparison of abundance estimates between 'potential impact' and 'reference' sites, and comparison with regional survey work if results are available. In future monitoring surveys, temporal analyses are to be conducted over the multiple phases of 'baseline' monitoring to determine inter-annual variability and compare these changes regionally.

It was only possible to determine presence from the current survey. Abundance could not be calculated or compared between impact and reference sites and with the DBCA regional survey work due to the absence of Northern Quolls recorded on the cameras.

4.3 Limitations

Following completion of the desktop assessment and analysis of camera monitoring data, a review of any limitations that may affect a complete assessment of the data collected was conducted. The limitations listed in Table 5 are based on those suggested as considerations in Technical Guidance - Terrestrial Fauna Surveys for Environmental Impact Assessment (Environmental Protection Authority 2020) of relevance to this fauna monitoring program. Due to the number of fauna surveys conducted in the survey area, the populations of MNES are relatively well documented.

Table 5: Statement of limitations for the targeted vertebrate fauna assessment.

Potential limitation	Degree of limitation	Statement regarding potential limitations
(i) Competency/experience	No limitation	The senior and principal zoologists planning and conducting the monitoring have over 10 years' experience with fauna surveys and specifically, Northern Quoll surveys and monitoring in the Pilbara region.
(ii) Scope What faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions.	No limitation	The survey scope and the sampling method was targeted for the Northern Quoll. The survey was undertaken at optimal timing in this monitoring survey (previously part of Phase 1 and all of Phase 2 were at sub-optimal timing), given the survey: • aligned with breeding and increased animal movement (between September to October) • occurred before the male Northern Quoll post breeding die-off (October) • occurred before female denning (between November and February). The survey duration of over two months was considered adequate given that Dunlop et al (2019) found that Northern Quolls are highly detectable, with 95% confidence of detection after 12.6 camera-nights (5 cameras for 2.5 nights).
(iii) Proportion of fauna identified, recorded and/or collected	No limitation	A single, targeted survey technique was employed to detect Northern Quoll over multiple years. The current knowledge of the species, as well as the combined results of the current field survey and previous Northern Quoll assessments for Hope Downs and surrounds, suggests low detections are likely a function of low density rather than due to the survey technique.
(iv) Sources of information Previously available information (whether historic or recent) as distinct from new data.	No limitation	Adequate information was available from database searches and previous studies in the survey area and region.
(v) Proportion of task achieved. Further work which might be needed?	No limitation	The survey scope was able to be completed.
(vi) Timing/weather/season/cycle	Minor limitation	Rainfall in the 12 months preceding the survey was 28.0% below the long-term average (226.8 mm versus 315.2 mm). However, the rainfall three months preceding the field survey was 52.9% above the long-term mean (86.4 mm versus 56.5 mm). Rainfall for Phases 1 and 2 were below average for the three months preceding the field survey, but had received good to above average summer rainfall.

Potential limitation	Degree of limitation	Statement regarding potential limitations
(vii) Disturbances For example fire, flood, accidental human intervention which affected results of survey	Potential limitation. Possible explanatory variables.	Large areas of BHT have previously been affected by fires (2019) that may have limited resource availability and population numbers during the initial phases of monitoring. Feral Cat activity was documented in previous field surveys by Astron and during the current phase of monitoring within the survey area (see Section 5.2.4).
(viii) Intensity In retrospect, was the intensity adequate?	No limitation	The intensity was considered adequate for targeted Northern Quoll monitoring.
(xi) Completeness Was the relevant area fully surveyed?	No limitation	The survey targeted high value Northern Quoll habitat and areas of historical presence.
(x) Resources Degree of expertise available in animal identification to taxon level.	No limitation	Adequate resources were available to identify fauna species. All technical personnel involved in identification have extensive experience in conducting targeted fauna surveys in the Pilbara.
(xi) Remoteness and/or access problems	No limitation	No access constraints affected the survey outcomes.
(xii) Availability of contextual information For example biogeographic information on the region.	No limitation	Database searches and previous vertebrate fauna surveys in the vicinity of the survey area provided contextual information.

5 Results

5.1 Desktop Assessment

A Protected Matters and NatureMap database search previously revealed 17 Northern Quoll records within 40 km of the survey area, with records including multiple observations of the same individual (Astron Environmental Services 2023a). There were four additional known records within the survey area (Astron Environmental Services 2020a, 2023c, 2023b) not returned in database searches including one scat record from Phase 1 (Table 6).

Table 6: Northern Quoll records within 40 km of the survey area.

Date	Collector	Type	Easting	Northing	Notes
23/06/2010	Biota	Elliott trap	712630	7457369	-
24/06/2010	Biota	Elliott trap	712630	7457369	Repeat capture
25/06/2010	Biota	Elliott trap	712630	7457369	Repeat capture
25/11/2017	Astron	Camera	710747	7450853	-
20/05/2018	Astron	Camera	717463	7449927	-
22/05/2018	Astron	Camera	716057	7450006	-
22/05/2018	Astron	Camera	712309	7450614	-
23/05/2018	Astron	Scat	707084	7449675	-
23/05/2018	Astron	Camera	711120	7450982	-
23/05/2018	Astron	Camera	707082	7449669	-
24/05/2018	Astron	Camera	710744	7450871	-
24/05/2018	Astron	Camera	711120	7450982	-
25/05/2018	Astron	Scat	707107	7449900	-
25/05/2018	Astron	Camera	710744	7450871	-
26/05/2018	Astron	Cage trap	707086	7449680	-
27/05/2018	Astron	Scat	710723	7450660	-
02/06/2018*	Unknown	Unknown	721960	7491907	*Returned in Protected Matters search only
14/03/2019*	Astron	Camera	716150	7449991	*Not returned in database searches
01/05/2020*	Astron	Camera	710041	7450760	*Not returned in database searches
04/05/2020*	Astron	Camera	718181	7450316	*Not returned in database searches
10/11/2020*	Astron	Scat	710762	7450674	Phase 1 *Not returned in database searches

A summary of literature review results of previous surveys undertaken in the vicinity of the survey area are presented in Table 7. Northern Quoll surveys conducted within the vicinity of the survey area have used a combination of Elliott traps, cage traps, motion sensitive cameras and opportunistic field observations at various times of the year and with variable survey effort. The total survey effort for the previous surveys is 9,530 camera nights, 3,727 combined cage and Elliott trap nights, 1,400 cage trap nights and 3,744 Elliott trap nights.

Table 7: Summary of literature review results from surveys conducted within the vicinity of the survey area. Only the survey effort that directly targeted or would reasonably be expected to record Northern Quoll within surveys has been included where possible.

Author (year)	Survey area; size (ha)	Survey level	Survey timing	Survey effort	Quoll records and targeted effort
Astron Environmental Services (2020a)	Hope Downs 2 survey area 10,817.7 ha	Level 2 (3 phases)	November 2017 May 2018 March 2019	Baseline fauna assessment of terrestrial vertebrate fauna and short range endemic (SRE) invertebrate fauna species within the survey area. Habitat assessments, 19 trapping sites, avifauna censuses at each trapping site, foot traverses, nocturnal searches, targeted searches for both vertebrates and SRE invertebrates, and the use of SM2 acoustic bat echolocation recorders and motion sensor cameras.	One male recorded from 1,265 combined cage and Elliott trap nights (<0.1 captures/100 trap nights). Ten records from 202 camera trap nights (4 captures/100 trap nights). Combined trap success of 0.2 captures/100 trap nights. Three scat records from targeted searches.
Astron Environmental Services (2023c)	Hope Downs 2 survey area 10,817.7 ha	Targeted (1 phase)	February to September 2020	Targeted Northern Quoll survey using long-term deployment of 12 motion sensitive cameras	Two records from 2,355 camera trap nights (<0.1 captures/100 trap nights).
Astron Environmental Services (2020b)	Hope Downs 2 survey area 10,817.7 ha	Targeted (1 phase)	September 2019	Targeted terrestrial MNES vertebrate fauna survey. Cage trapping, motion sensitive cameras, acoustic bat surveys, targeted searches.	Nil records from 1,400 cage trap nights. Nil records from 140 camera trap nights.
Astron Environmental Services (2023a)	Hope Downs 2 survey area 10,817.7 ha	Monitoring (1 phase)	September to November 2020	Northern Quoll monitoring using 35 long-term deployed motion sensitive cameras at five sites (three impact and two reference)	Nil records from 2,128 camera trap nights. One scat record from NQ2.
Astron Environmental Services (2023b)	Hope Downs 2 survey area 10,817.7 ha	Monitoring (1 phase)	October 2021 to February 2022	Northern Quoll monitoring using 35 long-term deployed motion sensitive cameras at five sites (three impact and two reference)	Nil records from 4,151 camera trap nights.

Author (year)	Survey area; size (ha)	Survey level	Survey timing	Survey effort	Quoll records and targeted effort
Biota Environmental Sciences (2006)	Hope Downs Rail Corridor (Juna Downs) Size not stated	Level 2 (1 phase)	September 2005	The survey focused on areas and habitat, which may not have been sampled in previous assessments. Sampling methods included the use of Elliott traps, avifauna surveys, harp nets, and opportunistic methods.	Nil records from 1,950 Elliott trap nights.
Biota Environmental Sciences (2009)	Yandicoogina Size not stated	Targeted (1 phase)	October 2009	Targeted Northern Quoll survey using lines of Elliott traps at eight sites.	Nil records from 1,294 Elliott trap nights.
Biota Environmental Sciences (2011a)	Hope Downs 1 Size not stated	Targeted/ Level 1	June 2010	Five Elliott trapping transects located within potential Northern Quoll habitat. Camera trapping and opportunistic searches.	One male recorded from 500 Elliott trap nights (0.2% captures/100 trap nights). One record from 100 camera trap nights (likely the same individual) (1 capture/100 trap nights).
Biota Environmental Sciences (2014a)	Hope Downs South West Marra Mamba deposit 2,758 ha	Targeted/ Level 1	September 2013	Four cage and large Elliott trapping transects located within potential Northern Quoll habitat and opportunistic searches. Motion sensor cameras and SM2 acoustic bat echolocation recorders were used to detect the presence of conservation significant fauna species.	Nil records from 960 combined cage and Elliott trap nights. Nil records from 16 camera trap nights.
Biota Environmental Sciences (2014b)	Yandi Billiards Size not stated	Phase 1 of a two-phase Level 2	March 2014	Two trap transects comprising Elliott traps and cage traps	Nil records from 507 combined cage and Elliott trap nights.

Author (year)	Survey area; size (ha)	Survey level	Survey timing	Survey effort	Quoll records and targeted effort
Ecologia Environment (2014)	Greater West Angelas 17,565 ha	Level 2 (2 phases)	September – October 2012 March 2013	Habitat assessments, 12 trapping sites, avifauna censuses at each trapping site, foot traverses, nocturnal searches, targeted searches for both vertebrates and SRE invertebrates, and the use of SM2 acoustic bat echolocation recorders and motion sensor cameras.	Nil records from 2,016 combined cage and Elliott trap nights. Nil records from 48 camera trap nights.
Ninox Wildlife Consulting (2009a)	Hope Downs 4 Option 1 Infrastructure Corridor Size not stated	Level 2 (1 phase)	May 2008	Four trapping sites, Anabat ultrasonic call detector, avifauna census, SRE sampling and opportunistic searches.	Nil records from 288 combined cage and Elliott trap nights.
Ninox Wildlife Consulting (2009b)	Hope Downs 4 Option 6 Infrastructure Corridor Size not stated	Level 2 (2 phases)	September 2008 April 2009	Six trapping sites, Anabat ultrasonic call detector, avifauna census, SRE sampling and opportunistic searches.	Nil records from 864 combined cage and Elliott trap nights.
Phoenix Environmental Sciences (2014)	Wonmunna Size not stated	Level 2 (2 phases)	May and October 2011	Ten systematic survey sites and two targeted Northern Quoll sites	Nil records from 350 combined cage and Elliott trap nights. Nil records from 390 camera trap nights.

Results from the DBCA Pilbara Northern Quoll research program (PNQRP; see Section 4.1.1) are based on the deployment of a standardised annual monitoring regime for Pilbara populations, including searching in previously unsurveyed or poorly surveyed areas to better understand the distribution and habitat requirements. Results are presented from the most recent available 2018 data (Dunlop et al. 2019). Generally, lower numbers were reported throughout 2019 and only limited surveys were conducted in 2020 (Dr Judy Dunlop, Research Scientist DBCA pers. comm., December 2020; unpublished data in prep.).

Sites with Northern Quoll records that are nearest to the current survey area (Karijini National Park and Roy Hill Rail) show lower capture rates than more northerly and coastal sites, such as Dampier Archipelago, Indee Station and the combined survey averages (PNQRP all sites; Table 8).

Table 8: Trap nights and capture rates from DBCA Pilbara Northern Quoll research program (2014 – 2018) (Dunlop et al. 2019).

Site	Trap nights	Captures/100 traps	Individuals/100 traps
Karijini National Park	800	3.0	1.13
Roy Hill Rail	240	2.50	2.92
Dampier Archipelago	1,000	15.8	6.90
Indee Station	1,000	34.1	11.50
PNQRP all sites	8,080	8.97	3.61

5.2 Field Survey

5.2.1 Habitat Suitability for Northern Quolls

Approximately 107 ha (1%) of the survey area, comprising Gorge/Gully and some Breakaway habitats, is considered 'high value habitat' (Rio Tinto 2022) (or 'core habitat' as per the referral guidelines (Department of the Environment and Energy 2016)), based on proximity to known Northern Quoll records, microhabitat features and orientation aspect (Figure D.1, Appendix D).

Approximately 2,058 ha (19%) of the survey area is considered 'moderate habitat value' (Rio Tinto 2022), comprising some smaller Breakaway habitats, as well as Minor Drainage and Rocky Hill habitats in close association with the Gorge/Gully and Breakaway habitats as they provided microhabitats such as crevices and cracks for foraging (Figure D.1, Appendix D).

Approximately 7,821 ha (73%) of the survey area was considered 'low habitat value' (Rio Tinto 2022), consisting of Alluvial Plain, Low Hills and Slopes, Mulga Woodland and Stony Plain habitats (Figure D.1, Appendix D). The remaining 832 ha (7%) of the survey area was 'null habitat value' (Rio Tinto 2022), as these were Disturbed areas (Figure D.1, Appendix D).

5.2.2 Northern Quoll Field Records

No Northern Quoll were recorded on any of the long-term cameras during the current survey (Phase 3; 2,221 trap nights), nor previous phases of the monitoring program (8,500 total trap nights for all three phases). The only record for the monitoring program to date is one scat recorded near site NQ2 within Gorge/Gully habitat during Phase 1 in 2020.

5.2.3 Other Terrestrial Vertebrate Species

During Phase 1 of monitoring, 28 vertebrate fauna species were recorded on the cameras and opportunistically: six reptile species, 13 bird species and nine mammal species, including the Northern Quoll (scat record). Thirty-four vertebrate fauna species were recorded on the cameras and opportunistically during Phase 2, including nine reptile species, 19 bird species and six mammal species.

Thirty vertebrate fauna species were recorded on the cameras during the current phase (Phase 3), including 11 mammals, 12 birds and seven reptiles. The five most recorded species were Common Rock-rat *(Zyzomys argurus)*, Grey Shrike-thrush (*Colluricincla harmonica*), Torresian Crow (*Corvus orru*), Rothschild's Rock-wallaby (*Petrogale rothschildi*) and Western Bowerbird (*Chlamydera guttata*) representing 82 records (41.2% of total records).

5.2.4 Introduced Fauna

Two introduced species were recorded on motion cameras during Phase 1 of monitoring: Dog/Dingo (**Canis familiaris*) and Feral Cat (**Felis catus*). There was one record of the Dog/Dingo with one capture from 2,128 trap nights (0.05% trap success), and one record of the Feral Cat with one capture from 2,128 trap nights (0.05% trap success).

One introduced species was recorded on the motion cameras during Phase 2 of monitoring, the Feral Cat (**Felis catus*). There were 15 records of Feral Cats across 13 cameras from 4,151 trap nights (0.36% trap success). This result indicates cat activity on approximately 40% of deployed cameras (13 of 35 cameras).

Two introduced species were recorded on motion cameras during the current survey (Phase 3), including the Dingo (*Canis familiaris dingo*) and Feral Cat (*Felis catus*). Across the 2,221 trap nights there were two records of the Dingo (0.09% trap success), one at site NQ2 and one at site NQ3, and 12 Feral Cat records (0.54% trap success) recorded at sites NQ2, NQ3 and NQ5. Feral Cat activity was present across six cameras in total which indicates cat activity on approximately 20% of the deployed cameras (six out of 35 cameras), of which four cameras were set behind HD1 camp.

6 Discussion

6.1 Northern Quoll Habitat

The Gorge/Gully and Breakaway habitats identified in the survey area are considered potentially important high value habitat for Northern Quoll. This is due to the microhabitats and refugia they provide, such as caves and semi-permanent water pools, that are important for species foraging, breeding and sheltering requirements. These habitats are preferred by females for denning and are considered critical for the long-term survival of a particular subpopulation according to referral guidelines (Department of the Environment and Energy 2016).. These habitats were divided into 'high value habitat' (or core habitat), which comprised most of the Gorge/Gully habitat within the survey area and Breakaway habitats within the BHT area; and 'moderate value habitat', comprising the smaller Breakaway habitats, particularly within the HD2 area. These Gorge/Gully and Breakaway habitats are well represented outside of the survey area and are considered only of potential significance for the Northern Quoll within the HD2 survey area given the low density population demonstrated from survey effort to date.

Other habitats of 'moderate habitat value' included the Rocky Hill and Minor Drainage habitats. The Rocky Hill habitat within the survey area is widespread and common throughout the Pilbara bioregion and is not restricted to the Chichester and Hamersley Ranges. This habitat generally had low vegetation complexity and low diversity of microhabitats and had recently been impacted by fire; however, Northern Quoll are likely to traverse and forage within these habitats as part of their home range. The Minor Drainage habitats within the survey area were generally devoid of vegetation and impacted from pastoral activities, and are unlikely to provide significant refuge for species, but may provide dispersal and/or foraging habitat. Minor Drainage Line habitats, although not necessarily large in terms of area, are also common and well-represented habitats within the immediate vicinity of the survey area and the broader Pilbara region.

The Low Hills and Slopes, Alluvial Plain, Mulga Woodland and Stony Plain habitat in the survey area provide fewer microhabitat opportunities for Northern Quoll or other MNES fauna species and are also widespread in the immediate vicinity as well as the Hamersley subregion and wider bioregion.

Habitat suitability, however, is unlikely to be constant and the factors determining it are susceptible to change, particularly over time. Rockpiles, for example, are considered to provide potential denning and foraging habitat for Northern Quoll but would be unlikely to do so if a particular rockpile became inhabited by Feral Cats, or if the vegetation were recently impacted by wildfire. Similarly, the degree of landscape-scale connectivity is likely to be important whereby a rockpile with requisite geological and topographic features would not be considered critical habitat if it were sufficiently small or became isolated from another suitable habitat such that it was unable to retain a viable subpopulation. An ongoing assessment of habitat suitability should therefore be considered at the time of monitoring to help understand and interpret results accordingly.

6.2 Northern Quoll Records

The presence of a scat recorded in Phase 1 (2020) of this monitoring program, suitable habitat, and previous records (2017 to 2019) within the survey area suggested that the Northern Quoll were present at a low density within the survey area. Despite previous records, Northern Quoll have not been recorded on the cameras of the monitoring program and an individual has not been sighted since May 2020, despite extensive survey effort completed within the HD2 Proposal area. Recent Northern Quoll records (e.g. Astron Environmental Services (2020a)), particularly within the BHT area between November 2017 and March 2019 were initially of potential significance, given that the survey area is

at the edge of the species' regional distribution, and there has been a paucity of previous local and regional records with only four prior records documented within 40 km of the survey area, three of which were of the same individual. Since the Detailed (formerly Level 2) surveys (2017 to 2019) (Astron Environmental Services 2020a), targeted surveys have resulted in few or no records of Northern Quoll, with two motion camera records and one opportunistic scat record across four surveys between 2019 and 2022. The overall distributional pattern of records surrounding the survey area suggest that the Northern Quoll is likely to be patchily distributed at a low density in the surrounding locality.

Other targeted surveys for Northern Quoll in the surrounding locality and broader south-east Pilbara have also reported low capture rates or no captures. Biota (2014c) conducted a targeted survey at Juna Downs to the north-west of the survey area comprising 1,420 Elliott trap nights, 134 camera trap nights and targeted searches and recorded no evidence of presence. Biota (2009, 2014b) also conducted targeted Northern Quoll surveys to the north of the survey area at nearby Yandi and similarly recorded no evidence from 1,294 Elliott trap nights across multiple years. A single individual was captured near the survey area by Biota (2011) at Hope Downs from 500 Elliott trap nights (three records; 0.2 captures/100 trap nights) and additional records were documented from 100 camera trap nights (0.2 captures/100 trap nights), although it is not known whether these captures were the same or multiple individuals.

The results from other surveys indicate capture rates for Northern Quolls can be highly variable. Biota (2011b, 2012) conducted targeted surveys at Gudai-Darri to the north of the survey area with 3,890 Elliott trap nights and recorded no individuals despite subsequent monitoring in the same locality (e.g. Biota 2014d, 2014e) obtaining multiple records. The DBCA PNQRP also shows the amount of survey effort required to detect Northern Quoll is highly variable and site dependent (Dunlop et al. 2018; Table 7). Dunlop et al. (2018) found Northern Quoll were less readily detected at more southern and eastern sites within the Pilbara region than northern and coastal locations, most likely as a function of greater population density. The capture rates for the sites nearest to the current survey area were typically low with 3.0 captures/100 trap nights and 2.5 captures/100 trap nights for Karijini National Park and Roy Hill Rail, respectively. Recent capture rates within the survey area were generally much less than the nearby sites (<0.1 to 0.2 captures/100 trap nights).

Capture rate variability between sites and over time may be attributed to seasonality, fire history, and predator and prey densities. Seasonality may be a factor reflective of the boom and bust life cycle of the Northern Quoll, whereby they are capable of high reproductive rates and large dispersal distances when conditions are favourable (Cramer et al. 2016, Department of the Environment and Energy 2016). In 2019 large areas of BHT within the survey area were affected by fires which may have possibly limited resource availability in the area, particularly during the earlier phases of monitoring. Prior to the fires there were 12 Northern Quoll records in May 2018 and post-fire there have been a total of four records. In addition, high Feral Cat (**Felis catus*) activity has been consistently documented within the survey area. During cage trapping in September 2019 (Astron Environmental Services 2020b) three cats were caught at three different sites across the survey area, and cats have been captured on cameras during each phase of the monitoring program to date, with up to 40% of cameras during Phase 2 detecting cats.

Despite surveying across different times of year, with and without scent-lures, no Northern Quolls have been recorded on the cameras. The timing of past surveys (September to November 2020, and October 2021 to February 2022) and lack of a scent lure in Phase 1 were thought to be contributing to the lack of records. The surveys were conducted after male die-off and before recruitment of juveniles into the population (Oakwood 2000), as well as times when Northern Quolls are likely to be less active (denning females with pouch young) and therefore less detectable. The previous absence of a scent lure was necessitated by ethical constraints at the time. The use of non-reward scent lures

was adopted in the second and third phases, and this most recent survey was conducted during optimal timing, yet still no Northern Quolls were recorded.

Given the extensive survey effort now completed (8,500 camera nights), the most recent monitoring used attractants and was also conducted during the optimal survey period to maximise detection probability, and the overall distribution pattern of records surrounding the HD2 area, it is concluded that currently, the Northern Quoll is patchily distributed and at a low density within the HD2 area and surrounding locality. It is not clear why the number of Northern Quoll records has decreased from 12 records in May 2018 to four records since then, but the presence of feral predators and recent fire may be explanatory variables (rather than limitations of the monitoring program).

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Appendix A: Background Information Figures

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Survey Area

WA Geology

QUATERNARY

Qa

Qrc

CENOZOIC

Czk

Czl

PALEOPROTEROZOIC

Lchk

Lchw

ARCHEAN

Alhw

Ashm

Adf

Awfj

Achm

Qrc Awfj Achm Awfj Czk Qrc Ashm Czl Qrc Czl Qa Ashm Lchk Lchw Ashm Alhw Alhw Lchk Qrc Achm Achm Qrc Lchw Achm Lchk Ashm Qa Qrc Achm Awfj Achm Adf Awfj Awfj Achm Awfj Czl

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Rio Tinto

Hope Downs 2 Proposal Matters of National Environmental Significance Northern Quoll Monitoring Phase 3 of 3 Results (July – October 2022) and Phases 1 to 3 Summary Report

Figure A.1: Geology of the Survey Area

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

astron an ecocene company

Author: D. Keirle | Drawn: C. Dyde | Date: 09-08-2023 | Figure Ref: 14324-22-BIDR-1Rev0_230809_FigA1_Geo

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Survey Area

Land System

- Boolgeeda System
- Calcrete System
- Egerton System
- McKay System
- Newman System
- Oakover System
- Pindering System
- Platform System
- River System
- Rocklea System
- Wannamunna System

PLA BOO NEW PLA OAK OAK PLA CAL RIV BOO NEW EGT PLA PIN PLA BOO NEW PIN NEW NEW NEW NEW NEW EGT PLA NEW PLA MCK NEW WAN BOO NEW NEW RKL EGT NEW NEW

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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Hope Downs 2 Proposal Matters of National Environmental Significance Northern Quoll Monitoring Phase 3 of 3 Results (July – October 2022) and Phases 1 to 3 Summary Report

Figure A.2: Land systems of the Survey Area

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

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Author: D. Keirle | Drawn: C. Dyde | Date: 09-08-2023 | Figure Ref: 14324-22-BIDR-1Rev0_230809_FigA2_LSys

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Survey Area

System Association

HAMERSLEY_18
HAMERSLEY_29
HAMERSLEY_82

HAMMERSLEY_18
HAMMERSLEY_82
HAMMERSLEY_18
HAMMERSLEY_82
HAMMERSLEY_82
HAMMERSLEY_18
HAMMERSLEY_82
HAMMERSLEY_29

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Hope Downs 2 Proposal Matters of National Environmental Significance Northern Quoll Monitoring Phase 3 of 3 Results (July – October 2022) and Phases 1 to 3 Summary Report

Figure A.3: Pre-European vegetation of the Survey Area

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

N

astron an ecocene company

Author: D. Keirle | Drawn: C. Dyde | Date: 09-08-2023 | Figure Ref: 14324-22-BIDR-1Rev0_230809_FigA3_PreEuroVeg

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Appendix B: Conservation Categories

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Table B.1: Definitions and criteria for Threatened Ecological Communities (Department of Environment and Conservation 2013).

Three categories exist for listing Threatened Ecological Communities under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). An ecological community may be categorised as:

Categories of ecological communities	
Critically endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

Reference: Department of Environment and Conservation 2013, Definitions, Categories and Criteria for Threatened and Priority Ecological Communities DEC (Parks and Wildlife), <https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf.>

Table B.2: Categories and definitions for EPBC Act listed fauna species.

Conservation category	Definition
Extinct	Taxa with no reasonable doubt that the last member of the species has died.
Extinct in the wild	Taxa known to survive only in cultivation, in captivity or as a naturalized population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriated seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (EN)	Taxa are not critically endangered; and are facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	Taxa are not critically endangered or endangered; and are facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation dependent (CD)	Taxa are the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or the following subparagraphs are satisfied: i) the taxa is a species of fish; ii) the taxa is the focus of a management plan that provides management actions necessary to stop the decline of, and support the recovery of, the taxa so that its chances of long term survival in nature are maximized; iii) the management plan is in force under a law of the Commonwealth or of a State or Territory; iv) Cessation of the management plan would adversely affect the conservation status of the taxa Fish includes all taxa of bony fish, sharks, rays, crustaceans, molluscs and other marine organisms, but does not include marine mammals/reptiles.
Migratory (IA)	Taxa are considered migratory species on International Agreements; i) if they are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II); ii) all migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA); and iii) Are native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Note: CD and IA are only related to conservation significant fauna

Appendix C: Long-term Northern Quoll Camera Monitoring Locations

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PEBBLE
MOUSE CREEK
Map Extent
NQ4-CAM7
NQ4-CAM6
NQ4-CAM5
NQ4-CAM4
NQ4-CAM2
NQ4-CAM1
NQ4-CAM3
NQ2
NQ1
NQ4
NQ5
NQ3
NQ2-CAM6
NQ2-CAM4
NQ2-CAM5
NQ2-CAM7
NQ2-CAM3
NQ2-CAM2
NQ2-CAM1
NQ1-CAM2
NQ1-CAM3
NQ1-CAM4
NQ1-CAM6
NQ1-CAM7
NQ1-CAM1
NQ1-CAM5
NQ3-CAM6
NQ3-CAM5
NQ3-CAM3
NQ3-CAM2
NQ3-CAM7
NQ3-CAM4
NQ3-CAM1
NQ5-CAM7
NQ5-CAM6
NQ5-CAM5
NQ5-CAM4
NQ5-CAM1
NQ5-CAM3
NQ5-CAM2
GPS Tracklogs
River/Creek
Mining Exclusion Zones (MEZ)
Survey Area
Northern Quoll Long-term Camera
Potential Impact Site
Reference Site

Rio Tinto

Hope Downs 2 Proposal Matters of National Environmental Significance Northern Quoll Monitoring Phase 3 of 3 Results (July – October 2022) and Phases 1 to 3 Summary Report

Figure C.1: Northern Quoll long-term camera monitoring locations

Coordinate System: GDA 1994 MGA Zone 50

0 500 1,000 1,500 2,000 2,500 3,000 Metres

N

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Author: A. Catterick-Stoll | Drawn: C. Dyde | Date: 09-08-2023 | Figure Ref: 14324-22-BIDR-1Rev0_230809_FigC1_Cams

Table C.1: Northern Quoll long-term motion camera monitoring locations.

Locality ID Camera ID	MGA Zone 50 K		Site type	Camera orientation	Sample start date	Sample finish date	Trap nights	Habitat	Condition	Disturbance	Microhabitats	Representative photo
	Easting (mE)	Northing (mN)										
NQ1-CAM1	715722	7450512	Potential Impact	Horizontal	02/08/2022	04/10/2022	63	Breakaway/cliff	1.0	None	Rocky outcrops, caves, overhangs, crevices, rock piles	
NQ1-CAM2	715973	7450688	Potential Impact	Downward	01/08/2022	04/10/2022	64	Breakaway/cliff	1.0	None	Rocky outcrops, caves, overhangs, crevices, rock piles	
NQ1-CAM3	715757	7450579	Potential Impact	Downward	01/08/2022	04/10/2022	64	Breakaway/cliff	1.0	None	Rocky outcrops, caves, overhangs, crevices, rock piles	
NQ1-CAM4	715632	7450545	Potential Impact	Downward	31/07/2022	04/10/2022	65	Gorge/gully	1.0	None	Rocky outcrops, caves, overhangs, crevices, rock piles	

Locality ID Camera ID	MGA Zone 50 K		Site type	Camera orientation	Sample start date	Sample finish date	Trap nights	Habitat	Condition	Disturbance	Microhabitats	Representative photo
	Easting (mE)	Northing (mN)										
NQ1-CAM5	715765	7450484	Potential Impact	Horizontal	31/07/2022	04/10/2022	65	Gorge/gully	1.0	None	Rocky outcrops, caves, overhangs, crevices, rock piles, leaf litter	
NQ1-CAM6	715803	7450543	Potential Impact	Downward	02/08/2022	04/10/2022	63	Gorge/gully	1.0	None	Rocky outcrops, caves, logs, tree hollows, crevices, rock piles	
NQ1-CAM7	715987	7450553	Potential Impact	Downward	02/08/2022	04/10/2022	63	Breakaway/cliff	1.0	None	Rocky outcrops, caves, overhangs, crevices, rock piles	
NQ2-CAM1	710706	7450605	Potential Impact	Downward	31/07/2022	04/10/2022	65	Breakaway/cliff	1.0	None	Rocky outcrops, caves, overhangs, logs, crevices, rock piles	

Locality ID Camera ID	MGA Zone 50 K		Site type	Camera orientation	Sample start date	Sample finish date	Trap nights	Habitat	Condition	Disturbance	Microhabitats	Representative photo
	Easting (mE)	Northing (mN)										
NQ2-CAM2	710755	7450674	Potential Impact	Downward	31/07/2022	04/10/2022	5	Breakaway/cliff	1.0	None	Rocky outcrops, caves, overhangs, crevices, rock piles	
NQ2-CAM3	710754	7450732	Potential Impact	Horizontal	31/07/2022	04/10/2022	65	Breakaway/cliff	1.0	None	Rocky outcrops, caves, overhangs, logs, tree hollows, crevices, rock piles	
NQ2-CAM4	710765	7450848	Potential Impact	Downward	31/07/2022	04/10/2022	65	Breakaway/cliff	1.0	None	Rocky outcrops, caves, overhangs, crevices, rock piles	
NQ2-CAM5	710743	7450867	Potential Impact	Downward	31/07/2022	04/10/2022	65	Breakaway/cliff	1.0	None	Rocky outcrops, caves, overhangs, crevices, rock piles, leaf litter	

Locality ID Camera ID	MGA Zone 50 K		Site type	Camera orientation	Sample start date	Sample finish date	Trap nights	Habitat	Condition	Disturbance	Microhabitats	Representative photo
	Easting (mE)	Northing (mN)										
NQ2-CAM6	710564	7450864	Potential Impact	Downward	31/07/2022	04/10/2022	65	Breakaway/cliff	1.0	None	Overhangs, crevices, rock piles, leaf litter	
NQ2-CAM7	710472	7450767	Potential Impact	Horizontal	31/07/2022	04/10/2022	65	Breakaway/cliff	1.0	None	Rocky outcrops, caves, overhangs, crevices, rock piles	
NQ3-CAM1	716417	7449912	Potential Impact	Horizontal	30/07/2022	05/10/2022	67	Breakaway/cliff	1.0	None	Rocky outcrops, overhangs, logs, tree hollows, rock piles, leaf litter	
NQ3-CAM2	716314	7449982	Potential Impact	Downward	30/07/2022	05/10/2022	67	Breakaway/cliff	1.0	None	Overhangs, crevices, rock pile, leaf litter	

Locality ID Camera ID	MGA Zone 50 K		Site type	Camera orientation	Sample start date	Sample finish date	Trap nights	Habitat	Condition	Disturbance	Microhabitats	Representative photo
	Easting (mE)	Northing (mN)										
NQ3-CAM3	716276	7449991	Potential Impact	Downward	30/07/2022	05/10/2022	67	Breakaway/cliff	1.0	None	Rocky outcrops, overhangs, logs, tree hollows, rock piles, leaf litter	
NQ3-CAM4	716210	7449971	Potential Impact	Downward	30/07/2022	05/10/2022	67	Breakaway/cliff	1.0	None	Caves, overhangs, crevices, rock pile, leaf litter	
NQ3-CAM5	716154	7449982	Potential Impact	Horizontal	30/07/2022	05/10/2022	67	Breakaway/cliff	1.0	None	Caves, overhangs, crevices, rock pile, leaf litter	
NQ3-CAM6	716083	7449998	Potential Impact	Downward	30/07/2022	05/10/2022	67	Breakaway/cliff	1.0	None	Caves, overhangs, crevices, rock pile, leaf litter	

Locality ID Camera ID	MGA Zone 50 K		Site type	Camera orientation	Sample start date	Sample finish date	Trap nights	Habitat	Condition	Disturbance	Microhabitats	Representative photo
	Easting (mE)	Northing (mN)										
NQ3-CAM7	715974	7449954	Potential Impact	Downward	30/07/2022	05/10/2022	67	Breakaway/cliff	1.0	None	Caves, overhangs, crevices, rock pile, leaf litter	
NQ4-CAM1	721306	7451097	Reference	Downward	01/08/2022	05/10/2022	65	Gorge/gully	1.0	None	Caves, rock pile, leaf litter	
NQ4-CAM2	721487	7451150	Reference	Horizontal	01/08/2022	05/10/2022	65	Breakaway/cliff	1.0	None	Rocky outcrops, caves, overhangs, logs, tree hollows, crevices, rock piles	
NQ4-CAM3	721573	7451105	Reference	Downward	01/08/2022	05/10/2022	65	Breakaway/cliff	1.0	None	Rocky outcrops, caves, overhangs, crevices, rock piles	

Locality ID Camera ID	MGA Zone 50 K		Site type	Camera orientation	Sample start date	Sample finish date	Trap nights	Habitat	Condition	Disturbance	Microhabitats	Representative photo
	Easting (mE)	Northing (mN)										
NQ4-CAM4	721567	7451164	Reference	Downward	01/08/2022	05/10/2022	65	Gorge/gully	1.0	None	Rocky outcrops, overhangs, crevices, rock piles	
NQ4-CAM5	721623	7451222	Reference	Downward	01/08/2022	05/10/2022	65	Gorge/gully	1.0	None	Rocky outcrops, caves, overhangs, logs, rock piles	
NQ4-CAM6	721721	7451288	Reference	Downward	01/08/2022	05/10/2022	65	Gorge/gully	1.0	None	Rocky outcrops, overhangs, logs, tree hollows, rock piles	
NQ4-CAM7	721841	7451312	Reference	Horizontal	01/08/2022	05/10/2022	65	Gorge/gully	1.0	None	Overhangs, logs, rock piles	

Locality ID Camera ID	MGA Zone 50 K		Site type	Camera orientation	Sample start date	Sample finish date	Trap nights	Habitat	Condition	Disturbance	Microhabitats	Representative photo
	Easting (mE)	Northing (mN)										
NQ5-CAM1	707075	7449711	Reference	Downward	30/07/2022	03/10/2022	65	Gorge/gully	1.0	None	Overhangs, crevices, rock pile, leaf litter	
NQ5-CAM2	707148	7449683	Reference	Horizontal	30/07/2022	03/10/2022	65	Breakaway/cliff	1.0	None	Rocky outcrops, caves, overhangs, logs, tree hollows, crevices, rock piles, leaf litter	
NQ5-CAM3	707272	7449713	Reference	Downward	30/07/2022	03/10/2022	65	Breakaway/cliff	1.0	None	Caves, overhangs, rock pile, leaf litter	
NQ5-CAM4	707314	7449735	Reference	Downward	30/07/2022	03/10/2022	65	Breakaway/cliff	1.0	None	Caves, overhangs, crevices, rock pile, leaf litter	

Locality ID Camera ID	MGA Zone 50 K		Site type	Camera orientation	Sample start date	Sample finish date	Trap nights	Habitat	Condition	Disturbance	Microhabitats	Representative photo
	Easting (mE)	Northing (mN)										
NQ5-CAM5	707358	7449762	Reference	Horizontal	30/07/2022	03/10/2022	65	Breakaway/cliff	1.0	None	Rocky outcrops, caves, overhangs, crevices, rock piles	
NQ5-CAM6	707322	7449809	Reference	Downward	30/07/2022	03/10/2022	65	Breakaway/cliff	1.0	None	Rocky outcrops, overhangs, logs, crevices, rock piles	
NQ5-CAM7	707290	7449908	Hope Downs 2 Reference	Downward	30/07/2022	03/10/2022	65	Breakaway/cliff	1.0	None	Rocky outcrops, overhangs, logs, tree hollows, crevices, rock piles, leaf litter	
						Total trap nights	**2,221**					

Habitat Condition: 1.0 (Excellent); 0.8 (Very Good); 0.6 (Good); 0.4 (Poor); 0.2 (Very Poor); 0.1 (Completely Degraded)

Appendix D: Northern Quoll Habitat Suitability Mapping

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Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Previous Northern Quoll records

Survey Area

Northern Quoll Habitat Suitability

High value habitat

Moderate value habitat

Low value habitat

Null habitat

Rio Tinto

Hope Downs 2 Proposal Matters of National Environmental Significance Northern Quoll Monitoring Phase 3 of 3 Results (July – October 2022) and Phases 1 to 3 Summary Report

Figure D.1: Northern Quoll habitat suitability mapping

Coordinate System: GDA 1994 MGA Zone 50

0 1 2 3 4 5 Kilometres

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astron an ecocene company

Author: D. Keirle | Drawn: C. Dyde | Date: 09-08-2023 | Figure Ref: 14324-22-BIDR-1Rev0_230809_FigD1_NQ

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C.8: Hope Downs 2 Short-Range Endemic Invertebrate Fauna Preliminary Risk Assessment







Memorandum:

Hope Downs 2 Short-Range Endemic Invertebrate Fauna Preliminary Risk Assessment

Biologic Environmental Survey

Report to Rio Tinto Iron Ore

July 2022

Document Status				
Revision No.	**Author**	**Review / Approved for Issue**	**Approved for Issue to**	
			Name	**Date**
1	T. Rudin, M. Lythe, N. Gunawardene	B. Durrant	Sally Pickard	08/06/2022
2	M. Lythe	Nihara Gunawardene	Sally Pickard	22/07/2022

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1 INTRODUCTION

Rio Tinto Iron Ore (Rio Tinto) commissioned Biologic Environmental Survey (Biologic) to undertake a preliminary risk assessment for short-range endemic (SRE) invertebrate fauna identified from the Hope Downs 2 Project area (the Study Area/Development Envelope, Figure 1.1). These results will then be used to support the environmental impact assessment (EIA) for SRE invertebrate fauna which will in turn inform the environmental review document (ERD) for the development.

This memorandum report provides:

1. Consolidation of SRE species and habitat information from all surveys to date within the Development Envelope, including:
    a. Alignment of SRE fauna identifications from all previous surveys (as much as practicable based on available specimens, taxonomic frameworks, and genetic sequences);
    b. Updated taxonomic and ecological information relevant to assessment of species distributions relative to potential impact areas;
    c. Indicative linear ranges in the local or wider regional area for all SRE taxa, based on the best available data;
    d. Consolidation of fauna habitat mapping and occurrence of SRE taxa in habitat types mapped throughout the Development Envelope; and
    e. Occurrence of SRE taxa in relation to proposed impact areas.
2. Preliminary Risk Assessment of SRE species values and habitat values in relation to potential impacts of the project, as much as practicable within the constraints of available data.

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7460000 7450000



MAC-E

South Flank

Hope Downs 1

West Angelas Rd

Great Northern Hwy

LEGEND

- Operating Mine
- Local Road
- State Road
- Rail
- Proposed Part IV Development Envelope
- Proposed Pits
- Proposed Infrastructure areas
- Proposed Waste areas

IBRA Region
- Pilbara

IBRA Subregion
- Chichester
- Fortescue
- Hamersley
- Roebourne

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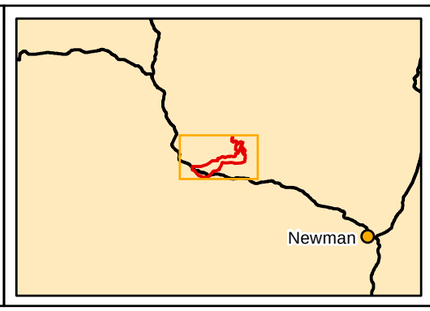
biologic Environmental Survey

Scale: 1:95,000

0 1 2 3 4 5 Km

Coordinate System: GDA2020 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA2020 Created 17/06/2022



RIO TINTO IRON ORE

Hope Downs 2 Preliminary SRE Risk Assessment

Figure 1.1: Project overview

2 DATA CONSOLIDATION AND ALIGNMENT

SRE species records were sourced from Rio Tinto's internal terrestrial invertebrate database (RTDB), Western Australian Museum databases (WAMDB) and external reports of surveys within the Development Envelope. These were:

- Astron Environmental Services (2020) Hope Downs 1 Development Envelope Fauna Habitat Mapping
- Astron Environmental Services (2019) Hope Downs 2 Proposal Fauna Survey.
- Astron Environmental Services (2018) Hope Downs 2, Bedded Hilltop and Wonmunna level 2 Fauna Survey
- Biota Environmental Sciences (2011) Hope Downs Project Life of Mine Targeted Fauna Survey
- Biota Environmental Sciences (2014) Hope Downs South West Marra Mamba Development Targeted Fauna Survey
- Ecologia Environment (2014) Greater West Angelas Terrestrial Fauna Assessment

Identifications at the species level were aligned as much as practicable based on the information available for morphological and molecular identification within existing taxonomic frameworks. Following alignment of taxonomic identifications between WAM database searches and external reports, the remaining indeterminate records were examined against potentially similar species from the same site or the same sampling event. The approach aimed to:

- Provide a single, consolidated list of species (morphological and molecular) occurring in the Development Envelope (DE);
- Inform the assessment of habitat associations and species occurrence relative to impact areas (proposed footprint) within the DE; and
- Facilitate the assessment of species distributions in the wider local and regional area beyond the DE.

2.1 Local and regional linear ranges

Preliminary linear ranges were calculated for all species based on collection records from the Development Envelope, WAM database records, and local and regional DNA databases, to the limit of available data.

3 SAMPLING ADEQUACY IN THE DEVELOPMENT ENVELOPE

3.1 Sample effort

The available habitat mapping was detailed throughout the entire DE and extended beyond the DE up to 5 km in most areas. This allowed for the extrapolation of habitat beyond the confines of the DE enabling us to determine whether significant habitat types or landscape features extended outside the DE. The mapping was adequately detailed for assessment of sample effort within each habitat type as well as to determine whether each habitat type was adequate sampled. This also enabled us to show the occurrence of habitat types mapped throughout the DE in relation to the potential impact areas from the Proposal. Figure 3.1 shows the habitat mapping within the DE and Table 3.1 details the sampling effort in each habitat type in relation to the percentage of the DE the habitat represents.

Table 3.1: Sample effort in each habitat type within the Hope Downs 2 Development Envelope.

Habitat	Site ID	Sampling method	Notes	% of DE
Alluvial Plain	HDSRE6	Targeted SRE	Fauna SRE Trapping Site - HDSRE6	2.7
	TS02	Pit Trap (Dry)	Trapping grid	
	TS07	Pit Trap (Dry)	Trapping grid	
Breakaway	SRE10	Targeted SRE searches	SRE Site	1.8
	SRE20	Targeted SRE searches	SRE Site	
	SRE5	Targeted SRE searches	SRE Site	
	SRE9	Targeted SRE searches	SRE Site	
Cleared	1950	Pit Trap (Dry)	Trapping grid	11.5
	RC07H1S005	Pit Trap (Dry)	Trapping grid	
	RC07H1S013	Pit Trap (Dry)	Trapping grid	
	RC07H1S028	Pit Trap (Dry)	Trapping grid	
	RC07H1S046	Pit Trap (Dry)	Trapping grid	
	RC07H1S083	Pit Trap (Dry)	Trapping grid	
	RC07H1S158	Pit Trap (Dry)	Trapping grid	
	RC07H1S190	Pit Trap (Dry)	Trapping grid	
	RC07H1S276	Pit Trap (Dry)	Trapping grid	
Gorge/Gully	Q1	Pit Trap (Dry)	Trapping grid	0.5
	SRE1	Targeted SRE searches	SRE Site	
	SRE13	Targeted SRE searches	SRE Site	
	SRE17	Targeted SRE searches	SRE Site	
	SRE18	Targeted SRE searches	SRE Site	
	SRE2	Targeted SRE searches	SRE Site	
	SRE4	Targeted SRE searches	SRE Site	
	TS10	Pit Trap (Dry)	Trapping grid	
	TS11	Pit Trap (Dry)	Trapping grid	
Low Hills and Slopes	LHS47	Pit Trap (Dry)	Trapping grid	41.2
	MW48	Pit Trap (Dry)	Trapping grid	
	SP50	Pit Trap (Dry)	Trapping grid	

Habitat	Site ID	Sampling method	Notes	% of DE
	SRE21	Targeted SRE searches	SRE Site	
	TS04	Pit Trap (Dry)	Trapping grid	
	TS05	Pit Trap (Dry)	Trapping grid	
	TS09	Pit Trap (Dry)	Trapping grid	
Minor Drainage	HDTSRE04	Active foraging	25m buffer of SRE site	7.4
		Targeted SRE	25m buffer of SRE site	
	SRE15	Targeted SRE searches	SRE Site	
	SRE23	Targeted SRE searches	SRE Site	
	SRE3	Targeted SRE searches	SRE Site	
Mulga Woodland	HDSRE1	Targeted SRE	Fauna SRE Trapping Site	14.8
	HDSRE15	Targeted SRE	Fauna SRE Trapping Site	
	HDSRE7	Targeted SRE	Fauna SRE Trapping Site	
	HDTSRE06	Active foraging	25m buffer of SRE site	
		Targeted SRE	25m buffer of SRE site	
	HDTSRE07	Active foraging	25m buffer of SRE site	
		Targeted SRE	25m buffer of SRE site	
	HDTSRE08	Active foraging	25m buffer of SRE site	
		Targeted SRE	25m buffer of SRE site	
	HDTSRE09	Active foraging	25m buffer of SRE site	
		Targeted SRE	25m buffer of SRE site	
	HDTSRE10	Active foraging	25m buffer of SRE site	
		Targeted SRE	25m buffer of SRE site	
	SRE11	Targeted SRE searches	SRE Site	
	SRE16	Targeted SRE searches	SRE Site	
	SRE6	Targeted SRE searches	SRE Site	
	SRE7	Targeted SRE searches	SRE Site	
	TS01	Pit Trap (Dry)	Trapping grid	
	TS03	Pit Trap (Dry)	Trapping grid	
Rocky Hill	SRE19	Targeted SRE searches	SRE Site	7.8
	TS08	Pit Trap (Dry)	Trapping grid	
	TS12	Pit Trap (Dry)	Trapping grid	
	TS13	Pit Trap (Dry)	Trapping grid	
Stony Plain	SRE12	Targeted SRE searches	SRE Site	12.2
	SRE22	Targeted SRE searches	SRE Site	

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Habitat Mapping (Astron 2020)

- Alluvial Plain
- Breakaway
- Cleared
- Gorge/Gully
- Low Hills and Slopes
- Minor Drainage
- Mulga Woodland
- Rocky Hill
- Stony Plain

LEGEND

- Proposed Part IV Development Envelope
- Proposed Footprint

Previous Sampling Sites

- Active foraging SRE site
- Pitfall/funnel trapping site

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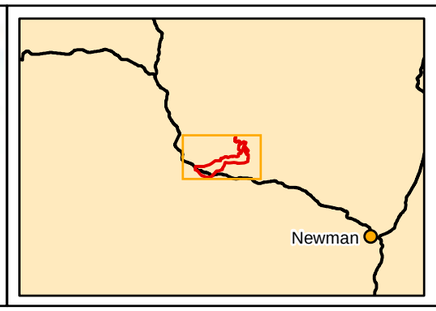
biologic Environmental Survey

Scale: 1:95,000

0 1 2 3 4 5 Km

Coordinate System: GDA2020 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA2020 Created 20/07/2022



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Hope Downs 2 Preliminary SRE Risk Assessment

Figure 3.1: Previous SRE sampling sites and habitat mapping

3.2 Sampling adequacy

Widespread habitat

Widespread habitat includes the generally low-lying landscape units with greater extent and connectivity throughout and beyond the DE. From the Astron (2020) habitat mapping, this comprises the Alluvial Plain, Cleared, Low Hills and Slopes, Minor Drainage, and Stony Plain habitat units, all also considered of Low suitability for SRE fauna. Mulga Woodland, while considered of Moderate suitability for SRE fauna, is also widespread throughout and beyond the DE. Any SRE taxa recorded from these landscape units are likely to be at low risk from the Proposal and are considered adequately sampled.

Restricted habitat

Restricted habitat includes the largely elevated landscape units that are disconnected from other areas of similar habitat. From the Astron (2020) habitat mapping, this comprises the Rocky Hill habitat (of Moderate suitability for SRE fauna) and the Gorge/Gully and Breakaway habitat units (both considered of High suitability for SRE fauna).

The available habitat mapping, as well as local topographic and aerial mapping, indicate that the areas of restricted habitat within the central section of the DE, comprising Rocky Hill and associated Breakaway and Gorge/Gully, is highly isolated. This ridgeline lies almost entirely within the DE and is separated from other ridgelines by a large drainage system at the eastern end and a large expanse of low hills, plains, and woodland on the other three sides. In addition, the proposed footprint covers much of the ridgeline. Of the ca.15 separate mapped areas of Gorge/Gully along the ridge, only four have been actively sampled for SRE fauna, and unique fauna have been found at three of these sites (see Section 4). It could be considered that these restricted habitats could be considered inadequately sampled based on: a) the fauna that has already been found in this area; b) the extent of the area that will be impacted by the footprint; and c) the limited amount of sampling of the ridgeline outside of the proposed footprint.

4 SRE INVERTEBRATE FAUNA IN THE DEVELOPMENT ENVELOPE

In total, three Confirmed and 35 Potential SRE invertebrate taxa have been recorded within the DE (Table 4.1; Figures 4.1, 4.2 & 4.3). Of these, 19 Potential SRE taxa are known only from within the DE, ten of which are currently only known from within the proposed footprint (Table 4.1). Details regarding the 19 taxa restricted to the DE, as well as the three Confirmed SRE taxa, the habitats in which they occur, and the assessment of their taxonomic status and distribution are provided further below. Additional Potential SRE taxa that could not be identified to species or morphospecies that were recorded within the proposed footprint are summarised in Appendix A. All were collected in multiple or widespread habitats and are not considered further in this analysis.

4.1 Araneae

Araneomorph and mygalomorph spiders were well-represented in the fauna collected from the DE. In addition to widespread species, two Confirmed and ten Potential SRE taxa were identified from within the DE (Figure 4.1, Table 4.1). Three of these Potential SRE taxa are only known from the DE, two of which were recorded from within the proposed footprint.

Karaops banyjima – Confirmed SRE

Many named *Karaops* species in the Pilbara are Confirmed SRE, having limited ranges due to their habitat specialization within the cracks and crevices of rocky outcrops (Crews, 2013; Crews & Harvey, 2011). *Karaops banyjima* is a Confirmed SRE and the type locality is 19.2 km north of the centre of the study area (Crews, 2013). *Karaops banyjima* was sampled from Gorge/Gully sites SRE18, SRE19 and SRE21. This could indicate that it is locally widespread within the DE, however, population fragmentation is a potential risk to this limited range species.

Teyl heuretes – Confirmed SRE

Confirmed SRE *Teyl heuretes* was collected from Mulga Woodlands from within and beyond the DE. It is found in a widespread habitat (Mulga Woodlands) and hence is likely to be locally prevalent.

Aurecocrypta `HD1` - Potential SRE

This taxon was represented by a single female specimen from site SRE17. While DNA sequences were obtained from this specimen, no matches could be found. This singleton record was collected in a deep gorge at the edge of a central ridgeline which is within the footprint of the DE.

Synothele `MYG055` - Potential SRE

This specimen was collected from a single site in Mulga Woodland habitat. Based on habitat values it is not considered likely to be restricted to the footprint or the DE.

Aname `R6` - Potential SRE

This specimen was collected at a single site from the Rhodes Ridge Study Area in Stony Plain habitat. No further information is available for this taxon; however, it occurs in habitat that is widespread and is unlikely to be restricted to the DE.

Table 4.1: Consolidated list of SRE invertebrate fauna recorded within the Development Envelope.

NB: Taxa in red are only known from within the proposed footprint.

Taxon	Source	ID Level	SRE category	Recorded within footprint	Recorded outside footprint	Linear range	Identification and distribution comments
ARANEAE							
Actinopidae							
Missulena `MYG045`	Biota 2011	med: morpho	Potential SRE	Yes	Yes	~83 km	WAM morphospecies. Recorded from widespread habitat (Mulga Woodland) and from beyond the DE.
Anamidae							
Aname `R6`	Astron 2019	med: morpho	Potential SRE	No	Yes	single site	Unknown morphospecies. Recorded from within DE but outside proposed footprint. Likely Widespread based on habitat (Stony Plain).
Kwonkan `MYG339`	Biota 2011	med: morpho	Potential SRE	Yes	Yes	~22 km	WAM morphospecies. Recorded from widespread habitat (Mulga Woodland) and from beyond the DE.
Teyl heuretes	Biota 2011	med: morpho	Confirmed SRE	Yes	Yes	~22 km	Known species. Recorded from widespread habitat (Mulga Woodland) and from beyond the DE.
Barychelidae							
Aurecocrypta `HD1`	Astron 2019	high: genetic	Potential SRE	Yes	No	single site	Molecular ID could not match this specimen to any other known taxon. Potentially restricted range based on collection in Gorge/Gully habitat.
Aurecocrypta `MYG315`	Astron 2019	high: genetic	Potential SRE	Yes	Yes	~57 km	Molecular ID confirmed WAM morphospecies. Recorded from widespread habitat (Stony Plain) and from beyond the DE.
Synothele `MYG055`	Biota 2011	med: morpho	Potential SRE	Yes	No	single site	WAM morphospecies. Only known from within proposed footprint but collected from widespread habitat (Mulga Woodland).
Synothele `MYG309`	Astron 2019	high: genetic	Potential SRE	Yes	Yes	~47 km	Molecular ID confirmed WAM morphospecies. Recorded from widespread habitat (Mulga Woodland) and from beyond the DE.
Synothele `MYG311`	Astron 2019	high: genetic	Potential SRE	Yes	Yes	~75 km	Molecular ID confirmed WAM morphospecies. Recorded from widespread habitat (Mulga Woodland) and from beyond the DE.
Halonoproctidae							
Conothele `MYG002`	Biota 2011	med: morpho	Potential SRE	Yes	Yes	~68 km	WAM morphospecies. Recorded from widespread habitat (Mulga Woodland) and from beyond the DE.
Selenopidae							
Karaops banyjima	Astron 2019	high: genetic	Confirmed SRE	Yes	Yes	~20 km	Molecular ID confirmed as known species. Restricted to rocky habitats but known from beyond the DE.

Taxon	Source	ID Level	SRE category	Recorded within footprint	Recorded outside footprint	Linear range	Identification and distribution comments
Karaops `ARA001`	Astron 2019	high: genetic	Potential SRE	Yes	Yes	~30 km	Molecular ID matched to other specimens. Restricted to rocky habitats but known from beyond the DE.
PSEUDOSCORPIONES							
Chthoniidae							
Austrochthonius `PSE135, pilbara`	Biota 2012	med: morpho	Potential SRE	Yes	Yes	~46 km	WAM morphospecies. Recorded from widespread habitat (Mulga Woodland) and from beyond the DE.
Tyrannochthonius `HD2`	Astron 2018 & 2019, Alacran 2019, Biota 2012	high: genetic	Potential SRE	Yes	No	single site	Molecular ID could not match this specimen to any other known taxon. Only known from with proposed footrpint. Potentially restricted range based on collection in Gorge/Gully habitat.
Olpiidae							
Austrohorus `HD5`	Astron 2019	high: genetic	Potential SRE	No	Yes	single site	Molecular ID could not match this specimen to any other known taxon. Recorded from restricted habitat (Gorge/Gully) on the edge of the proposed footprint,
Euryolpium `HD6`	Astron 2018 & 2019	high: genetic	Potential SRE	No	Yes	single site	Molecular ID could not match this specimen to any other known taxon. Recorded from within DE but outside proposed footprint. Collected from widespread habitat (Mulga Woodland).
Euryolpium `HD7`	Astron 2018 & 2019	high: genetic	Potential SRE	No	Yes	single site	Molecular ID could not match this specimen to any other known taxon. Recorded from potentially restricted habitat (Breakaway) but outside proposed footprint.
Olpiidae `Genus 7/4` `PSE118`	Astron 2018 & 2019, Alacran 2019, Biota 2012	high: genetic	Potential SRE	No	Yes	~26 km	Molecular ID confirmed WAM morphospecies. Recorded from potentially restricted habitat (Gorge/Gully) but outside proposed footprint and known from beyond the DE.
Olpiidae `PSEAAA` `HD4`	Astron 2019	high: genetic	Potential SRE	Yes	No	single site	Molecular ID could not match this specimen to any other known taxon. Only known from within proposed footprint but collected from widespread habitat (Mulga Woodland).
SCORPIONES							
Buthidae							
Lychas `bituberculatus complex`	Astron 2018 & 2019	med: morpho	Potential SRE	No	Yes	uncertain	Species complex. Recorded from within DE but outside proposed footprint.
Lychas `hairy tail complex`	Astron 2019	med: morpho	Potential SRE	No	Yes	uncertain	Species complex. Recorded from within DE but outside proposed footprint.
Lychas `multipunctatus complex`	Astron 2019	med: morpho	Potential SRE	No	Yes	uncertain	Species complex. Recorded from within DE but outside proposed footprint.
Urodacidae							

Taxon	Source	ID Level	SRE category	Recorded within footprint	Recorded outside footprint	Linear range	Identification and distribution comments
Urodacus `HD1`	Astron 2019	high: genetic	Potential SRE	No	Yes	single site	Molecular ID could not match this specimen to any other known taxon. Recorded from within DE but outside proposed footprint. Likely Widespread based on habitat (Stony Plain).
GEOPHILOMORPHA							
Chilenophilidae							
Sepedonophilus `HD1`	Astron 2019	high: genetic	Potential SRE	No	Yes	~17 km	Molecular ID could not match this specimen to any other known taxon. Recorded from within DE but outside proposed footprint. Likely Widespread based on collection in various habitats.
Sepedonophilus `HD2`	Astron 2019	high: genetic	Potential SRE	Yes	No	single site	Molecular ID could not match this specimen to any other known taxon. Only known from within proposed footprint but collected from widespread habitat (Mulga Woodland).
Mecistocephalidae							
Mecistocephalus `HD1`	Astron 2019	high: genetic	Potential SRE	No	Yes	~4 km	Molecular ID could not match this specimen to any other known taxon. Recorded from within DE but outside proposed footprint. Likely Widespread based on habitat (Mulga Woodland).
Mecistocephalus `HD2`	Astron 2019	high: genetic	Potential SRE	Yes	No	single site	Molecular ID could not match this specimen to any other known taxon. Only known from within proposed footprint but collected from widespread habitat (Mulga Woodland).
Mecistocephalus `HD3`	Astron 2019	high: genetic	Potential SRE	Yes	No	single site	Molecular ID could not match this specimen to any other known taxon. Only known from within proposed footprint but collected from widespread habitat (Mulga Woodland).
Oryidae							
Orphnaeus `HD1`	Astron 2019	high: genetic	Potential SRE	Yes	No	single site	Molecular ID could not match this specimen to any other known taxon. Only known from within proposed footprint but collected from widespread habitat (Mulga Woodland).
SCOLOPENDROMORPHA							
Cryptopidae							
Cryptops `HD1`	Astron 2019	high: genetic	Potential SRE	Yes	No	single site	Molecular ID could not match this specimen to any other known taxon. Only known from within proposed footprint but collected from widespread habitat (Stony Plain).
POLYDESMIDA							
Paradoxosomatidae							

Taxon	Source	ID Level	SRE category	Recorded within footprint	Recorded outside footprint	Linear range	Identification and distribution comments
Antichiropus `wonmunna, DIP163`	Astron 2019	high: genetic	Confirmed SRE	Yes	Yes	~10 km	Molecular ID confirmed WAM morphospecies. Recorded from widespread habitat (Mulga Woodland) and from beyond the DE.
SPIROBOLIDA							
Trigoniulidae							
Austrostrophus `clade A`	Astron 2019	high: genetic	Potential SRE	No	Yes	~33 km	Molecular ID confirmed WAM morphospecies. Recorded from within DE but outside proposed footprint and from beyond the DE.
Austrostrophus `clade E`	Astron 2019	high: genetic	Potential SRE	Yes	Yes	~40 km	Molecular ID confirmed WAM morphospecies. Recorded from widespread habitat (Mulga Woodland) and from beyond the DE.
ISOPODA							
Armadillidae							
Buddelundia `10ma`	Astron 2018 & 2019	med: morpho	Potential SRE	Yes	Yes	~1.5 km	Morphological ID. Part of Widespread species complex Buddelundia `10` but morphologically distinct. DNA sequencing required to confirm whether it is a distinct species. Only recorded from within the DE, inside and outside of proposed footprint, though likely Widespread due to collection in a various habitat.
Buddelundia `10ts`	WAM Records	med: morpho	Potential SRE	No	Yes	~47 km	Morphological ID. Part of Widespread species complex Buddelundia `10` but morphologically distinct. DNA sequencing required to confirm whether it is a distinct species. Recorded from within DE but outside proposed footprint, and from beyond the DE. Likely Widespread based on collection in various habitats.
Buddelundia `77`	Astron 2019	med: morpho	Potential SRE	Yes	Yes	~23 km	Morphological ID. Recorded from various habitats and from beyond the DE.
Pseudodiploexochus `C75046`	Astron 2019	med: morpho	Potential SRE	Yes	No	single site	Morphological ID. Only identified to genus but only second record of this genus from the Pilbara, the previous specimen being troglobitic. Only known from with proposed footprint. Highly likely to be range restricted based on collection in Gorge/Gully habitat and known ecology of the genus (see text).

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MAC-E

Hope Downs 1

South Flank

West Angelas Rd

Great Northern Hwy

Family, Taxon

- Anamidae, *Aname* `R6`
- Anamidae, *Kwonkan* `MYG339`
- Anamidae, *Teyl heuretes*
- Barychelidae, *Aurecocrypta* `HD1`
- Barychelidae, *Aurecocrypta* `MYG315`
- Barychelidae, *Synothele* `MYG055`
- Barychelidae, *Synothele* `MYG309`
- Barychelidae, *Synothele* `MYG311`
- Halonoproctidae, *Conothele* `MYG002`
- Selenopidae, *Karaops* `ARA001`
- Selenopidae, *Karaops banyjima*

LEGEND

- Operating Mine
- Local Road
- State Road
- Rail
- Proposed Part IV Development Envelope
- Proposed Pits
- Proposed Infrastructure areas
- Proposed Waste areas

N

biologic Environmental Survey

Scale: 1:95,000

0 1 2 3 4 5 Km

Coordinate System: GDA2020 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA2020 Created 19/07/2022

Newman

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Hope Downs 2 Preliminary SRE Risk Assessment

Figure 4.1: SRE fauna recorded in the Development Envelope (Araneae)

4.2 Pseudoscorpiones

Six pseudoscorpion taxa have been recorded from the DE, primarily identified by molecular analysis (Astron, 2019) (Figure 4.2). Of these, five are only known from the DE, two of which were collected from within the proposed footprint.

Tyrannochthonius `HD2` - Potential SRE

This specimen was initially identified as the widespread species, *Tyrannochthonius aridus,* however, molecular sequencing later revealed that this specimen did not match other sequences in the genus and it was determined to be a separate taxon. *Tyrannochthonius* `HD2` was collected in Gorge/Gully habitat which is disconnected in the landscape and can be highly significant for SRE invertebrate species, it is possible this taxon has a restricted distribution. It was collected from within the proposed footprint.

Olpiidae (five taxa) – Potential SRE

Olpiidae taxonomy is poorly developed, with identification even to genus considered challenging by taxonomic experts. Molecular analyses of the family indicate significant cryptic diversity and many taxa that appear to have restricted ranges. Four of the five pseudoscorpion taxa were collected from single sites from within the DE. *Euryolpium* `HD6` and Olpiidae `PSEAAA` `HD4` were collected from single sites in widespread Mulga Woodland habitat within the DE. *Austrohorus* `HD5` was collected from a single Gorge/Gully site and *Euryolpium* `HD7` was collected from a single site Breakaway habitat both of which are restricted and significant habitat types. Only Olpiidae `PSEAAA` `HD4` was collected from within the proposed footprint (in widespread habitat) however, *Austrohorus* `HD5` was collected at a restricted habitat site on the edge of the proposed footprint and may be subjected to impacts from the development.

4.3 Myriapoda

Geophilomorpha and Scolopendromorpha – Potential SRE

Geophilomorpha taxonomy in Australia is very poorly developed. Most genera and species are undescribed, and species designation is primarily via molecular analysis, which has found many species that appear to have restricted ranges. Eight taxa were morphologically identified from the DE, six of which were successfully sequenced (Figure 4.3). Four taxa (*Sepedonophilus* `HD2`, *Mecistocephalus* `HD1`, *Mecistocephalus* `HD3` and *Orphnaeus* `HD1`) are only known from within the proposed footprint, however all were collected in widespread Mulga Woodland habitat. The scolopendromorph *Cryptops* `HD1` is also only know from the proposed footprint but was also collected in widespread habitat (Stony Plain).

Polydesmida – Confirmed SRE

One Confirmed SRE polydesmid myriapod belonging to the genus *Antichiropus* was collected at two sites in the DE. The specimen was collected in Mulga Woodland habitat and was molecularly confirmed as belonging to *Antichiropus* `wonmunna, DIP163`. *Antichiropus* 'wonmunna' has been collected from

sites within 10 km of the DE and though it was collected in widespread habitat, these millipedes have been known to aestivate in rocky habitats and hence may be associated with the more restricted habitat type.

4.4 Isopoda

Four armadillid isopod taxa have been recorded from the DE (Figure 4.3). These were morphologically identified by Dr Simon Judd. Two were collected in multiple habitats spread throughout and beyond the DE. *Buddelundia* `10ma` has only been recorded within the DE but was collected in multiple widespread habitats. One taxon, *Pseudodiploexochus* `C75046`, was collected from restricted habitat (Gorge/Gully) within the proposed footprint.

Pseudodiploexochus `C75046` - Potential SRE

This unusual specimen was collected in a Gorge/Gully site (SRE17) from within the proposed footprint of the DE. Communication with Dr Simon Judd regarding this specimen was as follows:

"The specimen that you mention in your email was determined by me in May 2019 and collected on 11/03/2019 by Erich Volschenk. It was hand collected by litter sifting and lodged at WAM under registration C75046 (AES190304).

The other record I have for the genus in the Pilbara is in the Greater West Angelas Area collected by Ecologia. This specimen is definitely troglobitic and was collected in a troglofauna trap. It is certainly not the same species as C75046.

This epigean Pseudodiploexochus is one of three Armadillidae genera in the Pilbara that are known only from a single specimen at a single location. There are undoubtedly more species there, but they are just impossible to collect. C75046 is almost certainly an SRE and probably only occurs in the gorge where it was collected.

Pseudodiploexochus are Gondwanic isopods occurring in relictual habits. They are found all over WA from the Pilbara southwards but are uncommon. Most species are very small around 2mm in length (maximum). Even in the Warren IBRA subregion, which is relatively wet and forested, there are obvious SRE species. They are primitive armadillids without pleopodal lungs and as such, are more moisture dependant than Buddelundia (for example). They also lack uropod exopodites and have distinctive interlocking structures on the first two pereonites. In my opinion (outside of south-west WA), they are all almost certainly SRE species. Their ranges are more likely to be in the order of square metres rather than square kilometres."

690000 700000 710000 720000

7460000 7450000

MAC-E

South Flank

Hope Downs 1

West Angelas Rd

Great Northern Hwy

Family, Taxon

- Buthidae, *Lychas* `bituberculatus complex`
- Buthidae, *Lychas* `hairy tail complex`
- Buthidae, *Lychas* `harveyi complex`
- Buthidae, *Lychas* `multipunctatus complex`
- Urodacidae, *Urodacus* `HD1`
- Chthoniidae, *Austrochthonius* `PSE135`
- Chthoniidae, *Tyrannochthonius* `HD2`
- Olpiidae, *Austrohorus* `HD5`
- Olpiidae, *Euryolpium* `HD6`
- Olpiidae, *Euryolpium* `HD7`
- Olpiidae, `Genus 7/4` `PSE118`
- Olpiidae, `PSEAAA` `HD4`

LEGEND

- Operating Mine
- Local Road
- State Road
- Rail
- Proposed Part IV Development Envelope
- Proposed Pits
- Proposed Infrastructure areas
- Proposed Waste areas

N

biologic Environmental Survey

Scale: 1:95,000

0 1 2 3 4 5 Km

Coordinate System: GDA2020 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA2020 Created 20/07/2022

Newman

RIO TINTO IRON ORE

Hope Downs 2 Preliminary SRE Risk Assessment

Figure 4.2: SRE fauna recorded in the Development Envelope (Scorpiones and Psuedoscorpiones)

690000 700000 710000 720000

7460000 7450000

MAC-E

Hope Downs 1

South Flank

West Angelas Rd

Great Northern Hwy

Family, Taxon

- Armadillidae, *Buddelundia* `10ts`
- Armadillidae, *Buddelundia* `10ma`
- Armadillidae, *Buddelundia* `77`
- Armadillidae, *Pseudodiploexochus* `C75046`
- Cryptopidae, *Cryptops* `HD1`
- Chilenophilidae, *Sepedonophilus* `HD1`
- Chilenophilidae, *Sepedonophilus* `HD2`
- Mecistocephalidae, *Mecistocephalus* `HD1`
- Mecistocephalidae, *Mecistocephalus* `HD2`
- Mecistocephalidae, *Mecistocephalus* `HD3`
- Oryidae, *Orphnaeus* `HD1`
- Paradoxosomatidae, *Antichiropus* `DIP163`
- Trigoniulidae, *Austrostrophus* `clade A`
- Trigoniulidae, *Austrostrophus* `clade E`

Buddelundia `77`
Cryptops `HD1`
Mecistocephalus `HD3`
Antichiropus `DIP163`
Austrostrophus `clade E`

Buddelundia `77`
Mecistocephalus `HD1`
Mecistocephalus `HD2`
Orphnaeus `HD1`
Sepedonophilus `HD2`
Antichiropus `DIP163`

LEGEND

- Operating Mine
- Local Road
- State Road
- Rail
- Proposed Part IV Development Envelope
- Proposed Pits
- Proposed Infrastructure areas
- Proposed Waste areas

N

biologic Environmental Survey

Scale: 1:95,000

0 1 2 3 4 5 Km

Coordinate System: GDA2020 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA2020 Created 19/07/2022

Newman

RIO TINTO IRON ORE

Hope Downs 2 Preliminary SRE Risk Assessment

Figure 4.3: SRE fauna recorded in the Development Envelope (Isopoda and Myriapoda)

5 PRELIMINARY RISK ASSESSMENT

The level of impact to significant habitat or populations of SRE taxa from mining activities in a particular area can be varied and difficult to assess adequately. However, the taxa recorded for an area and the level to which significant habitats have been surveyed can indicate whether or not a level of risk of impact can be estimated. Here, we provide a preliminary level of risk from impact based on what we know of a particular taxon's range, the habitat that it occurs in and the amount of that habitat that will be impacted by mining activities, i.e the proposed footprint (Table 5.1). This is of particular relevance to taxa that, to date, have been collected from single sites within the DE.

Table 5.1: Definition of level of risk for SRE invertebrate fauna and habitats

Category	Description
High	Taxonomic factors indicate that a species is **likely to be** restricted in range based on what is known of the genus or species, it has been collected from a **restricted** habitat type and a significant proportion of the known or likely habitat that it occurs in will be removed by mining activities (inside proposed footprint).
Medium	Taxonomic factors indicate that a species is **possibly** restricted in range based on what is known of the genus or species, it has been collected from a **restricted** habitat type and a significant proportion of the known or likely habitat that it occurs in will be removed by mining activities (inside proposed footprint).
Low	Taxonomic factors indicate that a species is **possibly** restricted in range based on what is known of the genus or species, it has been collected from a **widespread** habitat type.

Of the 38 taxa recorded within the DE, 27 were collected from outside the proposed footprint, most in widespread or varied habitats, and many also from beyond the DE (see Table 4.1). These 27 taxa are considered not at risk from the Proposal as it is currently mapped. This includes the three Confirmed SRE species, two of which were found in widespread habitat. Only the *Karaops banyjima* was collected in a restricted habitat type, however it has been collected at more than one site within and beyond the DE. Additionally, none of the indeterminate taxa (Appendix A) are currently at risk from the Proposal, as all were recorded in widespread habitat. This leaves 11 taxa for which the Proposal carries some form of risk (Table 5.2).

Table 5.2: SRE fauna considered at risk from the currently proposed footprint.

Taxon	Taxonomic factors affecting risk	Distribution and habitat factors affecting risk	Risk level
Aurecocrypta `HD1`	Genus infrequently collected and needs review. No described species from the Pilbara. Specimen did not match any of the seven WAM sequences from the Pilbara. Several other Pilbara morphospecies seem to have restricted ranges.	Both were collected from a single site (SRE17) in restricted habitat (Gorge/Gully) within the footprint.	High
Pseudodiploexochus `C75046`	Genus has only been collected twice in the Pilbara. This is the first terrestrial collection. Genus		

Taxon	Taxonomic factors affecting risk	Distribution and habitat factors affecting risk	Risk level
	has no arid adaptations and is almost certainly restricted to areas that retain moisture all year round.		
Tyrannochthonius `HD2`	Could not be matched to any known sequences. Genus contains widespread and restricted taxa.	Collected from a single site in restricted habitat (Gorge/Gully).	Medium
Austrohorus `HD5`	Olpiidae taxonomy very limited and needs review. Molecular analysis seems to show many species with restricted ranges. Could not be matched to any other sequences.	Collected from a single site in restricted habitat (Gorge/Gully), on the edge of the proposed footprint, in area likely to be indirectly impacted.	
Synothele `MYG055`	Could not be matched to any known sequences. Genus contains widespread and restricted taxa.	Collected from a single site in widespread habitat (Mulga Woodland).	Low
Olpiidae `PSEAAA` `HD4`	Olpiidae taxonomy very limited and needs review. Molecular analysis seems to show many species with restricted ranges. Could not be matched to any other sequences.		
Sepedonophilus `HD2`	Taxonomic framework for geophilomorph centipedes severely lacking. Molecular analysis seems to show many species with restricted ranges.		
Mecistocephalus `HD2`			
Mecistocephalus `HD3`			
Orphnaeus `HD1`			
Cryptops 'HD1'	Could not be matched to any known sequences. Genus contains predominantly restricted taxa.	Collected from a single site in widespread habitat (Stony Plain).	

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Appendix°A: Consolidated list of indeterminate SRE invertebrate fauna recorded from within the proposed footprint.

Taxon	Source	SRE category	Identification and distribution comments
ARANEAE			
Missulena sp. indet.	Biota 2011	Potential SRE	Indeterminate taxa. Specimens recorded within proposed footprint collected in widespread habitat (Mulga Woodland).
Aname sp. indet.	Biota 2013, 2014 & 2015	Potential SRE	Indeterminate taxa. Specimens recorded within proposed footprint collected in widespread habitat (Mulga Woodland and Stony Plain).
Anamidae sp. indet.	Alacran 2019, Astron 2019	Potential SRE	Indeterminate taxa. Specimens recorded within proposed footprint collected in widespread habitat (Stony Plain).
Kwonkan sp. indet.	Biota 2012, 2013 & 2015	Potential SRE	Indeterminate taxa. Specimens recorded within proposed footprint collected in widespread habitat (Mulga Woodland).
Synothele sp. indet.	Astron 2019, Biota 2011 & 2012	Potential SRE	Indeterminate taxa. Specimens recorded within proposed footprint collected in widespread habitat (Mulga Woodland and Stony Plain).
Barychelidae sp. indet.	Biota 2011	Potential SRE	Indeterminate taxa. Specimen recorded within proposed footprint collected in widespread habitat (Mulga Woodland).
Gaius sp. indet.	Astron 2018 & 2019	Potential SRE	Indeterminate taxa. Specimen recorded within proposed footprint collected in widespread habitat (Minor Drainage).
Idiosoma sp. indet.	Biota 2011	Potential SRE	Indeterminate taxa. Specimen recorded within proposed footprint collected in widespread habitat (Mulga Woodland).
PSEUDOSCORPIONES			
Sundochernes sp. indet.	Astron 2019	Potential SRE	Indeterminate taxa. Specimen recorded within proposed footprint collected in widespread habitat (Mulga Woodland).
Beierolpium sp. indet.	Astron 2018 & 2019	Potential SRE	Indeterminate taxa. Specimens recorded within proposed footprint collected in widespread habitat (Mulga Woodland and Stony Plain).
Indolpium sp. indet.	Astron 2018 & 2019	Potential SRE	Indeterminate taxa. Specimens recorded within proposed footprint collected in both widespread (Mulga Woodland) and potentially restricted (Gorge/Gully) habitat.
GEOPHILOMORPHA			
Geophilomorpha sp. indet.	Astron 2019	Potential SRE	Indeterminate taxa. Specimen recorded within proposed footprint collected in widespread habitat (Mulga Woodland).
SCOLOPENDROMORPHA			
Cryptops sp. indet.	Stantec 2020	Potential SRE	Indeterminate taxa. Specimens recorded within proposed footprint collected in widespread habitat (Low Hills & Slopes and Mulga Woodland).
SPIROBOLIDA			
Austrostrophus sp. indet.	Astron 2019	Potential SRE	Indeterminate taxa. Specimens recorded within proposed footprint collected in both widespread (Mulga Woodland) and potentially restricted (Gorge/Gully) habitat.
ISOPODA			
Armadillidae sp. indet.	Astron 2019	Potential SRE	Indeterminate taxa. Specimens recorded within proposed footprint collected in widespread habitat (Mulga Woodland).
Buddelundia sp. indet.	Astron 2019	Potential SRE	Indeterminate taxa. Specimens recorded within proposed footprint collected in widespread habitat (Mulga Woodland).

C.9: Hope Downs 2 Proposal – Long Term Motion Cameras

9 August 2023

Our Reference: 14292B-20-BILR-1Rev0_230809

Sally Pickard
Senior Environmental Approvals Advisor
Rio Tinto
Central Park
152-158 St Georges Terrace
Perth WA 6000

Dear Sally,

Re: Hope Downs 2 Proposal – Long-term Motion Cameras, February to September 2020

1 Introduction

Astron Environmental Services (Astron) (2020a) first recorded the Northern Quoll (*Dasyurus hallucatus*) (EN; EN) on 14 occasions, including records at Bedded Hilltop (BHT), in the form of motion camera recordings and scat recordings at separate locations during the baseline fauna assessment. Based on these findings, Astron provided a recommendations letter and proposal to undertake further Northern Quoll work within the Hope Downs 2 (HD2) Proposal survey area, specifically a GPS tracking study (Astron Environmental Services 2019). However, given the low numbers of Northern Quoll captures recorded during the targeted Matters of National Environmental Significance (MNES) survey in September 2019 (Astron Environmental Services 2020b), the chances of capturing enough individuals to conduct a successful tracking study is low. Instead, Rio Tinto aimed to increase their knowledge of the presence/absence of this species in this area and commissioned Astron to deploy long-term motion sensitive cameras at BHT.

2 Methods

Astron zoologists Matthew Love and Lucy Dadour deployed 12 long-term cameras (supplied by Rio Tinto) between 27 and 29 February 2020. Twelve Hyperfire Reconyx were set in highly prospective locations across BHT (Figure A.1 and TableA.1, Attachment A) and 'baited' with scent lures to increase the chance of recording this species. The cameras were positioned horizontally with a wide field of view to capture all species that investigate the lure. Astron zoologists Brittany Osborn and Sean Smithies retrieved the 12 cameras between 11 and 13 September 2020.

3 Results

A total of 2,355 total camera nights were recorded on 12 long-term motion cameras (ranging from 195 to 199 camera trap nights) deployed within the survey area. A total of 142 species day-records were made from the long-term motion cameras. A day-record represents a different species being recorded on a camera from each individual date.

3.1 Northern Quoll

The Northern Quoll was recorded twice at two separate locations on 1 May (CAM2) and 4 May 2020 (CAM8). CAM2 was placed at the western end of BHT within a Breakaway fauna habitat type and CAM8 was placed in a Gorge/Gully fauna habitat type in the eastern end of BHT; these cameras were spaced 8.2 km apart. Both Breakaway and Gorge/Gully fauna habitat types represent core habitat as per the referral guidelines (Department of the Environment and Energy 2016). The Gorge/Gully and Breakaway habitats contain rocky environments of high relief that are particularly important for this species as they provide denning sites for breeding and shelter and diverse microhabitats for foraging. Comparison of individual spot markings was difficult as the photos captured from separate cameras recorded opposite sides of the individuals and/so individual status could not be deduced.



Plate 1. Northern Quoll Recorded at CAM2 (1 May 2020). Plate 2. Northern Quoll Recorded at CAM8 (4 May 2020).

3.2 Other Terrestrial Species

Twenty species were recorded: two reptile species, 11 bird species and seven mammal species (including the Northern Quoll) (Table 1).

Table 1: Summary of terrestrial vertebrate fauna species recorded on the long term motion cameras deployed within the Hope Downs 2 Proposal survey area.

Group	Number of species	Conservation significant species	Introduced species
Reptiles	2	0	0
Birds	11	0	0
Mammals	7	1	2
Total	**20**	**1**	**2**

The most commonly recorded species on the motion cameras were large mammals and birds, with the Rothschild Rock-wallaby (*Petrogale rothschildi*), Dog/Dingo (**Canis familiaris*) and Grey-headed Honeyeater (*Ptilotula keartlandi*) representing 42, 20, and 15 day-records, respectively (Attachment B).

3.3 Introduced Fauna

A total of two introduced species were recorded on motion cameras: Dog/Dingo and Feral Cat (**Felis catus*). There were 20 day-records of the Dog/Dingo from six of the 12 cameras (50% of deployed cameras), and six day-records of the Feral Cat from five of the 12 cameras (40% of deployed cameras). While staying at Hope Downs 1 (HD1), the September field team witnessed cats on two separate occasions moving about the camp. During the targeted MNES survey in September 2019 (Astron Environmental Services 2020b) three individual cats were captured at different cage trapping sites

across the BHT survey area. Also, an individual cat was observed on a motion sensitive camera within the HD2 area and the field team observed cat sightings in and around both the HD1 and Hope Downs 4 villages during the survey (Matthew Love, pers. obs.). These previous records of Feral Cats and the records made during this assessment indicate a potentially high level of cat activity within the survey area at the time of both surveys.

4 Conclusions

Since the initial 14 records made during the baseline assessment from November 2017 to March 2019 (Astron Environmental Services 2020a), the number of Northern Quoll records made during this long-term motion camera assessment and the targeted MNES survey conducted in September 2019 (Astron Environmental Services 2020b) have been low and sporadic. Since the baseline assessment, seasonal conditions have been poor (i.e. dry) and a seemingly high level of cat activity has been observed. Given the recent camera records were made in May at the onset of the mating season, the records are suggestive of a male expanding their home range looking for breeding opportunities. Home ranges of male Northern Quolls are similar to female home ranges before the mating season (10 ha to 35 ha), but expand during the mating season to > 100 ha to overlap extensively with several female home ranges (Oakwood 2002). However as individual status could not be deduced for certain for the two records generated, it is unclear whether this represents one or potentially two individuals. The recent findings suggest the habitat within BHT perhaps does not currently support breeding females, however only through capture can the sex of individuals and therefore breeding condition be accurately assessed. The records made at BHT during this long-term camera assessment have contributed to the understanding of this species' usage of habitats found at BHT, but further investigations will help to deduce whether the species is resident or transient, as well as seasonal usage patterns within BHT. An additional 35 long-term motion sensitive cameras were recently deployed within BHT and surrounds in September 2020.

This letter was prepared by Environmental Scientist Brittany Osborn and Senior Environmental Scientist Matthew Love, and was technically reviewed by Principal Environmental Scientist Dr Jessica Johnston. If you would like to discuss this further, please feel free to contact me on 9421 9600.

Yours sincerely

ASTRON ENVIRONMENTAL SERVICES



Brett Lucas
Manager - Biodiversity

Attachments

Attachment A: Site Survey Sampling Locations

Attachment B: Site x Species Matrix

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Attachment A: Survey Sampling Locations

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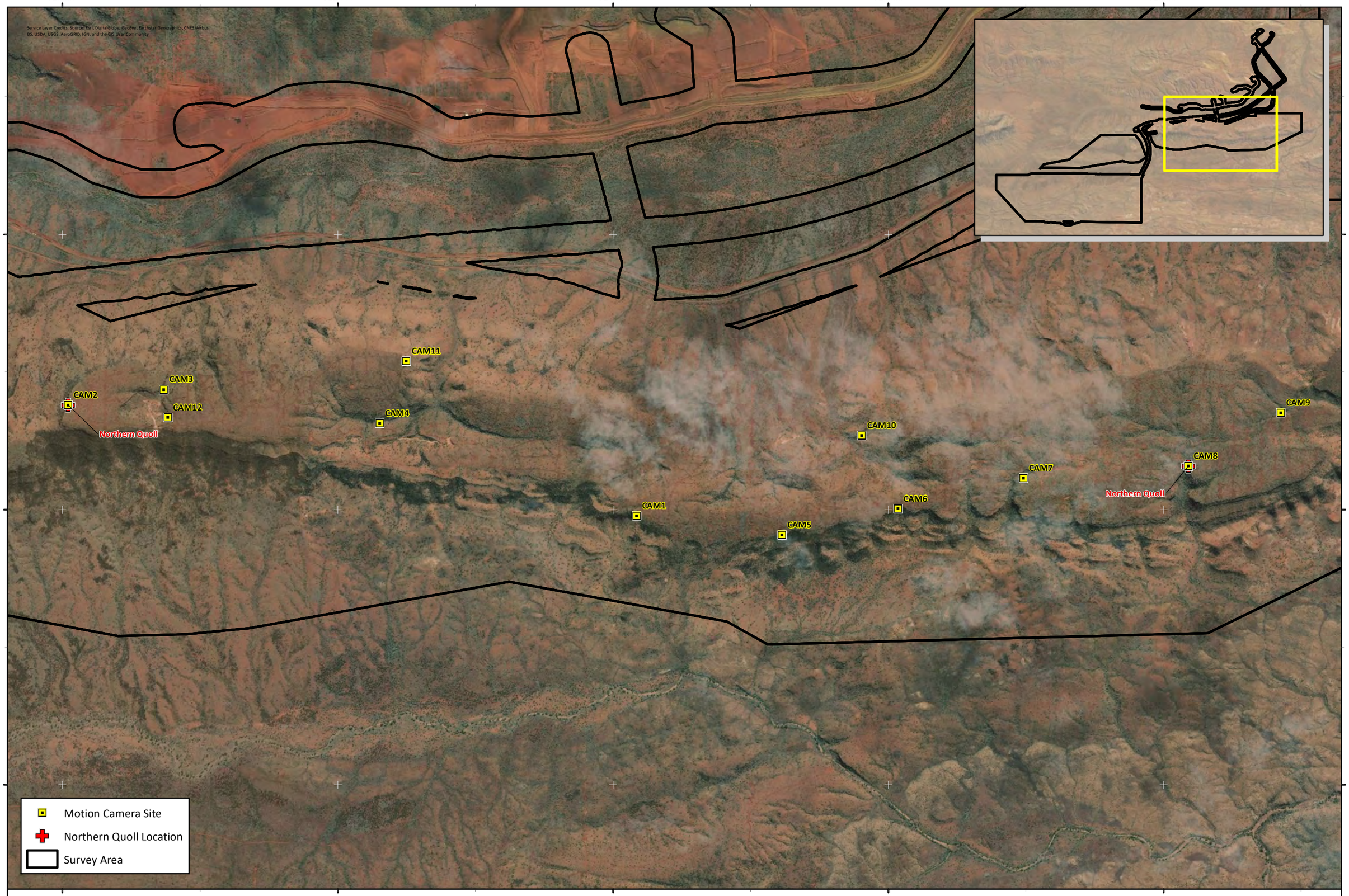


Rio Tinto

Hope Downs 2 Proposal – Long-term Motion Cameras

Figure A.1: Motion Camera Sites and Northern Quoll Locations

Coordinate System: GDA 1994 MGA Zone 50

0 500 1,000 1,500 Metres

N

astron delivering environmental intelligence™

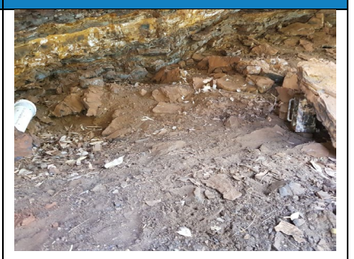
Author: J. Johnston | Drawn: C. Dyde | Date: 17-09-2020 | Figure Ref: 14292B-20-BIDR-1Rev1_200917_FigA1_Cams

Table A.1: Astron fauna sampling locations.

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
Long-term Motion Camera Sites												
CAM1	714173	7449956	Bedded Hilltop	Targeted MNES	Long-term Camera	28/02/2020	11/09/2020	Breakaway	1.0	None	Overhangs, crevices, thick undergrowth, leaf litter	
CAM2	710041	7450760	Bedded Hilltop	Targeted MNES	Long-term Camera	28/02/2020	12/09/2020	Breakaway	1.0	None	Overhangs, logs, crevices, thick undergrowth, leaf litter	 
CAM3	710737	7450873	Bedded Hilltop	Targeted MNES	Long-term Camera	28/02/2020	12/09/2020	Gully	1.0	None	Rocky outcrops, caves, overhangs, crevices, thick undergrowth, rock piles, leaf litter	

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
CAM4	712306	7450627	Bedded Hilltop	Targeted MNES	Long-term Camera	28/02/2020	12/09/2020	Gorge	1.0	None	South facing, caves, overhangs, tree hollows, crevices, thick undergrowth, old *Triodia*, leaf litter	 
CAM5	715228	7449816	Bedded Hilltop	Targeted MNES	Long-term Camera	29/02/2020	11/09/2020	Breakaway	1.0	None	Overhangs, logs, tree hollows, crevices, thick undergrowth	 

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
CAM6	716071	7450006	Bedded Hilltop	Targeted MNES	Long-term Camera	29/02/2020	11/09/2020	Breakaway	1.0	None	Caves, overhangs, logs, tree hollows, crevices, thick undergrowth, leaf litter	 
CAM7	716984	7450229	Bedded Hilltop	Targeted MNES	Long-term Camera	29/02/2020	11/09/2020	Gorge	1.0	None	Rocky outcrops, caves, overhangs, crevices, rock piles, leaf litter	 
CAM8	718181	7450316	Bedded Hilltop	Targeted MNES	Long-term Camera	29/02/2020	11/09/2020	Gorge	1.0	None	South facing, moist, rocky outcrops, caves, overhangs, logs, tree hollows, crevices, thick undergrowth, old *Triodia*, leaf litter	

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
CAM9	718853	7450706	Bedded Hilltop	Targeted MNES	Long-term Camera	29/02/2020	11/09/2020	Gully	1.0	None	Caves, overhangs, logs, tree hollows, crevices, thick undergrowth	 
CAM10	715808	7450538	Bedded Hilltop	Targeted MNES	Long-term Camera	27/02/2020	13/09/2020	Gully	1.0	Drill lines, weeds	Overhangs, tree hollows, crevices, thick undergrowth, old *Triodia*, leaf litter	 

Site ID	MGA Zone 50 K		Site location	Phase	Sampling method	Sample start date	Sample finish date	Habitat	Condition	Disturbance	Microhabitats	Photo
	Easting (mE)	Northing (mN)										
CAM11	712498	7451079	Bedded Hilltop	Targeted MNES	Long-term Camera	28/02/2020	12/09/2020	Breakaway	1.0	None	Overhangs, crevices, thick undergrowth	 
CAM12	710766	7450670	Bedded Hilltop	Targeted MNES	Long-term Camera	28/02/2020	12/09/2020	Breakaway	1.0	None	Caves, overhangs, crevices	 

Habitat Condition: 1.0 (Excellent); 0.8 (Very Good); 0.6 (Good); 0.4 (Poor); 0.2 (Very Poor); 0.1 (Completely Degraded)

Attachment B: Site x Species Matrix

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Table B.1: Number of day-records of species recorded on each long-term motion camera.

Species name	CAM1	CAM2	CAM3	CAM5	CAM6	CAM7	CAM8	CAM9	CAM10	CAM11	CAM12	Total
Reptiles												
Varanus giganteus					1		4	2			1	8
Varanus hamersleyensis		3	1								1	5
Birds												
Accipiter cirrocephalus											1	1
Artamus minor			3									3
Colluricincla harmonica			1	2		1						4
Corvus orru			1	1	2	1						5
Cracticus nigrogularis					1							1
Cracticus tibicen					1							1
Emblema pictum			1			3					2	6
Pomatostomus temporalis							1					1
Ptilonorhynchus maculatus guttatus	1			1	1							3
Ptilotula keartlandi		1	1	2		10				1		15
Rhipidura leucophrys						1		1			1	3
Mammals												
Canis familiaris	4	1	4		4		1	6				20
Dasyurus hallucatus		1					1					2
Felis catus				2	1		1	1	1			6
Petrogale rothschildi	1	10	14	1		3	4				9	42
Pseudantechinus woolleyae				1								1
Tachyglossus aculeatus acanthion		5					1					6
Zyzomys argurus		7		2								9
Total	**6**	**28**	**26**	**12**	**11**	**19**	**13**	**10**	**1**	**1**	**15**	**142**

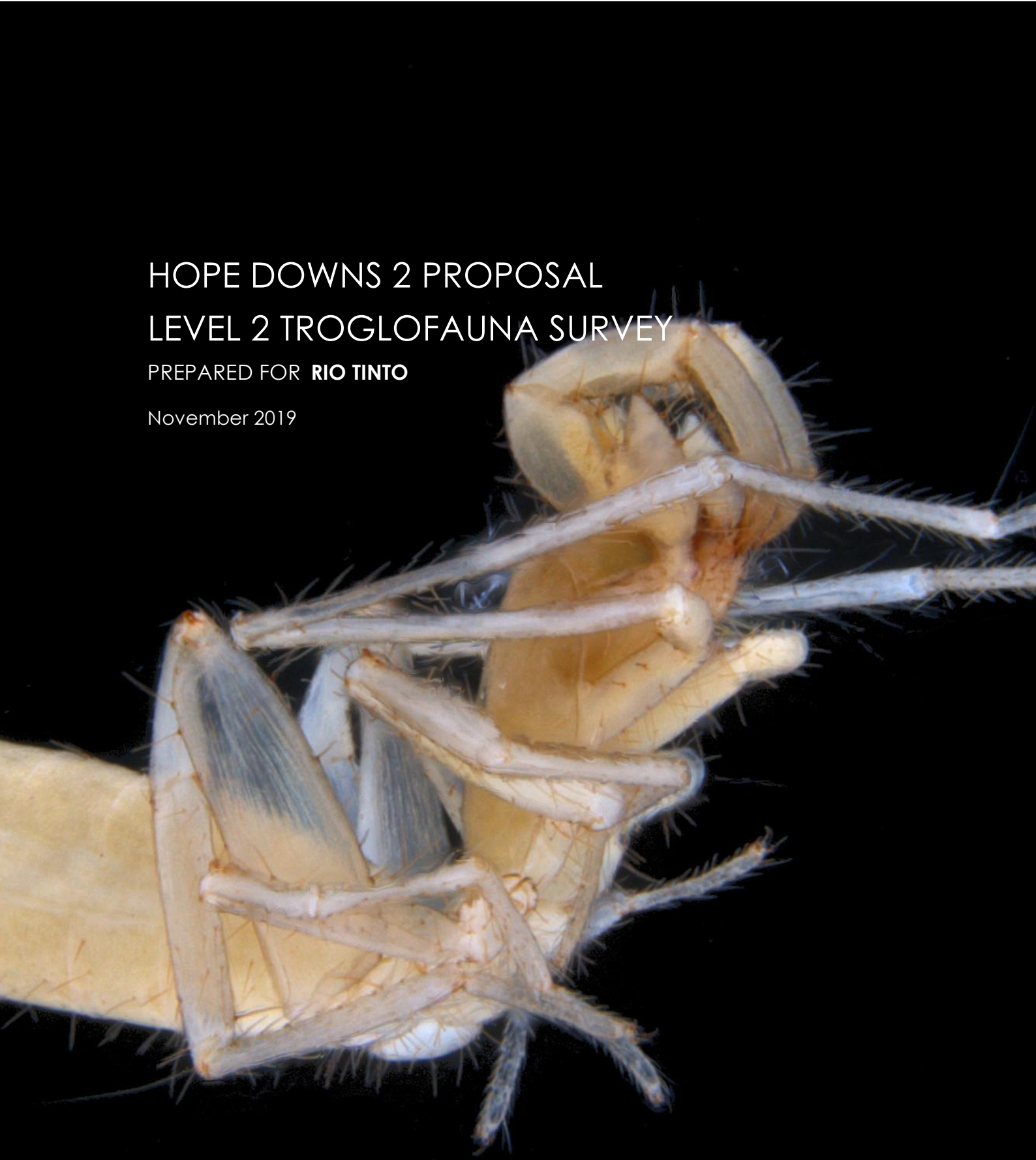
APPENDIX D SUBTERRANEAN FAUNA

D.1: Hope Downs 2 Proposal Level 2 Troglofauna Survey

HOPE DOWNS 2 PROPOSAL
LEVEL 2 TROGLOFAUNA SURVEY

PREPARED FOR **RIO TINTO**

November 2019



Draculoides SCH068

Stantec

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5	13/12/2019	Final	NS			NS

Executive Summary

Rio Tinto is evaluating the potential development of additional iron ore deposits at Hope Downs 2 (HD2), approximately 80 km northwest of Newman, in the Pilbara region of Western Australia. The HD2 Proposal includes two above water table (AWT) deposits: Bedded Hilltop (BHT) and HD2, including supporting infrastructure with transport of ore to existing processing plant at Hope Downs 1 (HD1).

Stantec was commissioned to undertake a level 2 troglofauna survey (the Study) for the HD2 Proposal which includes a 10,818 hectare (Ha) Development Envelope. This report presents the findings of the Study for the HD2 Proposal.

The main objective of the Study was to define the troglofauna values present for each of the deposits in order to enhance and contextualise the level of knowledge at the locality scale. The findings of the Study will inform an environmental impact assessment (EIA) as part of the regulatory approvals process for the HD2 Proposal.

Troglofauna sample effort:

- **BHT**: A total of 134 litter trap samples and 65 scrape samples were collected from 71 sites (**Table ES-1**).
  - 2015 — 38 trap samples and three scrape samples from 13 sites were collected by Biota in the early dry season from April 8 to May 21, 2015.
  - 2018 — 41 trap samples and 38 scrape samples from 38 sites were collected in the late dry season from October 26, 2018 to January 16, 2019.
  - 2019 — 55 trap samples and 37 scrape samples from 49 sites were collected in the late wet season from March 28 to May 30, 2019.
- **HD2**: A total of 75 litter trap samples and 50 scrape samples were collected from 38 sites (**Table ES-1**).
  - 2018 — 38 trap samples and 25 scrape samples from 38 sites were collected in the late dry season from October 26, 2018 to January 16, 2019.
  - 2019 — 37 trap samples and 25 scrape samples from 36 sites were collected in the late wet season from March 28 to May 30, 2019.

Table ES-1: Troglofauna sample effort.

Deposit	Litter Traps (n)	Net Scrapes (n)	TOTAL	Sites (n)
Bedded Hilltop	134	65	199	71
Hope Downs 2	75	50	125	38

Troglofauna Results

A total of 109 troglofauna specimens, representing at least 15 species from 8 higher level taxonomic groups were recorded from the 2018 and 2019 surveys for the HD2 Proposal. The summary of results are:

- Eleven species were collected from BHT;
- Eight species from HD2;
- Four species shared between the BHT and HD2 deposits; and
- Three species, *Dodecastyla* `sp. Biologic-ZYGE001`, Lophoproctidae `sp. Biologic-POLX001`, and *Nisia* `sp. Biologic-HEMI001` belonged to relatively widespread troglophillic species, with linear distributions extending for over 140 km, 300 km, and 175 km, respectively.

An additional species, *Lagynochthonius* `sp. WAMPSE096`, had been collected from BHT in 2015, bringing the total number of identified species from BHT to 12.

The nocticolid cockroaches were the most abundant group, with genetic analysis revealing four *Nocticola* species to occur. *Nocticola* `SP. BIOLOGIC-BLAT003` was the most abundant and widespread species, with 47 specimens collected from BHT and HD2 within mapped Brockman BIF, colluvial, and Mount McRae Shale surface geologies from modelled prospective habitat profiles ranging from deep, particularly at HD2, to more commonly relatively shallow.

The troglobitic schizomid, *Draculoides* SCH068, was also relatively abundant with eight specimens collected from the BHT deposit area. *Draculoides* SCH068 was also collected in 2015 from Baby Hope deposit and BHT. The species has been recorded from both mapped Brockman and Marra Mamba BIF, as well as Mount McRae Shale mapped surface geologies, from modelled prospective habitat profiles ranging from shallow to deep.

Species Richness Estimates and Survey Adequacy

The species richness predicted to occur across the Development Envelope ranged from 18 to 24 species. Sampling completed in this Study is estimated to have recorded between 63% to 85% of the total species predicted to occur in the Development Envelope. The species accumulation curves for five of the richness estimators were still trending upwards to varying degrees, with two estimators trending strongly downwards. The extrapolation to a 100 % increase in survey effort (from 282 to 564 samples) estimates an additional four troglofauna species to be recorded.

The sampling effort conducted to date within the Development Envelope (BHT — 199 (including Biota 2015 sample effort of 41 samples); HD2 — 125), has exceeded the recommended minimum requirements for a Level 2 troglofauna survey. The total number of troglofauna samples collected is therefore considered sufficient to provide a reliable characterisation of the troglofauna values present within the Development Envelope and to properly inform an environmental impact assessment (EIA).

Conclusion

The Study has shown that the BHT and HD2 deposits do host a relatively diverse troglofauna assemblage with prospective modelled habitat present within the mineralised Brockman and Marra Mamba BIF, as well as within the associated alluvial, colluvial and fractured, weathered rock units.

Rio Tinto

Level 2 Troglofauna Survey

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Appendix C	Western Australian Museum Database Seach Results
Appendix D	Pre-2018 Troglofauna Survey Results
Appendix E	2018 and 2019 Troglofauna Survey Results

1. Introduction

Rio Tinto is evaluating the potential development of additional iron ore deposits at Hope Downs 2 (HD2), approximately 80 km northwest of Newman, in the Pilbara region of Western Australia (**Figure 1-1**). The HD2 Proposal includes two above water table (AWT) deposits: Bedded Hilltop (BHT) and HD2, including supporting infrastructure with transport of ore to existing processing plant at Hope Downs 1 (HD1).

Stantec was commissioned to undertake a level 2 troglofauna survey (the Study) for the HD2 Proposal which includes a 10,818 hectare (Ha) Development Envelope. This report presents the findings of the Study for the HD2 Proposal.

The main objective of the Study was to define the troglofauna values present for each of the deposits in order to enhance and contextualise the level of knowledge at the locality scale. The findings of the Study will inform an environmental impact assessment (EIA) as part of the regulatory approvals process for the HD2 Proposal.

1.1 Scope and Objectives

The main objective of this Study was to define the troglofauna values present within the Development Envelope by means of a desktop study and Level 2 comprehensive surveys (dry and wet seasons) to enhance and contextualise the level of knowledge at the local scale. The findings of the study will inform environmental impact assessment (EIA) as part of the regulatory approvals process for the HD2 Proposal.

To achieve the above the following were completed:

- Desktop assessment including database searches, literature review including reports of previous completed surveys, habitat evaluation and characterisation at the local and regional scale from geological and hydrogeological data, and assessment of the likelihood of the occurrence of identified conservation listed species and/or communities in the Development Envelope.
- Two field survey phases for troglofauna; and
- Documentation and mapping of the diversity and distribution of troglofauna species recorded from current and past surveys;

The objectives and survey methods were aligned with relevant regulatory guidelines. These included:

- Environmental Protection Authority (EPA) (2016a) Technical Guidance Sampling Methods for Subterranean Fauna Survey (equivalent to EPA 2007 Guidance Statement No. 54A Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia); and
- EPA (2016b) Technical Guidance Subterranean Fauna Survey (equivalent to EPA 2013 EAG 12 Environmental Assessment Guideline for Consideration of subterranean fauna in environmental impact assessment in Western Australia).

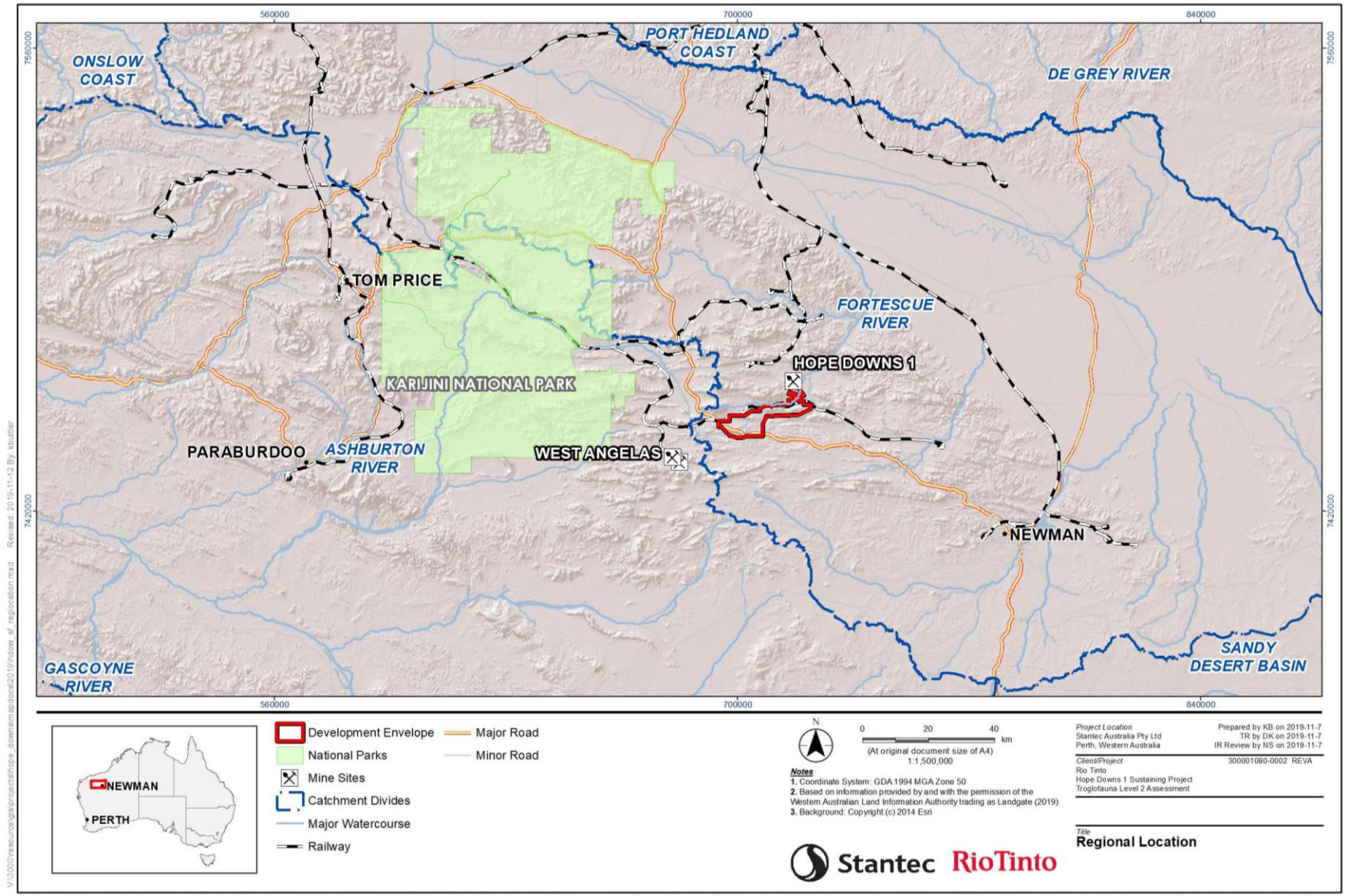

Figure 1-1: Regional location of the Hope Downs 2 Proposal

2. Existing Environment

2.1 Biogeographic Region

The HD2 Proposal is in the Hamersley subregion (PIL03) within the southern section of the Pilbara bioregion (**Figure 2-1**). The Hamersley subregion is 5,634,727 ha in size and classified as a Desert and Xeric Shrubland ecoregion, characterised as a mountainous area of Proterozoic sedimentary ranges and plateaux that are extensively dissected by gorges. The vegetation mainly consists of low mulga woodland over grasses on fine textured soils in valley floors, with *Eucalyptus leucophloia* over *Triodia brizoides* on skeletal soils of the ranges (Department of the Environment and Energy 2019; Kendrick 2001).

The Hamersley subregion hosts the headwaters of three of the main drainage systems in the Pilbara: the northern portion drains into the Fortescue catchment; the southern portion drains into the Ashburton catchment; and the western portion drains into the Robe catchment (Kendrick 2001)(**Figure 1-1**).

The subterranean fauna values for the subregion are known to be high with calcrete aquifer systems and banded iron formations (BIF) hosting diverse stygofauna and troglofauna assemblages (Halse *et al.* 2014; Kendrick 2001). Diverse subterranean fauna assemblages are known to inhabit many groundwater calcrete systems across the Pilbara and Murchison regions (Cooper et al. 2002, Humphreys 2008, Outback Ecology 2008, 2011b, 2012b, c, d, Subterranean Ecology 2011a).

2.2 Land Use

The tenure of the Pilbara bioregion is mostly comprised of Aboriginal land, pastoral and industry leasehold, with conservation reserves and areas managed by the Crown. The majority of the Pilbara falls under pastoral leasehold, with eight per cent of lands allocated to the conservation estate, including both the Karijini and Millstream Chichester National Parks (Pilbara Corridors 2019). Land within the Hamersley subregion is mainly used for native pasture grazing, with smaller areas classified as unallocated Crown land (UCL), Crown and Aboriginal reserves, as well as mining and small urban centres (Kendrick 2001). In the region neighbouring the HD2 Proposal previous mining exploration activities, and active mining, associated with Hope Downs 1 mine have occurred.

2.3 Climate

The climate of the Hamersley subregion is classed as semi-desert tropical, receiving the majority of the average 300mm rainfall during the wet season from cyclonic or tropical low thunderstorm events (Kendrick 2001). Winter rainfall (early to mid-dry season) also occurs but to a lesser extent (**Figure 2-2**). The nearest Bureau of Meteorology (BOM) weather stations to the HD2 Proposal, with reliable long-term and recent climatic data, are Marillana (station number 5009) and Newman Aero (station number 7176). Marillana station, located approximately 55 km northeast of the HD2 Proposal, provided long term rainfall trends. Newman Aero station, located approximately 85 km south-east of the HD2 Proposal provided long term temperature trends.

The mean long-term annual rainfall (1936 to 2019) recorded at Marillana is 328 mm with the majority falling during the warmer months from January to March (Bureau of Meteorology 2019) (**Figure 2-2**). The annual rainfall in 2018 was below average with 281 mm received. However, February and June received above-average rainfall with more than four times the monthly average falling in June with 83 mm compared to the average of 20 mm. Much drier than average conditions prevailed from July. The annual rainfall in 2019 was well below average with only 150 mm received.

The minimum and maximum temperatures recorded in both 2018 and 2019 were largely consistent with the mean temperatures recorded since 1997 at Newman Aero station, although the maximum and minimum temperatures were higher over the March to early May periods (Bureau of Meteorology 2019).

Dry conditions persisted throughout the 2018 phase of subterranean fauna sampling that began in November 2018 during the late dry season, and finished in mid-January 2019 in the early dry season (**Figure 2-3**). The 2019 sample phase extended from the late wet season, to the early dry season.

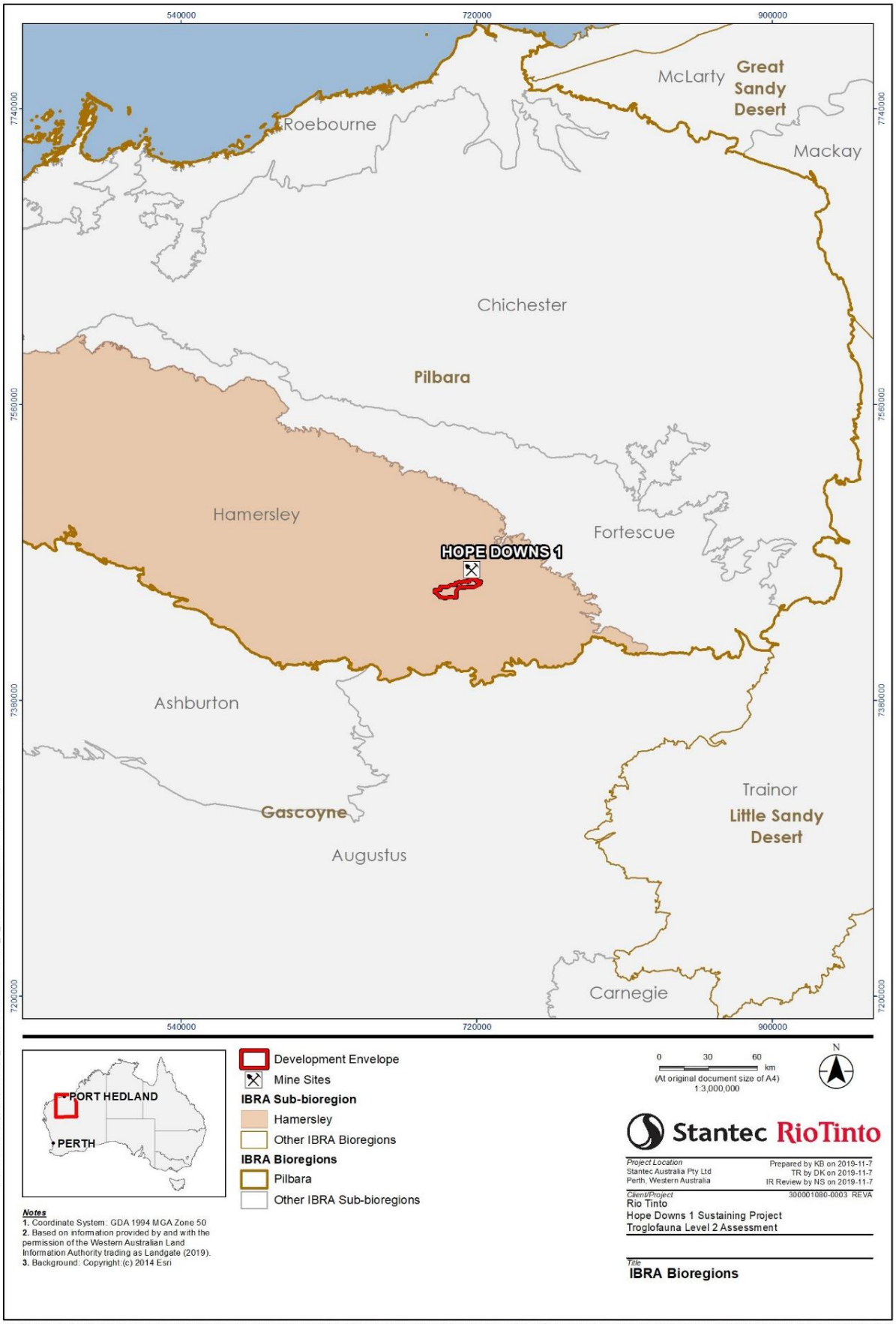

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Figure 2-1: IBRA Bioregions

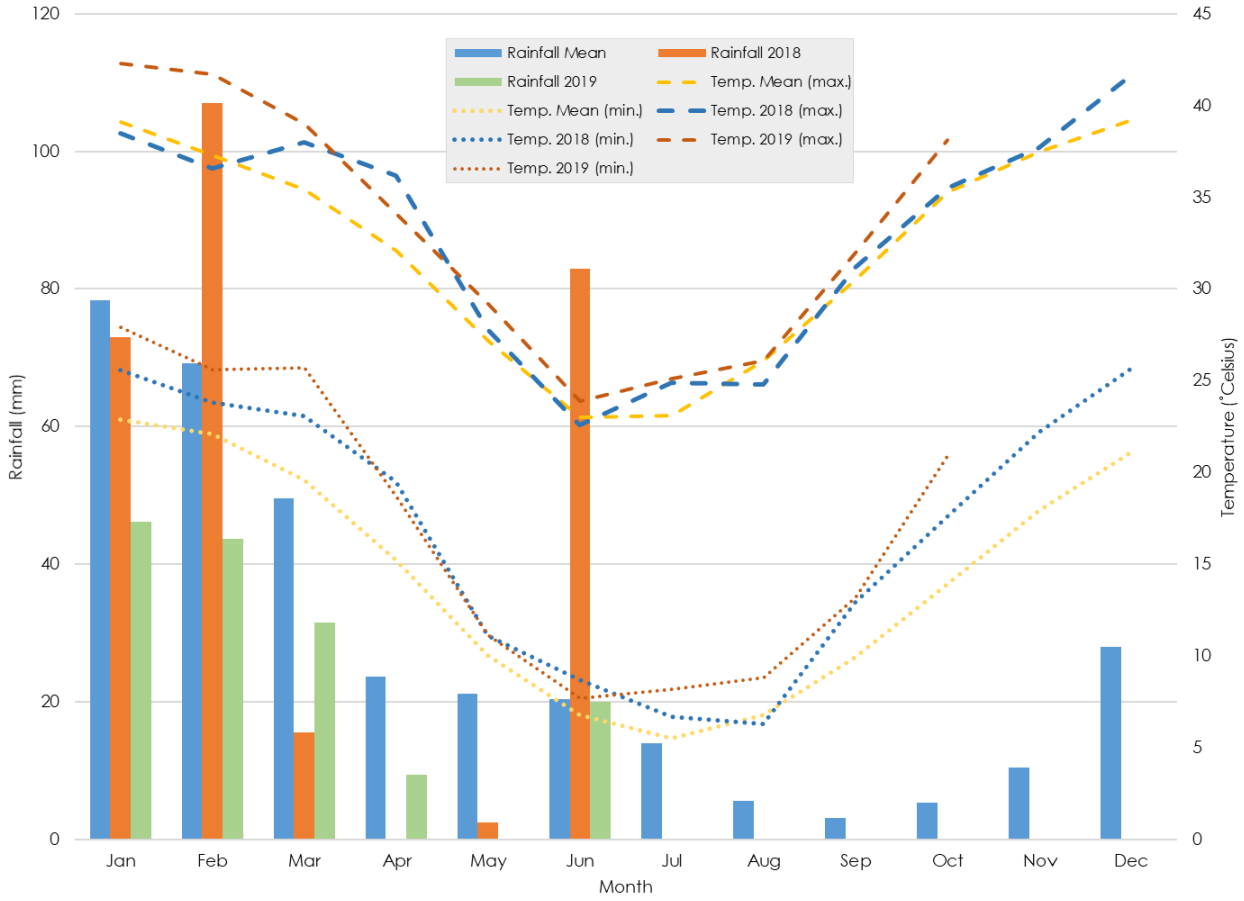

Figure 2-2: Long-term average monthly rainfall for Marillana Weather Station (5009; 1937 to 2019), and long-term average monthly minimum and maximum temperatures for Newman Weather Station (007176; 1972 to 2019) versus 2018 and 2019 data (Bureau of Meteorology accessed October 2019).

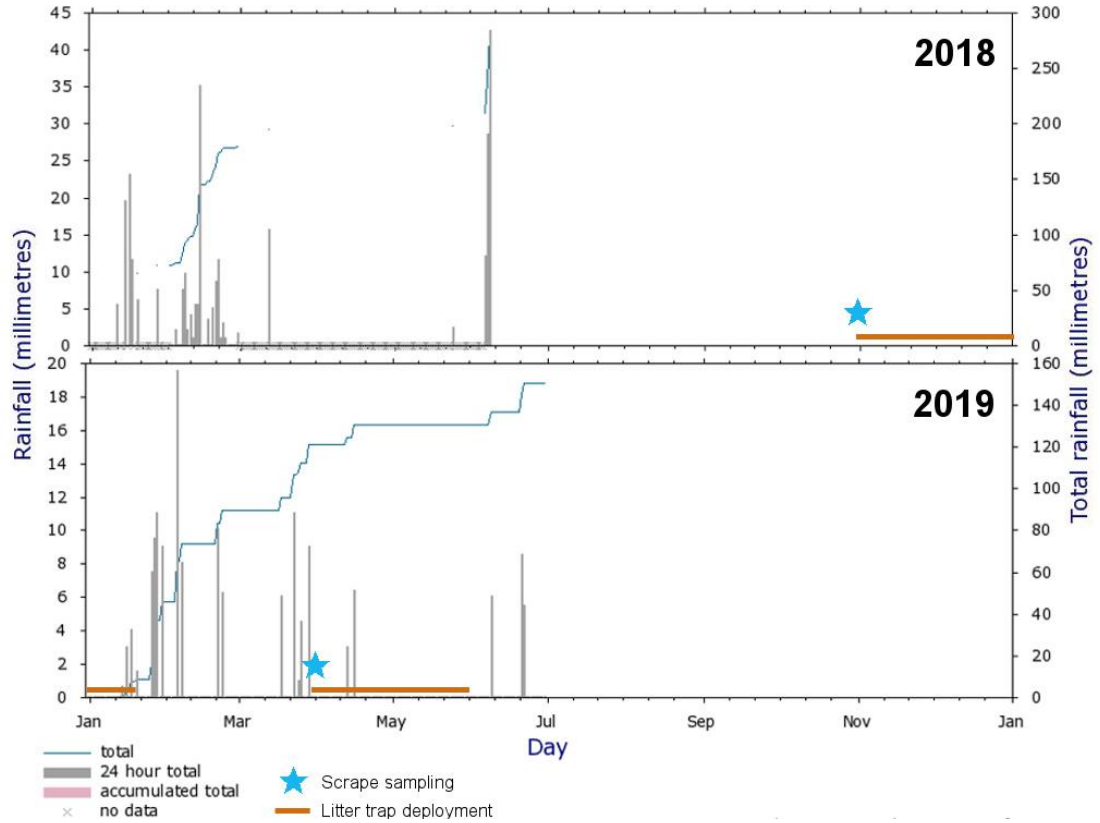

Figure 2-3: Daily rainfall data recorded for Marillana Weather Station (5009) in 2018 and 2019 (Bureau of Meteorology accessed October 2019).

3. Subterranean Fauna

3.1 Habitat

The prospective habitat for subterranean fauna (stygofauna and troglofauna) is dependent on the presence of voids of suitable size and connectivity to satisfy biological requirements. Subterranean fauna were previously believed to be mostly restricted to karst landscapes that provide a relatively high degree of secondary porosity, but in more recent times have been found to occur in various types of non-karstic geologies and aquifer systems that exhibit suitable voids for colonisation (Humphreys 2008). Stygofauna are now known to occur in non-karstic aquifers in coarse alluvial sediments, fractured rock, pisolites and thin rocky regoliths (Halse *et al.* 2014; Humphreys 2006;2008; MWH 2016b; Outback Ecology 2014). Likewise, recent surveys have identified troglofauna from non-karstic geologies such as vuggy pisolite ore beds, and fractured and weathered rock formations in the Pilbara and Yilgarn regions (Barranco and Harvey 2008; Bennelongia 2009; Halse *et al.* 2002; MWH 2015; Outback Ecology 2011b; Subterranean Ecology 2008d).

The extent of subterranean fauna habitat is dependent on the interconnection of sub-surface crevices, fractures and voids, within suitable geological and hydrogeological units and aquifer systems. In addition to allowing for the movement of subterranean fauna, adequate interconnected void spaces and associated high permeability can provide pathways for infiltration (vertical or lateral) of resources such as oxygen and nutrients, key factors influencing subterranean fauna persistence and distribution (Humphreys 2008; Strayer 1994). Geological, hydrological, and hydrogeological studies can give an indication of the extent of subterranean fauna habitat present by providing information on the geological units and structures present, as well as recharge zones, groundwater flow and aquifer characteristics.

3.2 Troglofauna

Troglofauna (air-breathing subterranean fauna) are often relictual forms related to surface dwelling (epigean) groups and can be distinguished by characteristics associated with a below-ground existence (Humphreys 2000b). Troglofauna can be divided into:

- troglophiles, which carry out most of their lifecycle underground but are able to survive in epigean habitats;
- trogloxenes, which can enter subsurface habitats passively or incidentally; and
- troglobites (the focus of this assessment), which are obligate or permanent subterranean inhabitants (Thurgate *et al.* 2001) that generally lack pigmentation, are blind (or have reduced eyes), have elongated limbs and may possess enhanced non-visual sensory adaptations (Culver and Sket 2000).

Troglofauna are found worldwide and historically had been generally classified as cave organisms (Culver and Sket 2000). However, the discovery of diverse troglofauna communities inhabiting sub-surface rock fractures in non-karst areas in Europe in the 1980s prompted broader consideration of potential habitat (Juberthie 2000). The most common environments in which troglofauna occur are those that support suitably sized and extensively connected crevices, small cavities or vugs associated with secondary porosity from erosion, fractures and shears zones, that remain relatively humid, an important condition considered to be a key requirement for troglofauna existence (Environmental Protection Authority 2016b). Troglobites are restricted to their subterranean environment and often have locally-restricted distributions. As a consequence, most species are considered to be short range endemics (SRE's) that are more vulnerable to extinction because of their limited distribution range (Harvey *et al.* 2011; Harvey 2002). An SRE categorisation system was developed by the Western Australian Museum (WAM) and is used for the assignment of SRE status for terrestrial and subterranean fauna in Western Australia (**Table 3-1**).

The most researched areas for troglofauna in Western Australia are the Cape Range and Barrow Island karst cave systems where large, diverse communities have been discovered(Hamilton-Smith and Eberhard 2000; Humphreys 1991;2000a). Diverse troglofauna assemblages have also been commonly collected from groundwater associated calcrete (i.e. non-pedogenic calcrete) and alluvial/colluvial geologies within palaeodrainage channels of the arid and semi-arid zones, particularly in the Pilbara and Yilgarn regions (Harrison *et al.* 2014; MWH 2015; Outback Ecology 2011b;2012a;b; Platnick 2008), but less so in the more arid interior of Australia (Outback Ecology 2011c). Less diverse troglofauna assemblages have also been recorded from weathered fractured rock (Outback Ecology 2011a;2014) and metamorphic mafic rock systems (Bennelongia 2009). Continued studies are likely to increase the understanding of prospective troglofauna habitat in Western Australia. It is only recently that troglofauna have become a focus of

environmental assessment in Western Australia, and there is still relatively little information on their distribution compared to stygofauna (Eberhard *et al.* 2007; Environmental Protection Authority 2016a).

Table 3-1: SRE categorisation used by Western Australian Museum (WAM)

<table>
<tr><th>Distribution Range</th><th>Taxonomic certainty</th><th>Taxonomic uncertainty</th></tr>
<tr><td>< 10,000 km²</td><td>Confirmed SRE
A known distribution of <10,000 km2;
Taxonomy well known; and
Group is well represented in collections and/or via comprehensive sampling.</td><td rowspan="2">Potential SRE
Patchy sampling resulting in incomplete knowledge of geographic distribution;
Incomplete taxonomic knowledge;
Group not well represented in collections; and
Category applies where there are significant knowledge gaps</td></tr>
<tr><td>> 10,000 km²</td><td>Widespread (not an SRE)
A known distribution of >10,000km2.
The taxonomy is well known.
The group is well represented in collections and/ or via comprehensive sampling.</td></tr>
<tr><td colspan="3">Sub-categories for Potential SRE:</td></tr>
<tr><td>A) Data Deficient</td><td colspan="2">There is insufficient data available to determine SRE status.
Factors that fall under this category include:
New species.
Lack of geographic information.
Lack of taxonomic information.
The group may be poorly represented in collections.
The individuals sampled (e.g. juveniles) may prevent identification to species level.</td></tr>
<tr><td>B) Habitat indicators</td><td colspan="2">It is becoming increasingly clear that habitat data can elucidate SRE status.
Where habitat is known to be associated with SRE taxa and vice versa, it will be noted here.</td></tr>
<tr><td>C) Morphology indicators</td><td colspan="2">A suite of morphological characters that are characteristic of SRE taxa.
Where morphological characters are known to be associated with SRE taxa and vice-versa, it will be noted here.</td></tr>
<tr><td>D) Molecular evidence</td><td colspan="2">If molecular work has been done on this taxon (or a close relative), it may reveal patterns congruent or incongruent with SRE status.</td></tr>
<tr><td>E) Research and expertise</td><td colspan="2">Previous research and/ or WAM expertise elucidates taxon SRE status.
This category considers the expert knowledge held within the WAM.</td></tr>
</table>

3.3 Risks and Relevant Legislation

Development and operation of mines in Western Australia pose a number of risks to subterranean fauna and their habitat, including:

- direct removal of, or disturbance to, habitats through mining excavation;
- lowering the groundwater table through groundwater abstraction for pit dewatering and supply; and
- altering water quality parameters, to levels which may exceed species tolerance limits.

Subterranean fauna are protected under State and Federal legislation, governed by three Acts:

- *Biodiversity Conservation Act 2016* (WA) (BC Act);
- *Environmental Protection Act 1986* (WA) (EP Act); and
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act).

With this legislation in mind, the EPA developed the technical Guidance (EPA 2016a, b) guidance documents. which outline considerations and sampling methods for subterranean fauna in Western Australia. These documents provide advice to proponents and the public on the requirements for environmental impact assessment (EIA) and management of subterranean fauna. The assessment reported here was designed in accordance with both the EPA (2016a, b) guidance documents.

Mining proposals that will potentially impact on groundwater, or hypogean habitats that support subterranean fauna, require a risk assessment to ensure mining operations do not threaten the viability of important species or communities. Proponents must demonstrate that any species existing within potential mine-related impact zones also occur outside this area. For taxa restricted to impact zones, a suitable management plan must be developed, which includes ongoing monitoring of subterranean fauna to ensure the persistence of the species.

3.4 Regulatory Survey Adequacy Guidelines

The EPA (2016a) stipulates that the appropriate level of survey depends on the likely presence of subterranean fauna, the degree of impact proposed, and adequacy to reliably inform decisions as part of the EIA process as to whether a proposal meets the EPA's objective and is tailored to the circumstances of the proposal.

For Level 1 low intensity (pilot) surveys the recommended survey intensity considered to provide a reliable indication of the habitat present hosting subterranean fauna is:

- Troglofauna — 10 to 15 samples; and
- Stygofauna — 6 to 10 samples.

If the findings from a desktop assessment and pilot survey indicate that an area is not prospective for subterranean fauna then no further survey would be required. If a pilot survey does collect stygofauna and / or troglofauna species, thereby demonstrating that subterranean fauna are a potential environmental factor, then a Level 2 (baseline or comprehensive) survey would be required.

For Level 2 (baseline) troglofauna surveys in areas that are likely to host 'significant troglofaunal values', a minimum of 60 litter trap samples deployed over two rounds for a minimum of six weeks each are recommended (EPA 2016b). The definition of 'significant values' is not specified or quantified but has been interpreted to relate to the presence of a relatively diverse troglofauna assemblage in or associated with the proposed development area.

4. Methods

4.1 Database Searches and Lists

Searches of both Commonwealth and WA State databases were undertaken as part of the desktop review to reveal if any troglofauna taxa had been previously recorded from within or near the Development Envelope, and to identify if any threatened or priority ecological communities (TEC's and PEC's) were in the vicinity. Search areas were either from a central point in the Development Envelope or a designated rectangular search area (**Figure 4-1**, **Table 4-1**). Database and internet information sources included:

- Department of Biodiversity, Conservation and Attractions (DBCA) TEC/PEC database was searched for TEC's and PEC's occurring within a 50 km radius of the Development Envelope;
- Western Australian Museum's (WAM) arachnid, crustacean, myriapod and oligochaete collection databases were searched for subterranean fauna;
- Atlas of Living Australia (ALA); and
- Nature Map of Western Australia.

The following Federal and State government lists were also checked against the database results, to identify any threatened or priority subterranean fauna that may occur within the search area:

- BC Act Specially Protected Species List;
- EPBC Act TEC List; and
- EPBC Act Threatened Fauna List.

Table 4-1: Defined search parameters of database and internet sources

Data Source	Search Area	Co-ordinates
DBCA TEC/PEC	50 km radius	Central point @ 23.060597 S, 119.038855°E
Nature Map		
Literature Review		
WAM Collections	80 km square	NW corner @ 22.694628°S, 118.630309 E SE corner @ 23.422667 S, 119.422871 E
ALA		

4.2 Literature Review

A literature review was conducted to gather existing information on troglofauna from within the vicinity of the Development Envelope. The review included technical reports, scientific journal articles and government publications. The areas of focus for the literature review were drainage and palaeochannel systems associated with and/or near to the HD2 Proposal, as well as BIF ridge systems within approximately 40 km of the Development Envelope.

4.3 Field Personnel and Licences

The field survey methods and sampling effort completed followed both the EPA (2016a, b) technical documents. A Regulation 17 licence to collect fauna for scientific purposes was obtained from the DBCA prior to survey (Licence Number: 08-003053-1). Personnel involved in the field sampling were Dr Nicholas Stevens and Emma Dobinson.

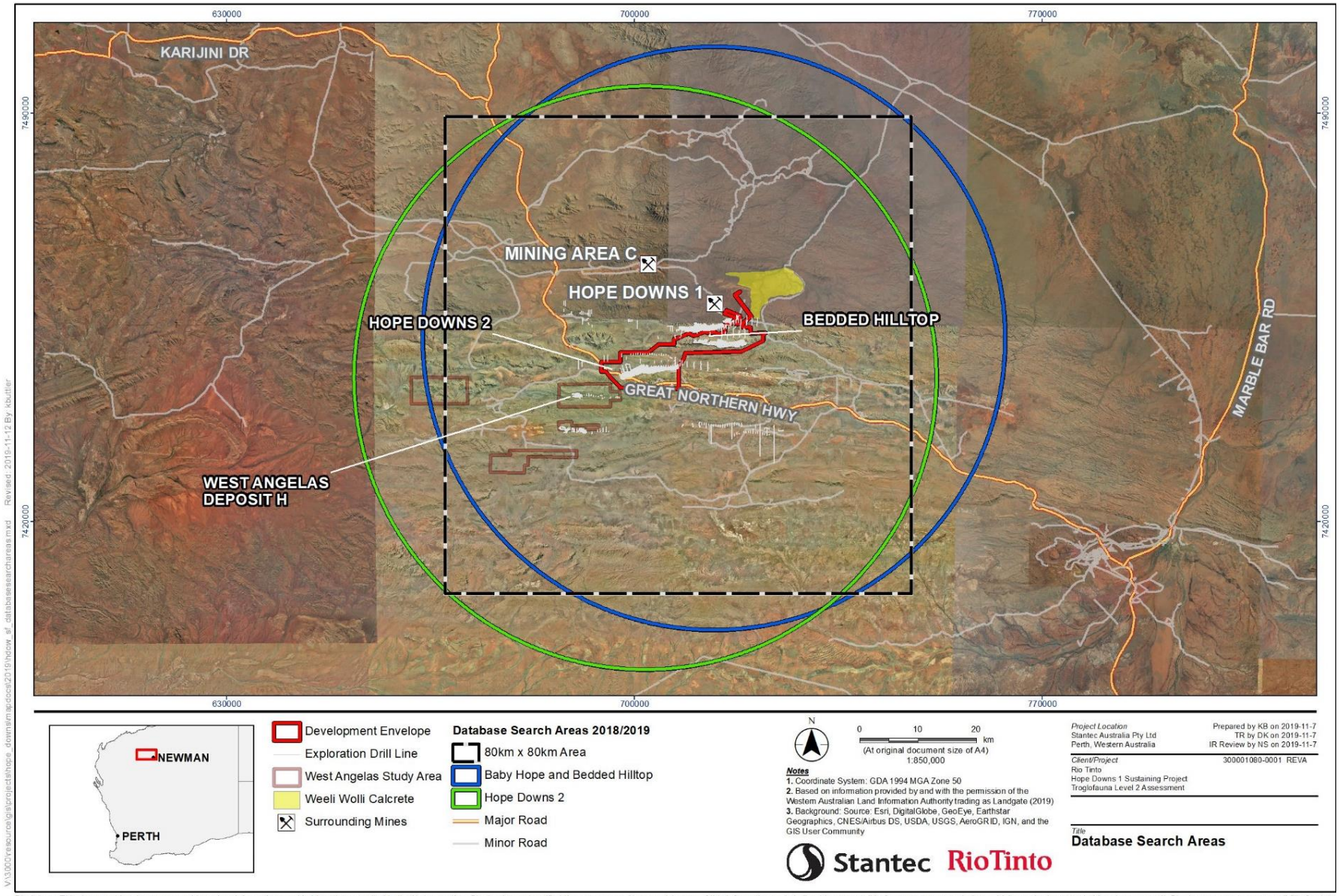

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Figure 4-1: HD2 Proposal database search areas

4.4 Troglofauna Survey

Troglofauna samples were taken from exploration drill holes, referred to hence forth as sites, using litter traps and net haul scrapes. The details of sites sampled are presented in **Appendix A.**

4.4.1 Litter Traps

Troglofauna were sampled using litter traps as follows:

- litter traps were packed with sterilised organic material and sealed to maintain moist, sterile conditions prior to field deployment;
- traps were then moistened with water prior to deployment in sites;
- once installed in the sites, traps were left in place for eight weeks to allow adequate time for colonisation by troglofauna; and
- on retrieval, traps were sealed in zip lock bags, labelled, and couriered to the Stantec laboratory in Perth for sorting and identification.

In the laboratory, troglofauna specimens were extracted from the litter using Tullgren funnels. Litter was placed into funnels, and light and low heat was applied from overhead lamps to create a temperature gradient of approximately 14°C in the litter. This method was applied to encourage any troglofauna, which are light sensitive and prefer humid conditions, to migrate down through the litter as it dried. Troglofauna specimens then fell through a mesh layer into collection vials at the base of the funnels, containing 100% ethanol. After collection of troglofauna in the vials, the litter was removed from the funnels and manually searched under magnification for any troglofauna specimens that may remain (**Figure 4-2**).



Figure 4-2: Troglofauna collection and extraction methods: A) Litter trap; B) Tullgren funnels.

4.4.2 Net Haul Scraping

Net haul scraping has been found to be an efficient method for sampling for troglofauna that compliments troglofauna trapping (Halse and Pearson 2014; Outback Ecology 2011b; Subterranean Ecology 2008c). Net haul scraping involves the following:

- Lowering a stygofauna haul net to the bottom of a dry site or at least 1 m below the standing water level if groundwater is present.
- Scraping the net up along the uncased wall surface of the site on retrieval, with the aim of dislodging and collecting any invertebrates that may be present.
- This process is repeated four times per site, with each scrape sampling a different side of the wall surface of the site.

Scraping for troglofauna can also be conducted simultaneously when sampling uncased bores with water present for stygofauna so that the stygofauna sample also counts as a troglofauna scrape sample. The only difference is the sample effort is greater with six net hauls taken per sample rather than four. Stygofauna sampling of fully-cased bores is not regarded as net haul scrape samples, regardless of whether potential troglofauna taxa may have been collected.

All haul samples were preserved in 100% ethanol prior to shipment back to the Stantec laboratory in Perth for processing. To enhance preservation of specimens and their DNA, samples were kept cool onsite in eskies with ice bricks then refrigerated at the end of each survey day. All samples were then shipped back to Perth in eskies with ice bricks then placed in freezers (at minus 20 Celsius) to preserve DNA.

4.4.3 Troglofauna Survey Effort

4.4.3.1 Bedded Hilltop

The total sample effort that has been completed for BHT includes 134 litter trap samples and 65 scrape samples from 71 sites (**Table 4-2**). In the 2018 and 2019 survey phases completed by Stantec, a total of 96 litter trap samples and 75 scrape samples were collected from 58 sites (**Figure 4-3, Figure 4-4, Figure 4-5, Appendix A**).

- The 2018 survey phase included 41 trap samples and 38 scrape samples from 38 sites collected in the late dry season from October 26, 2018 to January 16, 2019.
- The 2019 survey phase included 55 trap samples and 37 scrape samples from 49 sites collected in the late wet season from March 28 to May 30, 2019.

An earlier survey phase of BHT was completed in 2015 (Biota 2015b). The 2015 survey phase included 38 trap samples and three scrape samples from 13 sites collected in the early dry season from April 8 to May 21, 2015 (Biota 2015b).

4.4.3.2 Hope Downs 2

A total of 75 litter trap samples and 50 scrape samples were collected from 38 sites over the 2018 and 2019 survey phases (**Figure 4-3**, **Figure 4-4**, **Figure 4-5, Table 4-2**, **Appendix A**).

- The 2018 survey phase included 38 trap samples and 25 scrape samples from 38 sites collected in the late dry season from October 26, 2018 to January 16, 2019.
- The 2019 survey phase included 37 trap samples and 25 scrape samples from 36 sites collected in the late wet season from March 28 to May 30, 2019.

Table 4-2: Troglofauna sample effort, including Biota (2015b)

Deposit	Litter Traps (n)	Net Scrapes (n)	TOTAL	Sites (n)
Bedded Hilltop	134	65	199	71
Hope Downs 2	75	50	125	38

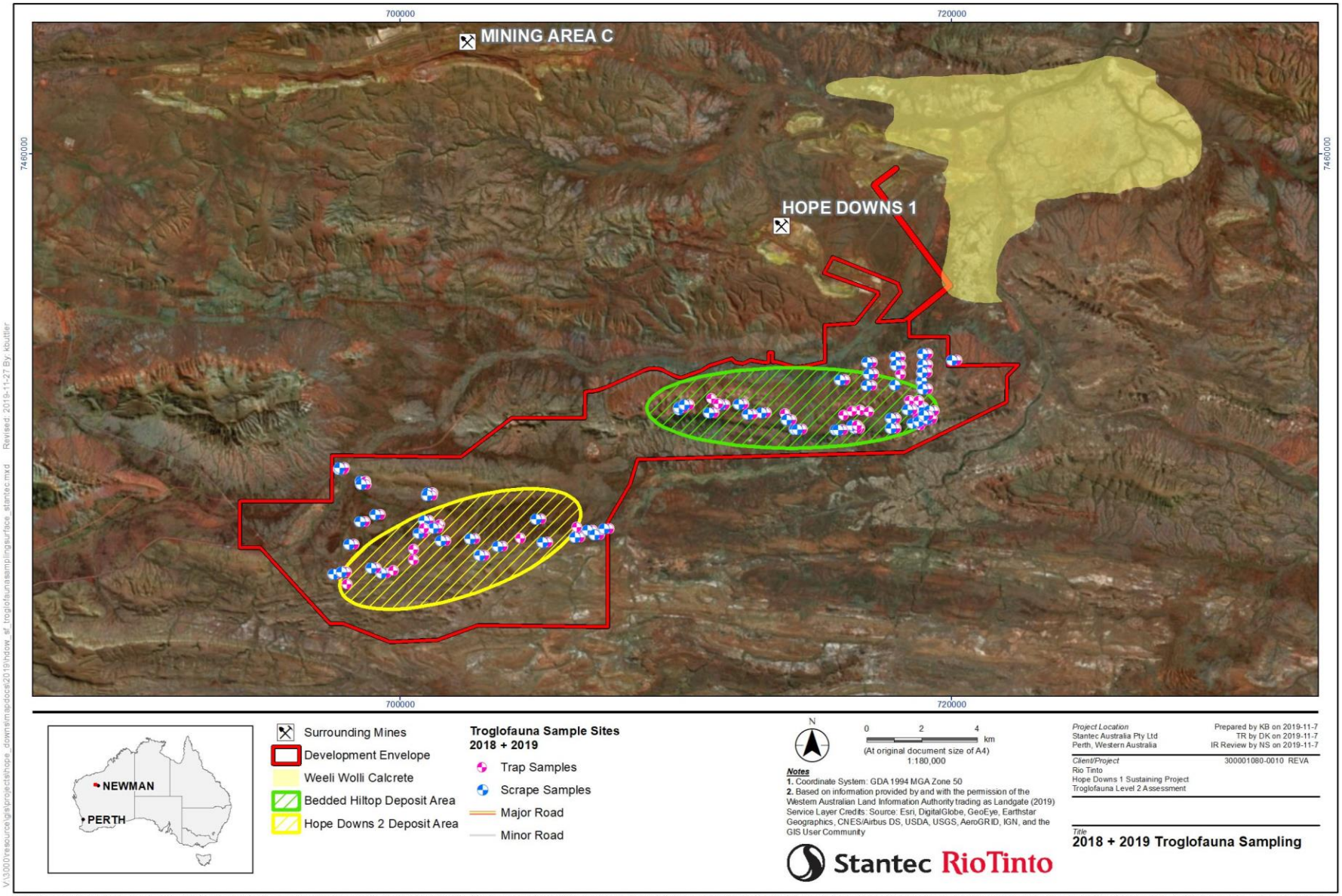

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Figure 4-3: Troglofauna sampling in 2018 and 2019

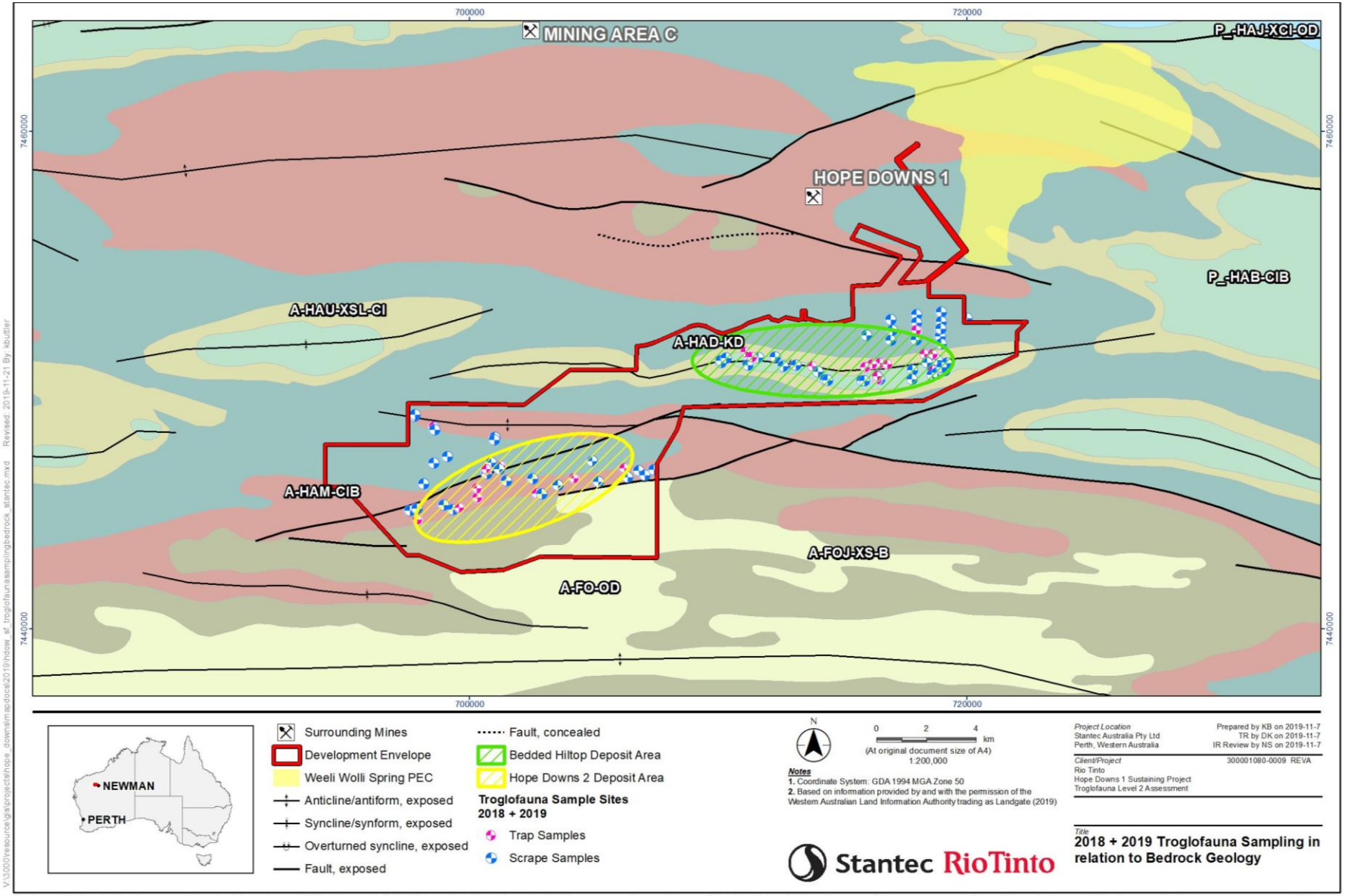

Figure 4-4: Troglofauna sampling in 2018 and 2019 in relation to bedrock geology (refer **Table 4-3** for descriptions of relevant geological codes)

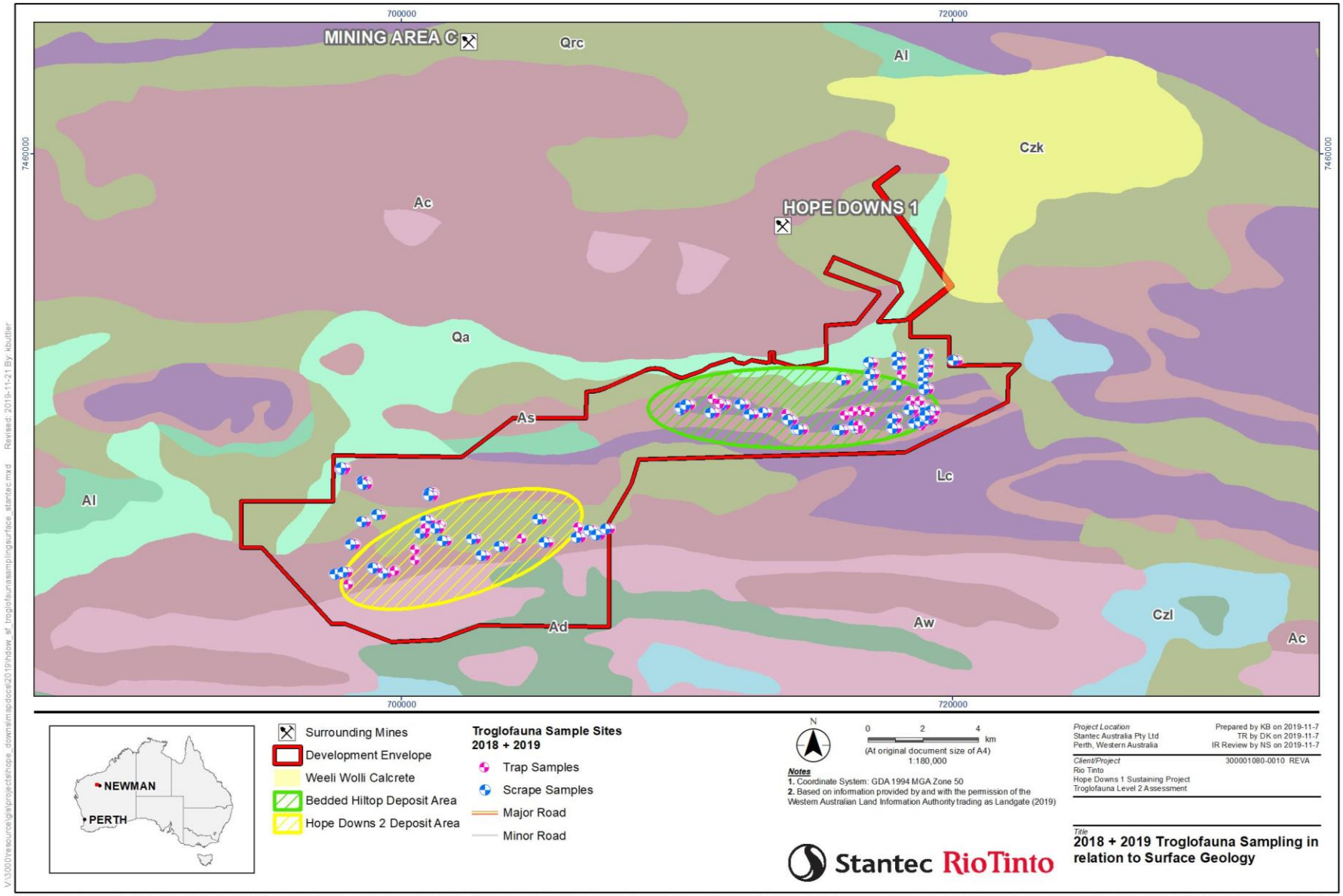

Figure 4-5: Troglofauna sampling in 2018 and 2019 in relation to surface geology (refer **Table 4-3** for descriptions of relevant geological codes)

Table 4-3: Description of bedrock and surface geological codes relevant to the HD2 Proposal

Geology	Code	Bedrock Unit Name	Description
Bedrock	A-FOj-xs-b	Jeerinah Formation	Siliciclastic sedimentary rocks, mafic volcanic rocks and minor felsic volcanic rocks; local carbonate rocks, chert, and dolerite sills
	A-FO-od	Fortescue Group	Dolerite dyke or sill
	A-HAd-kd	Wittenoom Formation	Thinly bedded dolomite and dolomitic shale, with minor black chert, shale, banded iron formation and sandstone
	A-HAm-cib	Marra Mamba Iron Formation	Chert, banded iron-formation, mudstone, and siltstone; minor carbonate; metamorphosed
	A-HAm-cib	Marra Mamba Iron Formation	Chert, banded iron-formation, mudstone, and siltstone; minor carbonate; metamorphosed
	A-HAu-xsl-ci	Mount McRae Shale and Mount Sylvia Formation	Mudstone, siltstone, chert, banded iron-formation, and dolomite; metamorphosed
	P_-HAb-cib	Brockman Iron Formation	Banded iron-formation, chert, mudstone, and siltstone; metamorphosed
Surface	Achm	Marra Mamba Iron Formation	Chert, ferruginous chert, jaspilite, banded iron-formation, minor shale, siltstone, mudstone.
	Ad	Fortescue Group - mafic intrusions	Metadolerite, dolerite, gabbro; medium to coarse grained, massive grey-green rock, usually foliated.
	Al	Wittenoom Formation	Calcitic dolomite, interbedded chert and shale in upper and lower parts, volcaniclastic sandstone
	As	Mount McRae Shale and Mount Sylvia Formation	Interbedded shale, chert, banded iron-formation.
	Aw	Jeerinah Formation	Shale, sandstone, siltstone, mudstone, dolomite, local microbanded chert, jaspilite, conglomerate; fine-grained massive rhyolite; mafic tuff with local accretionary lapilli and agglomerate; thin basalt/dolerite and andesitic basalt flows.
	Czk	Calcrete	Pisolitic, nodular or massive calcrete; ferruginous inclusions; calcareous cementing of bedrock and transported materials; locally with intercalated chalcedony; as low mounds, in playa lakes, or as valley calcrete; locally dissected and karstified.
	Lc	Brockman Iron Formation	Banded iron-formation, chert, mudstone and siltstone.
	Qa	Alluvium	Channel and flood plain alluvium; gravel, sand, silt, clay, locally calcreted.
	Qrc	Colluvium	Colluvium, sheetwash, talus; gravel piedmonts and aprons over and around bedrock; clay-silt-sand with sheet and nodular kankar; alluvial and aeolian sand-silt-gravel in depressions and broad valleys in Canning Basin; local calcrete, reworked laterite.

4.5 Sorting and Identification of Specimens

Preserved samples were sorted manually using Leica MZ6, MZ7.5, M80 and M205C stereomicroscopes within the Stantec laboratories by Emma Dobinson, Jake Daviot and Thomas de Silva. Once sorted, any potential subterranean fauna specimens found were preserved in 100% ethanol and stored at minus 20°C to allow future DNA analysis (if required). Taxa were identified by Dr Nicholas Stevens of Stantec, using published and unpublished keys and taxon descriptions. Undescribed taxa were assigned morphospecies names based on morphological features.

4.6 DNA Sequencing

Material from 44 specimens were sent to Biologic for genetic analysis (**Appendix B**). The main aim of the molecular analysis was to test the robustness of identifications based on morphological characters, including juvenile specimens, and align morphospecies with any described and/or previously sequenced taxa.

4.7 Diversity Analysis

The EstimateS software package (Colwell (2013) Version 9.1.0) was used to assess the survey adequacy by investigating the species richness recorded in the Development Envelope. The species richness was analysed using species accumulation rarefaction and extrapolation curves, and various species richness estimators (using incidence and abundance data).

The species richness analysis provided a statistical evaluation of the proportion of the stygofauna assemblage detected. A range in the number of species predicted to form the assemblage was developed using seven species richness estimators (ACE, Bootstrap, Chao1, Chao2, ICE, Jack 1 and Jack 2). Statistically, it is more robust to show the results of several estimators to provide a range in predicted richness rather than present only one prediction (Hortal *et al.* 2006).

4.8 Limitations of the Assessment

The availability of suitable sites for sampling from non-resource areas was limited with few sites present beyond the BIF. The seemingly restricted distributions of subterranean fauna species to within a specific resource target habitat type can largely be an artefact of the disproportionate sampling effort conducted between likely impact areas and reference areas.

Specimens were identified to the lowest taxonomic level possible. However, specimens may not always be identified to the level of species or morphospecies due to:

- loss or damage of important taxonomic features during collection and/or sorting of specimens;
- lack of adult specimens; or
- limitation in taxonomy, in that the current state of taxonomy for a particular group is insufficiently advanced, and/or relevant taxonomic keys and descriptions are lacking.

While every effort has been made to assess the taxonomy, distribution and conservation significance of the subterranean fauna collected, using in-house data collections, publications, publicly available reports, and information provided by specialist taxonomists, some accounts may be limited if specialist information was unavailable.

4.9 Habitat Assessment

The extent, thickness, and connectivity of local geological habitats above and below water table was assessed by Rio Tinto by creating a three-dimensional habitat model based on drill-hole logging data in the program Leapfrog® Geo v4.3.1. Drilling log data from reverse circulation and diamond core drill holes throughout the Development Envelope was compiled into a database in Microsoft Excel®. The drill log data was codified to indicate commonly encountered stratigraphic units (strands), as well as mineralisation and geomorphology (tags), using consistent codes/ terminology across all drilling campaigns undertaken throughout the Development Envelope. All strand/ tag code combinations were collaboratively assessed by a team of Rio Tinto personnel experienced with geology, hydrogeology, and subterranean fauna surveys/ ecology, to determine the most likely categorisation for each geological unit (combination of strand and tag) in relation to its general suitability for subterranean fauna. Where strand/ tag combinations or their descriptions in the database were unclear, further advice was sought from Rio

Tinto geologists and hydrogeologists experienced in the local geological setting. The habitat suitability assessment used the following categorisation system:

- **High certain**: strand/ tag indicates a geological unit that is known to frequently support subterranean fauna (AWT/BWT), including rich assemblages, in similar geological contexts in the Hamersley Ranges/ Pilbara region;
- **Medium certain**: strand/ tag indicates a geological unit that is known to sometimes support subterranean fauna (AWT/BWT), or may support less rich assemblages in similar geological contexts in the Hamersley Ranges/ Pilbara region;
- **Medium uncertain**: strand/ tag indicates a geological unit that is poorly sampled or not often associated with subterranean fauna assemblages (AWT/BWT), but may have potential to support subterranean fauna, based on known characteristics. This category was also used for geology/ geomorphology combinations that were difficult to categorise as high certain, medium, or low certain because of a lack of information, knowledge, personal experience, or regional context; and
- **Low certain**: strand/ tag indicates a geological unit that is known to very rarely support subterranean fauna in similar geological contexts in the Hamersley Ranges/ Pilbara region, or typically lacks the physical characteristics required for supporting subterranean fauna (i.e. sufficient void spaces or porosity).

The assessment of suitability (of the strand/ tag combinations) for subterranean fauna was based upon the following criteria:

- Presence or likelihood of subterranean voids, cavities, fractures, faults, vugs, or other geomorphological characteristics that typically form habitat for subterranean fauna;
- Permeability and/or likelihood of secondary weathering (including mineralisation by supergene enrichment, secondary weathering, and hydrated mineralisation);
- Geological formation/ stratigraphic unit, and the typical processes occurring within each unit that create and influence subterranean fauna habitat, within the local context of the Development Envelope; and
- Personal experience with subterranean fauna surveys and habitat assessment, and results from previous studies in similar geological contexts throughout the Hamersley Ranges/ Pilbara region.

Three-dimensional modelling of the extent of high certain and medium certain habitats was undertaken by spatially linking the occurrence of high certain and medium certain strands/tags within drill holes mapped in three-dimensional space throughout the Development Envelope, using Leapfrog® software.

The resulting 3D volumes were then exported as 2D thickness grids of high certain and medium certain habitats. These 2D grids were used to display the modelled thickness, spatial extent, and connectivity of high certain and medium certain habitats throughout the drilled area of the Development Envelope. Low certain and medium uncertain habitat units were not modelled or mapped as these were not considered significant habitat for subterranean fauna. ArcGIS® v10.6 was used for mapping. Pre-mining topography, bore/ drill hole locations, locations of sampling, and locations of key subterranean fauna species were added as separate layers for spatial reference.

Not all areas of the Development Envelope have been drilled, and the modelling is limited to the area within and immediately surrounding the locations of bores and drill holes; therefore, a 300 m buffer was used as a stopping point around the maximum extent of drilling, to provide a spatial indication of the area of confidence in the habitat modelling. Within this 300 m confidence boundary, the 3D habitat modelling is expected to be reasonably consistent with the data obtained from the drilling logs, while there is less confidence in habitat interpretations beyond this distance. Nevertheless, it is not suggested that suitable habitat ceases to occur beyond the 300 m confidence boundary; its occurrence is simply not supported by the same level of information.

5. Results

5.1 Database Searches

There have been no previous reports of threatened or priority subterranean fauna species in the Development Envelope or surrounds, based on a search of the DBCA's threatened and priority fauna database (DBCA 2019b).

A search of the DBCA's threatened and ecological communities database did identify two priority ecological groundwater communities (PEC's) within a 50 km radius of the Development Envelope: the Weeli Wolli Spring Community North, and Weeli Wolli Spring Community South PEC's (**Figure 5-1**, **Figure 5-2**) (DBCA 2019b). The large Weeli Wolli calcrete system, and associated wetlands, spring and creeklines are noted for their unique riparian floristic values as well as hosting diverse stygofauna assemblage/s (DBCA 2019a). Both PEC's are classified as priority 1 due to the 'poorly known ecological communities' that are 'known from very few occurrences with a very restricted distribution' (DBCA 2019a). The 5 km buffer zone associated with the Weeli Wolli Spring Community South PEC overlaps with the eastern portion of the proposed development envelope and the BHT deposit area.

A search of the WAM Arachnida, Crustacea, Insecta and Myriapoda databases identified 581 troglofauna records within a 50 km radius of the Development Envelope (**Figure 5-1**, **Figure 5-2, Appendix C**). The majority of records were from subterranean fauna environmental baseline studies for the regulatory assessment of iron ore resource development projects; e.g., Greater West Angelas, Hope Downs 1, Mining Area C, and South Flank (**Appendix C**). Therefore, many records are from BIF ridges within the Hamersley Ranges (**Figure 5-1**). However, there are also many records from alluvial/colluvial habitats, particularly in association with the Weeli Wolli Creek system (**Figure 5-2**).

A search of the DBCA's NatureMap database, and Atlas of Living Australia (ALA) for the Development Envelope did not return any additional listings of troglofauna records.

5.2 Literature Review

Studies undertaken in the immediate surrounds of the Development Envelope as part of the HD1 and Baby Hope (BH) subterranean fauna assessments have recorded troglofauna from the alluvial, colluvial, BIF (Brockman and Marra Mamba), and calcrete mapped geology (**Figure 5-4**, **Figure 5-5**, **Figure 5-6**, **Appendix D**) (Biota 2011;2014a;2015a;b). Many other studies in the Hamersley Ranges and the broader region have consistently demonstrated that relatively diverse troglofauna assemblages do commonly occur in such habitats in the Pilbara (Bennelongia 2014;2015a;c;2016; Biota 2009;2014b; ecologia Environment 2013; Halse and Pearson 2014; Subterranean Ecology 2008b).

A genetic study of material of the troglobitic schizomid genus, *Draculoides*, collected from in and near to the Development Envelope revealed that the BHT and BH deposits do not represent completely isolated subterranean systems (Abrams *et al.* 2019), in contrast to what has been shown for the Robe Valley pisolitic mesas that have each been shown represent distinct 'subterranean islands' (Burger *et al.* 2012; Harvey *et al.* 2008b; Humphreys *et al.* 2006). The distributions of two *Draculoides* species recorded from BH were found to extend beyond the deposit (**Figure 5-3**, **Figure 5-4**) (Abrams *et al.* 2019):

- *Draculoides SCH068* — distribution extended linearly from the BH deposit for 5.8 km to the northeast to just south of the HD1 mine within Marra Mamba BIF, and for 7.5 km to the southeast to two sites high up on the BHT ridge landform within Brockman BIF; and
- *D. SCH067* — distribution extended linearly from the Marra Mamba BIF within BH deposit for 13.5 km to the northeast to the Weeli Wolli calcrete system, north of the HD1 mine.

The *Draculoides* genetic results indicate that the subterranean habitats associated with the landforms that host the BH and BHT deposits are more broadly interconnected with the surrounding landscape and not strictly confined to each ridge system (**Figure 5-5**, **Figure 5-6**). Prospective troglofauna habitat modelling overlain mapped surface geology indicates that suitable troglofauna habitat is not confined to the BIF units of the BH and BHT deposits, but also exists within the alluvial (Qrc), colluvial (Qa), and weathered profile of the Mount McRae Shale and Mount Sylvia Formations (As) (**Figure 5-6**). It therefore appears that these geological units associated with the BIF deposits can host troglofauna and provide conduits for geneflow among the populations of species present.

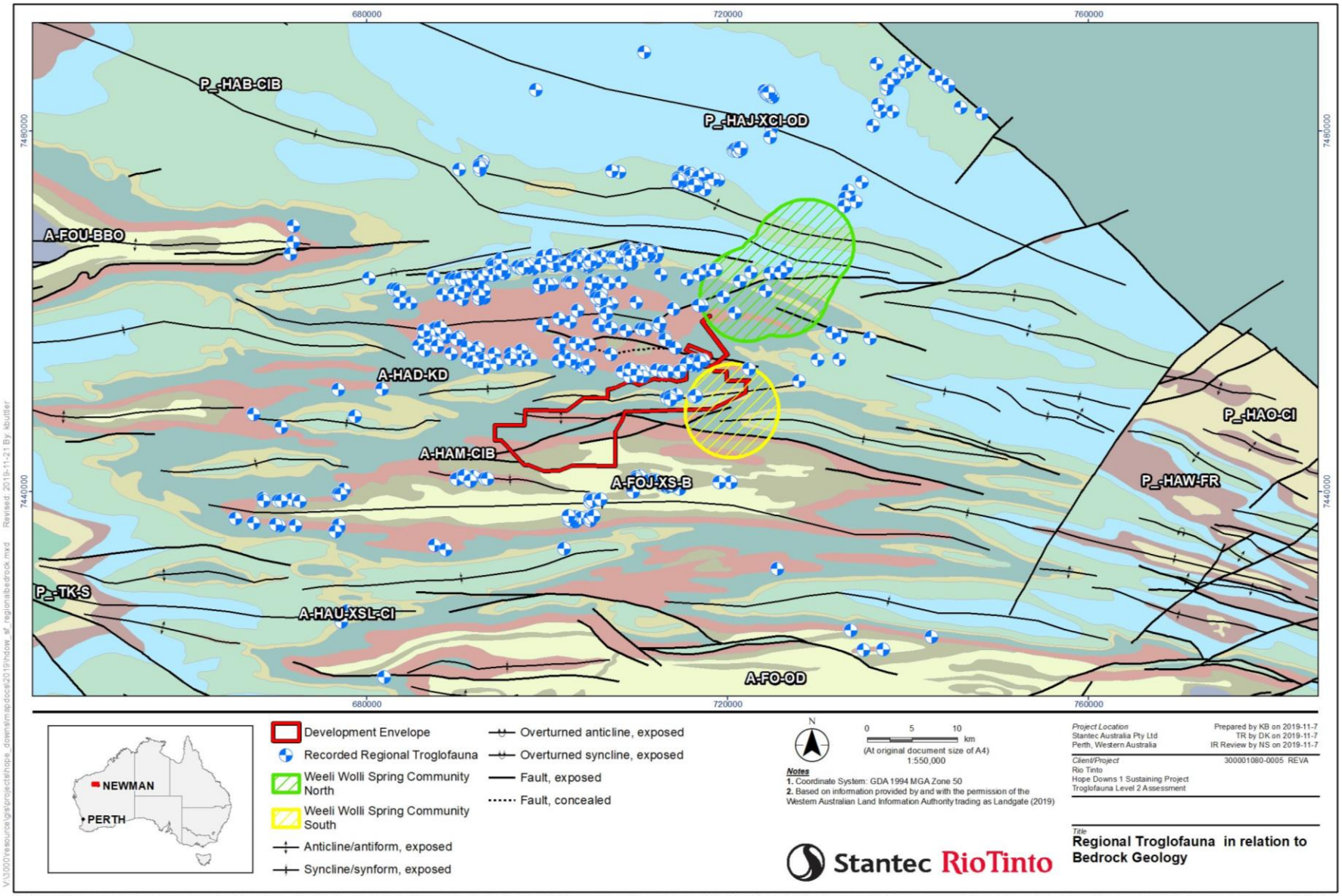

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Figure 5-1: Troglofauna records for the region surrounding the Development Envelope relevant to bedrock geology (refer **Table 4-3** for descriptions of relevant geological codes)

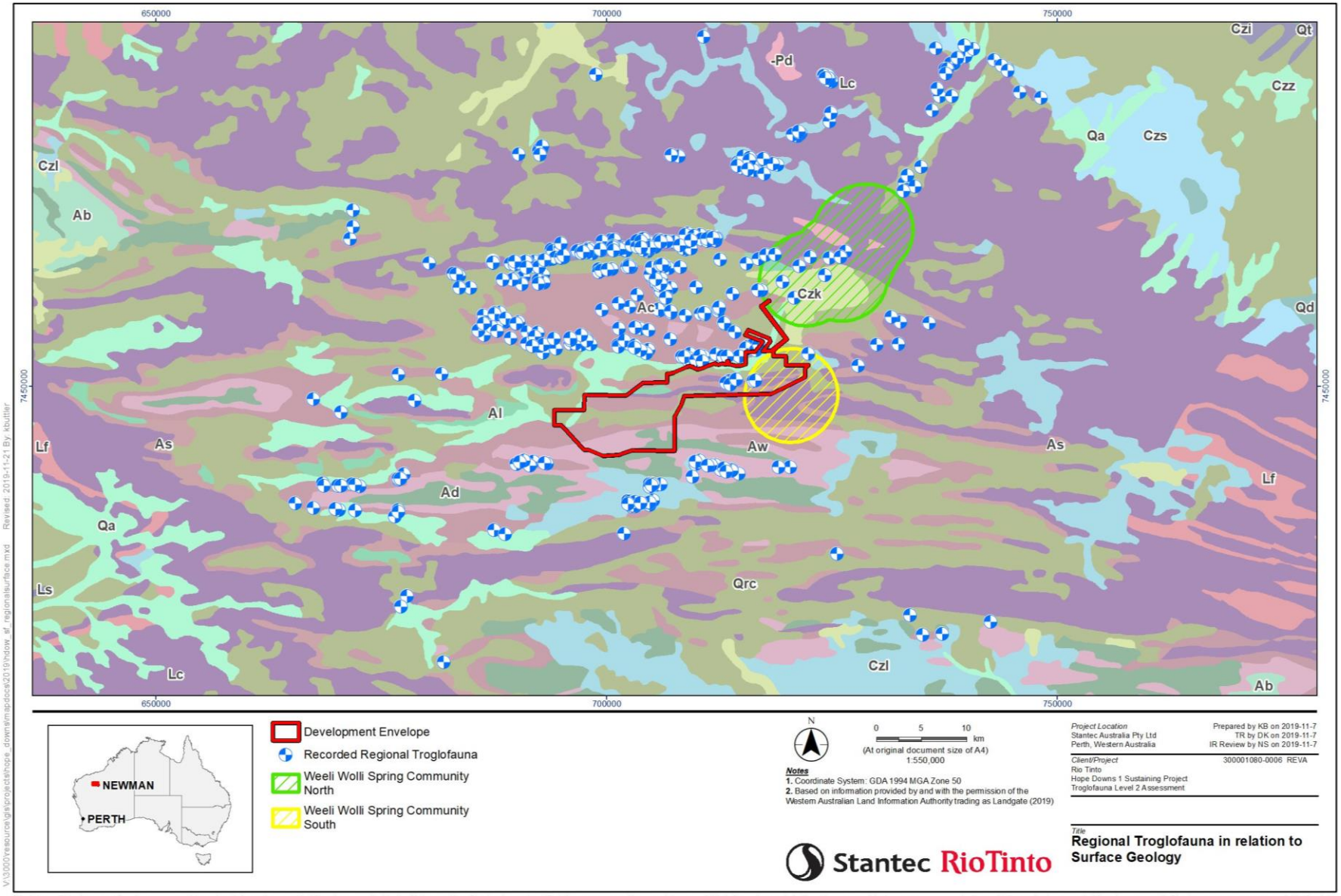

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Figure 5-2: Troglofauna records for the region surrounding the Development Envelope relevant to surface geology (refer **Table 4-3** for descriptions of relevant geological codes)

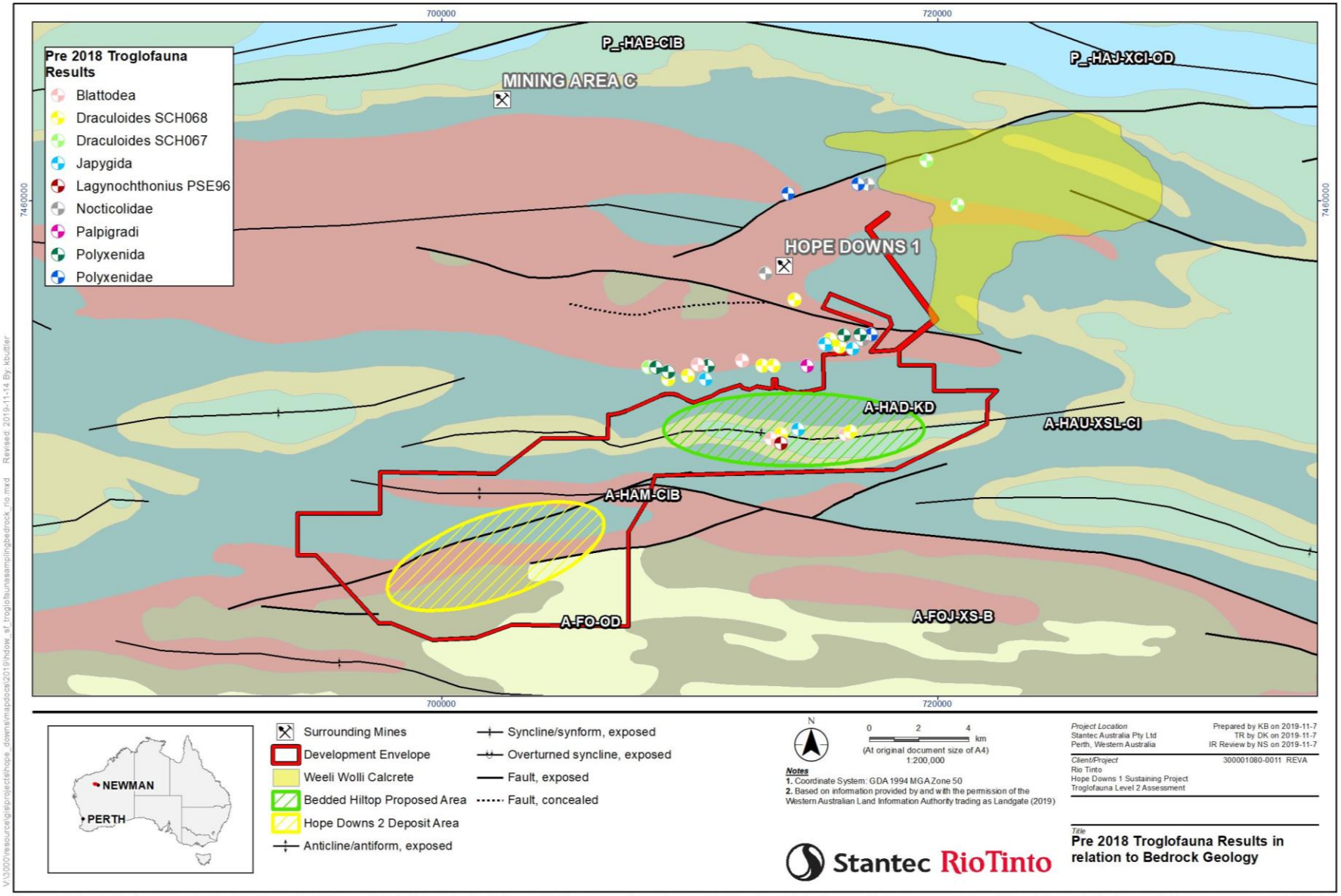

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Figure 5-3: Troglofauna taxa collected pre-2018 from in and near to the Development Envelope relevant to bedrock geology (refer **Table 4-3** for descriptions of relevant geological codes)

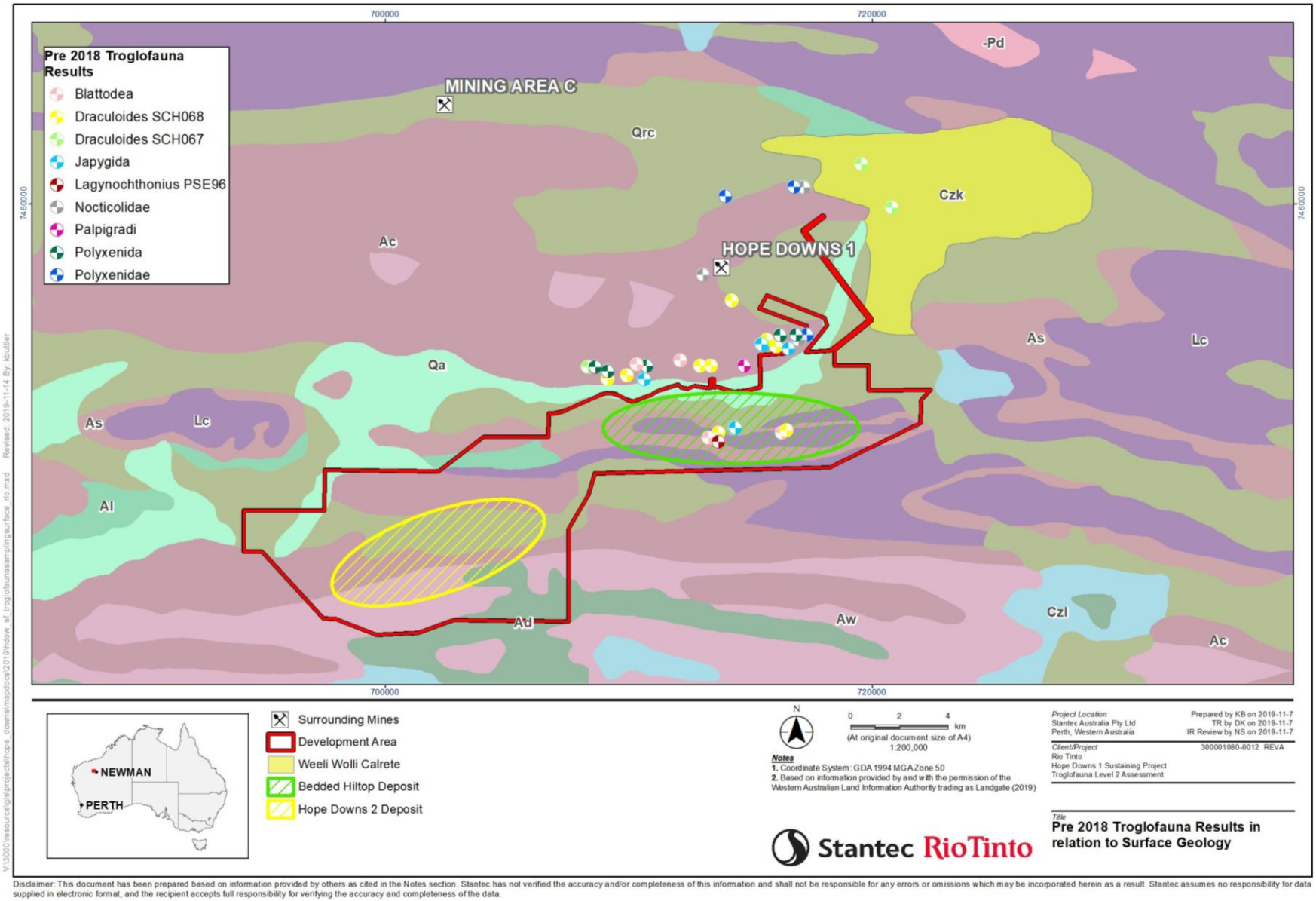

Figure 5-4: Troglofauna taxa collected pre-2018 from in and near to the Development Envelope relevant to surface geology (refer **Table 4-3** for descriptions of relevant geological codes)

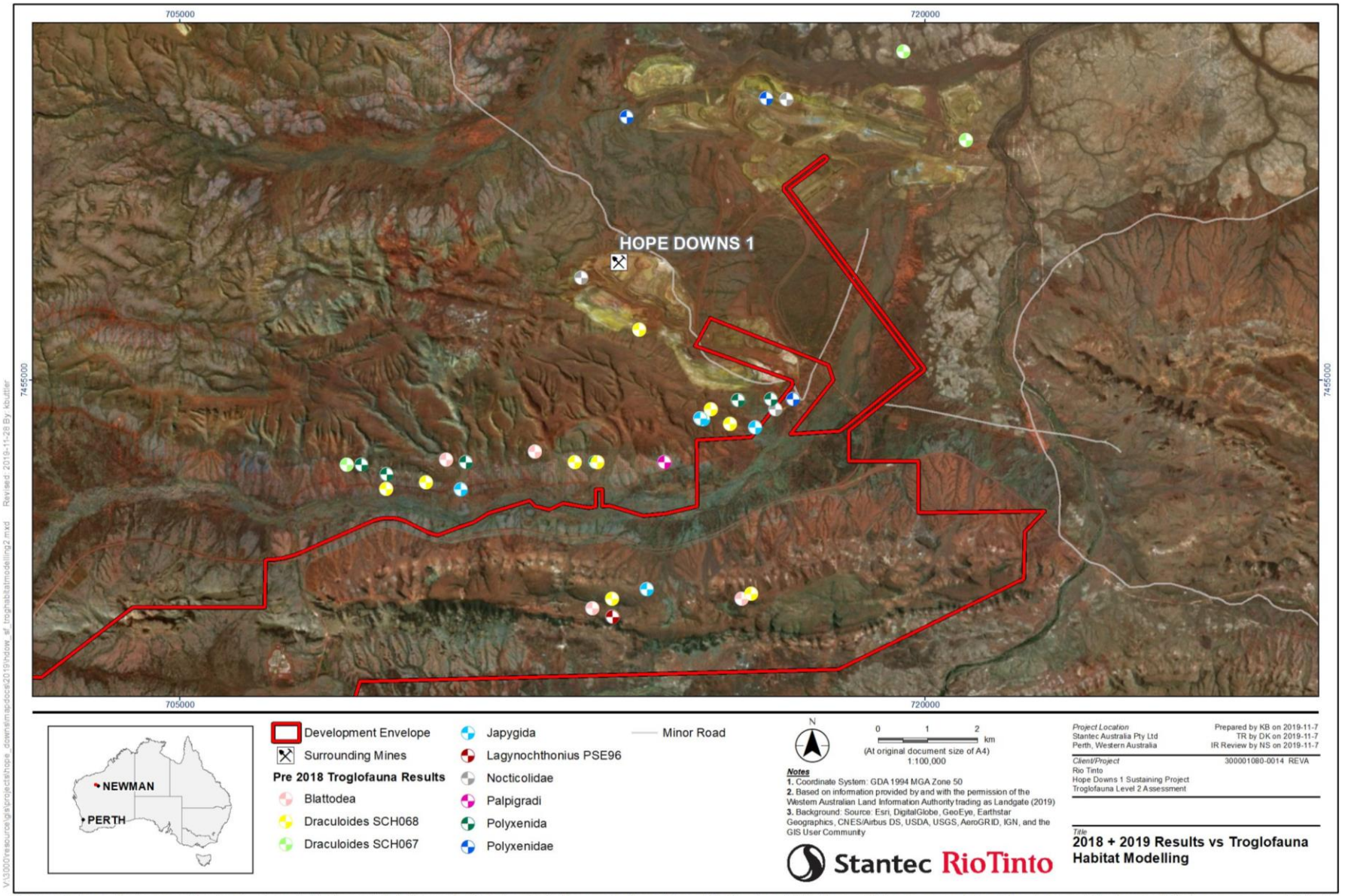

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Figure 5-5: Troglofauna taxa collected pre-2018 from in and near to the Development Envelope

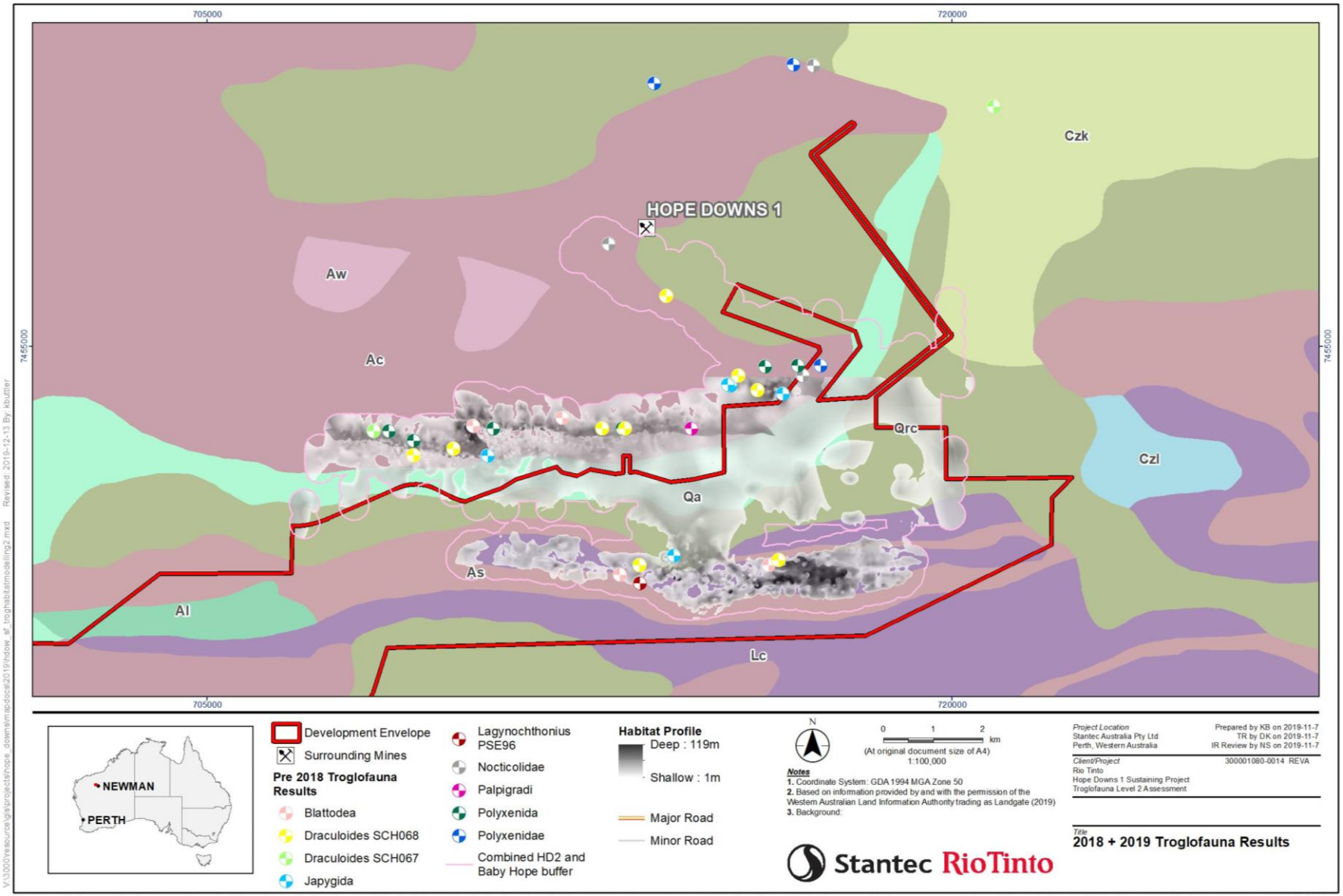

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Figure 5-6: Troglofauna taxa collected pre-2018 from in and near to the Development Envelope relevant to surface geology and modelled habitat (refer **Table 4-3** for descriptions of relevant geological codes)

5.3 Subterranean Habitats

The modelled extent of prospective troglofauna habitat in and near the Development Envelope has been shown to be associated with the mapped alluvial, colluvial and weathered BIF units, as well as within the weathered and fractured outcrop formations of the Mount McRae Shale and Mount Sylvia Formations (**Figure 5-1**, **Figure 5-2**, **Figure 5-6**, **Figure 5-11**).

5.3.1 Bedded Hilltop

The BHT deposit occurs within the mineralised Dales Gorge Member of the Brockman Iron Formation and forms part of a distinct ridge landform system (**Figure 5-7**). The deposit dips to the north beneath the colluvial and alluvial detritals within of the Pebble Mouse Creek valley, south of the BH deposit.

Suitable troglofauna habitat has been found in secondarily weathered and fractured zones of Brockman Iron Formation atop BHT. The topography of BHT is highly undulating and exposed, causing high amounts of weathering in the hilltop surface strata. The BHT landform is also ringed by a highly fractured, outcropping Mt Sylvia formation. The limited encroachment of habitat modelling on the Mt Sylvia formation does indicate that prospective troglofauna habitat can exist (**Figure 5-6**). However, the subsurface habitat properties of this geological unit have not been investigated across a broader extent outside of the deposit exploration program.

Surrounding the BHT landform is a ring of colluvial and alluvial sheet wash. This geology provides connection through the Pebble Mouse Creek valley with nearby habitats at BH (**Figure 5-6**). BH is located outside of the Development Envelope, in predominately Marra Mamba Formation. Extensive habitat is present at BH and the surrounding range.

Habitat modelling indicates that the prospective troglofauna habitat hosted at BHT is largely connected throughout the modelled area of the landform via varying thicknesses. The thickest sections of high and medium suitability troglofauna habitat (~107 m) occurs in the eastern section of the landform, in the Brockman Iron Formation (**Figure 5-6**).

Further suitable habitat is highly likely to occur outside of the area of high confidence 3D modelling. The most prospective areas and geologies are the Mt Sylvia formation, the colluvial and alluvial sheetwash units surrounding the landform, and the far western and eastern parts of the BHT landform. All of these geologies appear prospective at the surface but would require subsurface information prior to inclusion into the area of high confidence modelling.

5.3.2 Hope Downs 2

The HD2 deposit occurs within the Marra Mamba Formation and the overlying detrital deposits and does not represent a distinct ridge landform system (**Figure 5-8**). The low rolling hills of the HD2 deposit provides a less distinctive landform compared to the BHT range. A small amount of outcropping Marra Mamba rock exists, dissected by an upstream tributary of Pebble Mouse Creek in the west, and Weeli Wolli Creek in the east. Troglofauna habitat in the area is predominately within the Marra Mamba Formation, overlain by detrital cover with canga deposits in the southwest (**Figure 5-11**). The groundwater table in the HD2 area is located within both the Marra Mamba and abutting Wittenoom Formations and is generally below the base of the detrital deposits. Colluvium and alluvial sheet wash surround these small outcrops.

Habitat modelling indicates troglofauna habitat is connected throughout the modelled area of HD2 via varying thicknesses (**Figure 5-13**). The thickest sections of high and medium suitability troglofauna habitat (~112 m) occurs in the western section of the deposit, in the deepest area of detritals with some Marra Mamba Formation.

High confidence 3D modelling does not currently exist between the HD2 and BHT deposits, however, mapped surface geology indicates habitat connectivity may be present through valley floor colluvium and alluvium (**Figure 5-11**).

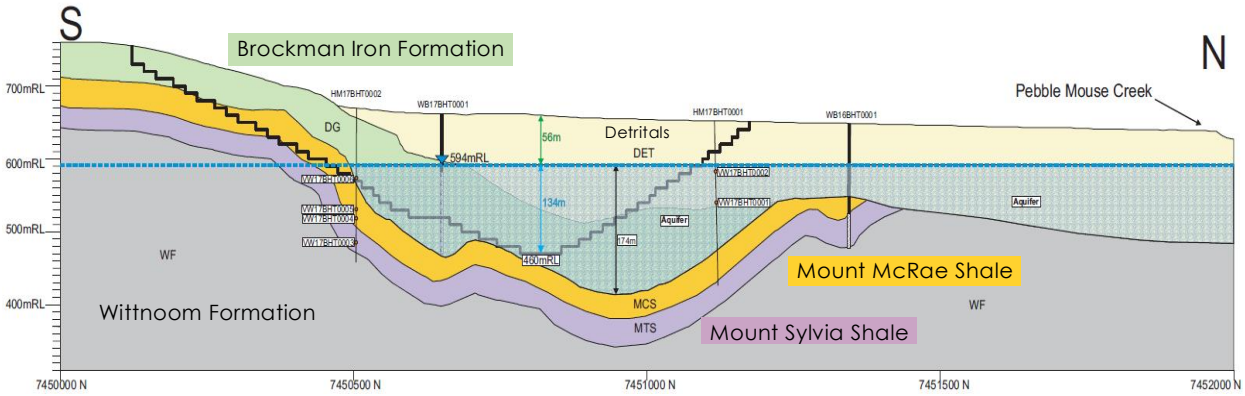

Figure 5-7: Hydrogeological cross section of the BHT deposit (Supplied by RTIO).

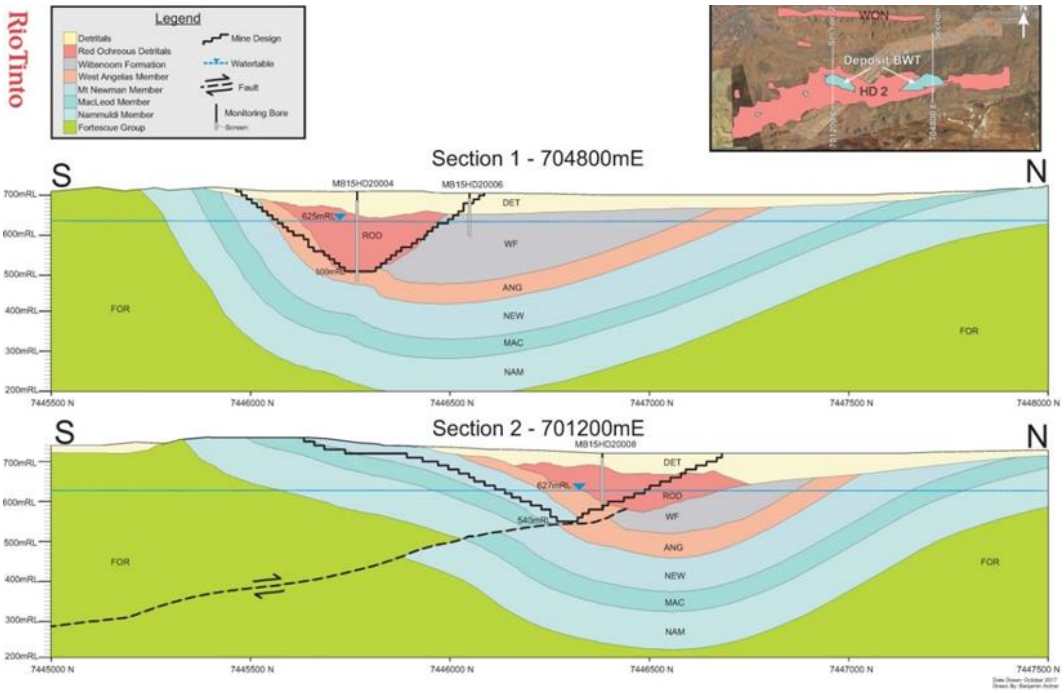

Figure 5-8: Hydrogeological cross sections of the HD2 deposit (Supplied by RTIO).

5.4 Troglofauna Findings

A total of 109 potential troglofauna specimens, representing at least 15 species from 8 higher level taxonomic groups (Blattodea, Scolopendromorpha, Diplura, Hemiptera, Palpigradi, Pseudoscorpiones, Schizomida, and Zygentoma) were recorded from the 2018 and 2019 surveys of BHT and HD2 deposits (**Table 5-1**, **Appendix E**). BHT was found to host a more diverse troglofauna assemblage than HD2 with 11 species collected compared to eight species from HD2 (**Figure 5-9**). An additional species, *Lagynochthonius* `sp. WAMPSE096`, was collected from BHT in 2015 (Biota 2015), meaning 12 species have been recorded from BHT in total (**Table 5-1**). Four taxa, *Eukoenenia* `sp. Biologic-PALP001`, Lophoproctidae `sp. Biologic-POLX001`, *Nocticola* `sp. Biologic-BLAT003`, and Pauropda sp. Indet., were found to occur in both deposits. The troglobitic species, *Draculoides* `sp. SCH068`, recorded from BHT had previously been collected from BH deposit.

Within BHT, troglofauna were recorded from 27 (50%) of the 54 sites sampled, and 36 (23%) of the 158 samples collected in 2018 and 2019. Within the HD2, troglofauna were not collected as commonly as at BHT, with material recorded from 10 (29%) of the 38 sites sampled, and 13 (10%) of the 124 samples collected.

The nocticolid cockroaches were the most abundant and species rich group, with genetic analysis revealing four *Nocticola* species to occur (**Appendix B**). *Nocticola* `sp. Biologic-BLAT003` was the most abundant and widespread species, with 47 specimens collected from BHT and HD2 (**Figure 5-9**, **Figure 5-10**). The 14 sites from which *Nocticola* `sp. Biologic-BLAT003` was recorded occurred within mapped Brockman BIF, colluvial, and Mount McRae Shale surface geologies (**Figure 5-10**) from modelled prospective habitat profiles ranging from deep, particularly at HD2, to more commonly relatively shallow (**Figure 5-11**, **Figure 5-12**, **Figure 5-13**, **Table 5-1**).

The troglobitic schizomid, *Draculoides* `sp. SCH068`, was also relatively abundant with 13 specimens collected in total from the BH and BHT deposits from within mapped Brockman and Marra Mamba BIF, and Mount McRae Shale surface geological units (**Figure 5-4**, **Figure 5-6**, **Figure 5-10**, **Table 5-1**) from modelled prospective habitat profiles that ranged in thickness from 14 to 53 m (**Figure 5-11**, **Figure 5-12**).

Of the 16 identified species recorded to date from BHT and HD2, seven species (*Dodecastyla* `sp. Biologic-ZYGE001`, *Indjapx* `sp. Biologic-DIPL001`, *Lagynochthonius* `sp. WAMPSE096`, *Nocticola* `sp. Biologic-BLAT001`, Scolopendromorpha `sp. Biologic-CHIL001`, *Trinemura* `sp. OES11`, and *Tyrannochthonius* `sp. Biologic-PSEU001`), were recorded as singletons or from a single site only (**Table 5-1**). There is the possibility that at least two of the singleton species, *Indjapx* `sp. Biologic-DIPL001` and *Nocticola* `sp. Biologic-BLAT001`, could be represented in material collected previously as part of the HD1 and BH troglofauna assessments that was not identified to species by morphological examination or molecular analysis (Biota 2011;2014a;2015a;b) (**Appendix D**). The early collected specimens of Blattodea and Japygidae have not yet been compared morphologically or genetically to the 2018 and 2019 material. Most of the Blattodea material collected in 2018 and 2019 was represented by juvenile specimens so morphological comparison would not be a valid method of investigating taxonomic alignment. Morphological examination of the japygid material could achieve a level of taxonomic alignment, however, this would not be as robust as genetic analysis.

The genetic analysis of 2018 and 2019 material, with other available sequences of Pilbara material included, did find that three species, the singleton *Dodecastyla* `sp. Biologic-ZYGE001`, Lophoproctidae `sp. Biologic-POLX001`, and *Nisia* `sp. Biologic-HEMI001` belonged to relatively widespread troglophillic species, with linear distributions extending for over 140 km, 300 km, and 175 km, respectively (**Appendix B**, **Table 5-2**).

The majority of the species recorded from BHT and HD2 are considered to be troglophiles for reasons outlined in **Table 5-2**. Four species are considered to be troglobitic: *Eukoenenia* `sp. Biologic-PALP001`, *Tyrannochthonius* `sp. Biologic-PSE001`, *Lagynochthonius* `sp. WAMPSE096` and *Draculoides* `sp. SCH068` (**Table 5-2**). All the troglobitic species have been recorded from BHT, with only one troglobite recorded from HD2, *Eukoenenia* `sp. Biologic-PALP001`, that was also shared with BHT. There are three species, Scolopendromorpha `sp. Biologic-CHIL001`, *Indjapx* OES7, and *Trinemura* OES11, all recorded as singletons from HD2, that are likely to be troglophiles but this status remains uncertain.

Additional details of the taxonomic groups recorded are provided in **Table 5-2**.

Table 5-1: Troglofauna results

Taxon	ID Method	Abun-dance	Deposit	Number of Sites	Linear Range (km)	Sample Method	Sample Depth (m bgl)	Mapped Geological Unit	Modelled Habitat Profile Thickness (m)	SRE Category (subcategory)	Troglofauna Status
Arachnida											
Palpigradi Eukoeneniidae											
Eukoenenia `sp. Biologic-PALP001`	DNA/ Morphology	2	BHT, HD2	2	11	Scrape	103	Brockman BIF, Colluvium	27	Potential (A, C, D, E)	Troglobite
Pseudoscorpiones: Chthoniidae											
Tyrannochthonius `sp. Biologic-PSEU001`	DNA	1	BHT	1		Scrape	32	Brockman BIF~Mt McRae Shale	14	Confirmed	Troglobite
Lagynochthonius `sp. WAMPSE096` (Biota 2015)	Morphology	1	BHT	1		Trap	?	Brockman BIF	5	Confirmed	Troglobite
Schizomida Hubbardiidae											
Draculoides `sp. SCH068`	DNA	8	BHT	4	7.5	Trap	20—30	Brockman BIF, Marra Mamba BIF, Mt McRae Shale	14—53	Confirmed	Troglobite
(Biota 2015; Abrams *et al* 2019)	DNA	5	BH, BHT	10							
Chilopoda											
Scolopendromorpha											
Scolopendromorpha `sp. Biologic-CHIL001`	DNA	1	HD2	1		Trap	30	Colluvium	38	Potential (A, D)	? Troglophile
Diplopoda											
Polyxenida: Lophoproctidae											
Lophoproctidae `sp. Biologic-POLX001`	DNA	2	BHT, HD2	2	14	Trap	15—40	Colluvium, Mt McRae Shale	12	Potential (A, D)	Troglophile
Entognatha											
Diplura: Japygidae											
Indjapx `sp. Biologic-DIPL001`	DNA	1	HD2	1		Scrape	56	Mt McRae Shale	45	Potential (A, D)	? Troglophile

Taxon	ID Method	Abun-dance	Deposit	Number of Sites	Linear Range (km)	Sample Method	Sample Depth (m bgl)	Mapped Geological Unit	Modelled Habitat Profile Depth	SRE Category (subcategory)	Troglofauna Status
Insecta											
Blattodea Nocticolidae											
Nocticola `sp. Biologic-BLAT001`	DNA	1	HD2	1		Scrape	26	Colluvium	43	Potential (A, D)	Troglophile
Nocticola `sp. Biologic-BLAT002`	DNA	18	BHT	9	8.5	Trap	20—50	Brockman BIF, Mt McRae Shale	13—25		
Nocticola `sp. Biologic-BLAT003`	DNA	47	BHT, HD2	14	22.5	Scrape Trap	23—113 20—50	Brockman BIF, Colluvium, Mt McRae Shale	1—45		
Nocticola `sp. Biologic-BLAT004`	DNA	7	BHT	6	2.5	Scrape Trap	104 15—40	Brockman BIF	11—21		
Hemiptera: Meenoplidae											
Nisia `sp. Biologic-HEMI001`	DNA	11	BHT	3	6.5	Scrape Trap	80 20—30	Brockman BIF	24—98	Potential (A, D)	Troglophile
Phaconeura `sp. Biologic-HEMI002`	DNA	2	BHT	2	0.1	Scrape	16—40	Brockman BIF, Mt McRae Shale	22	Potential (A, D)	Troglophile
Zygentoma: Nicoletiidae											
Dodecastyla `sp. Biologic-ZYGE001`	DNA	2	BHT	1		Scrape	46	Brockman BIF	24	Potential (A, D)	Troglophile
Trinemura `sp. OES11`	Morphology	1	HD2	1		Scrape	100	Colluvium	80	Potential (A)	? Troglophile
Pauropoda											
Pauropoda sp. Indet.	Morphology	4	BHT, HD2	4		Scrape	16—72	Brockman BIF, Colluvium	14—43	Potential (A)	Troglophile

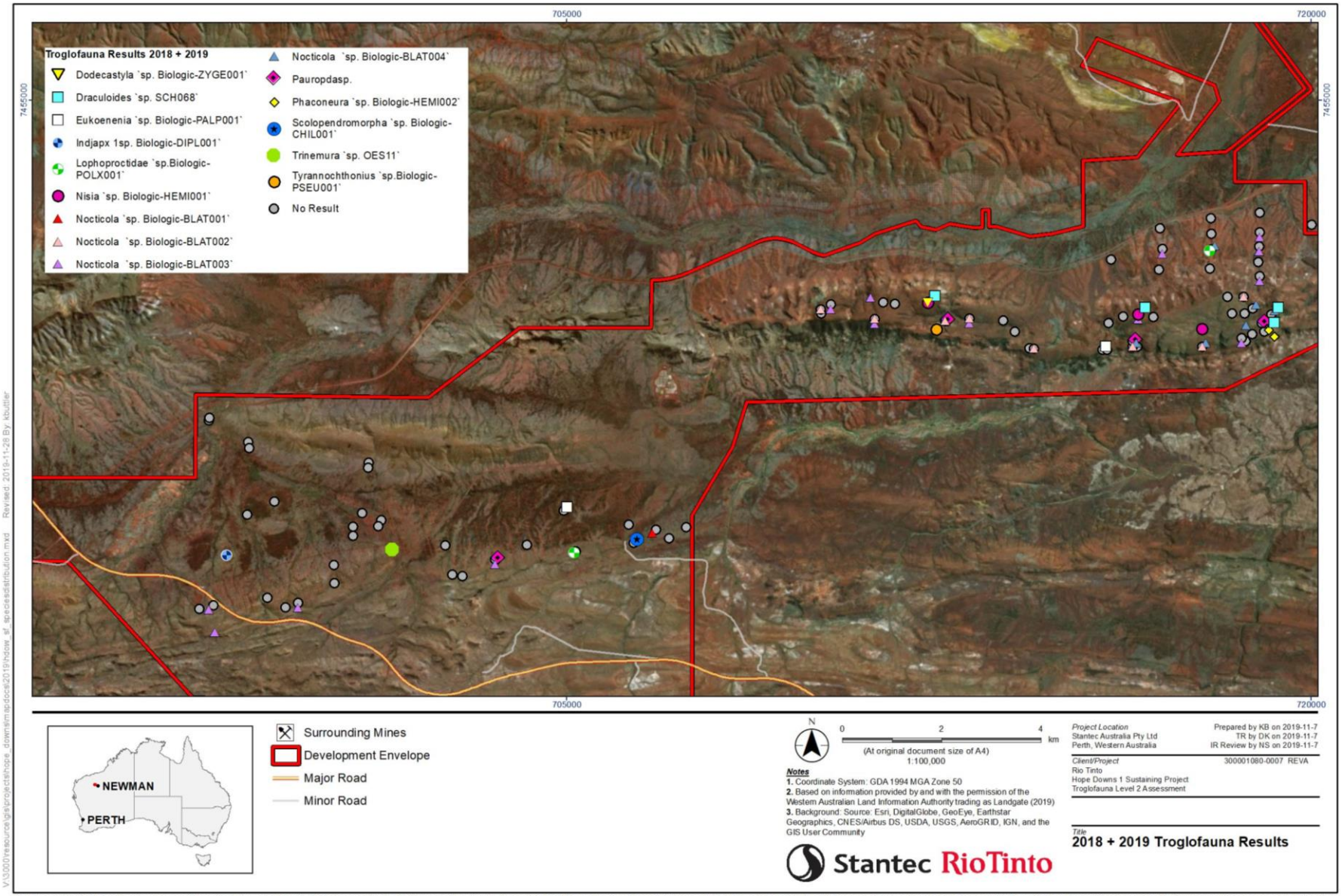

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Figure 5-9: Troglofauna taxa collected in 2018 and 2019 in the Development Envelope

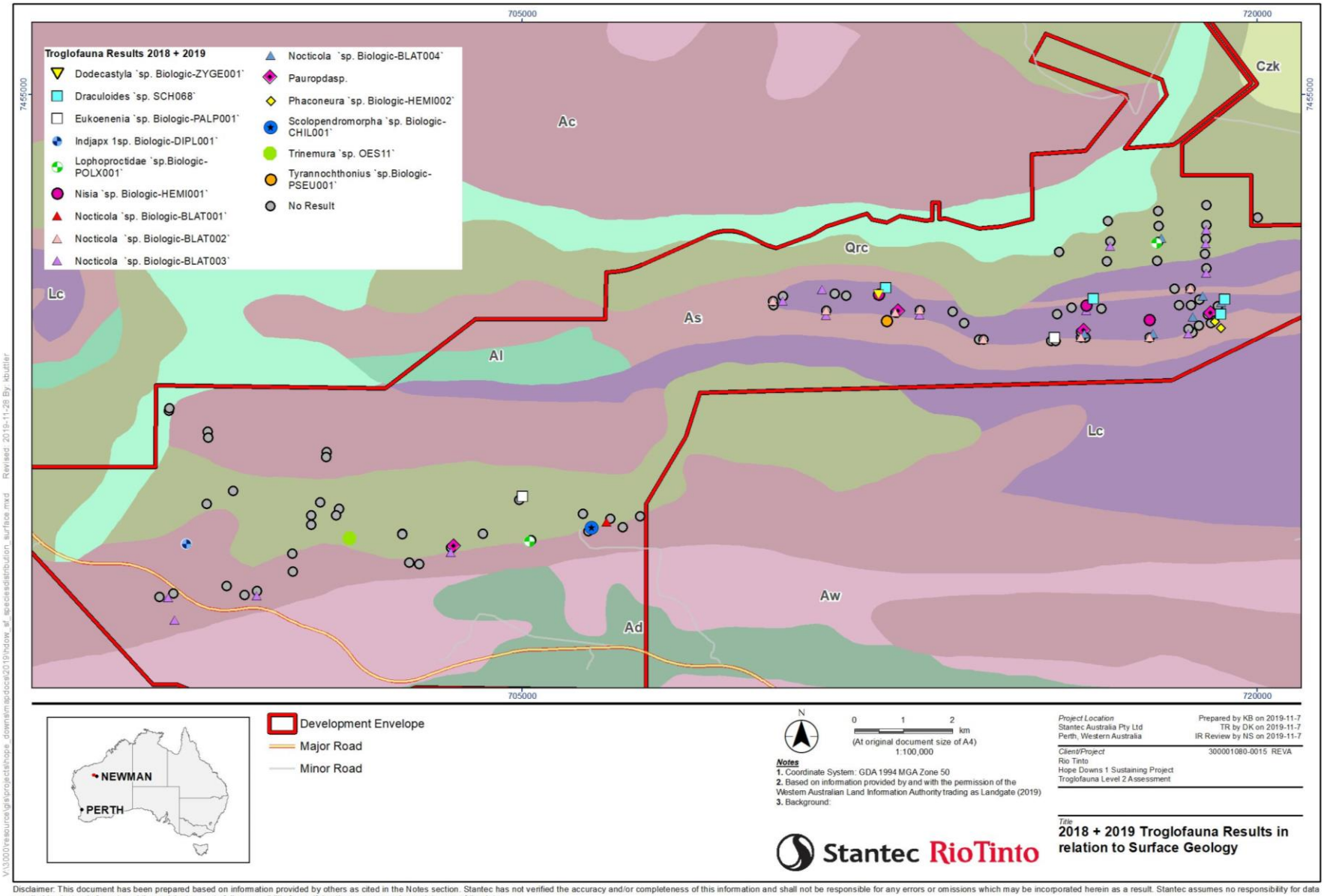

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Figure 5-10: Troglofauna taxa collected in 2018 and 2019 from in the Development Envelope relevant to surface geology (refer **Table 4-3** for descriptions of relevant geological codes).

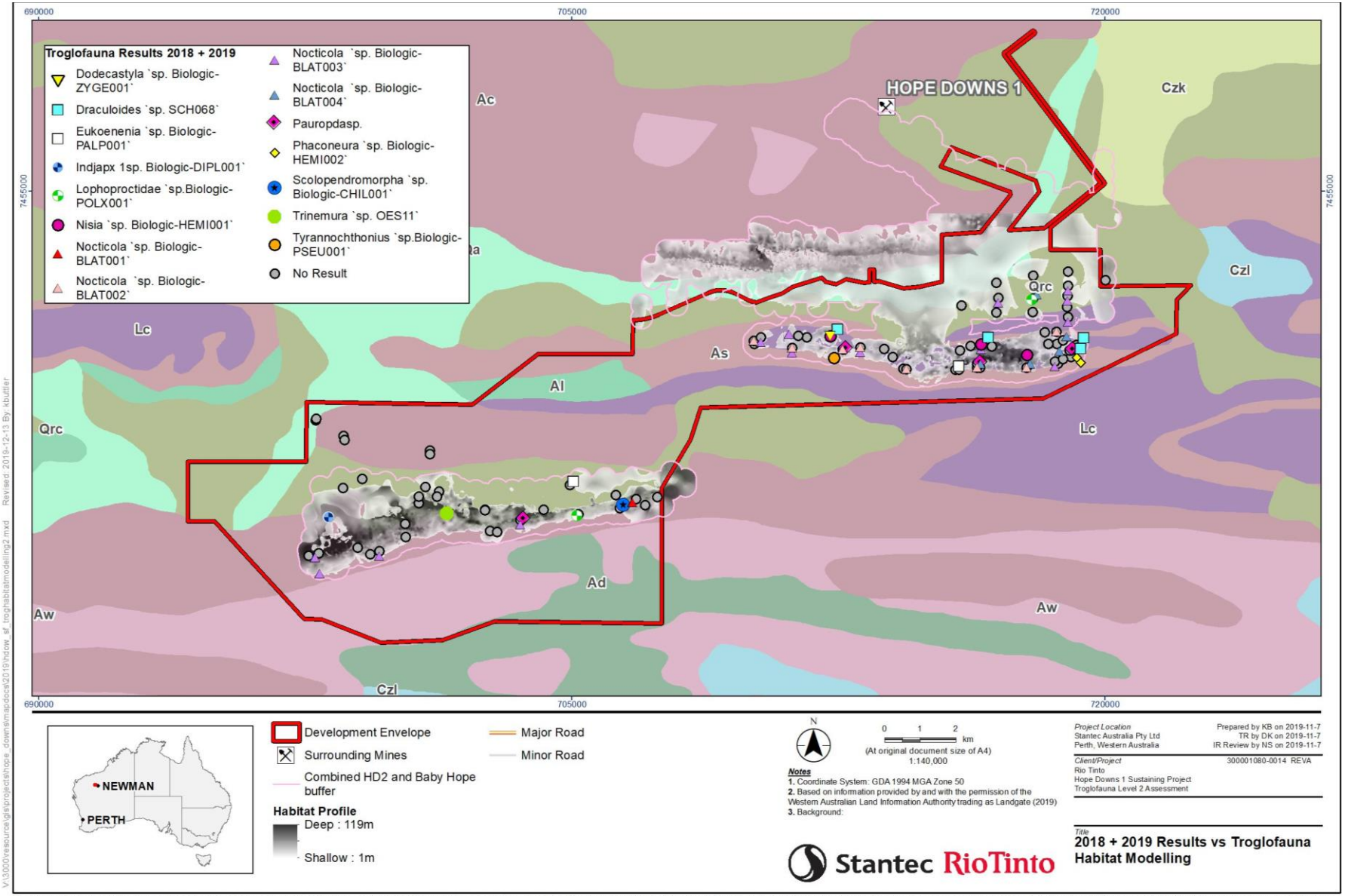

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Figure 5-11: Troglofauna taxa collected in 2018 and 2019 from in the Development Envelope relevant to surface geology and modelled habitat.

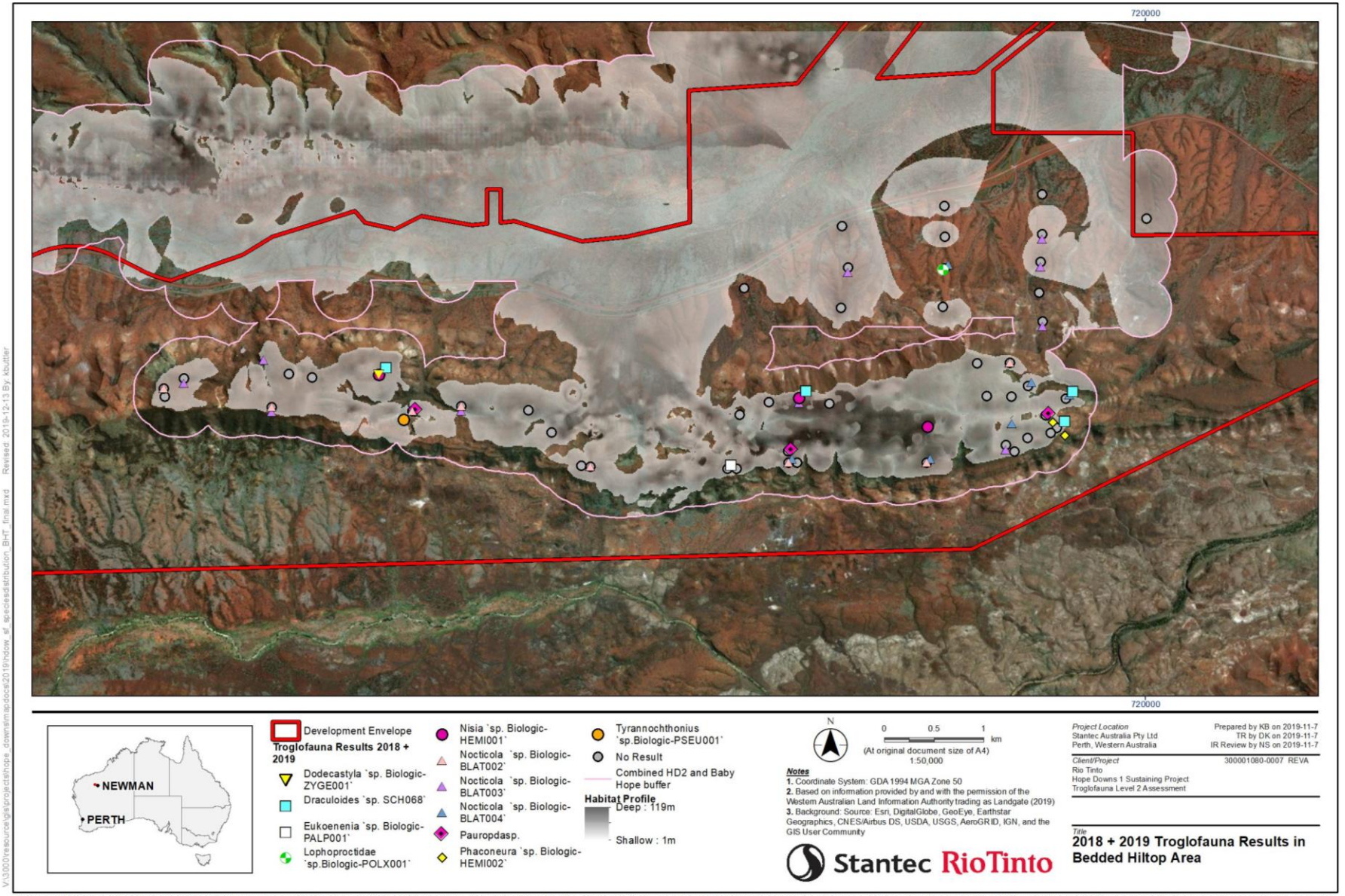

Figure 5-12: BHT troglofauna taxa collected in 2018 and 2019 relevant to modelled habitat.

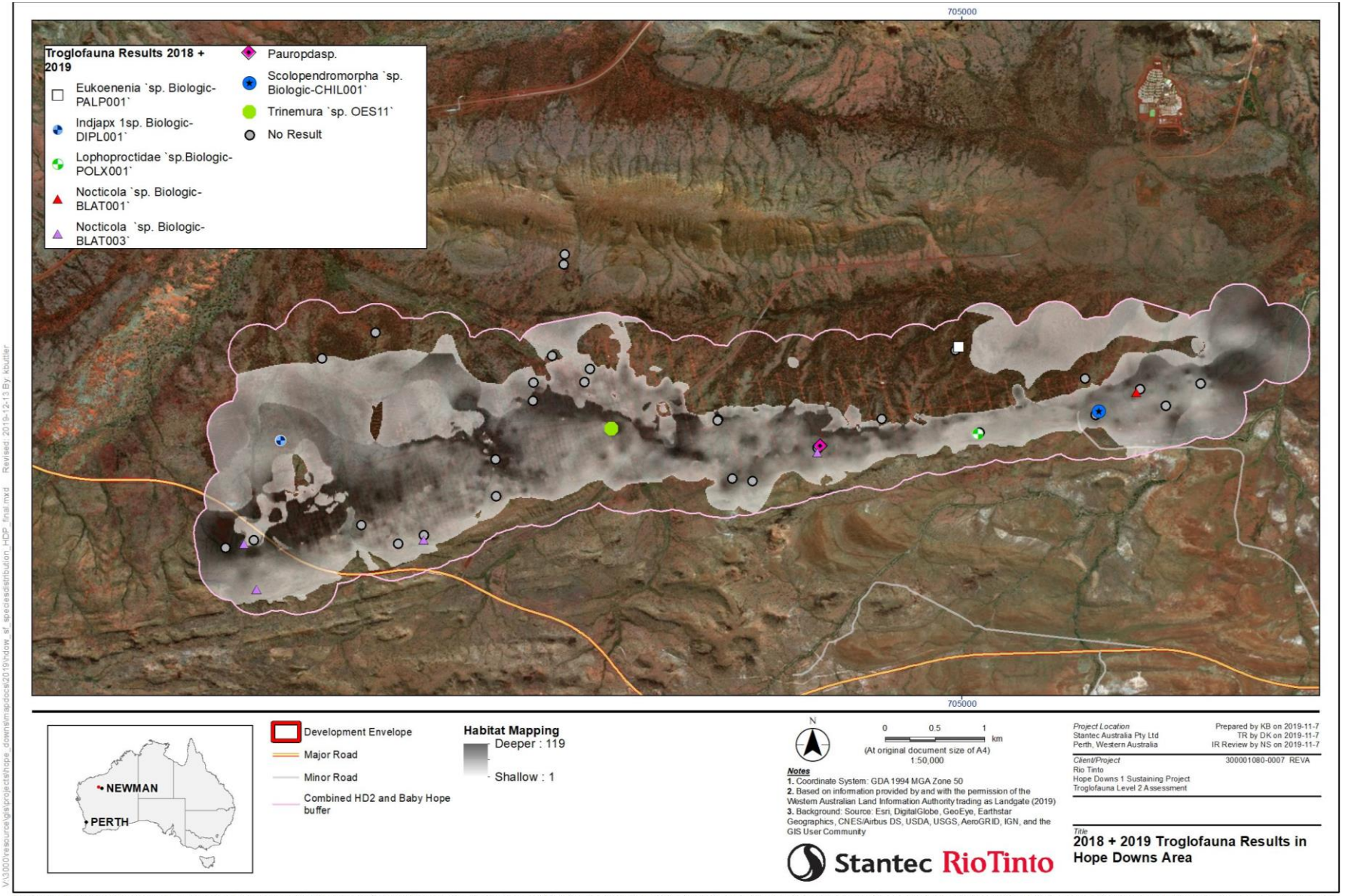

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Figure 5-13: HD2 troglofauna taxa collected in 2018 and 2019 relevant to modelled habitat.

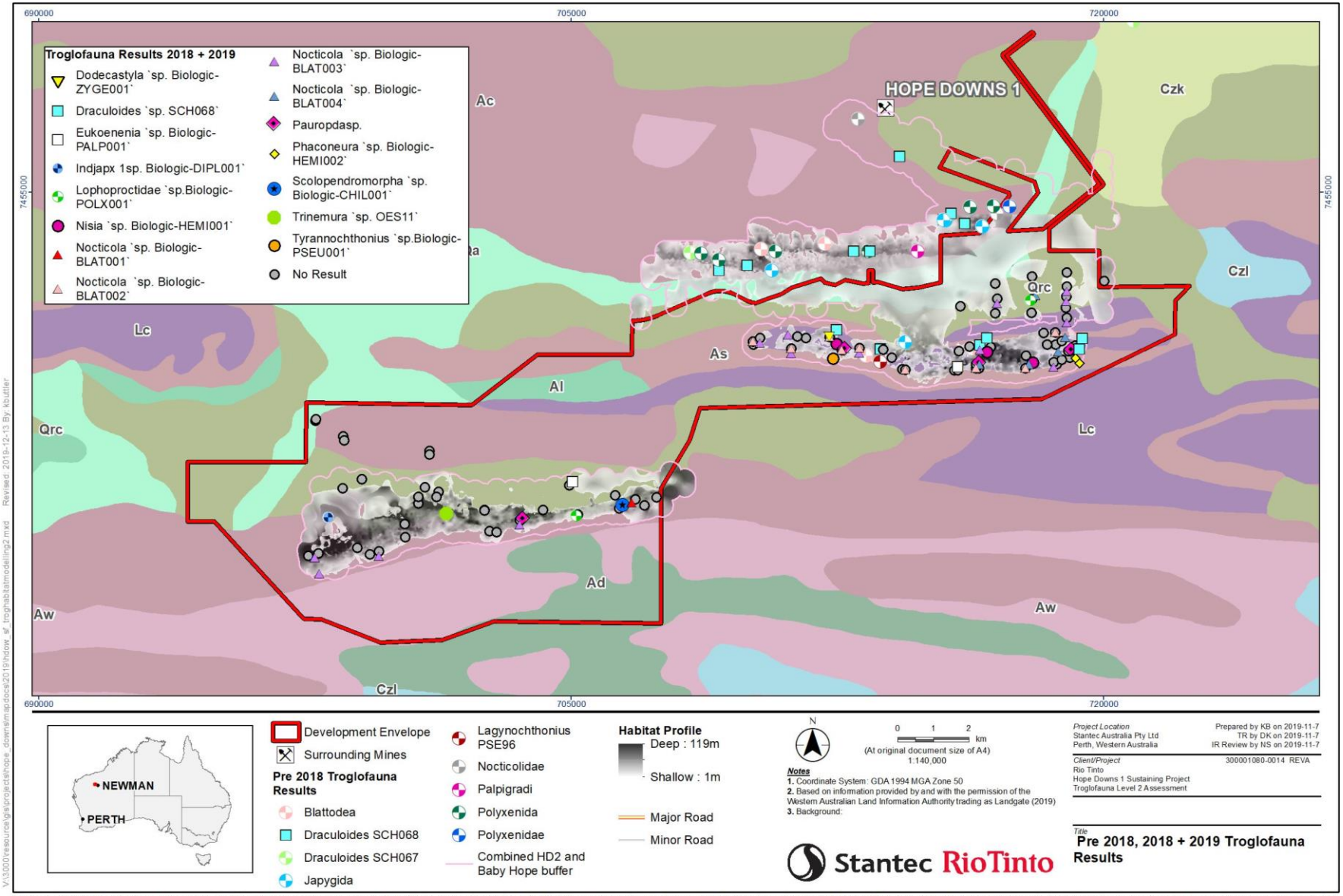

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Figure 5-14: Troglofauna taxa collected pre-2018 as well as 2018 and 2019 relevant to surface geology and modelled habitat.

Table 5-2: Details of troglofauna taxa recorded

Palpigradi
• Are de-pigmented, blind invertebrate-predators prone to desiccation so rarely seen on the surface, usually found in humid conditons in the soil, under rocks, or subterranean habitats in caves and karstic/ vuggy geology (Harvey 2003). • Taxonomic framework not well established, with few described species known globally and from Australia (Harvey et al. 2006). • Many of the described epigean species may display widespread distributions as a result of anthropogenic aided dispersal (Harvey et al. 2006). • There are known troglobitic species (Souza and Ferreira 2016;2019), including *Eukoenenia guzikae*, the first formally described Australian native species, recorded from the Sturt Meadows calcrete system in the Yilgarn region of Western Australia (Barranco and Harvey 2008). • Undescribed troglobitic species have been recorded from other Yilgarn calcrete habitats (Subterranean Ecology 2011b) as well as karstic, banded iron formation and alluvial/colluvial habitats in the Pilbara region, including areas near to the BHT and HD2 deposit sites (Bennelongia 2015b; Biota 2015b; Outback Ecology 2009)(Appendix C).
Eukoenenia `sp. Biologic-PALP001`
• Linear range of distribution displayed exceeds 11 km. The species distribution is considered likely to range further considering the contiguous habitat present that extends more broadly in and around each of the deposits. • DNA analysis — Only the HD2 specimen successfully sequenced (CO1). The lineage was found to be >55% divergent from the nearest lineage included in analysis. The BHT specimen failed to sequence, so conspecific status with HD2 is based on morphological examination only.
Pseudoscorpiones
• The pseudoscorpion genera *Lagynochthonius* and *Tyrannochthonius* were once considered to be two separate but closely related genera based on distinctive morphological characteristics differentiating the two groups (Edward and Harvey 2008). However, genetic data has demonstrated that the morphologically distinct groupings do actually form a single genus (Harrison *et al.* 2014). The group is composed of epigean (surface) species (possess eyes) and troglobitic species (no eye development and elongated appendages). • All species are considered to be SRE's (Edward and Harvey 2008; Harrison *et al.* 2014). • Troglobitic *Lagynochthonius* and *Tyrannochthonius* species are relatively commonly recorded in subterranean fauna surveys, often with numerous species recorded in a limited geographic area, but in low abundances, often as singletons (Bennelongia 2015b;2016; MWH 2015; Outback Ecology 2011b;2012b; Subterranean Ecology 2011a)(**Appendix C**). • Where multiple specimens of a species have been genetically analysed, linear distributions have been shown to range for a least 5 km or 12 km (MWH 2015; Outback Ecology 2011b;2012b; Harrison *et al.* 2014).
Tyrannochthonius `sp. Biologic-PSEU001`
• Collected as a singleton so not able to empirically determine distribution. However, based on results from better documented *Tyrannochthonius* and *Lagynochthonius* species, it is considered likely that this species has a broader distribution than currently known that is likely to extend along much of the BHT landform. • DNA analysis — The CO1 sequence was >19% divergent from the nearest lineage included in analysis.
Lagynochthonius `sp. WAMPSE096`
• Collected as a singleton so not able to empirically determine distribution. However, based on results from better documented *Tyrannochthonius* and *Lagynochthonius* species, it is considered likely that this species has a broader distribution than currently known that is likely to extend along much of the BHT landform. • Identified morphologically only, no DNA sequence obtained.
Schizomida
• Troglobitic schizomids in Western Australia have been relatively well studied with unpublished (e.g., Rio Tinto Robe Valley studies) and published (Abrams and Harvey 2015; Abrams *et al.* 2019; Harvey *et al.* 2008b) genetic studies confirming the SRE status of *Draculoides* species.
Draculoides `sp. SCH068`
• Distribution considered likely to extend throughout much of BHT and BH, and further west along the landform hosting BH deposit. Considered not to occur at HD2. • DNA analysis — The eight specimens sequenced were found to fall into the same clade as previously sequenced material (Abrams *et al.* 2019).

Scolopendromorpha
• A troglobitic scolopendromorph species with distinctly elongated appendages was described from the Nullarbor Plains of Western Australia (Edgecombe 2005), however, the troglomorphic status of centipedes collected in subterranean surveys is difficult to determine as many known epigean species are generally pale and eyeless. • Commonly collected as singletons (Bennelongia 2015b; MWH 2016a; Subterranean Ecology 2008b).
Scolopendromorpha `sp. Biologic-CHIL001`
• Singleton recorded from colluvial habitat within the HD2 deposit area. The species distribution is considered likely to range further considering the contiguous habitat present that extends more broadly in and around the deposit. • Did not display distinctly elongate appendages and considered more likely to be a troglophile. • DNA analysis — The specimen successfully sequenced for CO1. Was found to be >21% divergent from the nearest lineage included in analysis.
Polyxenida
• Genetic studies of troglomorphic polyxenida material have indicated that many polyxenid species are not short range endemics as they can have extensive distributions ranging across hundreds of kilometres from the northern Goldfields region of Western Australia to the Pilbara (MWH 2014b; Outback Ecology 2011b;2013; Stantec 2017b).
Lophoproctidae `sp. Biologic-POLX001`
• Recorded from BHT and HD2 within mapped colluvial and Mount McRae Shale surface geologies. • Distribution is considered likely to be relatively widespread within the colluvial and detritals in and around the Development Envelope. • DNA analysis — One specimen successfully sequenced for CO1 that was found to belong to a widespread species sequenced from other project areas (Greater Brockman, Robe Headwaters, West Turner Syncline, Mesa G, and Paraburdoo), displaying a linear distance of more than 300 km. Previously collected polyxenid material from BH and HD1 was not sequenced so has not been compared with BHT and HD2 material.
Diplura
• All dipluran species have evolved to be largely unpigmented with no eye development and rely on highly specialised antennae for sensing their environment. • Most species are known to be soil dwelling (edaphofauna), particularly in more mesic environments (Naumann 1991). • Dipluran taxa are often recorded in subterranean fauna assessments from cavernous subterranean habitats (Subterranean Ecology 2010) as well as alluvial soil profiles (Outback Ecology 2011b). • Not enough is known about the group to conclusively determine if specimens collected are true troglobites or if they are edaphofauna, particularly as all species are pale and blind. • A dipluran taxonomist has considered that most diplurans collected in Western Australia are likely to be soil dwelling species (A. Sendra pers. comm. in Subterranean Ecology 2011b).
Indjapx `sp. Biologic-DIPL001`
• The single specimen recorded from HD2 has not be compared morphologically or genetically to earlier collected Japygidae from BH and HD1. Morphological examination of the japygid material could achieve a level of taxonomic alignment, however, this would not be as robust as genetic analysis. • Distribution is considered to be relatively widespread, extending along the contiguous habitat present in and around the Development Envelope. • DNA analysis — The specimen successfully sequenced for CO1. Was found to be >16% divergent from the nearest lineage included in analysis.
Blattodea: Nocticola
• *Nocticola* species are relatively commonly found from many locations throughout the Pilbara and often represent the most abundant troglofauna group recorded (Ecologia Environment 2011; Stantec 2017b; Subterranean Ecology 2007;2008a;c;2012) (**Appendix C**). • Unpublished genetic data has shown a Pilbara *Nocticola* species to possess a linear distribution of over 125 km suggesting some species may not be SRE. • Many *Nocticola* species do appear to be SRE but with less confined distributions compared to troglobitic SRE: e.g. arachnids, diplopods (Ecologia Environment 2011; MWH 2014a; Subterranean Ecology 2012). • *Nocticola* material collected in the 2018 and 2019 surveys was mostly juvenile so morphological comparisons with previously collected material from HD1, BH and BHT would not be valid as adult material, particularly male, is required. Sequencing of previously collected material would be required to properly investigate relationships present and achieve taxonomic aligments.
Nocticola `sp. Biologic-BLAT001`

• Singleton collected from HD2 deposit area, from mapped colluvial surface geology within medium modelled habitat profile depth. • The distribution of this species appears likely to extend further to the west of HD2 and the Development Envelope, and likely not at BHT. • DNA analysis — The CO1 sequence was 7% divergent from *N*. BLAT002, 11% divergent from *N*. BLAT004 and >21% from *N*. BLAT003.
Nocticola `sp. Biologic-BLAT002`
• Collected from across much of the BHT ridge system within BIF and fractured rock surface geology within shallow to medium modelled habitat profile depths. • Not recorded from beyond the BHT landform, but is considered likely that does occur more broadly. • DNA analysis — The CO1 intra-specific divergence shown was 1%. The interspecific divergence shown was: 7% from *N*. BLAT001; >9% from *N*. BLAT004; and >21% from *N*. BLAT003.
Nocticola `sp. Biologic-BLAT003`
• The most abundant and widespread species recorded from both BHT and HD2, found within broad range of surface geologies from BIF, colluvial and fractured rock, from within shallow to deep modelled habitat profile depths. • The linear range of 22.5 km that extended from low lying areas, including the low HD2 landform, to along the BHT ridge system, indicates that this species would occur more broadly beyond the Development Envelope. • DNA analysis — The CO1 maximum intra-specific divergence shown was 3%. The interspecific divergence shown was >19% from all other *Nocticola* material sequenced from Development Envelope.
Nocticola `sp. Biologic-BLAT004`
• Collected from BHT within mapped Brockman BIF and colluvial surface geologies, from within shallow to deep modelled habitat profile depths. • Linear range extent 2.5 km, extending from low lying colluvial geology to north of BHT, to along eastern portion of BHT ridge system. • DNA analysis — The CO1 intra-specific divergence shown was 1%. The interspecific divergence shown was: 9% from *N*. BLAT002; >11% from *N*. BLAT001; and >20%from *N*. BLAT003.
Hemiptera: Meenoplidae
• Published and unpublished genetic studies have indicated that some Meenoplidae species collected in subterranean fauna surveys are relatively widely distributed and not likely SRE (Subterranean Ecology 2008c). • *Nisia* material can be relatively abundantly collected in subterranean fauna surveys, represented mostly by early and late juvenile stages, but less commonly by fully winged adults with full eye development (Stantec 2017b); therefore, as with cicadas, the blind juveniles are troglophilic confined to the hypogean environment feeding on plant roots with the adults representing the epigean dispersal stage. • Adult *Phaconeura* material collected has also displayed full wing development but with significantly reduced eyes such that are unlikely to be functional other than for detecting differences in light and dark. Due to the reduced eye development found, it is suspected that the dispersal capacity of *Phaconeura* species may be limited compared to *Nisia* species (Stantec 2017b). • No adult meenoplid material was collected in the 2018 and 2019 surveys.
Nisia `sp. Biologic-HEMI001`
• Distribution within the Development Envelope shown to extend along much of the BHT ridge system, from a limited number of sites (3) only. • DNA analysis — The CO1 sequence data found that BHT material belonged to a widespread species sequenced from another project area, Greater Brockman, displaying a linear distance of more than 175 km.
Phaconeura `sp. Biologic-HEMI002`
• Only known from two neighbouring sites located on the south eastern margin of BHT. However, based on knowledge of other Phaconeara species that also have a non-troglophillic adult dispersal stage, the distribution of this species is considered to occur more broadly beyond the Development Envelope. • DNA analysis — One specimen successfully sequenced for CO1 and was found to be >11% divergent from the nearest lineage included in analysis.

Zygentoma: Atelurinae
• Atelurinae species are more commonly regarded as inquilines within termite or ant nests, however, are also found within soil and cave environments independent of a host nest (Smith and McRae 2014). Recent species described from the Pilbara were considered to be troglophillic (Smith and McRae 2014).
Dodecastyla `sp. Biologic-ZYGE001`
• Collected from a single site within BHT ridge system. • Species considered troglophillic • DNA analysis — The 12S sequence was found to belong to a relatively widespread species sequenced from other project areas (West Angelas and Paraburdoo), displaying a linear distance of more than 140 km.
Zygentoma: Nicoletiinae
• Troglobitic *Trinemura* species have been described from the Pilbara, that displayed larger body size and elongated appendages (e.g., longer antennal length versus head width) compared to other Pilbara species commonly collected in subterranean fauna surveys that were considered to be hypogean (Smith 1998; Smith *et al.* 2012).
Trinemura `sp. OES11`
• Singleton recorded from colluvial geology at HD2. • Distribution is considered likely to be relatively widespread, extending along the contiguous habitat present in and around the HD2 deposit. • The specimen was missing all appendages so not able to assess morphologically for troglobitic features such as elongated appendages. However, condition of head and body sufficient for generic determination. Specimen not sent for DNA analysis.
Pauropoda
• All species are blind and pale known as soil and organic litter inhabitants. • Pauropods are relatively well documented from wetter regions in Australia, particularly Tasmania and the southwest of Western Australia, compared to the more arid regions of the continent where they are less common (Greenslade 2008; Scheller 2013). • Taxonomy of group not well known. • *Decapauropus tenuis*, known to occur in the Pilbara from Hope Downs, is considered to be a widespread species across the tropical, sub-tropical regions of the world (Scheller 2010).
Pauropoda sp. indet.
• Four specimens recorded from BHT and HD2 from mapped Brockman BIF and colluvial geology. • Specimens were not unable to be confirmed as the same species morphologically due to the lack of species level defining characters available for this group. • All specimens were submitted for genetic analysis but no DNA sequences were successfully obtained.

5.5 Troglofauna Species Richness Estimates and Survey Adequacy

Based on the 2018 and 2019 survey data only, the various species richness estimators indicated the total species richness within the Development Envelopment to range from 17.7 to 24 species (**Figure 5-15**, **Table 5-3**). The 15 taxa collected in 2018 and 2019 represent an estimated 63 % to 85 % of the total species predicted to occur in the Development Envelope. The species accumulation curves for five of the richness estimators were still trending upwards to varying degrees, with two estimators, Chao 1 and Chao 2 strongly trending downwards. The Bootstrap mean most closely resembled the rarefaction curve of the observed (S(est)). The species accumulation curves for other subterranean fauna surveys in Australia (e.g. Eberhard *et al.* 2009, Stantec 2017a) and overseas (Pipan and Culver 2007), can continue to trend upwards despite many years of intensive survey effort. The extrapolation of the observed species accumulation curve (S(ext)) indicates that increasing the survey effort by more than 100 % (i.e. from 283 to 566 samples) will likely record an additional four troglofauna species.

The sampling effort conducted to date across each of the deposit areas (BHT — 199 (including Biota 2015 sample effort of 41 samples); HD2 — 125), has exceeded the recommended minimum requirements of 60 impact samples for a Level 2 troglofauna survey (EPA 2016a, b). The total number of troglofauna samples collected is considered sufficient to provide a reliable characterisation of the troglofauna values present for the BHT and HD2 deposits within the Development Envelope to properly inform an EIA.

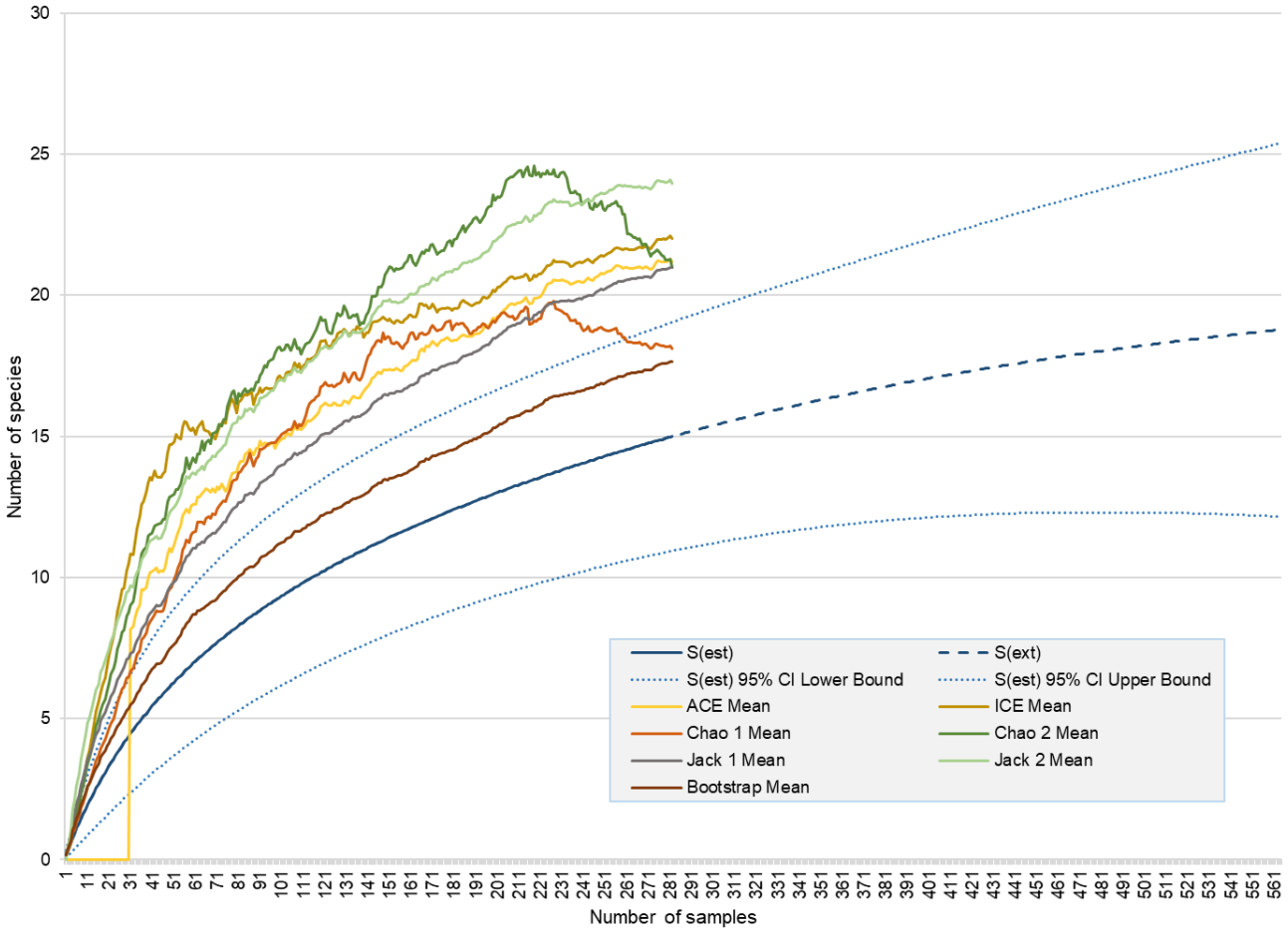

Figure 5-15: Troglofauna species accumulation curves for various diversity estimators and rarefaction curves for observed (S(est)) and extrapolated (S(ext) for the 2018 and 2019 results

Table 5-3: Observed 2018 and 2019 troglofauna species diversity for the Development Envelope compared to estimated diversity using EstimateS (Colwell 2013) diversity estimators

	Observed vs Estimated	Obs. & Pred. spp richness	% Predicted collected
Obs.	Sobs	15	
	Extrapolated (566 samples)	18.78	79.9%
Diversity estimators	Bootstrap Mean	17.7	84.9%
	Chao 1 Mean	18.1	82.9%
	Chao 2 Mean	21.0	71.5%
	Jack 1 Mean	21.0	71.5%
	ACE Mean	21.2	70.8%
	ICE Mean	22.0	68.1%
	Jack 2 Mean	24.0	62.6%
	Range	17.7 — 24	62.6 — 84.9%

6. Discussion

It is known in the Pilbara that the distribution of troglofauna can strongly depend on the continuity of the landforms in which they are found. A well documented example concerns the Robe Valley pisolitic mesas that have been shown to each host distinct troglofauna assemblages, with resident troglobitic species confined in distribution to a particular discrete landform (Burger *et al.* 2012; Harvey *et al.* 2008a; Humphreys *et al.* 2006). The genetic analysis of the Robe Valley schizomid fauna clearly demonstrated that six Mesa landforms each hosted an endemic schizomid species (Harvey *et al.* 2008a). This trend was also shown by other troglobitic arachnid and diplopod species (Burger *et al.* 2012). By contrast, the troglofauna distributions within HD2 Proposal Development Envelope indicate that the landforms present are not as isolated from the surrounding landscape as the Robe Valley Mesa's. The genetic analysis of the troglobitic schizomid material from in and around the Development Envelope demonstrated that both *Draculoides* `sp. SCH067`and *D*. `sp. SCH068`were not restricted to a single landform (**Figure 5-14**) (Abrams *et al.* 2019). The distribution of *D.* SCH067 was found to extend from the mapped BIF surface geology from within the BH deposit, north-eastwards to the Weeli Wolli calcrete system. *Draculoides* SCH068 was shown to extend in a southerly direction from near HD1, through BH to atop the BHT ridge system. *Eukoenenia* `sp. Biologic-PALP001` was also found to have a distribution that was not confined to a single landform, with specimens collected from both BHT and HD2 deposits (**Figure 5-14**).

The distribution range of *Draculoides* SCH068 within BH to BHT deposits correlated with the high confidence 3D modelled extent of prospective troglofauna habitat in and near the Development Envelope. The modelled habitat profiles showed that shallow to medium depth habitable profiles extend between both BH and BHT landforms, with deeper profiles occurring to varying depths along each landform. Within the high confidence modelled extent, shallow to medium habitat profiles were shown to occur within the mapped surface alluvial, colluvial and weathered and fractured outcrop formations of the Mount McRae Shale and Mount Sylvia Formations geological units. The deeper habitable profiles coincided more with the mapped BIF surface geological units present.

Seven of the troglofauna species recorded are known from a single specimen or site only. It is not possible to reliably assess the distribution range or habitat preferences of troglofauna species known from only a single location. The seemingly restricted distribution is considered more likely to be an artefact of that species occurring at a low population density and/or possessing an irregular distribution in response to varying habitat factors, biological interactions and availability of energy resources, rather than the actual distribution being confined to one limited area that was intercepted by a single drill hole.

Biological and physical surrogates can assist in determining likely species distributions and addressing the artefact of sampling difficulties associated with subterranean fauna, as recommended by the EPA (2016b). Considering the expanse of neighbouring geological habitat (physical surrogate) as well as reviewing records of closely related species, or species collected sympatrically (biological surrogates), can provide further insight into the potential distribution patterns of species that are known from limit records. The distribution of the troglobite and confirmed SRE, *D.* SCH068, along with the broader occurrence of the modelled habitat, support the notion that the species recorded to date from a single location are likely to possess a broader distribution within and around each landform.

7. Conclusion

The subterranean fauna assessment reported here has shown that the BHT and HD2 deposits do host a relatively diverse troglofauna assemblage with prospective modelled habitat present within the mineralised Brockman and Marra Mamba BIF, as well as within the associated alluvial, colluvial and fractured, weathered rock units.

8. Glossary

alluvium – sediment deposited by a stream or river

aquatic – relating to water

aquifer – a body of permeable rock or sediment capable of storing groundwater

arid – a region characterised by a severe lack of available water, to the extent that the growth and development of biota is hindered or prevented

bedrock – consolidated rock attached to the earth's crust

biodiversity – the diversity of biota in a particular environment or region

calcrete – carbonate deposits that form in arid environments, as a result of groundwater evaporation

cave – a subsurface cavity of sufficient size that a human could enter

dissolved oxygen – a measure of the amount of gaseous oxygen dissolved in a solution; oxic = > 3 mg/L; dysoxic = 0.3 to 3.0 mg/L; suboxic = < 0.3 mg/L levels

distribution range – the overall geographic area that a species is known to occur in

divergence – degree of separation from a common ancestor

diversity – a combination of species richness and abundance

drawdown – the lowering of the adjacent water table or piezometric surface as a result of groundwater extraction

ecotone – zone of transition among different ecosystems

electrical conductivity – an estimate of the total dissolved salts in a solution, or salinity

endemic – having a distribution restricted to a particular geographic region

epigean – pertaining to the surface zone

fractured rock – a rock formation characterized by separation or discontinuity, usually as a result of geological stress (e.g. faulting)

geological ages (e.g. Cainozoic) – distinct time periods within the geological history of the earth

groundwater – water occurring below the ground surface

habitat – an ecological or environmental area that is inhabited by a particular animal or plant species

hypogean – pertaining to the subterranean zone

hyporheic zone – spatially fluctuating ecotone within the bed of a river or stream between surface and groundwater. Considered important component of groundwater ecosystems and involved in the 'interstitial highway', forming hyporheic corridor linking associated aquifers.

invertebrates – animals lacking vertebrae

karst – a region of limestone or other soluble rock, characterized by distinctive features such as caves, caverns, sinkholes, underground streams and springs

lineage – a group of organisms related by descent from a common ancestor

molecular – pertaining to the genetic characteristics of an organism or group

morphology – the specific form and structure of an organism or taxon

morphospecies – a general grouping of organisms that share similar morphological traits, but is not necessarily defined by a formal taxonomic rank

palaeoriver, palaeochannel, palaeodrainage – a remnant of a stream or river channel cut in older rock and filled by the sediments of younger overlying rock

pH – a measure of the hydrogen ion concentration of a soil or solution (values below pH of 6.5 are 'acidic', and those above pH 7.5 are 'alkaline')

relictual – having survived as a remnant

salinity – the concentration of all dissolved salts in a solution. The salinity level classification *sensu* Hammer (1986): freshwater = salinity less than 5 mS/cm (3 ppt); hyposaline = salinity ranging from 5–30 mS/cm (3–20 ppt); mesosaline = salinity ranging from 30–70 mS/cm (20–50 ppt); hypersaline = salinity equal to or greater than 70 mS/cm (50 ppt)

semi-arid – a climatic region that receives low annual rainfall (250 – 500 mm)

species – a formal taxonomic unit defining a group or population of organisms that share distinctive characters or traits, are reproductively viable and/or are otherwise identifiable as a related group

species richness – the number of species present in a particular habitat, ecosystem or region

species accumulation curve – a model used to estimate species diversity or richness

standing water level (SWL) – the depth to groundwater from a particular reference point (e.g. in a monitoring bore)

stygal – pertaining to groundwater habitat or biota

stygobite – an obligate aquatic species of groundwater habitats

stygobiont – another term used to describe obligate inhabitants of groundwater systems

stygofauna – a general term for aquatic groundwater fauna

stygophile – an aquatic species that temporarily or permanently inhabits groundwater habitats

stygoxene – an aquatic species that has no fixed affinity with groundwater habitats, but may nonetheless occur in groundwater habitats

sympatry / sympatric – two or more species that are considered to exist in the same or overlapping geographic area and may regularly interact with, or encounter, each another (without interbreeding)

taxon (singular), taxa (plural) – an identifiable group of organisms, usually based on a known or inferred relationship or a shared set of distinctive characteristics

troglobite – an obligate terrestrial species of subterranean habitats

troglofauna – a general term for terrestrial subterranean fauna

troglomorphic features – morphological characteristics resulting from an adaptation to subterranean habitats (e.g. a reduction in pigment)

troglophile – a terrestrial species that temporarily or permanently inhabits subterranean habitats

trogloxene – a terrestrial species that has no fixed affinity with subterranean habitats, but may nonetheless occur in subterranean habitats

void – a pore space in the rock or stratum

Yilgarn – pertaining to the Yilgarn Craton, a 65,000 km2 body of the earth's crust in south-western Australia that dates back to the Archaean period, 2.6 to 3.7 million years ago

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Appendices



Draculoides SCH068

Appendix A Subterranean Fauna Survey Effort and Bore Details

Table A-1: 2018 and 2019 Troglofauna Survey Effort and Bore Details.

Deposit	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection method	Hole Angle	Hole Diameter (mm)
BHT	DD17BHT0020	716507.51	7450694.96	04/04/2019	30/05/2019	Litter Trap	90	150
BHT	DD17BHT0020	716507.51	7450694.96	04/04/2019	30/05/2019	Litter Trap	90	150
BHT	RC15HD10193	719110.49	7450383.67	27/10/2018		Net Scrape	90	150
BHT	RC15HD10193	719110.49	7450383.67	27/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC15HD10193	719110.49	7450383.67	01/04/2019		Net Scrape	90	150
BHT	RC15HD10193	719110.49	7450383.67	01/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC15HD10194	718685.72	7450144.64	01/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC15HD10194	718685.72	7450144.64	27/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC15HD10247	718662.53	7450690.96	01/04/2019		Net Scrape	90	150
BHT	RC15HD10247	718662.53	7450690.96	01/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC15HD10267	712308.25	7450892.62	04/11/2018		Net Scrape	90	150
BHT	RC15HD10267	712308.25	7450892.62	04/11/2018	16/01/2019	Litter Trap	90	150
BHT	RC15HD10267	712308.25	7450892.62	03/04/2019	29/05/2019	Litter Trap	<89	150
BHT	RC15HD10267	712308.25	7450892.62	03/04/2019		Net Scrape	<89	150
BHT	RC16BHT0037	713796.13	7450537.28	03/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC16BHT0084	711609.37	7450884.03	03/04/2019		Net Scrape	90	150
BHT	RC16BHT0084	711609.37	7450884.03	03/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC16BHT0084	711609.37	7450884.03	04/11/2018		Net Scrape	90	150
BHT	RC16BHT0084	711609.37	7450884.03	04/11/2018	16/01/2019	Litter Trap	90	150
BHT	RC16BHT0141	715811.79	7449993.92	01/04/2019		Net Scrape	90	150
BHT	RC16BHT0141	715811.79	7449993.92	01/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC16BHT0222	717806.82	7450396.58	01/04/2019		Net Scrape	90	150
BHT	RC16BHT0222	717806.82	7450396.58	01/04/2019	30/05/2019	Litter Trap	90	150
BHT	RC16BHT0222	717806.82	7450396.58	27/10/2018		Net Scrape	90	150
BHT	RC16BHT0222	717806.82	7450396.58	27/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC16BHT0268	718312.52	7451040.98	01/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC16BHT0268	718312.52	7451040.98	27/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC16BHT0291	718617.14	7450388.99	01/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC16BHT0293	718611.08	7450186.88	01/04/2019		Net Scrape	90	150
BHT	RC16BHT0293	718611.08	7450186.88	01/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC16BHT0293	718611.08	7450186.88	27/10/2018		Net Scrape	90	150
BHT	RC16BHT0293	718611.08	7450186.88	27/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC16BHT0300	718809.40	7450285.11	01/04/2019		Net Scrape	90	150
BHT	RC16BHT0300	718809.40	7450285.11	01/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC16BHT0308	719054.06	7450307.17	01/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC16BHT0308	719054.06	7450307.17	27/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0001	718816.70	7450798.35	01/04/2019		Net Scrape	90	150
BHT	RC18BHT0001	718816.70	7450798.35	01/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC18BHT0001	718816.70	7450798.35	27/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0001	718816.70	7450798.35	27/10/2018		Net Scrape	90	150

Deposit	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection method	Hole Angle	Hole Diameter (mm)
BHT	RC18BHT0003	718655.62	7451040.19	01/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC18BHT0003	718655.62	7451040.19	27/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0015	718410.27	7450689.14	01/04/2019		Net Scrape	90	150
BHT	RC18BHT0015	718410.27	7450689.14	01/04/2019	30/05/2019	Litter Trap	90	150
BHT	RC18BHT0015	718410.27	7450689.14	27/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0015	718410.27	7450689.14	27/10/2018		Net Scrape	90	150
BHT	RC18BHT0016	717795.63	7450034.46	01/04/2019		Net Scrape	90	150
BHT	RC18BHT0016	717795.63	7450034.46	01/04/2019	30/05/2019	Litter Trap	90	150
BHT	RC18BHT0016	717795.63	7450034.46	27/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0016	717795.63	7450034.46	27/10/2018		Net Scrape	90	150
BHT	RC18BHT0026	719209.77	7450684.91	01/04/2019		Net Scrape	90	150
BHT	RC18BHT0026	719209.77	7450684.91	01/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC18BHT0026	719209.77	7450684.91	27/10/2018		Net Scrape	90	150
BHT	RC18BHT0026	719209.77	7450684.91	27/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0030	719003.68	7450499.76	01/04/2019		Net Scrape	90	150
BHT	RC18BHT0030	719003.68	7450499.76	01/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC18BHT0030	719003.68	7450499.76	27/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0030	719003.68	7450499.76	27/10/2018		Net Scrape	90	150
BHT	RC18BHT0046	716810.71	7450634.78	06/04/2019	30/05/2019	Litter Trap	<89	150
BHT	RC18BHT0060	716212.19	7450640.66	06/04/2019	30/05/2019	Litter Trap	<89	150
BHT	RC18BHT0065	715906.44	7450515.62	06/04/2019	30/05/2019	Litter Trap	<89	150
BHT	RC18BHT0094	716491.71	7450037.46	01/04/2019		Net Scrape	90	150
BHT	RC18BHT0094	716491.71	7450037.46	01/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC18BHT0094	716491.71	7450037.46	27/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0094	716491.71	7450037.46	27/10/2018		Net Scrape	90	150
BHT	RC18BHT0099	716408.67	7450036.81	01/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC18BHT0099	716408.67	7450036.81	01/11/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0099	716408.67	7450036.81	27/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0100	716406.45	7450131.12	01/04/2019		Net Scrape	90	150
BHT	RC18BHT0100	716406.45	7450131.12	01/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC18BHT0100	716406.45	7450131.12	27/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0107	715907.37	7449952.58	01/04/2019		Net Scrape	90	150
BHT	RC18BHT0107	715907.37	7449952.58	01/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC18BHT0153	715006.28	7450637.41	03/04/2019	29/05/2019	Litter Trap	<89	150
BHT	RC18BHT0153	715006.28	7450637.41	03/04/2019		Net Scrape	<89	150
BHT	RC18BHT0153	715006.28	7450637.41	04/11/2018		Net Scrape	<89	150
BHT	RC18BHT0153	715006.28	7450637.41	04/11/2018	16/01/2019	Litter Trap	<89	150
BHT	RC18BHT0173	715956.82	7451789.11	04/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC18BHT0173	715956.82	7451789.11	04/04/2019		Net Scrape	90	150
BHT	RC18BHT0173	715956.82	7451789.11	26/10/2018		Net Scrape	90	150
BHT	RC18BHT0173	715956.82	7451789.11	26/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0174	716959.13	7452393.76	02/04/2019		Net Scrape	90	150
BHT	RC18BHT0174	716959.13	7452393.76	02/04/2019	28/05/2019	Litter Trap	90	150
BHT	RC18BHT0174	716959.13	7452393.76	27/10/2018		Net Scrape	90	150
BHT	RC18BHT0174	716959.13	7452393.76	27/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0175	716932.07	7451588.25	02/04/2019		Net Scrape	90	150

Deposit	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection method	Hole Angle	Hole Diameter (mm)
BHT	RC18BHT0175	716932.07	7451588.25	02/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC18BHT0175	716932.07	7451588.25	26/10/2018		Net Scrape	90	150
BHT	RC18BHT0175	716932.07	7451588.25	26/10/2018	15/01/2019	Litter Trap	90	150
BHT	RC18BHT0197	714406.16	7449994.68	03/04/2019	29/05/2019	Litter Trap	85	150
BHT	RC18BHT0197	714406.16	7449994.68	03/04/2019		Net Scrape	85	150
BHT	RC18BHT0197	714406.16	7449994.68	04/11/2018		Net Scrape	85	150
BHT	RC18BHT0197	714406.16	7449994.68	04/11/2018	16/01/2019	Litter Trap	85	150
BHT	RC18BHT0222	718946.25	7451734.91	31/03/2019		Net Scrape	90	50
BHT	RC18BHT0222	718946.25	7451734.91	26/10/2018		Net Scrape	90	50
BHT	RC18BHT0223	717978.97	7451595.46	31/03/2019		Net Scrape	90	50
BHT	RC18BHT0223	717978.97	7451595.46	26/10/2018		Net Scrape	90	50
BHT	RC18BHT0224	713106.69	7450602.75	03/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC18BHT0224	713106.69	7450602.75	03/04/2019		Net Scrape	90	150
BHT	RC18BHT0224	713106.69	7450602.75	04/11/2018		Net Scrape	90	150
BHT	RC18BHT0224	713106.69	7450602.75	04/11/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0246	714019.94	7450338.24	03/04/2019	29/05/2019	Litter Trap	85	150
BHT	RC18BHT0246	714019.94	7450338.24	03/04/2019		Net Scrape	85	150
BHT	RC18BHT0246	714019.94	7450338.24	04/11/2018		Net Scrape	85	150
BHT	RC18BHT0246	714019.94	7450338.24	04/11/2018	16/01/2019	Litter Trap	85	150
BHT	RC18BHT0248	712614.52	7450558.77	03/04/2019		Net Scrape	90	150
BHT	RC18BHT0248	712614.52	7450558.77	03/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC18BHT0248	712614.52	7450558.77	04/11/2018		Net Scrape	90	150
BHT	RC18BHT0248	712614.52	7450558.77	04/11/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0251	717007.23	7452000.81	02/04/2019		Net Scrape	90	150
BHT	RC18BHT0251	717007.23	7452000.81	02/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC18BHT0251	717007.23	7452000.81	26/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0251	717007.23	7452000.81	26/10/2018		Net Scrape	90	150
BHT	RC18BHT0252	718961.36	7452738.29	31/03/2019		Net Scrape	90	150
BHT	RC18BHT0252	718961.36	7452738.29	31/03/2019	30/05/2019	Litter Trap	90	150
BHT	RC18BHT0252	718961.36	7452738.29	26/10/2018		Net Scrape	90	150
BHT	RC18BHT0252	718961.36	7452738.29	26/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0253	718960.55	7452340.25	31/03/2019		Net Scrape	90	150
BHT	RC18BHT0253	718960.55	7452340.25	31/03/2019	30/05/2019	Litter Trap	90	150
BHT	RC18BHT0253	718960.55	7452340.25	31/03/2019	30/05/2019	Litter Trap	90	150
BHT	RC18BHT0253	718960.55	7452340.25	26/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0253	717978.97	7451595.46	06/03/2019	30/05/2019	Litter Trap	90	150
BHT	RC18BHT0253	717978.97	7451595.46	26/10/2018		Net Scrape	90	150
BHT	RC18BHT0254	718947.95	7452054.80	31/03/2019	30/05/2019	Litter Trap	90	150
BHT	RC18BHT0254	718947.95	7452054.80	31/03/2019	30/05/2019	Litter Trap	90	150
BHT	RC18BHT0254	718947.95	7452054.80	31/03/2019		Net Scrape	90	150
BHT	RC18BHT0254	718947.95	7452054.80	26/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0254	718961.58	7451459.44	26/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0254	718961.58	7451459.44	26/10/2018		Net Scrape	90	150
BHT	RC18BHT0255	718961.58	7451459.44	31/03/2019		Net Scrape	90	150
BHT	RC18BHT0255	718961.58	7451459.44	31/03/2019	30/05/2019	Litter Trap	90	150
BHT	RC18BHT0255	718961.58	7451459.44	26/10/2018		Net Scrape	90	150

Deposit	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection method	Hole Angle	Hole Diameter (mm)
BHT	RC18BHT0255	718961.58	7451459.44	26/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0256	717980.45	7452589.00	31/03/2019		Net Scrape	90	150
BHT	RC18BHT0256	717980.45	7452589.00	31/03/2019	29/05/2019	Litter Trap	90	150
BHT	RC18BHT0256	717980.45	7452589.00	26/10/2018		Net Scrape	90	150
BHT	RC18BHT0256	717980.45	7452589.00	26/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0257	717964.54	7452311.76	31/03/2019		Net Scrape	90	150
BHT	RC18BHT0257	717964.54	7452311.76	31/03/2019	30/05/2019	Litter Trap	90	150
BHT	RC18BHT0257	717964.54	7452311.76	26/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0257	717964.54	7452311.76	26/10/2018		Net Scrape	90	150
BHT	RC18BHT0258	717981.93	7451991.48	31/03/2019	29/05/2019	Litter Trap	90	150
BHT	RC18BHT0258	717981.93	7451991.48	26/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0259	720014.91	7452490.27	31/03/2019		Net Scrape	90	150
BHT	RC18BHT0259	720014.91	7452490.27	31/03/2019	29/05/2019	Litter Trap	90	150
BHT	RC18BHT0259	720014.91	7452490.27	26/10/2018	16/01/2019	Litter Trap	90	150
BHT	RC18BHT0304	712017.28	7450503.99	04/11/2018		Net Scrape	<89	150
BHT	RC18BHT0308	710112.85	7450789.25	03/04/2019		Net Scrape	85	150
BHT	RC18BHT0308	710112.85	7450789.25	03/04/2019	29/05/2019	Litter Trap	85	150
BHT	RC18BHT0308	710112.85	7450789.25	04/11/2018		Net Scrape	85	150
BHT	RC18BHT0308	710112.85	7450789.25	04/11/2018	16/01/2019	Litter Trap	85	150
BHT	RC18BHT0321	710310.13	7450889.44	03/04/2019		Net Scrape	<89	150
BHT	RC18BHT0321	710310.13	7450889.44	03/04/2019	29/05/2019	Litter Trap	<89	150
BHT	RC18BHT0321	710310.13	7450889.44	04/11/2018		Net Scrape	<89	150
BHT	RC18BHT0321	710310.13	7450889.44	04/11/2018	16/01/2019	Litter Trap	<89	150
BHT	RC18BHT0334	711209.48	7450589.41	03/04/2019		Net Scrape	85	150
BHT	RC18BHT0334	711209.48	7450589.41	03/04/2019	29/05/2019	Litter Trap	85	150
BHT	RC18BHT0334	711209.48	7450589.41	04/11/2018		Net Scrape	85	150
BHT	RC18BHT0334	711209.48	7450589.41	04/11/2018	16/01/2019	Litter Trap	85	150
BHT	RC18BHT0337	711134.17	7451117.50	03/04/2019	29/05/2019	Litter Trap	90	150
BHT	RC18BHT0339	711383.36	7450915.92	03/04/2019	29/05/2019	Litter Trap	<89	150
HD2	DD18HD20001	703535.89	7445768.32	05/04/2019		Net Scrape	85	150
HD2	DD18HD20001	703535.89	7445768.32	05/04/2019	30/05/2019	Litter Trap	85	150
HD2	DD18HD20001	703535.89	7445768.32	01/11/2018	16/01/2019	Litter Trap	85	150
HD2	DD18HD20001	703535.89	7445768.32	01/11/2018		Net Scrape	85	150
HD2	DD18HD20005	706347.95	7446082.22	04/04/2019	30/05/2019	Litter Trap	90	150
HD2	DD18HD20005	706347.95	7446082.22	04/04/2019		Net Scrape	90	150
HD2	DD18HD20005	706347.95	7446082.22	02/11/2018		Net Scrape	90	150
HD2	DD18HD20005	706347.95	7446082.22	02/11/2018	16/01/2019	Litter Trap	90	150
HD2	DD18HD20011	701273.17	7446530.66	05/04/2019	28/05/2019	Litter Trap	85	150
HD2	DD18HD20011	701273.17	7446530.66	31/10/2018	15/01/2019	Litter Trap	85	150
HD2	GD17HD20005	700316.57	7445268.04	06/04/2019	30/05/2019	Litter Trap	80	150
HD2	GD17HD20005	700316.57	7445268.04	01/11/2018	15/01/2019	Litter Trap	80	150
HD2	GD17HD20008	700873.79	7446681.57	05/04/2019	28/05/2019	Litter Trap	90	150
HD2	GD17HD20008	700873.79	7446681.57	05/04/2019		Net Scrape	90	150
HD2	GD17HD20008	700873.79	7446681.57	31/10/2018	15/01/2019	Litter Trap	90	150
HD2	GD17HD20008	700873.79	7446681.57	31/10/2018		Net Scrape	90	150
HD2	GD18HD20003	701212.24	7446427.06	05/04/2019	28/05/2019	Litter Trap	85	150

Deposit	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection method	Hole Angle	Hole Diameter (mm)
HD2	GD18HD20003	701212.24	7446427.06	05/04/2019		Net Scrape	85	150
HD2	GD18HD20003	701212.24	7446427.06	31/10/2018	15/01/2019	Litter Trap	85	150
HD2	GD18HD20003	701212.24	7446427.06	31/10/2018		Net Scrape	85	150
HD2	GD18HD20009	697798.98	7444823.81	06/04/2019	30/05/2019	Litter Trap	90	150
HD2	GD18HD20009	697798.98	7444823.81	31/10/2018	16/01/2019	Litter Trap	90	150
HD2	GD18HD20012	704545.61	7446082.45	05/04/2019	30/05/2019	Litter Trap	85	150
HD2	GD18HD20012	704545.61	7446082.45	01/11/2018	16/01/2019	Litter Trap	85	150
HD2	RC15HD200681	704687.73	7446117.04	01/11/2018	16/01/2019	Litter Trap	Vertical	150
HD2	RC15HD20788	700327.50	7445615.16	06/04/2019	30/05/2019	Litter Trap	<89	150
HD2	RC15HD20788	700327.50	7445615.16	01/11/2018	15/01/2019	Litter Trap	<89	150
HD2	RC16HD20171	697608.63	7444723.95	06/04/2019		Net Scrape	85	150
HD2	RC16HD20171	697608.63	7444723.95	06/04/2019	30/05/2019	Litter Trap	85	150
HD2	RC16HD20171	697608.63	7444723.95	06/04/2019	30/05/2019	Litter Trap	85	150
HD2	RC16HD20171	697608.63	7444723.95	31/10/2018		Net Scrape	85	150
HD2	RC16HD20171	697907.65	7444380.14	31/10/2018	15/01/2019	Litter Trap	85	150
HD2	RC16HD20174	697907.65	7444380.14	06/04/2019	30/05/2019	Litter Trap	70	150
HD2	RC16HD20174	697608.63	7444723.95	31/10/2018	15/01/2019	Litter Trap	70	150
HD2	RC17HD20002	699204.91	7444760.72	06/04/2019	30/05/2019	Litter Trap	70	150
HD2	RC17HD20002	699204.91	7444760.72	06/04/2019		Net Scrape	70	150
HD2	RC17HD20002	699204.91	7444760.72	01/11/2018	16/01/2019	Litter Trap	70	150
HD2	RC17HD20002	699204.91	7444760.72	01/11/2018		Net Scrape	70	150
HD2	RC17HD20011	699588.96	7444860.34	06/04/2019	30/05/2019	Litter Trap	75	150
HD2	RC17HD20011	699588.96	7444860.34	01/11/2018	15/01/2019	Litter Trap	75	150
HD2	RC17HD20068	702694.62	7445450.33	05/04/2019	30/05/2019	Litter Trap	85	150
HD2	RC17HD20068	702694.62	7445450.33	01/11/2018	16/01/2019	Litter Trap	85	150
HD2	RC17HD20074	702546.78	7446031.45	05/04/2019	30/05/2019	Litter Trap	<89	150
HD2	RC17HD20074	702546.78	7446031.45	05/04/2019		Net Scrape	<89	150
HD2	RC17HD20074	702546.78	7446031.45	01/11/2018	16/01/2019	Litter Trap	<89	150
HD2	RC17HD20074	702546.78	7446031.45	01/11/2018		Net Scrape	<89	150
HD2	RC17HD20234	698153.45	7445828.09	06/04/2019	30/08/2019	Litter Trap	90	150
HD2	RC17HD20234	698153.45	7445828.09	06/04/2019		Net Scrape	90	150
HD2	RC17HD20234	698153.45	7445828.09	01/11/2018		Net Scrape	90	150
HD2	RC17HD20234	698153.45	7445828.09	01/11/2018	16/01/2019	Litter Trap	90	150
HD2	RC17HD20237	697923.51	7446697.89	06/04/2019	30/05/2019	Litter Trap	90	150
HD2	RC17HD20237	697923.51	7446697.89	06/04/2019		Net Scrape	90	150
HD2	RC17HD20237	697923.51	7446697.89	31/10/2018	15/01/2019	Litter Trap	90	150
HD2	RC17HD20237	697923.51	7446697.89	31/10/2018		Net Scrape	90	150
HD2	RC17HD20240	699112.24	7446904.65	06/04/2019	30/05/2019	Litter Trap	<89	150
HD2	RC17HD20240	699112.24	7446904.65	06/04/2019		Net Scrape	<89	150
HD2	RC17HD20240	699112.24	7446904.65	01/11/2018	16/01/2019	Litter Trap	<89	150
HD2	RC17HD20240	699112.24	7446904.65	01/11/2018		Net Scrape	<89	150
HD2	RC17HD20252	698559.42	7446652.85	06/04/2019		Net Scrape	85	150
HD2	RC17HD20252	698559.42	7446652.85	06/04/2019	30/05/2019	Litter Trap	85	150
HD2	RC17HD20252	698559.42	7446652.85	01/11/2018	16/01/2019	Litter Trap	85	150
HD2	RC17HD20252	698559.42	7446652.85	01/11/2018		Net Scrape	85	150
HD2	RC18HD20019	700688.84	7446225.67	05/04/2019	28/05/2019	Litter Trap	90	150

Deposit	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection method	Hole Angle	Hole Diameter (mm)
HD2	RC18HD20019	700688.84	7446225.67	05/04/2019		Net Scrape	90	150
HD2	RC18HD20019	700688.84	7446225.67	31/10/2018	15/01/2019	Litter Trap	90	150
HD2	RC18HD20019	700688.84	7446225.67	31/10/2018		Net Scrape	90	150
HD2	RC18HD20071	701479.45	7445959.73	05/04/2019	28/05/2019	Litter Trap	80	150
HD2	RC18HD20071	701479.45	7445959.73	05/04/2019		Net Scrape	80	150
HD2	RC18HD20071	701479.45	7445959.73	31/10/2018		Net Scrape	80	150
HD2	RC18HD20071	701479.45	7445959.73	31/10/2018	15/01/2019	Litter Trap	80	150
HD2	RC18HD20073	702909.54	7445398.59	05/04/2019	30/05/2019	Litter Trap	90	150
HD2	RC18HD20073	702909.54	7445398.59	05/04/2019		Net Scrape	90	150
HD2	RC18HD20073	702909.54	7445398.59	01/11/2018		Net Scrape	90	150
HD2	RC18HD20073	702909.54	7445398.59	01/11/2018	16/01/2019	Litter Trap	90	150
HD2	RC18HD20120	704944.92	7446738.68	04/04/2019	30/05/2019	Litter Trap	90	150
HD2	RC18HD20120	704944.92	7446738.68	04/04/2019		Net Scrape	90	150
HD2	RC18HD20120	704944.92	7446738.68	02/11/2018		Net Scrape	90	150
HD2	RC18HD20120	704944.92	7446738.68	02/11/2018	16/01/2019	Litter Trap	90	150
HD2	RC18HD20160	706265.33	7446420.18	04/04/2019	29/05/2019	Litter Trap	90	150
HD2	RC18HD20160	706265.33	7446420.18	01/11/2018	16/01/2019	Litter Trap	90	150
HD2	RC18HD20171	706799.23	7446351.34	04/04/2019		Net Scrape	90	150
HD2	RC18HD20171	706799.23	7446351.34	04/04/2019	30/05/2019	Litter Trap	90	150
HD2	RC18HD20171	706799.23	7446351.34	02/11/2018	16/01/2019	Litter Trap	90	150
HD2	RC18HD20171	706799.23	7446351.34	02/11/2018		Net Scrape	90	150
HD2	RC18HD20202	707057.50	7446163.58	04/04/2019	30/05/2019	Litter Trap	85	150
HD2	RC18HD20202	707057.50	7446163.58	04/04/2019		Net Scrape	85	150
HD2	RC18HD20202	707057.50	7446163.58	02/11/2018		Net Scrape	85	150
HD2	RC18HD20202	707057.50	7446163.58	02/11/2018	15/01/2019	Litter Trap	85	150
HD2	RC18HD20240	707405.28	7446402.07	04/04/2019	30/05/2019	Litter Trap	80	150
HD2	RC18HD20240	707405.28	7446402.07	04/04/2019		Net Scrape	80	150
HD2	RC18HD20240	707405.28	7446402.07	02/11/2018	16/01/2019	Litter Trap	80	150
HD2	RC18HD20266	705167.45	7445881.79	04/04/2019	30/05/2019	Litter Trap	85	150
HD2	RC18HD20266	705167.45	7445881.79	04/04/2019		Net Scrape	85	150
HD2	RC18HD20266	705167.45	7445881.79	02/11/2018	16/01/2019	Litter Trap	85	150
HD2	RC18HD20266	705167.45	7445881.79	02/11/2018		Net Scrape	85	150
HD2	RC18HD20274	700796.08	7446409.02	05/04/2019	28/05/2019	Litter Trap	90	150
HD2	RC18HD20274	700796.08	7446409.02	31/10/2018	14/01/2019	Litter Trap	90	150
HD2	RC18HD20290	698975.22	7444968.21	06/04/2019	30/05/2019	Litter Trap	90	150
HD2	RC18HD20290	698975.22	7444968.21	06/04/2019		Net Scrape	90	150
HD2	RC18HD20290	698975.22	7444968.21	01/11/2018	15/01/2019	Litter Trap	90	150
HD2	RC18HD20290	698975.22	7444968.21	01/11/2018		Net Scrape	90	150
HD2	RC18WON0020	701007.37	7447803.27	06/04/2019	28/05/2019	Litter Trap	90	150
HD2	RC18WON0020	701007.37	7447803.27	06/04/2019		Net Scrape	90	150
HD2	RC18WON0020	701007.37	7447803.27	31/10/2018		Net Scrape	90	150
HD2	RC18WON0020	701007.37	7447803.27	31/10/2018	15/01/2019	Litter Trap	90	150
HD2	RC18WON0021	700997.71	7447605.99	06/04/2019	28/05/2019	Litter Trap	90	150
HD2	RC18WON0021	700997.71	7447605.99	06/04/2019		Net Scrape	90	150
HD2	RC18WON0021	700997.71	7447605.99	31/10/2018		Net Scrape	90	150
HD2	RC18WON0021	700997.71	7447605.99	31/10/2018	15/01/2019	Litter Trap	90	150

Deposit	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection method	Hole Angle	Hole Diameter (mm)
HD2	RC18WON0023	700997.85	7447401.44	06/04/2019	28/05/2019	Litter Trap	90	150
HD2	RC18WON0023	700997.85	7447401.44	06/04/2019		Net Scrape	90	150
HD2	RC18WON0023	700997.85	7447401.44	31/10/2018		Net Scrape	90	150
HD2	RC18WON0023	700997.85	7447401.44	31/10/2018	15/01/2019	Litter Trap	90	150
HD2	RC18WON0025	698603.12	7448098.52	06/04/2019	30/05/2019	Litter Trap	90	150
HD2	RC18WON0025	698603.12	7448098.52	31/10/2018	15/01/2019	Litter Trap	90	150
HD2	RC18WON0026	698600.62	7447996.30	06/04/2019		Net Scrape	90	150
HD2	RC18WON0026	698600.62	7447996.30	06/04/2019	30/05/2019	Litter Trap	90	150
HD2	RC18WON0026	698600.62	7447996.30	31/10/2018		Net Scrape	90	150
HD2	RC18WON0026	698600.62	7447996.30	31/10/2018	16/01/2019	Litter Trap	90	150
HD2	RC18WON0029	697802.21	7448398.22	06/04/2019	30/05/2019	Litter Trap	90	150
HD2	RC18WON0029	697802.21	7448398.22	06/04/2019		Net Scrape	90	150
HD2	RC18WON0029	697802.21	7448398.22	31/10/2018		Net Scrape	90	150
HD2	RC18WON0029	697802.21	7448398.22	31/10/2018	15/01/2019	Litter Trap	90	150
HD2	RC18WON0031	697797.57	7448603.03	31/10/2018		Net Scrape	90	150
HD2	RC18WON0031	697797.57	7448603.03	31/10/2018	15/01/2019	Litter Trap	90	150

Appendix B Molecular Analyses







Hope Downs 1
Subterranean Fauna
Molecular Systematics Analysis

Biologic Environmental Survey

Report to Stantec Pty Ltd

November 2019



1 INTRODUCTION

Stantec Pty Ltd (Stantec) commissioned Biologic Environmental Survey (Biologic) to undertake a molecular systematics analysis (DNA barcoding) of 44 subterranean fauna (stygofauna and troglofauna) specimens collected from Rio Tinto's Hope Downs 1 (HDOW1) Project (the Study Area).

1.1 Aims and objectives

The aims and objectives of the molecular systematics analysis were to:

- Undertake DNA sequencing of 44 subterranean fauna specimens to obtain barcoding sequences of the mitochondrial gene Cytochrome Oxidase I (COI; Hebert *et al.* 2003), and the nuclear gene 12S for Zygentoma specimens;
- Investigate the interspecific and intraspecific relationships between sequences of each higher taxonomic group (i.e. use the results of the DNA analysis to indicate how many different species/ OTUs are likely to occur within each genus or relevant higher taxon, based on published species-thresholds); and
- Investigate the relationships between sequences from the HDOW1 specimens and relevant previous sequences from the wider Pilbara region, using available DNA databases (i.e. compare the results of the current analysis with accessible DNA databases to assess whether any of the species/ OTUs from the Study Area have been collected previously or more widely beyond the Study Area).

This document reports the methods and results of the molecular systematics analysis. Any remaining specimen material has been returned to Stantec, and sequence data has been incorporated within the Rio Tinto (RTIO) molecular sequence database and uploaded to GenBank as per Rio Tinto requirements.

2 METHODS

2.1 Sub-sample preparation

A total of 44 subterranean fauna specimens collected from the HDOW1 Study Area by Stantec, were sent to Biologic for molecular systematics analysis. The specimens belonged to seven different classes comprising 11 orders, nine families, and eight genera, based on morphological identifications conducted by Stantec.

Where whole specimens were submitted, Biologic undertook tissue preparation by removing a leg, briefly drying off the ethanol, and placing the tissue in ATL buffer. Where tissue was submitted, these were briefly dried and placed in ATL buffer at Biologic's laboratories. In all instances, greatest care was taken to decontaminate all tools and equipment between samples, using bleach and repeated rinsing in deionised water. Table 2.1 provides morphological identification details for each specimen included in the analysis.

Table 2.1: Specimens and tissue samples included in the analysis (ordered by taxon and lot number).

Area	Site Name	Higher taxon	Morphological ID	Sample	Lot No. (LN)	BMR Code
BBH	MB16SW0006	Amphipoda	*Pilbarus* nr *millsi* OES12	Tissue	LN35584	BMR00484
BBH	MB16HD1SW0006	Amphipoda	Amphipoda sp.	1	LN35145	BMR00488
BHT	RC18BHT0334	Blattodea	*Nocticola* OES13	1	LN33372	BMR00373
BHT	RC18BHT0254	Blattodea	*Nocticola* OES13	tissue female	LN36582	BMR00374
BHT	DD17BHT0020	Blattodea	*Nocticola* OES13	1	LN37412	BMR00376
BHT	RC18BHT0016	Blattodea	*Nocticola* OES12	1	LN35427	BMR00377
BHT	RC18BHT0001	Blattodea	*Nocticola* OES12	1	LN33391	BMR00424
HD2	RC16HD20174	Blattodea	*Nocticola* OES13	1	LN36514	BMR00425
BHT	RC18BHT0224	Blattodea	*Nocticola* OES13	1 female	LN33532	BMR00426
HD2	RC17HD20011	Blattodea	*Nocticola* OES13	1 male	LN33514	BMR00427
HD2	GD18HD20009	Blattodea	*Nocticola* OES13	1	LN39408	BMR00428
BHT	RC18BHT0258	Blattodea	*Nocticola* OES12	1	LN37424	BMR00429
BHT	RC18BHT0099	Blattodea	*Nocticola* OES12	1	LN38726	BMR00430
HD2	RC18HD20171	Blattodea	*Nocticola* OES12	1	LN34133	BMR00431
BHT	RC18BHT0308	Blattodea	*Nocticola* OES13	1	LN34509	BMR00432
BHT	RC18BHT0026	Blattodea	*Nocticola* OES12	1 female	LN37717	BMR00433
BHT	RC18BHT0016	Blattodea	*Nocticola* OES13	1	LN34142	BMR00434
BHT	RC18BHT0248	Blattodea	*Nocticola* OES13	1	LN37718	BMR00435
HD2	DD18HD20001	Blattodea	*Nocticola* OES13	1	LN35535	BMR00437
BHT	RC16BHT0291	Blattodea	*Nocticola* OES13	tissue	LN38585	BMR00485
BHT	RC18BHT0254	Blattodea	*Nocticola* OES13	tissue male	LN33574	BMR00493
BHT	RC15BHT0267	Blattodea	*Nocticola* OES13	1	LN36536	BMR00497
HD2	DD18HD20005	Chilopoda	Scolopendromorpha sp.	1	LN37426	BMR00489
HD2	RC17HD20234	Diplura	*Indjapx* OES7	1	LN33785	BMR00490
BHT	DD17BHT0020	Hemiptera	*Nisia* OES16	1	LN35425	BMR00375
BHT	RC15BHT0267	Hemiptera	*Nisia* OES16	1	LN36535	BMR00436
BHT	RC16HD10193	Hemiptera	*Phaconeura* OES15	1	LN33774	BMR00486
BHT	RC16BHT0222	Hemiptera	*Nisia* OES16	1	LN33789	BMR00487
BBH	RC14HD10072	Hemiptera	*Phaconeura* OES15	1	LN35120	BMR00553
BHT	RC18BHT0030	Hemiptera	*Phaconeura* indet	1	LN32758	BMR00554
HD2	RC18HD20120	Palpigradi	*Eukoenenia* OES2	1	LN39264	BMR00707
BHT	RC16BHT0141	Palpigradi	*Eukoenenia* OES2	1	LN39263	BMR00780
BHT	RC18BHT0100	Pauropoda	Pauropoda sp.	1	LN35790	BMR00491
BHT	RC18BHT0258	Polyxenida	Lophoproctidae sp.	1	LN38435	BMR00492
BHT	RC18BHT0248	Pseudo-scorpiones	*Tyrannochthonius* OES20	1	LN35130	BMR00779
BHT	RC15BHT0267	Schizomida	*Draculoides* ?BHD4/ BHD5	Tissue	LN37569	BMR00528
BHT	RC15BHT0267	Schizomida	*Draculoides* ?BHD4/ BHD5	Tissue	LN38573	BMR00588

Area	Site Name	Higher taxon	Morphological ID	Sample	Lot No. (LN)	BMR Code
BHT	DD17BHT0020	Schizomida	*Draculoides* ?BHD4/ BHD5	Tissue	LN35582	BMR00648
BHT	RC18BHT0026	Schizomida	*Draculoides* ?BHD4/ BHD5	Tissue	LN38567	BMR00708
BHT	RC16HD10193	Schizomida	*Draculoides* ?BHD4/ BHD5	Tissue	LN33570	BMR00775
BHT	RC16HD10193	Schizomida	*Draculoides* ?BHD4/ BHD5	Tissue	LN33590	BMR00776
BHT	DD17BHT0020	Schizomida	*Draculoides* ?BHD4/ BHD5	Tissue	LN35572	BMR00777
BHT	RC15BHT0267	Schizomida	*Draculoides* ?BHD4/ BHD5	Tissue	LN36580	BMR00778
BHT	RC15BHT0267	Zygentoma	Ateluridae sp.	1	LN39280	BMR00555

Note: HD2 = Hope Downs 2; BBH = Baby Hope; and BHT = Bedded Hill Top.

2.2 DNA extraction, amplification and sequencing

DNA extraction and sequencing methods followed Cullen and Harvey (2017, 2018), as follows:

Subsampled tissue was placed directly into ATL buffer for extraction using the *QIAGEN DN-easy* extraction kit. 20µl of proteinase K was added and incubated overnight at 56°C, immediately prior to extraction. DNA samples were amplified by Polymerase Chain Reaction (PCR) using Folmer PCR primers (LCO1490, HCO2198; Folmer *et al.* 1994) to assess the variability of COI for taxa other than Zygentoma. Zygentoma samples were amplified using 12S primers (12Sai, 12Sbi; Simon *et al.* 1994).

Resulting PCR product was sequenced by the Australian Genomic Research Facility (AGRF) Perth node. Specimen records, extraction data, PCR results, and DNA sequence data were managed using GENEIOUS v 10.1.2 (Kearse *et al.* 2012) with the Biocode plugin (http://www.mooreabiocode.org).

2.3 Analysis of sequence alignments/ divergence

Raw sequence data were edited and assembled in GENEIOUS. Consensus sequences were BLASTed against GenBank to determine nearest matches within the target higher taxonomic group. The consensus sequences were then aligned using MAFFT (Multiple Alignment using Fast Fourier Transform) algorithm (Katoh *et al.* 2002). Trees were constructed on resulting alignments using the Geneious Tree Builder using Tamura-nei Genetic Distance Model and Neighbour-joining as the Tree Build Method. Sequence data obtained using the 12S primers were edited, aligned and resulting consensus sequences BLASTed against GenBank. Regional sequences were obtained from RTIO's molecular sequence database as well as genetic data from accessible previous reports (Helix Molecular Solutions) and were included in the tree building analyses.

Lineages determined in this study were defined using molecular data with reference to morphological identifications undertaken by Stantec. These designations were specific to each higher taxon and the level of taxonomic certainty involved. Fauna-specific thresholds for determining species-level divergence were used wherever possible, based on published literature and available previous reports.

Where fauna-specific thresholds from literature or reports were not available, the assessment used average divergence thresholds for related groups or higher taxa developed by broad-level studies (e.g. Hebert *et al.* 2003).

Based on the number of specimens within each taxonomic level, DNA comparisons were typically conducted at the order level as follows:

- Amphipoda (2 specimens, plus regional comparisons);
- Blattodea (20 specimens, plus regional comparisons);
- Chilopoda (1 specimen, plus regional comparisons);
- Diplura (1 specimen, plus regional comparisons);
- Hemiptera (6 specimens, plus regional comparisons);
- Palpigradi (2 specimens, plus regional comparisons);
- Pauropoda (1 specimen, plus regional comparisons);
- Polyxenida (1 specimen, plus regional comparisons);
- Pseudoscorpiones (1 specimen, plus regional comparisons);
- Schizomida (8 specimens, plus regional comparisons); and
- Zygentoma (1 specimen, plus regional comparisons).

2.4 Constraints and Limitations

The analysis was constrained by the breadth of data available to undertake comparisons, the accessibility of pre-existing regional sequences, and the success rate of genetic sequencing, which can be affected by specimen collection, preservation, and storage methods, as well as contamination. Our understanding is that best practises were followed during specimen collection, preservation, and storage, prior to specimens arriving at Biologic. All care was taken to ensure that the risks of laboratory contamination, data handling issues, and specimen management issues were minimised within Biologic's laboratories throughout the subsampling, processing and genetic analysis. This was largely reflected in the results, with a low rate of sequence failure (5/44 sequences, or 11%) and no contaminated samples detected.

The databases used for regional comparisons were limited to Genbank, the RTIO molecular sequence database, and available data from previous genetic reports conducted for RTIO (by Helix Molecular Solutions). While these sequence databases, in combination, comprise a large portion of the subterranean fauna genetic work that has been undertaken for RTIO in the Pilbara region, it is acknowledged that there may be many other relevant sequences from third party project areas nearby or elsewhere in the region that were not available for comparison at the time of the study.

DNA barcoding using the mitochondrial gene COI, while useful for explaining genetic differences between closely-related or moderately-related species, is limited in its ability to resolve deeper phylogenies/ relationships between taxa at higher taxonomic levels (e.g. genus, family, order). In the current study, phylogenetic relationships between species/ OTUs at >25% COI divergence are treated with caution. If further resolution of deeper phylogeny is important for project goals, this could be investigated using a multiple gene approach.

3 RESULTS AND DISCUSSION

3.1 Amphipoda

Two specimens of Amphipoda (LN35584 and LN35145) were successfully sequenced from Baby Hope, from bores MB16SW0006 and MB16HD1SW0006 respectively. The two sequences showed a negligible level of divergence within their lineage (`Biologic-AMPH001`), indicating a single OTU (<0.1% COI). Stantec's morphological identifications of one of these specimens revealed a paramelitid amphipod, *Pilbarus* OES12 (nr *millsi*). The genetic results indicate that both specimens can be considered to belong to this taxon. Figure 3.1 shows a neighbour joining tree based on a comparison of 38 Amphipoda sequences from the available regional databases while Appendix 1 shows pairwise comparisons of sequences from the Study Area vs the sequence databases.

The sequences from the Study Area were not closely aligned (26%-45% COI) with any of the sequences included in these comparisons, suggesting that *Pilbarus* OES12 (nr millsi) has not been sequenced from elsewhere in the region (Figure 3.1, Appendix 1). There was a relatively high level of divergence (27%-29% COI) from previous specimens in the same taxonomic group, including *Pilbarus* and *Yilgarus* sequences from Paraburdoo/ Turee Creek, and Paramelitidae sequences from Yandi and Weeli Wolli. However, the average divergence compared to other Amphipoda taxa was the same or even higher; 29%-35% divergence from Bogidiellidae at Paraburdoo and Robe Valley, 39%-40% from *Nedsia* and Eriopsidae from Paraburdoo and Robe Valley, and 45% from Niphargidae at Tods Bore (Appendix 1).

Further genetic and morphological work may be required to validate the phylogenetic relationships of the current sequences with *Pilbarus* OES12 (nr millsi). Nevertheless, based on current results, Lineage `Biologic-AMPH001`/ *Pilbarus* OES12 (nr millsi) appears to represent a new/ unique OTU currently known only from the Study Area.

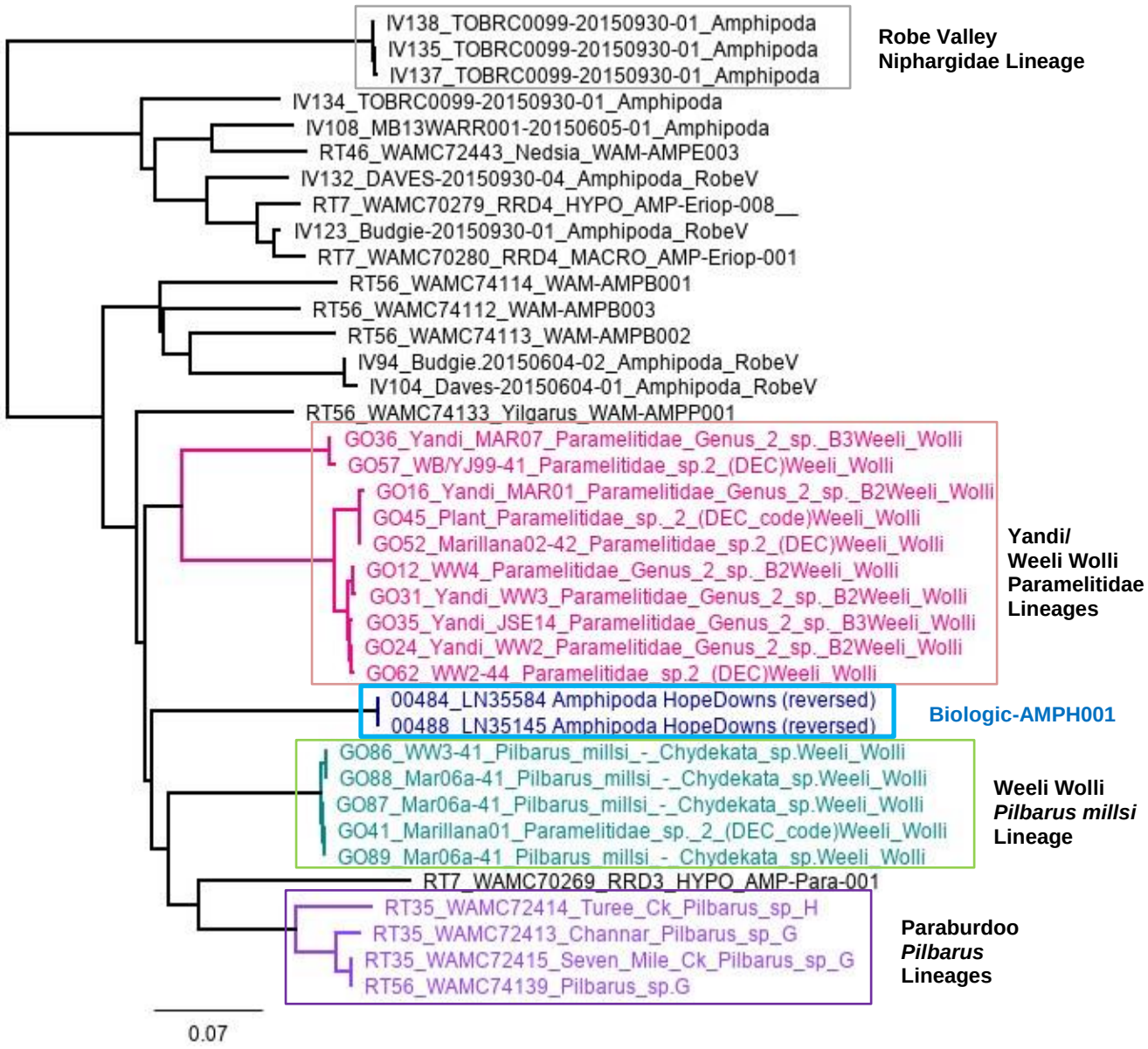

Figure 3.1. Neighbour Joining tree of Amphipoda haplotypes included in the analysis. Lineages from the Study Area are indicated by blue text.

3.2 Blattodea

All 20 specimens of Blattodea from Bedded Hill Top and Hope Downs 2 were successfully sequenced. Local comparisons revealed four lineages (intraspecific variability <3% COI), representing three to four potential OTUs (Table 3.1, Figure 3.2):

- *Nocticola* `Biologic-BLAT001` (LN34133, Hope Downs 2);
- *Nocticola* `Biologic-BLAT002` (LN33372, LN33532, LN34509, LN36536, and LN37718, Bedded Hill Top);
- *Nocticola* `Biologic-BLAT003` (LN33514, LN33574, LN35535, LN36514, LN36582, LN37412, and LN39408, Hope Downs 2 and Bedded Hill Top); and
- *Nocticola* `Biologic-BLAT004` (LN33391, LN35427, LN37424, LN37717, LN38726, LN34142, and LN38585, Bedded Hill Top).

Three of the four lineages (Biologic-BLAT002, BLAT003, and BLAT004) were well supported at COI divergences >8% (Appendix 2), indicating distinct species/ OTUs (based on average divergence thresholds Hebert *et al.* 2003). Lineage BLAT001 was only 7% different to BLAT002, indicating a borderline population/ species-level divergence, which may reflect geographical separation between Biologic-BLAT001 occurring in HD2 and BLAT002 in BHT. Nevertheless, based on a recent molecular study by Trotter *et al.* 2017 showing 3%-4% divergences between *Nocticola* species/ OTUs, 7% could be considered to indicate species-level divergence in *Nocticola*.

Table 3.1. Genetic results of *Nocticola* specimens from the Study Area (lineages represented by highlighted colours).

Area	Site Name	Morphological ID	No. of Individuals	Lot No. (LN)	BMR Code	Biologic-BLAT Lineage
HD2	RC17HD20011	*Nocticola* OES13	1 male	LN33514	BMR00427	003
BHT	RC18BHT0254	*Nocticola* OES13	tissue male	LN33574	BMR00493	003
HD2	DD18HD20001	*Nocticola* OES13	1	LN35535	BMR00437	003
HD2	RC16HD20174	*Nocticola* OES13	1	LN36514	BMR00425	003
BHT	RC18BHT0254	*Nocticola* OES13	tissue female	LN36582	BMR00374	003
BHT	DD17BHT0020	*Nocticola* OES13	1	LN37412	BMR00376	003
HD2	GD18HD20009	*Nocticola* OES13	1	LN39408	BMR00428	003
HD2	RC18HD20171	*Nocticola* OES12	1	LN34133	BMR00431	001
BHT	RC18BHT0334	*Nocticola* OES13	1	LN33372	BMR00373	002
BHT	RC18BHT0224	*Nocticola* OES13	1 female	LN33532	BMR00426	002
BHT	RC18BHT0308	*Nocticola* OES13	1	LN34509	BMR00432	002
BHT	RC15BHT0267	*Nocticola* OES13	1	LN36536	BMR00497	002
BHT	RC18BHT0248	*Nocticola* OES13	1	LN37718	BMR00435	002
BHT	RC18BHT0001	*Nocticola* OES12	1	LN33391	BMR00424	004
BHT	RC18BHT0016	*Nocticola* OES12	1	LN35427	BMR00377	004
BHT	RC18BHT0258	*Nocticola* OES12	1	LN37424	BMR00429	004
BHT	RC18BHT0026	*Nocticola* OES12	1 female	LN37717	BMR00433	004
BHT	RC18BHT0099	*Nocticola* OES12	1	LN38726	BMR00430	004
BHT	RC18BHT0016	*Nocticola* OES13	1	LN34142	BMR00434	004
BHT	RC16BHT0291	*Nocticola* OES13	tissue	LN38585	BMR00485	004

The genetic results did not match the morphological identifications, which determined only two OTUs (*N*. OES12 and *N*. OES13). While the morphological identifications within Lineages BLAT001, BLAT002, and BLAT003 were consistent (within each respective lineage), the high COI divergence (36%-39%) between Lineages BLAT002 and BLAT003 (both morphologically identified as *N*. OES13) suggested cryptic morphology or further taxonomic work may be required (Appendix 2).

In addition, BLAT004 contained specimens morphologically identified as both *N*. OES12 and *N*. OES13 (Table 3.1), despite intraspecific variability <1.1% (COI). Lineage BLAT003 showed slight intraspecific variability (2%-3% COI), although this was not consistent between specimens from the two different sampling areas; therefore, it is uncertain whether there could be separated populations within this lineage (Appendix 2).

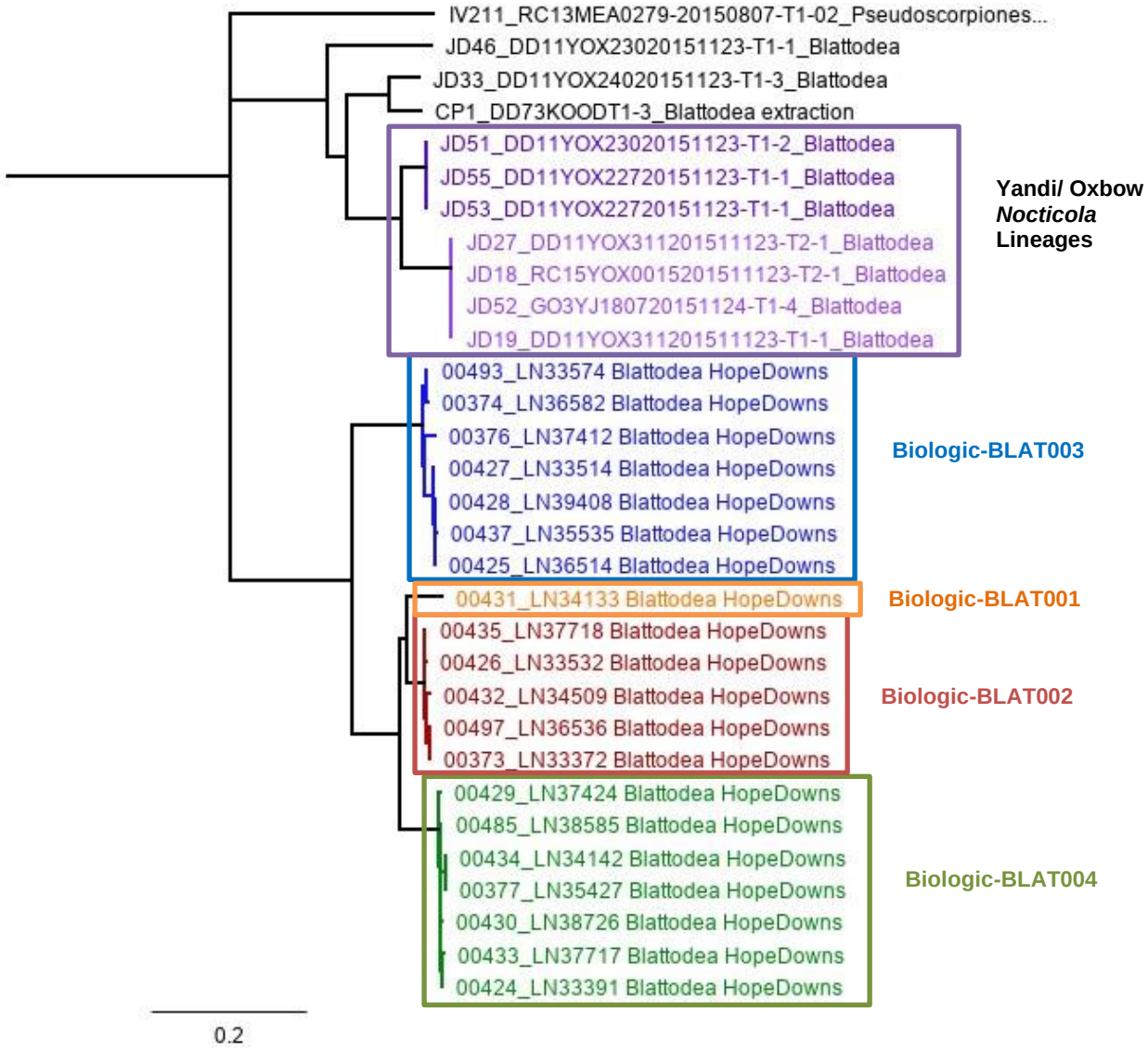

Figure 3.2. Neighbour Joining tree of Blattodea haplotypes (COI) included in the analysis. Lineages are indicated by coloured text.

In terms of sampling areas, Biologic-BLAT001, BLAT002, and BLAT004 were consistently collected from a single sampling area per lineage, while BLAT003 was collected in both Bedded Hill Top and Hope Downs 2. This suggests the potential for complicated evolutionary patterns such as allopatric and sympatric speciation, or multiple colonisations of subterranean habitats amongst the different OTUs of *Nocticola* from the Study Area.

Regional comparisons (Figure 3.2, Appendix 2) revealed that all sequences from the Study Area showed a high level of divergence (minimum 43% COI) from previous material based on a comparison of 11 regional sequences from the available databases. At this level of divergence all four lineages/ OTUs from the Study Area would be considered regionally unique (based on available sequences although further genetic (and potentially further morphological work) may be required to verify the deeper phylogenetic relationships.

3.3 Chilopoda

One specimen of Chilopoda (Scolopendromorpha sp.) (LN37426) was successfully sequenced at the COI gene (Biologic-CHIL001).

Regional comparisons (Figure 3.3) with previous sequences revealed a high COI divergence (min 21%) indicating that the lineage from the Study Area is not represented in the available sequence databases. This result was based on a comparison of 16 available subterranean Chilopoda sequences from the Pilbara region, and used the epigean species *Scolopendra mortisans* as an outgroup (Appendix 3).

Divergences were generally high between most lineages/ OTUs within the Chilopoda, excluding sequences likely representative of intraspecific variability (i.e. COI divergences below 3%) (Appendix 3). In this broader context the high divergences between Biologic-CHIL001 from the Study Area and other regional sequences was not considered out of trend with the rest of the group.

Based on comparisons with available databases, the Scolopendromorpha sp. `Biologic-CHIL001` collected from the Study Area appears to represent a new/ unique OTU that has not been sequenced elsewhere in the region.

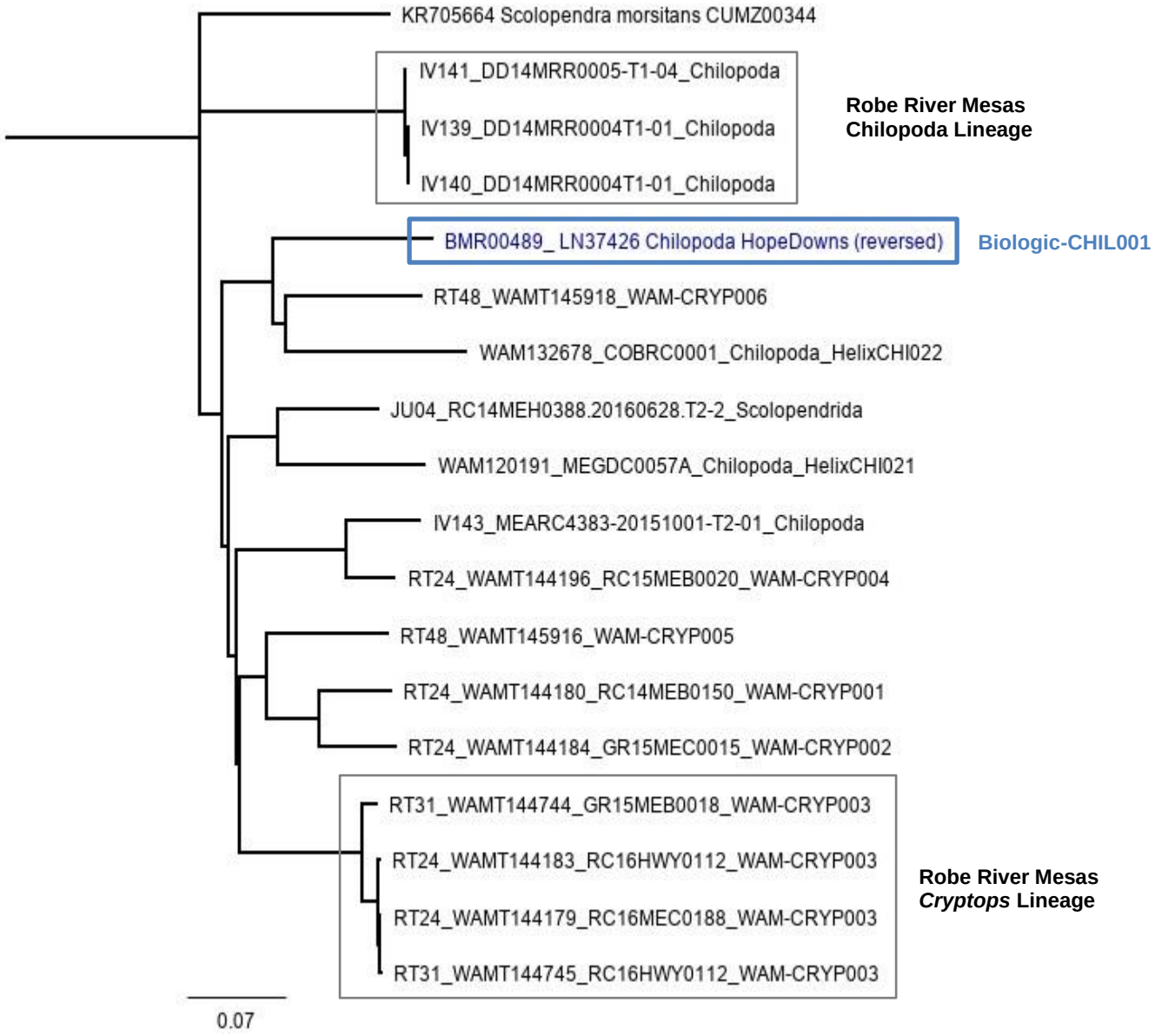

Figure 3.3. Neighbour Joining tree of Chilopoda haplotypes included in the analysis. Lineages from the Study Area are indicated by coloured text.

3.4 Diplura

One specimen of Diplura (LN33785; identified as *Indjapyx* OES7) was successfully sequenced (COI).

Regional comparisons (Figure 3.4) with previous sequences in Genbank and the RTIO databases revealed a high level of divergence (min 16% COI), indicating that Lineage DIPL001 from the Study Area is not represented elsewhere in the available sequence databases. This result was based on a comparison of 32 available Diplura sequences from the Pilbara region within the available sequence databases, and a Ptiliidae beetle was used as an outgroup (Figure 3.4, Appendix 4).

The dipluran sequenced from the Study Area (Lineage DIPL001) was closest to other diplurans identified as Japygidae, but at the high levels of divergence recorded (16%-19% COI), and due the lack of genus level identifications for most of the other sequences, further genetic or morphological information would be required to validate the phylogeny shown in Figure 3.4.

Indjapyx OES7 (Biologic-DIPL001) appears to represent a new/ unique OTU based on current comparisons with the available genetic databases.

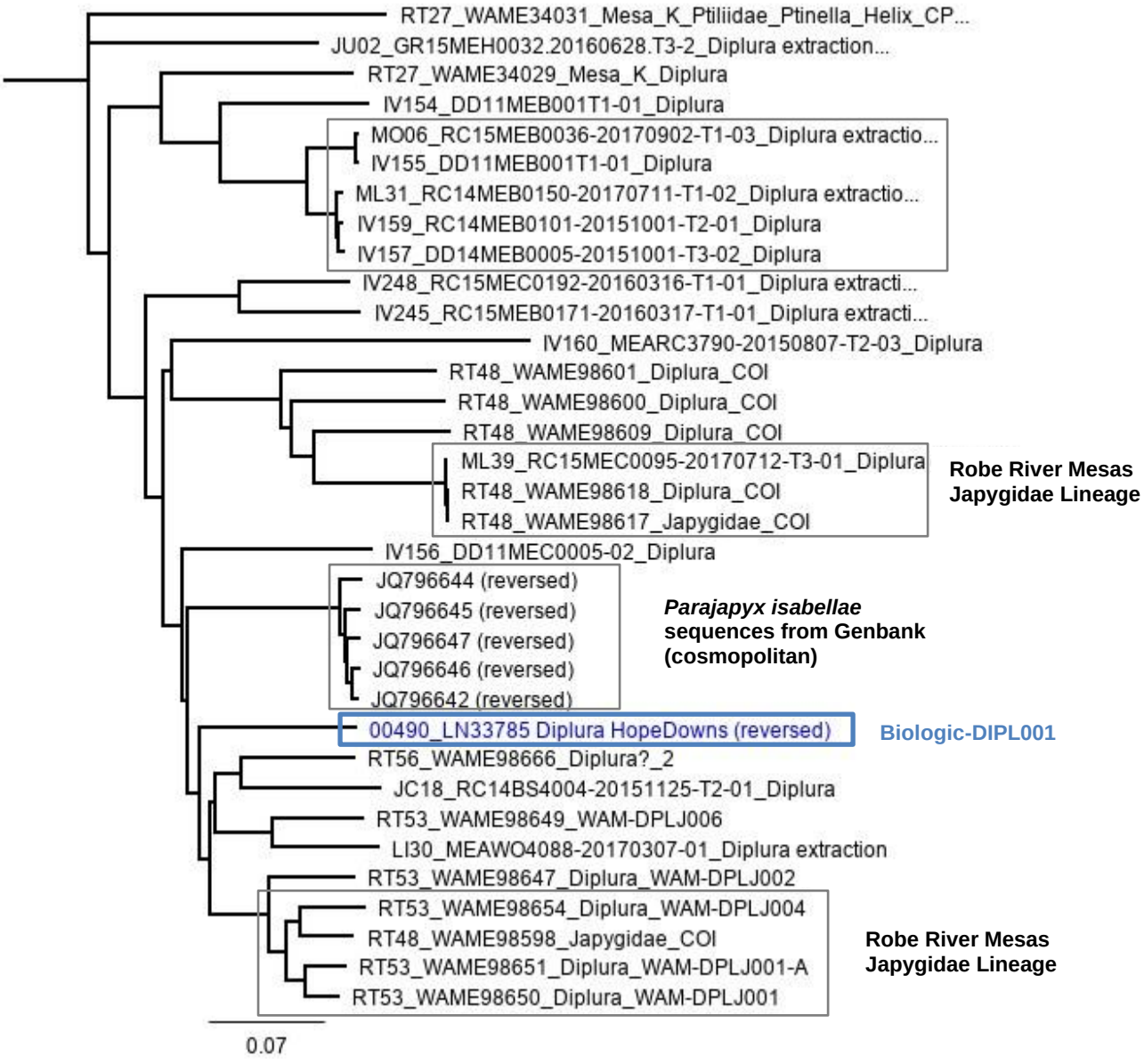

Figure 3.4. Neighbour Joining tree of Diplura haplotypes included in the analysis. Lineages from the Study Area are indicated by coloured text.

3.5 Hemiptera

Four of a total six specimens of Hemiptera from the Study Area were successfully sequenced (COI). Local comparisons revealed three well-supported lineages (intraspecific variability <1%), representing three distinct OTUs (Table 3.2, Figure 3.5):

- *Nisia* OES16 (HEMI001) (LN36535, 33789, Bedded Hill Top);
- *Phaconeura* HEMI002 (LN33774, Bedded Hill Top); and
- *Phaconeura* HEMI003 (LN35120, Bedded Hill Top);

These lineages each varied between 18% and 34% COI divergence (Appendix 5), indicating three highly divergent OTUs. Although morphological identifications (at Stantec) suggested that LN33774 and LN35120 belonged to the same morphospecies (*Phaconeura* OES15), the current genetic results revealed 18% (COI) divergence of Biologic-HEMI002 and HEMI003, indicating cryptic morphology or additional taxonomic work may be required.

Table 3.2. Genetic results of Hemiptera specimens (lineages represented by highlighted colours).

Area	Site Name	Morphospecies ID	No. of Individuals	Lot No. (LN)	BMR Code	HEMI Lineage
BHT	RC15BHT0267	*Nisia* OES16	1	LN36535	BMR00436	001
BHT	RC16BHT0222	*Nisia* OES16	1	LN33789	BMR00487	001
BHT	RC16HD10193	*Phaconeura* OES15	1	LN33774	BMR00486	002
BBH	RC14HD10072	*Phaconeura* OES15	1	LN35120	BMR00553	003

Regional comparisons (Figure 3.5 Appendix 5) revealed that each of the three lineages showed a high level of divergence (minimum 13-26% COI) from previously sequenced Hemiptera specimens. Specimens identified by Stantec as *Phaconeura* were clustered with other *Phaconeura* lineages, including one widespread OTU sampled at both Paraburdoo and West Angelas (P. WAM-PHAC001). However, at 13-14% COI divergence, *Phaconeura* sp. `Biologic-HEMI003` is regarded as a different OTU to *P*. `sp. WAM-PHAC001`, while *Phaconeura* `sp. Biologic-HEMI002` is regarded as different to another Paraburdoo taxon, P. `sp. WAM-PHAC002` (11-15% COI) (Appendix 5).

Nisia sp. Biologic-HEMI001 was highly divergent from all the available Meenoplidae sequences in the analysis (25-28% COI), although owing to the lack of genus level identifications for most of these sequences, further genetic (and/ or morphological work) may be required to validate these phylogenetic relationships.

Based on current results, the three Hemiptera OTUs from the Study Area do not appear to be represented elsewhere in the available databases.

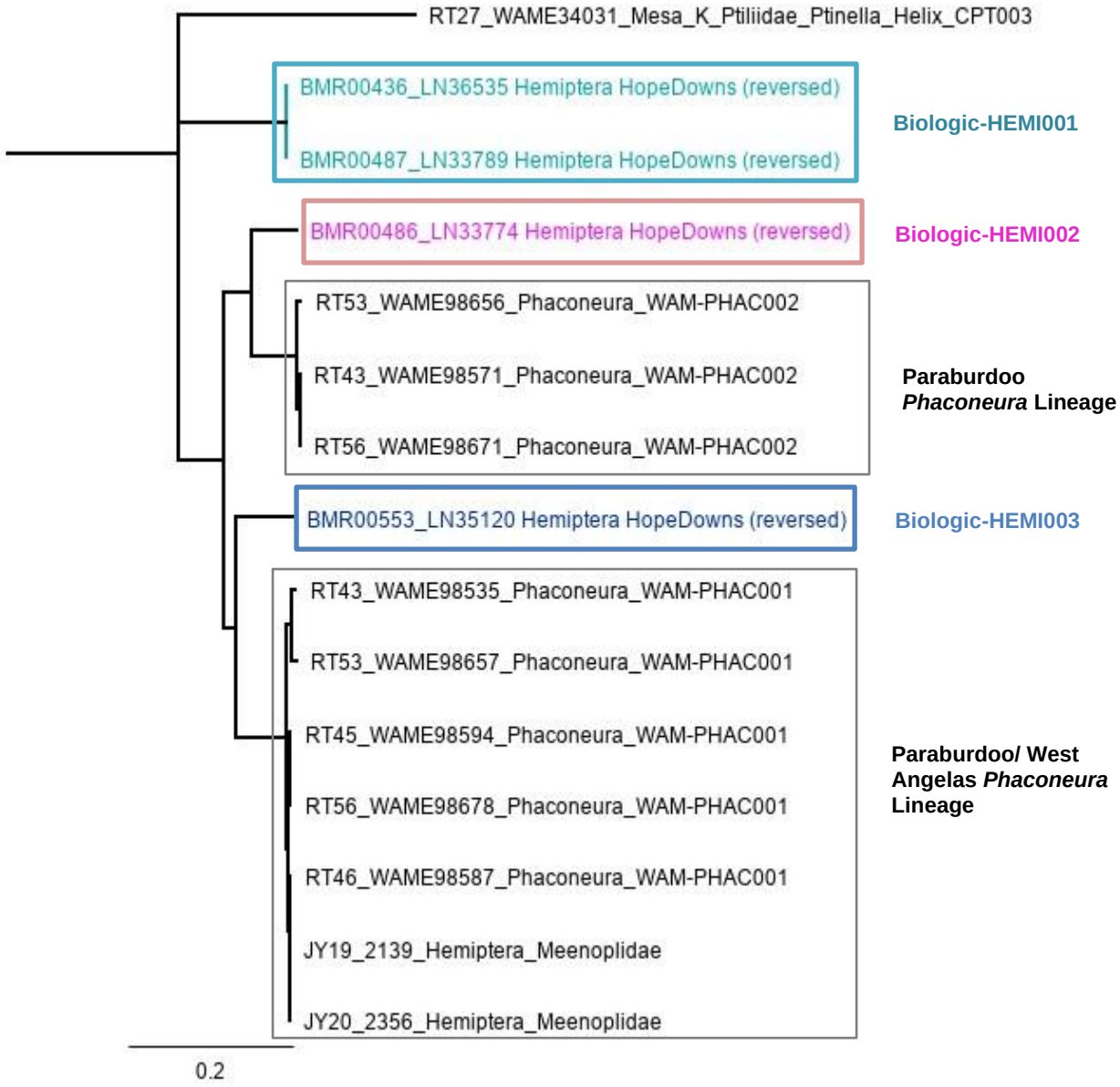

Figure 3.5. Neighbour Joining tree of Hemiptera haplotypes included in the analysis. Lineages from the Study Area are indicated by coloured text.

3.6 Palpigradi

One of the two specimens of Palpigradi (LN39264, identified as *Eukoenenia* OES2) was successfully sequenced (Lineage PALP001).

Regional sequences for this taxonomic group were very limited within the available databases, but the lineage from the Study Area was found to be 55-63% divergent (COI) from two other subterranean Palpigradi lineages collected at Paraburdoo (Figure 3.6, Appendix 6). A subterranean spider and an epigean spider sequence were used as outgroups in the analysis. At the high levels of divergence shown in this analysis, further genetic work (and potentially additional specimens/ sequences) would be required to verify the relationships between subterranean Palpigradi lineages from the region.

Based on the limited information currently available, *Eukoenenia* OES2 (Biologic-PAL001) does not appear to have been collected elsewhere to date.

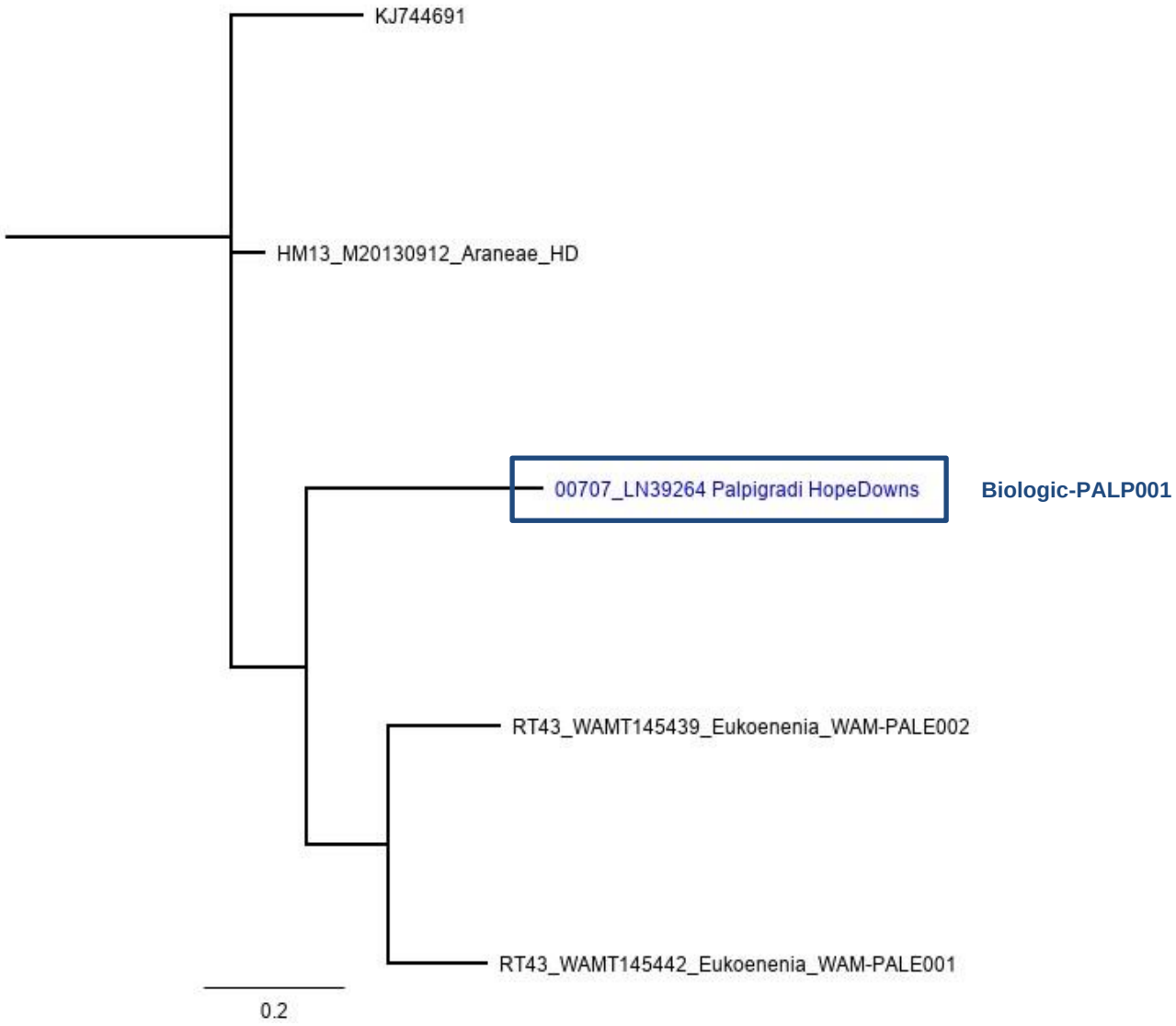

Figure 3.6. Neighbour Joining tree of Palpigradi haplotypes included in the analysis. Lineages from the Study Area are indicated by coloured text.

3.7 Pauropoda

One specimen of Pauropoda (LN35790) failed to sequence (COI). No further work was undertaken on this specimen.

3.8 Polyxenida

One specimen of Polyxenida (LN33785; Lophoproctidae sp.) was successfully sequenced (COI). Regional comparisons (Figure 3.7) were based on 25 available subterranean Polyxenida sequences from the Pilbara region (Appendix 7).

The analysis revealed a moderate level of divergence (9%-13% COI) with Polyxenida specimens collected at Robe Headwaters (S45), Cabbage Gum Bore (S12 and S31), Silvergrass (P3 and P1), and Western Range (P51 and P52). Based on average COI divergence thresholds of 8% (Hebert et al 2003), the sequence from the Study Area would still be considered to represent a distinct OTU (Biologic-POLYX001).

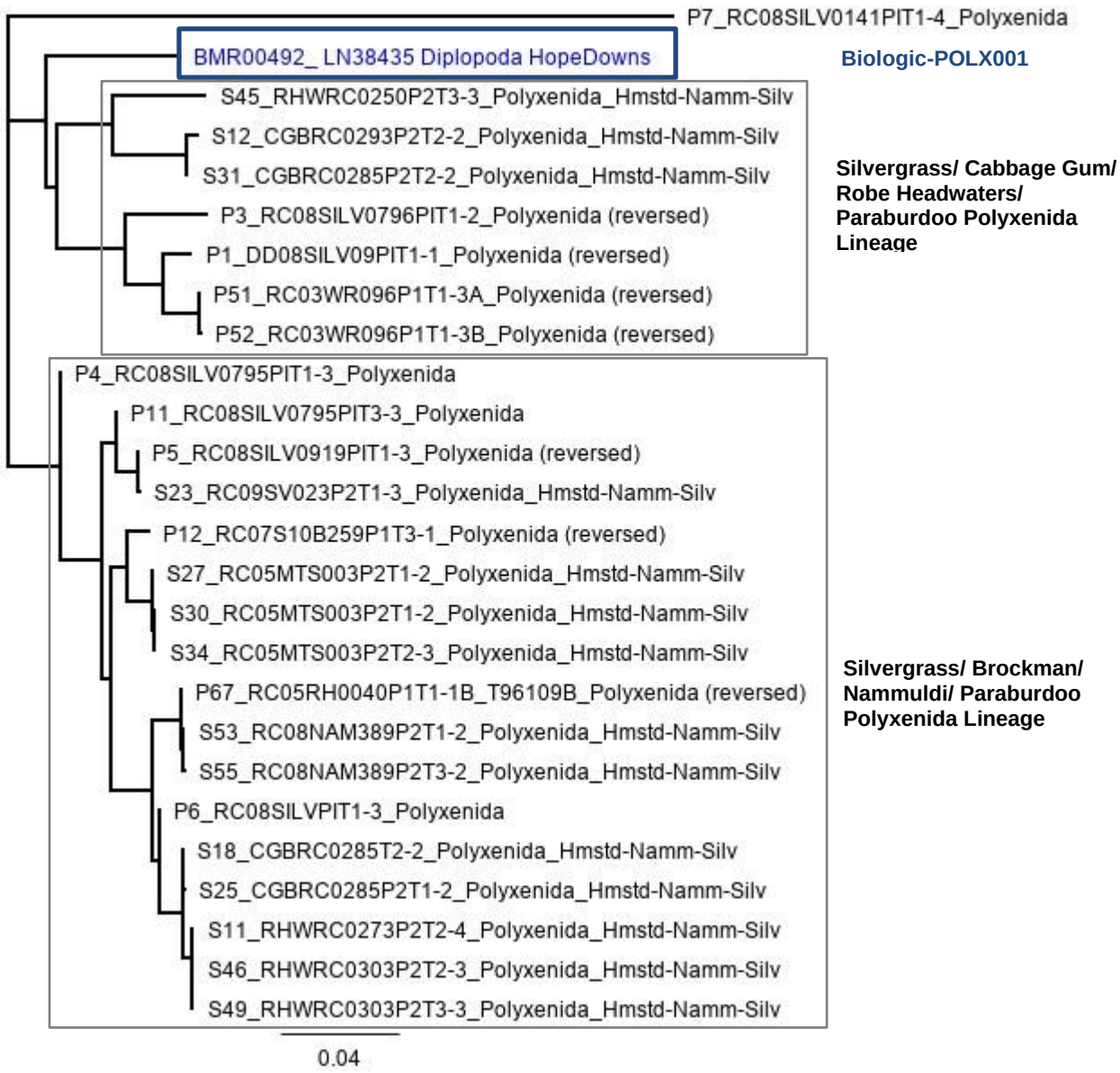

Figure 3.7. Neighbour Joining tree of Polyxenida haplotypes included in the analysis. Lineages from the Study Area are indicated by coloured text.

Although regionally widespread Lophoproctidae species are known to occur throughout the Pilbara region (i.e. the cosmopolitan species *Lophoturus madecassus,* which can be found in epigean and subterranean habitats), due to the lack of resolution in the accompanying morphological identifications, it is uncertain whether sequence material for this widespread species has been included in the current comparisons. However, it does appear that the most closely related lineages to the one collected at the Study Area have been recorded widely throughout the region.

Based on the currently available sequence information in the accessible databases, Lophoproctidae sp. (Biologic-POLYX001) does not appear to have been collected beyond the Study Area.

3.9 Pseudoscorpiones

One of the two specimens of Pseudoscorpiones (LN35130, identified as *Tyrannochthonius* OES20) was successfully sequenced at COI (Biologic-PSEU001). Figure 3.8 shows regional comparisons with 17 regional Chthoniidae sequences, and an *Aname* spider used as an outgroup.

Based on these regional comparisons, the Lineage PSEU001 from the Study Area was found to be highly divergent (19%-25% COI) from other sequences from Robe Valley (RT53 and RT48), and Paraburdoo (RT46) (Figure 3.8, Appendix 8). A subterranean spider and a subterranean Olpiidae sequence were used as outgroups in the analysis. Sequence data from the pseudoscorpion *Lagynochthonius* `sp. WAM-PSE096` previously collected from Baby Hope Downs were not available for genetic comparisons.

While the overall level of divergence between the sequence from the Study Area and other regional sequences in the same family was high, this was not considerably different from the range of divergences between *Tyrannochthonius* OTUs within the available databases (ranging from 12% to 24% COI, Appendix 8). In this broader context the high divergences between the lineage from the Study Area (Biologic-PSEU001) and other regional sequences was not considered out of trend with the range of divergences between other lineages in the genus.

Based on currently available information, *Tyrannochthonius* OES20/ Biologic-PSEU001 does not appear to have been collected elsewhere to date.

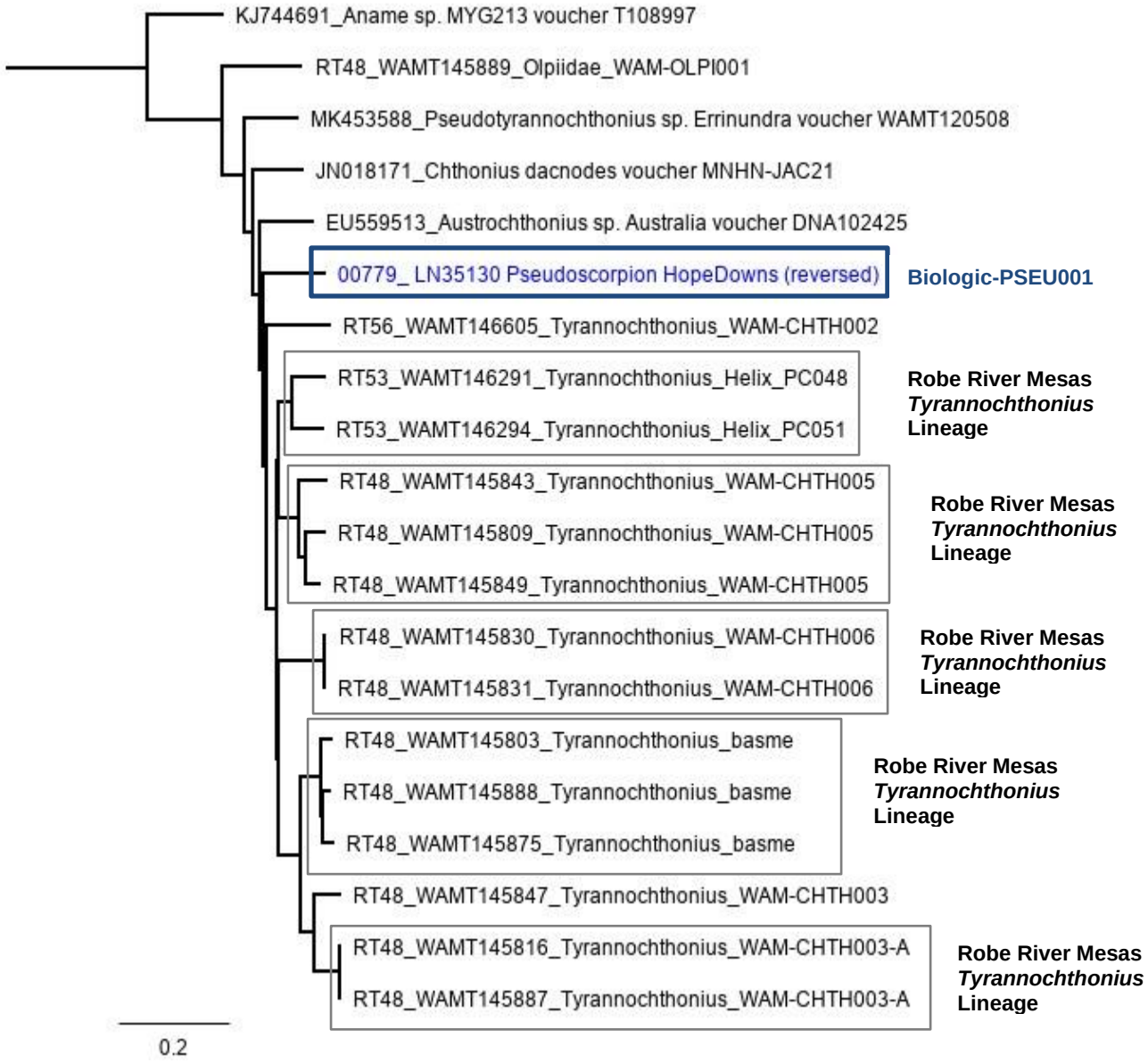

Figure 3.8. Neighbour Joining tree of Pseudoscorpiones haplotypes included in the analysis. Lineages from the Study Area are indicated by coloured text.

3.10 Schizomida

Eight specimens of Schizomida specimens were successfully sequenced at COI. Local comparisons revealed two potential lineages (intraspecific variability <1% COI, Appendix 9):

- Lineage A: LN35581, LN38567, LN33570, LN33590, and LN35572 from Bedded Hill Top; and
- Lineage B: LN37569, LN38573, and LN36580, also from Bedded Hill Top.

COI divergence between these lineages was only 6%- 7% (Appendix 9) and based on average COI divergence thresholds of 8% (Hebert et al 2003), these would be considered to represent a single OTU.

When compared to the sequences from specimens previously collected in the Hope Downs 1 South West area and Baby Hope Downs (Figure 3.9, Appendix 9), the two lineages are nested with the intraspecies variability within *Draculoides* sp. SCH068, as recently described by Abrams *et al.* (2019). Within the published sequences of *Draculoides* sp. SCH068, the current analysis showed variability between 3%-7% COI (Appendix 9). Current sequences within Lineage A varied from *D*. sp. SCH068 by 6%-9%, while sequences within Lineage B varied from *D*. sp. SCH068 by 2%-7% (Appendix 9). As stated above, Lineages A and B varied from each other by 6% - 7%.

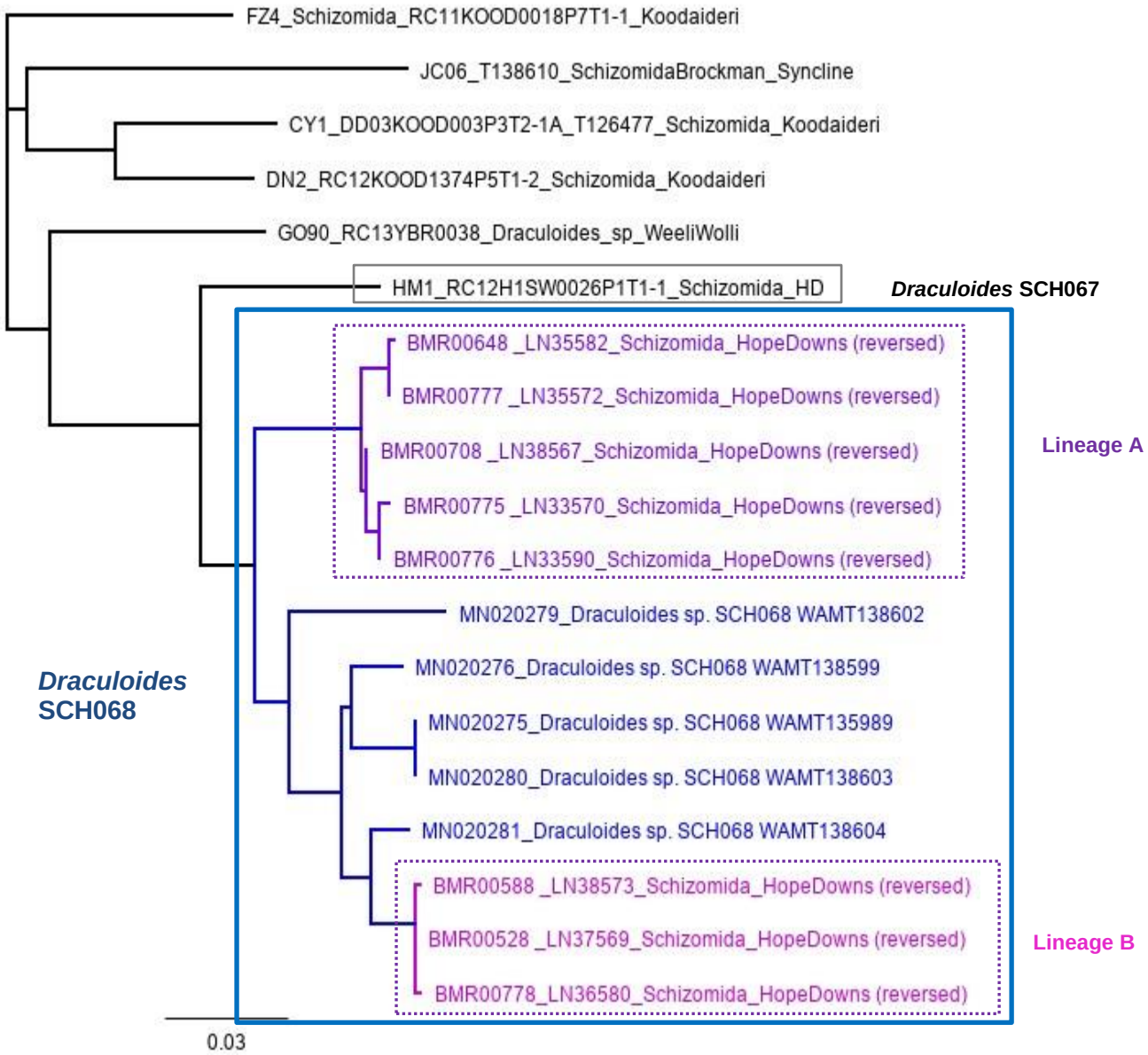

Figure 3.9. Neighbour Joining tree of Schizomida haplotypes included in the analysis. Lineages are indicated by coloured text.

The current analysis also suggests that Lineage A is also closely related to another OTU from Hope Downs 1 South West, *Draculoides* sp. SCH067 (Abrams *et al.* 2019). The average pairwise divergences of specimens in Lineage A vs SCH068 were 7% (SD 0.009), whereas Lineage A vs SCH067 was 8% (SD 0.004) (Table 3.3). This very marginal difference suggests that, even though both OTUs are quite similar to Lineage A, based on current sequences, Lineage A is closer to *Draculoides* sp. SCH068 (as in Figure 3.9).

Table 3.3: Average and standard deviation of COI divergences between lineages of Schizomida collected from the Hope Downs area, in the current analysis

	Lineage A (5)	Lineage B (3)	SCH068 (5)	SCH067 (1)
Lineage A (5)	1% (intra)	SD 0.003	SD 0.009	SD 0.004
Lineage B (3)	Ave 7%	0% (intra)	SD 0.017	SD <0.001
SCH068 (5)	Ave 7%	Ave 4%	4% (intra)	SD 0.004
SCH067 (1)	Ave 8%	Ave 10%	Ave 10%	n/a

Meanwhile, Lineage B was much more similar to *Draculoides* sp. SCH068 (COI divergence mean 4%, SD 0.017), which was within the same mean intraspecific variability as SCH068 itself (Table 3.3). Lineages A and B were also quite similar (COI divergence mean 7%, SD 0.003), indeed, the same average level of divergence as Lineage A vs SCH068, suggesting that Lineages A, B, and SCH068 can be regarded as the same OTU, albeit one with a relatively high level of intraspecific variability (mean 5%, range 0%-9%).

Based on the current results, all of the new sequences of Schizomida collected from the Study Area appear to align to the previously known OTU, *Draculoides* sp. SCH068. However, some of the divergences between the current lineages and the available sequence material for *Draculoides* sp. SCH068 and *Draculoides* sp. SCH067 were gradational/ marginal, therefore further genetic work using a multi-gene approach, potentially combined with morphological work as in Abrams *et al.* (2019) may be useful to validate the species-level phylogenetic relationships between these specimens.

3.11 Zygentoma

One specimen of Zygentoma (Atelurinae sp., LN39280) failed to sequence at COI, therefore analysis was conducted at 12S, following Smith *et al.* (2012). The specimen was successfully sequenced using 12S (Biologic-ZYGE001).

Based on comparisons with 20 regional Zygentoma sequences within the available databases, the lineage from the Study Area was found to be moderately divergent (8%-10% 12S) from a *Dodecastyla* OTU collected at Paraburdoo (*Dodecastyla* WAM-ZYGA001), and more highly divergent (19%-48% 12S) from other subterranean Zygentoma, several of which were morphologically identified as

Trinemura (Figure 3.10, Appendix 9). Smith *et al.* (2012) regarded sequences of *Dodecastyla* at 6.2% - 6.5% divergence (12S) as different species, therefore the lineage from Study Area would be considered distinct from *Dodecastyla* WAM-ZYGA001.

The current genetic results appear to confirm the morphological assessment, that the Zygentoma from the Study Area (ZYGE001) likely belongs to the Atelurinae (e.g. *Dodecastyla* sp.). This taxonomic group is commonly regarded as soil-dwelling (including inhabitants of termite nests), rather than troglobitic (Smith *et al.* 2012). While Biologic-ZYGE001 is closely related to *Dodecastyla* WAMZYGA001 sequenced at Paraburdoo, based on currently available information in the accessible databases, does not appear to have been collected elsewhere beyond the Study Area to date.

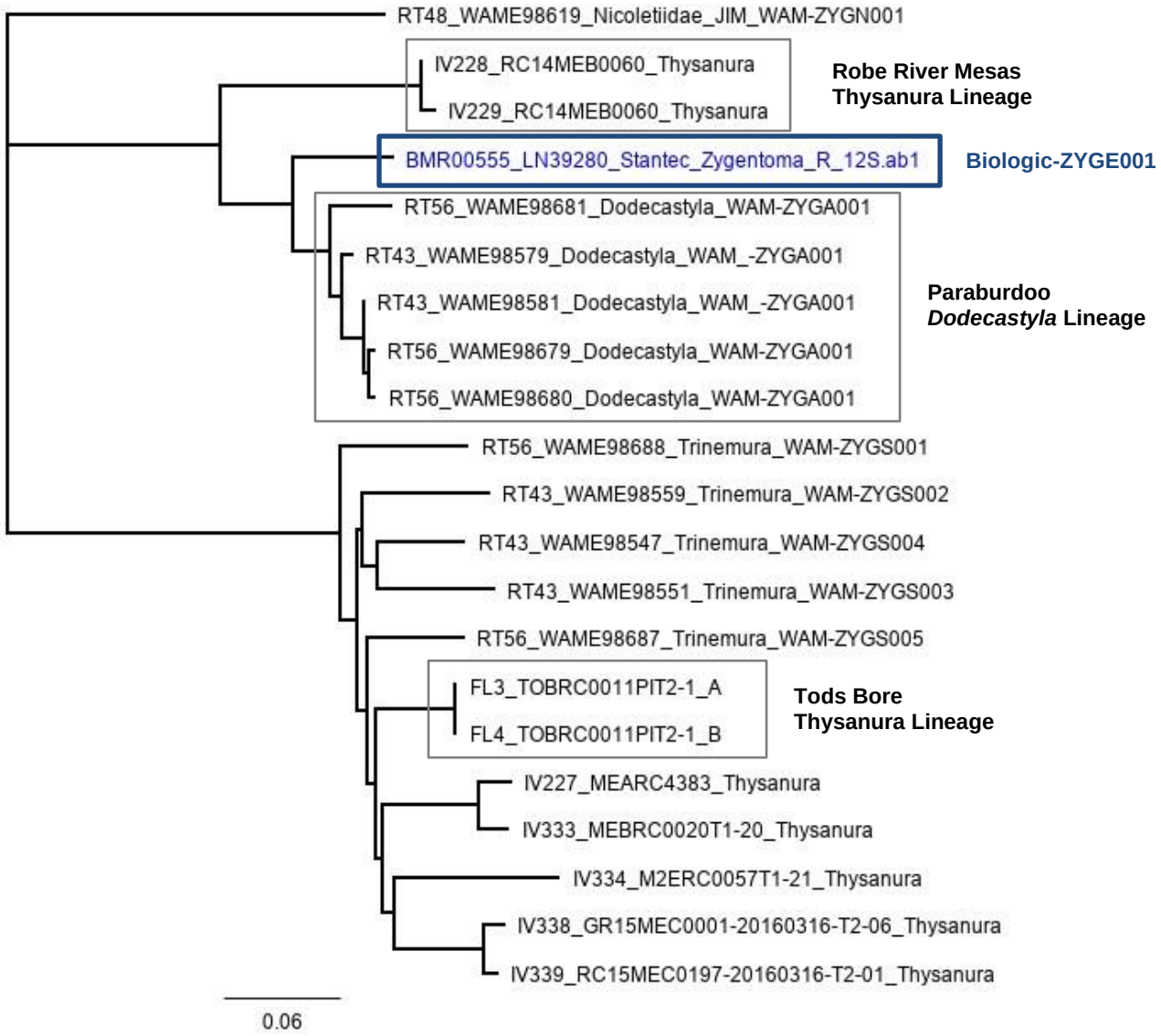

Figure 3.10. Neighbour Joining tree of Zygentoma haplotypes included in the analysis. Lineages from the Study Area are indicated by coloured text.

4 KEY FINDINGS

The molecular analysis of subterranean fauna from the HDOW1 Study Area resulted in the following key findings at the species/ OTU level:

- Amphipoda (CO1): 1 OTU, Biologic-AMPH001 (*Pilbarus* nr *millsi* OES12), regionally unique;
- Blattodea (CO1): 4 OTUs (formerly *Nocticola* sp. OES12 and OES13), Biologic-BLAT001, Biologic-BLAT002, Biologic-BLAT003, and Biologic-BLAT004, all regionally unique;
- Chilopoda (CO1): 1 OTU, Biologic-CHIL001 (Scolopendromorpha sp.), regionally unique;
- Diplura (CO1); 1 OTU, Biologic-DIPL001 (*Indjapyx* OES7), regionally unique;
- Hemiptera (CO1): 3 OTUs, Biologic-HEMI001 (*Nisia* OES16), Biologic-HEMI002 and Biologic-HEMI003 (the latter both formerly *Phaconeura* OES15), all regionally unique.
    - Two other specimens failed to sequence;
- Palpigradi (CO1): 1 OTU, Biologic-PALP001 (*Eukoenenia* OES2), regionally unique.
    - A second specimen failed to sequence;
- Pauropoda (CO1): failed to sequence;
- Polyxenida (CO1): 1 OTU, Biologic-POLX001 (Lophoproctidae sp.), regionally unique;
- Pseudoscorpiones (CO1): 1 OTU, Biologic-PSEU001 (*Tyrannochthonius* OES20).
- Schizomida (CO1): 1 OTU (*Draculoides* sp. SCH068),
    - Previously recorded OTU *Draculoides* sp. SCH068 encompasses Lineage A, Lineage B, and morphospecies *Draculoides* ?BH4/BH5;
- Zygentoma (12S): 1 OTU, Biologic-ZYGE001 (Ateluridae sp.), regionally unique.

Thank you for giving Biologic the opportunity to undertake this work. Please contact us if you have any further questions.

Sincerely,

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Appendix 1. Distance matrix of Amphipoda sequences/ lineages included in the analysis

COI divergence of Amphipoda (regional comparisons)	IV135	IV137	IV138	IV108	IV123	IV132	IV134	RT46	RT7	RT7	IV104	IV94	RT56	RT56	RT56	RT56	GO12	GO16	GO24	GO31	GO35	GO36	GO41	GO45	GO52	GO57	GO62	00484	00488	GO86	GO87	GO88	GO89	RT35	RT35	RT35	RT56	RT7
IV135_TOBRC0099-20150930-01_Amphipoda		0%	0%	41%	47%	43%	40%	43%	44%	49%	42%	43%	42%	40%	45%	39%	48%	46%	47%	47%	47%	39%	46%	47%	47%	39%	48%	45%	45%	45%	46%	45%	46%	48%	46%	47%	47%	49%
IV137_TOBRC0099-20150930-01_Amphipoda	0%		0%	41%	47%	43%	40%	43%	44%	49%	42%	44%	42%	40%	45%	39%	48%	47%	48%	48%	47%	39%	46%	47%	47%	39%	48%	45%	45%	45%	46%	45%	46%	48%	46%	47%	47%	49%
IV138_TOBRC0099-20150930-01_Amphipoda	0%	0%		41%	47%	43%	39%	43%	44%	49%	42%	43%	42%	40%	45%	39%	47%	46%	47%	47%	47%	39%	46%	47%	47%	39%	47%	45%	45%	45%	46%	45%	46%	48%	46%	47%	47%	49%
IV108_MB13WARR001-20150605-01_Amphipoda	41%	41%	41%		17%	16%	18%	11%	18%	18%	38%	36%	39%	40%	42%	37%	43%	42%	43%	43%	43%	37%	39%	42%	42%	38%	42%	40%	40%	39%	38%	39%	39%	37%	36%	36%	36%	39%
IV123_Budgie-20150930-01_Amphipoda_RobeV	47%	47%	47%	17%		11%	17%	19%	5%	2%	37%	36%	41%	39%	41%	37%	39%	38%	38%	39%	39%	34%	38%	38%	38%	35%	37%	39%	39%	39%	38%	39%	38%	38%	38%	38%	38%	41%
IV132_DAVES-20150930-04_Amphipoda_RobeV	43%	43%	43%	16%	11%		17%	19%	10%	12%	39%	38%	38%	40%	40%	37%	41%	41%	40%	41%	41%	37%	38%	41%	41%	37%	40%	39%	39%	38%	38%	38%	38%	39%	39%	38%	38%	39%
IV134_TOBRC0099-20150930-01_Amphipoda	40%	40%	39%	18%	17%	17%		22%	17%	17%	36%	36%	40%	41%	38%	37%	40%	41%	40%	40%	40%	35%	38%	41%	41%	36%	40%	39%	39%	38%	38%	38%	38%	36%	38%	38%	38%	37%
RT46_WAMC72443_Nedsia_WAM-AMPE003	43%	43%	43%	11%	19%	19%	22%		19%	20%	36%	36%	40%	36%	41%	40%	43%	42%	43%	43%	43%	35%	41%	42%	42%	35%	42%	39%	39%	41%	40%	41%	41%	39%	39%	39%	39%	41%
RT7_WAMC70279_RRD4_HYPO_AMP-Eriop-008__	44%	44%	44%	18%	5%	10%	17%	19%		5%	39%	40%	42%	39%	42%	40%	42%	41%	41%	42%	41%	35%	39%	41%	41%	36%	40%	39%	39%	40%	39%	40%	39%	38%	40%	40%	40%	40%
RT7_WAMC70280_RRD4_MACRO_AMP-Eriop-001	49%	49%	49%	18%	2%	12%	17%	20%	5%		39%	39%	42%	40%	44%	39%	41%	40%	40%	41%	40%	36%	41%	40%	40%	37%	39%	39%	39%	41%	41%	41%	41%	38%	42%	40%	40%	41%
IV104_Daves-20150604-01_Amphipoda_RobeV	42%	42%	42%	38%	37%	39%	36%	36%	39%	39%		1%	22%	19%	25%	34%	33%	34%	32%	32%	32%	29%	32%	34%	34%	29%	33%	31%	31%	32%	32%	32%	32%	32%	33%	30%	30%	36%
IV94_Budgie.20150604-02_Amphipoda_RobeV	43%	44%	43%	36%	36%	38%	36%	36%	40%	39%	1%		21%	20%	24%	31%	30%	31%	29%	30%	29%	27%	32%	31%	31%	27%	30%	31%	31%	33%	32%	33%	32%	32%	32%	31%	31%	36%
RT56_WAMC74112_WAM-AMPB003	42%	42%	42%	39%	41%	38%	40%	40%	42%	42%	22%	21%		19%	20%	25%	29%	29%	28%	28%	28%	27%	25%	29%	29%	27%	28%	29%	29%	25%	25%	25%	25%	30%	31%	29%	29%	32%
RT56_WAMC74113_WAM-AMPB002	40%	40%	40%	40%	39%	40%	41%	36%	39%	40%	19%	20%	19%		22%	29%	31%	32%	31%	30%	31%	28%	31%	32%	32%	28%	31%	31%	31%	31%	31%	31%	31%	35%	34%	34%	34%	31%
RT56_WAMC74114_WAM-AMPB001	45%	45%	45%	42%	41%	40%	38%	41%	42%	44%	25%	24%	20%	22%		26%	31%	30%	31%	32%	31%	30%	28%	31%	31%	30%	31%	35%	35%	29%	29%	29%	28%	33%	31%	31%	31%	31%
RT56_WAMC74133_Yilgarus_WAM-AMPP001	39%	39%	39%	37%	37%	37%	37%	40%	40%	39%	34%	31%	25%	29%	26%		24%	24%	24%	24%	24%	23%	23%	24%	24%	23%	24%	26%	26%	24%	23%	24%	23%	26%	28%	25%	25%	24%
GO12_WW4_Paramelitidae_Genus_2_sp._B2Weeli_Wolli	48%	48%	47%	43%	39%	41%	40%	43%	42%	41%	33%	30%	29%	31%	31%	24%		3%	1%	0%	1%	21%	25%	3%	3%	21%	1%	28%	28%	24%	25%	24%	25%	25%	27%	26%	26%	32%
GO16_Yandi_MAR01_Paramelitidae_Genus_2_sp._B2Weeli_Wol	46%	47%	46%	42%	38%	41%	41%	42%	41%	40%	34%	31%	29%	32%	30%	24%	3%		3%	3%	3%	21%	25%	0%	0%	21%	3%	29%	29%	26%	25%	26%	25%	27%	27%	27%	27%	31%
GO24_Yandi_WW2_Paramelitidae_Genus_2_sp._B2Weeli_Wolli	47%	48%	47%	43%	38%	40%	40%	43%	41%	40%	32%	29%	28%	31%	31%	24%	1%	3%		1%	0%	20%	24%	3%	3%	20%	0%	28%	28%	24%	24%	24%	24%	25%	27%	25%	25%	32%
GO31_Yandi_WW3_Paramelitidae_Genus_2_sp._B2Weeli_Wolli	47%	48%	47%	43%	39%	41%	40%	43%	42%	41%	32%	30%	28%	30%	32%	24%	0%	3%	1%		1%	21%	25%	3%	3%	21%	1%	28%	28%	24%	24%	24%	25%	25%	28%	26%	26%	32%
GO35_Yandi_JSE14_Paramelitidae_Genus_2_sp._B3Weeli_Wolli	47%	47%	47%	43%	39%	41%	40%	43%	41%	40%	32%	29%	28%	31%	31%	24%	1%	3%	0%	1%		20%	24%	3%	3%	21%	0%	28%	28%	24%	24%	24%	24%	25%	27%	25%	25%	32%
GO36_Yandi_MAR07_Paramelitidae_Genus_2_sp._B3Weeli_Wol	39%	39%	39%	37%	34%	37%	35%	35%	35%	36%	29%	27%	27%	28%	30%	23%	21%	21%	20%	21%	20%		23%	21%	21%	0%	20%	27%	27%	24%	23%	24%	23%	29%	31%	29%	29%	29%
GO41_Marillana01_Paramelitidae_sp._2_(DEC_code)Weeli_Wolli	46%	46%	46%	39%	38%	38%	38%	41%	39%	41%	32%	32%	25%	31%	28%	23%	25%	25%	24%	25%	24%	23%		25%	25%	24%	24%	26%	26%	1%	0%	1%	0%	23%	23%	22%	22%	25%
GO45_Plant_Paramelitidae_sp._2_(DEC_code)Weeli_Wolli	47%	47%	47%	42%	38%	41%	41%	42%	41%	40%	34%	31%	29%	32%	31%	24%	3%	0%	3%	3%	3%	21%	25%		0%	21%	3%	29%	29%	25%	25%	25%	25%	27%	27%	27%	27%	31%
GO52_Marillana02-42_Paramelitidae_sp.2_(DEC)Weeli_Wolli	47%	47%	47%	42%	38%	41%	41%	42%	41%	40%	34%	31%	29%	32%	31%	24%	3%	0%	3%	3%	3%	21%	25%	0%		21%	3%	29%	29%	25%	25%	25%	25%	27%	27%	27%	27%	31%
GO57_WB/YJ99-41_Paramelitidae_sp.2_(DEC)Weeli_Wolli	39%	39%	39%	38%	35%	37%	36%	35%	36%	37%	29%	27%	27%	28%	30%	23%	21%	21%	20%	21%	21%	0%	24%	21%	21%		21%	28%	28%	24%	23%	24%	24%	29%	31%	29%	29%	29%
GO62_WW2-44_Paramelitidae_sp.2_(DEC)Weeli_Wolli	48%	48%	47%	42%	37%	40%	40%	42%	40%	39%	33%	30%	28%	31%	31%	24%	1%	3%	0%	1%	0%	20%	24%	3%	3%	21%		28%	28%	24%	24%	24%	24%	25%	26%	25%	25%	32%
00484_LN35584 Amphipoda HopeDowns (reversed)	**45%**	**45%**	**45%**	**40%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**31%**	**31%**	**29%**	**31%**	**35%**	**26%**	**28%**	**29%**	**28%**	**28%**	**28%**	**27%**	**26%**	**29%**	**29%**	**28%**	**28%**		**0%**	**27%**	**27%**	**27%**	**26%**	**29%**	**30%**	**28%**	**28%**	**28%**
00488_LN35145 Amphipoda HopeDowns (reversed)	**45%**	**45%**	**45%**	**40%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**31%**	**31%**	**29%**	**31%**	**35%**	**26%**	**28%**	**29%**	**28%**	**28%**	**28%**	**27%**	**26%**	**29%**	**29%**	**28%**	**28%**	**0%**		**27%**	**27%**	**27%**	**26%**	**29%**	**30%**	**28%**	**28%**	**28%**
GO86_WW3-41_Pilbarus_millsi_-_Chydekata_sp.Weeli_Wolli	45%	45%	45%	39%	39%	38%	38%	41%	40%	41%	32%	33%	25%	31%	29%	24%	24%	26%	24%	24%	24%	24%	1%	25%	25%	24%	24%	27%	27%		0%	0%	1%	23%	24%	22%	22%	25%
GO87_Mar06a-41_Pilbarus_millsi_-_Chydekata_sp.Weeli_Wolli	46%	46%	46%	38%	38%	38%	38%	40%	39%	41%	32%	32%	25%	31%	29%	23%	25%	25%	24%	24%	24%	23%	0%	25%	25%	23%	24%	27%	27%	0%		0%	0%	23%	23%	22%	22%	24%
GO88_Mar06a-41_Pilbarus_millsi_-_Chydekata_sp.Weeli_Wolli	45%	45%	45%	39%	39%	38%	38%	41%	40%	41%	32%	33%	25%	31%	29%	24%	24%	26%	24%	24%	24%	24%	1%	25%	25%	24%	24%	27%	27%	0%	0%		1%	23%	24%	22%	22%	25%
GO89_Mar06a-41_Pilbarus_millsi_-_Chydekata_sp.Weeli_Wolli	46%	46%	46%	39%	38%	38%	38%	41%	39%	41%	32%	32%	25%	31%	28%	23%	25%	25%	24%	25%	24%	23%	0%	25%	25%	24%	24%	26%	26%	1%	0%	1%		23%	23%	22%	22%	25%
RT35_WAMC72413_Channar_Pilbarus_sp_G	48%	48%	48%	37%	38%	39%	36%	39%	38%	38%	32%	32%	30%	35%	33%	26%	25%	27%	25%	25%	25%	29%	23%	27%	27%	29%	25%	29%	29%	23%	23%	23%	23%		9%	2%	2%	24%
RT35_WAMC72414_Turee_Ck_Pilbarus_sp_H	46%	46%	46%	36%	38%	39%	38%	39%	40%	42%	33%	32%	31%	34%	31%	28%	27%	27%	27%	28%	27%	31%	23%	27%	27%	31%	26%	30%	30%	24%	23%	24%	23%	9%		8%	8%	25%
RT35_WAMC72415_Seven_Mile_Ck_Pilbarus_sp_G	47%	47%	47%	36%	38%	38%	38%	39%	40%	40%	30%	31%	29%	34%	31%	25%	26%	27%	25%	26%	25%	29%	22%	27%	27%	29%	25%	28%	28%	22%	22%	22%	22%	2%	8%		0%	22%
RT56_WAMC74139_Pilbarus_sp.G	47%	47%	47%	36%	38%	38%	38%	39%	40%	40%	30%	31%	29%	34%	31%	25%	26%	27%	25%	26%	25%	29%	22%	27%	27%	29%	25%	28%	28%	22%	22%	22%	22%	2%	8%	0%		22%
RT7_WAMC70269_RRD3_HYPO_AMP-Para-001	49%	49%	49%	39%	41%	39%	37%	41%	40%	41%	36%	36%	32%	31%	31%	24%	32%	31%	32%	32%	32%	29%	25%	31%	31%	29%	32%	28%	28%	25%	24%	25%	25%	24%	25%	22%	22%	

Appendix 2. Distance matrix of Blattodea sequences/ lineages included in the analysis

COI divergence of Blattodea (regional comparisons)	IV211	JD46	CP1	JD33	JD51	JD53	JD55	JD18	JD19	JD27	JD52	00431	00373	00426	00432	00435	00497	00374	00376	00425	00427	00428	00437	00493	00377	00424	00429	00430	00433	00434	00485
IV211_RC13MEA0279-20150807-T1-02_Pseudo		52%	52%	58%	55%	55%	55%	39%	39%	44%	39%	46%	50%	51%	56%	48%	50%	47%	43%	48%	52%	52%	63%	47%	59%	59%	58%	59%	59%	61%	59%
JD46_DD11YOX23020151123-T1-1_Blattodea	52%		27%	29%	22%	22%	22%	27%	27%	27%	27%	59%	55%	52%	53%	46%	55%	53%	60%	57%	55%	55%	57%	53%	51%	49%	47%	49%	50%	54%	49%
CP1_DD73KOODT1-3_Blattodea extraction	52%	27%		8%	22%	22%	22%	22%	22%	22%	22%	51%	55%	46%	54%	51%	43%	55%	53%	54%	57%	54%	57%	56%	43%	48%	47%	57%	48%	47%	48%
JD33_DD11YOX24020151123-T1-3_Blattodea	58%	29%	8%		20%	20%	20%	20%	20%	20%	20%	48%	44%	46%	45%	47%	44%	58%	53%	51%	56%	51%	56%	56%	51%	52%	51%	52%	51%	52%	52%
JD51_DD11YOX23020151123-T1-2_Blattodea	55%	22%	22%	20%		0%	0%	10%	10%	9%	10%	55%	53%	55%	52%	57%	59%	53%	61%	54%	52%	54%	55%	53%	46%	47%	46%	47%	46%	46%	46%
JD53_DD11YOX22720151123-T1-1_Blattodea	55%	22%	22%	20%	0%		0%	10%	10%	9%	10%	55%	53%	55%	52%	57%	59%	53%	61%	54%	52%	54%	55%	53%	46%	47%	46%	47%	46%	46%	46%
JD55_DD11YOX22720151123-T1-1_Blattodea	55%	22%	22%	20%	0%	0%		10%	10%	9%	10%	55%	53%	55%	52%	57%	59%	53%	61%	54%	52%	54%	55%	53%	46%	47%	46%	47%	46%	46%	46%
JD18_RC15YOX0015201511123-T2-1_Blattodea	39%	27%	22%	20%	10%	10%	10%		0%	0%	0%	57%	52%	50%	50%	52%	49%	68%	62%	58%	65%	52%	65%	61%	58%	56%	55%	55%	56%	57%	55%
JD19_DD11YOX311201511123-T1-1_Blattodea	39%	27%	22%	20%	10%	10%	10%	0%		0%	0%	57%	52%	50%	50%	52%	49%	68%	62%	58%	65%	52%	65%	61%	58%	56%	55%	55%	56%	57%	55%
JD27_DD11YOX311201511123-T2-1_Blattodea	44%	27%	22%	20%	9%	9%	9%	0%	0%		0%	57%	52%	50%	50%	52%	49%	68%	62%	51%	65%	51%	65%	61%	58%	58%	55%	55%	56%	56%	57%
JD52_GO3YJ180720151124-T1-4_Blattodea	39%	27%	22%	20%	10%	10%	10%	0%	0%	0%		57%	52%	50%	50%	52%	49%	68%	62%	58%	65%	52%	65%	61%	58%	56%	55%	55%	56%	57%	55%
00431_LN34133 Blattodea HopeDowns	46%	59%	51%	48%	55%	55%	55%	57%	57%	57%	57%		7%	7%	7%	7%	7%	21%	23%	22%	22%	22%	22%	22%	11%	11%	11%	11%	11%	11%	11%
00373_LN33372 Blattodea HopeDowns	50%	55%	55%	44%	53%	53%	53%	52%	52%	52%	52%	7%		1%	1%	1%	0%	22%	23%	22%	22%	22%	22%	22%	9%	9%	9%	9%	10%	9%	9%
00426_LN33532 Blattodea HopeDowns	51%	52%	46%	46%	55%	55%	55%	50%	50%	50%	50%	7%	1%		1%	0%	1%	22%	23%	22%	22%	22%	22%	21%	9%	9%	9%	9%	9%	9%	8%
00432_LN34509 Blattodea HopeDowns	56%	53%	54%	45%	52%	52%	52%	50%	50%	50%	50%	7%	1%	1%		1%	1%	22%	23%	23%	23%	23%	23%	22%	9%	9%	9%	9%	10%	9%	9%
00435_LN37718 Blattodea HopeDowns	48%	46%	51%	47%	57%	57%	57%	52%	52%	52%	52%	7%	1%	0%	1%		1%	22%	23%	22%	22%	22%	22%	22%	9%	9%	9%	9%	9%	8%	8%
00497_LN36536 Blattodea HopeDowns	50%	55%	43%	44%	59%	59%	59%	49%	49%	49%	49%	7%	0%	1%	1%	1%		22%	23%	22%	22%	22%	22%	22%	9%	10%	9%	9%	10%	9%	9%
00374_LN36582 Blattodea HopeDowns	47%	53%	55%	58%	53%	53%	53%	68%	68%	68%	68%	21%	22%	22%	22%	22%	22%		2%	2%	2%	2%	2%	0%	20%	20%	20%	20%	20%	21%	19%
00376_LN37412 Blattodea HopeDowns	43%	60%	53%	53%	61%	61%	61%	62%	62%	62%	62%	23%	23%	23%	23%	23%	23%	2%		3%	3%	3%	2%	2%	21%	21%	21%	21%	22%	22%	21%
00425_LN36514 Blattodea HopeDowns	48%	57%	54%	51%	54%	54%	54%	58%	58%	51%	58%	22%	22%	22%	23%	22%	22%	2%	3%		0%	0%	0%	2%	21%	22%	21%	21%	22%	21%	21%
00427_LN33514 Blattodea HopeDowns	52%	55%	57%	56%	52%	52%	52%	65%	65%	65%	65%	22%	22%	22%	23%	22%	22%	2%	3%	0%		0%	0%	2%	20%	21%	21%	21%	21%	21%	20%
00428_LN39408 Blattodea HopeDowns	52%	55%	54%	51%	54%	54%	54%	52%	52%	51%	52%	22%	22%	22%	23%	22%	22%	2%	3%	0%	0%		0%	2%	20%	21%	21%	21%	21%	21%	21%
00437_LN35535 Blattodea HopeDowns	63%	57%	57%	56%	55%	55%	55%	65%	65%	65%	65%	22%	22%	22%	23%	22%	22%	2%	2%	0%	0%	0%		2%	20%	21%	21%	21%	21%	21%	20%
00493_LN33574 Blattodea HopeDowns	47%	53%	56%	56%	53%	53%	53%	61%	61%	61%	61%	22%	22%	21%	22%	22%	22%	0%	2%	2%	2%	2%	2%		20%	20%	20%	20%	20%	21%	19%
00377_LN35427 Blattodea HopeDowns	59%	51%	43%	51%	46%	46%	46%	58%	58%	58%	58%	11%	9%	9%	9%	9%	9%	20%	21%	21%	20%	20%	20%	20%		1%	1%	1%	1%	0%	1%
00424_LN33391 Blattodea HopeDowns	59%	49%	48%	52%	47%	47%	47%	56%	56%	58%	56%	11%	9%	9%	9%	9%	10%	20%	21%	22%	21%	21%	21%	20%	1%		0%	0%	0%	1%	0%
00429_LN37424 Blattodea HopeDowns	58%	47%	47%	51%	46%	46%	46%	55%	55%	55%	55%	11%	9%	9%	9%	9%	9%	20%	21%	21%	21%	21%	21%	20%	1%	0%		0%	0%	1%	0%
00430_LN38726 Blattodea HopeDowns	59%	49%	57%	52%	47%	47%	47%	55%	55%	55%	55%	11%	9%	9%	9%	9%	9%	20%	21%	21%	21%	21%	21%	20%	1%	0%	0%		0%	1%	0%
00433_LN37717 Blattodea HopeDowns	59%	50%	48%	51%	46%	46%	46%	56%	56%	56%	56%	11%	10%	9%	10%	9%	10%	20%	22%	22%	21%	21%	21%	20%	1%	0%	0%	0%		1%	0%
00434_LN34142 Blattodea HopeDowns	61%	54%	47%	52%	46%	46%	46%	57%	57%	56%	57%	11%	9%	9%	9%	8%	9%	21%	22%	21%	21%	21%	21%	21%	0%	1%	1%	1%	1%		1%
00485_LN38585 Blattodea HopeDowns	59%	49%	48%	52%	46%	46%	46%	55%	55%	57%	55%	11%	9%	8%	9%	8%	9%	19%	21%	21%	20%	21%	20%	19%	1%	0%	0%	0%	0%	1%	

Appendix 3. Distance matrix of Chilopoda haplotypes included in the analysis

COI divergence of Chilopoda (regional comparisons)	KR705664	IV139	IV140	IV141	BMR00489	WAMT145918	WAM132678	JU04	MEGDC0057A	IV143	WAMT144196	WAMT145916	WAMT144180	WAMT144184	WAMT144179	WAMT144183	WAMT144744	WAMT144745
KR705664 Scolopendra morsitans CUMZ00344		28%	28%	28%	31%	32%	36%	26%	29%	29%	25%	26%	29%	30%	22%	23%	23%	22%
IV139_DD14MRR0004T1-01_Chilopoda	28%		0%	0%	28%	27%	33%	28%	29%	28%	30%	30%	28%	31%	27%	27%	28%	27%
IV140_DD14MRR0004T1-01_Chilopoda	28%	0%		0%	28%	27%	33%	28%	29%	28%	30%	30%	28%	31%	27%	27%	28%	27%
IV141_DD14MRR0005-T1-04_Chilopoda	28%	0%	0%		28%	27%	33%	28%	29%	28%	30%	30%	28%	31%	27%	27%	28%	27%
BMR00489_ LN37426 Chilopoda HopeDowns (reversed)	31%	28%	28%	28%		21%	25%	26%	31%	28%	27%	27%	24%	25%	28%	27%	27%	28%
RT48_WAMT145918_WAM-CRYP006	32%	27%	27%	27%	21%		22%	24%	29%	28%	27%	23%	26%	26%	27%	26%	27%	27%
WAM132678_COBRC0001_Chilopoda_HelixCHI022	36%	33%	33%	33%	25%	22%		26%	29%	30%	28%	30%	29%	28%	29%	29%	28%	29%
JU04_RC14MEH0388.20160628.T2-2_Scolopendrida	26%	28%	28%	28%	26%	24%	26%		17%	25%	24%	21%	20%	21%	20%	20%	20%	20%
WAM120191_MEGDC0057A_Chilopoda_HelixCHI021	29%	29%	29%	29%	31%	29%	29%	17%		27%	24%	27%	26%	25%	25%	25%	24%	25%
IV143_MEARC4383-20151001-T2-01_Chilopoda	29%	28%	28%	28%	28%	28%	30%	25%	27%		9%	25%	23%	24%	23%	23%	23%	23%
RT24_WAMT144196_RC15MEB0020_WAM-CRYP004	25%	30%	30%	30%	27%	27%	28%	24%	24%	9%		21%	21%	22%	22%	21%	21%	22%
RT48_WAMT145916_WAM-CRYP005	26%	30%	30%	30%	27%	23%	30%	21%	27%	25%	21%		18%	16%	20%	20%	19%	20%
RT24_WAMT144180_RC14MEB0150_WAM-CRYP001	29%	28%	28%	28%	24%	26%	29%	20%	26%	23%	21%	18%		10%	22%	22%	20%	22%
RT24_WAMT144184_GR15MEC0015_WAM-CRYP002	30%	31%	31%	31%	25%	26%	28%	21%	25%	24%	22%	16%	10%		21%	21%	21%	21%
RT24_WAMT144179_RC16MEC0188_WAM-CRYP003	22%	27%	27%	27%	28%	27%	29%	20%	25%	23%	22%	20%	22%	21%		0%	2%	0%
RT24_WAMT144183_RC16HWY0112_WAM-CRYP003	23%	27%	27%	27%	27%	26%	29%	20%	25%	23%	21%	20%	22%	21%	0%		2%	0%
RT31_WAMT144744_GR15MEB0018_WAM-CRYP003	23%	28%	28%	28%	27%	27%	28%	20%	24%	23%	21%	19%	20%	21%	2%	2%		2%
RT31_WAMT144745_RC16HWY0112_WAM-CRYP003	22%	27%	27%	27%	28%	27%	29%	20%	25%	23%	22%	20%	22%	21%	0%	0%	2%	

Appendix 4. Distance matrix of Diplura sequences/ lineages included in the analysis

COI divergence of Diplura (regional comparisons)	RT27	JU02	RT27	IV154	IV155	MO06	IV157	IV159	ML31	IV248	IV245	IV160	RT48	RT48	RT48	ML39	RT48	RT48	IV156	JQ 79664	JQ 79664	JQ 79664	JQ 79664	JQ 79664	00490	RT56	JC18	RT53	LI30	RT53	RT53	RT48	RT53	RT53
RT27_WAME34031_Mesa_K_Ptiliidae_CPT003		32%	31%	35%	35%	35%	34%	35%	33%	34%	31%	46%	38%	34%	34%	36%	36%	36%	36%	32%	34%	32%	31%	31%	33%	34%	36%	37%	36%	34%	37%	36%	36%	33%
JU02_GR15MEH0032.20160628.T3-2_Diplura	32%		30%	35%	33%	33%	32%	32%	31%	26%	27%	44%	35%	32%	34%	36%	36%	36%	30%	30%	30%	30%	30%	30%	28%	28%	31%	31%	33%	31%	30%	31%	31%	30%
RT27_WAME34029_Mesa_K_Diplura	31%	30%		23%	25%	25%	24%	25%	24%	33%	30%	37%	34%	30%	36%	33%	33%	33%	35%	30%	29%	30%	29%	30%	33%	29%	31%	32%	30%	30%	31%	30%	29%	28%
IV154_DD11MEB001T1-01_Diplura	35%	35%	23%		16%	16%	18%	18%	17%	33%	35%	39%	36%	33%	39%	36%	36%	36%	30%	33%	34%	34%	33%	34%	31%	31%	32%	29%	32%	30%	32%	30%	29%	29%
IV155_DD11MEB001T1-01_Diplura	35%	33%	25%	16%		0%	6%	5%	5%	32%	34%	35%	37%	35%	39%	38%	38%	38%	31%	31%	31%	32%	31%	32%	28%	30%	31%	29%	34%	30%	30%	30%	30%	28%
MO06_RC15MEB0036-20170902-T1-03_Diplura	35%	33%	25%	16%	0%		5%	5%	5%	31%	34%	35%	37%	35%	39%	38%	39%	39%	31%	31%	31%	32%	31%	32%	29%	30%	32%	28%	34%	30%	30%	30%	30%	28%
IV157_DD14MEB0005-20151001-T3-02_Diplura	34%	32%	24%	18%	6%	5%		1%	1%	29%	32%	33%	36%	35%	38%	37%	37%	37%	29%	31%	31%	31%	31%	32%	29%	29%	31%	27%	32%	28%	29%	28%	30%	27%
IV159_RC14MEB0101-20151001-T2-01_Diplura	35%	32%	25%	18%	5%	5%	1%		1%	29%	32%	34%	35%	35%	38%	37%	38%	38%	29%	31%	31%	31%	31%	31%	28%	29%	31%	27%	32%	28%	29%	28%	30%	27%
ML31_RC14MEB0150-20170711-T1-02_Diplura	33%	31%	24%	17%	5%	5%	1%	1%		29%	32%	33%	35%	35%	38%	37%	38%	38%	29%	31%	31%	31%	31%	31%	28%	30%	31%	27%	32%	28%	29%	29%	30%	27%
IV248_RC15MEC0192-20160316-T1-01_Diplura	34%	26%	33%	33%	32%	31%	29%	29%	29%		14%	38%	31%	28%	30%	28%	28%	28%	23%	26%	27%	27%	27%	27%	25%	24%	28%	26%	26%	25%	24%	24%	24%	24%
IV245_RC15MEB0171-20160317-T1-01_Diplura	31%	27%	30%	35%	34%	34%	32%	32%	32%	14%		38%	30%	31%	33%	31%	31%	31%	23%	25%	25%	25%	25%	24%	28%	25%	27%	28%	25%	26%	28%	27%	25%	25%
IV160_MEARC3790-20150807-T2-03_Diplura	46%	44%	37%	39%	35%	35%	33%	34%	33%	38%	38%		37%	40%	39%	38%	38%	38%	35%	35%	34%	35%	35%	35%	34%	37%	35%	30%	33%	34%	35%	33%	35%	34%
RT48_WAME98601_Diplura_COI	38%	35%	34%	36%	37%	37%	36%	35%	35%	31%	30%	37%		20%	19%	18%	18%	18%	31%	29%	29%	30%	29%	29%	29%	26%	26%	27%	29%	28%	30%	28%	26%	25%
RT48_WAME98600_Diplura_COI	34%	32%	30%	33%	35%	35%	35%	35%	35%	28%	31%	40%	20%		21%	17%	17%	17%	33%	28%	27%	27%	28%	28%	26%	27%	30%	31%	32%	30%	31%	31%	29%	30%
RT48_WAME98609_Diplura_COI	34%	34%	36%	39%	39%	39%	38%	38%	38%	30%	33%	39%	19%	21%		16%	16%	16%	31%	32%	33%	32%	32%	32%	29%	27%	28%	27%	31%	29%	27%	27%	27%	27%
ML39_RC15MEC0095-20170712-T3-01_Diplura	36%	36%	33%	36%	38%	38%	37%	37%	37%	28%	31%	38%	18%	17%	16%		0%	0%	31%	31%	32%	30%	31%	31%	30%	26%	27%	30%	28%	30%	32%	31%	28%	30%
RT48_WAME98617_Japygidae_COI	36%	36%	33%	36%	38%	39%	37%	38%	38%	28%	31%	38%	18%	17%	16%	0%		0%	32%	31%	32%	30%	31%	31%	30%	26%	27%	30%	28%	30%	32%	31%	28%	30%
RT48_WAME98618_Diplura_COI	36%	36%	33%	36%	38%	39%	37%	38%	38%	28%	31%	38%	18%	17%	16%	0%	0%		32%	31%	32%	30%	31%	31%	30%	26%	27%	30%	28%	30%	32%	31%	28%	30%
IV156_DD11MEC0005-02_Diplura	36%	30%	35%	30%	31%	31%	29%	29%	29%	23%	23%	35%	31%	33%	31%	31%	32%	32%		21%	22%	22%	22%	22%	24%	22%	24%	22%	23%	21%	21%	19%	21%	20%
JQ796642 (reversed)	32%	30%	30%	33%	31%	31%	31%	31%	31%	26%	25%	35%	29%	28%	32%	31%	31%	31%	21%		3%	2%	1%	1%	20%	20%	24%	21%	22%	20%	20%	19%	21%	20%
JQ796644 (reversed)	34%	30%	29%	34%	31%	31%	31%	31%	31%	27%	25%	34%	29%	27%	33%	32%	32%	32%	22%	3%		2%	3%	3%	20%	21%	25%	21%	22%	20%	20%	19%	20%	19%
JQ796645 (reversed)	32%	30%	30%	34%	32%	32%	31%	31%	31%	27%	25%	35%	30%	27%	32%	30%	30%	30%	22%	2%	2%		2%	2%	20%	20%	24%	21%	22%	20%	21%	20%	21%	20%
JQ796646 (reversed)	31%	30%	29%	33%	31%	31%	31%	31%	31%	27%	25%	35%	29%	28%	32%	31%	31%	31%	22%	1%	3%	2%		2%	19%	21%	24%	20%	22%	20%	21%	20%	21%	20%
JQ796647 (reversed)	31%	30%	30%	34%	32%	32%	32%	31%	31%	27%	24%	35%	29%	28%	32%	31%	31%	31%	22%	1%	3%	2%	2%		19%	20%	24%	21%	22%	20%	20%	20%	21%	20%
BMR00490_LN33785 Diplura HopeDowns (reversed)	**33%**	**28%**	**33%**	**31%**	**28%**	**29%**	**29%**	**28%**	**28%**	**25%**	**28%**	**34%**	**29%**	**26%**	**29%**	**30%**	**30%**	**30%**	**24%**	**20%**	**20%**	**20%**	**19%**	**19%**		**18%**	**20%**	**18%**	**22%**	**20%**	**20%**	**20%**	**16%**	**17%**
RT56_WAME98666_Diplura?_2	34%	28%	29%	31%	30%	30%	29%	29%	30%	24%	25%	37%	26%	27%	27%	26%	26%	26%	22%	20%	21%	20%	21%	20%	**18%**		15%	19%	18%	17%	18%	17%	16%	16%
JC18_RC14BS4004-20151125-T2-01_Diplura	36%	31%	31%	32%	31%	32%	31%	31%	31%	28%	27%	35%	26%	30%	28%	27%	27%	27%	24%	24%	25%	24%	24%	24%	**20%**	15%		20%	18%	19%	22%	21%	18%	18%
RT53_WAME98649_WAM-DPLJ006	37%	31%	32%	29%	29%	28%	27%	27%	27%	26%	28%	30%	27%	31%	27%	30%	30%	30%	22%	21%	21%	21%	20%	21%	**18%**	19%	20%		12%	17%	19%	17%	17%	18%
LI30_MEAWO4088-20170307-01_Diplura	36%	33%	30%	32%	34%	34%	32%	32%	32%	26%	25%	33%	29%	32%	31%	28%	28%	28%	23%	22%	22%	22%	22%	22%	**22%**	18%	18%	12%		19%	21%	19%	19%	19%
RT53_WAME98647_Diplura_WAM-DPLJ002	34%	31%	30%	30%	30%	30%	28%	28%	28%	25%	26%	34%	28%	30%	29%	30%	30%	30%	21%	20%	20%	20%	20%	20%	**20%**	17%	19%	17%	19%		10%	10%	11%	9%
RT53_WAME98654_Diplura_WAM-DPLJ004	37%	30%	31%	32%	30%	30%	29%	29%	29%	24%	28%	35%	30%	31%	27%	32%	32%	32%	21%	20%	20%	21%	21%	20%	**20%**	18%	22%	19%	21%	10%		7%	7%	7%
RT48_WAME98598_Japygidae_COI	36%	31%	30%	30%	30%	30%	28%	28%	29%	24%	27%	33%	28%	31%	27%	31%	31%	31%	19%	19%	19%	20%	20%	20%	**20%**	17%	21%	17%	19%	10%	7%		8%	8%
RT53_WAME98651_Diplura_WAM-DPLJ001-A	36%	31%	29%	29%	30%	30%	30%	30%	30%	24%	25%	35%	26%	29%	27%	28%	28%	28%	21%	21%	20%	21%	21%	21%	**16%**	16%	18%	17%	19%	11%	7%	8%		4%
RT53_WAME98650_Diplura_WAM-DPLJ001	33%	30%	28%	29%	28%	28%	27%	27%	27%	24%	25%	34%	25%	30%	27%	30%	30%	30%	20%	20%	19%	20%	20%	20%	**17%**	16%	18%	18%	19%	9%	7%	8%	4%	

Appendix 5 . Distance matrix of Hemiptera sequences/ lineages included in the analysis

COI divergence of Hemiptera (regional comparisons)	WAME34031	BMR00436	BMR00487	BMR00486	WAME98571	WAME98656	WAME98671	BMR00553	WAME98535	WAME98587	WAME98594	WAME98657	WAME98678	JY19_2139	JY20_2356
RT27_WAME34031_Mesa_K_Ptiliidae_Helix_CPT003		41%	41%	44%	45%	44%	45%	41%	41%	42%	42%	41%	42%	42%	42%
BMR00436_LN36535 Hemiptera HopeDowns (reversed)	41%		0%	27%	25%	25%	25%	26%	28%	27%	25%	27%	26%	27%	27%
BMR00487_LN33789 Hemiptera HopeDowns (reversed)	41%	0%		27%	25%	25%	25%	26%	28%	27%	26%	28%	27%	27%	27%
BMR00486_LN33774 Hemiptera HopeDowns (reversed)	44%	27%	27%		11%	12%	11%	17%	17%	16%	16%	17%	17%	17%	17%
RT43_WAME98571_Phaconeura_WAM-PHAC002	45%	25%	25%	11%		1%	0%	19%	18%	17%	18%	17%	17%	17%	17%
RT53_WAME98656_Phaconeura_WAM-PHAC002	44%	25%	25%	12%	1%		1%	19%	18%	17%	17%	17%	17%	17%	17%
RT56_WAME98671_Phaconeura_WAM-PHAC002	45%	25%	25%	11%	0%	1%		19%	18%	17%	18%	17%	17%	17%	17%
BMR00553_LN35120 Hemiptera HopeDowns (reversed)	41%	26%	26%	17%	19%	19%	19%		14%	13%	14%	14%	13%	13%	13%
RT43_WAME98535_Phaconeura_WAM-PHAC001	41%	28%	28%	17%	18%	18%	18%	14%		2%	2%	1%	2%	2%	2%
RT45_WAME98594_Phaconeura_WAM-PHAC001	42%	25%	26%	16%	18%	17%	18%	14%	2%	0%		2%	0%	0%	0%
RT46_WAME98587_Phaconeura_WAM-PHAC001	42%	27%	27%	16%	17%	17%	17%	13%	2%		0%	2%	0%	0%	0%
RT53_WAME98657_Phaconeura_WAM-PHAC001	41%	27%	28%	17%	17%	17%	17%	14%	1%	2%	2%		2%	2%	2%
RT56_WAME98678_Phaconeura_WAM-PHAC001	42%	26%	27%	17%	17%	17%	17%	13%	2%	0%	0%	2%		0%	0%
JY19_2139_Meenoplidae_WAN	42%	27%	27%	17%	17%	17%	17%	13%	2%	0%	0%	2%	0%		0%
JY20_2356_Meenoplidae_WAN	42%	27%	27%	17%	17%	17%	17%	13%	2%	0%	0%	2%	0%	0%	

Appendix 6 Distance matrix of Palpigradi sequences/ lineages included in the analysis

COI divergence of Palpigradi (regional comparisons)	KJ744691	HM13	00707	RT43_PALE002	RT43_PALE001
KJ744691 (Araneae)		23%	66%	50%	51%
HM13_M20130912_Araneae_HD	23%		43%	45%	46%
00707_LN39264 Palpigradi HopeDowns	66%	43%		63%	55%
RT43_WAMT145439_Eukoenenia_WAM-PALE002	50%	45%	63%		30%
RT43_WAMT145442_Eukoenenia_WAM-PALE001	51%	46%	55%	30%	

Appendix 7. Distance matrix of Polyxenida sequences/ lineages included in the analysis

COI divergence of Diplopoda (regional comparisons)	P7	BMR00492	S45	S12	S31	P3	P1	P51	P52	P4	P11	P5	S23	P12	S27	S30	S34	P67	S53	S55	P6	S18	S25	S11	S46	S49
P7_RC08SILV0141PIT1-4_Polyxenida		29%	28%	27%	27%	29%	27%	28%	28%	22%	23%	26%	28%	26%	27%	28%	28%	28%	30%	30%	26%	27%	28%	29%	29%	29%
BMR00492_ LN38435 Diplopoda HopeDowns	29%		11%	9%	9%	10%	8%	9%	9%	5%	7%	12%	12%	11%	11%	12%	12%	11%	12%	12%	10%	11%	11%	11%	11%	11%
S45_RHWRC0250P2T3-3_Polyxenida_Hmstd-Namm-Silv	28%	11%		6%	6%	11%	10%	10%	10%	7%	9%	12%	14%	13%	12%	13%	13%	12%	13%	13%	10%	11%	12%	11%	12%	12%
S12_CGBRC0293P2T2-2_Polyxenida_Hmstd-Namm-Silv	27%	9%	6%		0%	9%	8%	9%	9%	6%	8%	12%	13%	13%	12%	13%	13%	12%	12%	12%	10%	12%	12%	12%	12%	12%
S31_CGBRC0285P2T2-2_Polyxenida_Hmstd-Namm-Silv	27%	9%	6%	0%		9%	8%	8%	8%	6%	7%	12%	12%	12%	12%	12%	12%	11%	11%	11%	10%	11%	12%	11%	11%	11%
P3_RC08SILV0796PIT1-2_Polyxenida (reversed)	29%	10%	11%	9%	9%		5%	5%	5%	4%	6%	13%	13%	13%	12%	13%	13%	12%	13%	13%	11%	12%	13%	12%	12%	12%
P1_DD08SILV09PIT1-1_Polyxenida (reversed)	27%	8%	10%	8%	8%	5%		2%	2%	5%	6%	12%	13%	12%	12%	13%	13%	12%	13%	13%	10%	12%	12%	12%	12%	12%
P51_RC03WR096P1T1-3A_Polyxenida (reversed)	28%	9%	10%	9%	8%	5%	2%		0%	4%	6%	12%	13%	13%	12%	13%	13%	12%	13%	13%	11%	12%	12%	11%	11%	11%
P52_RC03WR096P1T1-3B_Polyxenida (reversed)	28%	9%	10%	9%	8%	5%	2%	0%		4%	6%	13%	13%	13%	12%	13%	13%	13%	13%	13%	11%	12%	12%	12%	12%	12%
P4_RC08SILV0795PIT1-3_Polyxenida	22%	5%	7%	6%	6%	4%	5%	4%	4%		0%	1%	1%	2%	2%	2%	2%	3%	3%	2%	1%	3%	3%	2%	2%	2%
P11_RC08SILV0795PIT3-3_Polyxenida	23%	7%	9%	8%	7%	6%	6%	6%	6%	0%		0%	0%	1%	1%	2%	2%	2%	3%	3%	2%	3%	3%	3%	3%	3%
P5_RC08SILV0919PIT1-3_Polyxenida (reversed)	26%	12%	12%	12%	12%	13%	12%	12%	13%	1%	0%		0%	2%	2%	2%	2%	3%	4%	4%	4%	4%	4%	4%	4%	4%
S23_RC09SV023P2T1-3_Polyxenida_Hmstd-Namm-Silv	28%	12%	14%	13%	12%	13%	13%	13%	13%	1%	0%	0%		2%	2%	2%	2%	3%	4%	4%	4%	4%	4%	4%	4%	4%
P12_RC07S10B259P1T3-1_Polyxenida (reversed)	26%	11%	13%	13%	12%	13%	12%	13%	13%	2%	1%	2%	2%		2%	2%	2%	3%	3%	3%	3%	4%	4%	4%	4%	4%
S27_RC05MTS003P2T1-2_Polyxenida_Hmstd-Namm-Silv	27%	11%	12%	12%	12%	12%	12%	12%	12%	2%	1%	2%	2%	2%		0%	0%	4%	4%	4%	3%	4%	4%	4%	4%	4%
S30_RC05MTS003P2T1-2_Polyxenida_Hmstd-Namm-Silv	28%	12%	13%	13%	12%	13%	13%	13%	13%	2%	2%	2%	2%	2%	0%		0%	4%	4%	4%	3%	4%	4%	4%	4%	4%
S34_RC05MTS003P2T2-3_Polyxenida_Hmstd-Namm-Silv	28%	12%	13%	13%	12%	13%	13%	13%	13%	2%	2%	2%	2%	2%	0%	0%		4%	4%	4%	3%	4%	4%	4%	4%	4%
P67_RC05RH0040P1T1-1B_T96109B_Polyxenida (reversed)	28%	11%	12%	12%	11%	12%	12%	12%	13%	3%	2%	3%	3%	3%	4%	4%	4%		0%	0%	1%	2%	2%	2%	2%	2%
S53_RC08NAM389P2T1-2_Polyxenida_Hmstd-Namm-Silv	30%	12%	13%	12%	11%	13%	13%	13%	13%	3%	3%	4%	4%	3%	4%	4%	4%	0%		0%	1%	2%	2%	2%	2%	2%
S55_RC08NAM389P2T3-2_Polyxenida_Hmstd-Namm-Silv	30%	12%	13%	12%	11%	13%	13%	13%	13%	2%	3%	4%	4%	3%	4%	4%	4%	0%	0%		1%	2%	2%	2%	2%	2%
P6_RC08SILVPIT1-3_Polyxenida	26%	10%	10%	10%	10%	11%	10%	11%	11%	1%	2%	4%	4%	3%	3%	3%	3%	1%	1%	1%		1%	1%	1%	1%	1%
S18_CGBRC0285T2-2_Polyxenida_Hmstd-Namm-Silv	27%	11%	11%	12%	11%	12%	12%	12%	12%	3%	3%	4%	4%	4%	4%	4%	4%	2%	2%	2%	1%		0%	0%	0%	0%
S25_CGBRC0285P2T1-2_Polyxenida_Hmstd-Namm-Silv	28%	11%	12%	12%	12%	13%	12%	12%	12%	3%	3%	4%	4%	4%	4%	4%	4%	2%	2%	2%	1%	0%		0%	0%	0%
S11_RHWRC0273P2T2-4_Polyxenida_Hmstd-Namm-Silv	29%	11%	11%	12%	11%	12%	12%	11%	12%	2%	3%	4%	4%	4%	4%	4%	4%	2%	2%	2%	1%	0%	0%		0%	0%
S46_RHWRC0303P2T2-3_Polyxenida_Hmstd-Namm-Silv	29%	11%	12%	12%	11%	12%	12%	11%	12%	2%	3%	4%	4%	4%	4%	4%	4%	2%	2%	2%	1%	0%	0%	0%		0%
S49_RHWRC0303P2T3-3_Polyxenida_Hmstd-Namm-Silv	29%	11%	12%	12%	11%	12%	12%	11%	12%	2%	3%	4%	4%	4%	4%	4%	4%	2%	2%	2%	1%	0%	0%	0%	0%	

Appendix 8. Distance matrix of Pseudoscorpiones sequences/ lineages included in the analysis

COI divergence of Pseudoscorpiones (regional comparisons)	KJ744691	WAMT145889	JN018171	MK453588	00779	EU559513	WAMT146605	WAMT146291	WAMT146294	WAMT145809	WAMT145843	WAMT145849	WAMT145830	WAMT145831	WAMT145803	WAMT145875	WAMT145888	WAMT145847	WAMT145816	WAMT145887
KJ744691 Aname MYG213		37%	34%	36%	41%	43%	42%	43%	38%	42%	45%	42%	41%	40%	36%	37%	39%	41%	40%	41%
RT48 WAMT145889 Olpiidae WAM-OLPI001	37%		29%	30%	31%	29%	30%	30%	29%	31%	30%	30%	31%	30%	27%	28%	28%	31%	31%	31%
JN018171 Chthonius dacnodes	34%	29%		18%	19%	19%	21%	21%	20%	22%	22%	19%	24%	23%	22%	24%	22%	24%	24%	23%
MK453588 Pseudotyrannochthonius	36%	30%	18%		22%	21%	24%	22%	23%	20%	21%	20%	22%	22%	25%	26%	25%	27%	28%	27%
00779 LN35130 Pseudoscorpion HopeDowns (reversed)	**41%**	**31%**	**19%**	**22%**		**21%**	**20%**	**20%**	**22%**	**21%**	**23%**	**21%**	**25%**	**24%**	**22%**	**23%**	**22%**	**25%**	**22%**	**22%**
EU559513 Austrochthonius	43%	29%	19%	21%	21%		19%	21%	22%	21%	22%	19%	21%	21%	21%	21%	21%	23%	22%	22%
RT56 WAMT146605 Tyrannochthonius WAM-CHTH002	42%	30%	21%	24%	20%	19%		21%	22%	21%	21%	19%	19%	20%	21%	22%	21%	24%	23%	23%
RT53 WAMT146291 Tyrannochthonius Helix PC048	43%	30%	21%	22%	20%	21%	21%		11%	17%	17%	14%	18%	18%	19%	20%	19%	19%	19%	19%
RT53 WAMT146294 Tyrannochthonius Helix PC051	38%	29%	20%	23%	22%	22%	22%	11%		16%	16%	15%	17%	17%	19%	19%	18%	19%	18%	18%
RT48 WAMT145809 Tyrannochthonius WAM-CHTH005	42%	31%	22%	20%	21%	21%	21%	17%	16%		9%	6%	17%	17%	19%	18%	18%	22%	21%	21%
RT48 WAMT145843 Tyrannochthonius WAM-CHTH005	45%	30%	22%	21%	23%	22%	21%	17%	16%	9%		9%	17%	17%	20%	20%	19%	21%	22%	22%
RT48 WAMT145849 Tyrannochthonius WAM-CHTH005	42%	30%	19%	20%	21%	19%	19%	14%	15%	6%	9%		16%	16%	19%	17%	17%	20%	21%	21%
RT48 WAMT145830 Tyrannochthonius WAM-CHTH006	41%	31%	24%	22%	25%	21%	19%	18%	17%	17%	17%	16%		0%	17%	17%	15%	19%	20%	19%
RT48 WAMT145831 Tyrannochthonius WAM-CHTH006	40%	30%	23%	22%	24%	21%	20%	18%	17%	17%	17%	16%	0%		18%	17%	16%	19%	20%	19%
RT48 WAMT145803 Tyrannochthonius basme	36%	27%	22%	25%	22%	21%	21%	19%	19%	19%	20%	19%	17%	18%		4%	4%	13%	11%	11%
RT48 WAMT145875 Tyrannochthonius basme	37%	28%	24%	26%	23%	21%	22%	20%	19%	18%	20%	17%	17%	17%	4%		3%	14%	13%	13%
RT48 WAMT145888 Tyrannochthonius basme	39%	28%	22%	25%	22%	21%	21%	19%	18%	18%	19%	17%	15%	16%	4%	3%		13%	12%	12%
RT48 WAMT145847 Tyrannochthonius WAM-CHTH003	41%	31%	24%	27%	25%	23%	24%	19%	19%	22%	21%	20%	19%	19%	13%	14%	13%		9%	9%
RT48 WAMT145816 Tyrannochthonius WAM-CHTH003-A	40%	31%	24%	28%	22%	22%	23%	19%	18%	21%	22%	21%	20%	20%	11%	13%	12%	9%		0%
RT48 WAMT145887 Tyrannochthonius WAM-CHTH003-A	41%	31%	23%	27%	22%	22%	23%	19%	18%	21%	22%	21%	19%	19%	11%	13%	12%	9%	0%	

Appendix 9. Distance matrix of Schizomida sequences/ lineages included in the analysis

COI divergence of Schizomida (regional comparisons)	FZ4	JC06	CY1	DN2	GO90	HM1	BMR00648	BMR00708	BMR00775	BMR00776	BMR00777	MN020279	MN020275	MN020276	MN020280	MN020281	BMR00528	BMR00588	BMR00778
FZ4_Schizomida_RC11KOOD0018P7T1-1_Koodaideri		15%	11%	12%	11%	14%	16%	16%	16%	16%	16%	14%	15%	15%	15%	16%	16%	15%	16%
JC06_T138610_SchizomidaBrockman_Syncline	15%		16%	14%	15%	19%	19%	20%	19%	19%	19%	19%	20%	21%	20%	21%	20%	20%	20%
CY1_DD03KOOD003P3T2-1A_T126477_Schizomida_Koodaideri	11%	16%		7%	15%	15%	16%	16%	16%	16%	15%	17%	16%	17%	16%	17%	17%	17%	17%
DN2_RC12KOOD1374P5T1-2_Schizomida_Koodaideri	12%	14%	7%		15%	15%	16%	16%	17%	16%	16%	17%	15%	15%	15%	16%	16%	15%	16%
GO90_RC13YBR0038_Draculoides_sp_WeeliWolli	11%	15%	15%	15%		14%	14%	14%	14%	14%	14%	13%	15%	14%	15%	14%	14%	14%	14%
HM1_RC12H1SW0026P1T1-1_Schizomida_HD_SCH067	14%	19%	15%	15%	14%		8%	7%	8%	8%	8%	10%	10%	9%	10%	10%	10%	10%	10%
BMR00648 _LN35582_Schizomida_HopeDowns (reversed)	16%	19%	16%	16%	14%	8%		1%	1%	1%	0%	9%	8%	7%	8%	7%	7%	7%	7%
BMR00708 _LN38567_Schizomida_HopeDowns (reversed)	16%	20%	16%	16%	14%	7%	1%		1%	0%	1%	8%	7%	6%	7%	6%	6%	7%	7%
BMR00775 _LN33570_Schizomida_HopeDowns (reversed)	16%	19%	16%	17%	14%	8%	1%	1%		0%	1%	9%	7%	7%	7%	7%	7%	7%	7%
BMR00776 _LN33590_Schizomida_HopeDowns (reversed)	16%	19%	16%	16%	14%	8%	1%	0%	0%		1%	8%	7%	7%	7%	6%	7%	7%	7%
BMR00777 _LN35572_Schizomida_HopeDowns (reversed)	16%	19%	15%	16%	14%	8%	0%	1%	1%	1%		9%	7%	7%	7%	6%	7%	7%	7%
MN020279_Draculoides sp. SCH068 WAMT138602	14%	19%	17%	17%	13%	10%	9%	8%	9%	8%	9%		7%	6%	7%	7%	7%	7%	7%
MN020275_Draculoides sp. SCH068 WAMT135989	15%	20%	16%	15%	15%	10%	8%	7%	7%	7%	7%	7%		3%	0%	3%	4%	4%	4%
MN020276_Draculoides sp. SCH068 WAMT138599	15%	21%	17%	15%	14%	9%	7%	6%	7%	7%	7%	6%	3%		3%	3%	3%	3%	3%
MN020280_Draculoides sp. SCH068 WAMT138603	15%	20%	16%	15%	15%	10%	8%	7%	7%	7%	7%	7%	0%	3%		3%	4%	4%	4%
MN020281_Draculoides sp. SCH068 WAMT138604	16%	21%	17%	16%	14%	10%	7%	6%	7%	6%	6%	7%	3%	3%	3%		2%	2%	2%
BMR00528 _LN37569_Schizomida_HopeDowns (reversed)	16%	20%	17%	16%	14%	10%	7%	6%	7%	7%	7%	7%	4%	3%	4%	2%		0%	0%
BMR00588 _LN38573_Schizomida_HopeDowns (reversed)	15%	20%	17%	15%	14%	10%	7%	7%	7%	7%	7%	7%	4%	3%	4%	2%	0%		0%
BMR00778_LN36580_Schizomida_HopeDowns (reversed)	16%	20%	17%	16%	14%	10%	7%	7%	7%	7%	7%	7%	4%	3%	4%	2%	0%	0%	

Appendix 10. Distance matrix of Zygentoma sequences/ lineages included in the analysis

12S divergence of Zygentoma (regional comparisons)	WAME98619	IV228	IV229	BMR00555	WAME98579	WAME98581	WAME98679	WAME98680	WAME98681	WAME98688	WAME98559	WAME98547	WAME98551	WAME98687	FL3	FL4	IV227	IV333	IV334	IV338	IV339
RT48_WAME98619_Nicoletiidae_JIM_WAM-ZYGN001		43%	43%	38%	34%	36%	36%	35%	35%	43%	45%	43%	46%	45%	42%	42%	44%	43%	46%	44%	45%
IV228_RC14MEB0060_Thysanura	43%		0%	19%	19%	18%	18%	18%	17%	46%	42%	43%	50%	42%	43%	43%	45%	44%	48%	48%	48%
IV229_RC14MEB0060_Thysanura	43%	0%		20%	19%	18%	19%	18%	18%	46%	42%	43%	50%	42%	45%	45%	48%	47%	52%	51%	50%
BMR00555_LN39280_Zygentoma_R_12S	38%	19%	20%		8%	8%	8%	9%	10%	44%	45%	43%	47%	44%	45%	45%	43%	40%	48%	47%	46%
RT43_WAME98579_Dodecastyla_WAM_-ZYGA001	34%	19%	19%	8%		2%	2%	2%	5%	38%	43%	41%	44%	41%	42%	42%	44%	42%	45%	44%	44%
RT43_WAME98581_Dodecastyla_WAM_-ZYGA001	36%	18%	18%	8%	2%		0%	0%	5%	38%	43%	42%	46%	42%	42%	42%	44%	42%	45%	45%	45%
RT56_WAME98679_Dodecastyla_WAM-ZYGA001	36%	18%	19%	8%	2%	0%		1%	5%	39%	44%	43%	48%	41%	43%	43%	45%	43%	48%	45%	45%
RT56_WAME98680_Dodecastyla_WAM-ZYGA001	35%	18%	18%	9%	2%	0%	1%		4%	38%	45%	42%	46%	41%	43%	43%	46%	45%	48%	47%	47%
RT56_WAME98681_Dodecastyla_WAM-ZYGA001	35%	17%	18%	10%	5%	5%	5%	4%		40%	46%	43%	46%	42%	43%	43%	46%	46%	49%	48%	48%
RT56_WAME98688_Trinemura_WAM-ZYGS001	43%	46%	46%	44%	38%	38%	39%	38%	40%		14%	12%	14%	12%	13%	13%	17%	15%	17%	14%	14%
RT43_WAME98559_Trinemura_WAM-ZYGS002	45%	42%	42%	45%	43%	43%	44%	45%	46%	14%		13%	12%	13%	11%	11%	14%	15%	18%	15%	14%
RT43_WAME98547_Trinemura_WAM-ZYGS004	43%	43%	43%	43%	41%	42%	43%	42%	43%	12%	13%		10%	10%	12%	12%	11%	13%	17%	13%	13%
RT43_WAME98551_Trinemura_WAM-ZYGS003	46%	50%	50%	47%	44%	46%	48%	46%	46%	14%	12%	10%		13%	14%	14%	14%	15%	17%	13%	13%
RT56_WAME98687_Trinemura_WAM-ZYGS005	45%	42%	42%	44%	41%	42%	41%	41%	42%	12%	13%	10%	13%		9%	9%	12%	12%	16%	11%	12%
FL3_TOBRC0011PIT2-1_A	42%	43%	45%	45%	42%	42%	43%	43%	43%	13%	11%	12%	14%	9%		0%	11%	11%	14%	10%	9%
FL4_TOBRC0011PIT2-1_B	42%	43%	45%	45%	42%	42%	43%	43%	43%	13%	11%	12%	14%	9%	0%		11%	11%	14%	10%	9%
IV227_MEARC4383_Thysanura	44%	45%	48%	43%	44%	44%	45%	46%	46%	17%	14%	11%	14%	12%	11%	11%		3%	15%	14%	14%
IV333_MEBRC0020T1-20_Thysanura	43%	44%	47%	40%	42%	42%	43%	45%	46%	15%	15%	13%	15%	12%	11%	11%	3%		14%	14%	13%
IV334_M2ERC0057T1-21_Thysanura	46%	48%	52%	48%	45%	45%	48%	48%	49%	17%	18%	17%	17%	16%	14%	14%	15%	14%		14%	14%
IV338_GR15MEC0001-20160316-T2-06_Thysanura	44%	48%	51%	47%	44%	45%	45%	47%	48%	14%	15%	13%	13%	11%	10%	10%	14%	14%	14%		2%
IV339_RC15MEC0197-20160316-T2-01_Thysanura	45%	48%	50%	46%	44%	45%	45%	47%	48%	14%	14%	13%	13%	12%	9%	9%	14%	13%	14%	2%	

Appendix 11. Table of lineages/ species results from the analysis

Area	Site Name	Higher taxon	Taxon ID	Lot No. (LN)	BMR Code	Biologic Lineage name	Local alignment (species level)	Regional alignment (species level)
BBH	MB16SW0006	Amphipoda	*Pilbarus* nr_*millsi*_OES12	LN35584	BMR00484	AMPH001	Biologic-AMPH001 (<0.1%)	No (>26%)
BBH	MB16HD1SW0006	Amphipoda	Amphipoda	LN35145	BMR00488	AMPH001	Biologic-AMPH001 (<0.1%)	No (>26%)
BHT	RC18BHT0334	Blattodea	*Nocticola* OES13	LN33372	BMR00373	BLAT002	Biologic-BLAT002 (<2%)	No (>43%)
BHT	RC18BHT0254	Blattodea	*Nocticola* OES13	LN36582	BMR00374	BLAT003	Biologic-BLAT003 (<3%)	No (>43%)
BHT	DD17BHT0020	Blattodea	*Nocticola* OES13	LN37412	BMR00376	BLAT003	Biologic-BLAT003 (<3%)	No (>43%)
BHT	RC18BHT0016	Blattodea	*Nocticola* OES12	LN35427	BMR00377	BLAT004	Biologic-BLAT004 (<1%)	No (>43%)
BHT	RC18BHT0001	Blattodea	*Nocticola* OES12	LN33391	BMR00424	BLAT004	Biologic-BLAT004 (<1%)	No (>43%)
HD2	RC16HD20174	Blattodea	*Nocticola* OES13	LN36514	BMR00425	BLAT003	Biologic-BLAT003 (<3%)	No (>43%)
BHT	RC18BHT0224	Blattodea	*Nocticola* OES13	LN33532	BMR00426	BLAT002	Biologic-BLAT002 (<2%)	No (>43%)
HD2	RC17HD20011	Blattodea	*Nocticola* OES13	LN33514	BMR00427	BLAT003	Biologic-BLAT003 (<3%)	No (>43%)
HD2	GD18HD20009	Blattodea	*Nocticola* OES13	LN39408	BMR00428	BLAT003	Biologic-BLAT003 (<3%)	No (>43%)
BHT	RC18BHT0258	Blattodea	*Nocticola* OES12	LN37424	BMR00429	BLAT004	Biologic-BLAT004 (<1%)	No (>43%)
BHT	RC18BHT0099	Blattodea	*Nocticola* OES12	LN38726	BMR00430	BLAT004	Biologic-BLAT004 (<1%)	No (>43%)
HD2	RC18HD20171	Blattodea	*Nocticola* OES12	LN34133	BMR00431	BLAT001	No (>7%)	No (>43%)
BHT	RC18BHT0308	Blattodea	*Nocticola* OES13	LN34509	BMR00432	BLAT002	Biologic-BLAT002 (<2%)	No (>43%)
BHT	RC18BHT0026	Blattodea	*Nocticola* OES12	LN37717	BMR00433	BLAT004	Biologic-BLAT004 (<1%)	No (>43%)
BHT	RC18BHT0016	Blattodea	*Nocticola* OES13	LN34142	BMR00434	BLAT004	Biologic-BLAT004 (<1%)	No (>43%)
BHT	RC18BHT0248	Blattodea	*Nocticola* OES13	LN37718	BMR00435	BLAT002	Biologic-BLAT002 (<2%)	No (>43%)
HD2	DD18HD20001	Blattodea	*Nocticola* OES13	LN35535	BMR00437	BLAT003	Biologic-BLAT003 (<3%)	No (>43%)
BHT	RC16BHT0291	Blattodea	*Nocticola* OES13	LN38585	BMR00485	BLAT004	Biologic-BLAT004 (<1%)	No (>43%)
BHT	RC18BHT0254	Blattodea	*Nocticola* OES13	LN33574	BMR00493	BLAT003	Biologic-BLAT003 (<3%)	No (>43%)
BHT	RC15BHT0267	Blattodea	*Nocticola* OES13	LN36536	BMR00497	BLAT002	Biologic-BLAT002 (<2%)	No (>43%)
HD2	DD18HD20005	Chilopoda	Scolopendromorpha	LN37426	BMR00489	CHIL001	No	No (>21%)
HD2	RC17HD20234	Diplura	*Indjapx* OES7	LN33785	BMR00490	DIPL001	No	No (>16%)
BHT	DD17BHT0020	Hemiptera	*Nisia* OES16	LN35425	BMR00375	Failed	n/a	n/a
BHT	RC15BHT0267	Hemiptera	*Nisia* OES16	LN36535	BMR00436	HEMI001	Biologic-HEMI001 (<0.1%)	No (>13%)
BHT	RC16HD10193	Hemiptera	*Phaconeura* OES15	LN33774	BMR00486	HEMI002	No (>18%)	No (>13%)
BHT	RC16BHT0222	Hemiptera	*Nisia* OES16	LN33789	BMR00487	HEMI001	Biologic-HEMI001 (<0.1%)	No (>13%)
BBH	RC14HD10072	Hemiptera	*Phaconeura* OES15	LN35120	BMR00553	HEMI003	No (>18%)	No (>13%)
BHT	RC18BHT0030	Hemiptera	*Phaconeura* indet	LN32758	BMR00554	Failed	n/a	n/a
HD2	RC18HD20120	Palpigradi	*Eukoenenia* OES2	LN39264	BMR00707	PALP001	No	No (>55%)
BHT	RC16BHT0141	Palpigradi	*Eukoenenia* OES2	LN39263	BMR00780	Failed	n/a	n/a
BHT	RC18BHT0100	Pauropoda	Pauropoda	LN35790	BMR00491	Failed	n/a	n/a
BHT	RC18BHT0258	Polyxenida	Lophoproctidae	LN38435	BMR00492	POLX001	No	No (>9%)
BHT	RC18BHT0248	Pseudoscorpiones	*Tyrannochthonius* OES20	LN35130	BMR00779	PSEU001	No	No (>19%)
BHT	RC15BHT0267	Schizomida	*Draculoides* ?BHD4/ BHD5	LN37569	BMR00528	n/a	Within lineage (<7%)	*Draculoides* SCH068 (<7%)
BHT	RC15BHT0267	Schizomida	*Draculoides* ?BHD4/ BHD5	LN38573	BMR00588	n/a	Within lineage (<7%)	*Draculoides* SCH068 (<7%)
BHT	DD17BHT0020	Schizomida	*Draculoides* ?BHD4/ BHD5	LN35582	BMR00648	n/a	Within lineage (<7%)	*Draculoides* SCH068 (<9%)
BHT	RC18BHT0026	Schizomida	*Draculoides* ?BHD4/ BHD5	LN38567	BMR00708	n/a	Within lineage (<7%)	*Draculoides* SCH068 (<8%)
BHT	RC16HD10193	Schizomida	*Draculoides* ?BHD4/ BHD5	LN33570	BMR00775	n/a	Within lineage (<7%)	*Draculoides* SCH068 (<9%)
BHT	RC16HD10193	Schizomida	*Draculoides* ?BHD4/ BHD5	LN33590	BMR00776	n/a	Within lineage (<7%)	*Draculoides* SCH068 (<8%)
BHT	DD17BHT0020	Schizomida	*Draculoides* ?BHD4/ BHD5	LN35572	BMR00777	n/a	Within lineage (<7%)	*Draculoides* SCH068 (<9%)
BHT	RC15BHT0267	Schizomida	*Draculoides* ?BHD4/ BHD5	LN36580	BMR00778	n/a	Within lineage (<7%)	*Draculoides* SCH068 (<7%)
BHT	RC15BHT0267	Zygentoma	Ateluridae indet.	LN39280	BMR00555	ZYGE001	No	No (>8% 12S)

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Biologic Environmental Survey Pty Ltd
PO Box 179
Floreat, WA, 6014

9th December 2019

Attn: Caitlin O'Neill

Rio Tinto Iron Ore

152-158 St Georges Tce

Perth, WA 6000

Dear Caitlin,

Biologic conducted molecular systematics analysis (DNA barcoding) of 44 subterranean fauna (stygofauna and troglofauna) specimens collected from Rio Tinto's Hope Downs 1 (HDOW1) Project in November 2019. Since the time of publication of the report for molecular systematics analysis (Biologic 2019), some of the sequences derived from HDOW1 have been included in additional regional genetic comparisons with other and/or new sequences. This has resulted in further genetic alignments which may be of interest to Rio Tinto in relation to the HDOW1 project, including:

1. Hemiptera: *Nisia* OES16 (LN36535 and LN33789). Sequences from this Operational Taxonomic Unit (OTU) have been found to occur within a large clade containing many specimens from the Greater Brockman (GBO) area. The COI divergence between the GBO and HDOW1 sequences is between 3.7 and 4.4%, which is considered to represent the same species. There appears to be a strong population level difference between the average divergence of GBO sequences (0.8% COI), and HDOW1 vs GBO sequences (average 4.0%), which may reflect their geographical separation, but is below the species threshold applied at present.

2. Polyxenida: Lophoproctidae (LN38435): Genetic divergences within this taxon appear to be very gradational throughout the region and thus it is difficult to define consistent species thresholds. There is a chance that there could all be one large, regionally widespread OTU with divergences ranging up to 12% (average 8.7%). However, we are hesitant to accept this interpretation (with a very high level of COI divergence) without further genetic or morphological evidence. Therefore, as a precaution the current interpretation splits two widespread clades at approximately 9-10% COI divergence, with the HDOW1 sequence aligning to other sequences collected from GBO, Robe Headwaters, West Turner Syncline, Mesa G, and Paraburdoo. The closest individual match to LN38435 is 8.0% from Robe Headwaters, which is borderline high population-level divergence or low species-level divergence. Given anecdotal evidence of widespread/ cosmopolitan Lophoproctidae specimens occurring throughout subterranean

habitats in the Pilbara region, we are reasonably comfortable with this interpretation; however, further work is required to derive valid species divergence thresholds at COI in this taxon.

3. Zygentoma: Ateluridae sp. (LN39280). The HDOW1 sequence aligned with a Zygentoma OTU from West Angelas at 6.7% (12s), and also at a slightly higher divergence, with *Dodecastyla* sp. WAM-ZYGA001 from Paraburdoo (average 8.5% 12s). Owing to the ecological interpretation of Ateluridae as soil fauna/ inquiline inhabitants of termite nests, and therefore likely troglophiles/ trogloxenes, this level of divergence is regarded as indicative of a single, widely occurring OTU, with divergent populations at these different locations.

The current interpretations of OTUs and species thresholds are limited to the available genetic sequence data and may be subject to change with incorporation of further morphological, ecological, or genetic information. In particular, further work using a multiple gene approach combined with morphological taxonomy may be required to determine specific, taxonomically valid species divergence thresholds across the various subterranean taxa occurring in the Pilbara region. The current results may also be affected by the general constraints and limitations of subterranean fauna studies such as incomplete sampling, unequal sub-sampling for genetic analyses, taxonomic and ecological uncertainties, and low detection rates for some taxonomic groups.

If you have any queries or would like to discuss details further, please do not hesitate to contact myself or Nihara Gunawardene (nihara@biologicenv.com.au).

Yours sincerely,

Shae Callan,
Principal Zoologist
shae@biologicenv.com.au

Appendix C Western Australian Museum Database Seach Results

Table C-1: Western Australian Museum database search results: Arachnida.

WAM REGNO	Order	Family	Taxon	Abun-dance	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection Method	Collectors
138745	Araneae	`Gnaphosidae?`	`Gnaphosidae?`	1	Ministers North, Yandi, 90 km NW. of Newman	-22.82733	119.1016	2/18/2010	4/8/2010	Litter Trap	Bell, P.; Car, C.
138671	Araneae	`Linyphiidae?`	`Linyphiidae? sp. S1`	1	Packsaddle 2, area C, 110 km WNW. of Newman	-22.90931	118.94352	6/5/2009		Trog Scrape	Stevens, N.; Callan, S.
138747	Araneae	`Oonopidae?`	`Oonopidae?`	1	Ministers North, Yandi, 90 km NW. of Newman	-22.82142	119.1291	4/9/2009		Trog Scrape	Bell, P.; Car, C.
138746	Araneae	`Theridiidae?`	`Theridiidae?`	1	Ministers North, Yandi, 90 km NW. of Newman	-22.82733	119.1016	2/18/2010		Trog Scrape	Bell, P.; Perina, G.
139269	Araneae	`Theridiidae?`	`Theridiidae?`	1	Yandi, c. 86 km NW. of Newman	-22.79278	119.1519	8/11/2015	10/9/2015	Litter Trap	Watson, N.; Cole, C.
140999	Araneae	Gnaphosidae		1	ca. 104 km WNW. of Newman	-23.13661	118.734	3/19/2016		Trog Scrape	Callan, S.; Volschenk, E.S.
138752	Araneae	Gnaphosidae	`Gnaphosidae sp. S3`	1	Ministers North, Yandi, 90 km NW. of Newman	-22.81825	119.1031	2/20/2009	5/23/2009	Litter Trap	Bell, P.; Perina, G.
138756	Araneae	Gnaphosidae	`Gnaphosidae sp. S3`	1	Ministers North, Yandi, 90 km NW. of Newman	-22.82733	119.1016	2/21/2009	5/23/2009	Litter Trap	Bell, P.; Perina, G.
100088	Araneae	Gnaphosidae	`Encoptarthria?`	1	Area C, ca. 80 km NW. of Newman	-22.94695	119.0208	7/25/2008		Trog Scrape	Cocking, J.S.; Scanlon, M.D.
129665	Araneae	Gnaphosidae	`nr Encoptarthria` `sp. B01`	1	Orebody 41, ca. 60 km NW. of Newman	-23.00083	119.2437	8/31/2011	8/31/2011	Trog Scrape	Main, D.C.; Quartermaine, J.W.
91747	Araneae	Gnaphosidae	Gnaphosidae	1	Area C, PSA0138R	-22.92281	118.8512	3/30/2008		Litter Trap	Subterranean Ecology
127512	Araneae	Gnaphosidae	Gnaphosidae	1	32.1 km SE. of Mt Meharry, RIOTIO Greater West Angelas	-23.12156	118.8636	10/5/2012	10/8/2012	Litter Trap	White, S.; Smith, L.
127531	Araneae	Gnaphosidae	Gnaphosidae	1	31.8 km SE. of Mt Meharry, RIOTIO Greater West Angelas	-23.12345	118.8591	10/5/2012	10/8/2012	Litter Trap	White, S.; Smith, L.
139276	Araneae	Gnaphosidae	Gnaphosidae	1	Yandi, c. 86 km NW. of Newman	-22.79278	119.1533	10/8/2015	11/24/2015	Litter Trap	Cole, C.; Keirle, D.
143348	Araneae	Gnaphosidae	Gnaphosidae `wonmunna`	1	Wonmunna, ca 75 km WNW. of Newman	-23.16616	118.985	5/19/2014		Trog Scrape	Leung, A.E.
143349	Araneae	Gnaphosidae	Gnaphosidae `wonmunna`	1	Wonmunna, ca 75 km WNW. of Newman	-23.16196	118.9986	5/19/2014		Trog Scrape	Leung, A.E.
139964	Araneae	Linyphiidae	`Linyphiidae? sp. OP`	1	Ophthalmia Range, 40 km NW. of Newman	-23.29036	119.2983	6/24/2010		Trog Scrape	Bell, P.; Coen, N.
137346	Araneae	Linyphiidae	Linyphiidae	1	Packsaddle East, ca. 80 km NW. Newman	-22.89968	119.0068	3/5/2015	5/5/2015	Litter Trap	M.K. Curran, J.S. Cocking
139275	Araneae	Linyphiidae	Linyphiidae	1	Yandi, c. 86 km NW. of Newman	-22.79	119.1583	10/8/2015	11/23/2015	Litter Trap	Cole, C.; Keirle, D.
141000	Araneae	Oonopidae		1	ca. 104 km WNW. of Newman	-23.13438	118.7321	5/11/2016		Trog Scrape	Callan, S.; Volschenk, E.S.
108275	Araneae	Oonopidae	Oonopidae	1	ca. 100 km NW. of Newman, mining Area C, bore PSD0129R	-22.89928	118.9901	6/27/2010		Trog Scrape	Pearson, G.B.; Curran, M.K.
137347	Araneae	Oonopidae	Pelicinus `sp. B02`	1	Packsaddle East, ca. 80 km NW. Newman	-22.89975	119.0073	3/5/2015	3/5/2015	Litter Trap	M.K. Curran, J.S. Cocking
138749	Araneae	Oonopidae	Prethopalpus	1	Ministers North, Yandi, 90 km NW. of Newman	-22.83165	119.119	4/9/2009		Trog Scrape	Bell, P.; Car, C.
136268	Araneae	Oonopidae	Prethopalpus `DNA01`	1	Wonmunna Mining Lease, ca 70 km WNW. of Newman	-23.12482	119.1395	5/14/2014		Trog Scrape	Leung, A.E.
136269	Araneae	Oonopidae	Prethopalpus `DNA01`	1	Wonmunna Mining Lease, ca 70 km WNW. of Newman	-23.12356	119.0663	5/17/2014		Trog Scrape	Leung, A.E.
136270	Araneae	Oonopidae	Prethopalpus `DNA01`	1	Wonmunna Mining Lease, ca 70 km WNW. of Newman	-23.1433	119.0027	5/20/2014		Trog Scrape	Leung, A.E.
136271	Araneae	Oonopidae	Prethopalpus `DNA01`	1	Wonmunna Mining Lease, ca 70 km WNW. of Newman	-23.14341	119.0003	5/18/2014		Trog Scrape	Leung, A.E.
131655	Araneae	Oonopidae	Prethopalpus `sp. B27`	1	32.8 km NW. of Mt Meharry	-22.81517	118.8542	6/10/2013	8/13/2013	Litter Trap	Cocking, J.S.; Pearson, G.B.
125179	Araneae	Oonopidae	Prethopalpus `sp. indet. (juvenile)`	1	Southern Flank,97 km WNW. of Newman, bore hole	-22.99881	118.9122	6/17/2010		Trog Scrape	Pearson, G.P.; Curran, M.K.
125181	Araneae	Oonopidae	Prethopalpus `sp. indet. (juvenile)`	1	Southern Flank, 106 km WNW. of Newman, bore hole	-22.98839	118.8272	3/18/2010		Trog Scrape	Main, D.C.; Cocking, J.S.
108271	Araneae	Oonopidae	Prethopalpus `sp. indet.`	1	ca. 100 km NW. of Newman, mining Area C, bore SF0803R	-22.99922	118.8948	6/17/2010		Trog Scrape	Pearson, G.B.; Curran, M.K.
108278	Araneae	Oonopidae	Prethopalpus `sp. indet.`	1	ca. 100 km NW. of Newman, mining Area C, bore PSD0140R	-22.90231	118.9961	6/28/2010		Trog Scrape	Pearson, G.B.; Curran, M.K.
108279	Araneae	Oonopidae	Prethopalpus `sp. indet.`	1	ca. 100 km NW. of Newman, mining Area C, bore SF0363R	-22.97961	118.8418	3/19/2010		Trog Scrape	Cocking, J.S.; Main, D.C.
108280	Araneae	Oonopidae	Prethopalpus `sp. indet.`	1	ca. 100 km NW. of Newman, mining Area C, bore GDR0070	-22.93061	118.9446	1/11/2008		Trog Scrape	Cocking, J.S.; Scanlon, M.D.

WAM REGNO	Order	Family	Taxon	Abun-dance	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection Method	Collectors
108281	Araneae	Oonopidae	Prethopalpus `sp. indet.`	1	ca. 100 km NW. of Newman, mining Area C, bore RP011	-22.96603	119.0728	6/4/2008		Litter Trap	Rumens-Thornber, C.R.; Scanlon, M.D.
108282	Araneae	Oonopidae	Prethopalpus `sp. indet.`	1	ca. 100 km NW. of Newman, mining Area C, bore GB0035R	-22.93819	119.0038	3/18/2010		Trog Scrape	Cocking, J.S.; Scanlon, M.D.
125180	Araneae	Oonopidae	Prethopalpus `sp. indet.`	1	Southern Flank, 106 km WNW. of Newman, bore hole	-22.99211	118.8128	6/14/2010		Trog Scrape	Pearson, G.P.; Curran, M.K.
127533	Araneae	Oonopidae	Prethopalpus `sp. indet.`	2	34.2 km SE. of Mt Meharry, RIOTIO Greater West Angelas	-23.12412	118.8859	10/5/2012	10/8/2012	Litter Trap	White, S.; Smith, L.
108273	Araneae	Oonopidae	Prethopalpus julianneae	1	ca. 100 km NW. of Newman, mining Area C, bore SF0569R	-22.99236	118.8332	3/18/2010		Trog Scrape	Cocking, J.S.; Main, D.C.
108272	Araneae	Oonopidae	Prethopalpus maini	1	ca. 100 km NW. of Newman, mining Area C, bore SF0288R	-22.98495	118.8184	3/18/2010		Trog Scrape	Cocking, J.S.; Main, D.C.
108274	Araneae	Oonopidae	Prethopalpus maini	1	ca. 100 km NW. of Newman, mining Area C, bore SF0383R	-22.98486	118.8536	3/19/2010		Trog Scrape	Cocking, J.S.; Main, D.C.
108276	Araneae	Oonopidae	Prethopalpus maini	1	ca. 100 km NW. of Newman, mining Area C, bore PSD0137R	-22.89828	118.9887	6/27/2010		Trog Scrape	Pearson, G.B.; Curran, M.K.
108277	Araneae	Oonopidae	Prethopalpus pearsoni	1	ca. 100 km NW. of Newman, mining Area C, bore PSD0115R	-22.90197	118.9887	4/17/2010		Trog Scrape	Pearson, G.B.; Curran, M.K.
136015	Araneae	Pholcidae	Trichocyclus	1	Yandi mine lease, 74.4 km NW. of Newman	-22.83825	119.2709	11/11/2010		Litter Trap	Alexander, J.; Cairnes, J.
138748	Araneae	Symphytognathidae	`Symphytognathidae sp. S1`	2	Ministers North, Yandi, 90 km NW. of Newman	-22.81432	119.0966	2/22/2009	5/23/2009	Litter Trap	Bell, P.; Perina, G.
139965	Araneae	Theridiidae		2	Ophthalmia Range, 40 km NW. of Newman	-23.27776	119.3672	6/24/2010		Trog Scrape	Bell, P.; Coen, N.
127532	Araneae	Theridiidae	Theridiidae	1	31.8 km SE. of Mt Meharry, RIOTIO Greater West Angelas	-23.12345	118.8591	10/5/2012	10/8/2012	Litter Trap	White, S.; Smith, L.
138751	Araneae	Theridiidae	Theridiidae	1	Ministers North, Yandi, 90 km NW. of Newman	-22.82733	119.1016	2/21/2009	5/23/2009	Litter Trap	Bell, P.; Perina, G.
138669	Araneae		`Aranaea sp. S5`	1	Packsaddle 4, area C, 100 km WNW. of Newman	-22.90651	118.9974	3/17/2008		Trog Scrape	Bell, P.; Moulds, T.
138670	Araneae		`Aranaea sp. S5`	1	Packsaddle 4, area C, 100 km WNW. of Newman	-22.90651	118.9974	3/17/2008		Trog Scrape	Bell, P.; Moulds, T.
138635	Araneae		`Araneae sp. S5`	1	Packsaddle 2 West, area C, 110 km WNW. of Newman	-22.91211	118.92525	7/30/2009		Trog Scrape	Bell, P.; Krawkzyk, N.
138758	Araneae		Araneae	1	Packsaddle 5, area C, 100 km WNW. of Newman	-22.90068	119.0151	10/16/2008		Trog Scrape	Bell, P.; Muirhead, K.
138759	Araneae		Araneae	1	Packsaddle 6, area C, 100 km WNW. Of Newman	-22.89691	119.0678	12/10/2008		Trog Scrape	Bell, P.; Vine, B.
138760	Araneae		Araneae	1	Packsaddle 5, area C, 100 km WNW. of Newman	-22.90011	119.0094	10/17/2008		Trog Scrape	Bell, P.; Muirhead, K.
100087	Opiliones	Assamiidae	Dampetrus `isolatus?`	1	Area C, ca. 80 km NW. of Newman	-22.92667	118.9728	1/14/2008		Trog Scrape	Cocking, J.S.; Scanlon, M.D.
137348	Opiliones	Assamiidae	Dampetrus `sp. B01 (nr isolatus)`	1	Packsaddle East, ca. 80 km NW. Newman	-22.91398	119.1706	3/20/2015	3/20/2015	Litter Trap	M.K. Curran, D.C. Main
129666	Palpigradi	`Family indet.`	Palpigradi `sp. B01`	5	Orebody 15, ca. 60 km NW. of Newman	-22.9782	119.3	2/24/2009	2/24/2009	Trog Scrape	Cocking, J.S.; Scanlon, M.D.
139982	Palpigradi		`Palpigradi sp. OP`	1	Ophthalmia Range, 40 km NW. of Newman	-23.27603	119.3719	6/24/2010		Trog Scrape	Bell, P.; Coen, N.
93967	Palpigradi		Palpigradi	1	Hamersley Range, ca. 15 km W. of The Governor, bore EXR0943 [Newman, ca. 150 km ENE]	-23.07548	118.6651	8/6/2008		Trog Scrape	Pearson, G.; Scanlon, M.
93968	Palpigradi		Palpigradi	1	Hamersley Range, ca. 15 km N. of The Governor [Newman, ca. 100 km NE]	-22.94083	118.8384	2/5/2008		Trog Scrape	Cocking, J.; Scanlon, M.
93969	Palpigradi		Palpigradi	1	Hamersley Range, ca. 15 km N. of The Governor [Newman, ca. 100 km NE]	-22.94067	118.8485	4/9/2008		Trog Scrape	Cocking, J.; Scanlon, M.
93970	Palpigradi		Palpigradi	2	Hamersley Range, ca. 30 km NE. of The Governor [Newman, ca. 100 km NE]	-22.92411	119.0084	5/13/2008		Trog Scrape	Cocking, J.; Scanlon, M.
93971	Palpigradi		Palpigradi	1	Hamersley Range, ca. 30 km NE. of The Governor [Newman, ca. 100 km NE]	-22.9295	118.9516	5/12/2008		Trog Scrape	Cocking, J.; Scanlon, M.
93972	Palpigradi		Palpigradi	2	Hamersley Range, ca. 30 km NE. of The Governor [Newman, ca. 100 km NE]	-22.92389	119.0109	3/11/2008		Trog Scrape	Cocking, J.; Scanlon, M.
95581	Palpigradi		Palpigradi	1	Weeli Wolli Creek area, `area C`, Boundary Ridge deposit, hole EXR0728	-23.03703	118.7265	3/15/2008		Litter Trap	Subterranean Ecology
95582	Palpigradi		Palpigradi	1	Weeli Wolli Creek area, `area C`, Packsaddle Range deposit, hole PSE105R	-22.9011	119.0088	4/9/2008		Trog Scrape	Subterranean Ecology
97277	Palpigradi		Palpigradi	1	Hamersley Range, `Packsaddle Range`, Packsaddle deposit 6, bore hole PSF0068R	-22.89889	119.0414	4/20/2008		Trog Scrape	Subterranean Ecology
97278	Palpigradi		Palpigradi	1	Hamersley Range, `Packsaddle Range`, Packsaddle deposit 6, bore hole PSF0105R	-22.89639	119.065	12/10/2008		Trog Scrape	Subterranean Ecology

WAM REGNO	Order	Family	Taxon	Abun-dance	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection Method	Collectors
137071	Palpigradi		Palpigradi	1	Baby Hope Downs, 75.2 km WNW. of Newman	-23.0145	119.0955	4/9/2015	5/20/2015	Litter Trap	Alexander, J.; Delaney, M.
138624	Palpigradi		Palpigradi	1	Packsaddle West Juna Downs Rd, Juna Downs, 110 km WNW. of Newman	-22.93564	118.78458	7/31/2009		Trog Scrape	Bell, P.; Krawkzyk, N.
138625	Palpigradi		Palpigradi	1	Packsaddle West Juna Downs Rd, Juna Downs, 110 km WNW. of Newman	-22.93582	118.78809	7/31/2009		Trog Scrape	Bell, P.; Krawkzyk, N.
138750	Palpigradi		Palpigradi	1	Ministers North, Yandi, 90 km NW. of Newman	-22.8164	119.1185	4/9/2009		Trog Scrape	Bell, P.; Car, C.
139981	Palpigradi		Palpigradi	2	Ophthalmia Range, 40 km NW. of Newman	-23.27086	119.2842	6/23/2010		Trog Scrape	Bell, P.; Coen, N.
139986	Palpigradi		Palpigradi	1	Ophthalmia Range, 40 km NW. of Newman	-23.2893	119.3195	6/24/2010		Trog Scrape	Bell, P.; Coen, N.
140967	Palpigradi		Palpigradi `sp. B01`	1	Packsaddle East, ca. 78 km NW. Newman	-22.92172	119.1018	3/4/2010	3/4/2010	Litter Trap	M.K. Curran, M.D. Scanlon
140966	Palpigradi		Palpigradi `sp. B19`	1	Packsaddle East, ca. 73 km NW. Newman	-22.92324	119.1587	3/3/2010	3/3/2010	Litter Trap	M.K. Curran, M.D. Scanlon
138774	Pseudoscorpiones	Chthoniidae	Chthoniidae	1	Packsaddle 6, AREA C, 100 km WNW. of Newman	-22.89889	119.0414	4/20/2008		Trog Scrape	Bell, P.; Muirhead, K.
138815	Pseudoscorpiones	Chthoniidae	Chthoniidae	1	Angelo River, 120 km WSW. of Newman	-23.32438	118.7794	6/22/2011	6/29/2011	Litter Trap	Coen, N.; Perina, G.
138966	Pseudoscorpiones	Chthoniidae	Chthoniidae	1	Packsaddle 4, AREA C, 100 km WNW. of Newman	-22.90616	118.9829	10/15/2008		Trog Scrape	Bell, P.; Muirhead, K.
119436	Pseudoscorpiones	Chthoniidae	Lagynochthonius `PSE039`	1	Deposit F, ca. 100 km NW. of Newman	-22.94345	118.8827	2/5/2008		Trog Scrape	Cocking, J.S.; Scanlon, M.D.
119437	Pseudoscorpiones	Chthoniidae	Lagynochthonius `PSE039`	1	Deposit B, ca. 90 km NW. of Newman	-22.9339	118.9976	3/17/2008		Trog Scrape	Cocking, J.S.; Scanlon, M.D.
119438	Pseudoscorpiones	Chthoniidae	Lagynochthonius `PSE039`	1	Deposit B, ca. 90 km NW. of Newman	-22.94267	119.0095	3/18/2008		Trog Scrape	Cocking, J.S.; Scanlon, M.D.
119439	Pseudoscorpiones	Chthoniidae	Lagynochthonius `PSE039`	1	South Flank, ca. 103 km NW. of Newman	-22.97528	118.83	3/19/2010		Trog Scrape	Cocking, J.S.; Main, D.C.
119441	Pseudoscorpiones	Chthoniidae	Lagynochthonius `PSE041`	1	Alligator Jaws, ca. 118 km WNW. of Newman	-23.06275	118.6348	4/23/2008		Trog Scrape	Pearson, G.B.; Scanlon, M.D.
119429	Pseudoscorpiones	Chthoniidae	Lagynochthonius `PSE043`	1	Iron Valley, ca. 83 km NNW. of Newman	-22.72831	119.3139	11/4/2009		Trog Scrape	Main, D.C.; Scanlon, M.D.
119431	Pseudoscorpiones	Chthoniidae	Lagynochthonius `PSE045`	1	Packsaddle P4, ca. 96 km NW. of Newman	-22.90422	118.9858	4/9/2010		Trog Scrape	Cocking, J.S.; Curran, M.K.
119432	Pseudoscorpiones	Chthoniidae	Lagynochthonius `PSE045`	2	Packsaddle P4, ca. 96 km NW. of Newman	-22.90111	118.9829	4/9/2010		Trog Scrape	Cocking, J.S.; Curran, M.K.
137072	Pseudoscorpiones	Chthoniidae	Lagynochthonius `PSE096`	1	Baby Hope Downs, 74.5 km WNW. of Newman	-23.04275	119.0857	4/9/2015	5/20/2015	Litter Trap	Alexander, J.; Delaney, M.
129664	Pseudoscorpiones	Chthoniidae	Lagynochthonius `PSE097`	1	Orebody 16, ca. 50 km NW. of Newman	-23.02214	119.2243	10/3/2008	10/3/2008	Trog Scrape	Cocking, J.S.; Pearson, G.B.
141003	Pseudoscorpiones	Chthoniidae	Lagynochthonius `PSE101`	1	ca. 104 km WNW. of Newman	-23.13661	118.734	3/19/2016		Trog Scrape	Callan, S.; Volschenk, E.S.
91728	Pseudoscorpiones	Chthoniidae	Lagynochthonius `sp. Packsaddle`	1	Area C, PSA0048R	-22.90411	118.901	2/11/2008		Litter Trap	Subterranean Ecology
91729	Pseudoscorpiones	Chthoniidae	Lagynochthonius `sp. Packsaddle`	1	Area C, PSA0015R	-22.92078	118.8834	4/1/2008		Trog Scrape	Subterranean Ecology
91730	Pseudoscorpiones	Chthoniidae	Lagynochthonius `sp. Packsaddle`	1	Area C, PSA0091R	-22.92381	118.8279	2/12/2008		Trog Scrape	Subterranean Ecology
138741	Pseudoscorpiones	Chthoniidae	Lagynochthonius `sp. S4`	1	Ministers North, Yandi, 90 km NW. of Newman	-22.82747	119.1078	2/21/2009	5/23/2009	Litter Trap	Bell, P.; Perina, G.
138742	Pseudoscorpiones	Chthoniidae	Lagynochthonius `sp. S4`	1	Ministers North, Yandi, 90 km NW. of Newman	-22.82747	119.1016	4/10/2010		Trog Scrape	Bell, P.; Car, C.
138743	Pseudoscorpiones	Chthoniidae	Lagynochthonius `sp. S4`	1	Ministers North, Yandi, 90 km NW. of Newman	-22.82834	119.1076	4/8/2010		Trog Scrape	Bell, P.; Car, C.
138744	Pseudoscorpiones	Chthoniidae	Lagynochthonius `sp. S4`	4	Ministers North, Yandi, 90 km NW. of Newman	-22.82733	119.1016	2/21/2009	5/23/2009	Litter Trap	Bell, P.; Perina, G.
97280	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius*	1	Hamersley Range, `Packsaddle Range`, Packsaddle deposit 6, bore hole PSF0004R	-22.8975	119.0589	12/10/2008		Trog Scrape	Subterranean Ecology
97281	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius*	1	Hamersley Range, `Packsaddle Range`, Packsaddle deposit 6, bore hole PSF0008R	-22.89917	119.0589	4/19/2008		Litter Trap	Subterranean Ecology
119446	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius*	1	Deposit A, ca. 90 km NW. of Newman	-22.92575	119.0304	12/8/2007		Trog Scrape	Cocking, J.S.; Scanlon, M.D.
119453	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius*	1	South Flank East, ca. 90 km NW. of Newman	-23.00722	118.9821	2/19/2010		Trog Scrape	Main, D.C.; Pearson, G.B.

WAM REGNO	Order	Family	Taxon	Abun-dance	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection Method	Collectors
136293	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius* `DNA05`	2	Wonmunna Mining Lease, ca 70 km WNW. of Newman	-23.11956	119.054	5/17/2014		Trog Scrape	Leung, A.E.
119433	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius* `PSE046`	1	Packsaddle P4, ca. 96 km NW. of Newman	-22.90108	118.9857	6/26/2010		Trog Scrape	Curran, M.K.; Pearson, G.B.
119434	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius* `PSE046`	1	Packsaddle P4, ca. 96 km NW. of Newman	-22.90283	118.9872	6/26/2010		Trog Scrape	Curran, M.K.; Pearson, G.B.
119435	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius* `PSE046`	1	Packsaddle P4, ca. 96 km NW. of Newman	-22.90497	118.9774	6/26/2010		Trog Scrape	Curran, M.K.; Pearson, G.B.
119456	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius* `PSE050`	1	Packsaddle P4, ca. 96 km NW. of Newman	-22.90064	118.9829	4/9/2010		Trog Scrape	Cocking, J.S.; Curran, M.K.
119457	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius* `PSE050`	1	Packsaddle P4, ca. 96 km NW. of Newman	-22.90033	118.983	4/9/2010		Trog Scrape	Cocking, J.S.; Curran, M.K.
119458	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius* `PSE050`	1	Packsaddle P4, ca. 96 km NW. of Newman	-22.90183	118.996	4/11/2010		Trog Scrape	Cocking, J.S.; Curran, M.K.
119466	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius* `PSE055`	1	Deposit A, ca. 90 km NW. of Newman	-22.925	119.0127	12/8/2007		Trog Scrape	Cocking, J.S.; Scanlon, M.D.
137350	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius* `sp. B37`	1	Upper Weeli Wolli, ca. 70 km NW. Newman	-22.93221	119.1868	3/21/2015	5/19/2015	Litter Trap	Curran, M.K.; Cocking, J.S.
139950	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius* `sp. OP`	1	Ophthalmia Range, 40 km NW. of Newman	-23.2893	119.3195	6/24/2010		Trog Scrape	Bell, P.; Coen, N.
138771	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius* `sp. S4`	1	Packsaddle 4, AREA C, 100 km WNW. of Newman	-22.90472	118.9975	3/17/2008	6/18/2008	Litter Trap	Bell, P.; Moulds, T.
138772	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius* `sp. S4`	1	Packsaddle 4, AREA C, 100 km WNW. of Newman	-22.90508	118.9966	10/15/2008		Trog Scrape	Bell, P.; Muirhead, K.
138969	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius* `sp. S4`	1	Packsaddle 6, AREA C, 100 km WNW. of Newman	-22.89797	119.053	4/19/2008	6/19/2008	Litter Trap	Bell, P.; Muirhead, K.
138970	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius* `sp. S4`	1	Packsaddle 4, AREA C, 100 km WNW. of Newman	-22.90593	119.0029	10/13/2008		Trog Scrape	Bell, P.; Muirhead, K.
138972	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius* `sp. S4`	1	Packsaddle 5, AREA C, 100 km WNW. of Newman	-22.90428	119.0296	4/11/2008		Trog Scrape	Bell, P.; Clarke, J.
138976	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius* `sp. S5`	1	Packsaddle 4, AREA C, 100 km WNW. Of Newman	-22.9093	118.9899	10/19/2008		Trog Scrape	Bell, P.; Muirhead, K.
119473	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius aridus*	1	Deposit F, ca. 100 km NW. of Newman	-22.94444	118.8768	2/5/2008		Litter Trap	Cocking, J.S.; Scanlon, M.D.
97275	Pseudoscorpiones	Hyidae	Indohya `PSE005`	1	Hamersley Range, `Packsaddle Range`, Packsaddle deposit 6, bore hole PSF0091R	-22.89917	119.0678	12/10/2008		Trog Scrape	Subterranean Ecology
111706	Pseudoscorpiones	Hyidae	Indohya `PSE005`	1	Deposit C, 100 km NW. of Newman	-22.9248	118.9745	1/13/2008		Trog Scrape	Scanlon, M.D.; Cocking, J.S.
111707	Pseudoscorpiones	Hyidae	Indohya `PSE005`	1	Deposit B, 100 km NW. of Newman	-22.93528	118.9987	3/17/2008		Trog Scrape	Scanlon, M.D.; Cocking, J.S.
111708	Pseudoscorpiones	Hyidae	Indohya `PSE005`	1	Deposit B, 100 km NW. of Newman	-22.94436	119.0077	7/25/2008		Trog Scrape	Scanlon, M.D.; Cocking, J.S.
111709	Pseudoscorpiones	Hyidae	Indohya `PSE005`	1	South Flank, 100 km NW. of Newman	-22.98495	118.8184	3/18/2010		Trog Scrape	Main, D.C.; Cocking, J.S.
111710	Pseudoscorpiones	Hyidae	Indohya `PSE005`	1	Packsaddle P4, 100 km NW. of Newman	-22.90147	118.9877	4/9/2010		Trog Scrape	Pearson, G.B.; Curran, M.K.
111711	Pseudoscorpiones	Hyidae	Indohya `PSE005`	1	Packsaddle P4, 100 km NW. of Newman	-22.9038	118.9843	4/9/2010		Trog Scrape	Pearson, G.B.; Curran, M.K.
111712	Pseudoscorpiones	Hyidae	Indohya `PSE005`	1	Packsaddle P4, 100 km NW. of Newman	-22.90283	118.9872	6/26/2010		Trog Scrape	Pearson, G.B.; Curran, M.K.
138967	Pseudoscorpiones	Hyidae	Indohya `PSE005`	1	Packsaddle 6, AREA C, 100 km WNW. of Newman	-22.8987	119.0678	4/18/2008		Trog Scrape	Bell, P.; Muirhead, K.
118284	Pseudoscorpiones	Lechytiidae	Lechytia `wonmunna`	1	ca. 79.5 km heading 285.5° from Newman	-23.162935	118.988838	7/22/2011	9/27/2011	Trog Scrape	Leung, A.
118286	Pseudoscorpiones	Lechytiidae	Lechytia `wonmunna`	8	ca. 77 km heading 286° from Newman	-23.161776	119.000488	9/24/2011	11/25/2011	Litter Trap	Leung, A.
118287	Pseudoscorpiones	Lechytiidae	Lechytia `wonmunna`	4	ca. 79.5 km heading 285.5° from Newman	-23.162464	118.990768	9/25/2011		Trog Scrape	Leung, A.
118288	Pseudoscorpiones	Lechytiidae	Lechytia `wonmunna`	1	ca. 79.5 km heading 285.5° from Newman	-23.162464	118.990768	9/24/2011	11/26/2011	Litter Trap	Leung, A.
118289	Pseudoscorpiones	Lechytiidae	Lechytia `wonmunna`	2	ca. 79.5 km heading 285.5° from Newman	-23.164454	118.979118	7/20/2011		Trog Scrape	Leung, A.
118290	Pseudoscorpiones	Lechytiidae	Lechytia `wonmunna`	1	ca. 79.5 km heading 285.5° from Newman	-23.164454	118.979118	11/25/2011		Trog Scrape	Leung, A.
118291	Pseudoscorpiones	Lechytiidae	Lechytia `wonmunna`	1	ca. 79.5 km heading 285.5° from Newman	-23.164892	118.979118	9/24/2011		Litter Trap	Leung, A.
132787	Pseudoscorpiones	Lechytiidae	Lechytia `wonmunna`	1	ca. 79.5 km heading 285.5° from Newman	-23.162935	118.988838	7/22/2011	9/27/2011	Trog Scrape	Leung, A.
132788	Pseudoscorpiones	Lechytiidae	Lechytia `wonmunna`	1	ca. 77 km heading 286° from Newman	-23.161776	119.000488	9/24/2011	11/25/2011	Litter Trap	Leung, A.
132789	Pseudoscorpiones	Lechytiidae	Lechytia `wonmunna`	1	ca. 77 km heading 286° from Newman	-23.161776	119.000488	9/24/2011	11/25/2011	Litter Trap	Leung, A.
132790	Pseudoscorpiones	Lechytiidae	Lechytia `wonmunna`	1	ca. 79.5 km heading 285.5° from Newman	-23.162464	118.990768	9/25/2011		Trog Scrape	Leung, A.

WAM REGNO	Order	Family	Taxon	Abun-dance	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection Method	Collectors
132791	Pseudoscorpiones	Lechytiidae	Lechytia `wonmunna`	1	ca. 79.5 km heading 285.5° from Newman	-23.162464	118.990768	9/24/2011	11/26/2011	Litter Trap	Leung, A.
132792	Pseudoscorpiones	Lechytiidae	Lechytia `wonmunna`	1	ca. 79.5 km heading 285.5° from Newman	-23.162464	118.990768	9/25/2011		Trog Scrape	Leung, A.
132793	Pseudoscorpiones	Lechytiidae	Lechytia `wonmunna`	1	ca. 79.5 km heading 285.5° from Newman	-23.162464	118.990768	9/25/2011		Trog Scrape	Leung, A.
132794	Pseudoscorpiones	Lechytiidae	Lechytia `wonmunna`	1	ca. 79.5 km heading 285.5° from Newman	-23.164892	118.979118	9/24/2011		Litter Trap	Leung, A.
118025	Pseudoscorpiones	Olpiidae	Beierolpium `sp. indet.`	1	ca. 71 km NW. of Newman	-23.12907	119.0889	9/23/2011	9/27/2011	Trog Scrape	Leung, A.E.
136300	Pseudoscorpiones	Olpiidae	Linnaeolpium `w1`	1	Wonmunna Mining Lease, ca 70 km WNW. of Newman	-23.16521	118.9849	5/20/2014		Trog Scrape	Leung, A.E.
136016	Pseudoscorpiones	Olpiidae	Olpiidae	1	Yandi mine lease, 85.4 km NW. of Newman	-22.76939	119.1908	11/10/2010		Litter Trap	Alexander, J.; Cairnes, J.
93782	Schizomida	Hubbardiidae	Draculoides	1	Packsaddle Range, 110 km NE. of Newman, hole PSA0317R	-22.92778	118.8772	12/12/2007		Trog Scrape	Subterranean Ecology staff
93784	Schizomida	Hubbardiidae	Draculoides	7	Packsaddle Range, 110 km NE. of Newman, hole PSA0461R	-22.92861	118.8639	2/9/2008		Trog Scrape	Subterranean Ecology staff
93787	Schizomida	Hubbardiidae	Draculoides	1	Packsaddle Range, 110 km NE. of Newman, hole PSA0286R	-22.91	118.9578	2/5/2008	3/28/2008	Litter Trap	Subterranean Ecology staff
93790	Schizomida	Hubbardiidae	Draculoides	1	Packsaddle Range, 110 km NE. of Newman, hole PSA0002R	-22.90722	119.0414	4/11/2008		Trog Scrape	Subterranean Ecology staff
100085	Schizomida	Hubbardiidae	Draculoides	1	Area C, ca. 80 km NW. of Newman	-22.97139	119.0572	4/11/2008		Trog Scrape	Cocking, J.S.; Scanlon, M.D.
100086	Schizomida	Hubbardiidae	Draculoides	1	Area C, ca. 80 km NW. of Newman	-22.93806	119.0039	7/25/2008		Trog Scrape	Cocking, J.S.; Scanlon, M.D.
127461	Schizomida	Hubbardiidae	Draculoides	1	Phil`s Creek, ca. 100 km NNW. of Newman	-22.73192	119.1816	7/7/2009	9/15/2009	Litter Trap	Cocking, J.S.; McRae, J.M.
127462	Schizomida	Hubbardiidae	Draculoides	1	Phil`s Creek, ca. 100 km NNW. of Newman	-22.7355	119.1885	2/11/2010		Trog Scrape	Curran, M.K.; Cocking, J.S.
138623	Schizomida	Hubbardiidae	Draculoides ` sp. S1`	1	Packsaddle 1 East, area C, 95 km WNW. of Newman	-22.91994	118.8879	12/13/2007	2/10/2008	Litter Trap	Stevens, N.; Moulds, T.
116221	Schizomida	Hubbardiidae	Draculoides `SCH002`	1	Ministers North [lease], 100 km NW. of Newman	-22.82404	119.09	2/17/2010	4/8/2010	Litter Trap	Bell, P.; Car, C.A.
138755	Schizomida	Hubbardiidae	Draculoides `SCH002`	1	Ministers North, Yandi, 90 km NW. of Newman	-22.82575	119.0945	2/20/2009	5/23/2009	Litter Trap	Bell, P.; Perina, G.
139772	Schizomida	Hubbardiidae	Draculoides `SCH012?`	3	Packsaddle 1 West, area C, 95 km WNW. of Newman	-22.92261	118.8722	12/12/2007	2/10/2008	Litter Trap	Stevens, N.
139775	Schizomida	Hubbardiidae	Draculoides `SCH012?`	1	Packsaddle 1 West, area C, 95 km WNW. of Newman	-22.923	118.8279	12/12/2007	2/10/2008	Litter Trap	Stevens, N.
93786	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle Range, 110 km NE. of Newman, hole PSA0317R	-22.92778	118.8772	12/12/2007		Trog Scrape	Subterranean Ecology staff
119486	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle P2, ca. 98 km WNW. of Newman	-22.91339	118.9229	4/12/2010		Trog Scrape	Cocking, J.S.; Curran, M.K.
138617	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle 2, area C, 95 km WNW. of Newman	-22.91065	118.9435	12/13/2007	2/10/2008	Litter Trap	Stevens, N.; Moulds, T.
138621	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle 1 West, area C, 95 km WNW. of Newman	-22.9239	118.8629	3/31/2008		Trog Scrape	Subterranean Ecology
138622	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle 1 East, area C, 95 km WNW. of Newman	-22.91821	118.8952	12/13/2007	2/10/2008	Litter Trap	Stevens, N.; Moulds, T.
138626	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle 1 West, area C, 95 km WNW. of Newman	-22.92433	118.8576	12/12/2007	2/10/2008	Litter Trap	Stevens, N.; Moulds, T.
138628	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle 1 West, area C, 95 km WNW. of Newman	-22.92301	118.864	3/31/2008		Litter Trap	Subterranean Ecology
138630	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle 1 West, area C, 95 km WNW. of Newman	-22.92303	118.8611	2/5/2008	3/29/2008	Trog Scrape	Subterranean Ecology
138631	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle 1 West, area C, 95 km WNW. of Newman	-22.923	118.8279	12/12/2007	2/10/2008	Litter Trap	Stevens, N.; Moulds, T.
138632	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle 1 East, area C, 95 km WNW. of Newman	-22.91598	118.9038	2/11/2008		Trog Scrape	Stevens, N.; Moulds, T.
138633	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle 1 West, area C, 95 km WNW. of Newman	-22.92386	118.8579	12/12/2007	2/10/2008	Litter Trap	Stevens, N.; Moulds, T.
138634	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle 1 West, area C, 95 km WNW. of Newman	-22.92261	118.8722	12/12/2007	2/10/2008	Litter Trap	Stevens, N.; Moulds, T.
138955	Schizomida	Hubbardiidae	Draculoides `SCH012`	2	Packsaddle 1 West, AREA C, 95 km WNW. of Newman	-22.92268	118.8629	3/31/2008	3/31/2008	Trog Scrape	
138957	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle 1 West, AREA C, 95 km WNW. of Newman	-22.92344	118.8279	2/12/2008		Trog Scrape	Stevens, N.
138963	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle 1 West, AREA C, 95 km WNW. of Newman	-22.92264	118.8639	3/31/2008		Trog Scrape	
142860	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle P2, ca. 90 km SE. of Wittenoom	-22.91359	118.9348	6/24/2010	6/24/2010	Litter Trap	Curran, M.K.; Pearson, G.B.
142872	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle P1, ca. 87 km SE. of Wittenoom	-22.91148	118.8924	6/6/2012	6/6/2012	Litter Trap	Quartermaine, J.W.; Pearson, G.B.
142873	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle P1, ca. 87 km SE. of Wittenoom	-22.90831	118.9005	2/18/2014	4/30/2014	Litter Trap	Quartermaine, J.W.; Cocking, J.S.

WAM REGNO	Order	Family	Taxon	Abun-dance	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection Method	Collectors
142874	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle P1, ca. 87 km SE. of Wittenoom	-22.90991	118.8907	11/7/2013	11/7/2013	Litter Trap	Quartermaine, J.W.; Bennett, S.R.
142876	Schizomida	Hubbardiidae	Draculoides `SCH012`	2	Packsaddle P2, ca. 90 km SE. of Wittenoom	-22.91265	118.9296	2/19/2014	4/30/2014	Litter Trap	Quartermaine, J.W.; Cocking, J.S.
142877	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle P2, ca. 89 km SE. of Wittenoom	-22.91	118.9296	2/19/2014	4/30/2014	Litter Trap	Quartermaine, J.W.; Cocking, J.S.
142878	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle P2, ca. 89 km SE. of Wittenoom	-22.91077	118.9296	2/19/2014	2/19/2014	Litter Trap	Quartermaine, J.W.; Bennett, S.R.
142879	Schizomida	Hubbardiidae	Draculoides `SCH012`	2	Packsaddle P2, ca. 90 km SE. of Wittenoom	-22.91034	118.9309	2/19/2014	4/30/2014	Litter Trap	Quartermaine, J.W.; Cocking, J.S.
142880	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle P2, ca. 89 km SE. of Wittenoom	-22.91047	118.9221	2/18/2014	4/30/2014	Litter Trap	Quartermaine, J.W.; Cocking, J.S.
142881	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle P2, ca. 90 km SE. of Wittenoom	-22.90907	118.9324	11/9/2013	11/9/2013	Litter Trap	Quartermaine, J.W.; Bennett, S.R.
142882	Schizomida	Hubbardiidae	Draculoides `SCH012`	2	Packsaddle P2, ca. 90 km SE. of Wittenoom	-22.90907	118.9324	2/19/2014	4/30/2014	Litter Trap	Quartermaine, J.W.; Cocking, J.S.
142883	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle P2, ca. 90 km SE. of Wittenoom	-22.90907	118.9324	11/9/2013	11/9/2013	Litter Trap	Quartermaine, J.W.; Bennett, S.R.
142884	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle P2, ca. 90 km SE. of Wittenoom	-22.91002	118.9326	2/19/2014	2/19/2014	Litter Trap	Quartermaine, J.W.; Bennett, S.R.
142885	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle P2, ca. 90 km SE. of Wittenoom	-22.91073	118.9325	2/19/2014	2/19/2014	Litter Trap	Quartermaine, J.W.; Bennett, S.R.
142886	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle P2, ca. 89 km SE. of Wittenoom	-22.91287	118.9208	2/18/2014	2/18/2014	Litter Trap	Quartermaine, J.W.; Bennett, S.R.
142887	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle P2, ca. 89 km SE. of Wittenoom	-22.91181	118.9208	2/18/2014	4/30/2014	Litter Trap	Quartermaine, J.W.; Cocking, J.S.
142888	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle P2, ca. 89 km SE. of Wittenoom	-22.91144	118.9192	2/18/2014	4/30/2014	Litter Trap	Quartermaine, J.W.; Cocking, J.S.
142889	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle P2, ca. 89 km SE. of Wittenoom	-22.91188	118.9179	2/18/2014	4/30/2014	Litter Trap	Quartermaine, J.W.; Cocking, J.S.
142890	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle P2, ca. 89 km SE. of Wittenoom	-22.91298	118.9238	2/18/2014	4/30/2014	Litter Trap	Quartermaine, J.W.; Cocking, J.S.
142891	Schizomida	Hubbardiidae	Draculoides `SCH012`	1	Packsaddle P2, ca. 89 km SE. of Wittenoom	-22.9087	118.931	11/8/2013	11/8/2013	Litter Trap	Quartermaine, J.W.; Bennett, S.R.
119484	Schizomida	Hubbardiidae	Draculoides `SCH013`	1	Packsaddle P4, ca. 93 km WNW. of Newman	-22.90055	118.9902	4/10/2010		Trog Scrape	Curran, M.K.; Scanlon, M.D.
119485	Schizomida	Hubbardiidae	Draculoides `SCH013`	1	Packsaddle P4, ca. 93 km WNW. of Newman	-22.90108	118.9857	6/26/2010		Trog Scrape	Main, D.C.; Pearson, G.B.
142875	Schizomida	Hubbardiidae	Draculoides `SCH013`	1	Packsaddle P2, ca. 90 km SE. of Wittenoom	-22.90107	118.9453	2/20/2014	5/31/2014	Litter Trap	Quartermaine, J.W.; Cocking, J.S.
119488	Schizomida	Hubbardiidae	Draculoides `SCH018`	1	Deposit R, ca. 85 km WNW. of Newman	-22.97417	119.0363	4/10/2008		Trog Scrape	Pearson, G.B.; Scanlon, M.D.
145053	Schizomida	Hubbardiidae	Draculoides `SCH018`	1	Deposit R, ca. 78 km WNW. of Newman	-22.96606	119.0728	8/8/2008	10/2/2008	Litter Trap	Cocking, J.S.; Pearson, G.B.
119496	Schizomida	Hubbardiidae	Draculoides `SCH020`	1	Iron Valley, ca. 84 km NNW. of Newman	-22.72378	119.3154	5/18/2009	7/9/2009	Litter Trap	Main, D.C.; Scanlon, M.D.
119497	Schizomida	Hubbardiidae	Draculoides `SCH020`	1	Iron Valley, ca. 81 km NNW. of Newman	-22.75103	119.308	11/3/2009	1/13/2010	Litter Trap	Cocking, J.S.; Trotter, A.J.
119499	Schizomida	Hubbardiidae	Draculoides `SCH021`	1	Phil`s Creek, ca. 90 km NNW. of Newman	-22.73814	119.1908	3/11/2009	7/7/2009	Litter Trap	Main, D.C.; Scanlon, M.D.
119500	Schizomida	Hubbardiidae	Draculoides `SCH021`	1	Phil`s Creek, ca. 90 km NNW. of Newman	-22.73453	119.1874	2/11/2010		Trog Scrape	Cocking, J.S.; Curran, M.K.
142869	Schizomida	Hubbardiidae	Draculoides `SCH021`	1	Phil`s Creek, ca. 84 km NW. of Newman	-22.73233	119.1873	1/12/2010	1/12/2010	Litter Trap	Cocking, J.S.; Trotter A.J.
142870	Schizomida	Hubbardiidae	Draculoides `SCH021`	1	Phil`s Creek, ca. 84 km NW. of Newman	-22.73242	119.1822	7/7/2009	9/15/2009	Litter Trap	McRae, J.M.; Cocking, J.S.
119501	Schizomida	Hubbardiidae	Draculoides `SCH022`	1	South Flank East, ca. 87 km WNW. of Newman	-23.01247	118.9943	2/12/2010	2/18/2010	Trog Scrape	Main, D.C.; Pearson, G.B.

WAM REGNO	Order	Family	Taxon	Abun-dance	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection Method	Collectors
119502	Schizomida	Hubbardiidae	Draculoides `SCH022`	1	South Flank East, ca. 87 km WNW. of Newman	-23.00464	118.9826	2/19/2010		Trog Scrape	Main, D.C.; Pearson, G.B.
142848	Schizomida	Hubbardiidae	Draculoides `SCH022`	1	Packsaddle East, ca. 80 km NW. of Newman	-22.91475	119.1913	3/20/2015	3/20/2015	Litter Trap	Curran, M.K.; Main, D.C.
142849	Schizomida	Hubbardiidae	Draculoides `SCH022`	1	Packsaddle East, ca. 70 km NW. of Newman	-22.91284	119.1224	3/23/2015	3/23/2015	Litter Trap	Curran, M.K.; Main, D.C.
142895	Schizomida	Hubbardiidae	Draculoides `SCH022`	2	South Flank East, ca. 84 km WNW. of Newman	-23.00603	118.9818	5/27/2010	5/27/2010	Litter Trap	Cocking, J.S.; Main, D.C.
142896	Schizomida	Hubbardiidae	Draculoides `SCH022`	3	South Flank East, ca. 83 km WNW. of Newman	-23.00997	118.9884	2/19/2010	2/19/2010	Litter Trap	Pearson, G.B.; Main, D.C.
142902	Schizomida	Hubbardiidae	Draculoides `SCH022`	1	South Flank East, ca. 84 km WNW. of Newman	-23.00553	118.9825	5/27/2010	7/21/2010	Litter Trap	Cocking, J.S.; Main, D.C.
142906	Schizomida	Hubbardiidae	Draculoides `SCH022`	1	South Flank, ca. 85 km WNW. of Newman	-23.00019	118.9708	6/16/2010	8/10/2010	Litter Trap	Pearson, G.B.; Main, D.C.
142907	Schizomida	Hubbardiidae	Draculoides `SCH022`	1	South Flank, ca. 90 km WNW. of Newman	-23.00406	118.9183	6/16/2010	6/16/2010	Litter Trap	Curran, M.K.; Pearson, G.B.
142908	Schizomida	Hubbardiidae	Draculoides `SCH022`	1	South Flank, ca. 89 km WNW. of Newman	-23.0011	118.9299	3/24/2010	5/19/2010	Litter Trap	Curran, M.K.; Cocking, J.S.
142910	Schizomida	Hubbardiidae	Draculoides `SCH022`	1	South Flank, ca. 84 km WNW. of Newman	-22.98784	118.9881	4/17/2012	7/11/2012	Litter Trap	Quartermaine, J.W.; Bennett, S.R.
142856	Schizomida	Hubbardiidae	Draculoides `SCH023?`	1	Deposit B, ca. 84 km WNW. of Newman	-22.95347	119.0151	3/7/2015	5/6/2015	Litter Trap	Curran, M.K.; Cocking, J.S.
119504	Schizomida	Hubbardiidae	Draculoides `SCH023`	1	South Flank, ca. 100 km WNW. of Newman	-22.98486	118.8536	3/19/2010	5/18/2010	Litter Trap	Cocking, J.S.; Curran, M.K.
119505	Schizomida	Hubbardiidae	Draculoides `SCH023`	1	South Flank, ca. 94 km WNW. of Newman	-23.00042	118.9126	3/23/2010		Trog Scrape	Curran, M.K.; Pearson, G.B.
138907	Schizomida	Hubbardiidae	Draculoides `SCH023`	1	South Flank, ca. 94 km WNW. of Newman	-23.00042	118.9126	3/23/2010		Trog Scrape	Curran, M.K.; Pearson, G.B.
142861	Schizomida	Hubbardiidae	Draculoides `SCH023`	1	Deposit F, ca. 88 km SE. of Wittenoom	-22.94503	118.8591	12/5/2007	2/5/2008	Litter Trap	Cocking, J.S.; Scanlon, M.D.
142862	Schizomida	Hubbardiidae	Draculoides `SCH023`	1	Deposit R, ca. 80 km NW. of Newman	-22.95714	119.0152	3/7/2015	5/6/2015	Litter Trap	Curran, M.K.; Cocking, J.S.
142900	Schizomida	Hubbardiidae	Draculoides `SCH023`	1	South Flank, ca. 90 km SE. of Wittenoom	-22.9832	118.8417	3/19/2010	3/19/2010	Litter Trap	Cocking, J.S.; Main, D.C.
142901	Schizomida	Hubbardiidae	Draculoides `SCH023`	1	South Flank, ca. 92 km SE. of Wittenoom	-22.99286	118.8654	4/18/2012	4/18/2012	Litter Trap	Cocking, J.S.; Pearson, G.B.
142904	Schizomida	Hubbardiidae	Draculoides `SCH023`	1	South Flank, ca. 93 km SE. of Wittenoom	-22.99327	118.877	3/23/2010	5/18/2010	Litter Trap	Curran, M.K.; Cocking, J.S.
142912	Schizomida	Hubbardiidae	Draculoides `SCH023`	1	South Flank, ca. 90 km SE. Wittenoom	-22.98291	118.839	4/17/2012	4/17/2012	Litter Trap	Cocking, J.S.; Pearson, G.B.
142915	Schizomida	Hubbardiidae	Draculoides `SCH023`	1	South Flank MAC, ca. 80 km NW. of Newman	-22.98315	118.8564	3/8/2015	5/7/2015	Litter Trap	Curran, M.K.; Cocking, J.S.
142917	Schizomida	Hubbardiidae	Draculoides `SCH023`	1	South Flank, ca. 80 km NW. of Newman	-22.95455	118.9839	5/1/2016	5/1/2016	Litter Trap	Curran, M.K.; Cocking, J.S.
142918	Schizomida	Hubbardiidae	Draculoides `SCH023`	1	South Flank, ca. 80 km NW. of Newman	-22.96312	118.964	2/20/2016	2/20/2016	Litter Trap	Curran, M.K.; Cocking, J.S.
142919	Schizomida	Hubbardiidae	Draculoides `SCH023`	1	South Flank, ca. 80 km NW. of Newman	-22.96999	118.946	2/22/2016	2/22/2016	Litter Trap	Curran, M.K.; Cocking, J.S.
142920	Schizomida	Hubbardiidae	Draculoides `SCH023`	3	South Flank, ca. 80 km NW. of Newman	-22.96651	118.9757	2/22/2016	2/22/2016	Litter Trap	Curran, M.K.; Cocking, J.S.
119476	Schizomida	Hubbardiidae	Draculoides `SCH024`	1	Upper Weeli Wolli, ca. 75 km NW. of Newman	-22.91358	119.2033	3/3/2010	4/27/2010	Litter Trap	Main, D.C.; Pearson, G.B.
119477	Schizomida	Hubbardiidae	Draculoides `SCH024`		Upper Weeli Wolli, ca. 75 km NW. of Newman	-22.91358	119.2033	3/3/2010		Trog Scrape	Curran, M.K.; Scanlon, M.D.
119478	Schizomida	Hubbardiidae	Draculoides `SCH025`	1	Packsaddle East, ca. 80 km NW. of Newman	-22.91203	119.1323	3/4/2010		Trog Scrape	Curran, M.K.; Scanlon, M.D.
119491	Schizomida	Hubbardiidae	Draculoides `SCH029`	2	Marillana Creek, ca. 81 km NNW. of Newman	-22.71944	119.3741	5/10/2011	7/4/2011	Litter Trap	Bennett, S.R.; Main, D.C.
119492	Schizomida	Hubbardiidae	Draculoides `SCH029`	1	Marillana Creek, ca. 84 km NNW. of Newman	-22.70905	119.3357	5/11/2011	7/5/2011	Litter Trap	Bennett, S.R.; Main, D.C.
142865	Schizomida	Hubbardiidae	Draculoides `SCH029`	1	Marillana Creek, ca. 77 km NNW. of Newman	-22.71111	119.3346	5/11/2011	5/11/2011	Litter Trap	Bennett, S.R.; Main, D.C.
142866	Schizomida	Hubbardiidae	Draculoides `SCH029`	1	Marillana Creek, ca. 77 km NNW. of Newman	-22.70353	119.3433	5/11/2011	7/5/2011	Litter Trap	Bennett, S.R.; Main, D.C.
142868	Schizomida	Hubbardiidae	Draculoides `SCH029`	1	Marillana Creek, ca. 74 km NNW. of Newman	-22.72467	119.3806	5/10/2011	5/10/2011	Litter Trap	Bennett, S.R.; Main, D.C.

WAM REGNO	Order	Family	Taxon	Abun-dance	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection Method	Collectors
119489	Schizomida	Hubbardiidae	Draculoides `SCH034`	1	Orebody 13, ca. 66 km NW. of Newman	-22.973	119.259	9/25/2008		Trog Scrape	Pearson, G.B.; Scanlon, M.D.
131650	Schizomida	Hubbardiidae	Draculoides `SCH064-DNA`	1	36.0 km NW. of Mt Meharry	-22.80669	118.8794	3/27/2013	5/23/2013	Litter Trap	Cocking, J.S.; Pearson, G.B.
119503	Schizomida	Hubbardiidae	Draculoides `SCH067/SCH068/SCH022?`	1	South Flank East, ca. 87 km WNW. of Newman	-23.00994	118.9885	5/26/2010		Trog Scrape	Cocking, J.S.; Main, D.C.
145054	Schizomida	Hubbardiidae	Draculoides `SCH067`	1	Orebody 13, ca. 61 km NW. of Newman	-22.97761	119.2693	9/24/2008		Litter Trap	Pearson, G.B.; Scanlon, M.D.
138596	Schizomida	Hubbardiidae	Draculoides `SCH067-DNA`	1	Baby Hope Downs, ca. 80.9 km WNW. of Newman	-23.01575	119.0331	9/12/2013	10/28/2013	Litter Trap	Cairnes, J.; Delaney, M.
138597	Schizomida	Hubbardiidae	Draculoides `SCH067-DNA`	1	Baby Hope Downs, ca. 80.9 km WNW. of Newman	-23.01575	119.0331	9/12/2013	10/28/2013	Litter Trap	Cairnes, J.; Delaney, M.
138619	Schizomida	Hubbardiidae	Draculoides `SCH067-DNA`	1	Packsaddle 6, area C, 100 km WNW. of Newman	-22.8935	119.0517	4/19/2008		Trog Scrape	Stevens, N.; Muirhead, K.
138766	Schizomida	Hubbardiidae	Draculoides `SCH067-DNA`	1	Packsaddle 6, area C, 100 km WNW. of Newman	-22.89876	119.0634	10/8/2008	12/10/2008	Litter Trap	Bell, P.; Vine, B.
138767	Schizomida	Hubbardiidae	Draculoides `SCH067-DNA`	1	Packsaddle 6, area C, 100 km WNW. of Newman	-22.89705	119.0649	10/8/2008	12/10/2008	Litter Trap	Bell, P.; Vine, B.
138769	Schizomida	Hubbardiidae	Draculoides `SCH067-DNA`	1	Packsaddle 6, area C, 100 km WNW. of Newman	-22.89446	119.0444	12/11/2008		Trog Scrape	Bell, P.; Vine, B.
138959	Schizomida	Hubbardiidae	Draculoides `SCH067-DNA`	1	Packsaddle 6 West, AREA C, 100 km WNW. of Newman	-22.89568	119.0604	4/19/2008	6/19/2008	Litter Trap	Bell, P.; Muirhead, K.
138598	Schizomida	Hubbardiidae	Draculoides `SCH068-DNA`	1	Baby Hope Downs, ca. 79.2 km WNW. of Newman	-23.01872	119.0488	9/12/2013	10/28/2013	Litter Trap	Cairnes, J.; Delaney, M.
138599	Schizomida	Hubbardiidae	Draculoides `SCH068-DNA`	2	Baby Hope Downs, ca. 76.9 km WNW. of Newman	-23.01472	119.0779	9/12/2013	10/28/2013	Litter Trap	Cairnes, J.; Delaney, M.
138600	Schizomida	Hubbardiidae	Draculoides `SCH068-DNA`	1	Baby Hope Downs, ca. 74.5 km WNW. of Newman	-23.00732	119.1083	4/9/2015	5/20/2015	Litter Trap	Alexander, J.
138601	Schizomida	Hubbardiidae	Draculoides `SCH068-DNA`	1	Baby Hope Downs, ca. 75.9 km WNW. of Newman	-23.00652	119.1025	4/9/2015	5/20/2015	Litter Trap	Alexander, J.
138602	Schizomida	Hubbardiidae	Draculoides `SCH068-DNA`	1	Baby Hope Downs, ca. 75.9 km WNW. of Newman	-23.00652	119.1025	4/9/2015	5/20/2015	Litter Trap	Alexander, J.
138603	Schizomida	Hubbardiidae	Draculoides `SCH068-DNA`	1	Baby Hope Downs, ca. 79.8 km WNW. of Newman	-23.02008	119.041	4/9/2015	5/20/2015	Litter Trap	Alexander, J.
138604	Schizomida	Hubbardiidae	Draculoides `SCH068-DNA`	1	Baby Hope Downs, ca. 74.7 km WNW. of Newman	-23.0395	119.0856	4/9/2015	5/20/2015	Litter Trap	Alexander, J.
138605	Schizomida	Hubbardiidae	Draculoides `SCH068-DNA`	1	Baby Hope Downs, ca. 72.4 km WNW. of Newman	-23.03818	119.1129	4/9/2015	5/20/2015	Litter Trap	Alexander, J.
138606	Schizomida	Hubbardiidae	Draculoides `SCH068-DNA`	1	Baby Hope Downs, ca. 76.4 km WNW. of Newman	-23.01469	119.0824	4/9/2015	5/20/2015	Litter Trap	Alexander, J.
145055	Schizomida	Hubbardiidae	Draculoides `SCH069`	1	Packsaddle P3, ca. 91 km SE. of Wittenoom	-22.89977	118.9585	6/25/2010		Litter Trap	Curran, M.K.; Pearson, G.B.
138627	Schizomida	Hubbardiidae	Draculoides `SCH069-DNA`	1	Packsaddle 3, area C, 95 km WNW. of Newman	-22.90739	118.957	2/5/2008	3/28/2008	Litter Trap	Subterranean Ecology
138763	Schizomida	Hubbardiidae	Draculoides `SCH069-DNA`	1	Packsaddle 4, area C, 100 km WNW. of Newman	-22.90454	119.0005	10/14/2008		Trog Scrape	Bell, P.; Muirhead, K.
138764	Schizomida	Hubbardiidae	Draculoides `SCH069-DNA`	1	Packsaddle 4, area C, 100 km WNW. of Newman	-22.90909	118.9944	10/17/2008		Trog Scrape	Bell, P.; Muirhead, K.
138958	Schizomida	Hubbardiidae	Draculoides `SCH069-DNA`	1	Packsaddle 6 West, AREA C, 100 km WNW. of Newman	-22.89346	119.0355	4/20/2008	6/19/2008	Litter Trap	Bell, P.; Muirhead, K.
138961	Schizomida	Hubbardiidae	Draculoides `SCH069-DNA`	1	Packsaddle 3 West, AREA C, 95 km WNW. of Newman	-22.90856	118.964	12/14/2007	2/10/2008	Litter Trap	Stevens, N.
138962	Schizomida	Hubbardiidae	Draculoides `SCH069-DNA`	1	Packsaddle 3 West, AREA C, 95 km WNW. of Newman	-22.90594	118.9576	2/5/2008	3/28/2008	Litter Trap	
138956	Schizomida	Hubbardiidae	Draculoides `SCH074-DNA`	1	Packsaddle 1 West, AREA C, 95 km WNW. of Newman	-22.92268	118.8629	3/31/2008	3/31/2008	Trog Scrape	
138964	Schizomida	Hubbardiidae	Draculoides `SCH097-DNA`	1	Packsaddle 1 East, AREA C, 95 km WNW. of Newman	-22.91819	118.9011	2/6/2008	3/29/2008	Litter Trap	
138965	Schizomida	Hubbardiidae	Draculoides `SCH097-DNA`	1	Packsaddle 1 East, AREA C, 95 km WNW. of Newman	-22.91819	118.9011	2/6/2008	3/29/2008	Litter Trap	
136303	Schizomida	Hubbardiidae	Draculoides `SCH107-DNA`	1	Hammersley Range, ca. 30 km ESE. of Juna Downs	-22.69497	119.052	3/28/2014		Trog Scrape	Dight, N.
100083	Schizomida	Hubbardiidae	Draculoides `sp. (male)`	1	Area C, ca. 80 km NW. of Newman	-22.94111	119.005	9/22/2008		Litter Trap	Cocking, J.S.; Scanlon, M.D.
93783	Schizomida	Hubbardiidae	Draculoides `sp. 01`	1	Packsaddle Range, 110 km NE. of Newman, hole PSA0391R	-22.92722	118.8722	12/12/2007	2/10/2008	Litter Trap	Subterranean Ecology staff
93785	Schizomida	Hubbardiidae	Draculoides `sp. 03`	1	Packsaddle Range, 110 km NE. of Newman, hole PSA0123R	-22.92889	118.9564	2/5/2008	3/28/2008	Litter Trap	Subterranean Ecology staff
93788	Schizomida	Hubbardiidae	Draculoides `sp. 03`	1	Packsaddle Range, 110 km NE. of Newman, hole PSA0024R	-22.90806	118.9975	3/16/2008		Trog Scrape	Subterranean Ecology staff
93789	Schizomida	Hubbardiidae	Draculoides `sp. 03`	1	Packsaddle Range, 110 km NE. of Newman, hole PSA0041R	-22.91083	118.9944	3/17/2008	6/18/2008	Litter Trap	Subterranean Ecology staff
138638	Schizomida	Hubbardiidae	Draculoides `sp. 1`	1	Packsaddle 2, area C, 110 km WNW. of Newman	-22.9103	118.94423	2/26/2009	6/5/2009	Litter Trap	Stevens, N.; Callan, S.
142894	Schizomida	Hubbardiidae	Draculoides `sp. B16`	1	South Flank, ca. 93 km SE. of Wittenoom	-23.00734	118.8714	3/26/2010	5/18/2010	Litter Trap	Curran, M.K.; Cocking, J.S.
142897	Schizomida	Hubbardiidae	Draculoides `sp. B16`	1	South Flank, ca. 93 km SE. of Wittenoom	-23.00456	118.8655	3/6/2012	3/6/2012	Litter Trap	Curran, M.K.; Quartermaine, J.W.

WAM REGNO	Order	Family	Taxon	Abun-dance	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection Method	Collectors
142898	Schizomida	Hubbardiidae	Draculoides `sp. B16`	1	South Flank, ca. 93 km SE. of Wittenoom	-23.00456	118.8655	2/18/2016	2/18/2016	Litter Trap	Curran, M.K.; Cocking, J.S.
142905	Schizomida	Hubbardiidae	Draculoides `sp. B16`	1	South Flank, ca. 93 km WNW. of Newman	-23.0053	118.8832	3/23/2010	5/18/2010	Litter Trap	Curran, M.K.; Cocking, J.S.
142911	Schizomida	Hubbardiidae	Draculoides `sp. B16`	1	South Flank, ca. 93 km SE. of Wittenoom	-22.99731	118.8741	3/6/2012	3/6/2012	Litter Trap	Curran, M.K.; Quartermaine, J.W.
142899	Schizomida	Hubbardiidae	Draculoides `sp. B20`	1	South Flank, ca. 93 km WNW. of Newman	-22.99545	118.924	3/24/2010	5/19/2010	Litter Trap	Curran, M.K.; Cocking, J.S.
142909	Schizomida	Hubbardiidae	Draculoides `sp. B20`	1	South Flank, ca. 86 km WNW. of Newman	-22.98814	118.9647	3/25/2010	5/19/2010	Litter Trap	Curran, M.K.; Cocking, J.S.
142913	Schizomida	Hubbardiidae	Draculoides `sp. B20`	1	South Flank, ca. 80 km NW. of Newman	-22.98953	118.997	3/8/2015	5/7/2015	Litter Trap	Curran, M.K.; Cocking, J.S.
142914	Schizomida	Hubbardiidae	Draculoides `sp. B20`	1	South Flank, ca. 81 km WNW. of Newman	-22.99819	119.0204	7/11/2012	7/11/2012	Litter Trap	Quartermaine, J.W.; Bennett, S.R.
142903	Schizomida	Hubbardiidae	Draculoides `sp. B32`	2	South Flank MAC, ca. 88 km SE. of Wittenoom	-22.97441	118.83	3/19/2010	5/18/2010	Litter Trap	Curran, M.K.; Cocking, J.S.
142855	Schizomida	Hubbardiidae	Draculoides `sp. B46`	1	Deposit B, ca. 85 km WNW. of Newman	-22.94143	119.0046	3/18/2008	5/14/2008	Litter Trap	Cocking, J.S.; Rumens-Thornber, C.
142854	Schizomida	Hubbardiidae	Draculoides `sp. B47`	1	Deposit A, ca. 85 km WNW. of Newman	-22.925	119.0126	12/8/2007	12/8/2007	Litter Trap	Cocking, J.S.; Scanlon, M.D.
142857	Schizomida	Hubbardiidae	Draculoides `sp. B47`	1	Deposit B, ca. 80 km NW. of Newman	-22.95063	119.0092	3/7/2015	3/7/2015	Litter Trap	Curran, M.K.; Cocking, J.S.
142858	Schizomida	Hubbardiidae	Draculoides `sp. B47`	1	Deposit B, ca. 80 km NW. of Newman	-22.93761	119.0095	3/6/2015	3/6/2015	Litter Trap	Curran, M.K.; Cocking, J.S.
142859	Schizomida	Hubbardiidae	Draculoides `sp. B47`	1	Deposit B, ca. 80 km NW. of Newman	-22.93761	119.0095	3/6/2015	5/6/2015	Litter Trap	Curran, M.K.; Cocking, J.S.
145056	Schizomida	Hubbardiidae	Draculoides `sp. B47`	1	Deposit B, ca. 84 km WNW. of Newman	-22.94906	119.0151	3/30/2011		Litter Trap	Scanlon, M.D.; Main, D.C.
145057	Schizomida	Hubbardiidae	Draculoides `sp. B47`	1	Deposit B, ca. 81 km WNW. of Newman	-22.94576	119.0472	3/29/2011	6/5/2011	Litter Trap	Pearson, G.B.; Bennett, S.R.
142892	Schizomida	Hubbardiidae	Draculoides `sp. B55`	2	Packsaddle West, ca. 80 km NW. of Newman	-22.92506	118.7583	9/25/2014	9/25/2014	Litter Trap	Cocking, J.S.; Main, D.C.
142863	Schizomida	Hubbardiidae	Draculoides `sp. B58`	1	Deposit R, ca. 80 km NW. of Newman	-22.9697	119.0086	4/30/2016	4/30/2016	Litter Trap	Curran, M.K.; Cocking, J.S.
142864	Schizomida	Hubbardiidae	Draculoides `sp. B58`	1	Deposit R, ca. 80 km NW. of Newman	-22.96865	119.007	2/21/2016	2/21/2016	Litter Trap	Curran, M.K.; Cocking, J.S.
142916	Schizomida	Hubbardiidae	Draculoides `sp. B59-DNA`	1	South Flank, ca. 80 km NW. of Newman	-23.01255	119.0422	4/28/2016	4/28/2016	Litter Trap	Curran, M.K.; Cocking, J.S.
100084	Schizomida	Hubbardiidae	Draculoides `sp. indet. (female)`	1	Area C, ca. 80 km NW. of Newman	-22.96694	119.0719	10/2/2008		Litter Trap	Cocking, J.S.; Scanlon, M.D.
139298	Schizomida	Hubbardiidae	Draculoides `sp. Koodaideri/Yandi`	1	Yandi ca. 86 km NW. of Newman	-22.78889	119.1561	10/8/2015	11/23/2015	Litter Trap	Cole, C.; Keirle, D.
139299	Schizomida	Hubbardiidae	Draculoides `sp. Koodaideri/Yandi`	1	Yandi ca. 86 km NW. of Newman	-22.78889	119.1561	10/8/2015	11/23/2015	Litter Trap	Cole, C.; Keirle, D.
139300	Schizomida	Hubbardiidae	Draculoides `sp. Koodaideri/Yandi`	1	Yandi ca. 86 km NW. of Newman	-22.78972	119.1567	10/8/2015	11/23/2015	Litter Trap	Cole, C.; Keirle, D.
139768	Schizomida	Hubbardiidae	Draculoides `sp. S1`	1	Packsaddle 1 West, AREA C, 95 km WNW. of Newman	-22.92344	118.8279	2/12/2008		Trog Scrape	Stevens, N.
138768	Schizomida	Hubbardiidae	Draculoides `sp. S2`	1	Packsaddle 6, area C, 100 km WNW. of Newman	-22.89446	119.0444	12/11/2008		Trog Scrape	Bell, P.; Vine, B.
138618	Schizomida	Hubbardiidae	Draculoides `sp. S3`	1	Packsaddle 3, area C, 95 km WNW. of Newman	-22.90745	118.9681	12/14/2007	2/10/2008	Litter Trap	Stevens, N.; Moulds, T.
138765	Schizomida	Hubbardiidae	Draculoides `sp. S3`	1	Packsaddle 4, area C, 100 km WNW. of Newman	-22.9073	118.9945	10/19/2009	11/26/2009	Litter Trap	Bell, P.; Muirhead, K.
138753	Schizomida	Hubbardiidae	Draculoides `sp. S4`	1	Ministers North, Yandi, 90 km NW. of Newman	-22.81576	119.1035	4/10/2010		Trog Scrape	Bell, P.; Car, C.
138754	Schizomida	Hubbardiidae	Draculoides `sp. S4`	1	Ministers North, Yandi, 90 km NW. of Newman	-22.82142	119.1291	2/20/2009	5/23/2009	Litter Trap	Bell, P.; Perina, G.
93781	Schizomida	Hubbardiidae	Draculoides `sp. SPB2`	1	Packsaddle Range, 110 km NE. of Newman, hole PSF0203R	-22.89361	119.0517	4/19/2008	6/19/2008	Litter Trap	Subterranean Ecology staff
136017	Schizomida	Hubbardiidae	Hubbardiidae	1	Yandi mine lease, 85.4 km NW. of Newman	-22.76939	119.1908	11/10/2010		Litter Trap	Alexander, J.; Cairnes, J.
126857			`sp. indet.`	1	ca. 77.5 km NW. of Newman	-23.14421	119.0081	7/20/2011	7/27/2011	Trog Scrape	Leung, A.E.
126858			`sp. indet.`	1	ca. 71 km NW. from Newman	-23.12652	119.081	9/23/2011	9/27/2011	Trog Scrape	Leung, A.E.

WAM REGNO	Order	Family	Taxon	Abun-dance	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection Method	Collectors
126860			`sp. indet.`	1	ca. 79.5 km NW. of Newman	-23.16521	118.983	11/23/2011	11/30/2011	Trog Scrape	Leung, A.E.
126861			`sp. indet.`	1	ca 74 km heading 290.7° from Newman	-23.12062	119.0497	7/20/2011	7/27/2011	Trog Scrape	Leung, A.E.
136281			`sp. indet.`	1	Wonmunna Mining Lease, ca 70 km WNW. of Newman	-23.16389	118.983	5/19/2014		Trog Scrape	Leung, A.E.
136275			Arachnida `DNA08`	1	Wonmunna Mining Lease, ca 70 km WNW. of Newman	-23.12093	119.0542	5/17/2014		Trog Scrape	Leung, A.E.

Table C-2: Western Australian Museum database search results: Myriapoda: Chilopoda

WAM REGNO	Order	Family	Taxon	Abun-dance	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection Method	Collectors
130456	Geophilida	Chilenophilidae	Chilenophilidae	1	Marillana Creek, ca. 86 km NNW. of Newman	-22.71283	119.3259	5/11/2011	5/11/2011	Trog Scrape	Main, D.C.; Bennett, S.R.
131656	Geophilida	Chilenophilidae	Ribautia `sp. B02`	1	35.2 km NW. of Mt Meharry	-22.81528	118.8766	6/11/2013	8/13/2013	Litter Trap	Cocking, J.S.; Pearson, G.B.
100186	Scolopendrida	Cryptopidae	Cryptopidae	1	55 km S. of Auski Roadhouse	-22.90195	118.6726	12/1/2008	3/23/2009	Litter Trap	Dight, N.
100187	Scolopendrida	Cryptopidae	Cryptopidae	1	55 km S. of Auski Roadhouse	-22.90195	118.6726	12/1/2008	3/23/2009	Litter Trap	Dight, N.
140043	Scolopendrida	Cryptopidae	Cryptops	1	Yandi, 90 km NW. of Newman	-22.8222	119.134	5/25/2009		Trog Scrape	Bell, P.; Perina, G.
118071	Scolopendrida	Cryptopidae	Cryptops `DNA17`	1	ca. 77.5 km NW. of Newman	-23.14481	119.0023	9/23/2011	9/27/2011	Trog Scrape	Leung, A.E.
127529	Scolopendrida	Scolopendridae	Cormocephalus `CHI003?`	1	31.5 km SE. of Mt Meharry, RIOTIO Greater West Angelas	-23.12345	118.8591	10/5/2012	10/8/2012	Litter Trap	White, S.; Smith, L.
120962	Scolopendrida	Scolopendridae	Cormocephalus `CHI005?`	1	95 km WNW. of Newman	-22.92261	118.8722	2/10/2008		Litter Trap	Stevens, N.
120946	Scolopendrida	Scolopendridae	Cormocephalus `CHI005`	1	Packsaddle P4 mine lease, ca. 96 km NW. of Newman	-22.901	118.993	6/27/2010		Trog Scrape	Curran, M.K.; Pearson, G.B.
115448	Scolopendrida	Scolopendridae	Scolopendra laeta	1	Hope Downs, 78.3 km NW. of Newman, troglofauna trap, 9m	-22.98111	119.0786	8/18/2010		Litter Trap	Runham, P.

Table C-3: Western Australian Museum database search results: Myriapoda: Diplopoda.

WAM REGNO	Order	Family	Taxon	Abun-dance	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection Method	Collectors
116537	Polydesmida	Dalodesmidae	Dalodesmidae	11	Marillana, ca. 80 km NW. of Newman	-22.70008	119.3334	7/4/2011		Litter Trap	Main, D.C.; Bennett, D.C.
127459	Polydesmida		Polydesmida	1	Phil`s Creek, ca. 100 km NNW. of Newman	-22.73464	119.1852	3/10/2009		Trog Scrape	Scanlon, M.D.; Pearson, G.B.
141006	Polyxenida	`Lophoproctidae?`	`Lophoproctidae?`	12	ca. 113 km WNW. of Newman	-23.17375	118.6817	3/18/2016		Trog Scrape	Callan, S.; Volschenk, E.S.
141007	Polyxenida	`Lophoproctidae?`	`Lophoproctidae?`	3	ca. 113 km WNW. of Newman	-23.1726	118.6602	3/19/2016		Trog Scrape	Callan, S.; Volschenk, E.S.
102935	Polyxenida	Lophoproctidae	Lophoproctidae	4	Yandi, 74.9 km NW. of Newman	-22.82222	119.2886	12/9/2009		Litter Trap	Cairnes, J.; Keirle, D.
127514	Polyxenida	Lophoproctidae	Lophoproctidae	1	31.8 km SE. of Mt Meharry, RIOTIO Greater West Angelas	-23.12546	118.8557	10/5/2012	10/8/2012	Litter Trap	White, S.; Smith, L.
127515	Polyxenida	Lophoproctidae	Lophoproctidae	1	20.7 km SSE. of Mt Meharry, RIOTIO Greater West Angelas	-23.14786	118.6813	10/5/2012	10/8/2012	Litter Trap	White, S.; Smith, L.
127516	Polyxenida	Lophoproctidae	Lophoproctidae	1	20 km SSE. of Mt Meharry, RIOTIO Greater West Angelas	-23.14919	118.6626	10/5/2012	10/8/2012	Litter Trap	White, S.; Smith, L.
127517	Polyxenida	Lophoproctidae	Lophoproctidae	1	20.4 km SSE. of Mt Meharry, RIOTIO Greater West Angelas	-23.14755	118.6777	10/5/2012	10/8/2012	Litter Trap	White, S.; Smith, L.
127518	Polyxenida	Lophoproctidae	Lophoproctidae	8	34.1 km SE. of Mt Meharry, RIOTIO Greater West Angelas	-23.19147	118.8324	10/5/2012	10/8/2012	Litter Trap	White, S.; Smith, L.
127519	Polyxenida	Lophoproctidae	Lophoproctidae	1	22.9 km SE. of Mt Meharry, RIOTIO Greater West Angelas	-23.14242	118.7283	10/5/2012	10/8/2012	Litter Trap	White, S.; Smith, L.
127521	Polyxenida	Lophoproctidae	Lophoproctidae	2	19.1 km SSE. of Mt Meharry, RIOTIO Greater West Angelas	-23.14686	118.6465	10/5/2012	10/8/2012	Litter Trap	White, S.; Smith, L.
127522	Polyxenida	Lophoproctidae	Lophoproctidae	1	35.4 km SE. of Mt Meharry, RIOTIO Greater West Angelas	-23.19583	118.8445	10/5/2012	10/8/2012	Litter Trap	White, S.; Smith, L.
127523	Polyxenida	Lophoproctidae	Lophoproctidae	9	23 km SE. of Mt Meharry, RIOTIO Greater West Angelas	-23.14158	118.7302	10/5/2012	10/8/2012	Litter Trap	White, S.; Smith, L.
127524	Polyxenida	Lophoproctidae	Lophoproctidae	1	25.9 km SE. of Mt Meharry, RIOTIO Greater West Angelas	-23.17938	118.7247	10/5/2012	10/8/2012	Litter Trap	White, S.; Smith, L.
127525	Polyxenida	Lophoproctidae	Lophoproctidae	4	22.7 km SE. of Mt Meharry, RIOTIO Greater West Angelas	-23.14153	118.7283	10/5/2012	10/8/2012	Litter Trap	White, S.; Smith, L.
127526	Polyxenida	Lophoproctidae	Lophoproctidae	3	25.6 km SSE. of Mt Meharry, RIOTIO Greater West Angelas	-23.1727	118.7286	10/5/2012	10/8/2012	Litter Trap	White, S.; Smith, L.
127527	Polyxenida	Lophoproctidae	Lophoproctidae	7	22.6 km SSE. of Mt Meharry, RIOTIO Greater West Angelas	-23.17361	118.6639	10/5/2012	10/8/2012	Litter Trap	White, S.; Smith, L.
127528	Polyxenida	Lophoproctidae	Lophoproctidae	1	20 km SSE. of Mt Meharry, RIOTIO Greater West Angelas	-23.14925	118.6662	10/5/2012	10/8/2012	Litter Trap	White, S.; Smith, L.
137351	Polyxenida	Lophoproctidae	Lophoturus madecassus	2	Mining Area C, ca. 85 km NW. Newman	-22.95714	119.0152	3/7/2015	5/6/2015	Litter Trap	M.K. Curran, J.S. Cocking
137352	Polyxenida	Lophoproctidae	Lophoturus madecassus	6	Packsaddle East, ca. 80 km NW. Newman	-22.91767	119.0734	3/20/2015	5/20/2015	Litter Trap	M.K. Curran, J.S. Cocking
136313	Polyxenida	Polyxenidae	Polyxenida `DNA01`	1	Wonmunna Mining Lease, ca 70 km WNW. of Newman	-23.12461	119.1524	5/15/2014		Trog Scrape	Leung, A.E.
100089	Polyxenida	Polyxenidae	Polyxenidae	3	Area C, ca. 80 km NW. of Newman	-22.92667	118.9994	2/4/2008		Litter Trap	Cocking, J.S.; Scanlon, M.D.
100090	Polyxenida	Polyxenidae	Polyxenidae	2	Area C, ca. 80 km NW. of Newman	-22.93972	118.85	7/25/2008		Litter Trap	Cocking, J.S.; Scanlon, M.D.
126897	Polyxenida	Polyxenidae	Polyxenidae `DNA01`	1	ca. 79.5 km NW. of Newman	-23.16168	118.9849	11/23/2011	11/30/2011	Trog Scrape	Leung, A.E.
115425	Polyxenida	Polyxenidae	Unixenus	1	Yandi, 73.1 km NW. of Newman	-22.84194	119.2825	12/9/2009		Litter Trap	Cairnes, J.; Keirle, D.
100179	Polyxenida		Polyxenida	1	55 km S. of Auski Roadhouse	-22.88972	118.6757	12/1/2008	3/23/2009	Litter Trap	Dight, N.
100183	Polyxenida		Polyxenida	2	55 km S. of Auski Roadhouse	-22.8733	118.6755	12/1/2008	3/23/2009	Litter Trap	Dight, N.
127464	Spirostreptida	Iulomorphidae	Iulomorphidae	1	Phil's Creek, ca. 100 km NNW. of Newman	-22.732	119.1826	7/7/2009	9/15/2009	Litter Trap	Cocking, J.S.; McRae, J.M.
116535	Spirostreptida	Lulomorphidae	Lulomorphidae	7	Phils Creek, ca. 100 km NW. of Newman	-22.7355	119.1885	6/8/2009		Trog Scrape	Scanlon, M.D.; Main, D.C.
127463	Spirostreptida	Lulomorphidae	Lulomorphidae	1	Phil`s Creek, ca. 100 km NNW. of Newman	-22.73728	119.1878	3/10/2009		Trog Scrape	Scanlon, M.D.; Pearson, G.B.
136314			Diplopoda `sp. indet.`	1	Wonmunna Mining Lease, ca 70 km WNW. of Newman	-23.1433	119.0027	5/20/2014		Trog Scrape	Leung, A.E.
129605	Tetramerocerata	Pauropodidae	`Pauropodidae sp. B01`	1	Deposit C, ca. 100 km NNW. of Newman	-22.92611	118.9751	1/13/2008	1/13/2008	Trog Scrape	Cocking, J.S.; Scanlon, M.D.
129606	Tetramerocerata	Pauropodidae	`Pauropodidae sp. B01`	1	Deposit R, ca. 100 km NNW. of Newman	-22.97065	119.0206	8/7/2008	8/7/2008	Trog Scrape	Pearson, G.B.
129607	Tetramerocerata	Pauropodidae	`Pauropodidae sp. B01`	1	South Flank East, ca. 100 km NNW. of Newman	-22.98736	118.9823	2/18/2010	2/18/2010	Trog Scrape	Pearson, G.B.; Main, D.C.

WAM REGNO	Order	Family	Taxon	Abun-dance	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collection Method	Collectors
129610	Tetramerocerata	Pauropodidae	`Pauropodidae sp. B04`	1	Packsaddle P4, ca. 100 km NNW. of Newman	-22.90667	118.9873	4/10/2010	4/10/2010	Trog Scrape	Curran, M.K.; Pearson, G.B.
129614	Tetramerocerata	Pauropodidae	`Pauropodidae sp. B04`	1	Packsaddle P4, ca. 100 km NNW. of Newman	-22.90058	118.9873	6/26/2010	6/26/2010	Trog Scrape	Curran, M.K.; Pearson, G.B.
129629	Tetramerocerata	Pauropodidae	`Pauropodidae sp. B04`	1		-22.73453	119.1874	1/12/2010	1/12/2010	Trog Scrape	Trotter, A.J.; Cocking, J.S.
129628	Tetramerocerata	Pauropodidae	`Pauropodidae sp. B06`	1		-22.73242	119.1822	7/7/2009	7/7/2009	Trog Scrape	Scanlon, M.D.; Main, D.C.
129630	Tetramerocerata	Pauropodidae	`Pauropodidae sp. B06`	1		-22.73242	119.1822	2/11/2010	2/11/2010	Trog Scrape	Curran, M.K.; Cocking, J.S.
129627	Tetramerocerata	Pauropodidae	`Pauropodidae sp. B07`	4		-22.73467	119.1843	3/10/2009	3/10/2009	Trog Scrape	Scanlon, M.D.; Pearson, G.B.
129611	Tetramerocerata	Pauropodidae	`Pauropodidae sp. B15`	1	Packsaddle P4,ca. 100 km NNW. of Newman	-22.89845	118.9901	4/10/2010	6/27/2010	Litter Trap	Curran, M.K.; Pearson, G.B.
129609	Tetramerocerata	Pauropodidae	Allopauropus `sp. B11`	1	South Flank, ca. 90 km NW. of Newman	-22.99936	118.9299	3/24/2010	3/24/2010	Trog Scrape	Curran, M.K.; Pearson, G.B.
129615	Tetramerocerata	Pauropodidae	Allopauropus `sp. B11`	1	Mudlark, ca. 100 km NW. of Newman	-22.94944	118.8033	6/7/2012	6/7/2012	Trog Scrape	Pearson, G.B.; Quartermaine, J.W.
127458	Tetramerocerata	Pauropodidae	Pauropodidae	4	Phil`s Creek, ca. 100 km NNW. of Newman	-22.73467	119.1843	3/10/2009		Trog Scrape	Scanlon, M.D.; Pearson, G.B.
129616	Tetramerocerata	Pauropodidae	Polypauropus `sp. B01`	1	Mudlark, ca. 100 km NW. of Newman	-22.94958	118.7916	6/8/2012	6/8/2012	Trog Scrape	Pearson, G.B.; Quartermaine, J.W.
100091			Pauropoda	1	Area C, ca. 80 km NW. of Newman	-22.92611	118.975	1/13/2008		Trog Scrape	Cocking, J.S.; Scanlon, M.D.
102936			Pauropoda	1	Yandi, 74.9 km NW. of Newman	-22.84667	119.27	12/9/2009		Litter Trap	Cairnes, J.; Keirle, D.
136321			Pauropoda	1	Wonmunna Mining Lease, ca 70 km WNW. of Newman	-23.12451	119.0625	5/16/2014		Trog Scrape	Leung, A.E.
141185	Cephalostigmata	Scutigerellidae	Scutigerellidae	14	c.a. 113 km WNW. of Newman	-23.14934	118.6864	5/11/2016		Trog Scrape	Callan, S.
127457	Cephalostigmata	Scutigerellidae	Symphyella	1	Iron Valley, ca. 90 km NNW. of Newman	-22.74392	119.305	5/13/2009		Trog Scrape	Scanlon, M.D.; Main, D.C.
126846	Cephalostigmata		Cephalostigmata	1	ca. 77.5 km NW. of Newman	-23.14481	119.0023	7/20/2011	7/27/2011	Trog Scrape	Leung, A.E.
126848	Cephalostigmata		Cephalostigmata	1	ca. 71 km NW. from Newman	-23.12986	119.083	7/20/2011	7/27/2011	Trog Scrape	Leung, A.E.
126849	Cephalostigmata		Cephalostigmata	1	ca. 77.5 km NW. of Newman	-23.14605	119.0002	9/23/2011	9/27/2011	Trog Scrape	Leung, A.E.
126850	Cephalostigmata		Cephalostigmata	1	ca. 77.5 km NW. of Newman	-23.14379	119.0042	9/23/2011	9/27/2011	Trog Scrape	Leung, A.E.
126851	Cephalostigmata		Cephalostigmata	1	ca. 77.5 km NW. of Newman	-23.14347	119.012	9/23/2011	9/27/2011	Trog Scrape	Leung, A.E.
126855	Cephalostigmata		Cephalostigmata	1	ca. 79.5 km NW. of Newman	-23.16246	118.9908	9/23/2011	9/27/2011	Trog Scrape	Leung, A.E.
141186	Cephalostigmata		Cephalostigmata	14	c.a. 113 km WNW. of Newman	-23.14917	118.6472	3/22/2016		Trog Scrape	Callan, S.
136323	Cephalostigmata		Cephalostigmata `DNA06`	2	Wonmunna Mining Lease, ca 70 km WNW. of Newman	-23.16085	118.9771	5/20/2014		Trog Scrape	Leung, A.E.
136324	Cephalostigmata		Cephalostigmata `DNA06`	1	Wonmunna Mining Lease, ca 70 km WNW. of Newman	-23.16128	118.979	5/20/2014		Trog Scrape	Leung, A.E.
126854	Cephalostigmata		Cephalostigmata `DNA07`	2	ca. 71 km NW. from Newman	-23.12652	119.081	9/23/2011	9/27/2011	Trog Scrape	Leung, A.E.
126853	Cephalostigmata		Cephalostigmata `DNA08`	1	ca. 79.5 km NW. of Newman	-23.16396	118.9771	7/20/2011	7/27/2011	Trog Scrape	Leung, A.E.
139344	Cephalostigmata		Cephalostigmata`sp. Yandi`	1	Yandi ca. 86 km NW. of Newman	-22.79194	119.1494	10/8/2015	11/24/2015	Litter Trap	Cole, C.; Keirle, D.

Table C-4: Western Australian Museum database search results: Crustacea: Isopoda.

WAM REGNO	Order	Family	Taxon	Abundance	Site	Latitude	Longitude	Collection Method	Collectors
51539	Isopoda	Armadillidae	Acanthodillo won1	1	ca 79.5 km heading 285.5° from Newman	-23.1648	118.979	Litter Trap	Leung, A.
47578	Isopoda	Armadillidae	Armadillidae	1	Hope Downs	-22.9825	119.079	Litter Trap	Runham, P.
47579	Isopoda	Armadillidae	Armadillidae	1	Hope Downs	-23.0044	119.117	Litter Trap	Runham, P.
47611	Isopoda	Armadillidae	Armadillidae	1	Yandi, 84.7km NW of Newman	-22.7783	119.189	Litter Trap	Cairnes, J. & Keirle, D.
45678	Isopoda	Armadillidae	Armadillidae sp.		Mindy	-22.7513	119.417	Litter Trap	Trotter, A.J. & Main, D.C.
45691	Isopoda	Armadillidae	Armadillidae sp. B03		Mindy	-22.7458	119.394	Litter Trap	Trotter, A.J. & Main, D.C.
45692	Isopoda	Armadillidae	Armadillidae sp. B03		Deposit D	-22.9291	118.942	Trog Scrape	Cocking, J.S. & Scanlon, M.D.
45707	Isopoda	Armadillidae	Armadillidae sp. B03		Deposit A	-22.9269	118.999	Trog Scrape	Cocking, J.S. & Scanlon, M.D.
45708	Isopoda	Armadillidae	Armadillidae sp. B03		Deposit A	-22.9269	118.999	Litter Trap	Cocking, J.S. & Scanlon, M.D.
45709	Isopoda	Armadillidae	Armadillidae sp. B03		Deposit F	-22.9375	118.861	Litter Trap	Cocking, J.S. & Scanlon, M.D.
45710	Isopoda	Armadillidae	Armadillidae sp. B03		Deposit F	-22.9397	118.85	Litter Trap	Cocking, J.S. & Scanlon, M.D.
45711	Isopoda	Armadillidae	Armadillidae sp. B03		Deposit F	-22.9408	118.838	Litter Trap	Cocking, J.S. & Scanlon, M.D.
45695	Isopoda	Armadillidae	Armadillidae sp. B06		Phil's Creek	-22.7355	119.189	Litter Trap	McRae, J.M. & Cocking, J.S.
45696	Isopoda	Armadillidae	Armadillidae sp. B06		Phil's Creek	-22.738	119.191	Trog Scrape	Pearson, G.B. & Scanlon, M.D.
45697	Isopoda	Armadillidae	Armadillidae sp. B06		Phil's Creek	-22.7347	119.185	Litter Trap	Main, D.C. & Scanlon, M.D.
60657	Isopoda	Armadillidae	Armadillidae sp. B11	1	Upper Weeli Wolli, ca. 70 km NW. Newman	-22.9135	119.203	Litter Trap	Curran, M.K., Cocking, J.S.
45702	Isopoda	Armadillidae	Armadillidae sp. B13		South Flank	-22.9738	118.836	Litter Trap	Cocking, J.S. & Scanlon, M.D.
45703	Isopoda	Armadillidae	Armadillidae sp. B13		South Flank	-23.0133	118.883	Litter Trap	Cocking, J.S. & Scanlon, M.D.
45712	Isopoda	Armadillidae	Armadillidae sp. B14		South Flank	-23.0094	118.897	Trog Scrape	Pearson, G.B. & Scanlon, M.D.
45713	Isopoda	Armadillidae	Armadillidae sp. B14		South Flank	-23.0094	118.897	Litter Trap	Pearson, G.B. & Cocking, J.S.
45714	Isopoda	Armadillidae	Armadillidae sp. B14		South Flank	-23.0094	118.897	Litter Trap	Thornber, C.R. & Scanlon, M.D.
45679	Isopoda	Armadillidae	Armadillidae sp. B4		Iron Valley	-22.7238	119.315	Litter Trap	Main, D.C. & Scanlon, M.D.
45680	Isopoda	Armadillidae	Armadillidae sp. B6		South Flank	-22.9961	118.819	Trog Scrape	Main, D.C. & Cocking, J.S.
49942	Isopoda	Armadillidae	Troglarmadillo A	1	Rhodes Ridge, Newman	-23.2105	119.204	Litter Trap	Cole, C. and O'Neill, C.
60490	Isopoda	Armadillidae	Troglarmadillo DNA03	1	Wonmunna Mine Lease	-23.1608	118.977	Trog Scrape	Leung, A.E.
51421	Isopoda	Armadillidae	Troglarmadillo sp.	1	ca 77.5 km heading 287.6° from Newman	-23.1434	119.012	Litter Trap	Leung, A.
60656	Isopoda	Armadillidae	Troglarmadillo sp. B44	2	Packsaddle P1, ca. 87 km SE. Wittenoom	-22.9257	118.876	Trog Scrape	Quartermaine, J.W., Bennett, S.R.
51240	Isopoda	Philosciidae	?Andricophiloscia	1	Iron Valley	-22.7655	119.3	Trog	Pearson, G.B. & Bennett, S.R.
45600	Isopoda	Philosciidae	Philosciidae sp. B03		South Flank	-23.0044	118.934	Trog Scrape	Pearson, G.B. & Scanlon, M.D.
45601	Isopoda	Philosciidae	Philosciidae sp. B03		South Flank	-23.0044	118.934	Litter Trap	Thornber, C.R. & Scanlon, M.D.
45604	Isopoda	Philosciidae	Philosciidae sp. B04		South Flank	-23.0044	118.934	Litter Trap	Thornber, C.R. & Scanlon, M.D.
45619	Isopoda	Philosciidae	Philosciidae sp. B10		South Flank	-22.7336	119.187	Litter Trap	Cocking, J.S. & McRae, J.M.
45628	Isopoda	Philosciidae	Philosciidae sp. B15		South Flank	-22.9966	118.819	Litter Trap	Cocking, J.S. & Curran, M.K.
45629	Isopoda	Philosciidae	Philosciidae sp. B16		South Flank	-23.0052	118.964	Litter Trap	Thornber, C.R. & Scanlon, M.D.
60741	Isopoda		Isopoda	3	Yandi ca. 86km NW Newman	-22.7913	119.158	Litter Trap	Cole, C., Keirle, D.
60742	Isopoda		Isopoda	1	Yandi ca. 86km NW Newman	-22.793	119.155	Litter Trap	Cole, C., Keirle, D.
60743	Isopoda		Isopoda	1	Yandi ca. 86km NW Newman	-22.7922	119.154	Litter Trap	Cole, C., Keirle, D.
60744	Isopoda		Isopoda	2	Yandi ca. 86km NW Newman	-22.7911	119.151	Litter Trap	Cole, C., Keirle, D.
60745	Isopoda		Isopoda	2	Yandi ca. 86km NW Newman	-22.7911	119.151	Litter Trap	Cole, C., Keirle, D.
60749	Isopoda		Isopoda	1	Yandi ca. 86km NW Newman	-22.7888	119.156	Litter Trap	Cole, C., Keirle, D.
60750	Isopoda		Isopoda	7	Yandi ca. 86km NW Newman	-22.7897	119.157	Litter Trap	Cole, C., Keirle, D.
60763	Isopoda		Isopoda	1	Yandi ca. 86km NW Newman	-22.7897	119.157	Litter Trap	Watson, N., Cole. C.

Table C-4: Western Australian Museum database search results: Insecta.

REGNO	ORDER	FAMILY	Taxon	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collectors
83160	Diplura	Japygidae	Japygidae `DPL002`	Governor Range	-23.06318	118.74478	24/04/2008	24/04/2008	Pearson, G.B. & Scanlon, M.D.
83164	Diplura	Japygidae	Japygidae `DPL005`	Alligator Jaws	-23.06275	118.63475	23/04/2008	23/04/2008	Pearson, G.B. & Scanlon, M.D.
83166	Diplura	Japygidae	Japygidae `DPL007`	Deposit R	-22.97194	119.02058	21/02/2010	21/02/2010	Main, D.C. & Pearson, G.B.
83171	Diplura	Japygidae	Japygidae `DPL011`	Deposit R	-22.97117	119.05697	25/05/2010	25/05/2010	Cocking, J.S. & Main, D.C.
83172	Diplura	Japygidae	Japygidae `DPL011`	South Flank	-23.00522	118.92392	27/03/2010	27/03/2010	Curran, M.K. & Pearson, G.B.
83173	Diplura	Japygidae	Japygidae `DPL011`	South Flank	-23.00400	118.91233	24/03/2010	24/03/2010	Curran, M.K. & Pearson, G.B.
83182	Diplura	Japygidae	Japygidae `DPL017`	Yandi	-22.73456	118.93586	17/08/2011	17/08/2011	Cocking, J.S. & Quartermaine, J.W.
83186	Diplura	Parajapygidae	Parajapygidae `DPL020`	Orebody 41	-22.99994	119.26731	31/03/2009	31/03/2009	Cocking, J.S. & Pearson, G.B.
83190	Diplura	Parajapygidae	Parajapygidae `DPL023`	South Flank	-22.99947	118.84789	15/06/2010	15/06/2010	Curran, M.K. & Pearson, G.B.
83191	Diplura	Parajapygidae	Parajapygidae `DPL024`	South Flank	-23.00369	118.97700	16/06/2010	16/06/2010	Cocking, J.S. & Main, D.C.
83206	Blattodea	Nocticolidae	Nocticola `BLA001`	Iron Valley, approx.	-22.71825	119.32214	14/05/2009		Main, D.C. & Scanlon, M.D.
83207	Blattodea	Nocticolidae	Nocticola `BLA001`	Deposit F, approx.	-22.94081	118.87681	06/12/2007	05/02/2008	Cocking, J.S. & Scanlon, M.D.
83208	Blattodea	Nocticolidae	Nocticola `BLA001`	Packsaddle East, approx.	-22.91706	119.11467	04/03/2010	27/04/2010	Cocking, J.S. & Pearson, G.B.
83209	Blattodea	Nocticolidae	Nocticola `BLA004`	Coondewanna, approx.	-23.19350	118.97294	10/06/2010		Main, D.C. & Pearson, G.B.
83212	Blattodea	Nocticolidae	Nocticola `BLA003`	Deposit B, approx.	-22.94203	119.00814	05/03/2010		Curran, M.K. & Scanlon, M.D.
83213	Blattodea	Nocticolidae	Nocticola `BLA003`	Packsaddle P3, approx.	-22.89969	118.95533	24/06/2010		Curran, M.K. & Pearson, G.B.
84111	Blattodea	Nocticolidae	Nocticola `BLA001`	Iron Valley	-22.71825	119.32214	14/05/2009	09/07/2009	Scanlon, M.D. & Main, D.C.
84112	Blattodea	Nocticolidae	Nocticola	Phil`s Creek	-22.73639	119.18625	11/05/2009	07/07/2009	Scanlon, M.D. & Main, D.C.
84113	Blattodea	Nocticolidae	Nocticola	Phil`s Creek	-22.73639	119.18625	11/05/2009	07/07/2009	Scanlon, M.D. & Main, D.C.
84114	Blattodea	Nocticolidae	Nocticola	Phil`s Creek	-22.73550	119.18797	12/01/2010		Trotter, A.J. & Cocking, J.S.
84116	Diplura	Japygidae	Japygidae `DPL002`	Iron Valley	-22.71830	119.31910	14/05/2009		Scanlon, M.D. & Main, D.C.
84117	Diplura	Projapygidae	Projapygidae	Iron Valley	-22.72380	119.31340	05/11/2009	11/01/2010	Trotter, A.J. & Cocking, J.S.
84119	Thysanura	Nicoletiidae	Nicoletiidae Nicoletiidae	Phil`s Creek	-22.73630	119.18620	11/05/2009	07/07/2009	Scanlon, M.D. & Main, D.C.
84120	Thysanura	Nicoletiidae	Nicoletiidae Trinemura	Phil`s Creek	-22.73810	119.19080	11/05/2009	07/07/2009	Scanlon, M.D. & Main, D.C.
84160	Blattodea	Nocticolidae	Nocticola		-22.97300	119.05720	20/02/2010		Pearson, G.B. & Main, D.C.
84161	Blattodea	Nocticolidae	Nocticola		-22.97300	119.05720	20/02/2010		Pearson, G.B. & Main, D.C.
84162	Blattodea	Nocticolidae	Nocticola		-22.96940	119.07200	10/04/2008		Pearson, G.B. & Scanlon, M.D.
84163	Blattodea	Nocticolidae	Nocticola		-22.96940	119.07200	08/08/2008		Pearson, G.B. & Rumens-Thornber, C.
84164	Blattodea	Nocticolidae	Nocticola		-22.97250	119.05290	20/02/2010		Pearson, G.B. & Main, D.C.
84165	Blattodea	Nocticolidae	Nocticola		-22.96600	119.07280	10/04/2008		Pearson, G.B. & Scanlon, M.D.
84166	Blattodea	Nocticolidae	Nocticola		-23.00600	118.98180	27/05/2010		Cocking, J.S. & Main, D.C.
84167	Blattodea	Nocticolidae	Nocticola		-23.00600	118.98180	27/05/2010	21/07/2010	Cocking, J.S. & Main, D.C.
84168	Blattodea	Nocticolidae	Nocticola		-23.01070	118.99430	19/02/2010		Pearson, G.B. & Main, D.C.
84169	Blattodea	Nocticolidae	Nocticola		-23.01070	118.99430	26/05/2010		Cocking, J.S. & Main, D.C.
84177	Blattodea	Nocticolidae	Nocticola		-22.92630	119.01560	11/03/2008		Cocking, J.S. & Scanlon, M.D.
84178	Blattodea	Nocticolidae	Nocticola		-22.94200	119.00400	25/07/2008	22/09/2008	Cocking, J.S. & Pearson, G.B.
84179	Blattodea	Nocticolidae	Nocticola		-22.93230	118.94220	12/01/2008		Cocking, J.S. & Scanlon, M.D.
84180	Blattodea	Nocticolidae	Nocticola		-22.93560	118.88210	09/01/2008		Cocking, J.S. & Scanlon, M.D.
84181	Blattodea	Nocticolidae	Nocticola		-23.01080	119.17000	12/07/2011		Main, D.C. & Quartermaine, J.W.
84182	Blattodea	Nocticolidae	Nocticola		-23.01080	119.17000	12/07/2011		Main, D.C. & Quartermaine, J.W.
84183	Blattodea	Nocticolidae	Nocticola		-22.97710	118.81830	08/06/2012	07/08/2012	Quartermaine, J.W. & Cocking, J.S.
84184	Blattodea	Nocticolidae	Nocticola		-22.97710	118.81830	08/06/2012	07/08/2012	Quartermaine, J.W. & Cocking, J.S.
84185	Blattodea	Nocticolidae	Nocticola		-22.97710	118.81830	08/06/2012	07/08/2012	Quartermaine, J.W. & Cocking, J.S.
84186	Blattodea	Nocticolidae	Nocticola		-23.00930	118.99730	08/03/2012	11/05/2012	Quartermaine, J.W. & Bennett, S.R.
84187	Blattodea	Nocticolidae	Nocticola		-23.00930	118.99730	11/07/2012		Quartermaine, J.W. & Bennett, S.R.
89984	Coleoptera	Ptiliidae	Ptinella `sp. B01`	Upper Weeli Wolli, approx.	-22.91350	119.20320	20/03/2015	19/05/2015	Curran, M.K. and Cocking, J.S.
89987	Hemiptera	Meenoplidae	Meenoplidae `sp. B04`	Upper Weeli Wolli, approx.	-22.90820	119.20870	21/03/2015		Curran, M.K. and Main, D.C.

REGNO	ORDER	FAMILY	Taxon	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collectors
90049	Blattodea	Nocticolidae	Nocticola	West Angelas Aerodome, approx.	-23.12150	118.86360	05/10/2012	08/10/2012	White, S.
90051	Blattodea	Nocticolidae	Nocticola	West Angelas Aerodome, approx.	-23.12680	118.87010	05/10/2012	08/10/2012	White, S.
90054	Blattodea	Nocticolidae	Nocticola	West Angelas Aerodome, approx.	-23.12420	118.88900	05/10/2012	08/10/2012	White, S.
90093	Diplura	Japygidae	Japygidae `sp. B04`	Area C	-22.92690	119.01750	07/12/2007		Cocking, J.S. and Scanlon, M.D.
90095	Hemiptera	Meenoplidae	Meenoplidae `sp. B04`	Area C	-23.00440	118.93440	21/04/2008		Cocking, J.S. and Scanlon, M.D.
90096	Blattodea	Nocticolidae	Nocticola `sp. B07`	Area C	-23.00630	118.96440	22/04/2008		Cocking, J.S. and Scanlon, M.D.
90097	Thysanura	Nicoletiidae	Nicoletiidae `sp. B02`	Area C	-22.92770	119.00390	11/03/2008		Cocking, J.S. and Scanlon, M.D.
90098	Diplura	Japygidae	Japygidae `sp. B04`	Area C	-22.97300	119.05720	10/04/2008		Cocking, J.S. and Scanlon, M.D.
90100	Hemiptera	Meenoplidae	Meenoplidae `sp. B02`	Area C	-22.92660	118.97670	13/01/2008		Cocking, J.S. and Scanlon, M.D.
90104	Hemiptera	Meenoplidae	Meenoplidae `sp. B02`	Area C	-22.92660	118.97670	13/01/2008		Cocking, J.S. and Scanlon, M.D.
90109	Thysanura	Nicoletiidae	Nicoletiidae Trinemura	Marillana Creek	-22.72310	119.38050	10/05/2011		Main, D.C. and Bennett, S.R.
90110	Diplura	Projapygidae	Projapygidae `sp. B09`	Marillana Creek	-22.71400	119.36580	10/05/2011		Main, D.C. and Bennett, S.R.
90274	Thysanura	Nicoletiidae	Nicoletiidae `sp. BO2`	Lamb's Creek, approx.	-22.81440	119.01870	11/06/2013		Cocking, J.S. and Pearson, G.B.
90277	Diplura	Japygidae	Japygidae `sp. B34`	Lamb's Creek, approx.	-22.81030	118.87560	26/03/2013		Cocking, J.S. and Pearson, G.B.
90278	Hemiptera	Meenoplidae	Meenoplidae `sp. B08`	Lamb's Creek, approx.	-22.81530	119.02680	11/06/2013		Cocking, J.S. and Pearson, G.B.
90279	Blattodea	Nocticolidae	Nocticola `sp. B29 (nr sp. B10)`	Lamb's Creek, approx.	-22.81440	119.01870	11/06/2013		Cocking, J.S. and Pearson, G.B.
90280	Blattodea	Nocticolidae	Nocticola `sp. B31`	Lamb's Creek, approx.	-22.80980	118.87850	27/03/2013		Cocking, J.S. and Pearson, G.B.
90282	Thysanura	Nicoletiidae	Nicoletiidae Trinemura`sp. B25`	Lamb's Creek, approx.	-22.81210	118.87560	26/03/2013		Cocking, J.S. and Pearson, G.B.
90337	Hemiptera	Meenoplidae	Meenoplidae `Won3`	approx.	-23.12820	119.08880	23/11/2011	30/11/2011	Leung, A.
90338	Hemiptera	Meenoplidae	Meenoplidae `Won2`	approx.	-23.16170	119.00050	23/11/2011	30/11/2011	Leung, A.
90339	Hemiptera	Meenoplidae	Meenoplidae `Won2`	approx.	-23.16230	119.00050	23/11/2011	30/11/2011	Leung, A.
90340	Hemiptera	Meenoplidae	Meenoplidae `Won1`	approx.	-23.16610	118.98110	23/11/2011	27/11/2011	Leung, A.
90354	Diplura	Projapygidae	Projapygidae `Won3`	approx.	-23.16460	119.00060	20/07/2011	27/07/2011	Leung, A.
90355	Diplura	Projapygidae	Projapygidae `Won1`	approx.	-23.12790	119.07710	23/11/2011	30/11/2011	Leung, A.
90358	Diplura	Japygidae	Japygidae `Won1`	approx.	-23.12840	119.08110	20/07/2011	27/70/2011	Leung, A.
90359	Diplura	Japygidae	Japygidae `Won1`	approx.	-23.12700	119.08100	23/09/2011	27/09/2011	Leung, A.
90377	Blattodea	Nocticolidae	Nocticola `Won1`	approx.	-23.12390	119.07130	20/07/2011	27/07/2011	Leung, A.
90378	Blattodea	Nocticolidae	Nocticola `Won1`	approx.	-23.12390	119.07130	23/11/2011	30/11/2011	Leung, A.
90379	Blattodea	Nocticolidae	Nocticola `Won1`	approx.	-23.12390	119.07130	23/09/2011	27/09/2011	Leung, A.
90380	Blattodea	Nocticolidae	Nocticola `Won1`	approx.	-23.12980	119.08300	23/11/2011	30/11/2011	Leung, A.
90381	Blattodea	Nocticolidae	Nocticola `Won1`	approx.	-23.12290	119.04980	20/07/2011	27/07/2011	Leung, A.
90382	Blattodea	Nocticolidae	Nocticola `Won1`	approx.	-23.12290	119.04980	23/11/2011	30/11/2011	Leung, A.
90389	Thysanura	Nicoletiidae	Nicoletiidae `Won2`	approx.	-23.14480	119.00230	23/09/2011	27/09/2011	Leung, A.
90390	Thysanura	Nicoletiidae	Nicoletiidae `Won1`	approx.	-23.16000	119.00440	23/09/2011	27/09/2011	Leung, A.
90391	Diplura	Parajapygidae	Parajapygidae	approx.	-23.13560	119.04630	19/05/2011	23/06/2011	Langlands, P.R.
90392	Diplura	Projapygidae	Projapygidae `Won2`	approx.	-23.13180	119.09640	21/05/2011		Langlands, P.R.
90612	Blattodea	Nocticolidae	Nocticolidae		-22.70340	119.30280	22/10/2010		Bell, P.S., Eberhard, S.
90637	Blattodea	Nocticolidae	`Nocticolidae sp. S3`		-23.03590	118.77350	15/03/2008		Bell, P.S., Moulds, T.
90638	Blattodea	Nocticolidae	Nocticolidae		-22.91810	118.90390	06/02/2008	28/03/2008	
90639	Blattodea	Nocticolidae	`Nocticolidae sp. S3`		-22.91810	118.90110	06/02/2008	28/03/2008	
90640	Blattodea	Nocticolidae	Nocticola		-22.91850	118.90100	06/02/2008	29/03/2008	
90644	Blattodea	Nocticolidae	`Blattidae sp. S2`		-22.92260	118.87220	12/12/2007	10/02/2008	Stevens, N.
90645	Blattodea	Nocticolidae	Nocticola		-22.92340	118.86350	31/03/2008		
90646	Blattodea	Nocticolidae	Nocticolidae		-22.91530	118.90090	11/02/2008		Stevens, N.
90647	Blattodea	Nocticolidae	Nocticola		-22.90650	118.95660	05/02/2008	28/03/2008	
90648	Blattodea	Nocticolidae	Nocticola `sp. S3`		-22.91000	118.97110	07/02/2008		Stevens, N.
90649	Blattodea	Nocticolidae	Nocticolidae		-22.92430	118.85760	12802/2008		Stevens, N.
90650	Blattodea	Nocticolidae	`Nocticolidae sp. S1`		-22.90480	119.00050	18/03/2008	18/06/2008	Bell, P, Muirhead, K.

REGNO	ORDER	FAMILY	Taxon	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collectors
90651	Blattodea	Nocticolidae	`Nocticolidae sp. S3`		-22.90600	118.99740	17/03/2008	18/06/2008	Bell, P.S., Moulds, T.
90652	Blattodea	Nocticolidae	Nocticola		-22.90780	118.95650	05/02/2008	28/03/2008	
90653	Blattodea	Nocticolidae	`Nocticolidae sp. S3`		-22.89740	119.04140	20/04/2008	19/06/2008	Bell, P, Muirhead, K.
90654	Blattodea	Nocticolidae	`Nocticolidae sp. S3`		-22.89740	119.04140	09/10/2008	09/10/2008	Bell, P, Vine, B.
90655	Blattodea	Nocticolidae	Nocticola		-22.92490	118.84670	01/04/2008		
90656	Blattodea	Nocticolidae	Nocticola		-22.92560	118.85120	04/02/2008	29/03/2008	
90657	Blattodea	Nocticolidae	Nocticola `sp. S1`		-22.92430	118.82790	12/02/2008		Stevens, N.
90658	Blattodea	Nocticolidae	Nocticola		-22.91000	118.97110	07/02/2008		Stevens, N.
90659	Blattodea	Nocticolidae	Nocticolidae		-22.89530	119.05890	12/10/2008		Stevens, N., Perina, G.
90660	Blattodea	Nocticolidae	Nocticola		-22.91000	118.97110	13/04/2008		
90661	Blattodea	Nocticolidae	Nocticola `sp. S1`		-22.90100	119.02390	17/10/2008		Bell, P., Muirhead, K.
90662	Blattodea	Nocticolidae	Nocticola `sp. S1`		-22.89700	119.06490	11/12/2008		Bell, P., Vine, B.
90663	Blattodea	Nocticolidae	Nocticola		-22.90690	118.95650	05/02/2008	28/03/2008	
90664	Blattodea	Nocticolidae	Nocticola		-22.90750	119.03530	18/10/2008		Bell, P., Muirhead, K.
90665	Blattodea	Nocticolidae	Nocticola		-22.89510	119.06620	10/12/2008		Bell, P., Vine, B.
90666	Blattodea	Nocticolidae	Nocticola `sp. S1`		-22.92250	118.82790	12/2/2008		Stevens, N.
90667	Blattodea	Nocticolidae	Nocticola `sp. S1`		-22.89210	119.03840	11/12/2008		Bell, P., Vine, B.
90668	Blattodea	Nocticolidae	Nocticola `sp. S1`		-22.90730	119.03290	14/10/2008		Stevens, N., Perina, G.
90669	Blattodea	Nocticolidae	Nocticola		-22.91820	118.89520	11/02/2008		Stevens, N.
90670	Blattodea	Nocticolidae	Nocticola `sp. S1`		-22.89460	119.03990	11/12/2008		Bell, P., Vine, B.
90671	Blattodea	Nocticolidae	Nocticola		-22.90750	119.03530	18/10/2008		Bell, P., Muirhead, K.
90672	Blattodea	Nocticolidae	Nocticola		-22.90780	118.99000	19/10/2008		Bell, P., Muirhead, K.
90673	Blattodea	Nocticolidae	Nocticola		-22.90770	118.99460	19/10/2008		Bell, P., Muirhead, K.
90674	Blattodea	Nocticolidae	Nocticola		-22.90780	118.99000	14/04/2008		Bell, P., Clarke, J
90675	Blattodea	Nocticolidae	Nocticola `sp. S1`		-22.89830	119.06630	10/12/2008		Bell, P., Vine, B.
90676	Blattodea	Nocticolidae	Nocticola `sp. S3`		-22.92120	118.88050	11/02/2008		Stevens, N.
90677	Blattodea	Nocticolidae	Nocticola `sp. S1`		-22.90590	119.00290	18/03/2008		Bell., P. Moulds, T.
90678	Blattodea	Nocticolidae	Nocticola `sp. S1`		-22.90730	119.03290	14/10/2008		Stevens, N., Perina, G.
90679	Blattodea	Nocticolidae	Nocticola `sp. S1`		-22.90430	119.04130	11/04/2008	19/06/2008	Bell, P., Muirhead, K.
90680	Blattodea	Nocticolidae	Nocticola `sp. S1`		-22.89610	119.06920	19/04/2008	19/06/2008	Bell, P., Muirhead, K.
90681	Blattodea	Nocticolidae	Nocticola `sp. S1`		-22.89790	119.06050	19/04/2008	19/06/2008	Bell, P., Muirhead, K.
90682	Blattodea	Nocticolidae	Nocticola `sp. S1`		-22.89880	119.04140	20/04/2008		Stevens, N., Muirhead, K.
90683	Blattodea	Nocticolidae	Nocticola `sp. S1`		-22.89790	119.05300	19/04/2008	19/06/2008	Bell, P., Muirhead, K.
90684	Blattodea	Nocticolidae	Nocticola `sp. S1`		-22.90470	118.99750	17/03/2008		Bell., P. Moulds, T.
90685	Blattodea	Nocticolidae	Nocticola `sp. S1`		-22.90470	118.99750	21/04/2008		Bell, P., Muirhead, K.
90686	Blattodea	Nocticolidae	Nocticola `sp. S1`		-22.92340	118.82790	12/02/2008		Stevens, N.
90687	Blattodea	Nocticolidae	Nocticola `sp. S1`		-22.91980	118.89210	13/12/2007	10/02/2008	Stevens, N.
90688	Blattodea	Nocticolidae	Nocticola		-22.91000	118.97030	07/02/2008		Stevens, N.
90689	Blattodea	Nocticolidae	Nocticola		-22.90100	119.02090	10/04/2008		Bell, P., Clarke, J
90690	Blattodea	Nocticolidae	Nocticola		-22.90830	119.03550	22/04/2008		Stevens, N., Muirhead, K.
90691	Blattodea	Nocticolidae	Nocticola		-22.90730	118.99450	19/03/2008		Bell., P. Moulds, T.
90692	Blattodea	Nocticolidae	Nocticola		-22.90510	118.98290	18/03/2008		Bell., P. Moulds, T.
90693	Blattodea	Nocticolidae	Nocticola		-22.90610	118.98290	18/03/2008	18/06/2008	Bell, P., Muirhead, K.
90694	Blattodea	Nocticolidae	Nocticola		-22.89650	119.06050	19/04/2008	19/06/2008	Bell, P., Muirhead, K.
90695	Blattodea	Nocticolidae	Nocticola		-22.90730	118.99450	19/10/2008		Bell, P., Muirhead, K.
90696	Blattodea	Nocticolidae	Nocticola		-22.89650	119.06190	12/10/2008		Stevens, N., Perina, G.
90698	Blattodea	Nocticolidae	Nocticola		-22.89670	119.04940	11/10/2008		Stevens, N., Perina, G.
90699	Blattodea	Nocticolidae	Nocticola		-22.90600	118.99740	14/10/2008		Bell, P., Muirhead, K.

REGNO	ORDER	FAMILY	Taxon	Site	Latitude	Longitude	Sample Start Date	Sample End Date	Collectors
90700	Blattodea	Nocticolidae	`sp. S1`		-22.82350	119.09500	20/02/2009	23/05/2009	Bell, P., Perina, G.
90701	Blattodea	Nocticolidae	`sp. S1`		-22.82210	119.09170	25/05/2009		Bell, P., Perina, G.
90702	Blattodea	Nocticolidae	`sp. S1`		-22.81960	119.11250	20/02/2009	23/05/2009	Bell, P., Perina, G.
90703	Blattodea	Nocticolidae	`sp. S1`		-22.83160	119.11900	22/02/2009		Bell, P., Muirhead, K.
90704	Blattodea	Nocticolidae	`sp. S1`		-22.82740	119.10780	21/02/2009	23/05/2009	Bell, P., Perina, G.
90705	Blattodea	Nocticolidae	`sp. S1`		-22.82030	119.09080	21/02/2009	23/05/2009	Bell, P., Perina, G.
90706	Blattodea	Nocticolidae	`sp. S1`		-22.82800	119.10990	25/05/2009		Bell, P., Perina, G.
90707	Blattodea	Nocticolidae	`sp. S1`		-22.82110	119.09180	21/02/2009	23/05/2009	Bell, P., Perina, G.
90708	Blattodea	Nocticolidae	`sp. S1`		-22.82740	119.10780	21/02/2009		Bell, P., Muirhead, K.
90709	Blattodea	Nocticolidae	`sp. S1`		-22.82300	119.09080	21/02/2009	23/05/2009	Bell, P., Perina, G.
90713	Thysanura	Nicoletiidae	Nicoletiidae `Trinemura sp. AR`		-23.26960	118.73270	27/06/2011		Coen, N., Perina, G.
90717	Blattodea	Nocticolidae	Nocticola		-23.25880	118.73900	27/06/2011		Coen, N., Perina, G.
90982	Diplura	Japygidae	Japygidae	Packsaddle West Juna Downs Rd	-22.93740	118.79130	31/07/2009		Bell, P., Krawkzyk, N.

Appendix D Pre-2018 Troglofauna Survey Results

Table D-1: Previous Troglofauna sample results from within and near to Development Envelope (GDA 94, Zone 50).

Project	Site	Easting (mE)	Northing (mN)	Group	Taxon	Source Data
Baby Hope Downs	RC07H1S390	715795	7454250		nil	Biota July 2015
Baby Hope Downs	RC07H1S395	715803	7454501		nil	Biota July 2015
Baby Hope Downs	RC07H1S439	716004	7454497		nil	Biota July 2015
Baby Hope Downs	RC07H1S554	716148	7454397		nil	Biota July 2015
Baby Hope Downs	RC07H1S559	716389	7454288		nil	Biota July 2015
Baby Hope Downs	RC10H1SW017	712569	7453347		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC10H1SW039	708665	7453041		nil	Biota July 2015
Baby Hope Downs	RC10H1SW043	709766	7452983		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC11H1SW0008	708064	7452787		nil	Biota July 2015
Baby Hope Downs	RC11H1SW0022	708959	7452990		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC11H1SW0030	710171	7452995		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0009	709572	7453165		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0014	709958	7453291		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0019	710157	7453240		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0074	710959	7453275		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0076	710357	7453040		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0080	710346	7453485		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0085	710553	7453846		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0091	710567	7453136		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0102	711167	7453366		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0120	711561	7452791		nil	Biota July 2015
Baby Hope Downs	RC12H1SW0124	713765	7453491		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0128	711345	7453585		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0132	711562	7453296		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0134	711762	7453286		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0137	712155	7453550		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0178	714167	7453293		nil	Biota Jan 2014 & April 2015

Project	Site	Easting (mE)	Northing (mN)	Group	Taxon	Source Data
Baby Hope Downs	RC12H1SW0203	714913	7450889		nil	Biota July 2015
Baby Hope Downs	RC13HD10011	710056	7452890		nil	Biota July 2015
Baby Hope Downs	RC13HD10066	710650	7453601		nil	Biota July 2015
Baby Hope Downs	RC13HD10106	710266	7453895		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC13HD10124	710476	7453533		nil	Biota Jan 2014 & April 2015
Baby Hope Downs	RC13HD10151	711061	7453239		nil	Biota July 2015
Baby Hope Downs	RC13HD10169	711959	7453145		nil	Biota July 2015
Baby Hope Downs	RC13HD10230*	713957	7453242		nil	Biota July 2015
Baby Hope Downs	RC13HD10277	710459	7452485		nil	Biota July 2015
Baby Hope Downs	RC13HD10299	713708	7450791		nil	Biota July 2015
Baby Hope Downs	RC13HD10319	713162	7453392		nil	Biota July 2015
Baby Hope Downs	RC13HD10327	713309	7450792		nil	Biota July 2015
Baby Hope Downs	RC13HD10344	716713	7450589		nil	Biota July 2015
Baby Hope Downs	RC13HD10356	716313	7450290		nil	Biota July 2015
Baby Hope Downs	RC13HD10359	716101	7450071		nil	Biota July 2015
Baby Hope Downs	RC13HD10362	715520	7450320		nil	Biota July 2015
Baby Hope Downs	RC14HD10674	711313	7453588		nil	Biota July 2015
Baby Hope Downs	RC14HD10933	710214	7453243		nil	Biota July 2015
Baby Hope Downs	RC14HD10968	709107	7452938		nil	Biota July 2015
Baby Hope Downs	RD13HD10020	712571	7453141		nil	Biota July 2015
Hope Downs 1	1675	713856	7460426		nil	Biota Jan 2011
Hope Downs 1	1677	713860	7460527		nil	Biota Jan 2011
Hope Downs 1	1766	717665	7460643		nil	Biota Jan 2011
Hope Downs 1	1950	716455	7454677		nil	Biota Jan 2011
Hope Downs 1	5514	719587	7461211		nil	Biota Jan 2011
Hope Downs 1	5522	721214	7459257		nil	Biota Jan 2011
Hope Downs 1	RC06D065	715278	7460224		nil	Biota Jan 2011
Hope Downs 1	RC07H1S013	717152	7454402		nil	Biota Jan 2011
Hope Downs 1	RC07H1S046	716754	7454571		nil	Biota Jan 2011
Hope Downs 1	RC07H1S083	716600	7454527		nil	Biota Jan 2011

Project	Site	Easting (mE)	Northing (mN)	Group	Taxon	Source Data
Hope Downs 1	RC07H1S1118	714060	7456102		nil	Biota Jan 2011
Hope Downs 1	RC07H1S1132	713074	7456906		nil	Biota Jan 2011
Hope Downs 1	RC07H1S1180	713064	7456510		nil	Biota Jan 2011
Hope Downs 1	RC07H1S158	717018	7455008		nil	Biota Jan 2011
Hope Downs 1	RC07H1S190	717219	7454948		nil	Biota Jan 2011
Baby Hope Downs	RC07H1S422	716241	7454589	Blattodea	Blattodea	Biota July 2015
Baby Hope Downs	RC07H1S613	715485	7454223	Blattodea	Blattodea	Biota July 2015
Baby Hope Downs	RC12H1SW0026	708360	7453289	Blattodea	Blattodea	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0082	710362	7453390	Blattodea	Blattodea	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0137	712155	7453550	Blattodea	Blattodea	Biota July 2015
Baby Hope Downs	RC13HD10331*	713310	7450392	Blattodea	Blattodea	Biota July 2015
Baby Hope Downs	RC13HD10336	713716	7450225	Blattodea	Blattodea	Biota July 2015
Baby Hope Downs	RC13HD10339	716312	7450593	Blattodea	Blattodea	Biota July 2015
Hope Downs 1	RC06HD429	717219	7460655	Blattodea	Nocticolidae	Biota Jan 2011
Hope Downs 1	RC07H1S028	716996	7454410	Blattodea	Nocticolidae	Biota Jan 2011
Hope Downs 1	RC07H1S1141	713088	7457062	Blattodea	Nocticolidae	Biota Jan 2011
Baby Hope Downs	RC07H1S356	715543	7454208	Diplura	Japygidae	Biota July 2015
Baby Hope Downs	RC07H1S613	715485	7454223	Diplura	Japygidae	Biota July 2015
Baby Hope Downs	RC13HD10055	710658	7452791	Diplura	Japygidae	Biota July 2015
Baby Hope Downs	RC14HD11114	714405	7450784	Diplura	Japygidae	Biota July 2015
Hope Downs 1	RC07H1S093	716590	7454039	Diplura	Japygidae	Biota Jan 2011
Baby Hope Downs	RC14HD10022	714759	7453338	Palpigradi	Palpigradi	Biota July 2015
Baby Hope Downs	RC07H1S422	716241	7454589	Polyxenida	Polyxenida	Biota July 2015
Baby Hope Downs	RC10H1SW013	713367	7453340	Polyxenida	Polyxenida	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0008	709162	7453102	Polyxenida	Polyxenida	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0042	708663	7453287	Polyxenida	Polyxenida	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0064	710761	7453339	Polyxenida	Polyxenida	Biota Jan 2014 & April 2015
Hope Downs 1	RC07H1S276	716904	7454612	Polyxenida	Polyxenida	Biota Jan 2011
Hope Downs 1	1218	720840	7459830	Polyxenida	Polyxenidae	Biota Jan 2011
Hope Downs 1	1678	714000	7460300	Polyxenida	Polyxenidae	Biota Jan 2011

Project	Site	Easting (mE)	Northing (mN)	Group	Taxon	Source Data
Hope Downs 1	RC06HD781	716811	7460677	Polyxenida	Polyxenidae	Biota Jan 2011
Hope Downs 1	RC07H1S005	717353	7454608	Polyxenida	Polyxenidae	Biota Jan 2011
Baby Hope Downs	RC13HD10336	713716	7450225	Pseudoscorpiones	Lagynochthonius PSE96	Biota July 2015
Baby Hope Downs	GD13HD10016	716087	7454116	Schizomida	Draculoides BHD3/WAM SCH068	Biota July 2015
Baby Hope Downs	RC07H1S198	715491	7454213	Schizomida	Draculoides BHD3/WAM SCH068	Biota July 2015
Baby Hope Downs	RC07H1S374	715699	7454403	Schizomida	Draculoides BHD3/WAM SCH068	Biota July 2015
Baby Hope Downs	RC12H1SW0005	709160	7452800	Schizomida	Draculoides BHD4/WAM SCH068	Biota July 2015
Baby Hope Downs	RC13HD10298	713708	7450585	Schizomida	Draculoides BHD4/WAM SCH068	Biota July 2015
Baby Hope Downs	RC14HD10195	713413	7453337	Schizomida	Draculoides BHD4/WAM SCH068	Biota July 2015
Baby Hope Downs	RC13HD10342	716510	7450691	Schizomida	Draculoides BHD5/WAM SCH068	Biota July 2015
Hope Downs 1	RC07H1S1048	714252	7456010	Schizomida	Draculoides BHD1/WAM SCH068	Biota Jan 2011 & Biota July 2015
Baby Hope Downs	RC12H1SW0051	709962	7452939	Schizomida	Draculoides BHD2/WAM SCH068	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0144	712958	7453339	Schizomida	Draculoides BHD2/WAM SCH068	Biota Jan 2014 & April 2015
Baby Hope Downs	RC12H1SW0026	708360	7453289	Schizomida	Draculoides CI1/WAM SCH067	Biota Jan 2014 & April 2015
Hope Downs 1	1218	720840	7459830	Schizomida	Draculoides CI1/WAM SCH067	Biota Jan 2011 & Biota July 2015
Hope Downs 1	5515	719573	7461623	Schizomida	Draculoides CI1/WAM SCH067	Biota Jan 2011 & Biota July 2015

Appendix E 2018 and 2019 Troglofauna Survey Results

Table E-1: 2018 and 2019 troglofauna survey results arranged by taxon. Deposits: BH = Baby Hope; BHT = Bedded Hilltop; HD2 = Hope Downs 2.

Class	Group	Family	Taxon	Abun-dance	Sequence	Deposit	Site	Eastings	Northings	Sample Start Date	Sample End Date	Collection method
Arachnida	Palpigradi	Eukoeneniidae	*Eukoenenia* `sp. Biologic-PALP001`	1	Failed	BHT	RC16BHT0141	715811.78	7449993.92	01/04/2019		Net Scrape
Arachnida	Palpigradi	Eukoeneniidae	*Eukoenenia* `sp. Biologic-PALP001`	1	BMR00707	HD2	RC18HD20120	704944.92	7446738.68	04/04/2019		Net Scrape
Arachnida	Pseudoscorpiones	Chthoniidae	*Tyrannochthonius* `sp. Biologic-PSE001`	1	BMR00779	BHT	RC18BHT0248	712614.52	7450558.77	04/11/2018		Net Scrape
Arachnida	Schizomida	Hubbardiidae	Draculoides `SCH068`	1	BMR00708	BHT	RC18BHT0026	716507.51	7450694.96	01/04/2019	29/05/2019	Litter Trap
Arachnida	Schizomida	Hubbardiidae	Draculoides `SCH068`	2	BMR00777	BHT	DD17BHT0020	719110.49	7450383.67	04/04/2019	30/05/2019	Litter Trap
Arachnida	Schizomida	Hubbardiidae	Draculoides `SCH068`	2	BMR00775, BMR00776	BHT	RC16HD10193	712308.24	7450892.62	01/04/2019	29/05/2019	Litter Trap
Arachnida	Schizomida	Hubbardiidae	Draculoides `SCH068`	3	BMR00528, BMR00588	BHT	RC15HD10267	719209.77	7450684.91	03/04/2019	29/05/2019	Litter Trap
Diplopoda	Polyxenida	Lophoproctidae	Lophoproctidae `sp. Biologic-POLX001`	1	BMR00492	BHT	RC18BHT0258	717981.93	7451991.48	31/03/2019	29/05/2019	Litter Trap
Diplopoda	Polyxenida	Lophoproctidae	Lophoproctidae `sp. Biologic-POLX001`	1		HD2	RC18HD20266	705167.45	7445881.79	02/11/2018	16/01/2019	Litter Trap
Entognatha	Diplura	Japygidae	Indjapx `sp. Biologic-DIPL001`	1	BMR00490	HD2	RC17HD20234	698153.45	7445828.09	06/04/2019		Net Scrape
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT001`	1	BMR00431	HD2	RC18HD20171	706799.23	7446351.34	02/11/2018		Net Scrape
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT002`	4	BMR00497	BHT	RC15BHT0267	712308.24	7450892.62	03/04/2019	29/05/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT002`	2		BHT	RC18BHT0003	718655.62	7451040.19	27/10/2018	16/01/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT002`	1	BMR00434	BHT	RC18BHT0016	717795.63	7450034.46	01/04/2019	30/05/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT002`	1	BMR00430	BHT	RC18BHT0099	716408.67	7450036.81	01/11/2018	16/01/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT002`	1		BHT	RC18BHT0197	714406.16	7449994.68	03/04/2019	29/05/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT002`	2	BMR00426	BHT	RC18BHT0224	713106.69	7450602.75	03/04/2019		Net Scrape

Class	Group	Family	Taxon	Abun-dance	Sequence	Deposit	Site	Eastings	Northings	Sample Start Date	Sample End Date	Collection method
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT002`	1	BMR00435	BHT	RC18BHT0248	712614.52	7450558.77	04/11/2018	16/01/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT002`	3	BMR00432	BHT	RC18BHT0308	710112.85	7450789.25	04/11/2018	16/01/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT002`	1	BMR00373	BHT	RC18BHT0334	711209.49	7450589.41	04/11/2018	16/01/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT003`	1	BMR00376	BHT	DD17BHT0020	716507.51	7450694.96	04/04/2019	30/05/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT003`	2	BMR00437	HD2	DD18HD20001	703535.89	7445768.32	05/04/2019	30/05/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT003`	1	BMR00428	HD2	GD18HD20009	697798.98	7444823.81	31/10/2018	16/01/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT003`	3		HD2	GD18HD20009	697798.98	7444823.81	06/04/2019	30/05/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT003`	1		BHT	RC16BHT0293	718611.08	7450186.88	27/10/2018	16/01/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT003`	4	BMR00425	HD2	RC16HD20174	697907.65	7444380.14	31/10/2018	15/01/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT003`	14		HD2	RC16HD20174	697907.65	7444380.14	06/04/2019	30/05/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT003`	2	BMR00427	HD2	RC17HD20011	699588.96	7444860.34	06/04/2019	30/05/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT003`	4	BMR00426	BHT	RC18BHT0224	713106.69	7450602.75	03/04/2019	29/05/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT003`	1		BHT	RC18BHT0251	717007.23	7452000.81	26/10/2018	16/01/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT003`	1		BHT	RC18BHT0253	718960.55	7452340.25	31/03/2019	30/05/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT003`	10	BMR00374	BHT	RC18BHT0254	718947.95	7452054.80	26/10/2018	16/01/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT003`	1		BHT	RC18BHT0255	718961.58	7451459.44	26/10/2018		Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT003`	1		BHT	RC18BHT0321	710310.13	7450889.44	03/04/2019	29/05/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT003`	1	BMR00373	BHT	RC18BHT0334	711209.49	7450589.41	03/04/2019	29/05/2019	Litter Trap

Class	Group	Family	Taxon	Abun-dance	Sequence	Deposit	Site	Eastings	Northings	Sample Start Date	Sample End Date	Collection method
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT003`	2		BHT	RC18BHT0337	711134.17	7451117.50	03/04/2019	29/05/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT004`	1	BMR00485	BHT	RC16BHT0291	718617.14	7450388.99	01/04/2019	29/05/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT004`	1	BMR00424	BHT	RC18BHT0001	718816.70	7450798.35	27/10/2018	16/01/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT004`	1	BMR00377	BHT	RC18BHT0016	717795.63	7450034.46	27/10/2018	16/01/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT004`	1	BMR00434	BHT	RC18BHT0016	717795.63	7450034.46	27/10/2018		Net Scrape
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT004`	1	BMR00433	BHT	RC18BHT0026	719209.77	7450684.91	27/10/2018	16/01/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT004`	1	BMR00430	BHT	RC18BHT0099	716408.67	7450036.81	27/10/2018	16/01/2019	Litter Trap
Insecta	Blattodea	Nocticolidae	Nocticola `SP. BIOLOGIC-BLAT004`	1	BMR00429	BHT	RC18BHT0258	717981.93	7451991.48	31/03/2019	29/05/2019	Litter Trap
Insecta	Hemiptera	Meenoplidae	Nisia `SP. BIOLOGIC-HEMI001`	1	Failed	BHT	DD17BHT0020	716507.51	7450694.96	04/04/2019	30/05/2019	Litter Trap
Insecta	Hemiptera	Meenoplidae	Nisia `SP. BIOLOGIC-HEMI001`	1	BMR00487	BHT	RC16BHT0222	716507.51	7450694.96	01/04/2019		Net Scrape
Insecta	Hemiptera	Meenoplidae	Nisia `SP. BIOLOGIC-HEMI001`	3	BMR00436	BHT	RC15BHT0267	712308.25	7450892.62	03/04/2019		Net Scrape
Insecta	Hemiptera	Meenoplidae	Nisia `SP. BIOLOGIC-HEMI001`	5		BHT	RC16BHT0222	717806.82	7450396.58	27/10/2018		Net Scrape
Insecta	Hemiptera	Meenoplidae	Phaconeura `SP. BIOLOGIC-HEMI002`	1	BMR00486	BHT	RC16HD10193	717806.82	7450396.58	01/04/2019		Net Scrape
Insecta	Hemiptera	Meenoplidae	Phaconeura `SP. BIOLOGIC-HEMI002`	1	Failed	BHT	RC18BHT0030	719110.49	7450383.67	27/10/2018		Net Scrape
Insecta	Zygentoma	Nicoletiidae	Dodecastyla `sp. Biologic-ZYGE001`	2	BMR00555	BHT	RC15BHT0267	719003.68	7450499.77	03/04/2019		Net Scrape
Insecta	Zygentoma	Nicoletiidae	Trinemura `sp. OES11`	1		HD2	RC18HD20071	714058.08	7453139.28	31/10/2018		Net Scrape
Pauropoda	Pauropoda		Pauropoda sp. indet.	1		BHT	RC18BHT0030	703535.89	7445768.32	27/10/2018		Net Scrape
Pauropoda	Pauropoda		Pauropoda sp. indet.	1	Failed	BHT	RC18BHT0100	719003.68	7450499.77	01/04/2019		Net Scrape
Pauropoda	Pauropoda		Pauropoda sp. indet.	1		BHT	RC18BHT0248	716406.45	7450131.12	04/11/2018		Net Scrape
Pauropoda	Pauropoda		Pauropoda sp. indet.	1		HD2	DD18HD20001	712614.52	7450558.77	05/04/2019		Net Scrape

Class	Group	Family	Taxon	Abun-dance	Sequence	Deposit	Site	Eastings	Northings	Sample Start Date	Sample End Date	Collection method
Chilopoda	Scolopendro-morpha		Scolopendromorpha `sp. Biologic-CHIL001`	1	BMR00489	HD2	DD18HD20005	706347.95	7446082.22	04/04/2019	30/05/2019	Litter Trap

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D.2: Hope Downs 2 Proposal Level 2 Stygofauna Survey

FINAL REPORT

HOPE DOWNS 2
LEVEL 2 STYGOFAUNA SURVEY

PREPARED FOR **RIO TINTO**

28 March 2022



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REVISION SCHEDULE

Rev No.	Date	Description	Signature or Typed Name (documentation on file)			
			Prepared by	Checked by	Reviewed by	Approved by
v0.2	18/03/2020	Draft report for review	ET/CH	FT	FT/CON	FT
v1.0	18/4/2020	Final report	ET/CH	FT	FT/CON	FT
V 1.1	16/11/2020	Final report with updated figures	ET/CH	FT	FT/CON	FT
V1.2	28/03/2022	Revised report following peer review	CH	ET	FT	FT

Executive Summary

Rio Tinto is evaluating the potential development of additional iron ore deposits at Hope Downs 2 (HD2), approximately 80 km northwest of Newman, in the Pilbara region of Western Australia. The HD2 Proposal (the Proposal) comprises three above water table (AWT) deposits; Baby Hope (BH), Bedded Hilltop (BHT) and HD2, as well as supporting infrastructure. Stantec Australia Pty Ltd (Stantec), was commissioned to undertake a desktop review and Level 2 stygofauna survey (the Survey) for the Proposal. The main objective of the Survey was to define the stygofauna values within the Survey area, to enhance and contextualise the level of knowledge at a local scale.

Sample Effort and Survey Adequacy

A total of 88 stygofauna haul net samples were collected from 57 sites during the Survey; 52 in Phase 1 (October/November 2018, late dry season) and 36 in Phase 2 (March/April 2019, late wet season) (**Table** ES-1). The Survey area encompassed the BH, BHT and HD2 deposit areas together with regional reference sites from the Weeli Wolli calcrete and riparian zone. Sampling effort exceeded the minimum recommended regulatory requirement of 40 samples for the Survey area.

Table ES-1: Stygofauna sample effort during the Survey.

Deposit Area	Phase 1 Samples (n)	Phase 2 Samples (n)	Total Samples (n)	Total Sites (n)
BH	21	8	29	23
BHT	11	10	21	11
HD2	14	11	25	16
Regional	6	7	13	7
Total	52	36	88	57

Stygofauna Findings

A total of four stygofauna specimens were recorded during the two field phases of the Survey. All specimens were Paramelitidae amphipods collected from a single site in the BHT area, within the alluvial/colluvial detritals and calcrete along Pebble Mouse Creek. The four specimens were identified as *Pilbarus* 'sp. Biologic-AMPH001' using morphological and DNA sequencing techniques. Genetic analysis suggested that *Pilbarus* 'sp. Biologic-AMPH001' may represent a new operational taxonomic unit (OTU) or taxon, only known from the Survey area. However, this may be an artefact of limited sampling or available sequences for comparison.

The presence of prospective habitat (alluvial/colluvial detritals and calcrete), together with previous amphipod records from the area, suggest *Pilbarus* 'sp. Biologic-AMPH001' may have a broader distribution along the Pebble Mouse and Weeli Wolli drainage lines. No stygofauna were collected from the Banded Iron Formation (BIF)-hosted groundwaters sampled from the BH, BHT and HD2 deposit areas during the Survey.

Conclusion

The results of this Survey indicated that stygofauna diversity and abundance within the Survey area are likely to be low. During the Survey, BHT deposit area yielded one stygofauna taxon, a potentially new paramelitid amphipod *Pilbarus* 'sp. Biologic-AMPH001', associated with alluvial/colluvial detritals and calcrete along Pebble Mouse Creek. These results were consistent with previous collections from the the Survey area, limited an amphipod and a Bathynellacean from colluvial/alluvial detritals of Pebble Mouse Creek.

Although apparently restricted to the Survey area based on genetic sequencing, it is likely that *Pilbarus* 'sp. Biologic-AMPH001' is distributed more broadly in prospective habitat along the Pebble Mouse and Weeli Wolli drainage lines. BIF geology within the BHT, BH and HD2 deposits did not yield any stygofauna, suggesting these habitats are not conducive to stygofauna within the Survey area, Additionally, hydrogeological conceptualisation indicated that the BIF aquifers are compartmentalised and expected to have limited connectivity with the more prospective, shallow groundwaters of the drainage lines. Sample effort for the Survey area was sufficient to meet regulatory guidance, with the BHT deposit area characterised by higher stygofauna values in comparison to the remaining areas.

Glossary

alluvium – sediment deposited by a stream or river

aquatic – relating to water

aquifer – a body of permeable rock or sediment capable of storing groundwater

arid – a region characterised by a severe lack of available water, to the extent that the growth and development of biota is hindered or prevented

bedrock – consolidated rock attached to the earth's crust

biodiversity – the diversity of biota in a particular environment or region

calcrete – carbonate deposits that form in arid environments, as a result of groundwater evaporation

cave – a subsurface cavity of sufficient size that a human could enter

dissolved oxygen – a measure of the amount of gaseous oxygen dissolved in a solution; oxic = > 3 mg/L; dysoxic = 0.3 to 3.0 mg/L; suboxic = < 0.3 mg/L levels

distribution range – the overall geographic area that a species is known to occur in

divergence – degree of separation from a common ancestor

diversity – a combination of species richness and abundance

drawdown – the lowering of the adjacent water table or piezometric surface as a result of groundwater extraction

electrical conductivity – an estimate of the total dissolved salts in a solution, or salinity

endemic – having a distribution restricted to a particular geographic region

epigean – pertaining to the surface zone

fractured rock – a rock formation characterized by separation or discontinuity, usually as a result of geological stress (e.g. faulting)

geological ages (e.g. Cainozoic) – distinct time periods within the geological history of the earth

groundwater – water occurring below the ground surface

habitat – an ecological or environmental area that is inhabited by a particular animal or plant species

hypogean – pertaining to the subterranean zone

hyporheic zone – spatially fluctuating ecotone within the bed of a river or stream between surface and groundwater. Considered important component of groundwater ecosystems and involved in the 'interstitial highway', forming hyporheic corridor linking associated aquifers.

invertebrates – animals lacking vertebrae

karst – a region of limestone or other soluble rock, characterized by distinctive features such as caves, caverns, sinkholes, underground streams and springs

lineage – a group of organisms related by descent from a common ancestor

molecular – pertaining to the genetic characteristics of an organism or group

morphology – the specific form and structure of an organism or taxon

morphospecies – a general grouping of organisms that share similar morphological traits, but is not necessarily defined by a formal taxonomic rank

palaeoriver, palaeochannel, palaeodrainage – a remnant of a stream or river channel cut in older rock and filled by the sediments of younger overlying rock

relictual – having survived as a remnant

salinity – the concentration of all dissolved salts in a solution. The salinity level classification *sensu* Hammer (1986): freshwater = salinity less than 5 mS/cm (3 ppt); hyposaline = salinity ranging from 5–30 mS/cm (3–20 ppt); mesosaline = salinity ranging from 30–70 mS/cm (20–50 ppt); hypersaline = salinity equal to or greater than 70 mS/cm (50 ppt)

semi-arid – a climatic region that receives low annual rainfall (250 – 500 mm)

species – a formal taxonomic unit defining a group or population of organisms that share distinctive characters or traits, are reproductively viable and/or are otherwise identifiable as a related group

species richness – the number of species present in a particular habitat, ecosystem or region

standing water level (SWL) – the depth to groundwater from a particular reference point (e.g. in a monitoring bore)

stygal – pertaining to groundwater habitat or biota

stygobite – an obligate aquatic species of groundwater habitats

stygobiont – another term used to describe obligate inhabitants of groundwater systems

stygofauna – a general term for aquatic groundwater fauna

stygophile – an aquatic species that temporarily or permanently inhabits groundwater habitats

stygoxene – an aquatic species that has no fixed affinity with groundwater habitats, but may nonetheless occur in groundwater habitats

sympatry / sympatric – two or more species that are considered to exist in the same or overlapping geographic area and may regularly interact with, or encounter, each another (without interbreeding)

taxon (singular), taxa (plural) – an identifiable group of organisms, usually based on a known or inferred relationship or a shared set of distinctive characteristics

void – a pore space in the rock or stratum

Rio Tinto

Level 2 Stygofauna Survey

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1. Introduction

Rio Tinto is evaluating the potential development of additional iron ore deposits at Hope Downs 2 (HD2), approximately 80 km northwest of Newman, in the Pilbara region of Western Australia (**Figure 1-1**). The HD2 Proposal (the Proposal) comprises three above water table (AWT) deposits; Baby Hope (BH), Bedded Hilltop (BHT) and HD2, as well as supporting infrastructure. Ore is will be transported to the existing processing plant at Hope Downs 1 (HD1). Stantec was commissioned by Rio Tinto in 2018 to undertake a desktop review and Level 2 stygofauna survey (the Survey) for the Proposal.

1.1 Scope and Objectives

The main objective was to define the stygofauna values present within the Survey area by undertaking a desktop review and Level 2 comprehensive survey (dry and wet seasons) to enhance and contextualise the level of knowledge at a local scale.

To address the objective, the following were completed:

- desktop assessment including database searches, literature review, habitat evaluation and characterisation (local and regional scale), and assessment of the likelihood of the occurrence significant species and/or communities in the Survey area;
- two phases of field surveys for stygofauna within the Survey area; and
- reporting and mapping of the diversity and distribution of stygofauna species recorded from this and previous surveys in the Survey area and surrounds.

The objective and the survey methods were aligned with relevant regulatory guidelines, comprising:

- Environmental Protection Authority (2016a). Technical Guidance Sampling Methods for Subterranean Fauna Survey (equivalent to EPA 2007 Guidance Statement No. 54A Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia); and
- Environmental Protection Authority (2016b). Technical Guidance Subterranean Fauna Survey (equivalent to EPA 2013 EAG 12 Environmental Assessment Guideline for Consideration of subterranean fauna in environmental impact assessment in Western Australia).

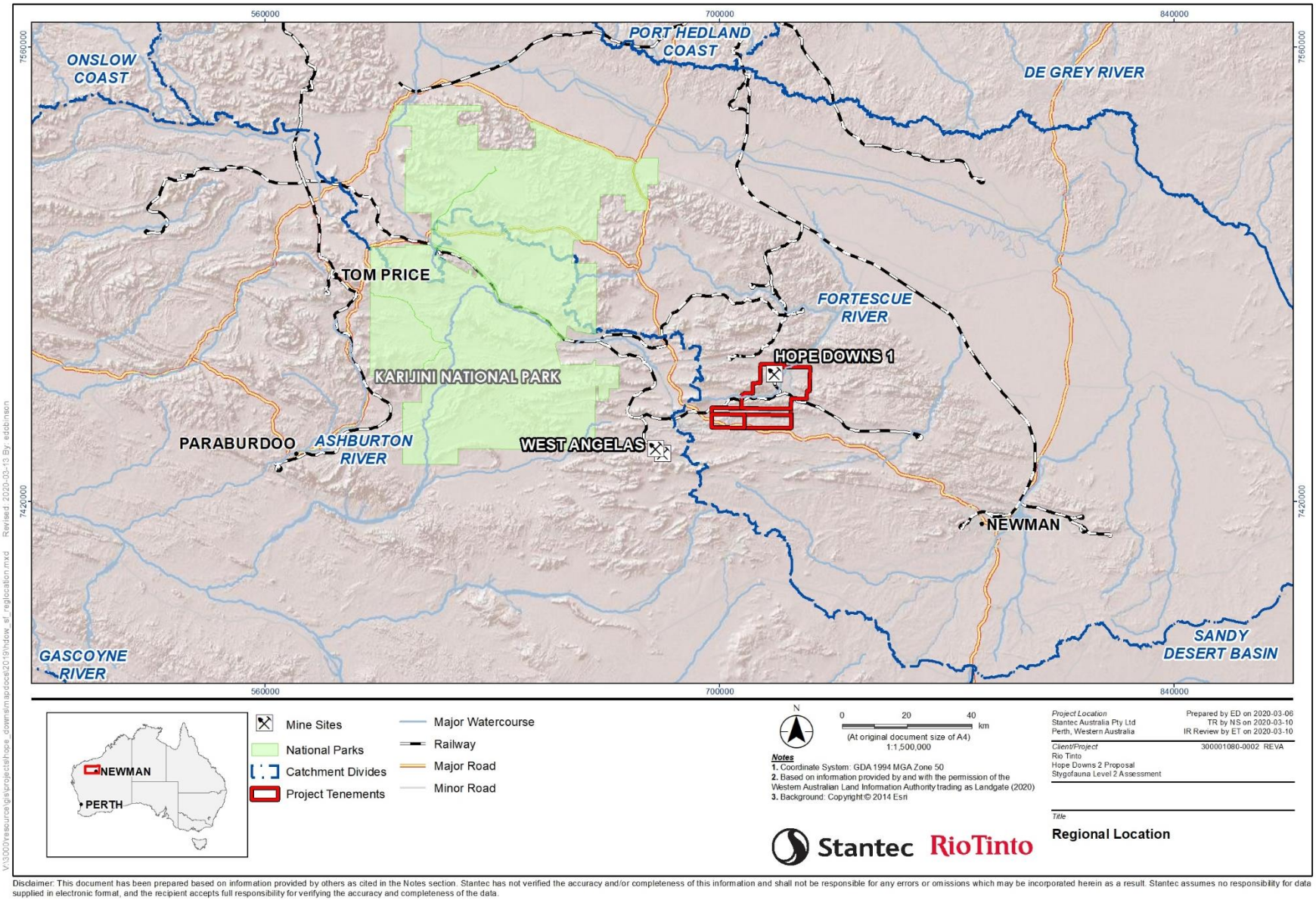

Figure 1-1: Regional location of the Survey.

2. Existing Environment

2.1 Biogeographical Context

The Survey area is located in the Hamersley subregion (PIL03) within the southern section of the Pilbara bioregion (**Figure 2-1**). The subregion is 5,634,727 ha in size and classified as a Desert and Xeric Shrubland ecoregion, characterised as a mountainous area of Proterozoic sedimentary ranges and plateaux that are extensively dissected by gorges (Kendrick 2001). The vegetation of the subregion mainly consists of low mulga woodland over grasses on fine textured soils in valley floors, with *Eucalyptus leucophloia* over *Triodia brizoides* on skeletal soils of the ranges (Department of the Environment and Energy 2019a; Kendrick 2001).

The subregion hosts the headwaters of three of the main drainage systems in the Pilbara; the northern portion drains into the Fortescue catchment; the southern portion drains into the Ashburton catchment; and the western portion drains into the Robe catchment (Kendrick 2001) (**Figure 1-1**). The subterranean fauna values of the subregion are known to be high, with alluvial and calcrete aquifer systems and banded iron formations (BIF) supporting diverse stygofauna and troglofauna assemblages (Halse *et al.* 2014; Kendrick 2001).

Land within the subregion is mainly used for native pasture grazing, with smaller areas classified as unallocated Crown land (UCL), Crown and Aboriginal reserves, as well as mining and small urban centres (Kendrick 2001). Adjacent to the Survey area, exploration activities and active mining are associated with the HD1 mine.

2.2 Regional Hydrology and Hydrogeology

The Survey area is located within the upper reaches of the Weeli Wolli Creek catchment, which forms part of the Fortescue River Basin. The Weeli Wolli catchment covers an area of approximately 4,770 km^2, underlain by formations of the Hamersley Group, encompassing dolomite, shale and ironstone, with minor felsic volcanics and intrusives, dolerite dykes and sills (Environmental Protection Authority 2018). The Survey area also intersects Pebble Mouse Creek, a major tributary of Weeli Wolli Creek with a sub-catchment area of 340 km^2 (Rio Tinto Iron Ore 2014). The BH and BHT deposits lie either side of the shallow and broad (2 km wide) Pebble Mouse Creek valley, where a relatively well-defined creek drains in a north-easterly direction into Weeli Wolli Creek (Rio Tinto Iron Ore 2014).

The karstic dolomite of the Wittenoom Formation (Paraburdoo member) form a regionally important aquifer (Environmental Protection Authority 2018; Johnson and Wright 2003). Groundwaters also occur in the West Angela Member (Wittenoom Formation) and within fractured Marra Mamba Iron Formation, where mineralisation or structural features increase permeability. Aquifers exist in association with alluvium, pisolite and calcrete, with the latter units forming significant groundwater systems (Johnson and Wright 2003). Regional groundwater flow is generally from south-west to north-east, following the surface water drainage.

2.3 Climate

The climate of the Hamersley subregion is classified as semi-desert tropical. The area receives an average of 300 mm rainfall, the majority of which occurs during the wet season, linked to cyclonic or tropical low weather events (Kendrick 2001). Winter rainfall (early to mid-dry season) also occurs but to a lesser extent. The nearest Bureau of Meteorology (BOM) weather stations to the Survey area with reliable long-term and recent climatic data, are Marillana (station number 5009) and Newman Aero (station number 7176). Marillana station, approximately 55 km northeast of the Survey area, provided long-term rainfall records. Newman Aero, approximately 85 km south-east of the Survey area, provided long-term temperature trends.

The mean long-term annual rainfall recorded at Marillana is 328 mm with the majority falling between January to March (**Figure 2-2**) (Bureau of Meteorology 2019). The annual rainfall in 2018 was below average, totalling 281 mm. February and June were exceptions, the latter receiving more than four times the monthly rainfall average. The annual rainfall total in 2019 was also well-below average, with only 150 mm received. The minimum and maximum temperatures recorded in 2018 and 2019 were largely consistent with the mean temperatures recorded since 1997 at Newman Aero, although the maximum and minimum temperatures were comparatively higher between March to early May (Bureau of Meteorology 2019).

Phase 1 of the Survey was undertaken in the late dry season between 26 October and 03 November 2018 (**Figure 2-3**). Phase 2 of the Survey was completed in the late wet season between 29 March and 04 April 2019 (**Figure 2-3**). In 2019, total rainfall recorded at Marillana preceding Phase 2 was approximately 120 mm, amounting to 80% of total rainfall received in 2019 (**Figure 2-3**).

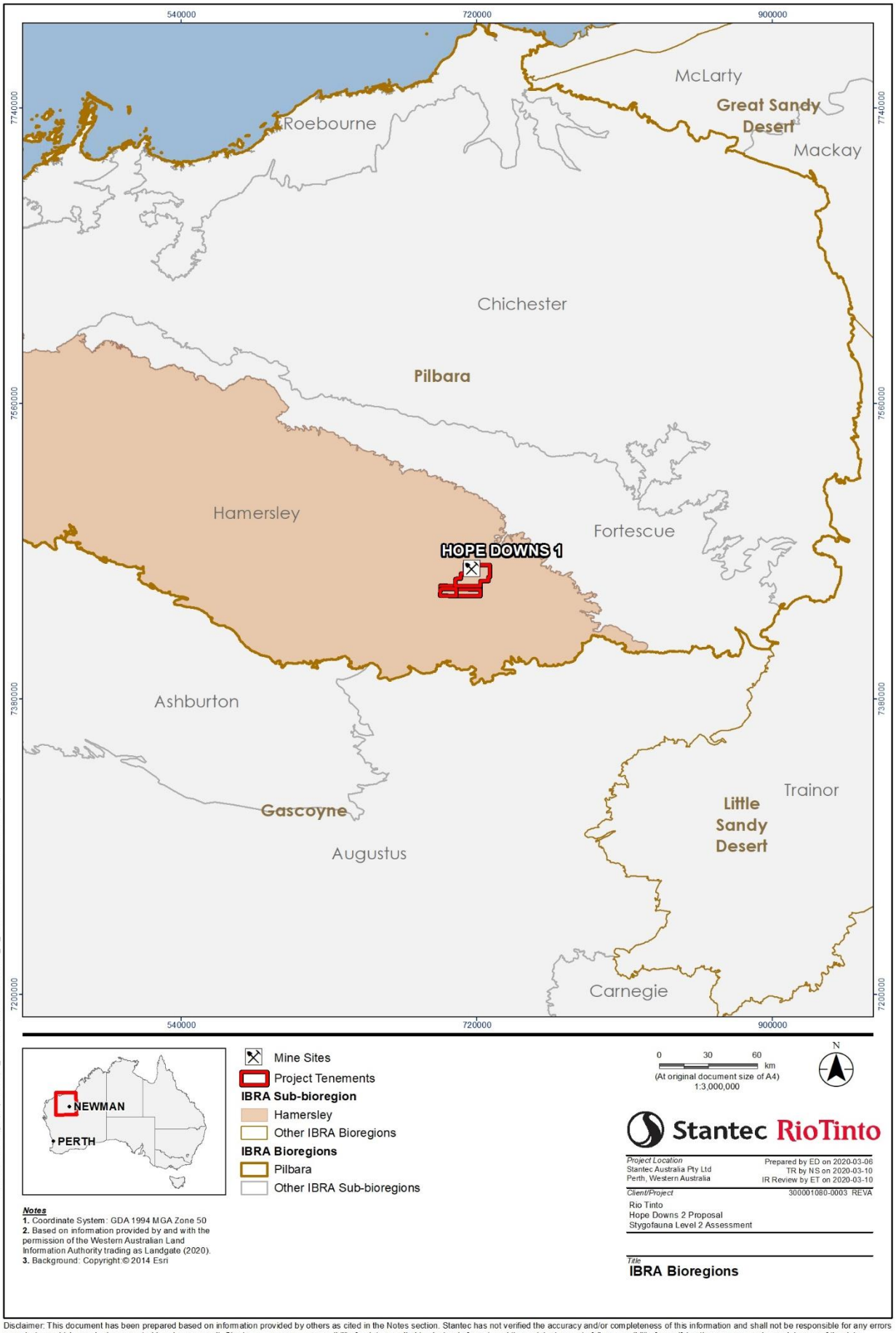

Figure 2-1: Location of the Survey area within the IBRA Hamersley bioregion.

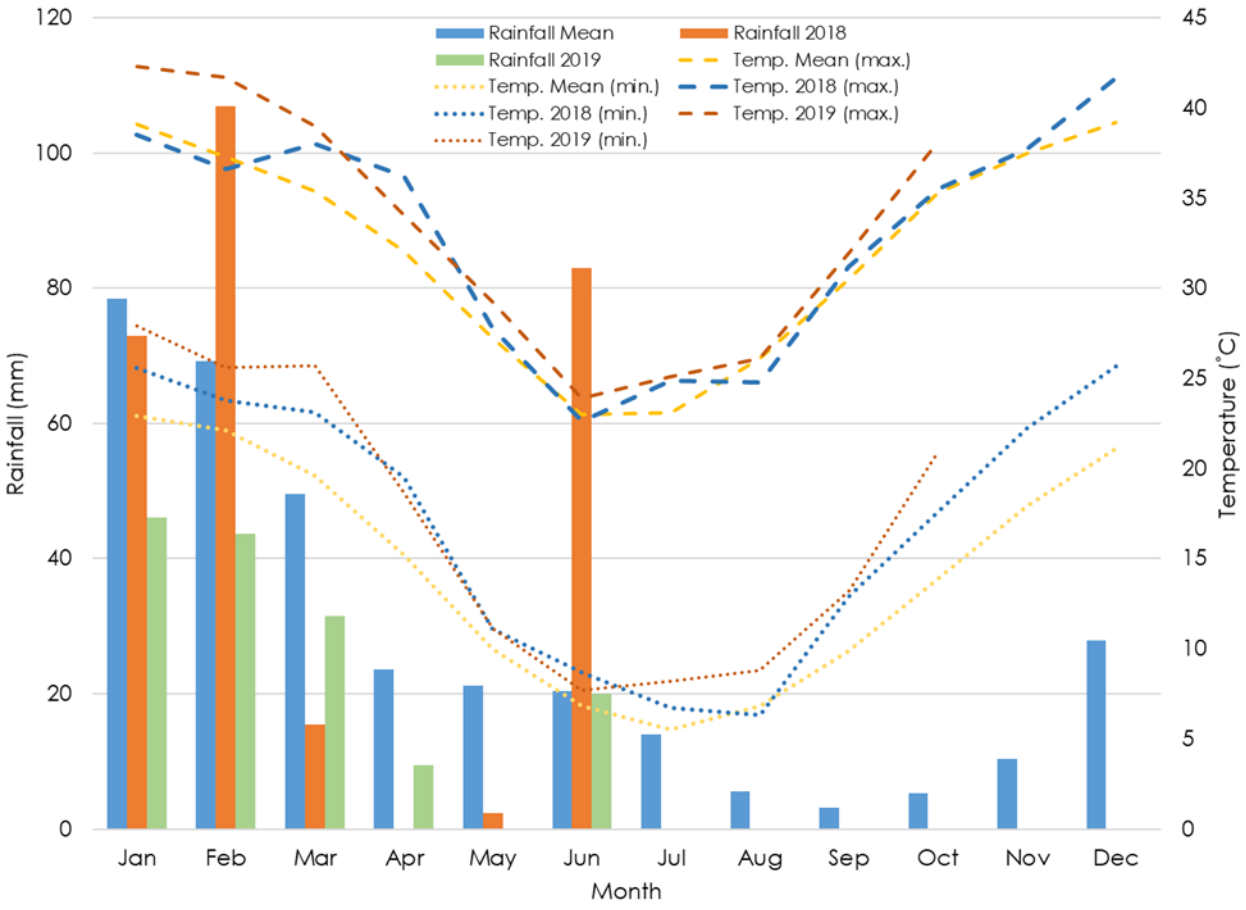

Figure 2-2: Long-term average monthly rainfall for Marillana Weather Station (5009; 1937 to 2019), and long-term average monthly minimum and maximum temperatures for Newman Weather Station (007176; 1972 to 2019) compared to 2018 and 2019 data (Bureau of Meteorology 2019).

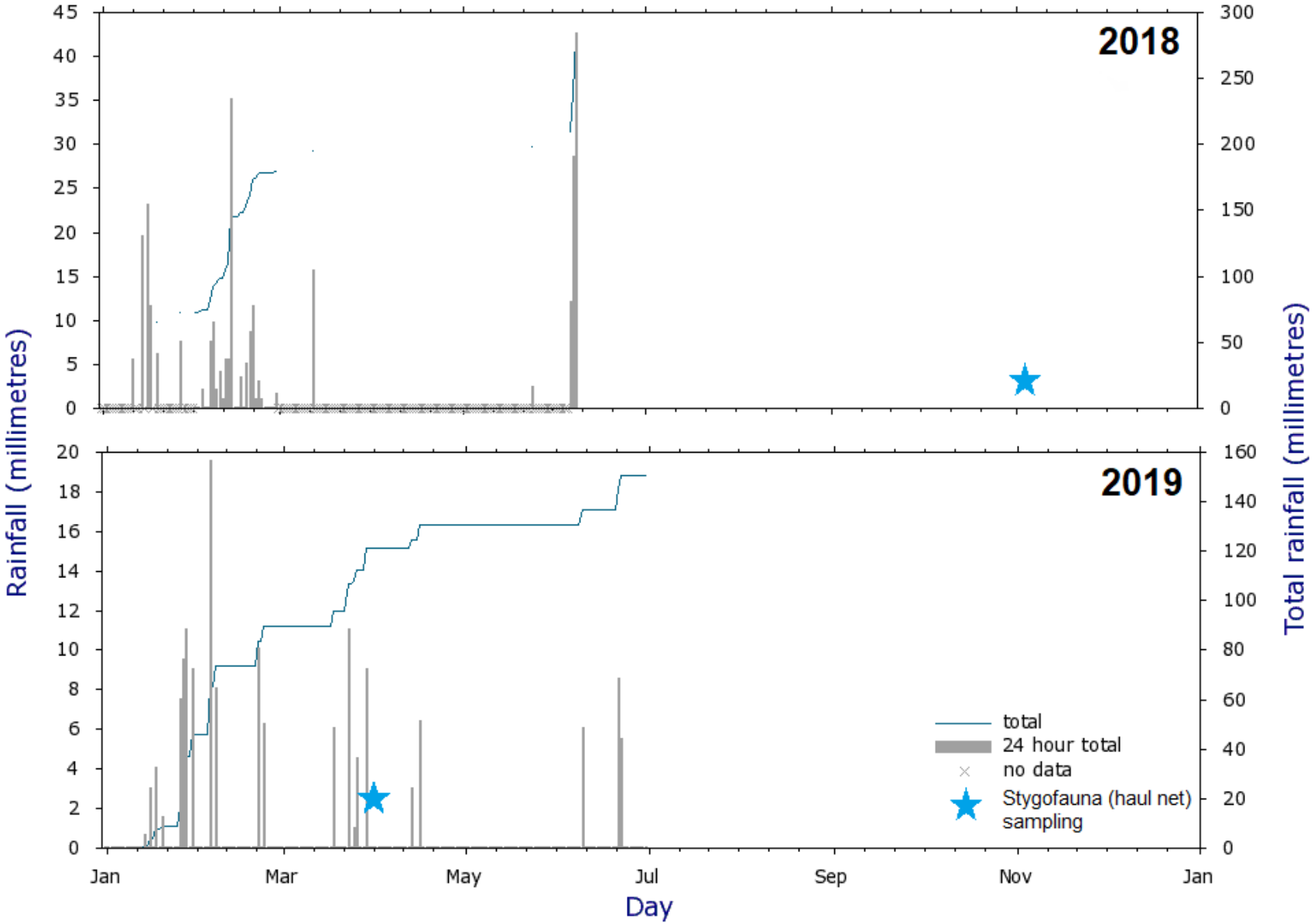

Figure 2-3: Daily rainfall data recorded for Marillana (Station:5009) in 2018 and 2019 (Bureau of Meteorology 2019).

3. Subterranean Fauna

Subterranean fauna inhabit underground environments and are often relictual forms of surface dwelling (epigean) groups. They can be divided into stygofauna and troglofauna: the former are aquatic, occupying groundwater systems, with the latter persisting in air-filled voids. Both groups often display evolutionary adaptations according to their subterranean existence, including reduced pigmentation, poorly functioning or non-existent eyes, and the presence of extended locomotory and sensory appendages. Subterranean fauna comprise invertebrate and vertebrates, with the former prevalent in Western Australia (Culver and Pipan 2009; Environmental Protection Authority 2016b). Both stygofauna and troglofauna include short-range endemic (SRE) species that have geographically restricted ranges of less than 10,000 km^2 and are considered vulnerable to extinction (Harvey *et al.* 2011; Harvey 2002).

3.1 Stygofauna

Stygofauna predominantly comprise crustaceans (such as ostracods, copepods, amphipods and syncarids), while other invertebrate stygofauna groups can include gastropods (snails), insects, water mites and worms. In Western Australia, studies have shown that calcrete and alluvial aquifers associated with palaeodrainage channels of the arid and semi-arid zones can contain rich stygofauna communities. Specifically the Pilbara region stands out as a global hotspot for stygofauna diversity (Humphreys 2008). Stygofauna can be classified according to their level of dependency on the subterranean environment:

stygoxenes are animals that enter groundwaters passively or accidentally;

stygophiles inhabit groundwaters on a permanent or temporary basis; and

stygobites are obligate groundwater dwellers.

3.2 Habitat

Prospective habitat for stygofauna is dependent on the presence of sub-surface crevices, fractures and voids of suitable size and connectivity to satisfy biological requirements. Adequate interconnected spaces and associated high permeability allows for movement of stygofauna. These spaces can also provide pathways for the infiltration of resources such as dissolved oxygen and nutrients, key factors influencing subterranean fauna (Humphreys 2008; Strayer 1994). Geologies with suitable secondary porosity can include karst, calcrete, coarse alluvium, fractured rock, pisolites and thin rocky regoliths (Halse *et al.* 2002; Humphreys 2006;2008; MWH 2016b;c; Outback Ecology 2014).

3.3 Relevant Legislation and Risk

Subterranean fauna are protected under State and Federal legislation, governed by three Acts comprising:

- *Biodiversity Conservation Act 2016* (WA) (BC Act);
- *Environmental Protection Act 1986* (WA) (EP Act); and
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act).

The development and operation of mines in Western Australia poses several key risks to subterranean fauna and their habitat, including:

- direct removal of, or disturbance to, habitats through mining excavation;
- lowering the water table through groundwater abstraction for pit dewatering and supply; and
- altering water quality parameters, to levels which may exceed species tolerance limits.

Mining proposals that will potentially impact on groundwater, or hypogean habitats that support subterranean fauna, require environmental impact assessment (EIA) to ensure mining operations do not threaten the viability of significant species or communities. Proponents must demonstrate that any species existing within potential mine-related impact zones also occur outside of this area. For taxa restricted to impact zones, a suitable management plan must be developed, which includes ongoing monitoring of subterranean fauna to ensure the persistence of the species.

3.4 Regulatory Survey Adequacy Guidelines

The EPA (2016a,b) stipulates that the appropriate level of survey effort depends on the likely presence of subterranean fauna, the degree of impact proposed, and adequacy to reliably inform decisions as part of the EIA process in relation to the EPA's objective. The EPA objective for the environmental factor of subterranean fauna is to protect subterranean fauna so that biological diversity and ecological integrity are maintained (Environmental Protection Authority 2016c).

The EPA (2016a) recommends that for a Level 2 (baseline) stygofauna survey in an area that is prospective for stygofauna, a minimum of 40 net haul samples should be collected over at least two survey seasons from within proposed impact areas. The minimum survey effort relates to proposed impacts across interconnected habitat.

4. Methods

4.1 Desktop Review

4.1.1 Database Search and Lists

Searches of both Commonwealth and State databases were undertaken as part of the desktop review for the Survey. These focused on identifying threatened or priority ecological communities (TEC's and PEC's) and stygofauna taxa recorded from within or near the Survey area. Search areas were either from a central point in the Survey area or a designated rectangular search area (**Table 4-1**, **Figure 4-1**). Database and internet information sources included:

- Department of Biodiversity, Conservation and Attractions (DBCA) TEC/PEC database was searched for TEC's and PEC's occurring within a 50 km radius of the Survey area (Department of Biodiversity Conservation and Attractions 2019b);
- Western Australian Museum's (WAM) Arachnida, Myriapoda, Crustacea, Mollusca and Insecta collection databases were searched for subterranean fauna (Western Australian Museum 2018a;b;c;d);
- Atlas of Living Australia (ALA) (Atlas of Living Australia 2020); and
- NatureMap of Western Australia (Department of Biodiversity Conservation and Attractions 2020).

The following Federal and State government lists were also assessed against the database results, to identify any threatened or priority subterranean fauna that may occur within the search area:

- BC Act Specially Protected Species List (Department of Biodiversity Conservation and Attractions 2018);
- EPBC Act Threatened Ecological Communities (TEC) List (Department of the Environment and Energy 2019b); and
- EPBC Act Threatened Fauna List (Department of the Environment and Energy 2019c).

Table 4-1: Defined area and coordinates of database searches for the Survey.

Database	Search Area	GPS Coordinates
DBCA TEC/PEC	50 km radius	Central point @ 23.060597 S, 119.038855°E
NatureMap		
Literature Review		
WAM Collections	80 km square	NW corner @ 22.694628°S, 118.630309 E SE corner @ 23.422667 S, 119.422871 E
ALA		

4.1.2 Literature Review

A literature review was conducted to gather existing information on stygofauna from within the vicinity of the Survey area. The review included technical reports, scientific journal articles and government publications. The literature review focussed on drainage and palaeochannel systems associated with or adjacent to the Survey area, as well as BIF ridge systems within approximately 40 km of the Survey area.

4.1.3 Stygofauna Habitat Characterisation

A review of geological and hydrogeological information was undertaken to characterise potential stygofauna habitat and assess stygofauna prospectivity in the Survey area. Information reviewed included bore logs, hydrogeological cross section diagrams and mapping of interpreted aquifer extent provided by Rio Tinto and mapped geological units (surface and bedrock).

4.2 Stygofauna Survey

4.2.1 Field Personnel and Fauna Licences

The field survey methods and sampling effort aligned with EPA technical guidance (Environmental Protection Authority 2016a;b). A Regulation 17 licence to collect fauna for scientific purposes was obtained from the DBCA prior to the field surveys (Licence Number 08-003053-1). Personnel involved in the field sampling for both phases were Dr Nicholas Stevens (BSc Hons. (Zoology), PhD; 20+ years' experience) and Emma Dobinson (BSc Hons. (Marine Biology), MRes (Ecology, Evolution and Conservation); 5+ years' exp.

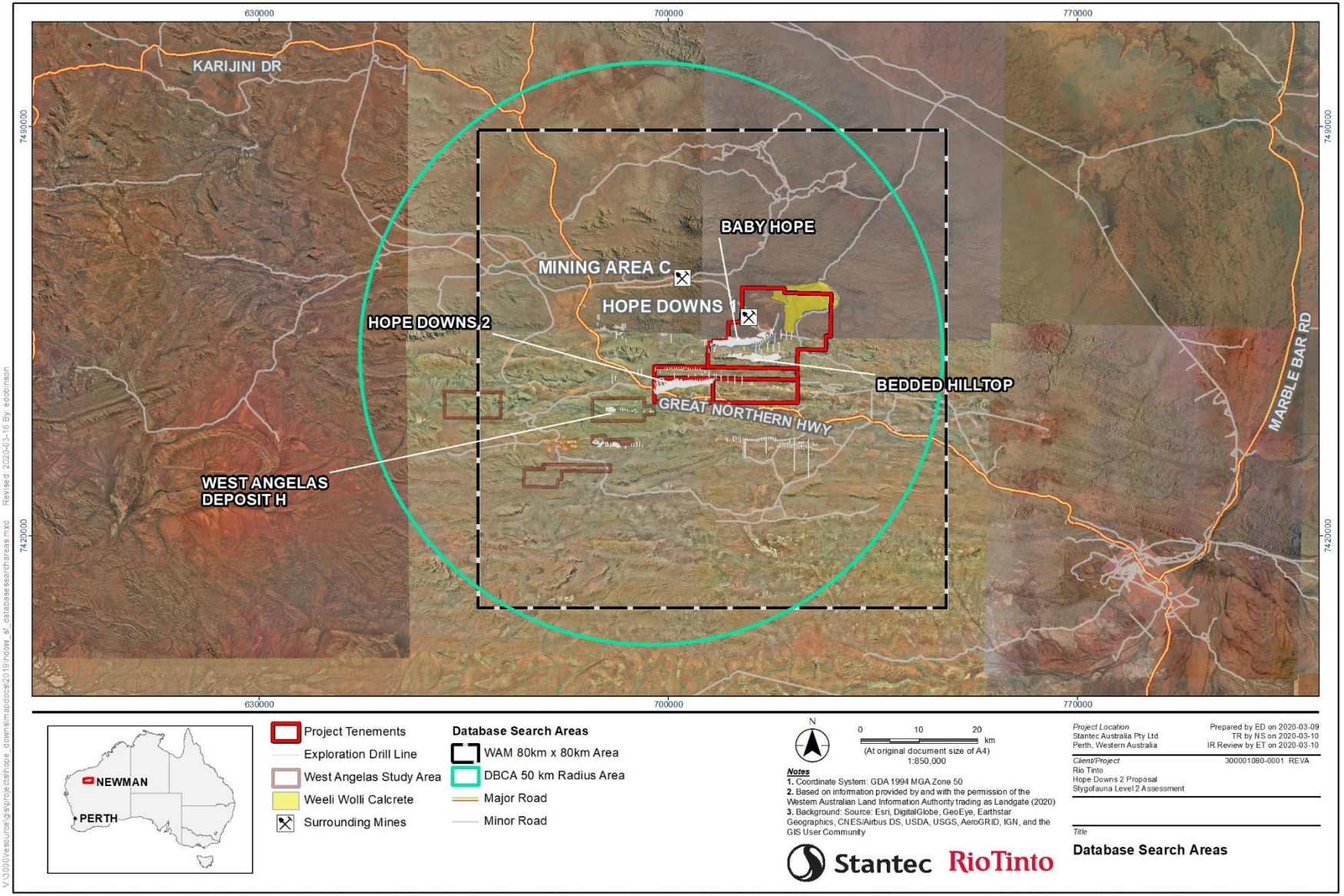

Figure 4-1: Database search areas for the Survey.

4.2.2 Survey Effort

The Survey comprised a total of 88 stygofauna net haul samples collected from 57 sites across two phases of field surveys: Phase 1 (October-November 2018, late-dry season) and Phase 2 (March-April 2019, late-wet season) (**Table 4-2, Figure 4-2, Appendix A).** This incorporated sites from within the BH, BHT and HD2 deposits area and regional reference sites in the Weeli Wolli Creek calcrete and riparian zone; referred to as the Survey area. Representative site images are presented in **Appendix A**.

The majority of samples (75) were collected from the deposit areas, with 13 samples collected from regional reference sites. The survey effort for the Survey area meets the minimum number of 40 impact samples for a Level 2 baseline stygofauna survey, as long as there is habitat connectivity (Environmental Protection Authority 2016a).

Table 4-2: Stygofauna sample effort for the Survey.

Deposit Area	Phase 1 Samples (n)	Phase 2 Samples (n)	Total Samples (n)	Total Sites (n)
BH	21	8	29	23
BHT	11	10	21	11
HD2	14	11	25	16
Regional Reference	6	7	13	7
Total	52	36	88	57

4.2.3 Net Haul Sampling

Stygofauna samples were collected from a combination of drill holes, monitoring bores and production bores (referred to as 'sites') using haul nets, which have been found to be the most efficient retrieval method (Allford *et al.* 2008). Sampling was consistent with the procedures outlined in the EPA (2016a) technical guidance. The sampling method was as follows:

- samples were collected using two weighted haul nets with mesh sizes of 150 µm and 50 µm (each net was fitted with a collection vial with a base mesh of 50 µm);
- the 150 µm net was lowered first, near the bottom of the site;
- once at the bottom, the net was gently raised up and down to agitate the sediments;
- the net was then raised slowly, to minimise the 'bow wave' effect that may result in the loss of specimens, filtering stygofauna from the water column on retrieval;
- once retrieved, the collection vial was removed, and the net contents emptied into a 2 L polyethylene sample container;
- this process was repeated three times alternating with three samples with the 50 µm net;
- the 2 L sample container comprising the contents of all six net hauls was elutriated through a decontaminated 50 µm net into a 250 mL polyethylene vial, with the contents preserved with 100% undenatured ethanol;
- to prevent cross-contamination, all sampling equipment was decontaminated after each site using a Decon 90 (2 to 5% concentration) after each site and then rinsed with water;
- samples were placed into eskies with ice bricks in the field, prior to being transferred into a refrigerated environment on-site at the end of each field survey day; and
- on completion of each field survey, samples were couriered to the Stantec laboratory in Perth, where they were stored in 100% ethanol, at approximately minus 20°C.

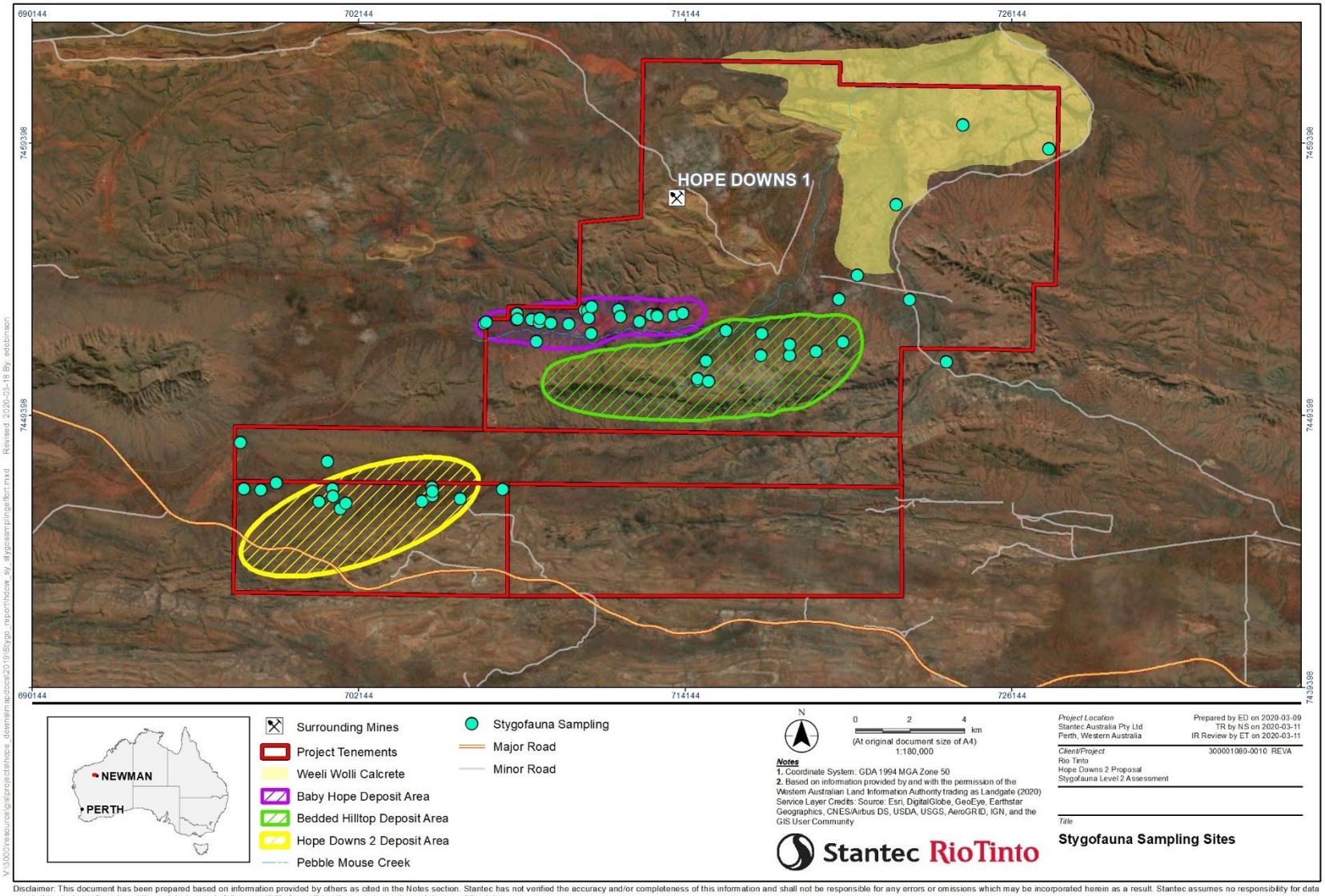

Figure 4-2: Stygofauna sampling effort for the Survey.

4.2.4 Sorting and Identification of Specimens

Preserved stygofauna samples collected from the two phases of the field surveys were sorted manually using Leica MZ6, MZ7.5, M80 and M205C stereomicroscopes within the Stantec laboratory by Emma Dobinson, Jake Daviot and Thomas de Silva (aquatic and subterranean fauna scientists). Once sorted, any potential subterranean fauna specimens found were preserved in 100% ethanol (preserving DNA for sequencing) and stored at minus 20°C. Higher taxonomic resolution was provided by Dr Nicholas Stevens of Stantec to identify stygofauna species, using published and unpublished keys and taxon descriptions. Undescribed taxa were assigned morphospecies names based on morphological features.

4.2.5 DNA Sequencing

Material from two stygofauna specimens was sent to Biologic Environmental for genetic analysis. The molecular analysis provided a comparison to identifications based on morphological characters, including juvenile specimens. Genetic analysis also allows for the alignment of morphospecies with any described and/or previously sequenced taxa.

4.2.6 Limitations

Fewer stygofauna samples were collected (88) than originally proposed (150) for the Survey, due to the lack of suitable and accessible sites. The number of sites in the vicinity of the proposed development that intercept the water table is limited. Many of the bores sampled in Phase 1 in the BH active mining area had been destroyed by pre-mining stripping of the eastern portion prior to the Phase 2 field survey. Many other sites sampled during Phase 1 were no longer accessible during Phase 2, due to the recent installation of fixed electronic monitoring equipment.

The availability of suitable reference sites from the non-resource area was limited, with few sites present beyond the BIF. The seemingly restricted distributions of subterranean fauna species to within a specific resource target habitat type can largely be an artefact of the disproportionate sampling effort conducted between likely impact areas and reference areas.

Every effort was made to accurately assess the taxonomy, distribution and conservation significance of collected stygofauna specimens using in-house data collections, publications, publicly available reports, and information provided by specialist taxonomists. However, assessment was limited by available information.

5. Results

5.1 Desktop Review

5.1.1 Database Searches

A search of the DBCA's threatened and ecological communities database identified two priority ecological groundwater communities within a 50 km radius of the Survey area; Weeli Wolli Spring Community North and Weeli Wolli Spring Community South (Department of Biodiversity Conservation and Attractions 2019b). The area, encompassing the Weeli Wolli Spring and sections of the Weeli Wolli Creek is known to support a high diversity of stygofauna, likely attributed to the large-scale calcrete and alluvial aquifer system associated with the watercourse (Department of Biodiversity Conservation and Attractions 2019a). Both PECs are classified as Priority 1, a ranking allocated to poorly known ecological communities of restricted distribution (Department of Environment and Conservation 2013). The 5 km buffer zone associated with the Weeli Wolli Spring Community South PEC overlaps with the eastern portion of the Survey area, including the BHT deposit (**Figure 5-1**, **Figure 5-2**).

An area of 6,400 km^2 around the Survey area was investigated during searches of the WAM Arachnida, Myriapoda, Crustacea, Mollusca and Insecta databases (**Figure 4-1**). A total of 367 stygal crustaceans, and eight stygal arachnids, were identified during these searches (**Figure 5-1**, **Figure 5-2**, **Appendix B**). Crustacea records comprised primarily Copepoda (98 records), Amphipoda (91 records) and Isopoda (81 records), with Ostracoda (49 records) and Syncarida (48 records) less-well represented (**Appendix B**). All eight Arachnida records belonged to the Acari (water mite) group (**Appendix B**). No records of stygal Insecta, Myriopoda or Mollusca were found (Western Australian Museum 2018a;c;d). Most records were from subterranean fauna environmental baseline studies for iron ore projects such as Greater West Angelas, Hope Downs 1, Yandicoogina, Mining Area C and South Flank. Records were typically highest within the alluvial/colluvial habitats, particularly in association with the Marillana and Weeli Wolli Creek systems (**Figure** 5-2).

A search of the DBCA's NatureMap database found 34 potential stygofauna taxa within a 40 km radius of the Survey area, with representatives from Copepoda (three taxa), Ostracoda (13 taxa), Oligochaeta (three taxa), Amphipoda (6 taxa), Syncarida (one taxa), Rotifera (one taxa) and Acari (seven taxa) (Department of Biodiversity Conservation and Attractions 2020). The majority of these were from the regional Pilbara stygofauna survey conducted by Halse *et al.* (2014). A search of the ALA database for the Survey area did not return any additional stygofauna records (Atlas of Living Australia 2020).

5.1.2 Literature Review

Previous sampling within or near the Survey area has been undertaken for two Projects; Rio Tinto Yandicoogina (Yandi) Operations and Rio Tinto Hope Downs Project (Biota 2006, Biota 2015). Additionally in 2011 Bennelongia conducted the Weeli Wolli Creek catchment stygofauna assessment on behalf of BHP (Bennelongia 2013). Sampling for Yandi in 2009 identified stygofauna from six bores in or adjacent to the Survey area. Over 20 stygofauna specimens were recorded from the following groups; Amphipoda, Copepoda, Bathynellacea, Isopoda and Ostracoda, with identification to class or order only (Biota 2015). Each site was located in the vicinity of the Pebble Mouse or Weeli Wolli Creeks within calcrete mapped surface geology (**Figure 5-3**). The mapped bedrock units included Wittenoom Formation, Mount McRae Shale and Mount Sylvia Formation (**Figure 5-4**).

The Weeli Wolli Creek Catchment assessment by Bennelongia (2013) comprised sampling of 64 sites across the Upper Weeli Wolli Creek catchment, Lower Weeli Wolli Creek catchment, and Rhodes Ridge area, with 111 samples collected. Of these, 60 samples were collected from the Upper Weeli Wolli Creek catchment area, adjacent to the BH and BHT deposits. In total, 459 stygofauna specimens recorded from the Weeli Wolli Creek catchment area, comprising 23 stygofauna taxa from six higher order groups (Nemtaoda, Ostracoda, Copepoda, Amphipoda, Isopoda and Oligochaeta). The catchment is described as primarily dominated by Hamersley Group rocks alongside areas of Tertiary detritals and calcrete in the palaeochannel creeklines. All bores sampled for during the assessment were situated upon palaeochannel aquifers and calcrete formations, which are well known as prospective stygofauna habitat. Coordinates for individual taxa records are not provided, and so it is uncertain whether any of the stygofauna taxa were recorded from within the BHT or BH deposit areas.

The assessment for Hope Downs, undertaken between 2002 and 2004 (Biota 2006), identified stygofauna from alluvium, colluvium (detritals), calcrete and Marra Mamba Iron Formation mapped surface geology (**Figure 5-3**). The mapped bedrock units comprised Wittenoom and Weeli Wolli Formations, Mount McRae Shale, Mount Sylvia Formation, Brockman Formation and Marra Mamba Iron Formation (**Figure 5-4**).

Over 600 stygofauna specimens were collected from 30 sites during the Hope Downs assessment (Biota 2006). Most of these specimens were recorded from saturated alluvium and calcrete associated with Weeli Wolli Creek. Sampling in the Survey area was limited to two sites (**Figure 5-3, Figure 5-4**). One of these sites, near Pebble Mouse Creek witin the BH deposit area, yielded a bathynellacean (family Parabathynellidae). Two specimens of the amphipod Paramelitidae sp. 2 were collected from the second site, located north of the BHT banded iron formation (BIF) ridge towards Pebble Mouse Creek. The mapped surface geologies for these specimen records were colluvium (bathynellacean) and Wittenoom Formation (Paramelitidae sp. 2) (**Table** 5-1**, Figure 5-3, Figure 5-4**).

Paramelitidae sp. 2 has been recorded during a number of surveys in the Pilbara region (Biota 2010a;b; Outback Ecology 2009). During the Hope Downs surveys, this taxon was documented along a distance of approximately 40 km, from the BHT area near Pebble Mouse Creek northwards past the confluence of Weeli Wolli and Marillana Creeks (**Table 5-1**, **Figure 5-3**, **Figure 5-4**) (Biota 2006). The isopod *Pygolabis* 'weeliwolli' also demonstrated the broader distribution of taxa within the Weeli Wolli catchment. Morphological identification in conjunction with genetic analysis indicated a distribution in excess of 20 km, along the drainage (**Figure** 5-3**, Figure 5-4**) (Biota 2006). The distribution of these taxa highlights the interconnectivity of habitat along the Weeli Wolli drainage system, supported by the mapped extent of alluvial/colluvial detritals, calcrete and underlying units (**Figure 5-3**, **Figure 5-4**).

The bathynellacean recorded from the BH deposit area was only identified to family level (Parabathynellidae), and so its broader distribution is uncertain. Several representatives from the family Parabathynellidae have been recorded across the Weeli Wolli Creek catchment (Biota 2015, Bennelongia 2013). Biota (2015) recorded 62 Parabathynellidae specimens from at least eight taxa from the lower Weeli Wolli Creek and Marillana Creek areas between 2011 and 2015. Of these, five were singletons having only been recorded from a single site. Despite the records of these singletons amongst the Parabathynellidae, Biota (2015) suggest that most taxa from the Weeli Wolli Creek catchment are unlikely to be restricted in distribution, given the relatively large distance that separate some specimens of the same species (>9 km), and the catchment-wide distribution of other constituents of the the stygal community (particularly larger crustaceans such as Paramelitidae sp. 2).

Similar trends have been found on a wider regional scale, with the results of various studies for iron ore projects indicating the greatest diversity and abundance of stygofauna occurs within detritals (alluvium, colluvium) and calcrete units along drainage lines (**Figure 5-2**) (Biota 2015; MWH 2014; Subterranean Ecology 2012). In contrast, sampling within the BIF units has tended to yield little or no stygofauna (Biota 2008; ecologia Environment 2013; MWH 2016a; Subterranean Ecology 2008a).

For example, two surveys by Subterranean Ecology (2008, 2009) assessed the Area C Packsaddle deposits for stygofauna, located immediately to the north-west of the Survey area. The first of these surveyed Deposit 1, 2 and 3 in 2008. A total of 37 sites were sampled across two phases, however, only a single species of enchytraeid oligochaete was collected from two bores, located within the Packsaddle 3 deposit. The survey effort at Packsaddle Deposits 4 to 6 in 2009 consisted of 45 sites and 96 samples, again yielding only enchytraeid oligochaetes from a single bore. The host rock geology of the region is BIF with little to no voids or pore spaces, with a low water table constituting unfavourable stygofauna habitat.

There are several exceptions, where diverse stygofauna communities have been recorded from both alluvial/calcrete aquifers and BIF hosted groundwaters. A survey of Callawa Ridge, as part of the Cundaline and Callawa mining assessment, found a moderately diverse stygofauna assemblage. However, this was attributed to a perched aquifer system with a reasonable degree of hydraulic connectivity to the De Grey River system aquifers (Subterranean Ecology 2008a). At Hope Downs 4, diverse and abundant communities were primarily recorded in superficial alluvial and calcrete deposits associated with Coondiner Creek (**Figure 5-2**). A speciose community also occurred at an orebody site that intersected heavily mineralised Dales Gorge Member; folded to the surface and with a relatively shallow depth to groundwater (Outback Ecology 2009).

While several deposits at West Angelas did not yield any stygofauna (Biota 2008; ecologia Environment 2013; Rio Tinto 2018), moderate stygofauna diversity was documented within and/or near Deposits C and D (Biologic 2016; Rio Tinto 2018). The primary habitats in the area were identified as mineralised Marra Mamba Iron Formation, Wittenoom Formation and overlying weathered regolith, alluvial/colluvial detritals, pisolite and calcrete. The superficial hydrogeological units along the drainage lines were also considered to provide connectivity of stygofauna habitat beyond the study area (Biologic 2016;2017; Rio Tinto 2018).

Table 5-1: Summary of previous stygofauna records from the Survey area and associated mapped geology

Taxon	Reference	Deposit Area	Wider Distribution	Mapped surface Geology	Mapped Bedrock Geology
Amphipoda Paramelitidae					
Paramelitidae sp. 2	Biota (2006)	BHT	Weeli Wolli & Marillana Creek catchments	Wittenoom Formation	Wittenoom Formation
Syncarida Parabathynellidae					
Parabathynellidae sp.	Biota (2006)	BH	Unknown	Alluvium	Wittenoom Formation

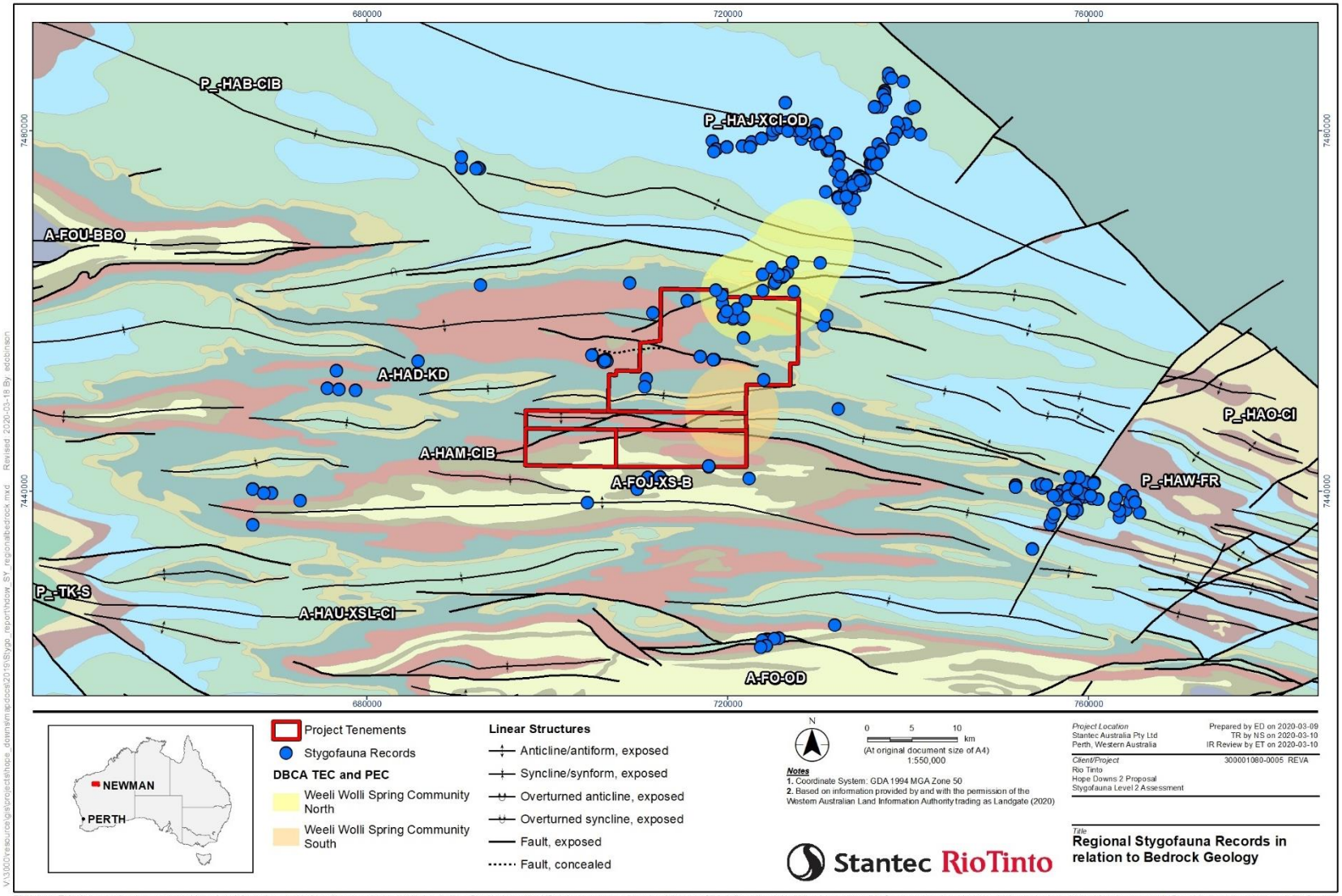

Figure 5-1: Stygofauna records for the region surrounding the Survey area based on database searches, previous surveys (Biota 2006, Biota 2015, Outback Ecology 2009) and client supplied data, in relation to bedrock geology (refer to **Appendix C** for descriptions of relevant geological codes).

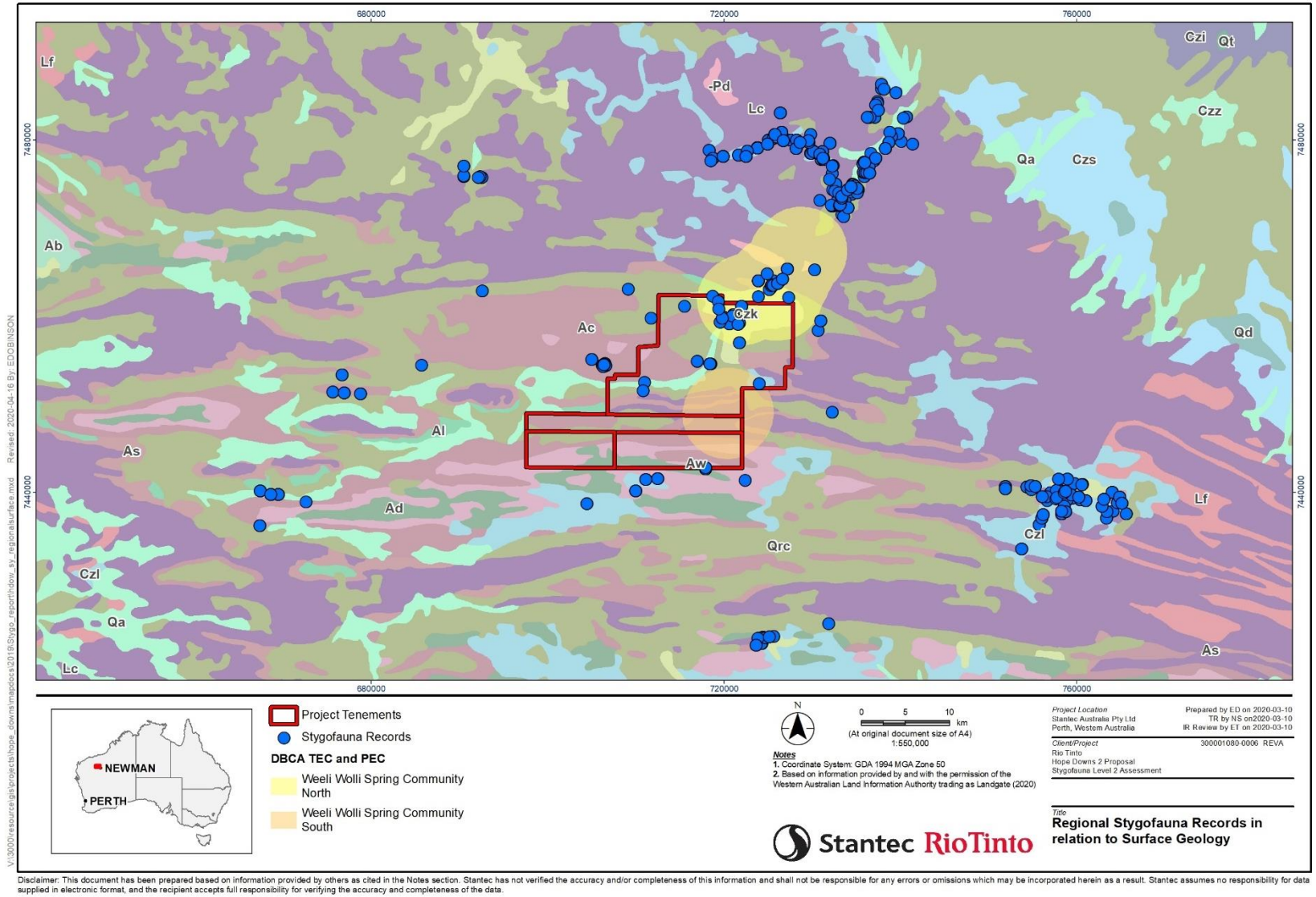

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Figure 5-2: Stygofauna records for the region surrounding the Survey area based on database searches, previous surveys (Biota 2006, Biota 2015, Outback Ecology 2009) and client supplied data, in relation to surface geology (refer to **Appendix C** for descriptions of relevant geological codes).

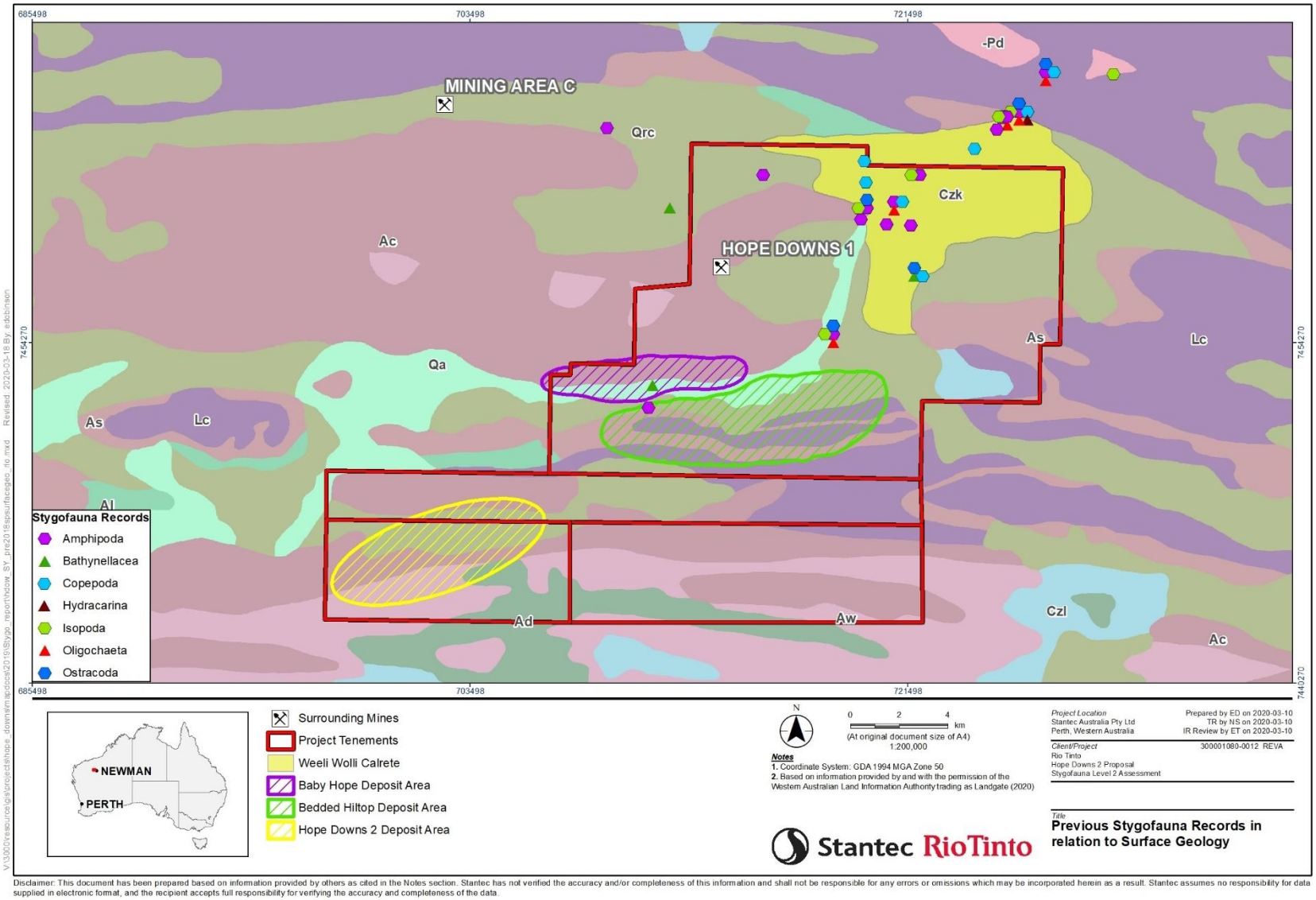

Figure 5-3: Stygofauna groups recorded during previous surveys within or near the Survey area (Biota 2006, Biota 2015), in relation to surface geology (refer to **Appendix C** for descriptions of relevant geological codes).

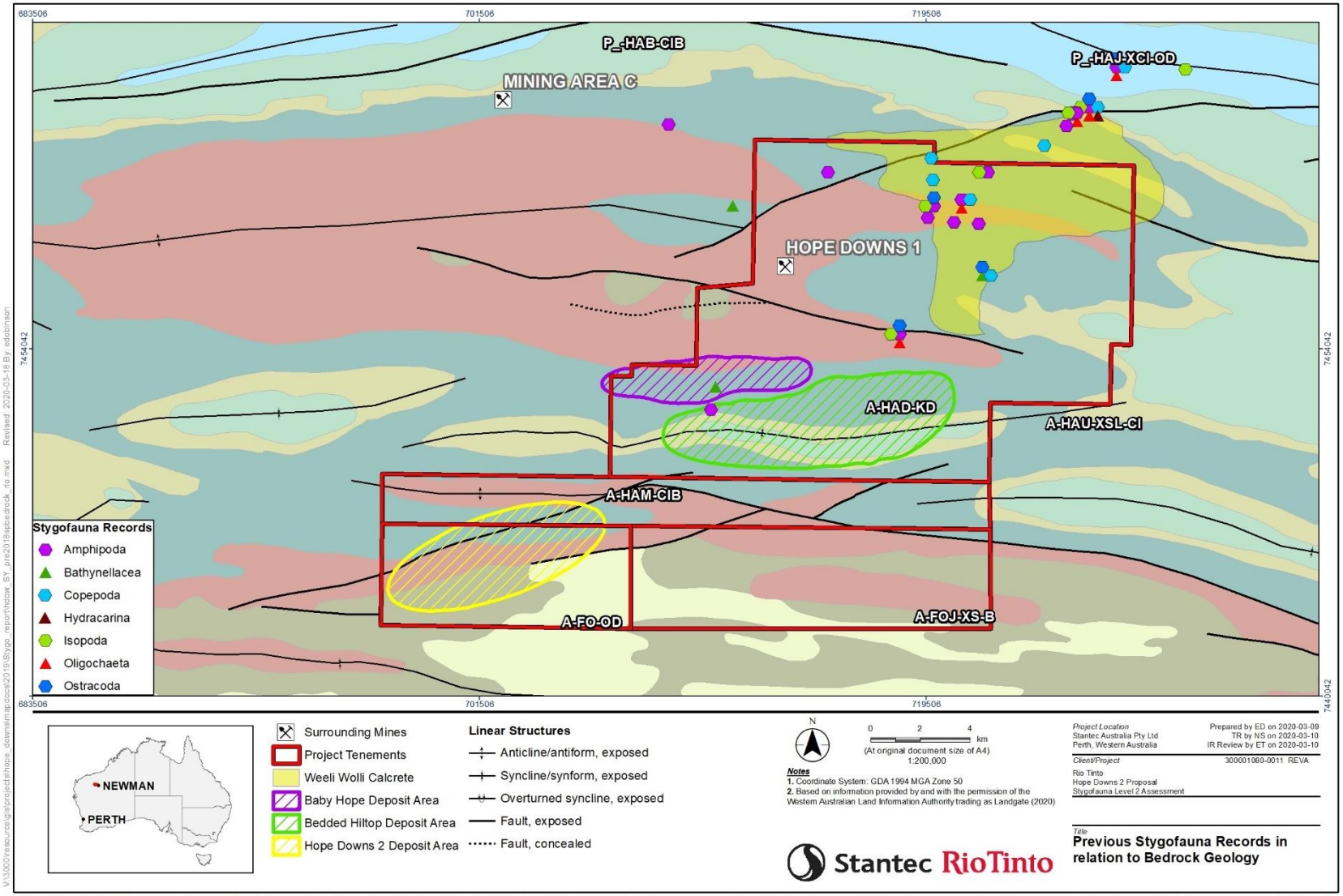

Figure 5-4: Stygofauna groups recorded during previous surveys within or near the Survey area (Biota 2006, Biota 2015), in relation to bedrock geology (refer to **Appendix C** for descriptions of relevant geological codes).

5.2 Stygofauna Habitat Characterisation

5.2.1 Bedded Hilltop

The BHT deposit forms part of a distinct ridge landform system, occurring in association with the mineralised Dales Gorge Member of the Brockman Iron Formation. The deposit dips beneath the colluvial and alluvial detrital deposits to the north, within the Pebble Mouse Creek valley. A localised and mostly isolated aquifer (the Mineralised Brockman Aquifer) occurs within the Brockman Iron Formation where the orebody mineralisation extends below the local water table (Rio Tinto 2019) (**Figure 5-5**). The surrounding regionally extensive Wittenoom Aquifer encompasses colluvial and alluvial detritals, weathered rock and karst features (**Figure 5-5**).

The Mineralised Brockman Aquifer is predominantly separated from the Wittenoom Aquifer by the Mount McRae Shale (**Figure 5-5**). The latter primarily outcrops, surrounding the orebody and the associated aquifer. The exception is a small area of interpreted connection between the Mineralised Brockman Aquifer and Wittenoom Aquifer in the central northern portion of the deposit, where the Mount McRae Shale subcrops below the water table (Rio Tinto 2019) (**Figure 5-5, Figure 5-6**).

The BHT aquifers (Mineralised Brockman and Wittenoom Aquifers) are bounded by outcropping unmineralized Marra Mamba Formation (MacLeod and Nammuldi Members) to the north and outcropping Mount McRae Shale to the south; the relatively impermeable units forming a discontinuity of groundwater flow. A north-west to south-east trending dyke forms the eastern boundary, separating the BHT aquifers from the aquifer associated with HD1 to the east. The interpreted aquifer boundaries are expected to compartmentalise the groundwaters from surrounding aquifers, forming a mostly isolated system. In hydrogeological terms, outflow is likely to be negligible, potentially occurring through groundwater overtopping or through the low permeability dykes along the eastern boundary (Rio Tinto 2019). However, biological data suggests a degree of groundwater flow between the adjacent aquifers (Biota 2006).

The water table in the BHT deposit area occurs at approximately 594 m AHD. This corresponds to groundwater depths of between 25 to 100 m bgl, reflecting the wide variation in surface elevation. The greatest depths to groundwater are associated with the BIF ridge. Groundwaters in the northern section of BHT, along Pebble Mouse Creek, are comparatively shallow, ranging from 30 m bgl in the west to 25 m bgl in the east (Rio Tinto 2019). In contrast, along the ridge, the distance to groundwater is greater, typically around 50 to 60 m bgl and ranging up to 100 m bgl (Rio Tinto 2019).

Groundwaters associated with the BHT BIF ridge are considered unlikely to host stygofauna communities. Surveys in the broader region have predominantly recorded stygofauna from the superficial alluvium or calcrete aquifers of the Weeli Wolli drainage system, with few records from the elevated BIF ridges (Biota 2006;2008; MWH 2014; Subterranean Ecology 2008a;2012). Exceptions, where diverse stygofauna have been collected from both alluvial or calcrete aquifers of drainage systems and BIF deposit areas, generally tend to reflect shallow depths to groundwater and/or degrees of hydraulic connection between the aquifers (Outback Ecology 2009; Subterranean Ecology 2008a).

Groundwaters along Pebble Mouse Creek represent the most prospective habitat for stygofauna in the BHT area, supported by previous amphipod records (Biota 2006)(**Figure 5-3**). This reflects the presence of favourable hydrogeological units, examples of which include gravelly clay and calcrete (**Appendix C**), with alluvial/colluvial detritals and associated units spanning a considerable distance along the drainage lines (**Figure 5-3**). In addition, the water table is comparatively shallow (25 to 30 m bgl). Depth to groundwater is recognised as a likely constraint on stygofauna abundance and diversity (Halse *et al.* 2014; Strayer 1994). Extensive sampling across the Pilbara region yielded low numbers of stygofauna from groundwaters in excess of 30 m bgl (Halse *et al.* 2014). Work in eastern Australia also found an inverse relationship between groundwater depth and stygofauna diversity (Hancock and Boulton 2008).

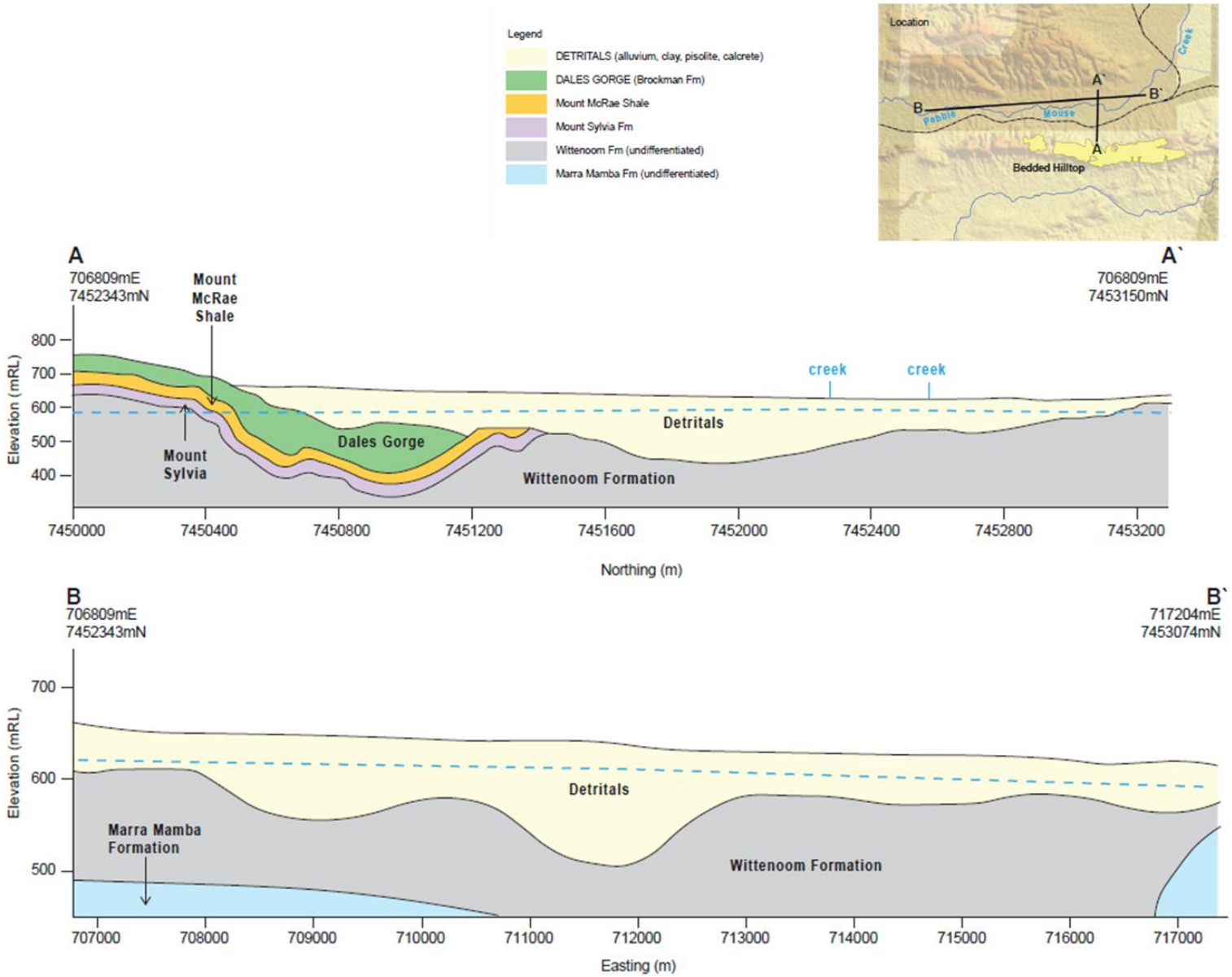

Figure 5-5: Hydrogeological cross sections of the BHT deposit (image supplied by Rio Tinto).

5.2.2 Baby Hope

The BH deposit occurs within the mineralised Marra Mamba Formation on the northern margin of the broad, shallow Pebble Mouse Creek valley (Rio Tinto 2015). The groundwaters are primarily hosted within the Wittenoom Formation (Rio Tinto 2015), extending into the overlying detritals in some sections (**Figure 5-6, Appendix E**). The natural water table at the deposit is approximately 50 m bgl, corresponding with 595 m AHD in the west to 585 m AHD in the east. However, dewatering of the adjacent HD1 deposit has lowered the groundwaters in the eastern portion by at least 5 m (Rio Tinto 2015).

A zone of low permeability silica to the west of BH forms an interpreted boundary to the Wittenoom Aquifer, indicated by a 20 m head difference. The aquifer is bounded to the east by a pair of dykes. Consistent with this, groundwater levels on the eastern side have decreased from 570 to 540 m AHD, in response to dewatering of the HD1 deposit, while depth to groundwater on the western side has remained relatively stable (Rio Tinto 2019).

The depth to groundwaters in the northern portion of the BH deposit area (≥50 m bgl) are considered sub-optimal for stygofauna. However, the alluvial/colluvial detritals to the south, towards Pebble Mouse Creek, represent more favourable habitat as groundwater is <50 m bgl. This was supported by the collection of a bathynellacean in the BH area, approximately 200 m from Pebble Mouse Creek (Biota 2006). It is likely that the groundwaters immediately adjacent to Pebble Mouse Creek are the primary habitat for stygofauna, with habitat continuity, largely alluvium, implied by mapped geology (**Figure 5-3**).

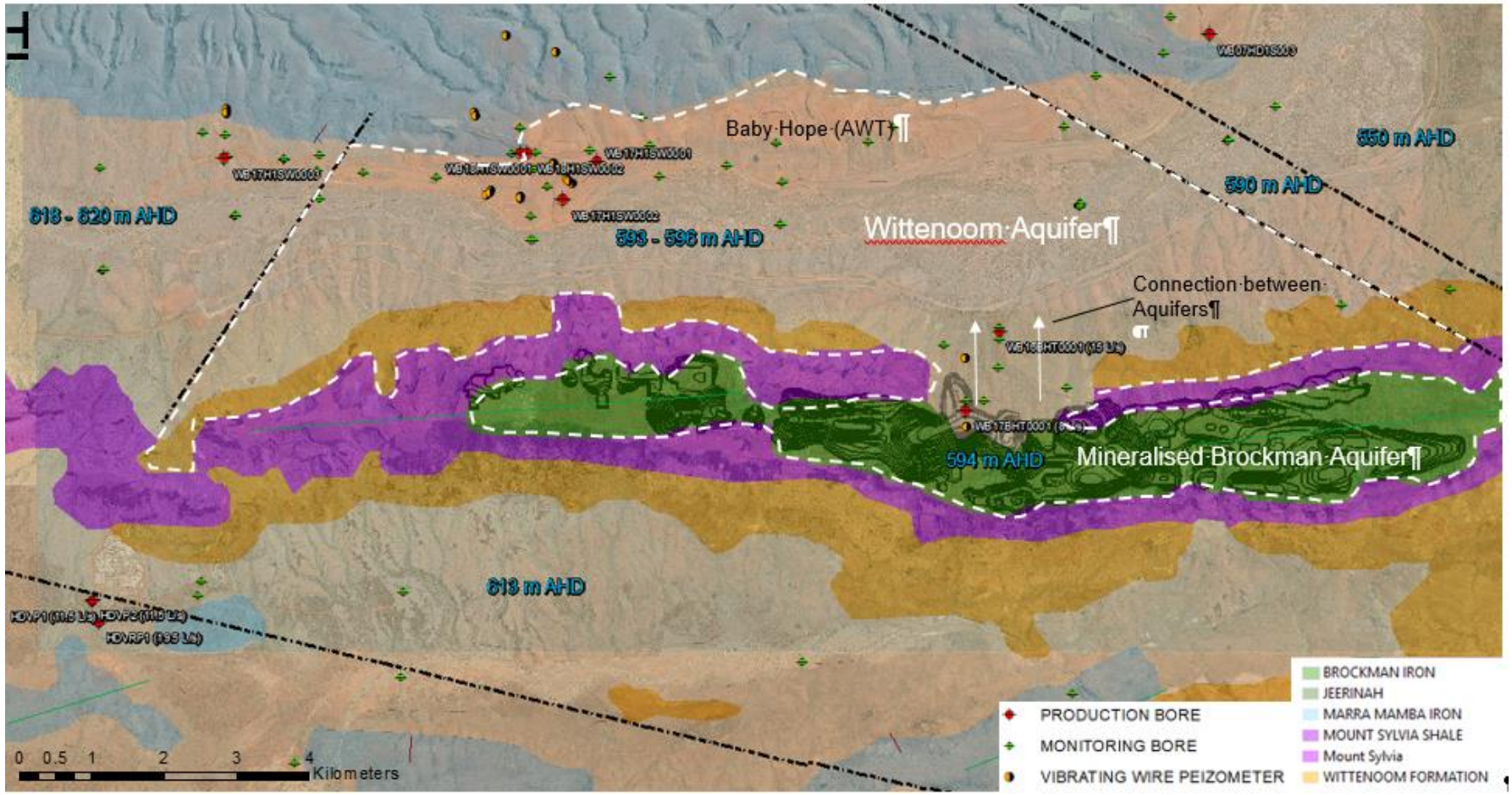

Figure 5-6: Interpreted extent of the aquifer in the BHT deposit area (supplied by Rio Tinto). Groundwater levels are shown in blue text.

5.2.3 Hope Downs 2

The HD2 deposit is located between Pebble Mouse Creek and Weeli Wolli Creeks, in an area of low hills. The deposit is associated with the Marra Mamba Formation and overlying detritals. The water table occurs within the Marra Mamba and abutting Wittenoom Formation, generally below the base of the detritals (**Figure 5-7**). Hydrogeological conceptualisation infers that groundwaters within the Marra Mamba Iron Formation are hydraulically connected to the adjacent Wittenoom Formation, largely forming a single aquifer (Wittenoom Aquifer) (Rio Tinto 2019) (**Figure 5-7**,**Figure 5-8**).

Secondary permeability within the Wittenoom Formation (Bee Gorge and Paraburdoo Members) is likely related to weathering and potential karst features. For the West Angela Member and underlying Marra Mamba Iron Formation, secondary permeability is expected to reflect mineralisation and fractures (Rio Tinto 2019).

The Wittenoom Aquifer in the HD2 area is bounded by outcropping unmineralized Marra Mamba Iron Formation to the north and south. A regionally extensive south-west to north-east trending dyke forms a boundary to the west. To the east, a folded zone of low permeability silica (north-east) and a dyke (south-east) compartmentalise groundwater flow. Groundwater discharge, albeit at a very slow rate, is likely to occur via groundwater flow through the eastern boundaries (low permeability silica and dyke) (Rio Tinto 2019).

The groundwaters of the elevated HD2 deposit area are considered unlikely to support stygofauna. The deposit is located higher in the catchment comparative to BHT and BH and is likely to have limited connection to the more prospective, shallow groundwaters further along the drainage lines. Depth to groundwater is also considered a limiting factor, with the water table at the HD2 deposit typically ranging between 60 to 80 m bgl. Depth to groundwater in the area decreases along the Pebble Mouse and Weeli Wolli Creeks (~40 m bgl), however still exceeds the values typically associated with diverse stygofauna communities (Halse *et al.* 2014). It is also unclear whether these groundwaters are hosted within the alluvial/colluvial detrital deposits or underlying weathered rock.

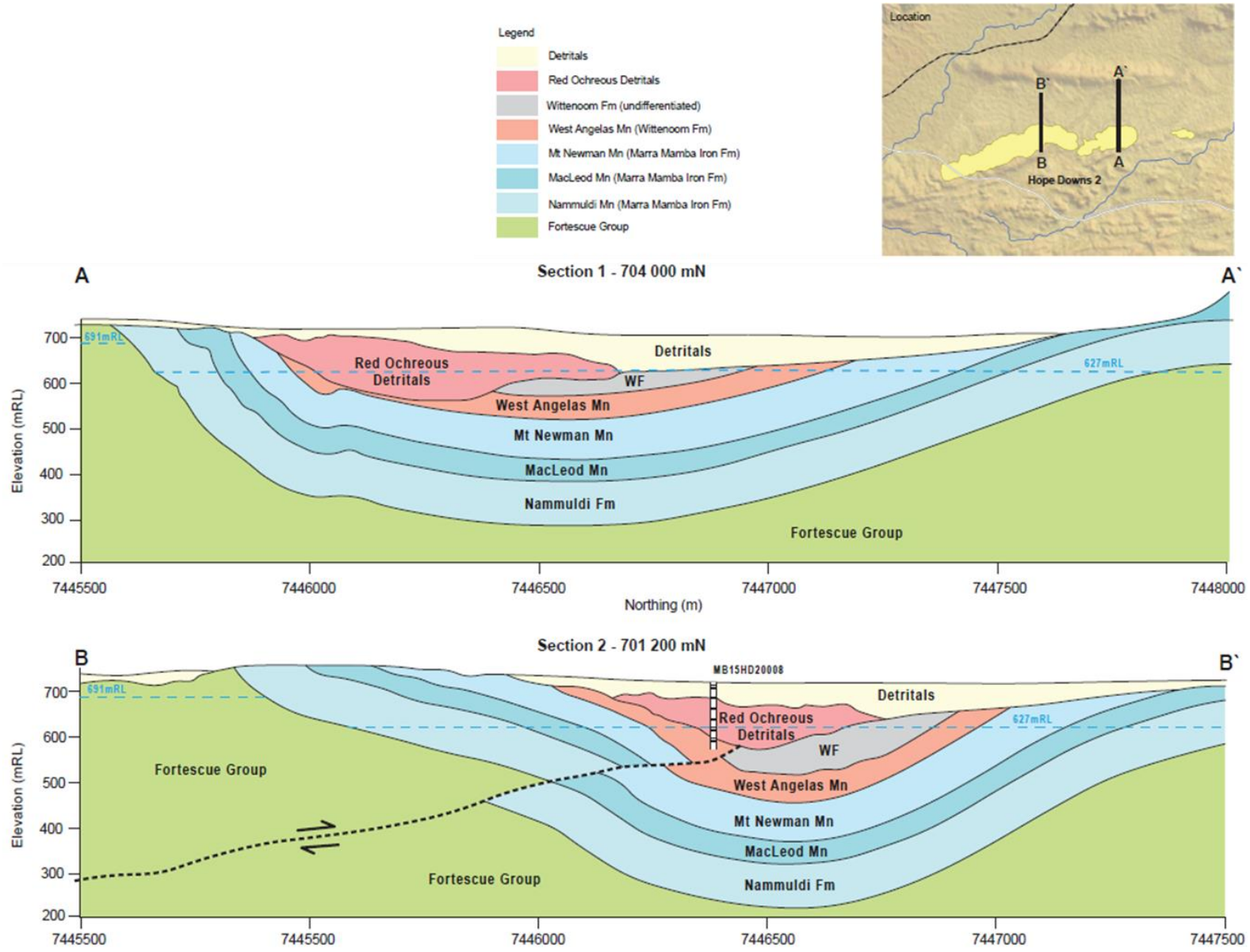

Figure 5-7: Hydrogeological cross sections of the HD2 deposit (supplied by Rio Tinto).

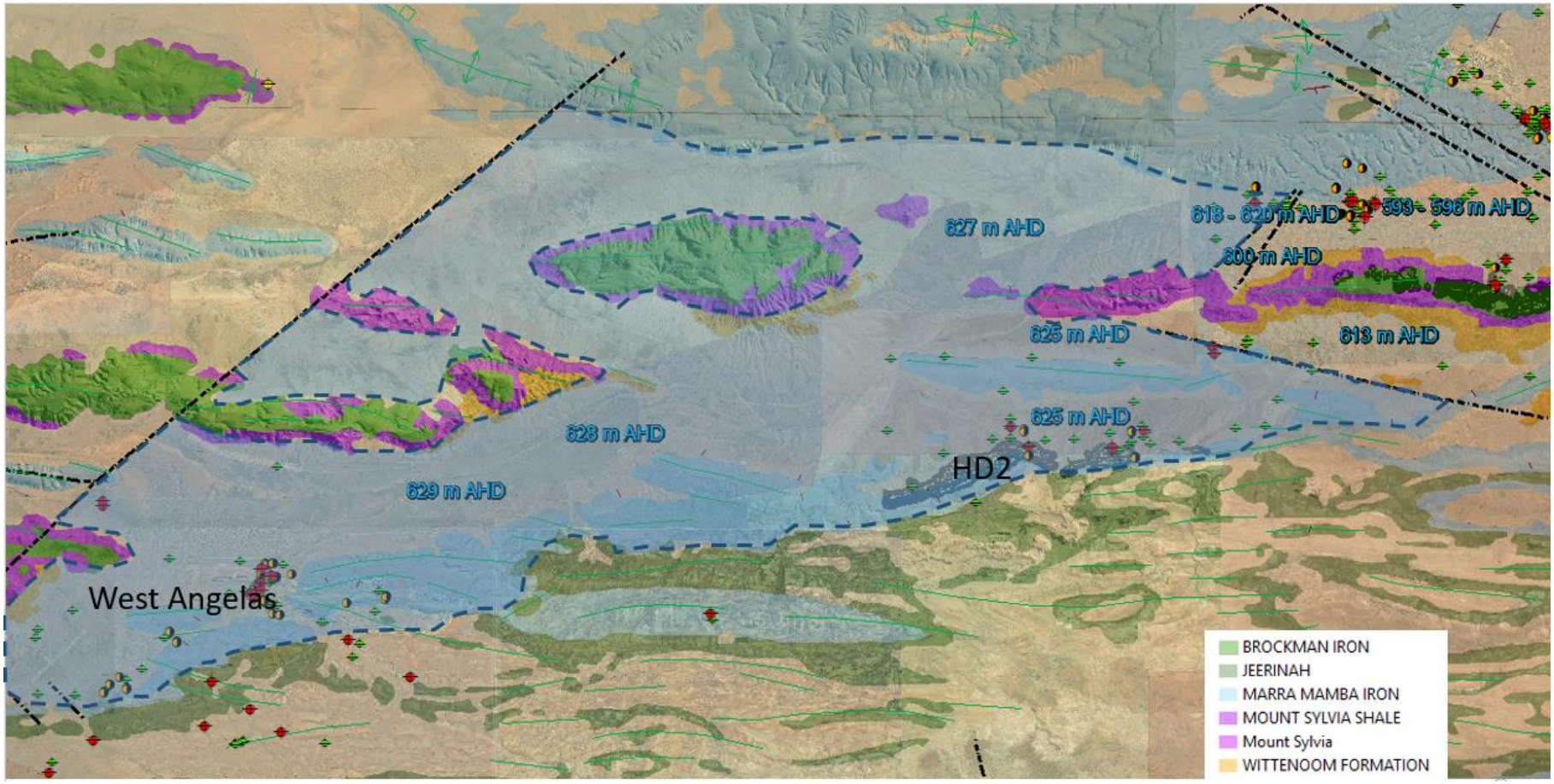

Figure 5-8: Interpreted extent of the aquifer in the HD2 deposit area (supplied by Rio Tinto).

5.3 Stygofauna Survey

5.3.1 Groundwater Properties

The standing water levels (SWL) within the deposit areas ranged from 27.0 to 108.0 m bgl, while at regional reference sites, ranged from 45.1 m bgl to 65.5 m bgl (**Figure 5-9, Appendix F)**. The shallowest depth to groundwater was recorded at site MB16HD1SW0006 (27 m bgl), within the Pebble Mouse Creek valley channel. In contrast, the greatest depth to groundwater (108 m bgl) was recorded at site RC18HD20071, in the elevated HD2 deposit area (**Figure 5-9, Appendix F**).

The mean SWL was highest at HD2 (75.4 m bgl), followed by BHT (53.4 m bgl) and BH (51.3 m bgl), in comparison to the mean SWL of 53.3 m bgl at regional reference sites (**Figure 5-9, Appendix F**). Between Phase 1 (late dry season) and Phase 2 (early wet season), there was a slight decrease in mean SWL at BH (- 4.5 m) and BHT (-2.4 m), whereas mean SWL increased between phases at HD2 (+3.3 m) and regional reference sites (+2.4 m) (**Figure 5-9, Appendix F**).

The groundwater salinity (measured as electrical conductivity; EC) across the deposit areas was classified as freshwater (Hammer 1986), ranging from 200 to 1,362 µS/cm (**Figure 5-9, Appendix F**). Mean EC was highest at BHT (993 µS/cm), followed by HD2 (894 µS/cm) and BH (657 µS/cm). Freshwater conditions were also characteristic of the regional reference sites (ranging from 214 to 1,027 µS/cm, with a mean 788 µS/cm) (**Figure 5-9, Appendix F)**. While stygofauna have been recorded from salinities in excess of 100,000 µS/cm (Outback Ecology 2011b, 2012a), significant stygofauna communities are typically associated with values below approximately 80,000 µS/cm (Environmental Protection Authority 2016a).

Groundwater pH across the deposit areas ranged from 6.4 (circumneutral) to 9.4 (alkaline), with means of between 7.0 to 7.6 across the deposits. In comparison, groundwater pH at the regional reference sites ranged from 6.5 to 7.5, with a similar mean of 7.1 (**Figure 5-9, Appendix F**). The pH values of groundwaters across the Survey area (deposit and regional reference sites) are within the range considered suitable for stygofauna. The most diverse stygal communities are often associated with calcareous environments between pH 7.2 and 8.2 (Humphreys 2008). However, while low pH can restrict stygofauna distribution, some ostracods have been documented from pH as low as 4.4 (Reeves *et al.* 2007).

Dissolved oxygen (DO) levels recorded within the deposit areas ranged from 0.8 mg/L to 6.2 mg/L. Mean DO levels were also similar across the deposit areas; 2.6 mg/L at BH, 2.4 mg/L at BHT and 2.3 mg/L at HD2. The DO at regional reference sites ranged from 0.8 mg/L to 3.0 mg/L, with a mean of 1.8 mg/L (**Figure 5-9, Appendix F**). DO concentrations are often patchy in the subterranean environment, commonly ranging from suboxic (<0.3 mg/L) to oxic (>3 mg/L) over temporal and spatial scales. Given this variability, stygofauna tend to be more resistant to low levels of oxygen than their surface water counterparts (Malard and Hervant 1999, Strayer 1994). While concentrations below 5 mg/L may adversely affect surface water biota for example, stygofauna are known to occur in sub-oxic conditions well below 1 mg/L (Chapman and Kimstach 1996, Humphreys 2008).

The groundwater properties represented by the basic suite of physicochemical parameters measured during the Phase 1 and Phase 2 field surveys, indicate conditions are suitable to support stygofauna across the Survey area. Based on these results, groundwater quality was considered unlikely to represent a barrier to stygofauna.

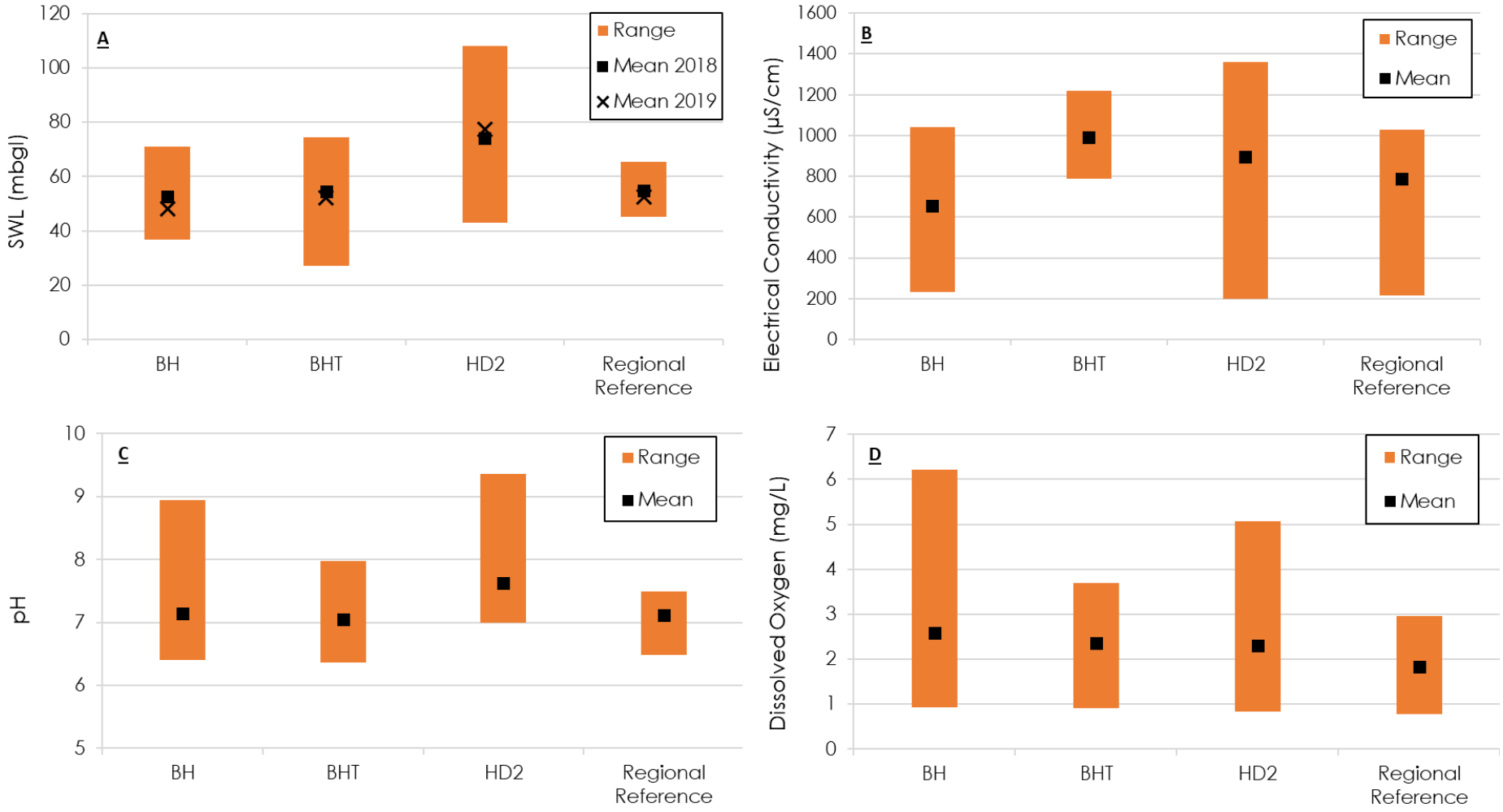

Figure 5-9: Groundwater properties (A) SWL, (B) EC, (C) pH, and (D) DO, indicating ranges and means across the Survey area.

5.3.2 Stygofauna Findings

A total of four stygal amphipod specimens were collected during the two field phases of the Survey. This comprised one specimen in Phase 1 (2018) and three specimens in Phase 2 (2019) (

Table 5-2**, Plate 5-1**). All four specimens were collected from site MB16HD1SW0006 within the BHT deposit area. This site is located immediately north of the BHT landform, along the alluvial/colluvial channel associated with Pebble Mouse Creek, underlain by Wittenoom Formation (**Figure 5-10, Figure 5-11, Figure 5-12**). The bore log also indicates the presence of calcrete in the superficial strata at this site (**Appendix D**).

The specimen collected from MB16HD1SW0006 in Phase 1 was a juvenile that would not reliably key to a described genus or family. Specimens from Phase 2 were identified as the *Pilbarus* OES12 (nr *millsi*) (Paramelitidae) based on morphological characteristics. DNA sequencing of two specimens (the Phase 1 juvenile and a tissue sample from a mature Phase 2 specimen), indicated there was negligible divergence between their lineages (<0.1% CO1), with all specimens considered to belong to *Pilbarus* OES12 (nr *millsi*) (Biologic code Biologic-AMPH001), herein referred to as *Pilbarus* 'sp. Biologic-AMPH001' (**Appendix G**).

Sequences of the specimens did not closely align with any Amphipoda sequences from available regional databases, including between 27-29% divergence CO1 divergence from Paramelitidae sequences from Weeli Wolli and Marillana Creeks (Biologic 2019). Therefore, based on available results to date, *Pilbarus* 'sp. Biologic-AMPH001' may represent a new operational taxonomic unit (OTU) or taxon, known only from the Survey area (Biologic 2019).

No stygofauna were collected from the BIF-hosted groundwaters sampled from the BH, BHT and HD2 deposit areas during the Survey. Similarly, the samples collected from the regional reference sites of the Weeli Wolli calcrete system and Weeli Wolli Creek riparian zone did not yield stygofauna (**Figure 5-10**,**Figure 5-11**,**Figure 5-12**, **Appendix A**).

Table 5-2: Summary of stygofauna results

Taxon	Identification Method	Collection Site	Abundance			Deposit Area	Sample Depth (m bgl)	Mapped Geology
			Phase 1	Phase 2	Total			
Amphipoda Paramelitidae								
Pilbarus 'sp. Biologic-AMPH001`	Morphology, DNA	MB16HD1SW0006	1	3	4	BHT	26 - 27	Alluvium, Colluvium

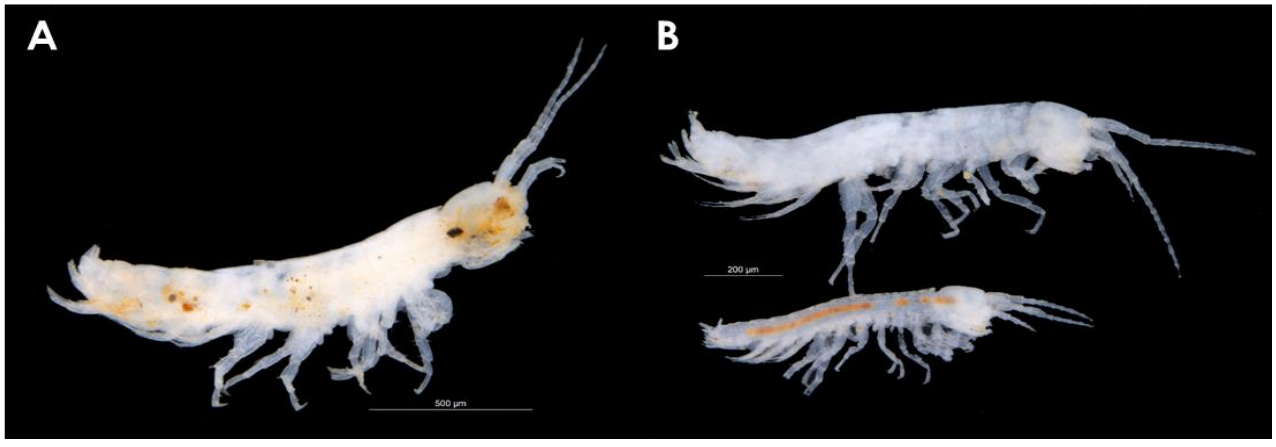

Plate 5-1: *Pilbarus* 'sp. Biologic-AMPH001' (A-B) specimens from Phase 2.

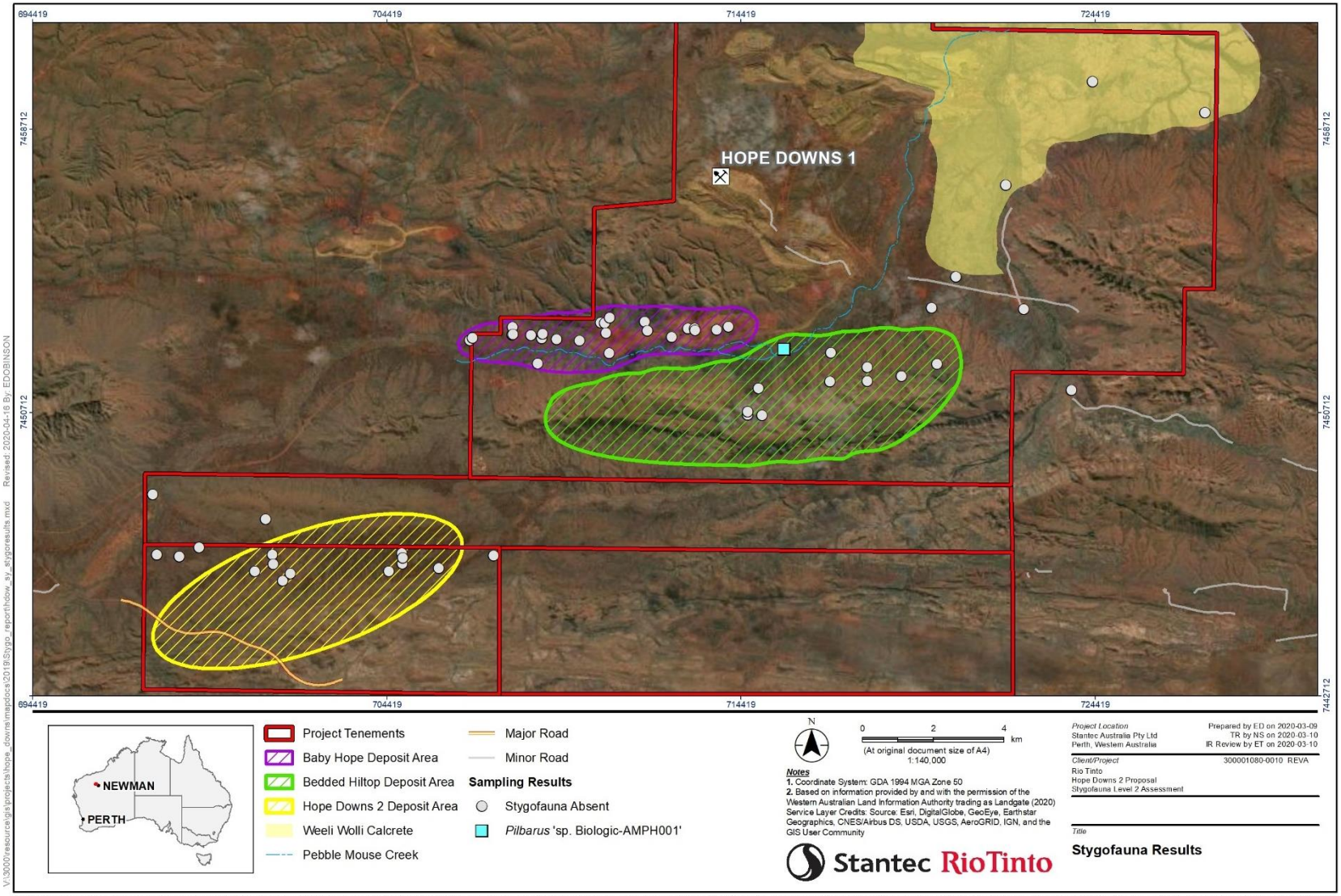

Figure 5-10: Stygofauna taxa collected during the Survey.

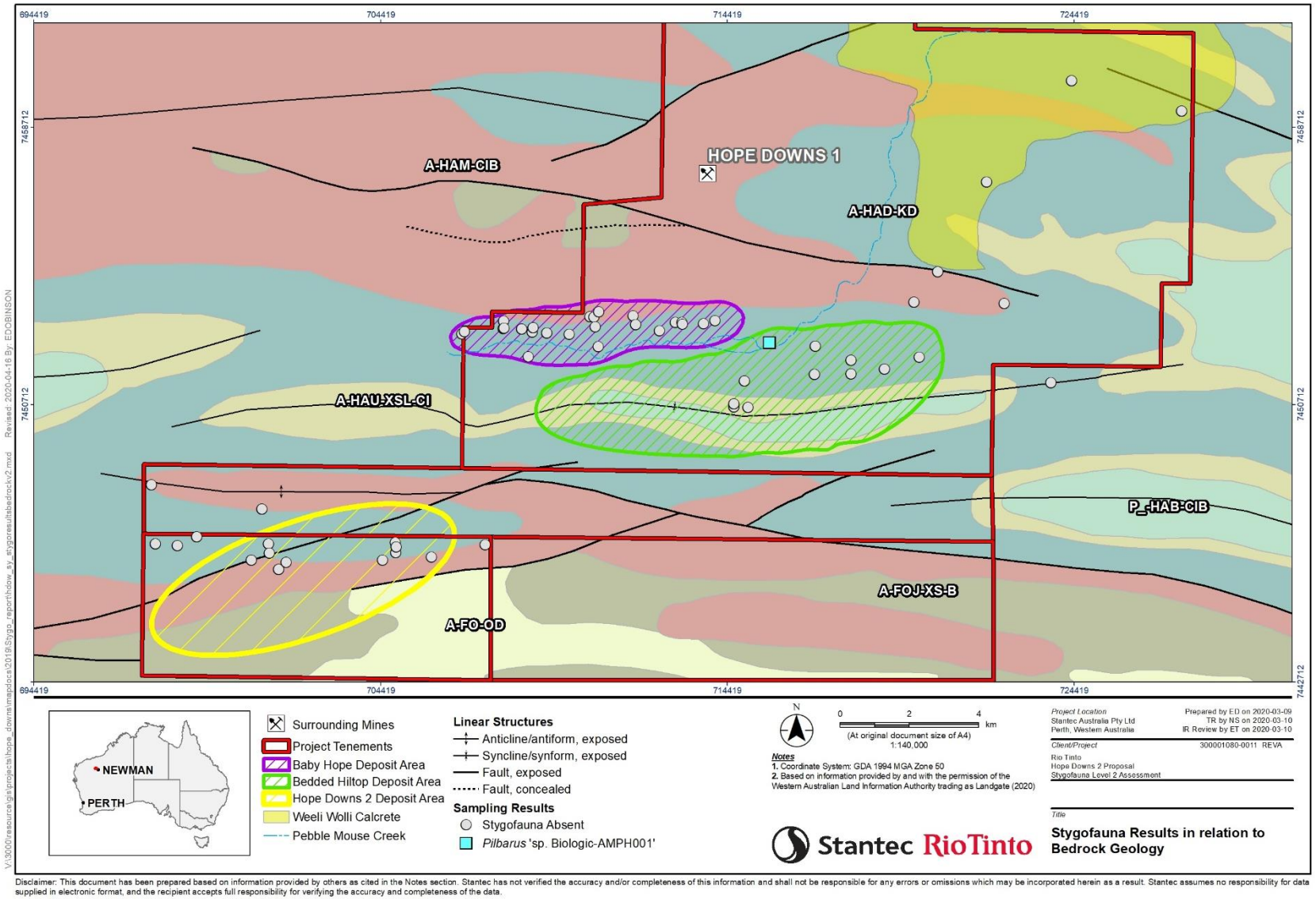

Figure 5-11: Stygofauna taxa collected during the Survey in relation to bedrock geology (refer to **Appendix C** for descriptions of relevant geological codes).

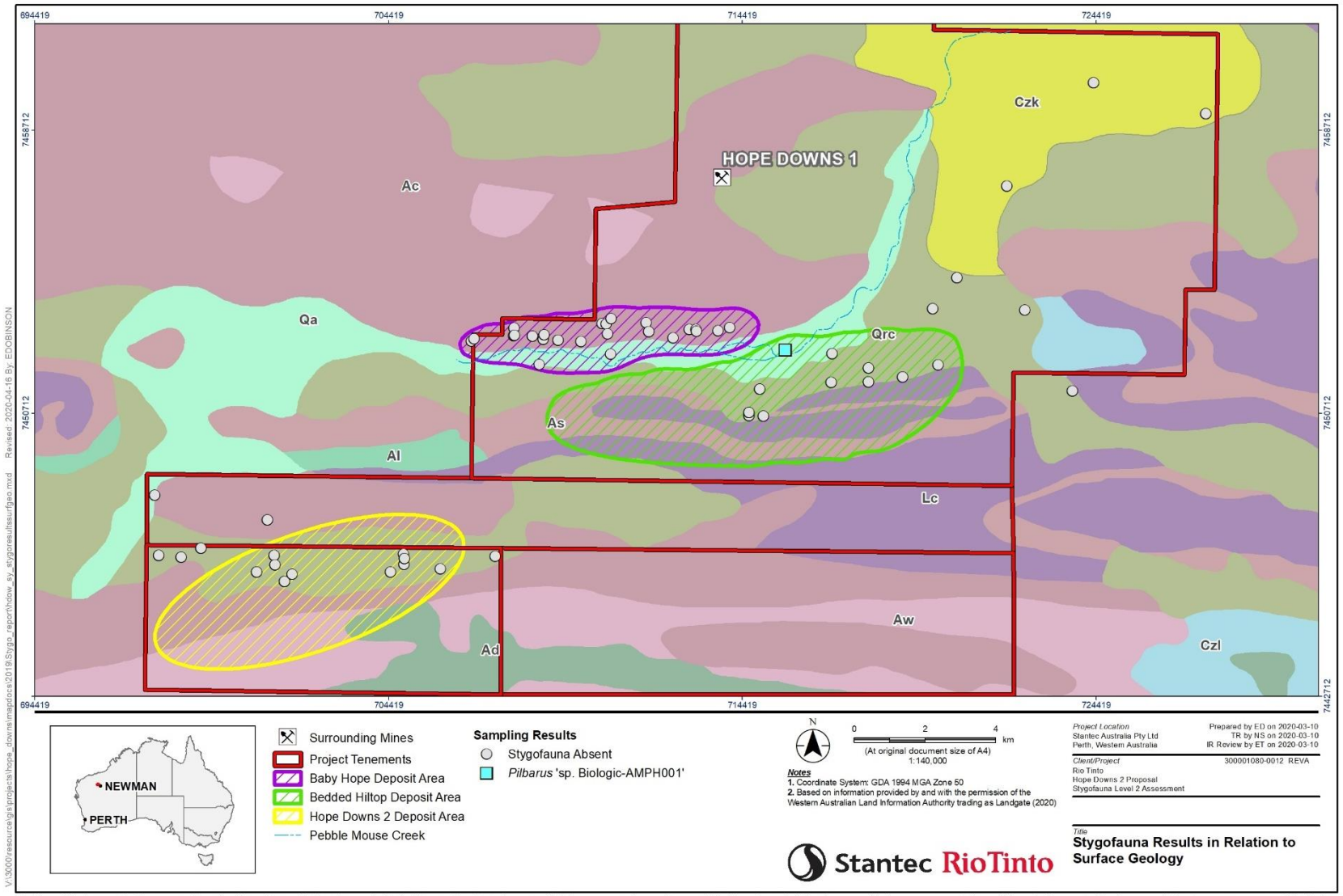

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Figure 5-12: Stygofauna taxa collected during the Survey in relation to surface geology (refer **to Appendix C** for descriptions of relevant geological codes).

6. Discussion

The results of this Survey indicated that stygofauna diversity and abundance within the Survey area are likely to be low. The only taxon collected, the paramelitid amphipod *Pilbarus* 'sp. Biologic-AMPH001', occurred at one site within the BHT deposit area. This site was to the north of the BHT landform, in strata that intersected alluvium, pisolite, gravelly clay and calcrete, with groundwaters of suitable quality. These findings align with previous sampling in the Survey area and surrounds (Biota 2006, Biota 2015), which identified alluvial/colluvial detritals and calcrete along the Pebble Mouse and Weeli Wolli Creeks as the core habitat for stygofauna. This includes the previous collection of a bathynellid (Parabathynellidae sp.) from the Pebble Mouse Creek alluvials within the BH deposit.

Additionally, Biota (2006) collected the amphipod Paramelidiate sp. 2 from Wittenoom Formation, immediately adjacent Pebble Mouse Creek alluvials within the BHT depost area. The regionally extensive Wittenoom Aquifer encompasses colluvial and alluvial detritals, weathered rock and karst features, and is predominantly separated from the Mineralised Brockman Aquifer by the Mount McRae Shale.

Contrastingly, the BIF geology across the BH, BHT and HD2 deposits did not yield any stygofauna. This was also consistent with previous surveys in the broader region, indicating limited prospectivity within the BIF (Biota 2008, ecologia Environmental 2013, MWH 2016a, Subterranean Ecology 2008a). HD2, in particular, is located higher in the catchment, with greater depth to groundwaters. Additionally, hydrogeological conceptualisation suggests that the aquifers associated with the BHT and BH deposits are compartmentalised from the adjacent HD1 aquifer, and are expected to have limited connectivity with the more prospective, shallow groundwaters of the drainage lines, likely providing limited dispersal pathaways and creating sub-optimal conditions for stygofauna.

The limited distribution of *Pilbarus* 'sp. Biologic-AMPH001' during this Survey was likely an artefact of the low number of accessible sites available for sampling proximal to Pebble Mouse Creek. In this instance, biological and physical surrogates can assist in determining likely taxon distribution (Environmental Protection Authority 2016b). The former focuses on the distribution of similar taxa, while investigating the extent of geological habitat can act as a physical surrogate.

Based on mapped geology, the alluvial/colluvial detrital and calcrete habitat supporting *Pilbarus* 'sp. Biologic-AMPH001' extends along the Pebble Mouse and Weeli Wolli drainage lines. Similarly, the distribution of the amphipod Paramelitidae sp. 2, recorded during the Hope Downs surveys (Biota 2006) was also found to predominantly occur along the drainage lines over a distance of approximately 40 km. It is presumed that larger stygal crustaceans such as Paramelitidae sp. 2, which are known to utilise surface and hyporheic waters as well as groundwaters, are distributed within catchments during flood events (Biota 2015).

Genetic analysis indicated that *Pilbarus* 'sp. Biologic-AMPH001' may represent a new operational taxonomic unit (OTU) or taxon, known only from the Survey area. Sequences from the analysed specimens did not closely align with any known Amphipoda sequences from available databases, including Paramelitidae from Yandi and Weeli Wolli (Biologic 2019). However, this may also reflect limited sampling and available genetic sequences for comparison. The continuity of prospective habitat, supported by the geology, and the extent of a similar taxon, Paramelitidae sp. 2, suggest that *Pilbarus* 'sp. Biologic-AMPH001' may have a broader distribution along the drainage lines.

There were no stygofauna recorded at the regional reference sites within the Weeli Wolli calcrete or Weeli Wolli Creek riparian zone during the Survey, despite a number of records from within the vicinity over time (Biota 2006, Biota 2015). However, approximately half of the BHT deposit lies within the 5 km buffer of the Weeli Wolli Spring Community South PEC. This area is known to support a high diversity of stygofauna, attributed to the large-scale calcrete and alluvial aquifer system associated with the Weeli Wolli spring.

7. Conclusion

The Survey indicated that the BHT deposit area hosted one stygofauna taxon, a potentially new paramelitid amphipod *Pilbarus* 'sp. Biologic-AMPH001'. This species occurred in groundwaters of suitable quality, associated with prospective habitat comprising alluvial/colluvial detritals and calcrete, along Pebble Mouse Creek. These results were consistent with previous surveys of the area, whereby a bathynellacean was also recorded within alluvial/colluvial detritals of the Pebble Mouse Creek drainage, and an amphipod (Paramelitidae sp. 2) was recorded from the Wittenoom Aqifer immediately adjacent Pebble Mouse Creek. While apparently restricted to within the Survey area based on genetic sequencing, it is likely that *Pilbarus* 'sp. Biologic-AMPH001'is distributed more broadly in suitable habitat along the drainage lines. BIF geology within the BHT, BH and HD2 deposits are not considered prospective for stygofauna. Sample effort for the

Survey area was sufficient to meet regulatory guidance, with the BHT deposit area characterised by higher stygofauna values in comparison to the remaining areas, particularly where it intersects the surficial alluvial/colluvials of the Pebble Mouse Creek drainage, as well as the 5 km buffer of the Weeli Wolli Spring Community South PEC.

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Appendices

Appendix A Survey Site Details and Sample Effort.

Table A-1: Survey site details and sample effort.

Project Area	Site Name	Easting	Northing	Sample Phase	Sample Date	Ground RL (AHD)	Stygofauna Presence	Abundance
Baby Hope	DD17HD10002	710562.58	7453242.08	Phase 1	30/10/2018		NIL	0
Baby Hope	HSF0065	706759.67	7452760.74	Phase 1	02/11/2018		NIL	0
Baby Hope	MB13H1SW001	709861.03	7452739.38	Phase 1	30/10/2018	643.96	NIL	0
Baby Hope	MB13H1SW002	708811.88	7452936.59	Phase 1	30/10/2018	656.72	NIL	0
Baby Hope	MB15H1SW0003	712460.98	7452841.53	Phase 1	29/10/2018	634.70	NIL	0
Baby Hope	MB17H1SW0002	709203.39	7452776.36	Phase 1	30/10/2018	648.40	NIL	0
Baby Hope	MB17H1SW0005	711695.79	7453275.22	Phase 1	29/10/2018	657.9	NIL	0
Baby Hope	MB17H1SW0010	711777.62	7453020.90	Phase 1	29/10/2018	644.21	NIL	0
Baby Hope	MB17H1SW0011	713732.12	7453047.94	Phase 1	28/10/2018	647.18	NIL	0
Baby Hope	MB17H1SW0012	710700.40	7452390.46	Phase 1	02/11/2018	645.89	NIL	0
Baby Hope	MB17H1SW0016	708491.00	7452899.00	Phase 1	30/10/2018	654.50	NIL	0
Baby Hope	MB17H1SW0017	707961.25	7453118.45	Phase 1	30/10/2018	666.26	NIL	0
Baby Hope	RC13HD10120	710458.62	7453247.82	Phase 1	30/10/2018		NIL	0
Baby Hope	RC14HD10006	710704.00	7453391.00	Phase 1	29/10/2018		NIL	0
Baby Hope	RC14HD10072	714058.08	7453139.28	Phase 1	28/10/2018		NIL	0
Baby Hope	RC14HD10259	713104.27	7453090.05	Phase 1	28/10/2018		NIL	0
Baby Hope	RC14HD10260	713117.85	7453032.96	Phase 1	28/10/2018		NIL	0
Baby Hope	RC14HD10292	712910.71	7453086.60	Phase 1	28/10/2018		NIL	0
Baby Hope	WB17H1SW0003	707955.30	7452909.94	Phase 1	30/10/2018	662.98	NIL	0
Baby Hope	WB18HDS10001	710608.42	7452961.96	Phase 1	30/10/2018	651.55	NIL	0
Baby Hope	LHRP1	708672.62	7452096.58	Phase 1	29/10/2018	652.00	NIL	0
Baby Hope	MB13H1SW002	708811.88	7452936.59	Phase 2	02/04/2019	656.72	NIL	0
Baby Hope	MB17H1SW0001	708794.75	7452800.60	Phase 2	3/30/2019	658.74	NIL	0
Baby Hope	MB17H1SW0002	709203.39	7452776.36	Phase 2	30/03/2019	648.4	NIL	0
Baby Hope	MB17H1SW0010	711777.62	7453020.90	Phase 2	29/03/2019	644.21	NIL	0
Baby Hope	MB17H1SW0012	710700.40	7452390.46	Phase 2	02/04/2019	647.18	NIL	0
Baby Hope	MB17H1SW0015	707981.72	7452920.73	Phase 2	30/03/2019	663.04	NIL	0
Baby Hope	MB17H1SW0016	708491.00	7452899.00	Phase 2	02/04/2019	654.5	NIL	0
Baby Hope	MB17H1SW0017	707961.25	7453118.45	Phase 2	02/04/2019	666.26	NIL	0
Bedded Hilltop	RC18BHT0153	715006.28	7450637.41	Phase 1	04/11/2018		NIL	0
Bedded Hilltop	RC18BHT0174	716959.13	7452393.76	Phase 1	27/10/2018		NIL	0
Bedded Hilltop	RC18BHT0175	716932.07	7451588.25	Phase 1	26/10/2018		NIL	0
Bedded Hilltop	RC18BHT0218	714907.83	7451391.81	Phase 1	04/11/2018	636.01	NIL	0
Bedded Hilltop	RC18BHT0220	714611.54	7450739.93	Phase 1	04/11/2018	648.36	NIL	0
Bedded Hilltop	RC18BHT0221	719948.00	7452084.67	Phase 1	26/10/2018	628.75	NIL	0

Project Area	Site Name	Easting	Northing	Sample Phase	Sample Date	Ground RL (AHD)	Stygofauna Presence	Abundance
Bedded Hilltop	RC18BHT0222	718946.25	7451734.91	Phase 1	26/10/2018	648.36	NIL	0
Bedded Hilltop	RC18BHT0223	717978.97	7451595.46	Phase 1	26/10/2018	661.76	NIL	0
Bedded Hilltop	RC18BHT0258	717981.93	7451991.48	Phase 1	26/10/2018		NIL	0
Bedded Hilltop	WB17BHT0001	714602.00	7450651.22	Phase 1	03/11/2018	650.86	NIL	0
Bedded Hilltop	MB16HD1SW0006	715637.83	7452507.20	Phase 1	29/10/2018	620.92	AMPHIPODA: *Pilbarus* 'sp. Biologic-AMPH0001'	1
Bedded Hilltop	RC18BHT0153	715006.28	7450637.41	Phase 2	03/04/2019		NIL	0
Bedded Hilltop	RC18BHT0174	716959.13	7452393.76	Phase 2	02/04/2019		NIL	0
Bedded Hilltop	RC18BHT0175	716932.07	7451588.25	Phase 2	02/04/2019		NIL	0
Bedded Hilltop	RC18BHT0218	714907.83	7451391.81	Phase 2	04/04/2019	636.01	NIL	0
Bedded Hilltop	RC18BHT0220	714611.54	7450739.93	Phase 2	04/04/2019	648.36	NIL	0
Bedded Hilltop	RC18BHT0222	718946.25	7451734.91	Phase 2	31/03/2019	648.36	NIL	0
Bedded Hilltop	RC18BHT0223	717978.97	7451595.46	Phase 2	31/03/2019	661.76	NIL	0
Bedded Hilltop	RC18BHT0258	717981.93	7451991.48	Phase 2	31/03/2019		NIL	0
Bedded Hilltop	WB17BHT0001	714602.00	7450651.22	Phase 2	04/04/2019	650.86	NIL	0
Bedded Hilltop	MB16HD1SW0006	715637.83	7452507.20	Phase 2	02/04/2019	620.92	AMPHIPODA: *Pilbarus* 'sp. Biologic-AMPH0001'	3
Hope Downs 2	GD18HD20003	701212.24	7446427.06	Phase 1	31/10/2018	610.90	NIL	0
Hope Downs 2	MB15HD20002	707434.76	7446673.03	Phase 1	01/11/2018	683.761	NIL	0
Hope Downs 2	MB15HD20003	705877.69	7446321.58	Phase 1	02/11/2018	688.42	NIL	0
Hope Downs 2	MB18HD20003	701185.23	7446694.82	Phase 1	31/10/2018	707.87	NIL	0
Hope Downs 2	MB18HD20006	704856.59	7446440.03	Phase 1	02/11/2018	695.96	NIL	0
Hope Downs 2	MB18HD20008	704469.88	7446235.02	Phase 1	01/11/2018	705.89	NIL	0
Hope Downs 2	MB18HD20010	704847.85	7446738.47	Phase 1	01/11/2018	693.36	NIL	0
Hope Downs 2	RC17HD20237	697923.51	7446697.89	Phase 1	31/10/2018		NIL	0
Hope Downs 2	RC17HD20240	699112.24	7446904.65	Phase 1	01/11/2018		NIL	0
Hope Downs 2	RC17HD20252	698559.42	7446652.85	Phase 1	01/11/2018		NIL	0
Hope Downs 2	RC18HD20019	700688.84	7446225.67	Phase 1	31/10/2018		NIL	0
Hope Downs 2	RC18HD20071	701479.45	7445959.73	Phase 1	31/10/2018		NIL	0
Hope Downs 2	RC18WON0131	701000.85	7447705.20	Phase 1	31/10/2018		NIL	0
Hope Downs 2	WB18HD20002	704866.72	7446604.58	Phase 1	02/11/2018	693.54	NIL	0
Hope Downs 2	GD18HD20003	701212.24	7446427.06	Phase 2	05/04/2019		NIL	0
Hope Downs 2	MB18HD20003	701185.23	7446694.82	Phase 2	05/04/2019	695.31	NIL	0
Hope Downs 2	RC17HD20237	697923.51	7446697.89	Phase 2	4/6/2019		NIL	0
Hope Downs 2	RC17HD20240	699112.24	7446904.65	Phase 2	4/6/2019		NIL	0
Hope Downs 2	RC17HD20252	698559.42	7446652.85	Phase 2	4/6/2019		NIL	0

Project Area	Site Name	Easting	Northing	Sample Phase	Sample Date	Ground RL (AHD)	Stygofauna Presence	Abundance
Hope Downs 2	RC18HD20019	700688.84	7446225.67	Phase 2	05/04/2019		NIL	0
Hope Downs 2	RC18HD20071	701479.45	7445959.73	Phase 2	05/04/2019		NIL	0
Hope Downs 2	RC18WON0029	697802.21	7448398.22	Phase 2	06/04/2019		NIL	0
Hope Downs 2	RC18WON0131	701000.85	7447705.20	Phase 2	06/04/2019		NIL	0
Hope Downs 2	WB16HD20001	701687.56	7446167.94	Phase 2	05/04/2019	712.81	NIL	0
Hope Downs 2	WB18HD20002	704866.72	7446604.58	Phase 2	04/04/2019	693.54	NIL	0
Regional Reference	LHRE19	720477.20	7454543.69	Phase 1	03/11/2018		NIL	0
Regional Reference	LHRP7	719794.37	7453665.40	Phase 1	03/11/2018		NIL	0
Regional Reference	MB13HD1N006	721894.62	7457137.10	Phase 1	03/11/2018		NIL	0
Regional Reference	MB16HD1N0007	727513.69	7459174.93	Phase 1	03/11/2018		NIL	0
Regional Reference	MB16HD1N0010	724341.15	7460050.57	Phase 1	03/11/2018		NIL	0
Regional Reference	WB11JND001	723750.00	7451350.00	Phase 1	03/11/2018		NIL	0
Regional Reference	BH20s	722398.72	7453632.77	Phase 2	30/03/2019		NIL	0
Regional Reference	LHRE19	720477.20	7454543.69	Phase 2	30/03/2019		NIL	0
Regional Reference	LHRP7	719794.37	7453665.40	Phase 2	30/03/2019		NIL	0
Regional Reference	MB13HD1N006	721894.62	7457137.10	Phase 2	29/03/2019		NIL	0
Regional Reference	MB16HD1N0007	727513.69	7459174.93	Phase 2	29/03/2019		NIL	0
Regional Reference	MB16HD1N0010	724341.15	7460050.57	Phase 2	29/03/2019		NIL	0
Regional Reference	WB11JND001	723750.00	7451350.00	Phase 2	29/03/2019		NIL	0



Plate A-1: (A) MB16HD1SW0006 (B) RC18BHT0222 (C) WB17BHT0001 (D) RC18BHT0153 (E) RC18BHT0258 F) MB17H1SW00016 (H) MB17H1SW0010 (I) MB17H1SW0012 (J) MB17H1SW0015.



Plate A-2: (A) MB18HD20003 (B) MB18HD20006 (C) MB18HD20008 (D) DD17HD10002 (E) RC18HD20019 (F) WB11JND001 (G) BH20s (H) LHRE19 (I) LHRP7.

Appendix B Western Australian Museum Database Search Results.

Table B-1: Western Australian Museum database search results: Crustacea.

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
40087	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.79020	119.25300	?	Armstrong, K.	Net Haul
40088	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.79020	119.25300	?	Armstrong, K.	Net Haul
54525	Amphipoda	Paramelitidae	Paramelitidae sp. OB1	1	Fortescue Catchment	-23.00550	119.01300	?	Catomore, S., Coen, N.	Net Haul
54529	Amphipoda	Paramelitidae	Paramelitidae sp. OB3	1	Fortescue Catchment	-23.00500	119.01400	?	Catomore, S., Coen, N.	Net Haul
54531	Amphipoda	Paramelitidae	Paramelitidae sp. OB3	1	Fortescue Catchment	-23.00520	119.01400	?	Catomore, S., Bell, P.	Net Haul
54507	Amphipoda	Paramelitidae	*Chydaekata acuminata*	1	Fortescue Catchment	-23.00520	119.01400	?	Catomore, S., Coen, N.	Net Haul
54512	Amphipoda	Paramelitidae	*Chydaekata acuminata*	1	Fortescue Catchment	-23.00380	119.01500	?	Catomore, S., Bell, P.	Net Haul
24651	Amphipoda	Paramelitidae	*Chydaekata acuminata*	1	Newman Bore W152	-23.26660	119.26700	?	Eberhard, S.M.	Net Haul
54513	Amphipoda	Paramelitidae	*Chydaekata acuminata*	1	Fortescue Catchment	-23.00500	119.01400	?	Catomore, S., Bell, P.	Net Haul
54510	Amphipoda	Paramelitidae	*Chydaekata acuminata*	1	Fortescue Catchment	-23.00520	119.01400	?	Catomore, S., Coen, N.	Net Haul
54508	Amphipoda	Paramelitidae	*Chydaekata acuminata*	1	Fortescue Catchment	-23.00470	119.01400	?	Catomore, S., Coen, N.	Net Haul
54509	Amphipoda	Paramelitidae	*Chydaekata acuminata*	1	Fortescue Catchment	-23.00520	119.01400	?	Catomore, S., Coen, N.	Net Haul
54511	Amphipoda	Paramelitidae	*Chydaekata acuminata*	1	Fortescue Catchment	-23.00520	119.01400	?	Catomore, S., Coen, N.	Net Haul
54517	Amphipoda	Paramelitidae	*Chydaekata* sp. OB1	1	Fortescue Catchment	-23.00660	119.01300	?	Catomore, S., Bell, P.	Net Haul
54516	Amphipoda	Paramelitidae	*Chydaekata* sp. OB1	1	Fortescue Catchment	-23.00660	119.01300	?	Catomore, S., Coen, N.	Net Haul
60650	Amphipoda	Paramelitidae	Genus 2 `sp. B02`	1	Upper Weeli Wolli, ca. 70 km NW. Newman	-22.91870	119.20100	?	Curran, M.K., Main, D.C.	Net Haul
70157	Amphipoda	Paramelitidae	*Kruptus*	1	ca. 113 km WNW of Newman	-23.14930	118.68600	?	Callan, S., Volschenk, E.S.	Net Haul
70159	Amphipoda	Paramelitidae	*Kruptus*	1	ca. 113 km WNW of Newman	-23.17420	118.63500	?	Callan, S., Volschenk, E.S.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
70160	Amphipoda	Paramelitidae	*Kruptus*	1	ca. 113 km WNW of Newman	-23.17420	118.63500	?	Callan, S., Volschenk, E.S.	Net Haul
54521	Amphipoda	Paramelitidae	*Maarrka etheli*	1	Fortescue Catchment	-23.00520	119.01400	?	Catomore, S., Bell, P.	Net Haul
51231	Amphipoda	Paramelitidae	*Maarrka weeliwollii*	1	Iron Valley	-22.71380	119.31600	?	Pearson, G.B. & Bennett, S.R.	Net Haul
52162	Amphipoda	Paramelitidae	*Maarrka weeliwollii*	1	Upper Weeli Wolli	-23.00000	119.11700	?	Main, D.C., Quartermaine, J.W.	Net Haul
57303	Bathynellacea	Bathynellidae	Bathynellidae	1	Bore T399	-23.00470	119.01400	?	G. Perina & S. Eberhard	Net Haul
57302	Bathynellacea	Bathynellidae	Bathynellidae	1	Bore T399	-23.00470	119.01400	?	G. Perina & S. Eberhard	Net Haul
57305	Bathynellacea	Bathynellidae	Bathynellidae	1	Bore W013	-23.00550	119.01200	?	G. Perina & B. Scanlon	Net Haul
57299	Bathynellacea	Bathynellidae	Bathynellidae	1	Bore W262	-23.00500	119.01400	?	G. Perina & S. Eberhard	Net Haul
57298	Bathynellacea	Bathynellidae	Bathynellidae	1	Bore W262	-23.00500	119.01400	?	G. Perina & S. Eberhard	Net Haul
57311	Bathynellacea	Bathynellidae	Bathynellidae	1	Bore W088	-23.00630	119.01400	?	G. Perina & B. Scanlon	Net Haul
57310	Bathynellacea	Bathynellidae	Bathynellidae	1	Bore W088	-23.00630	119.01400	?	G. Perina & B. Scanlon	Net Haul
57294	Bathynellacea	Bathynellidae	Bathynellidae	1	Bore W088	-23.00630	119.01400	?	G. Perina & S. Eberhard	Net Haul
57308	Bathynellacea	Bathynellidae	Bathynellidae	1	Bore WP56	-23.00500	119.01400	?	S. Catomore. & P. Bell	Net Haul
57307	Bathynellacea	Bathynellidae	Bathynellidae	1	Bore W099	-23.00610	119.01400	?	S. Catomore. & P. Bell	Net Haul
57297	Bathynellacea	Bathynellidae	Bathynellidae	1	Bore W262	-23.00500	119.01400	?	G. Perina & S. Eberhard	Net Haul
57295	Bathynellacea	Bathynellidae	Bathynellidae	1	Bore W088	-23.00630	119.01400	?	G. Perina & S. Eberhard	Net Haul
57293	Bathynellacea	Bathynellidae	Bathynellidae	1	Bore W088	-23.00630	119.01400	?	G. Perina & S. Eberhard	Net Haul
57292	Bathynellacea	Bathynellidae	Bathynellidae	1	Bore W088	-23.00630	119.01400	?	G. Perina & S. Eberhard	Net Haul
57306	Bathynellacea	Bathynellidae	Bathynellidae	1	Bore W099	-23.00610	119.01400	?	S. Catomore. & P. Bell	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
57300	Bathynellacea	Bathynellidae	Bathynellidae	1	Bore W262	-23.00500	119.01400	?	G. Perina & S. Eberhard	Net Haul
57309	Bathynellacea	Bathynellidae	Bathynellidae	1	Bore WP56	-23.00500	119.01400	?	S. Catomore. & P. Bell	Net Haul
57304	Bathynellacea	Bathynellidae	Bathynellidae	1	Bore W013	-23.00550	119.01200	?	G. Perina & B. Scanlon	Net Haul
70168	Bathynellacea	Parabathynellidae	*Atopobathynella*	1	ca. 113 km WNW of Newman	-23.13850	118.63500	?	Callan, S., Volschenk, E.S.	Net Haul
57187	Bathynellacea	Parabathynellidae	*Billibathynella cassidis*	1	Bore T411A, 11 Km ENE of Newman	-23.00550	119.01300	?	Perina, G., Scanlon, B.	Net Haul
57188	Bathynellacea	Parabathynellidae	*Billibathynella cassidis*	1	Bore F3NR, 11 Km ENE of Newman	-23.00550	119.01400	?	Perina, G., Scanlon, B.	Net Haul
57186	Bathynellacea	Parabathynellidae	*Billibathynella cassidis*	1	Bore T411A, 11 Km ENE of Newman	-23.00550	119.01300	?	Perina, G., Scanlon, B.	Net Haul
57192	Bathynellacea	Parabathynellidae	*Billibathynella* `sp. S1`	1	Area C: 110 km WNW of Newman	-23.03740	118.72700	?	Muirhead, K., Guzik, M.	Net Haul
57189	Bathynellacea	Parabathynellidae	*Billibathynella* `sp. S1`	1	110 km WNW of Newman	-23.03650	118.71400	?	Bell, P., Moulds, T.	Net Haul
57190	Bathynellacea	Parabathynellidae	*Billibathynella* `sp. S1`	1	110 km WNW of Newman	-23.03650	118.71400	?	Bell, P., Moulds, T.	Net Haul
57193	Bathynellacea	Parabathynellidae	*Billibathynella* `sp. S1`	1	Area C: 110 km WNW of Newman	-23.03740	118.72700	?	Muirhead, K., Guzik, M.	Net Haul
57194	Bathynellacea	Parabathynellidae	*Billibathynella* `sp. S1`	1	Area C: 110 km WNW of Newman	-23.03810	118.74500	?	Bell, P., Vine, B.	Net Haul
57195	Bathynellacea	Parabathynellidae	*Billibathynella* `sp. S1`	1	Area C: 110 km WNW of Newman	-23.03810	118.74500	?	Bell, P., Vine, B.	Net Haul
57196	Bathynellacea	Parabathynellidae	*Billibathynella* `sp. S1`	1	Area C: 110 km WNW of Newman	-23.03810	118.74500	?	Bell, P., Vine, B.	Net Haul
60067	Cyclopoida	Cyclopidae	*Anzcyclops* sp. OB	1	Bore OB23REG1	-23.00520	119.01400	?	G. Perina, S. Eberhard	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
28649	Cyclopoida	Cyclopidae	*Australoeucyclops karaytugi*	1	Surface Pool, Weeli Wolli Spring, Pilbara	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
28648	Cyclopoida	Cyclopidae	*Australoeucyclops karaytugi*	1	Surface Pool, Weeli Wolli Spring, Pilbara	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
34056	Cyclopoida	Cyclopidae	*Diacyclops cockingi*	1	Bou-Rouche Pump, Weeli Wolli Spring, Pilbara	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
34057	Cyclopoida	Cyclopidae	*Diacyclops cockingi*	1	Bou-Rouche Pump, Weeli Wolli Spring, Pilbara	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
34060	Cyclopoida	Cyclopidae	*Diacyclops cockingi*	1	Bore Bh16s, Weeli Wolli Spring, Pilbara	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
28748	Cyclopoida	Cyclopidae	*Diacyclops humphreysi*	1	Bore Hd11d (00245), Weeli Wolli, Pilbara	-22.95160	119.15600	?	Humphreys, G.	Net Haul
28685	Cyclopoida	Cyclopidae	*Diacyclops humphreysi*	1	Bore Bh17d, Weeli Wolli Spring, Pilbara	-22.91860	119.20100	?	Cocking, J. & Scanlon, M.	Net Haul
28749	Cyclopoida	Cyclopidae	*Diacyclops humphreysi*	1	Bore Hdbh32s (00216), Weeli Wolli, Pilbara	-22.91660	119.20000	?	Humphreys, G.	Net Haul
28722	Cyclopoida	Cyclopidae	*Diacyclops humphreysi*	1	Surface Pool, Weeli Wolli Spring, Pilbara	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
28683	Cyclopoida	Cyclopidae	*Diacyclops humphreysi*	1	Bore Wb04, Yandi, Pilbara	-22.79360	119.29800	?	Cocking, J. & Scanlon, M.	Net Haul
28607	Cyclopoida	Cyclopidae	*Diacyclops sobeprolatus*	1	Bore Bh17s, Weeli Wolli Spring, Pilbara	-22.91860	119.20100	?	Cocking, J. & Scanlon, M.	Net Haul
34040	Cyclopoida	Cyclopidae	*Diacyclops sobeprolatus*	1	Bore W218, Ob23 (Ore Body 23, About 4.5 Km N	-22.91860	119.20100	?	Humphreys, G., Bradbury, J. & Armstrong, K.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
60654	Cyclopoida	Cyclopidae	*Dussartcyclops* `sp. B10`	1	Coondewanna Flat, ca. 80 km NW. Newman	-23.00800	118.81200	?	Cocking, J.S., Main, D.C.	Net Haul
54622	Cyclopoida	Cyclopidae	*Mesocyclops brooksi*	1	Fortescue Catchment	-23.00580	119.01600	?	Bell, P., Catomore, S.	Net Haul
28663	Cyclopoida	Cyclopidae	*Mesocyclops holynskae*	1	Surface Pool, Weeli Wolli Spring, Pilbara	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
28662	Cyclopoida	Cyclopidae	*Mesocyclops holynskae*	1	Surface Pool, Weeli Wolli Spring, Pilbara	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
28661	Cyclopoida	Cyclopidae	*Mesocyclops holynskae*	1	Surface Pool, Weeli Wolli Spring, Pilbara	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
70254	Cyclopoida	Cyclopidae	*Metacyclops* `B01 (nr *pilbaricus*)`	1	c.a. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
70255	Cyclopoida	Cyclopidae	*Metacyclops* `B01 (nr *pilbaricus*)`	1	c.a. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
70256	Cyclopoida	Cyclopidae	*Microcyclops varicans*	1	c.a. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
70250	Cyclopoida	Cyclopidae	*Microcyclops varicans*	1	c.a. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
70253	Cyclopoida	Cyclopidae	*Microcyclops varicans*	1	c.a. 113 km WNW of Newman	-23.14200	118.64700	?	Callan, S., Volschenk, E.S.	Net Haul
70252	Cyclopoida	Cyclopidae	*Microcyclops varicans*	1	c.a. 113 km WNW of Newman	-23.14200	118.64700	?	Callan, S., Volschenk, E.S.	Net Haul
70251	Cyclopoida	Cyclopidae	*Microcyclops varicans*	1	c.a. 113 km WNW of Newman	-23.14200	118.64700	?	Callan, S., Volschenk, E.S.	Net Haul
70175	Cyclopoida	Cyclopidae	*Microcyclops varicans*	1	ca. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
70242	Cyclopoida	Cyclopidae	*Microcyclops varicans*	1	c.a. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
70243	Cyclopoida	Cyclopidae	*Microcyclops varicans*	1	c.a. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
70246	Cyclopoida	Cyclopidae	*Microcyclops varicans*	1	c.a. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
70247	Cyclopoida	Cyclopidae	*Microcyclops varicans*	1	c.a. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
60065	Cyclopoida	Cyclopidae	nr. *Pilbaracyclops* sp. OB	1	Bore WP56	-23.00500	119.01400	?	G. Perina, B. Scanlon	Net Haul
60066	Cyclopoida	Cyclopidae	nr. *Pilbaracyclops* sp. OB	1	Bore W78	-23.00520	119.01400	?	G. Perina, S. Eberhard	Net Haul
67618	Cyclopoida	Cyclopidae	*Thermocyclops* sp.	1	c.a. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
67619	Cyclopoida	Cyclopidae	*Thermocyclops* sp.	1	c.a. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
70249	Harpacticoida	Canthocamptidae	*Australocamptus* `sp. B13`	1	c.a. 113 km WNW of Newman	-23.14200	118.64700	?	Callan, S., Volschenk, E.S.	Net Haul
70245	Harpacticoida	Canthocamptidae	*Australocamptus* `sp. B13`	1	c.a. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
70248	Harpacticoida	Canthocamptidae	*Australocamptus* `sp. B13`	1	c.a. 113 km WNW of Newman	-23.13850	118.63500	?	Callan, S., Volschenk, E.S.	Net Haul
54638	Harpacticoida	Parastenocarididae	*Parastenocaris* `sp. B25`	1	Boundary Deposit	-22.81340	118.85600	?	Cocking, J.S., Pearson, G.B.	Net Haul
70244	Harpacticoida	Parastenocarididae	*Parastenocaris* `sp. Indet.`	1	c.a. 113 km WNW of Newman	-23.14200	118.64700	?	Callan, S., Volschenk, E.S.	Net Haul
60064	Isopoda	Microcerberidae	*Coxicerberus* sp. OB2	1	Bore W115	-23.00520	119.01400	?	G. Perina, B. Scanlon	Net Haul
61299	Isopoda	Tainisopidae	*Pygolabis*	1	PSS182, well GNHSLK1236, Fortescue	-23.12120	119.17200	?		Net Haul
54538	Isopoda	Tainisopidae	*Pygolabis humphreysi*	1	Fortescue Catchment	-23.00470	119.01400	?	Catomore, S., Coen, N.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
54536	Isopoda	Tainisopidae	*Pygolabis humphreysi*	1	Fortescue Catchment	-23.00660	119.01300	?	Catomore, S., Coen, N.	Net Haul
54537	Isopoda	Tainisopidae	*Pygolabis humphreysi*	1	Fortescue Catchment	-23.00520	119.01400	?	Catomore, S., Coen, N.	Net Haul
54539	Isopoda	Tainisopidae	*Pygolabis humphreysi*	1	Fortescue Catchment	-23.00520	119.01400	?	Catomore, S., Coen, N.	Net Haul
54540	Isopoda	Tainisopidae	*Pygolabis humphreysi*	1	Fortescue Catchment	-23.00520	119.01400	?	Catomore, S., Coen, N.	Net Haul
54541	Isopoda	Tainisopidae	*Pygolabis humphreysi*	1	Fortescue Catchment	-23.00520	119.01400	?	Catomore, S., Coen, N.	Net Haul
34948	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	1	Weeli Wolli Area, Pilbara, Bore Bh32s	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
61289	Isopoda	Tainisopidae	*Pygolabis* `sp. 6`	1	`Giles`, 55 km WNW of Newman, GMP022, Spearho	-23.28830	119.19300	?	W.F. Humphreys	Net Haul
61290	Isopoda	Tainisopidae	*Pygolabis* `sp. 6`	1	`Giles`, 55 km WNW of Newman, GMP077, Spearho	-23.29000	119.18700	?	W.F. Humphreys	Net Haul
54639	Isopoda	Tainisopidae	*Pygolabis* `sp.`	1	Boundary Deposit	-22.80350	118.85600	?	Cocking, J.S., Pearson, G.B.	Net Haul
51439	Ostracoda		Ostracoda	1	ca 67 km heading 299° from Newman	-23.11010	119.12800	?	Leung, A.	Net Haul
28422	Podocopida	Candonidae	*Deminutiocandona mica*	1	Bou-Rouche Pump, Weeli Wolli Spring, Pilbara	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
28420	Podocopida	Candonidae	*Deminutiocandona mica*	1	Bou-Rouche Pump, Weeli Wolli Spring, Pilbara	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
28421	Podocopida	Candonidae	*Deminutiocandona mica*	1	Bou-Rouche Pump, Weeli Wolli Spring, Pilbara	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
52164	Podocopida	Candonidae	*Meridiescandona lucerna*	1	Upper Weeli Wolli	-22.93330	119.21700	?	Pearson, G.B., Main, D.C.	Net Haul
35670	Podocopida	Candonidae	*Meridiescandona marillanae*	1	Marillana, Yjdd239, Pilbara Region	-22.95690	119.25300	?	Cocking, J. & Barron, H.	Net Haul
52165	Podocopida	Candonidae	*Meridiescandona marillanae*	1	Rhodes Ridge	-23.05000	119.26700	?	Curran, M.K., Main, D.C.	Net Haul
35672	Podocopida	Candonidae	*Meridiescandona marillanae*	1	Marillana, Yjdd239, Pilbara Region	-22.95690	119.25300	?	Cocking, J. & Barron, H.	Net Haul
35671	Podocopida	Candonidae	*Meridiescandona marillanae*	1	Marillana, Yjdd239, Pilbara Region	-22.95690	119.25300	?	Cocking, J. & Barron, H.	Net Haul
28266	Podocopida	Candonidae	*Notacandona boultoni*	1	Weeliwolli Spring (B-R)	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
28267	Podocopida	Candonidae	*Notacandona boultoni*	1	Weeliwolli Spring (B-R)	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
28264	Podocopida	Candonidae	*Notacandona modesta*	1	Weeliwolli Spring (B-R)	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
28263	Podocopida	Candonidae	*Notacandona modesta*	1	Weeliwolli Spring (B-R)	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
28262	Podocopida	Candonidae	*Notacandona modesta*	1	Weeliwolli Spring (B-R)	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
70184	Podocopida	Candonidae	*Notocandona gratia*	1	ca. 113 km WNW of Newman	-23.14200	118.64700	?	Callan, S., Volschenk, E.S.	Net Haul
57713	Podocopida	Limnocytheridae	*Gomphodella yandii*	1	borehole MNEW1upstream -501	-22.76910	119.20100	?		Net Haul
57714	Podocopida	Limnocytheridae	*Gomphodella yandii*	1	borehole Mar01-0611-02	-22.78050	119.18000	?	Alexander, J.	Net Haul
57712	Podocopida	Limnocytheridae	*Gomphodella yandii*	1	borehole Marillana 01-504	-22.78050	119.18000	?		Net Haul
57715	Podocopida	Limnocytheridae	*Gomphodella yandii*	1	borehole Mar01-P7-01	-22.78050	119.18000	?		Net Haul
52171	Podocopida	Limnocytheridae	*Gomphodella yandii*	1	Upper Weeli Wolli	-22.91660	119.20000	?	Cocking, J.S., Main, D.C.	Net Haul
51867	Podocopida	Lymnocytheridae	*Gomphodella alexanderi*	1	Newman	-22.78050	119.18000	?	Alexander, J.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
51868	Podocopida	Lymnocytheridae	*Gomphodella alexanderi*	1	Newman	-22.78050	119.18000	?	Alexander, J.	Net Haul
51871	Podocopida	Lymnocytheridae	*Gomphodella alexanderi*	1	Newman	-22.78050	119.18000	?	Alexander, J.	Net Haul
51869	Podocopida	Lymnocytheridae	*Gomphodella alexanderi*	1	Newman	-22.78050	119.18000	?	Alexander, J.	Net Haul
51870	Podocopida	Lymnocytheridae	*Gomphodella alexanderi*	1	Newman	-22.78050	119.18000	?	Alexander, J.	Net Haul
51872	Podocopida	Lymnocytheridae	*Gomphodella alexanderi*	1	Newman	-22.77270	119.20800	?	Alexander, J.	Net Haul
51244	Syncarida	Parabathynellidae	*Atopobathynella* sp. B07	1	Iron Valley	-22.74740	119.30400	?	Pearson, G.B. & Bennett, S.R.	Net Haul
60659	Syncarida	Parabathynellidae	nr *Billibathynella* `sp. B02`	1	Boundary Ridge North, ca. 87 km SSE. Wittenoo	-23.01890	118.72400	?	Cocking, J.S., Main, D.C.	Net Haul
54530	Amphipoda	Paramelitidae	Paramelitidae sp. OB3	2	Fortescue Catchment	-23.00520	119.01400	?	Catomore, S., Coen, N.	Net Haul
51230	Amphipoda	Paramelitidae	*Chydaekata* sp. E	2	Iron Valley	-22.73470	119.31000	?	Scanlon, M.D.& Main, D.C.	Net Haul
60649	Amphipoda	Paramelitidae	*Chydaekata* `sp. E`	2	Upper Weeli Wolli, ca. 70 km NW. Newman	-22.90400	119.21500	?	Curran, M.K., Main, D.C.	Net Haul
52166	Amphipoda	Paramelitidae	Genus 2 sp. B02	2	Upper Weeli Wolli	-22.91660	119.20000	?	Curran, M.K., Main, D.C.	Net Haul
52167	Amphipoda	Paramelitidae	Genus 2 sp. B03	2	Upper Weeli Wolli	-22.91660	119.20000	?	Curran, M.K., Main, D.C.	Net Haul
54633	Amphipoda	Paramelitidae	*Maarrka weeliwollii*	2	Boundary Deposit	-22.81400	118.87400	?	Cocking, J.S., Pearson, G.B.	Net Haul
57312	Bathynellacea	Bathynellidae	*Pilbaranella ethelensis*	2	Bore W088	-23.00630	119.01400	?	G. Perina & B. Scanlon	Net Haul
57191	Bathynellacea	Parabathynellidae	*Billibathynella* `sp. S1`	2	Area C: 110 km WNW of Newman	-23.03740	118.72700	?	Muirhead, K., Guzik, M.	Net Haul
70177	Cyclopoida		Cyclopoida	2	ca. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
28650	Cyclopoida	Cyclopidae	*Australoeucyclops karaytugi*	2	Surface Pool, Weeli Wolli Spring, Pilbara	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
37305	Cyclopoida	Cyclopidae	*Diacyclops humphreysi*	2	Bore Wb04, Yandi, Pilbara	-22.79360	119.29800	?	Cocking, J. & Scanlon, M.	Net Haul
28684	Cyclopoida	Cyclopidae	*Diacyclops humphreysi*	2	Bore Bh17d, Weeli Wolli Spring, Pilbara	-22.91860	119.20100	?	Cocking, J. & Scanlon, M.	Net Haul
70231	Cyclopoida	Cyclopidae	*Metacyclops* `B01 (nr *pilbaricus*)`	2	c.a. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
70236	Cyclopoida	Cyclopidae	*Microcyclops varicans*	2	c.a. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
54623	Cyclopoida	Cyclopoidae	*Thermocyclops aberrans*	2	Fortescue Catchment	-23.00500	119.01400	?	Coen, N., Catomore, S.	Net Haul
37344	Harpacticoida	Ameiridae	*Gordanitocrella trajani*	2	Pilbara	-23.00250	119.13200	?	Cocking, J. & Scanlon, M.	Net Haul
60658	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	2	Upper Weeli Wolli, ca. 70 km NW. Newman	-22.91730	119.20600	?	Curran, M.K., Main, D.C.	Net Haul
51532	Ostracoda		Ostracoda	2	ca 77.5 km heading 287.6° from Newman	-23.14750	118.99700	?	Leung, A.	Net Haul
51526	Ostracoda		Ostracoda	2	ca 73.9 km heading 289.8 ° from Newman	-23.13360	119.05100	?	Leung, A.	Net Haul
28417	Podocopida	Candonidae	*Meridiescandona facies*	2	Yandicoogina Mine, 80 Km N Of Newman	-22.81660	119.26700	?	Anstee, S.	Net Haul
28268	Podocopida	Candonidae	*Notacandona boultoni*	2	Weeliwolli Spring (B-R)	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
28265	Podocopida	Candonidae	*Notacandona modesta*	2	Weeliwolli Spring (B-R)	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
52158	Amphipoda	Paramelitidae	*Chydaekata* sp. E	3	Upper Weeli Wolli	-22.91660	119.20000	?	Curran, M.K., Main, D.C.	Net Haul
54634	Bathynellacea	Parabathynellidae	Parabathynellidae `sp. B08`	3	Boundary Deposit	-22.81430	118.85600	?	Cocking, J.S., Pearson, G.B.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
51536	Bathynellacea	Parabathynellidae	Parabathynellidae `won1`	3	ca 74 km heading 290.7° from Newman	-23.12180	119.06200	?	Leung, A.	Net Haul
34063	Cyclopoida	Cyclopidae	*Diacyclops cockingi*	3	Bore Bh17s, Weeli Wolli Spring, Pilbara	-22.91860	119.20100	?	Cocking, J. & Scanlon, M.	Net Haul
34059	Cyclopoida	Cyclopidae	*Diacyclops cockingi*	3	Bore Bh32s, Weeli Wolli Spring, Pilbara	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
70171	Cyclopoida	Cyclopidae	*Metacyclops* `B01` (nr *pilbaricus*)	3	ca. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
70181	Cyclopoida	Cyclopidae	*Microcyclops varicans*	3	ca. 113 km WNW of Newman	-23.14200	118.64700	?	Callan, S., Volschenk, E.S.	Net Haul
51528	Harpacticoida		Harpacticoida	3	ca 72.1km heading 291.1° from Newman	-23.12090	119.07500	?	Leung, A.	Net Haul
52168	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	3	Upper Weeli Wolli	-22.91660	119.20000	?	Curran, M.K., Main, D.C.	Net Haul
34950	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	3	Weeli Wooli Area, Pilbara, Bore Bh32s	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
34949	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	3	Weeli Wolli Area, Pilbara, Bore Bh32s	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
52163	Podocopida	Candonidae	*Meridiescandona facies*	3	Upper Weeli Wolli	-23.00000	119.11700	?	Cocking, J.S., Scanlon, M.D.	Net Haul
51235	Amphipoda	Paramelitidae	Paramelitidae sp. B26	4	Iron Valley	-22.71830	119.31600	?	Scanlon, M.D.& Main, D.C.	Net Haul
54637	Amphipoda	Paramelitidae	Paramelitidae `sp. B16`	4	Boundary Deposit	-22.81480	118.87600	?	Cocking, J.S., Pearson, G.B.	Net Haul
57301	Bathynellacea	Bathynellidae	Bathynellidae	4	Bore W262	-23.00500	119.01400	?	G. Perina & S. Eberhard	Net Haul
51523	Cyclopoida		Cyclopoida	4	ca 73.9 km heading 289.8 ° from Newman	-23.13360	119.05100	?	Leung, A.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
60652	Cyclopoida	Cyclopidae	*Diacyclops cockingi*	4	Upper Weeli Wolli, ca. 70 km NW. Newman	-22.92430	119.19700	?	Curran, M.K., Main, D.C.	Net Haul
60653	Cyclopoida	Cyclopidae	*Diacyclops humphreysi*	4	Upper Weeli Wolli, ca. 70 km NW. Newman	-22.90400	119.21500	?	Curran, M.K., Main, D.C.	Net Haul
70238	Cyclopoida	Cyclopidae	*Microcyclops varicans*	4	c.a. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
70233	Cyclopoida	Cyclopidae	*Microcyclops varicans*	4	c.a. 113 km WNW of Newman	-23.14200	118.64700	?	Callan, S., Volschenk, E.S.	Net Haul
70234	Cyclopoida	Cyclopidae	*Microcyclops varicans*	4	c.a. 113 km WNW of Newman	-23.14200	118.64700	?	Callan, S., Volschenk, E.S.	Net Haul
70235	Cyclopoida	Cyclopidae	*Microcyclops varicans*	4	c.a. 113 km WNW of Newman	-23.14200	118.64700	?	Callan, S., Volschenk, E.S.	Net Haul
51833	Harpacticoida	Ameiridae	*Nitocrella karanovici*	4	EEX917	-23.00520	119.01400	?	Catomore, S. & Coen, N.	Net Haul
51242	Ostracoda	Candonidae	*Meridiescandona lucerna*	4	Iron Valley	-22.71830	119.31900	?	Scanlon, M.D.& Main, D.C.	Net Haul
28418	Podocopida	Candonidae	*Meridiescandona facies*	4	Yandicoogina Mine, 80 Km N Of Newman	-22.81660	119.26700	?	Anstee, S.	Net Haul
28419	Podocopida	Candonidae	*Meridiescandona facies*	4	Yandicoogina Mine, 80 Km N Of Newman	-22.83330	119.25000	?	Anstee, S.	Net Haul
51233	Amphipoda	Paramelitidae	Paramelitidae sp. B02	5	Iron Valley	-22.73470	119.31000	?	Scanlon, M.D.& Main, D.C.	Net Haul
54547	Bathynellacea	Bathynellidae	*Pilbaranella ethelensis*	5	Fortescue Catchment	-23.00630	119.01400	?	Catomore, S., Bell, P.	Net Haul
70182	Cyclopoida		Cyclopoida	5	ca. 113 km WNW of Newman	-23.13850	118.63500	?	Callan, S., Volschenk, E.S.	Net Haul
52159	Cyclopoida	Cyclopidae	*Diacyclops cockingi*	5	Upper Weeli Wolli	-22.93330	119.13300	?	Pearson, G.B., Quartermaine, J.W.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
70237	Cyclopoida	Cyclopidae	*Microcyclops varicans*	5	c.a. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
70232	Cyclopoida	Cyclopidae	*Microcyclops varicans*	5	c.a. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
51527	Harpacticoida		Harpacticoida	5	ca 73.9 km heading 289.8 ° from Newman	-23.13360	119.05100	?	Leung, A.	Net Haul
28423	Podocopida	Candonidae	*Deminutiocandona mica*	5	Bou-Rouche Pump, Weeli Wolli Spring, Pilbara	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
51232	Amphipoda	Paramelitidae	Paramelitidae sp. B01	6	Iron Valley	-22.73110	119.31200	?	Scanlon, M.D.& Main, D.C.	Net Haul
54526	Amphipoda	Paramelitidae	Paramelitidae sp. OB1	6	Fortescue Catchment	-23.00550	119.01300	?	Catomore, S., Bell, P.	Net Haul
70165	Bathynellacea	Bathynellidae	Bathynellidae `1614-01`	6	ca. 113 km WNW of Newman	-23.13850	118.63500	?	Callan, S., Volschenk, E.S.	Net Haul
57296	Bathynellacea	Bathynellidae	*Pilbaranella ethelensis*	6	Bore W088	-23.00630	119.01400	?	G. Perina & S. Eberhard	Net Haul
52170	Bathynellacea	Parabathynellidae	*Atopobathynella* sp. B04	6	Orebody 13	-22.96660	119.25000	?	Pearson, G.B., Main, D.C.	Net Haul
70173	Cyclopoida	Cyclopidae	*Microcyclops varicans*	6	ca. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
34104	Cyclopoida	Cyclopidae	*Microcyclops varicans*	6	Surface Pool, Weeli Wolli Spring, Pilbara	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
51441	Cyclopoida		Cyclopoida	7	ca 67 km heading 299° from Newman	-23.10900	119.12800	?	Leung, A.	Net Haul
52160	Cyclopoida	Cyclopidae	*Diacyclops humphreysi*	7	Upper Weeli Wolli	-22.91660	119.18300	?	Cocking, J.S., Scanlon, M.D.	Net Haul
51535	Harpacticoida		Harpacticoida	7	ca 74 km heading 290.7° from Newman	-23.12180	119.06200	?	Leung, A.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
51834	Harpacticoida	Ameiridae	*Nitocrella karanovici*	7	EEX917	-23.00520	119.01400	?	Catomore, S. & Bell, P.	Net Haul
70241	Harpacticoida	Canthocamptidae	*Australocamptus* `sp. B13`	7	c.a. 113 km WNW of Newman	-23.14200	118.64700	?	Callan, S., Volschenk, E.S.	Net Haul
51241	Isopoda	Tainisopidae	*Pygolabis* sp. B06	7	Iron Valley	-22.73470	119.31000	?	Scanlon, M.D.& Main, D.C.	Net Haul
51537	Ostracoda		Ostracoda	7	ca 74 km heading 290.7° from Newman	-23.12180	119.06200	?	Leung, A.	Net Haul
60651	Amphipoda	Paramelitidae	Paramelitidae `sp. B03`	8	Boundary Ridge North, ca. 87 km SSE. Wittenoo	-23.01890	118.72400	?	Cocking, J.S., Main, D.C.	Net Haul
60655	Harpacticoida	Ameiridae	*Gordonitocrella trajani*	8	Upper Weeli Wolli, ca. 70 km NW. Newman	-22.91730	119.20600	?	Curran, M.K., Main, D.C.	Net Haul
51243	Ostracoda	Candonidae	*Meridiescandona* sp. BOS 171	8	Iron Valley	-22.74010	119.31300	?	Scanlon, M.D.& Main, D.C.	Net Haul
51524	Ostracoda		Ostracoda	8	ca 73.9 km heading 289.8 ° from Newman	-23.13360	119.05100	?	Leung, A.	Net Haul
51239	Copepoda	Cyclopidae	*Thermocyclops aberrans*	9	Iron Valley	-22.74730	119.30900	?	Scanlon, M.D.& Main, D.C.	Net Haul
51533	Cyclopoida		Cyclopoida	9	ca 77.5 km heading 287.6° from Newman	-23.14750	118.99700	?	Leung, A.	Net Haul
52161	Cyclopoida	Ameiridae	*Gordonitocrella trajani*	9	Upper Weeli Wolli	-22.91660	119.18300	?	Cocking, J.S., Scanlon, M.D.	Net Haul
37340	Harpacticoida	Ameiridae	*Gordanitocrella trajani*	9	Pilbara	-22.79220	119.30900	?	Hancock, P.	Net Haul
70166	Bathynellacea	Bathynellidae	Bathynellidae `1614-01`	10	ca. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
70240	Harpacticoida	Canthocamptidae	*Australocamptus* `sp. B13`	10	c.a. 113 km WNW of Newman	-23.13850	118.63500	?	Callan, S., Volschenk, E.S.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
51440	Ostracoda		Ostracoda	10	ca 67 km heading 299° from Newman	-23.10900	119.12800	?	Leung, A.	Net Haul
54636	Amphipoda	Paramelitidae	Genus 2 `sp. B02`	11	Boundary Deposit	-22.80350	118.85600	?	Cocking, J.S., Pearson, G.B.	Net Haul
48105	Ostracoda		Ostracoda	11	Yandi Stygofauna; 74.4km NW of Newman	-22.83750	119.27200	?	Alexander, J.	Net Haul
54546	Bathynellacea	Bathynellidae	Bathynellidae sp. OB2	12	Fortescue Catchment	-23.00500	119.01400	?	Catomore, S., Bell, P.	Net Haul
51237	Copepoda	Cyclopidae	*Diacyclops humphreysi*	12	Iron Valley	-22.71380	119.31600	?	Pearson, G.B. & Bennett, S.R.	Net Haul
70179	Cyclopoida		Cyclopoida	12	ca. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
51436	Ostracoda		Ostracoda	12	ca 67 km heading 299° from Newman	-23.11010	119.12800	?	Leung, A.	Net Haul
70178	Cyclopoida		Cyclopoida	14	ca. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
51529	Bathynellacea	Parabathynellidae	Parabathynellidae `won1`	15	ca 72.1km heading 291.1° from Newman	-23.12090	119.07500	?	Leung, A.	Net Haul
60988	Popocopida	Cyprididae	*Cypretta seurati*	15	Packsaddle East, ca. 73 km NW. Newman	-22.90950	119.19300	?	Curran, M.K., Main, D.C.	Net Haul
70239	Harpacticoida	Canthocamptidae	*Australocamptus* `sp. B13`	16	c.a. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
54632	Copepoda	Cyclopidae	*Diacyclops humphreysi*	17	Boundary Deposit	-22.81480	118.87200	?	Cocking, J.S., Pearson, G.B.	Net Haul
51238	Copepoda	Cyclopidae	*Microcyclops varicans*	18	Iron Valley	-22.74730	119.30900	?	Scanlon, M.D.& Main, D.C.	Net Haul
51525	Cyclopoida		Cyclopoida	20	ca 73.9 km heading 289.8 ° from Newman	-23.13360	119.05100	?	Leung, A.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
51234	Amphipoda	Paramelitidae	Paramelitidae sp. B16	23	Iron Valley	-22.74740	119.30100	?	Scanlon, M.D.& Main, D.C.	Net Haul
70174	Cyclopoida	Cyclopidae	*Microcyclops varicans*	25	ca. 113 km WNW of Newman	-23.14200	118.64700	?	Callan, S., Volschenk, E.S.	Net Haul
70180	Cyclopoida		Cyclopoida	29	ca. 113 km WNW of Newman	-23.14200	118.64700	?	Callan, S., Volschenk, E.S.	Net Haul
51236	Copepoda	Cyclopidae	*Diacyclops cockingi*	30	Iron Valley	-22.72170	119.33200	?	Pearson, G.B. & Bennett, S.R.	Net Haul
70183	Harpacticoida	Canthocamptidae	*Australocamptus* `sp. B13`	31	ca. 113 km WNW of Newman	-23.13850	118.63500	?	Callan, S., Volschenk, E.S.	Net Haul
70172	Cyclopoida	Cyclopidae	*Microcyclops varicans*	33	ca. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
70167	Bathynellacea	Bathynellidae	Bathynellidae `1614-01`	49	ca. 113 km WNW of Newman	-23.14200	118.64700	?	Callan, S., Volschenk, E.S.	Net Haul
70169	Bathynellacea	Parabathynellidae	Atopobathynella	49	ca. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
51437	Cyclopoida		Cyclopoida	50	ca 67 km heading 299° from Newman	-23.11010	119.12800	?	Leung, A.	Net Haul
51538	Cyclopoida		Cyclopoida	50	ca 74 km heading 290.7° from Newman	-23.12180	119.06200	?	Leung, A.	Net Haul
51530	Cyclopoida		Cyclopoida	50	ca 72.1km heading 291.1° from Newman	-23.12090	119.07500	?	Leung, A.	Net Haul
51435	Cyclopoida		Cyclopoida	50	ca 67 km heading 299° from Newman	-23.11010	119.12800	?	Leung, A.	Net Haul
51438	Harpacticoida		Harpacticoida	50	ca 67 km heading 299° from Newman	-23.11010	119.12800	?	Leung, A.	Net Haul
51531	Harpacticoida		Harpacticoida	50	ca 72.1km heading 291.1° from Newman	-23.12090	119.07500	?	Leung, A.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
48104	Ostracoda		Ostracoda	51	Yandi Stygofauna; Phase 3, 85km NW of Newman	-22.76910	119.20100	?	Alexander, J. & Lynas, J.	Net Haul
48103	Ostracoda		Ostracoda	56	Yandi Stygofauna; 85km NW of Newman	-22.76910	119.20100	?	Alexander, J.	Net Haul
48107	Ostracoda		Ostracoda	77	Yandi Stygofauna; 85km NW of Newman	-22.76910	119.20100	?	Alexander, J. & Sasche, T.	Net Haul
70176	Cyclopoida	Cyclopidae	*Microcyclops varicans*	85	ca. 113 km WNW of Newman	-23.14190	118.65500	?	Callan, S., Volschenk, E.S.	Net Haul
48101	Ostracoda		Ostracoda	85	Yandi Stygofauna; Phase 3, 85.5km NW of Newma	-22.78050	119.18000	?	Alexander, J. & Lynas, J.	Net Haul
70170	Bathynellacea	Parabathynellidae	Atopobathynella	91	ca. 113 km WNW of Newman	-23.14200	118.64700	?	Callan, S., Volschenk, E.S.	Net Haul
48102	Ostracoda		Ostracoda	97	Yandi Stygofauna; 85km NW of Newman	-22.77050	119.19700	?	Alexander, J.	Net Haul
48106	Ostracoda		Ostracoda	100	Yandi Stygofauna; 85.5km NW of Newman	-22.78050	119.18000	?	Alexander, J. & Sasche, T.	Net Haul
34058	Cyclopoida	Cyclopidae	*Diacyclops cockingi*	101	Bou-Rouche Pump, Weeli Wolli Spring, Pilbara	-22.91660	119.18300	?	Eberhard, S.M.	Net Haul
51245	Syncarida	Parabathynellidae	nr *Billibathynella* sp. B01	200	Iron Valley	-22.74740	119.30100	?	Scanlon, M.D.& Main, D.C.	Net Haul
38142	Amphipoda		Amphipoda	?	Hope Downs	-22.96000	119.15300	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
38131	Amphipoda		Amphipoda	?	Hope Downs	-23.00250	119.13100	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38132	Amphipoda		Amphipoda	?	Hope Downs	-23.00250	119.13100	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38133	Amphipoda		Amphipoda	?	Hope Downs	-22.96000	119.15300	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38134	Amphipoda		Amphipoda	?	Hope Downs	-22.96000	119.15300	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38135	Amphipoda		Amphipoda	?	Hope Downs	-22.96000	119.15300	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38137	Amphipoda		Amphipoda	?	Weeli Wolli Creek	-22.91880	119.20100	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38138	Amphipoda		Amphipoda	?	Weeli Wolli Creek	-22.91750	119.20600	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38139	Amphipoda		Amphipoda	?	Weeli Wolli Creek	-22.91750	119.20600	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38130	Amphipoda		Amphipoda	?	Hope Downs	-23.00250	119.13100	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38118	Amphipoda		Amphipoda	?	Weeli Wolli Creek	-22.92080	119.19900	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38109	Amphipoda		Amphipoda	?	Weeli Wolli Creek	-22.92020	119.19900	?	Humphreys, G.,	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
									Armstrong, K., Higgs, P.	
38110	Amphipoda		Amphipoda	?	Weeli Wolli Creek	-22.92020	119.19900	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38111	Amphipoda		Amphipoda	?	Weeli Wolli Creek	-22.92020	119.19900	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38112	Amphipoda		Amphipoda	?	Weeli Wolli Creek	-22.92020	119.19900	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38113	Amphipoda		Amphipoda	?	Weeli Wolli Creek	-22.92020	119.19900	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38114	Amphipoda		Amphipoda	?	Weeli Wolli Creek	-22.92080	119.19900	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38115	Amphipoda		Amphipoda	?	Weeli Wolli Creek	-22.92080	119.19900	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38117	Amphipoda		Amphipoda	?	Weeli Wolli Creek	-22.92080	119.19900	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38141	Amphipoda		Amphipoda	?	Hope Downs	-22.96000	119.15300	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38143	Amphipoda		Amphipoda	?	Hope Downs	-22.96000	119.15300	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38144	Amphipoda		Amphipoda	?	Hope Downs	-22.95970	119.14200	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
38158	Amphipoda		Amphipoda	?	Marillana Creek	-22.77050	119.19700	?	Armstrong, K. & Runham, P.	Net Haul
38159	Amphipoda		Amphipoda	?	Marillana Creek	-22.77250	119.19200	?	Armstrong, K. & Runham, P.	Net Haul
38160	Amphipoda		Amphipoda	?	Marillana Creek	-22.78330	119.25200	?	Armstrong, K. & Runham, P.	Net Haul
38161	Amphipoda		Amphipoda	?	Marillana Creek	-22.76660	119.19900	?	Armstrong, K. & Runham, P.	Net Haul
38164	Amphipoda		Amphipoda	?	Marillana Creek	-22.78050	119.22300	?	Armstrong, K. & Runham, P.	Net Haul
38165	Amphipoda		Amphipoda	?	Marillana Creek	-22.78500	119.24300	?	Armstrong, K. & Runham, P.	Net Haul
38166	Amphipoda		Amphipoda	?	Marillana Creek	-22.77470	119.26000	?	Armstrong, K. & Runham, P.	Net Haul
38167	Amphipoda		Amphipoda	?	Marillana Creek	-22.77470	119.26000	?	Armstrong, K. & Runham, P.	Net Haul
38157	Amphipoda		Amphipoda	?	Marillana Creek	-22.77050	119.19700	?	Armstrong, K. & Runham, P.	Net Haul
38156	Amphipoda		Amphipoda	?	Marillana Creek	-22.78550	119.23900	?	Armstrong, K. & Runham, P.	Net Haul
38146	Amphipoda		Amphipoda	?	Hope Downs	-22.95160	119.15600	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38147	Amphipoda		Amphipoda	?	Hope Downs	-22.95410	119.14500	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38148	Amphipoda		Amphipoda	?	Hope Downs	-22.95410	119.14500	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
38149	Amphipoda		Amphipoda	?	Hope Downs	-22.96020	119.16300	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38150	Amphipoda		Amphipoda	?	Weeli Wolli Creek	-22.91880	119.20100	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38152	Amphipoda		Amphipoda	?	Marillana Creek	-22.76910	119.20100	?	Armstrong, K. & Runham, P.	Net Haul
38153	Amphipoda		Amphipoda	?	Marillana Creek	-22.76910	119.20100	?	Armstrong, K. & Runham, P.	Net Haul
38155	Amphipoda		Amphipoda	?	Marillana Creek	-22.78550	119.23900	?	Armstrong, K. & Runham, P.	Net Haul
38168	Amphipoda		Amphipoda	?	Marillana Creek	-22.77470	119.26000	?	Armstrong, K. & Runham, P.	Net Haul
38145	Amphipoda		Amphipoda	?	Hope Downs	-22.95160	119.15600	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38116	Amphipoda		Amphipoda	?	Weeli Wolli Creek	-22.92080	119.19900	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38163	Amphipoda	Paramelitidae	Paramelitidae	?	Marillana Creek	-22.78050	119.22300	?	Armstrong, K. & Runham, P.	Net Haul
38170	Amphipoda	Paramelitidae	Paramelitidae	?	Marillana Creek	-22.77470	119.26000	?	Armstrong, K. & Runham, P.	Net Haul
38171	Amphipoda	Paramelitidae	Paramelitidae	?	Marillana Creek	-22.80580	119.26300	?	Armstrong, K. & Runham, P.	Net Haul
38172	Amphipoda	Paramelitidae	Paramelitidae	?	Marillana Creek	-22.82610	119.27900	?	Armstrong, K. & Runham, P.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
38151	Amphipoda	Paramelitidae	Paramelitidae	?	Weeli Wolli Creek	-22.91880	119.20100	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38140	Amphipoda	Paramelitidae	Paramelitidae	?	Weeli Wolli Creek	-22.91750	119.20600	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38162	Amphipoda	Paramelitidae	Paramelitidae	?	Marillana Creek	-22.77410	119.23700	?	Armstrong, K. & Runham, P.	Net Haul
38136	Amphipoda	Paramelitidae	Paramelitidae	?	Hope Downs	-22.95410	119.14500	?	Humphreys, G., Armstrong, K., Higgs, P.	Net Haul
38154	Amphipoda	Paramelitidae	Paramelitidae	?	Marillana Creek	-22.77440	119.22700	?	Armstrong, K. & Runham, P.	Net Haul
45492	Amphipoda	Paramelitidae	*Maarrka etheli*	?	Ethel Gorge	-23.00000	119.00000	?	Scanlon, M.D. & Barron, H.	Net Haul
38169	Amphipoda	Paramelitidae	*Maarrka* sp.	?	Marillana Creek	-22.77470	119.26000	?	Armstrong, K. & Runham, P.	Net Haul
47038	Amphipoda	Paramelitidae	*Maarrka weeliwolli*	?	Marillana	-22.79020	119.25300	?	Cocking, J.S. & Barron, H.J.	Net Haul
47037	Amphipoda	Paramelitidae	*Maarrka weeliwolli*	?	Iron Valley WW029	-22.73300	119.31200	?	Main, D.C. & Scanlon, M.D.	Net Haul
60385	Bathynellacea	Parabathynellidae	Parabathynellidae	?	Ophthalmia Dam	-23.00000	119.00000	?	Rodman, S. & Shay, B.	Net Haul
40213	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.79020	119.25300	?	Armstrong, K.	Net Haul
40214	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.79020	119.25300	?	Armstrong, K.	Net Haul
40211	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.77220	119.21700	?	Armstrong, K.	Net Haul
40156	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.77220	119.21700	?	Armstrong, K.	Net Haul
40100	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.79020	119.25300	?	Armstrong, K.	Net Haul
40151	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.79020	119.25300	?	Armstrong, K.	Net Haul
40153	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.77220	119.21700	?	Armstrong, K.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
40240	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.78500	119.24300	?	Armstrong, K.	Net Haul
40241	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.78500	119.24300	?	Armstrong, K.	Net Haul
40155	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.77220	119.21700	?	Armstrong, K.	Net Haul
40212	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.77220	119.21700	?	Armstrong, K.	Net Haul
40154	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.77220	119.21700	?	Armstrong, K.	Net Haul
40094	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.79020	119.25300	?	Armstrong, K.	Net Haul
40096	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.78500	119.24300	?	Armstrong, K.	Net Haul
40097	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.78500	119.24300	?	Armstrong, K.	Net Haul
40152	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.77220	119.21700	?	Armstrong, K.	Net Haul
40098	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.78500	119.24300	?	Armstrong, K.	Net Haul
40099	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.78500	119.24300	?	Armstrong, K.	Net Haul
40242	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.77220	119.21700	?	Armstrong, K.	Net Haul
40243	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.77220	119.21700	?	Armstrong, K.	Net Haul
40275	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Giles Mini	-23.29000	119.18700	?	Humphreys, G.	Net Haul
40274	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Giles Mini	-23.28830	119.19300	?	Humphreys, G.	Net Haul
40246	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.78500	119.24300	?	Armstrong, K.	Net Haul
40239	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.78500	119.24300	?	Armstrong, K.	Net Haul
40244	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.77220	119.21700	?	Armstrong, K.	Net Haul
40245	Isopoda	Tainisopidae	*Pygolabis humphreysi*	?	Marillana Creek	-22.77220	119.21700	?	Armstrong, K.	Net Haul
40269	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	?	Weeli Wolli Creek	-22.95410	119.14500	?	Humphreys, G.	Net Haul
40272	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	?	Weeli Wolli Creek	-23.00250	119.13100	?	Humphreys, G.	Net Haul
40215	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	?	Weeli Wolli Creek	-22.91750	119.20600	?		Net Haul
40277	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	?	Weeli Wolli Creek	-22.82220	119.26400	?		Net Haul
40278	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	?	Weeli Wolli Creek	-23.00250	119.13100	?	Humphreys, G.	Net Haul
40268	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	?	Weeli Wolli Creek	-23.00250	119.13100	?	Humphreys, G.	Net Haul
40266	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	?	Weeli Wolli Creek	-22.91750	119.20600	?		Net Haul
40265	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	?	Weeli Wolli Creek	-22.91750	119.20600	?	Humphreys, G.	Net Haul

WAM REGNO	Group	Family	Taxon	Abund.	Site	Latitude	Longitude	Sample Date	Collectors	Collection Method
40260	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	?	Weeli Wolli Creek	-22.83910	119.26400	?	Mould, L.	Net Haul
40261	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	?	Weeli Wolli Creek	-22.82130	119.28700	?	Mould, L.	Net Haul
40220	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	?	Weeli Wolli Creek	-22.91750	119.20600	?		Net Haul
40219	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	?	Weeli Wolli Creek	-22.91750	119.20600	?		Net Haul
40262	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	?	Weeli Wolli Creek	-22.91750	119.20600	?		Net Haul
40264	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	?	Weeli Wolli Creek	-23.02190	119.18600	?		Net Haul
40216	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	?	Weeli Wolli Creek	-22.91750	119.20600	?		Net Haul
40217	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	?	Weeli Wolli Creek	-22.91750	119.20600	?		Net Haul
40218	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	?	Weeli Wolli Creek	-22.91750	119.20600	?		Net Haul
40263	Isopoda	Tainisopidae	*Pygolabis weeliwolli*	?	Weeli Wolli Creek	-22.91750	119.20600	?	Humphreys, G.	Net Haul
42978	Isopoda	Tainisopidae	*Pygolabis?*	?	Marillana Creek	-22.78500	119.24300	?	Armstrong, K.	Net Haul
42979	Isopoda	Tainisopidae	*Pygolabis?*	?	Marillana Creek	-22.78500	119.24300	?	Armstrong, K.	Net Haul
42989	Isopoda	Tainisopidae	*Pygolabis?*	?	Marillana Creek	-22.77220	119.22300	?	Armstrong, K.	Net Haul
42990	Isopoda	Tainisopidae	*Pygolabis?*	?	Marillana Creek	-22.77220	119.22300	?	Armstrong, K.	Net Haul
42991	Isopoda	Tainisopidae	*Pygolabis?*	?	Marillana Creek	-22.77220	119.22300	?	Armstrong, K.	Net Haul
42977	Isopoda	Tainisopidae	*Pygolabis?*	?	Marillana Creek	-22.78500	119.24300	?	Armstrong, K.	Net Haul
42976	Isopoda	Tainisopidae	*Pygolabis?*	?	Marillana Creek	-22.78500	119.24300	?	Armstrong, K.	Net Haul
42975	Isopoda	Tainisopidae	*Pygolabis?*	?	Marillana Creek	-22.78500	119.24300	?	Armstrong, K.	Net Haul
42971	Isopoda	Tainisopidae	*Pygolabis?*	?	Marillana Creek	-22.77220	119.22300	?	Armstrong, K.	Net Haul
42965	Isopoda	Tainisopidae	*Pygolabis?*	?	Marillana Creek	-22.77220	119.22300	?	Armstrong, K.	Net Haul
42966	Isopoda	Tainisopidae	*Pygolabis?*	?	Marillana Creek	-22.77220	119.22300	?	Armstrong, K.	Net Haul
42967	Isopoda	Tainisopidae	*Pygolabis?*	?	Marillana Creek	-22.77220	119.22300	?	Armstrong, K.	Net Haul
42968	Isopoda	Tainisopidae	*Pygolabis?*	?	Marillana Creek	-22.77220	119.22300	?	Armstrong, K.	Net Haul
42969	Isopoda	Tainisopidae	*Pygolabis?*	?	Marillana Creek	-22.77220	119.22300	?	Armstrong, K.	Net Haul
42970	Isopoda	Tainisopidae	*Pygolabis?*	?	Marillana Creek	-22.77220	119.22300	?	Armstrong, K.	Net Haul
42972	Isopoda	Tainisopidae	*Pygolabis?*	?	Marillana Creek	-22.77220	119.22300	?	Armstrong, K.	Net Haul
42973	Isopoda	Tainisopidae	*Pygolabis?*	?	Marillana Creek	-22.77220	119.22300	?	Armstrong, K.	Net Haul
42974	Isopoda	Tainisopidae	*Pygolabis?*	?	Marillana Creek	-22.78500	119.24300	?	Armstrong, K.	Net Haul

Table B - 2. Western Australian Museum database search results: Arachnida.

WAM REGNO	Group	Family	FAMILY	Taxon	Abun-dance	SITE	Latitude	Longitude	Sample Date	Collectors	Collection Method
106133	Acari	Aturidae	Aturidae	*Axonopsella*	1	80.5 km NW. of Newman, site MAR06a-106	-22.78333	119.2519	4/08/2008	Alexander, J.; Lynas, J.	Net Haul
106136	Acari	Unionicolidae	Unionicolidae	*Recifella* `sp. 1`	1	85 km NW. of Newman, site Marillana MNEW1upstream-46	-22.76917	119.2014	9/10/2009	Alexander, J.; Lynas, J.; Cairnes, J.; Kierle, D.	Net Haul
106135	Acari	Unionicolidae	Unionicolidae	*Recifella* `sp. 1`	1	85 km NW. of Newman, site Marillana MNEW1upstream-46	-22.76917	119.2014	9/10/2009	Alexander, J.; Lynas, J.; Cairnes, J.; Kierle, D.	Net Haul
106132	Acari	Unionicolidae	Unionicolidae	*Recifella* `sp. 1`	1	85 km NW. of Newman, site Marillana MNEW1upstream-46	-22.76917	119.2014	9/10/2009	Alexander, J.; Lynas, J.; Cairnes, J.; Kierle, D.	Net Haul
106131	Acari	Unionicolidae	Unionicolidae	*Recifella* `sp. 1`	1	85 km NW. of Newman, site Marillana 7-103	-22.77056	119.1972	4/08/2008	Alexander, J.; Lynas, J.	Net Haul
106130	Acari	Unionicolidae	Unionicolidae	*Recifella* `sp. 1`	1	85 km NW. of Newman, site Marillana 01-015	-22.78056	119.1797	4/08/2008	Alexander, J.; Lynas, J.	Net Haul
106129	Acari	Unionicolidae	Unionicolidae	*Recifella* `sp. 1`	1	85 km NW. of Newman, site MNEW1upstream-101	-22.76917	119.2014	4/08/2008	Alexander, J.; Lynas, J.	Net Haul
127465	Acari	Unionicolidae	Unionicolidae	*Recifella*	1	Iron Valley, ca. 90 km NNW of Newman	-22.74742	119.3011	4/11/2009	Scanlon, M.D.; Main, D.C.	Net Haul

Appendix C Geological Codes for Mapped Geological Units.

Table C-1: Descriptions of bedrock geology codes relevant to the Survey area.

Code	Unit Name	Description
A-FAU-BBO	Bunjinah Formation	Pillowed and massive basaltic flows; basaltic breccia and basaltic volcanic sandstone; minor chert; amygdaloidal basalt flows occur in upper parts of formation; metamorphosed.
A-FO-OD	Fortescue Group	Dolerite dyke or sill.
A-HAD-KD	Wittenoom Formation	Thinly bedded dolomite and dolomitic shale, with minor black chert, shale, banded iron formation and sandstone.
A-HAM-CIB	Marra Mamba Iron Formation	Chert, banded iron-formation, mudstone, and siltstone; minor carbonate; metamorphosed.
A-HAU-XSL-CI	Mount McRae Shale and Mount Sylvia Formation	Mudstone, siltstone, chert, banded iron-formation, and dolomite; metamorphosed.
A-FOJ-XS-B	Jeerinah Formation	Siliciclastic sedimentary rocks, mafic volcanic rocks and minor felsic volcanic rocks; local carbonate rocks, chert, and dolerite sills.
A-FO-OD	Fortescue Group	Dolerite dyke or sill.
P_-HAB-CIB	Brockman Iron Formation	Banded iron-formation, chert, mudstone, and siltstone; metamorphosed.
P_-HAO-CI	Boolgeeda Iron Formation	Fine-grained, finely laminated iron-formation, mudstone, siltstone, and chert; metamorphosed.
P_-HAJ-XCI-OD	Weeli Wolli Formation	Banded iron-formation (commonly jaspilitic), mudstone, siltstone, and numerous dolerite sills; metamorphosed.
P_-HAW-FR	Woongarra Rhyolite	Rhyolite, rhyodacite, rhyolitic breccia, and banded iron-formation; metamorphosed.
P_-TK-S	Turee Creek Group	Mudstone, siltstone, sandstone, conglomerate, dolomite; minor diamictite, limestone and iron formation; intruded by Balgara Dolerite sills.

Table C-2: Descriptions of surface geology codes relevant to the Survey area.

Code	Unit Name	Description
Ad	Fortescue Group - mafic intrusions	Metadolerite, dolerite, gabbro; medium to coarse grained, massive grey-green rock, usually foliated.
Al	Wittenoom Formation	Calcitic dolomite, interbedded chert and shale in upper and lower parts, volcaniclastic sandstone
As	Mount McRae Shale and Mount Sylvia Formation	Interbedded shale, chert, banded iron-formation.
Ac	Marra Mamba Iron Formation	Chert, ferruginous chert, jaspilite, banded iron-formation, minor shale, siltstone, mudstone.
Ab	Bunjinah Formation	Pillowed and massive basaltic flows; basaltic breccia; and basaltic volcanic sandstone; minor chert; amygdaloidal basalt flows occur in upper parts of formation; metamorphosed.
Aw	Jeerinah Formation	Shale, sandstone, siltstone, mudstone, dolomite, local microbanded chert, jaspilite, conglomerate; fine-grained massive rhyolite; mafic tuff with local accretionary lapilli and agglomerate; thin basalt/dolerite and andesitic basalt flows.
Czk	Calcrete	Pisolitic, nodular or massive calcrete; ferruginous inclusions; calcareous cementing of bedrock and transported materials; locally with intercalated chalcedony; as low mounds, in playa lakes, or as valley calcrete; locally dissected and karstified.
Czl	Ferruginous duricrust 38498	Ferruginous duricrust, laterite; pisolitic, nodular, vuggy; may include massive to pisolitic ferruginous subsoil, mottled clays, magnesite, reworked products of ferruginous and siliceous duricrusts, calcrete, gossan; residual ferruginous saprolite
Czz	Silcrete 42026	Silcrete, silicified gravel, siliceous duricrust, siliceous breccia; opaline silica, jasperoidal chalcedony, local chrysoprase caprock over ultramafic rock
Czs	Sand plain 38499	Sand or gravel plains; may include some residual alluvium; quartz sand sheets commonly with ferruginous pisoliths or pebbles; local clay, calcrete, laterite, silcrete, silt, colluvium
Czi	Millstream Formation	Dolomite, calcareous dolomite, calcrete; with silcrete, clay, chert breccia, and local basal conglomerate.
Lc	Brockman Iron Formation	Banded iron-formation, chert, mudstone and siltstone.

Code	Unit Name	Description
Lf	Woongarra Rhyolite	Rhyolite, rhyodacite, rhyolitic volcaniclastic breccia and banded iron formation.
-Pd	Mafic, ultramafic, intermediate intrusions 74431	Dolerite, gabbro, norite, pyroxenite, peridotite, diorite, tonalite; locally metamorphosed; rare biotite rock, amphibolite
Qa	Alluvium	Channel and flood plain alluvium; gravel, sand, silt, clay, locally calcreted.
Qrc	Colluvium	Colluvium, sheetwash, talus; gravel piedmonts and aprons over and around bedrock; clay-silt-sand with sheet and nodular kankar; alluvial and aeolian sand-silt-gravel in depressions and broad valleys in Canning Basin; local calcrete, reworked laterite.
Qt	Lake deposits 38492	Lake and swamp deposits; mud, silt, evaporites, limestone; minor sand, peat

Appendix D Bore Log from Bedded Hilltop.

MB16HD1SW0006

HOLE DETAILS
PROJECT: Hope Downs 1
LOCATION: Hope Downs
DATE COMMENCED: 10/11/2016
DATE COMPLETED: 11/11/2016

DRILLING DETAILS
DRILLING COMPANY: Boart Longyear
DRILLER: Ben Watson
DRILLING METHOD: RC
HYDROGEOLOGIST: Damon Greenhalgh

LOCATION
GRID NAME: MGA94_Z50
EASTING: 715630.437
NORTHING: 7452497.757
ELEVATION: 620.737 mAHD

Shallow 40m monitoring bore in a cluster of 5 monitoring bores, designed to enable discrete sampling of groundwater from specific depths for age profiling, and also to sample gas from discrete locations at 5 depths, all above the current SWL.

Depth (mbgl)	Geology	Lithology	Lithological Description	Gamma Log	Field Notes	Well Design	Well Construction
0	Detritals		SILTY GRAVEL (ALLUVIUM): Red/brown to blue/grey, poorly sorted, fine to massive "pebble sized". Angular to well rounded gravel of predominantly BIF/Ironstone and Chert, with well rounded pisoliths (to 20%) and fine silt.	0 150	Cement/Bent Grout Gas inlet: 5m Cement/Bent Grout Gas inlet: 10m Cement/Bent Grout Gas inlet: 15m Cement/Bent Grout Gas inlet: 20m Cem/Bent Grout Bentonite Seal Gas inlet: 25m SWL 28.13m bToC on 11/11/2016 Cement/Bent Grout Penetration Rates: 10-42m : 15mins/rod Drilled to 42m to allow for fallback.		0-2m - 200mm uPVC collar Fine sand over Gravel pack 1.6-3.2mm Fine sand over Gravel pack 1.6-3.2mm Fine sand over Gravel pack 1.6-3.2mm Fine sand over Gravel pack 1.6-3.2mm Fine sand over Gravel pack 1.6-3.2mm -1 - 38m: 50mm CL 18 PVC blank casing Fine sand over Gravel pack 1.6-3.2mm 38-40m : 50mm CL18 PVC slotted casing
5							
10			CLAY(Pisolite): Dark red-brown, soft to medium plasticity clay with minor fine pisolitic gravel. Very soft/sticky 16-20m.				
15							
20			PISOLITIC CLAYEY GRAVEL: Dark brown to red-brown, f/med grained, rounded pisolitic gravel with minor ironstone in med plasticity clay.				
25			GRAVELLY LIMONITIC CLAY: Yellow/mustard to khaki and brown, soft low plasticity clay with fine, matrix supported gravelly sediment (goeth/shale). Minor Quartz.				
30			CALCRETE/CALCAREOUS CLAY: Off-white to yellow/khaki, fine to med sub-angular to sub-rounded chips of calcrete, majority clast-supported in calcareous clay (med to firm, to 30mm diameter)				
35			LIMONITIC CLAY: Yellow/mustard soft/sticky grading to high plasticity (34-36m). Pred clay, with minor gravelly fragments.				
40			CLAYEY GOETHITIC GRAVEL: Grey/brown to khaki, fine-med, angular to sub-rounded, platy fragments of goethitic gravel (semi-consolidated) in soft to med clay. Highr plasticity and % clay 40-42m.				
45							

WB17BHT0001

HOLE DETAILS
PROJECT: H1SW (BWT)
LOCATION: Bedded Hill Top
DATE COMMENCED: 29/06/2017
DATE COMPLETED: 13/07/2017

DRILLING DETAILS
DRILLING COMPANY: Boart Longyear
DRILLER: Hayden Offen/Glen Foreman
DRILLING METHOD: DTFR
HYDROGEOLOGIST: Ian Lee

LOCATION
GRID NAME: MGA 94
EASTING: 714602.004
NORTHING: 7450651.218
ELEVATION: 651.181 (TOC Steel)

Drilling: 0-6m 28" tricone coventional mud. 17 1/2" tricone conventional mud 6-51m, 17 1/2" DTFR 51-192m

Depth (mbgl)	Geology	Lithology	Lithological Description	Gamma Log	Field Notes	Well Design	Well Construction
0-70	Detritals		PISOLITE/BIF, dark red brown, dark grey, strongly weathered, hard, rounded PISOLITHS with angular BIF fragments	0 150	No water data during drilling due to mud drilling		0-6m 609mm steel collar
70-180	Dales Gorge		CLAY/BIF, light grey, red brown, pink red, soft, sticky CLAY matrix with angular, dark grey maghemite fragments and subrounded clasts, limonite weathering, magnetic		DTW 57.27mbgl 14/07/2017		0-80.3m 323mm blank steel casing (threaded couplings)
			BIF/SLT, dark grey, hard, angular maghemite fragments with 15% red brown, brown, pink brown SILT matrix				
			CLAY/SHALE, dark yellow brown, soft, sticky with firm bands				
			BIF/SILT, dark grey, angular, hard BIF with red brown, pink brown SILT matrix, 10%				
			SHALE, dark grey, hard, angular, mineralised BIF with dark yellow brown SHALE, bedded				0-191m Gravel Pack (3.2 - 6.4mm) 23 tonne
			BIF, dark grey, hard, angular with red brown, yellow brown SILT/SHALE bands, finely bedded alternating hard/soft bands				
			SHALE, dark yellow brown with thin BIF bands				
			BIF/SHALE:, mineralised, non-magnetic interbedded with yellow brown shales				80.3-190.9m 323mm slotted steel casing (threaded couplings) (3mm slots and end cap)
			SHALE, yellow brown, soft, minor dark grey BIF				
			BIF, dark grey, hard, angular, mineralised with bands of red brown SHALE		Airlift (cased hole): Duration: 12hrs Q: 7 L/s EC: 1421uS/cm pH: 8.04 Temp: 29deg C Appearance:Clear		
			SHALE, dark yellow brown, soft, slightly sticky, bedded with thin dark grey BIF				
			BIF, dark grey with minor SHALE yellow brown				
			BIF dark grey, hard, angular, non-magnetic, mineralised with SHALE, yellow brown, thin bands				
180-190	FWZ		BIF, green grey, moderately hard, angular with SHALE, yellow brown, firm, well bedded (overall colour change from grey and brown to green grey and yellow brown)				191-192m fallback 192m EOH

Appendix E Bore Logs from Baby Hope.

MB17H1SW0012

HOLE DETAILS
PROJECT: H1SW (Baby Hope)
LOCATION: H1SW (Baby Hope)
DATE COMMENCED: 15/05/2017
DATE COMPLETED: 17/05/2017

DRILLING DETAILS
DRILLING COMPANY: Foraco
DRILLER: Daniel Stewart
DRILLING METHOD: Conventional Air
HYDROGEOLOGIST: Kit Pannell

LOCATION
GRID NAME: MGA Zone 50
EASTING: 710700.403 mE
NORTHING: 7452390.455 mN
ELEVATION: 646.948 mAHD

Drilling Notes; 12 " (0 - 14m) , 8 1/2" (14 - 195m).

Depth (mbgl)	Geology	Lithology	Lithological Description	Gamma Log	Field Notes	Well Design	Well Construction
0–200	Detritals (Pisolite); Detritals (Limonite Waste); Witt Fm (West Ang Shale); Fm (Mt Newm		Detritals; Red-brown, surface waste, sub-angular to sub-rounded, large - medium fragments, minor shale Detritals; Shale and Pisolites; Red-brown, red shale (60%), lesser well rounded pisolites Detritals; Red-brown, red shale and clay dominant, lesser hydrated material, angular Detritals; Light brown-yellow, yellow shale dominant, limonite, clay bands from 44-48m and 52-56m, trace hydrated material, sub-angular Black Shale; Black, soft, trace weathered hematite Detritals; Light brown-red, clay and shale dominant, minor sub-angular to sub-rounded hydrated material Shale and Dolomite; Brown, soft red and yellow shales, lesser dolomite, angular, trace black shale and quartz Weathered BIF and Shale; Yellow-brown, highly weathered goethite and hematite BIF, sub-angular to sub-rounded, yellow and red shales, minor hydrated material, trace quartz	0 – 150	Airlift: Yield 2 L/sec, pH 8.23 , Temp 26.6degC, EC 659 uS/cm, colour: brown Time 2.5 hours Standing Water Level; 52.26mbgl 4/06/2017. Q= ~1 L/sec at 92m Q= ~6 L/sec at 116m Q= 8-10 L/sec at 152m Q= ~14 L/sec at 182m		Precollar: 0 - 14m 50mm Blank PVC class 18: 0 - 106 m 50mm Slotted PVC class 18: 106 - 190m Gravel Pack; Total: 5 tonnes 50mm End cap: 190m 195m: EOH

MB17H1SW0015

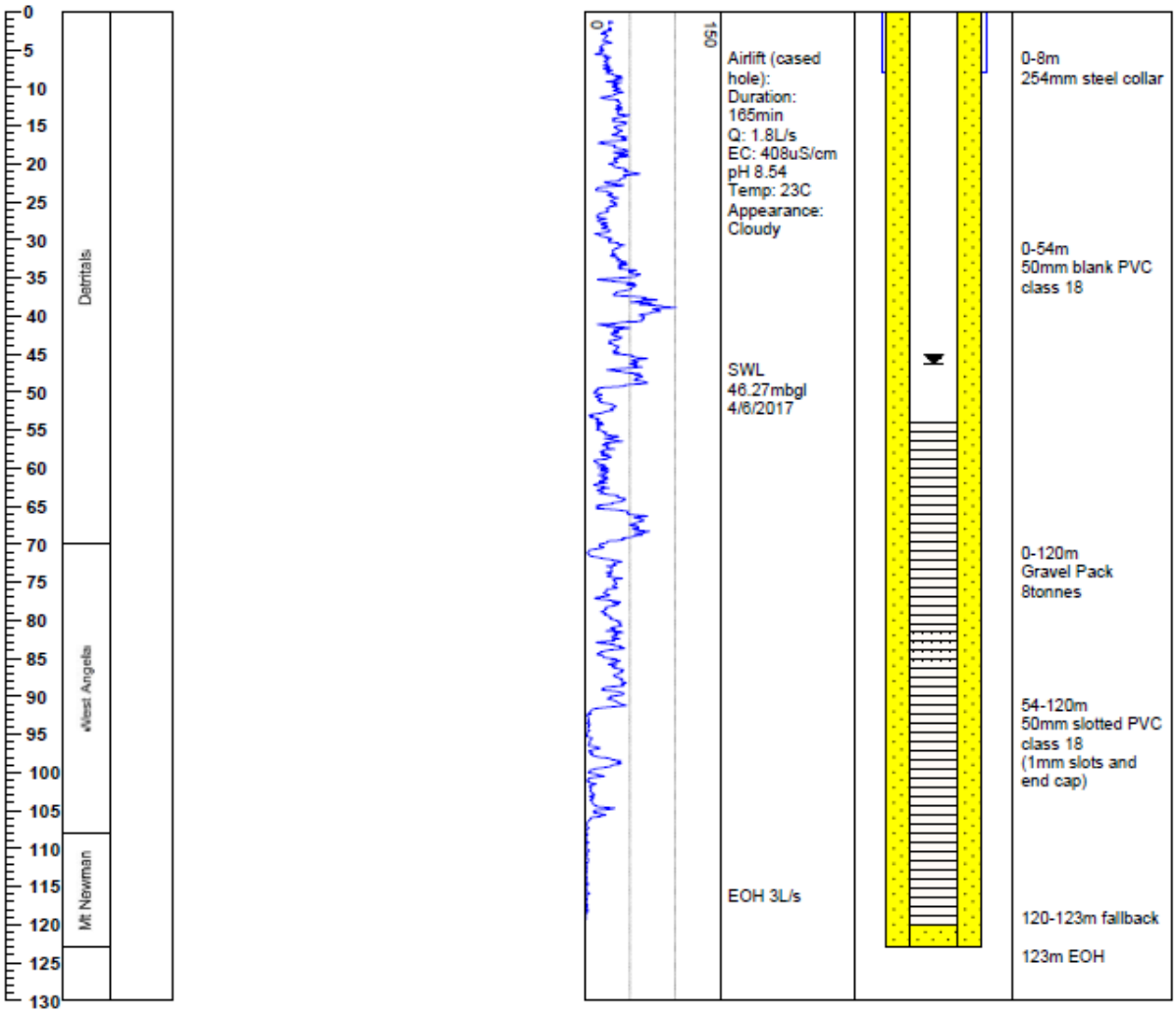
HOLE DETAILS
PROJECT: H1SW (Baby Hope)
LOCATION: H1SW (Baby Hope)
DATE COMMENCED: 21/05/17
DATE COMPLETED: 23/05/17

DRILLING DETAILS
DRILLING COMPANY: Foraco
DRILLER: Daniel Stewart
DRILLING METHOD: Reverse Circulation
HYDROGEOLOGIST: Tony Venables

LOCATION
GRID NAME: MGA Zone 50
EASTING: 707981.718 mE
NORTHING: 7452920.728 mN
ELEVATION: 663.871 mAHD

Drilling: 0-8m 14 3/4 ", 8-123m 8 1/2"

Depth (mbgl)	Geology	Lithology	Lithological Description	Gamma Log	Field Notes	Well Design	Well Construction



MB17H1SW0002

HOLE DETAILS
PROJECT: H1SW (Baby Hope)
LOCATION: H1SW (Baby Hope)
DATE COMMENCED: 07/04/2017
DATE COMPLETED: 08/04/2017

DRILLING DETAILS
DRILLING COMPANY: Foraco
DRILLER: Conrad Brown
DRILLING METHOD: Conventional Air
HYDROGEOLOGIST: John Hemson

LOCATION
GRID NAME: MGA Zone 50
EASTING: 709203.392 mE
NORTHING: 7452776.364 mN
ELEVATION: 649.494 mAHD

Drilling Notes; 12 1/4 " (0 - 8m) , 8 1/2" (8 - 80m).

Depth (mbgl)	Geology	Lithology	Lithological Description	Gamma Log	Field Notes	Well Design	Well Construction
0 - 50	Detritals		Detritals; Top cover, red brown, 80%, hard, fine fragments, SA, trace, 10% brown, hard, SA, chert, trace, 10%, brown, low plasticity clay. Detritals; Yellow brown, 40%, soft, low plasticity, clay, 40%, fine fragments, SA, hard, hydrated with GOL staining, trace, 10%, red, low plasticity, soft clay.	0 - 150	Airlift: Yield; <1L/sec, pH; 8.4, Temp; 27.2, EC; 625, colour; murky, Time: 2hrs. Standing Water Level; 51.17m 08/04/2017. First Water Strike: 56m	Precollar: 0 - 8m 50mm Blank PVC class 18: 0 - 60m Gravel Pack; Total: 5 tonnes	
50 - 80	West Ang		West Ang; Brown, 100%, shale. West Ang; Red brown, hard, SA, fine fragments, 50% BIF, 30%, soft, low plasticity, yellow clay, 20%, brown, hard, SA, chert.		Water Yields; ~2L/sec	50mm Slotted PVC class 18: 60 - 78m 50mm End cap: 78m Fallback; 78 - 80m	

Appendix F Groundwater Properties for the Survey.

Table F-1: Groundwater properties of sites sampled during the Survey. NR = Water quality not recorded.

Project Area	Site Name	Sample Phase	Sample Date	SWL (m gbl)	pH (unit)	EC (µS/cm)	DO (mg/L)	Redox (mV)	Water Temp. (C)
Baby Hope	DD17HD10002	Phase 1	30/10/2018	62.90	6.45	481	3.09	189.1	27.1
Baby Hope	HSF0065	Phase 1	02/11/2018	36.90	7.83	520	1.61	131.8	29.9
Baby Hope	MB13H1SW001	Phase 1	30/10/2018	48.98	7.04	694	3.42	183.7	29.3
Baby Hope	MB13H1SW002	Phase 1	30/10/2018	55.72	7.11	353.5	3.37	147.3	30.9
Baby Hope	MB15H1SW0003	Phase 1	29/10/2018	43.03	6.93	703	2.67	185.6	29.2
Baby Hope	MB17H1SW0002	Phase 1	30/10/2018	51.80	7.04	742	3.81	745.6	30.2
Baby Hope	MB17H1SW0005	Phase 1	29/10/2018	63.42	6.53	806	1.18	122.0	30.4
Baby Hope	MB17H1SW0010	Phase 1	29/10/2018	49.93	7.07	681	2.47	162.2	29.9
Baby Hope	MB17H1SW0011	Phase 1	28/10/2018	53.40	7.18	661	1.74	175.8	29.1
Baby Hope	MB17H1SW0012	Phase 1	02/11/2018	38.04	7.05	683	1.91	146.7	29.3
Baby Hope	MB17H1SW0016	Phase 1	30/10/2018	40.12	7.13	713	3.32	161.8	29.7
Baby Hope	MB17H1SW0017	Phase 1	30/10/2018	49.01	6.82	625	4.19	126.1	29.7
Baby Hope	RC13HD10120	Phase 1	30/10/2018	68.50	6.41	230.2	4.01	198.1	28.6
Baby Hope	RC14HD10006	Phase 1	29/10/2018	71.10	6.90	NR	0.95	-60.1	29.7
Baby Hope	RC14HD10072	Phase 1	28/10/2018	52.30	7.02	1041	1.84	197.5	28.7
Baby Hope	RC14HD10259	Phase 1	28/10/2018	NR	6.96	754	4.08	161.7	29.4
Baby Hope	RC14HD10260	Phase 1	28/10/2018	50.40	7.09	742	3.72	176.3	29.1
Baby Hope	RC14HD10292	Phase 1	28/10/2018	59.00	7.07	681	6.22	169.3	29.0
Baby Hope	WB17H1SW0003	Phase 1	30/10/2018	45.45	7.51	638	1.42	-133.6	29.2
Baby Hope	WB18HDS10001	Phase 1	30/10/2018	57.78	8.94	395.6	1.25	186.8	28.3
Baby Hope	LHRP1	Phase 1	29/10/2018	58.08	7.17	875	2.04	186.3	28.7
Baby Hope	MB13H1SW002	Phase 2	02/04/2019	56.74	7.09	641	2.88	156.6	29.4
Baby Hope	MB17H1SW0001	Phase 2	3/30/2019	53.45	7.70	641	1.23	-90.1	29.5
Baby Hope	MB17H1SW0002	Phase 2	30/03/2019	51.91	7.01	788	1.26	133.0	29.3
Baby Hope	MB17H1SW0010	Phase 2	29/03/2019	50.40	7.21	632	2.49	123.3	30.0
Baby Hope	MB17H1SW0012	Phase 2	02/04/2019	38.20	7.24	659	0.92	147.1	29.1
Baby Hope	MB17H1SW0015	Phase 2	30/03/2019	45.90	7.35	685	2.17	119.9	29.4
Baby Hope	MB17H1SW0016	Phase 2	02/04/2019	40.42	7.23	736	1.50	165.0	28.8
Baby Hope	MB17H1SW0017	Phase 2	02/04/2019	49.08	7.05	600	3.91	161.7	29.3

Project Area	Site Name	Sample Phase	Sample Date	SWL (m gbl)	pH (unit)	EC (µS/cm)	DO (mg/L)	Redox (mV)	Water Temp. (C)
Bedded Hilltop	RC18BHT0153	Phase 1	04/11/2018	66.60	NR	NR	NR	NR	NR
Bedded Hilltop	RC18BHT0174	Phase 1	27/10/2018	NR	7.13	1076	3.69	246.1	27.6
Bedded Hilltop	RC18BHT0175	Phase 1	26/10/2018	64.80	6.71	803	3.42	154.2	27.6
Bedded Hilltop	RC18BHT0218	Phase 1	04/11/2018	43.33	6.78	1019	3.40	34.7	29.8
Bedded Hilltop	RC18BHT0220	Phase 1	04/11/2018	54.61	6.75	865	0.90	67.1	29.6
Bedded Hilltop	RC18BHT0221	Phase 1	26/10/2018	74.52	6.37	977	1.39	-77.4	29.7
Bedded Hilltop	RC18BHT0222	Phase 1	26/10/2018	55.60	7.04	1081	2.83	79.5	30.0
Bedded Hilltop	RC18BHT0223	Phase 1	26/10/2018	48.60	6.53	1218	1.82	-60.7	29.2
Bedded Hilltop	RC18BHT0258	Phase 1	26/10/2018	54.00	6.99	961	2.38	107.3	29.7
Bedded Hilltop	WB17BHT0001	Phase 1	03/11/2018	57.00	7.73	1006	1.73	58.8	30.0
Bedded Hilltop	MB16HD1SW0006	Phase 1	29/10/2018	26.96	7.26	1037	1.92	171.2	29.0
Bedded Hilltop	RC18BHT0153	Phase 2	03/04/2019	63.86	7.05	991	2.10	170.0	30.4
Bedded Hilltop	RC18BHT0174	Phase 2	02/04/2019	34.31	7.09	1035	3.37	163.4	30.7
Bedded Hilltop	RC18BHT0175	Phase 2	02/04/2019	64.80	6.99	789	2.36	160.0	29.3
Bedded Hilltop	RC18BHT0218	Phase 2	04/04/2019	43.10	6.91	980	3.50	166.5	29.3
Bedded Hilltop	RC18BHT0220	Phase 2	04/04/2019	54.65	7.01	888	1.16	166.7	28.9
Bedded Hilltop	RC18BHT0222	Phase 2	31/03/2019	55.53	7.49	1064	3.49	-179.7	29.3
Bedded Hilltop	RC18BHT0223	Phase 2	31/03/2019	68.40	6.69	1156	2.00	18.3	28.7
Bedded Hilltop	RC18BHT0258	Phase 2	31/03/2019	53.10	7.07	941	1.42	129.0	29.4
Bedded Hilltop	WB17BHT0001	Phase 2	04/04/2019	57.00	7.98	891	1.36	89.1	28.1
Bedded Hilltop	MB16HD1SW0006	Phase 2	02/04/2019	27.18	7.28	1084	2.77	161.6	28.6
Hope Downs 2	GD18HD20003	Phase 1	31/10/2018	84.60	7.12	950	1.77	66.5	28.9
Hope Downs 2	MB15HD20002	Phase 1	01/11/2018	58.88	7.24	1052	3.34	158.1	27.7
Hope Downs 2	MB15HD20003	Phase 1	02/11/2018	64.19	7.13	1104	4.11	164.1	29.0
Hope Downs 2	MB18HD20003	Phase 1	31/10/2018	82.28	7.78	720	0.86	-58.7	29.4
Hope Downs 2	MB18HD20006	Phase 1	02/11/2018	70.24	7.16	1076	2.03	152.5	28.8
Hope Downs 2	MB18HD20008	Phase 1	01/11/2018	76.39	6.99	897	1.73	112.9	28.9
Hope Downs 2	MB18HD20010	Phase 1	01/11/2018	68.30	7.14	1044	2.14	142.3	28.8
Hope Downs 2	RC17HD20237	Phase 1	31/10/2018	76.50	7.30	1056	3.82	144.2	28.3
Hope Downs 2	RC17HD20240	Phase 1	01/11/2018	72.90	NR	NR	NR	NR	NR

Project Area	Site Name	Sample Phase	Sample Date	SWL (m gbl)	pH (unit)	EC (µS/cm)	DO (mg/L)	Redox (mV)	Water Temp. (C)
Hope Downs 2	RC17HD20252	Phase 1	01/11/2018	81.90	NR	NR	NR	NR	NR
Hope Downs 2	RC18HD20019	Phase 1	31/10/2018	82.80	NR	NR	NR	NR	NR
Hope Downs 2	RC18HD20071	Phase 1	31/10/2018	99.00	NR	NR	NR	NR	NR
Hope Downs 2	RC18WON0131	Phase 1	31/10/2018	53.10	7.42	1147	2.32	141.2	28.6
Hope Downs 2	WB18HD20002	Phase 1	02/11/2018	68.41	8.62	729	2.47	134.6	29.8
Hope Downs 2	GD18HD20003	Phase 2	05/04/2019	83.83	7.11	1362	1.48	125.2	30.5
Hope Downs 2	MB18HD20003	Phase 2	05/04/2019	81.98	8.28	726	0.83	137.1	29.1
Hope Downs 2	RC17HD20237	Phase 2	4/6/2019	NR	NR	NR	NR	NR	NR
Hope Downs 2	RC17HD20240	Phase 2	4/6/2019	NR	NR	NR	NR	NR	NR
Hope Downs 2	RC17HD20252	Phase 2	4/6/2019	NR	NR	NR	NR	NR	NR
Hope Downs 2	RC18HD20019	Phase 2	05/04/2019	85.68	7.34	1124	3.46	128.3	30.5
Hope Downs 2	RC18HD20071	Phase 2	05/04/2019	108.00	7.24	533	NR	179.0	28.6
Hope Downs 2	RC18WON0029	Phase 2	06/04/2019	43.12	7.44	200	5.06	144.7	28.1
Hope Downs 2	RC18WON0131	Phase 2	06/04/2019	63.32	7.54	1107	1.43	155.8	28.8
Hope Downs 2	WB16HD20001	Phase 2	05/04/2019	85.94	9.36	577	1.10	157.2	28.7
Hope Downs 2	WB18HD20002	Phase 2	04/04/2019	68.41	8.97	683	1.17	112.4	29.6
Regional Reference	LHRE19	Phase 1	03/11/2018	53.71	7.12	873	1.43	21.9	30.6
Regional Reference	LHRP7	Phase 1	03/11/2018	65.50	6.95	1010	0.77	141.4	31.6
Regional Reference	MB13HD1N006	Phase 1	03/11/2018	43.1	7.46	NR	1.26	-20.4	28.6
Regional Reference	MB16HD1N0007	Phase 1	03/11/2018	43.7	7.08	NR	1.24	172.7	27.6
Regional Reference	MB16HD1N0010	Phase 1	03/11/2018	55.07	7.42	NR	1.12	165.0	27.6
Regional Reference	WB11JND001	Phase 1	03/11/2018	45.11	7.34	545	2.95	128.1	29.6
Regional Reference	BH20s	Phase 2	30/03/2019	45.84	6.49	214.2	1.27	108.7	28.3
Regional Reference	LHRE19	Phase 2	30/03/2019	49.99	7.15	933	1.57	-35.9	30.3
Regional Reference	LHRP7	Phase 2	30/03/2019	65.19	7.06	976	1.39	117.9	31.2
Regional Reference	MB13HD1N006	Phase 2	29/03/2019	31.23	7.09	766	1.43	96.7	28.2
Regional Reference	MB16HD1N0007	Phase 2	29/03/2019	43.97	6.97	1003	1.94	133.7	29.0
Regional Reference	MB16HD1N0010	Phase 2	29/03/2019	55.34	7.49	1027	2.91	131.4	27.2
Regional Reference	WB11JND001	Phase 2	29/03/2019	45.72	7.33	533	2.33	107.5	29.2

Appendix G Molecular Analyses (Biologic 2019).







Hope Downs 1
Subterranean Fauna
Molecular Systematics Analysis

Biologic Environmental Survey

Report to Stantec Pty Ltd

November 2019



1 INTRODUCTION

Stantec Pty Ltd (Stantec) commissioned Biologic Environmental Survey (Biologic) to undertake a molecular systematics analysis (DNA barcoding) of 44 subterranean fauna (stygofauna and troglofauna) specimens collected from Rio Tinto's Hope Downs 1 (HDOW1) Project (the Study Area).

1.1 Aims and objectives

The aims and objectives of the molecular systematics analysis were to:

- Undertake DNA sequencing of 44 subterranean fauna specimens to obtain barcoding sequences of the mitochondrial gene Cytochrome Oxidase I (COI; Hebert *et al.* 2003), and the nuclear gene 12S for Zygentoma specimens;
- Investigate the interspecific and intraspecific relationships between sequences of each higher taxonomic group (i.e. use the results of the DNA analysis to indicate how many different species/ OTUs are likely to occur within each genus or relevant higher taxon, based on published species-thresholds); and
- Investigate the relationships between sequences from the HDOW1 specimens and relevant previous sequences from the wider Pilbara region, using available DNA databases (i.e. compare the results of the current analysis with accessible DNA databases to assess whether any of the species/ OTUs from the Study Area have been collected previously or more widely beyond the Study Area).

This document reports the methods and results of the molecular systematics analysis. Any remaining specimen material has been returned to Stantec, and sequence data has been incorporated within the Rio Tinto (RTIO) molecular sequence database and uploaded to GenBank as per Rio Tinto requirements.

2 METHODS

2.1 Sub-sample preparation

A total of 44 subterranean fauna specimens collected from the HDOW1 Study Area by Stantec, were sent to Biologic for molecular systematics analysis. The specimens belonged to seven different classes comprising 11 orders, nine families, and eight genera, based on morphological identifications conducted by Stantec.

Where whole specimens were submitted, Biologic undertook tissue preparation by removing a leg, briefly drying off the ethanol, and placing the tissue in ATL buffer. Where tissue was submitted, these were briefly dried and placed in ATL buffer at Biologic's laboratories. In all instances, greatest care was taken to decontaminate all tools and equipment between samples, using bleach and repeated rinsing in deionised water. Table 2.1 provides morphological identification details for each specimen included in the analysis.

Table 2.1: Specimens and tissue samples included in the analysis (ordered by taxon and lot number).

Area	Site Name	Higher taxon	Morphological ID	Sample	Lot No. (LN)	BMR Code
BBH	MB16SW0006	Amphipoda	*Pilbarus* nr *millsi* OES12	Tissue	LN35584	BMR00484
BBH	MB16HD1SW0006	Amphipoda	Amphipoda sp.	1	LN35145	BMR00488
BHT	RC18BHT0334	Blattodea	*Nocticola* OES13	1	LN33372	BMR00373
BHT	RC18BHT0254	Blattodea	*Nocticola* OES13	tissue female	LN36582	BMR00374
BHT	DD17BHT0020	Blattodea	*Nocticola* OES13	1	LN37412	BMR00376
BHT	RC18BHT0016	Blattodea	*Nocticola* OES12	1	LN35427	BMR00377
BHT	RC18BHT0001	Blattodea	*Nocticola* OES12	1	LN33391	BMR00424
HD2	RC16HD20174	Blattodea	*Nocticola* OES13	1	LN36514	BMR00425
BHT	RC18BHT0224	Blattodea	*Nocticola* OES13	1 female	LN33532	BMR00426
HD2	RC17HD20011	Blattodea	*Nocticola* OES13	1 male	LN33514	BMR00427
HD2	GD18HD20009	Blattodea	*Nocticola* OES13	1	LN39408	BMR00428
BHT	RC18BHT0258	Blattodea	*Nocticola* OES12	1	LN37424	BMR00429
BHT	RC18BHT0099	Blattodea	*Nocticola* OES12	1	LN38726	BMR00430
HD2	RC18HD20171	Blattodea	*Nocticola* OES12	1	LN34133	BMR00431
BHT	RC18BHT0308	Blattodea	*Nocticola* OES13	1	LN34509	BMR00432
BHT	RC18BHT0026	Blattodea	*Nocticola* OES12	1 female	LN37717	BMR00433
BHT	RC18BHT0016	Blattodea	*Nocticola* OES13	1	LN34142	BMR00434
BHT	RC18BHT0248	Blattodea	*Nocticola* OES13	1	LN37718	BMR00435
HD2	DD18HD20001	Blattodea	*Nocticola* OES13	1	LN35535	BMR00437
BHT	RC16BHT0291	Blattodea	*Nocticola* OES13	tissue	LN38585	BMR00485
BHT	RC18BHT0254	Blattodea	*Nocticola* OES13	tissue male	LN33574	BMR00493
BHT	RC15BHT0267	Blattodea	*Nocticola* OES13	1	LN36536	BMR00497
HD2	DD18HD20005	Chilopoda	Scolopendromorpha sp.	1	LN37426	BMR00489
HD2	RC17HD20234	Diplura	*Indjapx* OES7	1	LN33785	BMR00490
BHT	DD17BHT0020	Hemiptera	*Nisia* OES16	1	LN35425	BMR00375
BHT	RC15BHT0267	Hemiptera	*Nisia* OES16	1	LN36535	BMR00436
BHT	RC16HD10193	Hemiptera	*Phaconeura* OES15	1	LN33774	BMR00486
BHT	RC16BHT0222	Hemiptera	*Nisia* OES16	1	LN33789	BMR00487
BBH	RC14HD10072	Hemiptera	*Phaconeura* OES15	1	LN35120	BMR00553
BHT	RC18BHT0030	Hemiptera	*Phaconeura* indet	1	LN32758	BMR00554
HD2	RC18HD20120	Palpigradi	*Eukoenenia* OES2	1	LN39264	BMR00707
BHT	RC16BHT0141	Palpigradi	*Eukoenenia* OES2	1	LN39263	BMR00780
BHT	RC18BHT0100	Pauropoda	Pauropoda sp.	1	LN35790	BMR00491
BHT	RC18BHT0258	Polyxenida	Lophoproctidae sp.	1	LN38435	BMR00492
BHT	RC18BHT0248	Pseudo-scorpiones	*Tyrannochthonius* OES20	1	LN35130	BMR00779
BHT	RC15BHT0267	Schizomida	*Draculoides* ?BHD4/ BHD5	Tissue	LN37569	BMR00528
BHT	RC15BHT0267	Schizomida	*Draculoides* ?BHD4/ BHD5	Tissue	LN38573	BMR00588

Area	Site Name	Higher taxon	Morphological ID	Sample	Lot No. (LN)	BMR Code
BHT	DD17BHT0020	Schizomida	*Draculoides* ?BHD4/ BHD5	Tissue	LN35582	BMR00648
BHT	RC18BHT0026	Schizomida	*Draculoides* ?BHD4/ BHD5	Tissue	LN38567	BMR00708
BHT	RC16HD10193	Schizomida	*Draculoides* ?BHD4/ BHD5	Tissue	LN33570	BMR00775
BHT	RC16HD10193	Schizomida	*Draculoides* ?BHD4/ BHD5	Tissue	LN33590	BMR00776
BHT	DD17BHT0020	Schizomida	*Draculoides* ?BHD4/ BHD5	Tissue	LN35572	BMR00777
BHT	RC15BHT0267	Schizomida	*Draculoides* ?BHD4/ BHD5	Tissue	LN36580	BMR00778
BHT	RC15BHT0267	Zygentoma	Ateluridae sp.	1	LN39280	BMR00555

Note: HD2 = Hope Downs 2; BBH = Baby Hope; and BHT = Bedded Hill Top.

2.2 DNA extraction, amplification and sequencing

DNA extraction and sequencing methods followed Cullen and Harvey (2017, 2018), as follows:

Subsampled tissue was placed directly into ATL buffer for extraction using the *QIAGEN DN-easy* extraction kit. 20µl of proteinase K was added and incubated overnight at 56°C, immediately prior to extraction. DNA samples were amplified by Polymerase Chain Reaction (PCR) using Folmer PCR primers (LCO1490, HCO2198; Folmer *et al.* 1994) to assess the variability of COI for taxa other than Zygentoma. Zygentoma samples were amplified using 12S primers (12Sai, 12Sbi; Simon *et al.* 1994).

Resulting PCR product was sequenced by the Australian Genomic Research Facility (AGRF) Perth node. Specimen records, extraction data, PCR results, and DNA sequence data were managed using GENEIOUS v 10.1.2 (Kearse *et al.* 2012) with the Biocode plugin (http://www.mooreabiocode.org).

2.3 Analysis of sequence alignments/ divergence

Raw sequence data were edited and assembled in GENEIOUS. Consensus sequences were BLASTed against GenBank to determine nearest matches within the target higher taxonomic group. The consensus sequences were then aligned using MAFFT (Multiple Alignment using Fast Fourier Transform) algorithm (Katoh *et al.* 2002). Trees were constructed on resulting alignments using the Geneious Tree Builder using Tamura-nei Genetic Distance Model and Neighbour-joining as the Tree Build Method. Sequence data obtained using the 12S primers were edited, aligned and resulting consensus sequences BLASTed against GenBank. Regional sequences were obtained from RTIO's molecular sequence database as well as genetic data from accessible previous reports (Helix Molecular Solutions) and were included in the tree building analyses.

Lineages determined in this study were defined using molecular data with reference to morphological identifications undertaken by Stantec. These designations were specific to each higher taxon and the level of taxonomic certainty involved. Fauna-specific thresholds for determining species-level divergence were used wherever possible, based on published literature and available previous reports.

Where fauna-specific thresholds from literature or reports were not available, the assessment used average divergence thresholds for related groups or higher taxa developed by broad-level studies (e.g. Hebert *et al.* 2003).

Based on the number of specimens within each taxonomic level, DNA comparisons were typically conducted at the order level as follows:

- Amphipoda (2 specimens, plus regional comparisons);
- Blattodea (20 specimens, plus regional comparisons);
- Chilopoda (1 specimen, plus regional comparisons);
- Diplura (1 specimen, plus regional comparisons);
- Hemiptera (6 specimens, plus regional comparisons);
- Palpigradi (2 specimens, plus regional comparisons);
- Pauropoda (1 specimen, plus regional comparisons);
- Polyxenida (1 specimen, plus regional comparisons);
- Pseudoscorpiones (1 specimen, plus regional comparisons);
- Schizomida (8 specimens, plus regional comparisons); and
- Zygentoma (1 specimen, plus regional comparisons).

2.4 Constraints and Limitations

The analysis was constrained by the breadth of data available to undertake comparisons, the accessibility of pre-existing regional sequences, and the success rate of genetic sequencing, which can be affected by specimen collection, preservation, and storage methods, as well as contamination. Our understanding is that best practises were followed during specimen collection, preservation, and storage, prior to specimens arriving at Biologic. All care was taken to ensure that the risks of laboratory contamination, data handling issues, and specimen management issues were minimised within Biologic's laboratories throughout the subsampling, processing and genetic analysis. This was largely reflected in the results, with a low rate of sequence failure (5/44 sequences, or 11%) and no contaminated samples detected.

The databases used for regional comparisons were limited to Genbank, the RTIO molecular sequence database, and available data from previous genetic reports conducted for RTIO (by Helix Molecular Solutions). While these sequence databases, in combination, comprise a large portion of the subterranean fauna genetic work that has been undertaken for RTIO in the Pilbara region, it is acknowledged that there may be many other relevant sequences from third party project areas nearby or elsewhere in the region that were not available for comparison at the time of the study.

DNA barcoding using the mitochondrial gene COI, while useful for explaining genetic differences between closely-related or moderately-related species, is limited in its ability to resolve deeper phylogenies/ relationships between taxa at higher taxonomic levels (e.g. genus, family, order). In the current study, phylogenetic relationships between species/ OTUs at >25% COI divergence are treated with caution. If further resolution of deeper phylogeny is important for project goals, this could be investigated using a multiple gene approach.

3 RESULTS AND DISCUSSION

3.1 Amphipoda

Two specimens of Amphipoda (LN35584 and LN35145) were successfully sequenced from Baby Hope, from bores MB16SW0006 and MB16HD1SW0006 respectively. The two sequences showed a negligible level of divergence within their lineage (`Biologic-AMPH001`), indicating a single OTU (<0.1% COI). Stantec's morphological identifications of one of these specimens revealed a paramelitid amphipod, *Pilbarus* OES12 (nr *millsi*). The genetic results indicate that both specimens can be considered to belong to this taxon. Figure 3.1 shows a neighbour joining tree based on a comparison of 38 Amphipoda sequences from the available regional databases while Appendix 1 shows pairwise comparisons of sequences from the Study Area vs the sequence databases.

The sequences from the Study Area were not closely aligned (26%-45% COI) with any of the sequences included in these comparisons, suggesting that *Pilbarus* OES12 (nr millsi) has not been sequenced from elsewhere in the region (Figure 3.1, Appendix 1). There was a relatively high level of divergence (27%-29% COI) from previous specimens in the same taxonomic group, including *Pilbarus* and *Yilgarus* sequences from Paraburdoo/ Turee Creek, and Paramelitidae sequences from Yandi and Weeli Wolli. However, the average divergence compared to other Amphipoda taxa was the same or even higher; 29%-35% divergence from Bogidiellidae at Paraburdoo and Robe Valley, 39%-40% from *Nedsia* and Eriopsidae from Paraburdoo and Robe Valley, and 45% from Niphargidae at Tods Bore (Appendix 1).

Further genetic and morphological work may be required to validate the phylogenetic relationships of the current sequences with *Pilbarus* OES12 (nr millsi). Nevertheless, based on current results, Lineage `Biologic-AMPH001`/ *Pilbarus* OES12 (nr millsi) appears to represent a new/ unique OTU currently known only from the Study Area.

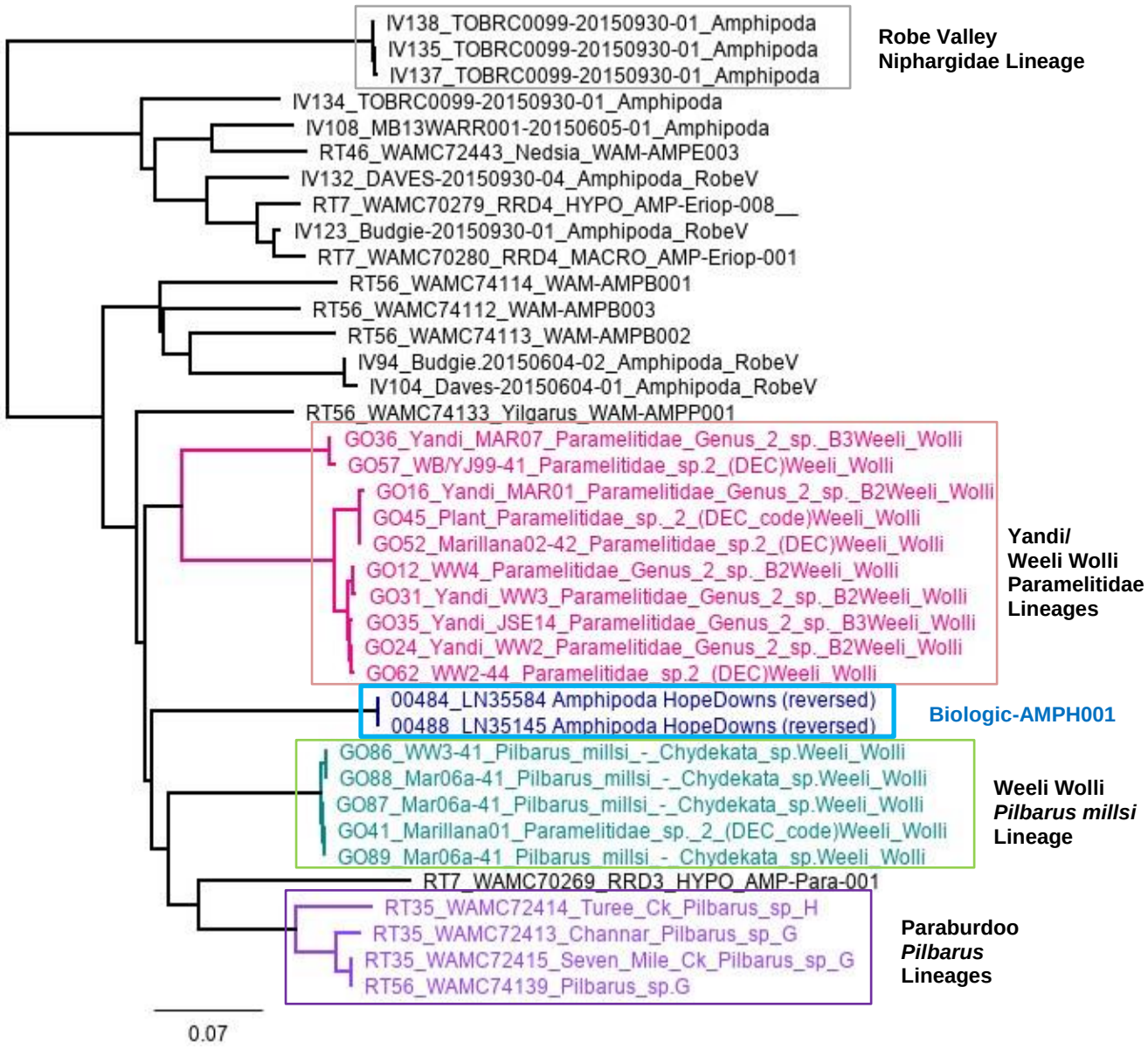


Figure 3.1. Neighbour Joining tree of Amphipoda haplotypes included in the analysis. Lineages from the Study Area are indicated by blue text.

3.2 Blattodea

All 20 specimens of Blattodea from Bedded Hill Top and Hope Downs 2 were successfully sequenced. Local comparisons revealed four lineages (intraspecific variability <3% COI), representing three to four potential OTUs (Table 3.1, Figure 3.2):

- *Nocticola* `Biologic-BLAT001` (LN34133, Hope Downs 2);
- *Nocticola* `Biologic-BLAT002` (LN33372, LN33532, LN34509, LN36536, and LN37718, Bedded Hill Top);
- *Nocticola* `Biologic-BLAT003` (LN33514, LN33574, LN35535, LN36514, LN36582, LN37412, and LN39408, Hope Downs 2 and Bedded Hill Top); and
- *Nocticola* `Biologic-BLAT004` (LN33391, LN35427, LN37424, LN37717, LN38726, LN34142, and LN38585, Bedded Hill Top).

Three of the four lineages (Biologic-BLAT002, BLAT003, and BLAT004) were well supported at COI divergences >8% (Appendix 2), indicating distinct species/ OTUs (based on average divergence thresholds Hebert *et al.* 2003). Lineage BLAT001 was only 7% different to BLAT002, indicating a borderline population/ species-level divergence, which may reflect geographical separation between Biologic-BLAT001 occurring in HD2 and BLAT002 in BHT. Nevertheless, based on a recent molecular study by Trotter *et al.* 2017 showing 3%-4% divergences between *Nocticola* species/ OTUs, 7% could be considered to indicate species-level divergence in *Nocticola*.

Table 3.1. Genetic results of *Nocticola* specimens from the Study Area (lineages represented by highlighted colours).

Area	Site Name	Morphological ID	No. of Individuals	Lot No. (LN)	BMR Code	Biologic-BLAT Lineage
HD2	RC17HD20011	*Nocticola* OES13	1 male	LN33514	BMR00427	003
BHT	RC18BHT0254	*Nocticola* OES13	tissue male	LN33574	BMR00493	003
HD2	DD18HD20001	*Nocticola* OES13	1	LN35535	BMR00437	003
HD2	RC16HD20174	*Nocticola* OES13	1	LN36514	BMR00425	003
BHT	RC18BHT0254	*Nocticola* OES13	tissue female	LN36582	BMR00374	003
BHT	DD17BHT0020	*Nocticola* OES13	1	LN37412	BMR00376	003
HD2	GD18HD20009	*Nocticola* OES13	1	LN39408	BMR00428	003
HD2	RC18HD20171	*Nocticola* OES12	1	LN34133	BMR00431	001
BHT	RC18BHT0334	*Nocticola* OES13	1	LN33372	BMR00373	002
BHT	RC18BHT0224	*Nocticola* OES13	1 female	LN33532	BMR00426	002
BHT	RC18BHT0308	*Nocticola* OES13	1	LN34509	BMR00432	002
BHT	RC15BHT0267	*Nocticola* OES13	1	LN36536	BMR00497	002
BHT	RC18BHT0248	*Nocticola* OES13	1	LN37718	BMR00435	002
BHT	RC18BHT0001	*Nocticola* OES12	1	LN33391	BMR00424	004
BHT	RC18BHT0016	*Nocticola* OES12	1	LN35427	BMR00377	004
BHT	RC18BHT0258	*Nocticola* OES12	1	LN37424	BMR00429	004
BHT	RC18BHT0026	*Nocticola* OES12	1 female	LN37717	BMR00433	004
BHT	RC18BHT0099	*Nocticola* OES12	1	LN38726	BMR00430	004
BHT	RC18BHT0016	*Nocticola* OES13	1	LN34142	BMR00434	004
BHT	RC16BHT0291	*Nocticola* OES13	tissue	LN38585	BMR00485	004

The genetic results did not match the morphological identifications, which determined only two OTUs (*N*. OES12 and *N*. OES13). While the morphological identifications within Lineages BLAT001, BLAT002, and BLAT003 were consistent (within each respective lineage), the high COI divergence (36%-39%) between Lineages BLAT002 and BLAT003 (both morphologically identified as *N*. OES13) suggested cryptic morphology or further taxonomic work may be required (Appendix 2).

In addition, BLAT004 contained specimens morphologically identified as both *N*. OES12 and *N*. OES13 (Table 3.1), despite intraspecific variability <1.1% (COI). Lineage BLAT003 showed slight intraspecific variability (2%-3% COI), although this was not consistent between specimens from the two different sampling areas; therefore, it is uncertain whether there could be separated populations within this lineage (Appendix 2).

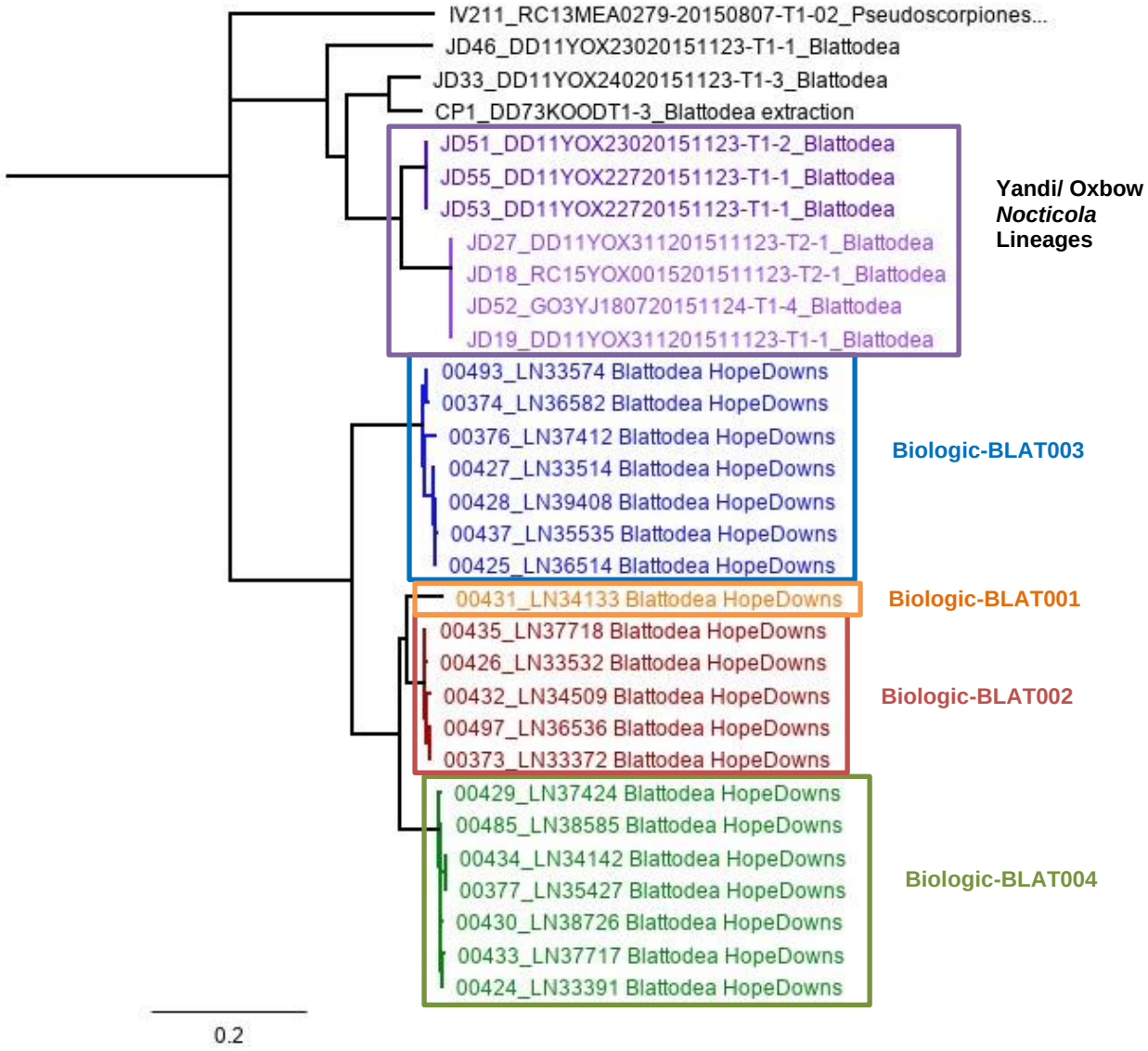


Figure 3.2. Neighbour Joining tree of Blattodea haplotypes (COI) included in the analysis. Lineages are indicated by coloured text.

In terms of sampling areas, Biologic-BLAT001, BLAT002, and BLAT004 were consistently collected from a single sampling area per lineage, while BLAT003 was collected in both Bedded Hill Top and Hope Downs 2. This suggests the potential for complicated evolutionary patterns such as allopatric and sympatric speciation, or multiple colonisations of subterranean habitats amongst the different OTUs of *Nocticola* from the Study Area.

Regional comparisons (Figure 3.2, Appendix 2) revealed that all sequences from the Study Area showed a high level of divergence (minimum 43% COI) from previous material based on a comparison of 11 regional sequences from the available databases. At this level of divergence all four lineages/ OTUs from the Study Area would be considered regionally unique (based on available sequences although further genetic (and potentially further morphological work) may be required to verify the deeper phylogenetic relationships.

3.3 Chilopoda

One specimen of Chilopoda (Scolopendromorpha sp.) (LN37426) was successfully sequenced at the COI gene (Biologic-CHIL001).

Regional comparisons (Figure 3.3) with previous sequences revealed a high COI divergence (min 21%) indicating that the lineage from the Study Area is not represented in the available sequence databases. This result was based on a comparison of 16 available subterranean Chilopoda sequences from the Pilbara region, and used the epigean species *Scolopendra mortisans* as an outgroup (Appendix 3).

Divergences were generally high between most lineages/ OTUs within the Chilopoda, excluding sequences likely representative of intraspecific variability (i.e. COI divergences below 3%) (Appendix 3). In this broader context the high divergences between Biologic-CHIL001 from the Study Area and other regional sequences was not considered out of trend with the rest of the group.

Based on comparisons with available databases, the Scolopendromorpha sp. `Biologic-CHIL001` collected from the Study Area appears to represent a new/ unique OTU that has not been sequenced elsewhere in the region.

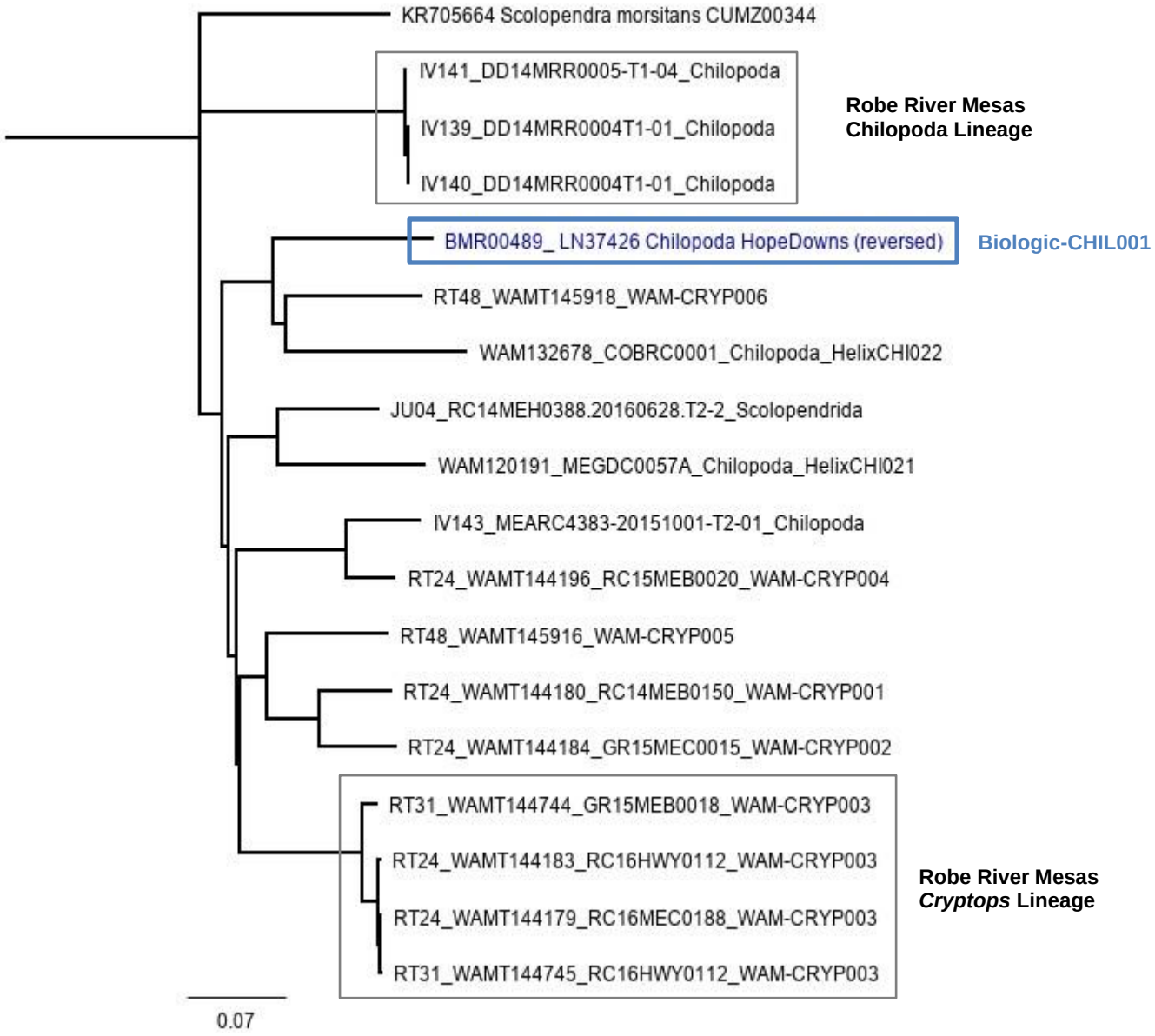


Figure 3.3. Neighbour Joining tree of Chilopoda haplotypes included in the analysis. Lineages from the Study Area are indicated by coloured text.

3.4 Diplura

One specimen of Diplura (LN33785; identified as *Indjapyx* OES7) was successfully sequenced (COI).

Regional comparisons (Figure 3.4) with previous sequences in Genbank and the RTIO databases revealed a high level of divergence (min 16% COI), indicating that Lineage DIPL001 from the Study Area is not represented elsewhere in the available sequence databases. This result was based on a comparison of 32 available Diplura sequences from the Pilbara region within the available sequence databases, and a Ptiliidae beetle was used as an outgroup (Figure 3.4, Appendix 4).

The dipluran sequenced from the Study Area (Lineage DIPL001) was closest to other diplurans identified as Japygidae, but at the high levels of divergence recorded (16%-19% COI), and due the lack of genus level identifications for most of the other sequences, further genetic or morphological information would be required to validate the phylogeny shown in Figure 3.4.

Indjapyx OES7 (Biologic-DIPL001) appears to represent a new/ unique OTU based on current comparisons with the available genetic databases.

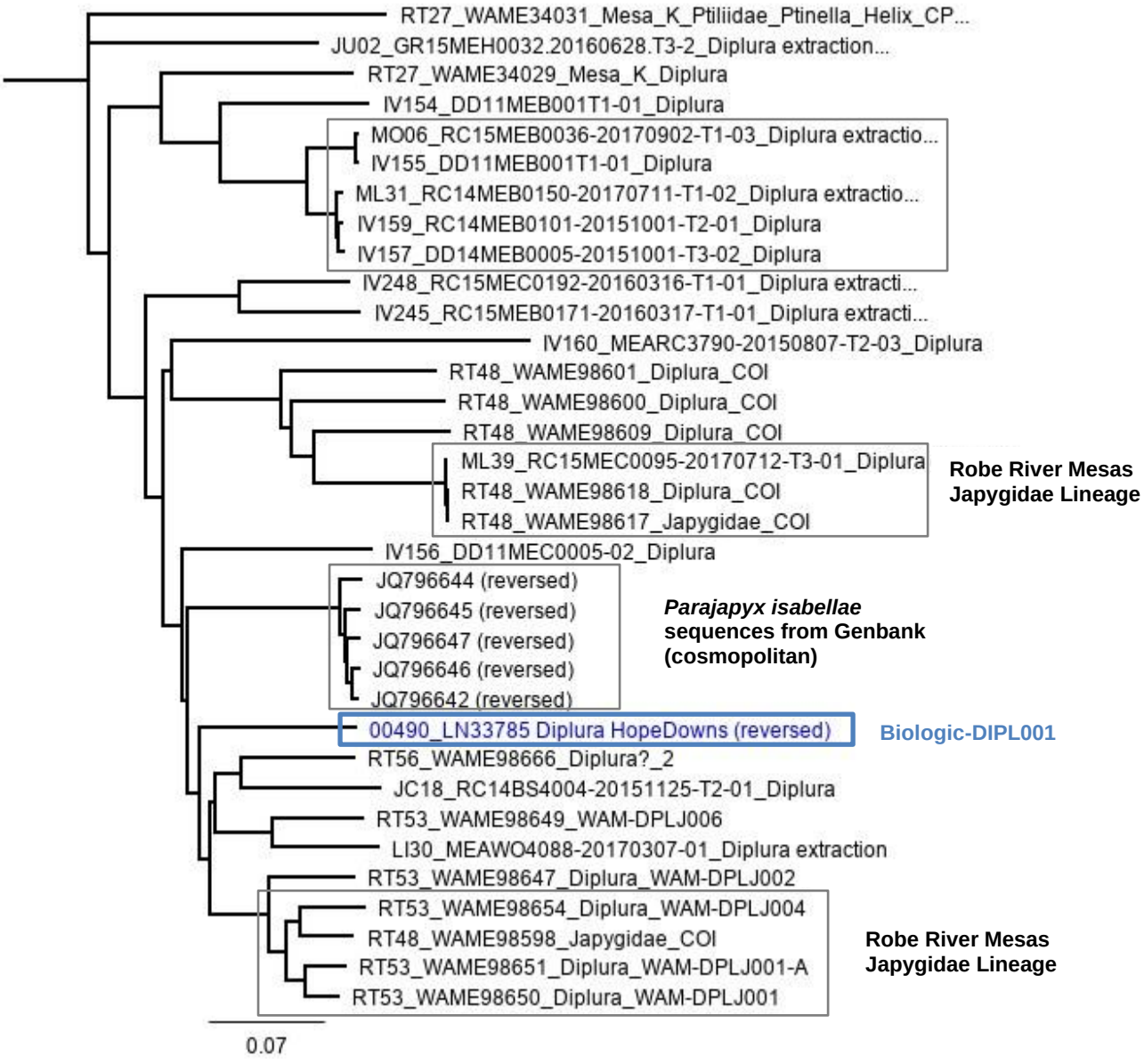


Figure 3.4. Neighbour Joining tree of Diplura haplotypes included in the analysis. Lineages from the Study Area are indicated by coloured text.

3.5 Hemiptera

Four of a total six specimens of Hemiptera from the Study Area were successfully sequenced (COI). Local comparisons revealed three well-supported lineages (intraspecific variability <1%), representing three distinct OTUs (Table 3.2, Figure 3.5):

- *Nisia* OES16 (HEMI001) (LN36535, 33789, Bedded Hill Top);
- *Phaconeura* HEMI002 (LN33774, Bedded Hill Top); and
- *Phaconeura* HEMI003 (LN35120, Bedded Hill Top);

These lineages each varied between 18% and 34% COI divergence (Appendix 5), indicating three highly divergent OTUs. Although morphological identifications (at Stantec) suggested that LN33774 and LN35120 belonged to the same morphospecies (*Phaconeura* OES15), the current genetic results revealed 18% (COI) divergence of Biologic-HEMI002 and HEMI003, indicating cryptic morphology or additional taxonomic work may be required.

Table 3.2. Genetic results of Hemiptera specimens (lineages represented by highlighted colours).

Area	Site Name	Morphospecies ID	No. of Individuals	Lot No. (LN)	BMR Code	HEMI Lineage
BHT	RC15BHT0267	*Nisia* OES16	1	LN36535	BMR00436	001
BHT	RC16BHT0222	*Nisia* OES16	1	LN33789	BMR00487	001
BHT	RC16HD10193	*Phaconeura* OES15	1	LN33774	BMR00486	002
BBH	RC14HD10072	*Phaconeura* OES15	1	LN35120	BMR00553	003

Regional comparisons (Figure 3.5 Appendix 5) revealed that each of the three lineages showed a high level of divergence (minimum 13-26% COI) from previously sequenced Hemiptera specimens. Specimens identified by Stantec as *Phaconeura* were clustered with other *Phaconeura* lineages, including one widespread OTU sampled at both Paraburdoo and West Angelas (P. WAM-PHAC001). However, at 13-14% COI divergence, *Phaconeura* sp. `Biologic-HEMI003` is regarded as a different OTU to *P*. `sp. WAM-PHAC001`, while *Phaconeura* `sp. Biologic-HEMI002` is regarded as different to another Paraburdoo taxon, P. `sp. WAM-PHAC002` (11-15% COI) (Appendix 5).

Nisia sp. Biologic-HEMI001 was highly divergent from all the available Meenoplidae sequences in the analysis (25-28% COI), although owing to the lack of genus level identifications for most of these sequences, further genetic (and/ or morphological work) may be required to validate these phylogenetic relationships.

Based on current results, the three Hemiptera OTUs from the Study Area do not appear to be represented elsewhere in the available databases.

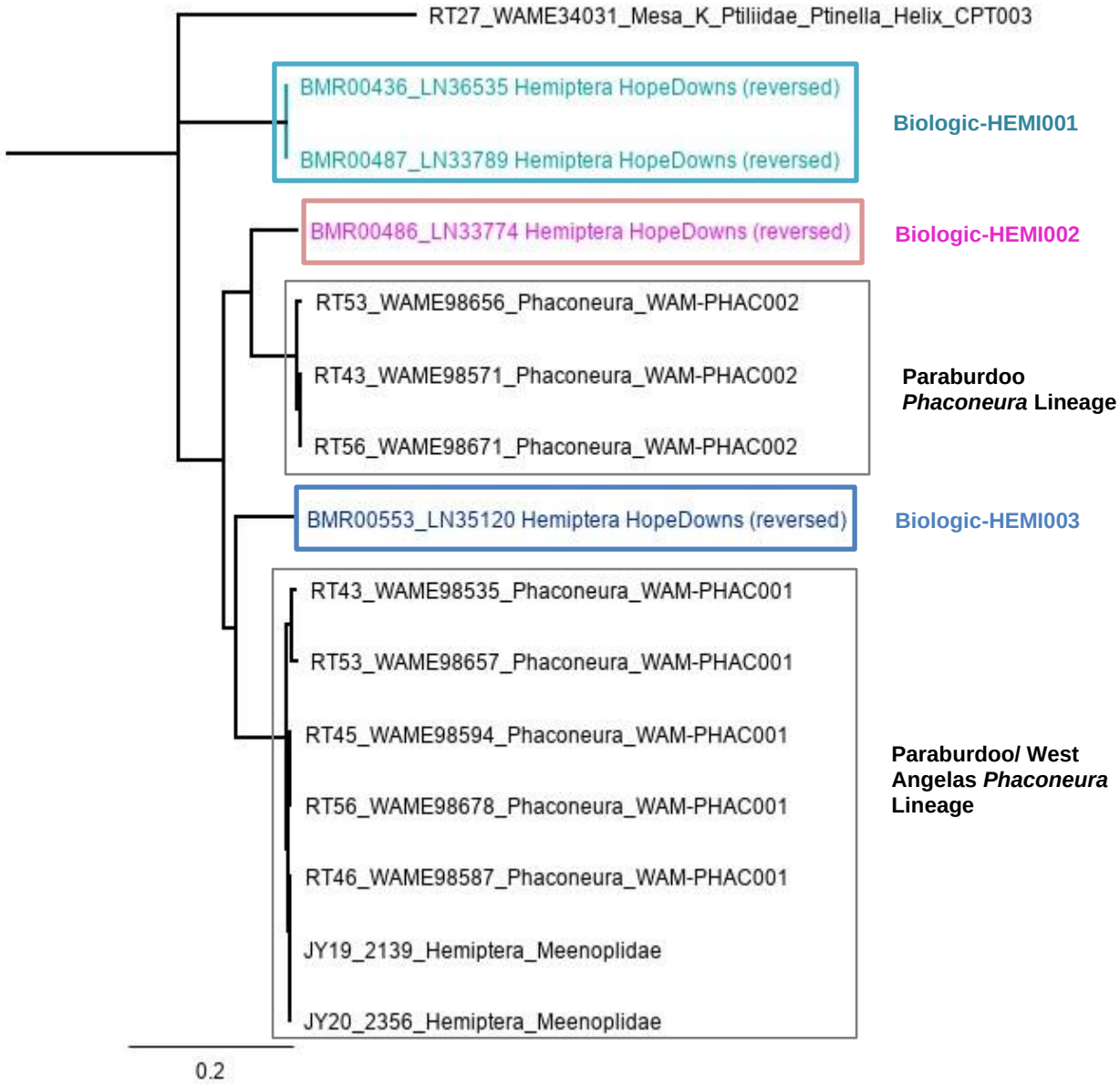


Figure 3.5. Neighbour Joining tree of Hemiptera haplotypes included in the analysis. Lineages from the Study Area are indicated by coloured text.

3.6 Palpigradi

One of the two specimens of Palpigradi (LN39264, identified as *Eukoenenia* OES2) was successfully sequenced (Lineage PALP001).

Regional sequences for this taxonomic group were very limited within the available databases, but the lineage from the Study Area was found to be 55-63% divergent (COI) from two other subterranean Palpigradi lineages collected at Paraburdoo (Figure 3.6, Appendix 6). A subterranean spider and an epigean spider sequence were used as outgroups in the analysis. At the high levels of divergence shown in this analysis, further genetic work (and potentially additional specimens/ sequences) would be required to verify the relationships between subterranean Palpigradi lineages from the region.

Based on the limited information currently available, *Eukoenenia* OES2 (Biologic-PAL001) does not appear to have been collected elsewhere to date.

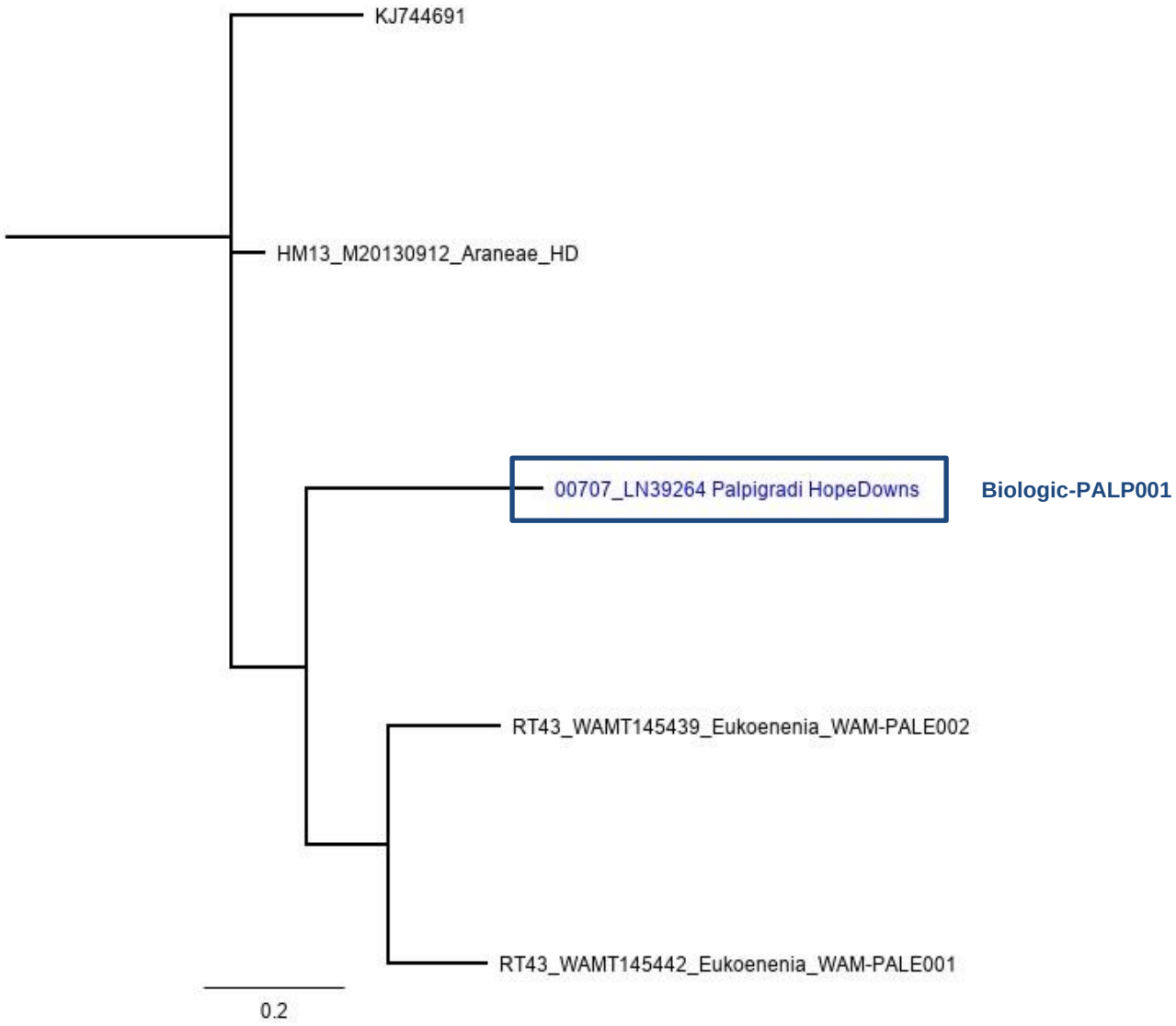


Figure 3.6. Neighbour Joining tree of Palpigradi haplotypes included in the analysis. Lineages from the Study Area are indicated by coloured text.

3.7 Pauropoda

One specimen of Pauropoda (LN35790) failed to sequence (COI). No further work was undertaken on this specimen.

3.8 Polyxenida

One specimen of Polyxenida (LN33785; Lophoproctidae sp.) was successfully sequenced (COI). Regional comparisons (Figure 3.7) were based on 25 available subterranean Polyxenida sequences from the Pilbara region (Appendix 7).

The analysis revealed a moderate level of divergence (9%-13% COI) with Polyxenida specimens collected at Robe Headwaters (S45), Cabbage Gum Bore (S12 and S31), Silvergrass (P3 and P1), and Western Range (P51 and P52). Based on average COI divergence thresholds of 8% (Hebert et al 2003), the sequence from the Study Area would still be considered to represent a distinct OTU (Biologic-POLYX001).

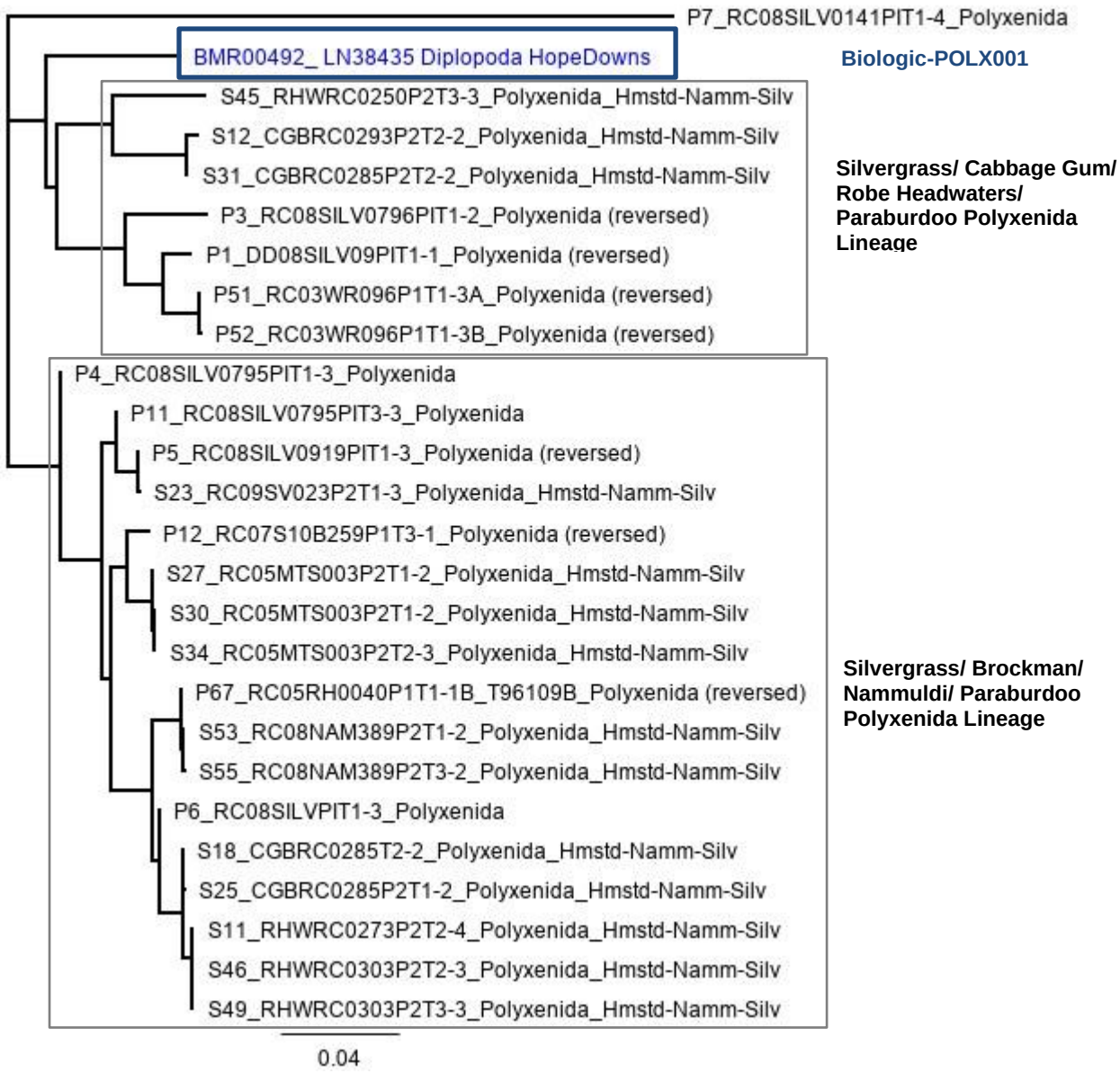


Figure 3.7. Neighbour Joining tree of Polyxenida haplotypes included in the analysis. Lineages from the Study Area are indicated by coloured text.

Although regionally widespread Lophoproctidae species are known to occur throughout the Pilbara region (i.e. the cosmopolitan species *Lophoturus madecassus,* which can be found in epigean and subterranean habitats), due to the lack of resolution in the accompanying morphological identifications, it is uncertain whether sequence material for this widespread species has been included in the current comparisons. However, it does appear that the most closely related lineages to the one collected at the Study Area have been recorded widely throughout the region.

Based on the currently available sequence information in the accessible databases, Lophoproctidae sp. (Biologic-POLYX001) does not appear to have been collected beyond the Study Area.

3.9 Pseudoscorpiones

One of the two specimens of Pseudoscorpiones (LN35130, identified as *Tyrannochthonius* OES20) was successfully sequenced at COI (Biologic-PSEU001). Figure 3.8 shows regional comparisons with 17 regional Chthoniidae sequences, and an *Aname* spider used as an outgroup.

Based on these regional comparisons, the Lineage PSEU001 from the Study Area was found to be highly divergent (19%-25% COI) from other sequences from Robe Valley (RT53 and RT48), and Paraburdoo (RT46) (Figure 3.8, Appendix 8). A subterranean spider and a subterranean Olpiidae sequence were used as outgroups in the analysis. Sequence data from the pseudoscorpion *Lagynochthonius* `sp. WAM-PSE096` previously collected from Baby Hope Downs were not available for genetic comparisons.

While the overall level of divergence between the sequence from the Study Area and other regional sequences in the same family was high, this was not considerably different from the range of divergences between *Tyrannochthonius* OTUs within the available databases (ranging from 12% to 24% COI, Appendix 8). In this broader context the high divergences between the lineage from the Study Area (Biologic-PSEU001) and other regional sequences was not considered out of trend with the range of divergences between other lineages in the genus.

Based on currently available information, *Tyrannochthonius* OES20/ Biologic-PSEU001 does not appear to have been collected elsewhere to date.

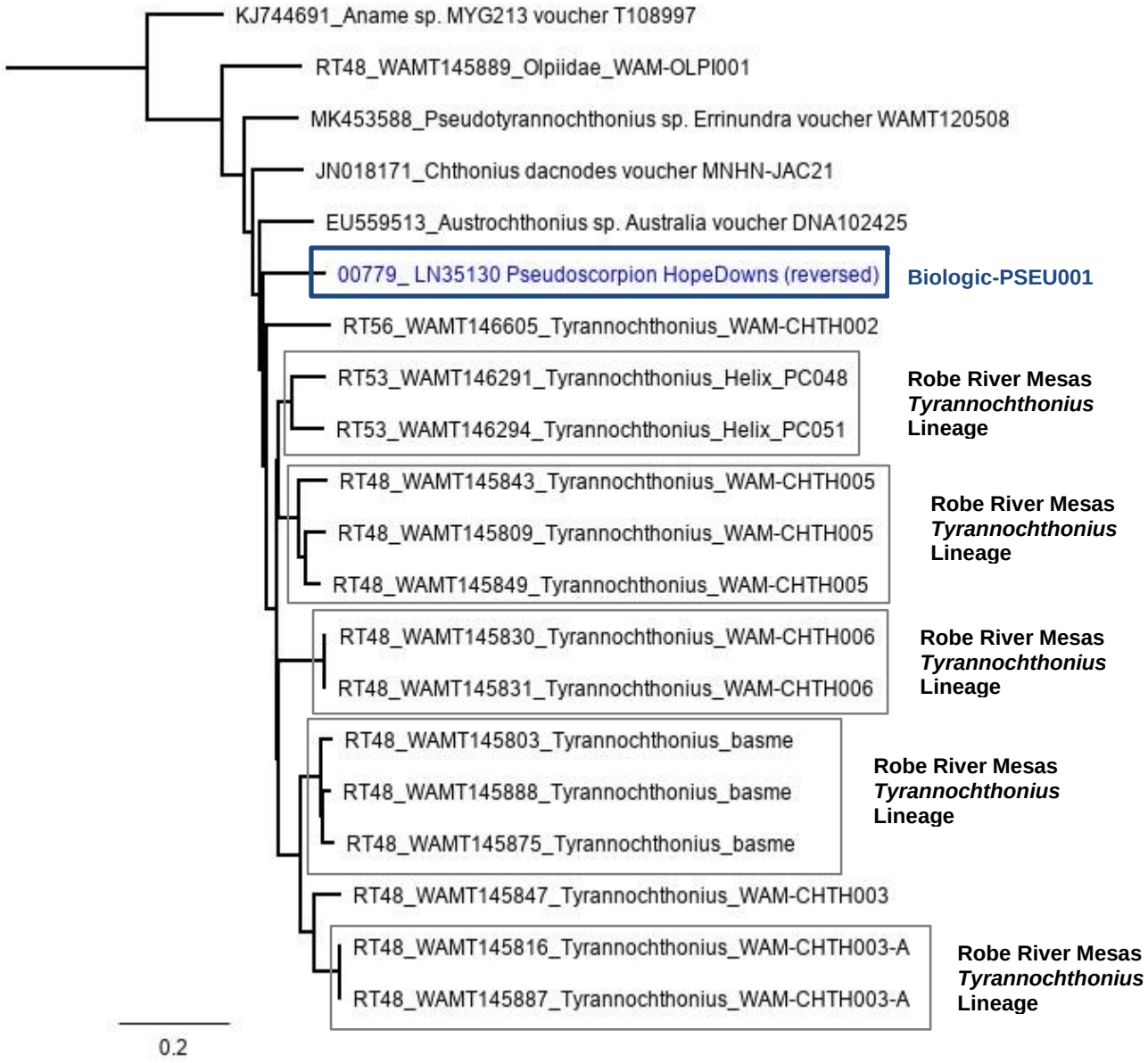


Figure 3.8. Neighbour Joining tree of Pseudoscorpiones haplotypes included in the analysis. Lineages from the Study Area are indicated by coloured text.

3.10 Schizomida

Eight specimens of Schizomida specimens were successfully sequenced at COI. Local comparisons revealed two potential lineages (intraspecific variability <1% COI, Appendix 9):

- Lineage A: LN35581, LN38567, LN33570, LN33590, and LN35572 from Bedded Hill Top; and
- Lineage B: LN37569, LN38573, and LN36580, also from Bedded Hill Top.

COI divergence between these lineages was only 6%- 7% (Appendix 9) and based on average COI divergence thresholds of 8% (Hebert et al 2003), these would be considered to represent a single OTU.

When compared to the sequences from specimens previously collected in the Hope Downs 1 South West area and Baby Hope Downs (Figure 3.9, Appendix 9), the two lineages are nested with the intraspecies variability within *Draculoides* sp. SCH068, as recently described by Abrams *et al.* (2019). Within the published sequences of *Draculoides* sp. SCH068, the current analysis showed variability between 3%-7% COI (Appendix 9). Current sequences within Lineage A varied from *D*. sp. SCH068 by 6%-9%, while sequences within Lineage B varied from *D*. sp. SCH068 by 2%-7% (Appendix 9). As stated above, Lineages A and B varied from each other by 6% - 7%.

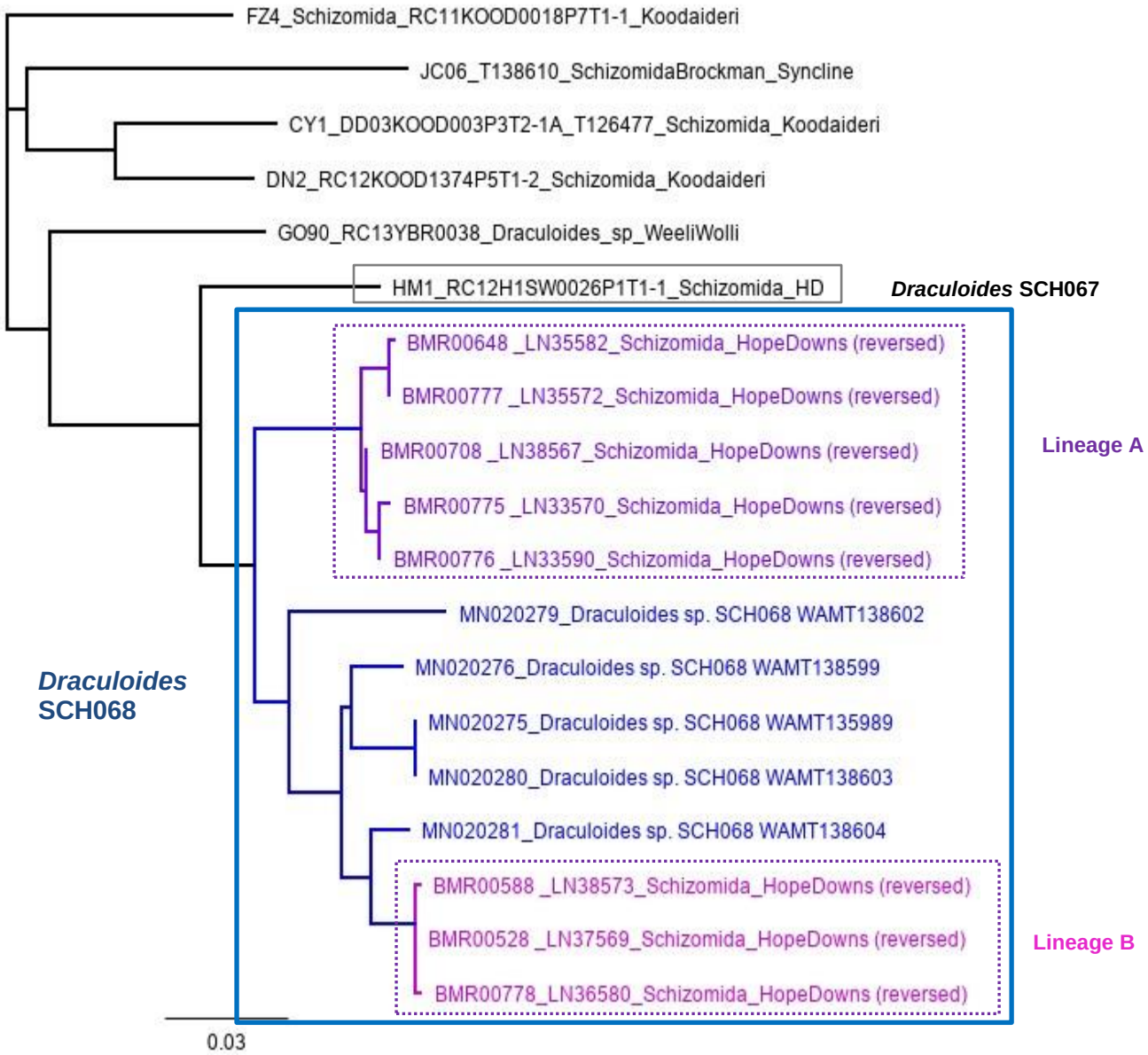


Figure 3.9. Neighbour Joining tree of Schizomida haplotypes included in the analysis. Lineages are indicated by coloured text.

The current analysis also suggests that Lineage A is also closely related to another OTU from Hope Downs 1 South West, *Draculoides* sp. SCH067 (Abrams *et al.* 2019). The average pairwise divergences of specimens in Lineage A vs SCH068 were 7% (SD 0.009), whereas Lineage A vs SCH067 was 8% (SD 0.004) (Table 3.3). This very marginal difference suggests that, even though both OTUs are quite similar to Lineage A, based on current sequences, Lineage A is closer to *Draculoides* sp. SCH068 (as in Figure 3.9).

Table 3.3: Average and standard deviation of COI divergences between lineages of Schizomida collected from the Hope Downs area, in the current analysis

	Lineage A (5)	Lineage B (3)	SCH068 (5)	SCH067 (1)
Lineage A (5)	1% (intra)	SD 0.003	SD 0.009	SD 0.004
Lineage B (3)	Ave 7%	0% (intra)	SD 0.017	SD <0.001
SCH068 (5)	Ave 7%	Ave 4%	4% (intra)	SD 0.004
SCH067 (1)	Ave 8%	Ave 10%	Ave 10%	n/a

Meanwhile, Lineage B was much more similar to *Draculoides* sp. SCH068 (COI divergence mean 4%, SD 0.017), which was within the same mean intraspecific variability as SCH068 itself (Table 3.3). Lineages A and B were also quite similar (COI divergence mean 7%, SD 0.003), indeed, the same average level of divergence as Lineage A vs SCH068, suggesting that Lineages A, B, and SCH068 can be regarded as the same OTU, albeit one with a relatively high level of intraspecific variability (mean 5%, range 0%-9%).

Based on the current results, all of the new sequences of Schizomida collected from the Study Area appear to align to the previously known OTU, *Draculoides* sp. SCH068. However, some of the divergences between the current lineages and the available sequence material for *Draculoides* sp. SCH068 and *Draculoides* sp. SCH067 were gradational/ marginal, therefore further genetic work using a multi-gene approach, potentially combined with morphological work as in Abrams *et al.* (2019) may be useful to validate the species-level phylogenetic relationships between these specimens.

3.11 Zygentoma

One specimen of Zygentoma (Atelurinae sp., LN39280) failed to sequence at COI, therefore analysis was conducted at 12S, following Smith *et al.* (2012). The specimen was successfully sequenced using 12S (Biologic-ZYGE001).

Based on comparisons with 20 regional Zygentoma sequences within the available databases, the lineage from the Study Area was found to be moderately divergent (8%-10% 12S) from a *Dodecastyla* OTU collected at Paraburdoo (*Dodecastyla* WAM-ZYGA001), and more highly divergent (19%-48% 12S) from other subterranean Zygentoma, several of which were morphologically identified as

Trinemura (Figure 3.10, Appendix 9). Smith *et al.* (2012) regarded sequences of *Dodecastyla* at 6.2% - 6.5% divergence (12S) as different species, therefore the lineage from Study Area would be considered distinct from *Dodecastyla* WAM-ZYGA001.

The current genetic results appear to confirm the morphological assessment, that the Zygentoma from the Study Area (ZYGE001) likely belongs to the Atelurinae (e.g. *Dodecastyla* sp.). This taxonomic group is commonly regarded as soil-dwelling (including inhabitants of termite nests), rather than troglobitic (Smith *et al.* 2012). While Biologic-ZYGE001 is closely related to *Dodecastyla* WAMZYGA001 sequenced at Paraburdoo, based on currently available information in the accessible databases, does not appear to have been collected elsewhere beyond the Study Area to date.

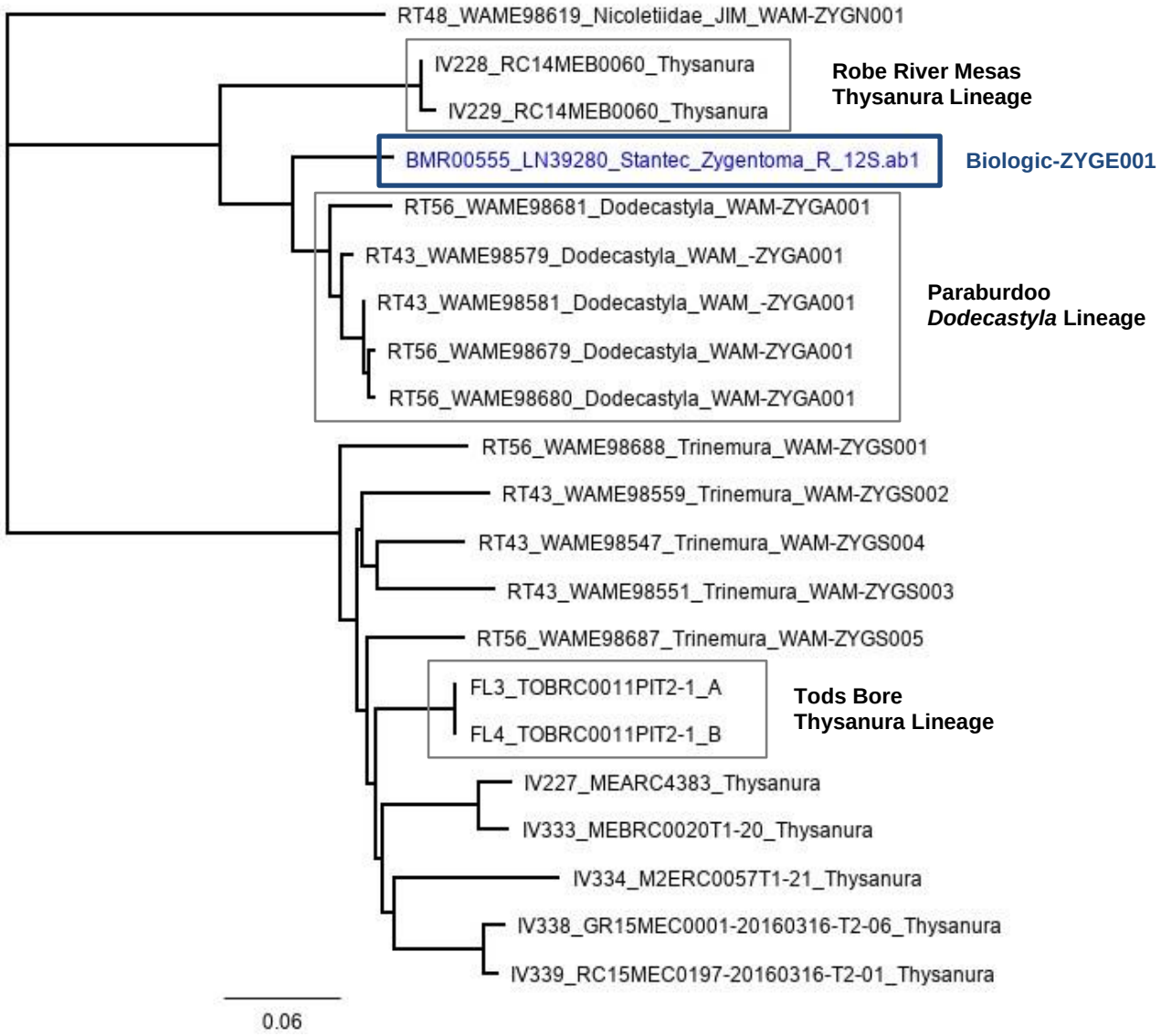


Figure 3.10. Neighbour Joining tree of Zygentoma haplotypes included in the analysis. Lineages from the Study Area are indicated by coloured text.

4 KEY FINDINGS

The molecular analysis of subterranean fauna from the HDOW1 Study Area resulted in the following key findings at the species/ OTU level:

- Amphipoda (CO1): 1 OTU, Biologic-AMPH001 (*Pilbarus* nr *millsi* OES12), regionally unique;
- Blattodea (CO1): 4 OTUs (formerly *Nocticola* sp. OES12 and OES13), Biologic-BLAT001, Biologic-BLAT002, Biologic-BLAT003, and Biologic-BLAT004, all regionally unique;
- Chilopoda (CO1): 1 OTU, Biologic-CHIL001 (Scolopendromorpha sp.), regionally unique;
- Diplura (CO1); 1 OTU, Biologic-DIPL001 (*Indjapyx* OES7), regionally unique;
- Hemiptera (CO1): 3 OTUs, Biologic-HEMI001 (*Nisia* OES16), Biologic-HEMI002 and Biologic-HEMI003 (the latter both formerly *Phaconeura* OES15), all regionally unique.
    - Two other specimens failed to sequence;
- Palpigradi (CO1): 1 OTU, Biologic-PALP001 (*Eukoenenia* OES2), regionally unique.
    - A second specimen failed to sequence;
- Pauropoda (CO1): failed to sequence;
- Polyxenida (CO1): 1 OTU, Biologic-POLX001 (Lophoproctidae sp.), regionally unique;
- Pseudoscorpiones (CO1): 1 OTU, Biologic-PSEU001 (*Tyrannochthonius* OES20).
- Schizomida (CO1): 1 OTU (*Draculoides* sp. SCH068),
    - Previously recorded OTU *Draculoides* sp. SCH068 encompasses Lineage A, Lineage B, and morphospecies *Draculoides* ?BH4/BH5;
- Zygentoma (12S): 1 OTU, Biologic-ZYGE001 (Ateluridae sp.), regionally unique.

Thank you for giving Biologic the opportunity to undertake this work. Please contact us if you have any further questions.

Sincerely,

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Appendix 1. Distance matrix of Amphipoda sequences/ lineages included in the analysis

COI divergence of Amphipoda (regional comparisons)	IV135	IV137	IV138	IV108	IV123	IV132	IV134	RT46	RT7	RT7	IV104	IV94	RT56	RT56	RT56	RT56	GO12	GO16	GO24	GO31	GO35	GO36	GO41	GO45	GO52	GO57	GO62	00484	00488	GO86	GO87	GO88	GO89	RT35	RT35	RT35	RT56	RT7
IV135_TOBRC0099-20150930-01_Amphipoda		0%	0%	41%	47%	43%	40%	43%	44%	49%	42%	43%	42%	40%	45%	39%	48%	46%	47%	47%	47%	39%	46%	47%	47%	39%	48%	45%	45%	45%	46%	45%	46%	48%	46%	47%	47%	49%
IV137_TOBRC0099-20150930-01_Amphipoda	0%		0%	41%	47%	43%	40%	43%	44%	49%	42%	44%	42%	40%	45%	39%	48%	47%	48%	48%	47%	39%	46%	47%	47%	39%	48%	45%	45%	45%	46%	45%	46%	48%	46%	47%	47%	49%
IV138_TOBRC0099-20150930-01_Amphipoda	0%	0%		41%	47%	43%	39%	43%	44%	49%	42%	43%	42%	40%	45%	39%	47%	46%	47%	47%	47%	39%	46%	47%	47%	39%	47%	45%	45%	45%	46%	45%	46%	48%	46%	47%	47%	49%
IV108_MB13WARR001-20150605-01_Amphipoda	41%	41%	41%		17%	16%	18%	11%	18%	18%	38%	36%	39%	40%	42%	37%	43%	42%	43%	43%	43%	37%	39%	42%	42%	38%	42%	40%	40%	39%	38%	39%	39%	37%	36%	36%	36%	39%
IV123_Budgie-20150930-01_Amphipoda_RobeV	47%	47%	47%	17%		11%	17%	19%	5%	2%	37%	36%	41%	39%	41%	37%	39%	38%	38%	39%	39%	34%	38%	38%	38%	35%	37%	39%	39%	39%	38%	39%	38%	38%	38%	38%	38%	41%
IV132_DAVES-20150930-04_Amphipoda_RobeV	43%	43%	43%	16%	11%		17%	19%	10%	12%	39%	38%	38%	40%	40%	37%	41%	41%	40%	41%	41%	37%	38%	41%	41%	37%	40%	39%	39%	38%	38%	38%	38%	39%	39%	38%	38%	39%
IV134_TOBRC0099-20150930-01_Amphipoda	40%	40%	39%	18%	17%	17%		22%	17%	17%	36%	36%	40%	41%	38%	37%	40%	41%	40%	40%	40%	35%	38%	41%	41%	36%	40%	39%	39%	38%	38%	38%	38%	36%	38%	38%	38%	37%
RT46_WAMC72443_Nedsia_WAM-AMPE003	43%	43%	43%	11%	19%	19%	22%		19%	20%	36%	36%	40%	36%	41%	40%	43%	42%	43%	43%	43%	35%	41%	42%	42%	35%	42%	39%	39%	41%	40%	41%	41%	39%	39%	39%	39%	41%
RT7_WAMC70279_RRD4_HYPO_AMP-Eriop-008__	44%	44%	44%	18%	5%	10%	17%	19%		5%	39%	40%	42%	39%	42%	40%	42%	41%	41%	42%	41%	35%	39%	41%	41%	36%	40%	39%	39%	40%	39%	40%	39%	38%	40%	40%	40%	40%
RT7_WAMC70280_RRD4_MACRO_AMP-Eriop-001	49%	49%	49%	18%	2%	12%	17%	20%	5%		39%	39%	42%	40%	44%	39%	41%	40%	40%	41%	40%	36%	41%	40%	40%	37%	39%	39%	39%	41%	41%	41%	41%	38%	42%	40%	40%	41%
IV104_Daves-20150604-01_Amphipoda_RobeV	42%	42%	42%	38%	37%	39%	36%	36%	39%	39%		1%	22%	19%	25%	34%	33%	34%	32%	32%	32%	29%	32%	34%	34%	29%	33%	31%	31%	32%	32%	32%	32%	32%	33%	30%	30%	36%
IV94_Budgie.20150604-02_Amphipoda_RobeV	43%	44%	43%	36%	36%	38%	36%	36%	40%	39%	1%		21%	20%	24%	31%	30%	31%	29%	30%	29%	27%	32%	31%	31%	27%	30%	31%	31%	33%	32%	33%	32%	32%	32%	31%	31%	36%
RT56_WAMC74112_WAM-AMPB003	42%	42%	42%	39%	41%	38%	40%	40%	42%	42%	22%	21%		19%	20%	25%	29%	29%	28%	28%	28%	27%	25%	29%	29%	27%	28%	29%	29%	25%	25%	25%	25%	30%	31%	29%	29%	32%
RT56_WAMC74113_WAM-AMPB002	40%	40%	40%	40%	39%	40%	41%	36%	39%	40%	19%	20%	19%		22%	29%	31%	32%	31%	30%	31%	28%	31%	32%	32%	28%	31%	31%	31%	31%	31%	31%	31%	35%	34%	34%	34%	31%
RT56_WAMC74114_WAM-AMPB001	45%	45%	45%	42%	41%	40%	38%	41%	42%	44%	25%	24%	20%	22%		26%	31%	30%	31%	32%	31%	30%	28%	31%	31%	30%	31%	35%	35%	29%	29%	29%	28%	33%	31%	31%	31%	31%
RT56_WAMC74133_Yilgarus_WAM-AMPP001	39%	39%	39%	37%	37%	37%	37%	40%	40%	39%	34%	31%	25%	29%	26%		24%	24%	24%	24%	24%	23%	23%	24%	24%	23%	24%	26%	26%	24%	23%	24%	23%	26%	28%	25%	25%	24%
GO12_WW4_Paramelitidae_Genus_2_sp._B2Weeli_Wolli	48%	48%	47%	43%	39%	41%	40%	43%	42%	41%	33%	30%	29%	31%	31%	24%		3%	1%	0%	1%	21%	25%	3%	3%	21%	1%	28%	28%	24%	25%	24%	25%	25%	27%	26%	26%	32%
GO16_Yandi_MAR01_Paramelitidae_Genus_2_sp._B2Weeli_Wol	46%	47%	46%	42%	38%	41%	41%	42%	41%	40%	34%	31%	29%	32%	30%	24%	3%		3%	3%	3%	21%	25%	0%	0%	21%	3%	29%	29%	26%	25%	26%	25%	27%	27%	27%	27%	31%
GO24_Yandi_WW2_Paramelitidae_Genus_2_sp._B2Weeli_Wolli	47%	48%	47%	43%	38%	40%	40%	43%	41%	40%	32%	29%	28%	31%	31%	24%	1%	3%		1%	0%	20%	24%	3%	3%	20%	0%	28%	28%	24%	24%	24%	24%	25%	27%	25%	25%	32%
GO31_Yandi_WW3_Paramelitidae_Genus_2_sp._B2Weeli_Wolli	47%	48%	47%	43%	39%	41%	40%	43%	42%	41%	32%	30%	28%	30%	32%	24%	0%	3%	1%		1%	21%	25%	3%	3%	21%	1%	28%	28%	24%	24%	24%	25%	25%	28%	26%	26%	32%
GO35_Yandi_JSE14_Paramelitidae_Genus_2_sp._B3Weeli_Wolli	47%	47%	47%	43%	39%	41%	40%	43%	41%	40%	32%	29%	28%	31%	31%	24%	1%	3%	0%	1%		20%	24%	3%	3%	21%	0%	28%	28%	24%	24%	24%	24%	25%	27%	25%	25%	32%
GO36_Yandi_MAR07_Paramelitidae_Genus_2_sp._B3Weeli_Wol	39%	39%	39%	37%	34%	37%	35%	35%	35%	36%	29%	27%	27%	28%	30%	23%	21%	21%	20%	21%	20%		23%	21%	21%	0%	20%	27%	27%	24%	23%	24%	23%	29%	31%	29%	29%	29%
GO41_Marillana01_Paramelitidae_sp._2_(DEC_code)Weeli_Wolli	46%	46%	46%	39%	38%	38%	38%	41%	39%	41%	32%	32%	25%	31%	28%	23%	25%	25%	24%	25%	24%	23%		25%	25%	24%	24%	26%	26%	1%	0%	1%	0%	23%	23%	22%	22%	25%
GO45_Plant_Paramelitidae_sp._2_(DEC_code)Weeli_Wolli	47%	47%	47%	42%	38%	41%	41%	42%	41%	40%	34%	31%	29%	32%	31%	24%	3%	0%	3%	3%	3%	21%	25%		0%	21%	3%	29%	29%	25%	25%	25%	25%	27%	27%	27%	27%	31%
GO52_Marillana02-42_Paramelitidae_sp.2_(DEC)Weeli_Wolli	47%	47%	47%	42%	38%	41%	41%	42%	41%	40%	34%	31%	29%	32%	31%	24%	3%	0%	3%	3%	3%	21%	25%	0%		21%	3%	29%	29%	25%	25%	25%	25%	27%	27%	27%	27%	31%
GO57_WB/YJ99-41_Paramelitidae_sp.2_(DEC)Weeli_Wolli	39%	39%	39%	38%	35%	37%	36%	35%	36%	37%	29%	27%	27%	28%	30%	23%	21%	21%	20%	21%	21%	0%	24%	21%	21%		21%	28%	28%	24%	23%	24%	24%	29%	31%	29%	29%	29%
GO62_WW2-44_Paramelitidae_sp.2_(DEC)Weeli_Wolli	48%	48%	47%	42%	37%	40%	40%	42%	40%	39%	33%	30%	28%	31%	31%	24%	1%	3%	0%	1%	0%	20%	24%	3%	3%	21%		28%	28%	24%	24%	24%	24%	25%	26%	25%	25%	32%
00484_LN35584 Amphipoda HopeDowns (reversed)	**45%**	**45%**	**45%**	**40%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**31%**	**31%**	**29%**	**31%**	**35%**	**26%**	**28%**	**29%**	**28%**	**28%**	**28%**	**27%**	**26%**	**29%**	**29%**	**28%**	**28%**		**0%**	**27%**	**27%**	**27%**	**26%**	**29%**	**30%**	**28%**	**28%**	**28%**
00488_LN35145 Amphipoda HopeDowns (reversed)	**45%**	**45%**	**45%**	**40%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**31%**	**31%**	**29%**	**31%**	**35%**	**26%**	**28%**	**29%**	**28%**	**28%**	**28%**	**27%**	**26%**	**29%**	**29%**	**28%**	**28%**	**0%**		**27%**	**27%**	**27%**	**26%**	**29%**	**30%**	**28%**	**28%**	**28%**
GO86_WW3-41_Pilbarus_millsi_-_Chydekata_sp.Weeli_Wolli	45%	45%	45%	39%	39%	38%	38%	41%	40%	41%	32%	33%	25%	31%	29%	24%	24%	26%	24%	24%	24%	24%	1%	25%	25%	24%	24%	27%	27%		0%	0%	1%	23%	24%	22%	22%	25%
GO87_Mar06a-41_Pilbarus_millsi_-_Chydekata_sp.Weeli_Wolli	46%	46%	46%	38%	38%	38%	38%	40%	39%	41%	32%	32%	25%	31%	29%	23%	25%	25%	24%	24%	24%	23%	0%	25%	25%	23%	24%	27%	27%	0%		0%	0%	23%	23%	22%	22%	24%
GO88_Mar06a-41_Pilbarus_millsi_-_Chydekata_sp.Weeli_Wolli	45%	45%	45%	39%	39%	38%	38%	41%	40%	41%	32%	33%	25%	31%	29%	24%	24%	26%	24%	24%	24%	24%	1%	25%	25%	24%	24%	27%	27%	0%	0%		1%	23%	24%	22%	22%	25%
GO89_Mar06a-41_Pilbarus_millsi_-_Chydekata_sp.Weeli_Wolli	46%	46%	46%	39%	38%	38%	38%	41%	39%	41%	32%	32%	25%	31%	28%	23%	25%	25%	24%	25%	24%	23%	0%	25%	25%	24%	24%	26%	26%	1%	0%	1%		23%	23%	22%	22%	25%
RT35_WAMC72413_Channar_Pilbarus_sp_G	48%	48%	48%	37%	38%	39%	36%	39%	38%	38%	32%	32%	30%	35%	33%	26%	25%	27%	25%	25%	25%	29%	23%	27%	27%	29%	25%	29%	29%	23%	23%	23%	23%		9%	2%	2%	24%
RT35_WAMC72414_Turee_Ck_Pilbarus_sp_H	46%	46%	46%	36%	38%	39%	38%	39%	40%	42%	33%	32%	31%	34%	31%	28%	27%	27%	27%	28%	27%	31%	23%	27%	27%	31%	26%	30%	30%	24%	23%	24%	23%	9%		8%	8%	25%
RT35_WAMC72415_Seven_Mile_Ck_Pilbarus_sp_G	47%	47%	47%	36%	38%	38%	38%	39%	40%	40%	30%	31%	29%	34%	31%	25%	26%	27%	25%	26%	25%	29%	22%	27%	27%	29%	25%	28%	28%	22%	22%	22%	22%	2%	8%		0%	22%
RT56_WAMC74139_Pilbarus_sp.G	47%	47%	47%	36%	38%	38%	38%	39%	40%	40%	30%	31%	29%	34%	31%	25%	26%	27%	25%	26%	25%	29%	22%	27%	27%	29%	25%	28%	28%	22%	22%	22%	22%	2%	8%	0%		22%
RT7_WAMC70269_RRD3_HYPO_AMP-Para-001	49%	49%	49%	39%	41%	39%	37%	41%	40%	41%	36%	36%	32%	31%	31%	24%	32%	31%	32%	32%	32%	29%	25%	31%	31%	29%	32%	28%	28%	25%	24%	25%	25%	24%	25%	22%	22%	

Appendix 2. Distance matrix of Blattodea sequences/ lineages included in the analysis

COI divergence of Blattodea (regional comparisons)	IV211	JD46	CP1	JD33	JD51	JD53	JD55	JD18	JD19	JD27	JD52	00431	00373	00426	00432	00435	00497	00374	00376	00425	00427	00428	00437	00493	00377	00424	00429	00430	00433	00434	00485
IV211_RC13MEA0279-20150807-T1-02_Pseudo		52%	52%	58%	55%	55%	55%	39%	39%	44%	39%	46%	50%	51%	56%	48%	50%	47%	43%	48%	52%	52%	63%	47%	59%	59%	58%	59%	59%	61%	59%
JD46_DD11YOX23020151123-T1-1_Blattodea	52%		27%	29%	22%	22%	22%	27%	27%	27%	27%	59%	55%	52%	53%	46%	55%	53%	60%	57%	55%	55%	57%	53%	51%	49%	47%	49%	50%	54%	49%
CP1_DD73KOODT1-3_Blattodea extraction	52%	27%		8%	22%	22%	22%	22%	22%	22%	22%	51%	55%	46%	54%	51%	43%	55%	53%	54%	57%	54%	57%	56%	43%	48%	47%	57%	48%	47%	48%
JD33_DD11YOX24020151123-T1-3_Blattodea	58%	29%	8%		20%	20%	20%	20%	20%	20%	20%	48%	44%	46%	45%	47%	44%	58%	53%	51%	56%	51%	56%	56%	51%	52%	51%	52%	51%	52%	52%
JD51_DD11YOX23020151123-T1-2_Blattodea	55%	22%	22%	20%		0%	0%	10%	10%	9%	10%	55%	53%	55%	52%	57%	59%	53%	61%	54%	52%	54%	55%	53%	46%	47%	46%	47%	46%	46%	46%
JD53_DD11YOX22720151123-T1-1_Blattodea	55%	22%	22%	20%	0%		0%	10%	10%	9%	10%	55%	53%	55%	52%	57%	59%	53%	61%	54%	52%	54%	55%	53%	46%	47%	46%	47%	46%	46%	46%
JD55_DD11YOX22720151123-T1-1_Blattodea	55%	22%	22%	20%	0%	0%		10%	10%	9%	10%	55%	53%	55%	52%	57%	59%	53%	61%	54%	52%	54%	55%	53%	46%	47%	46%	47%	46%	46%	46%
JD18_RC15YOX0015201511123-T2-1_Blattodea	39%	27%	22%	20%	10%	10%	10%		0%	0%	0%	57%	52%	50%	50%	52%	49%	68%	62%	58%	65%	52%	65%	61%	58%	56%	55%	55%	56%	57%	55%
JD19_DD11YOX311201511123-T1-1_Blattodea	39%	27%	22%	20%	10%	10%	10%	0%		0%	0%	57%	52%	50%	50%	52%	49%	68%	62%	58%	65%	52%	65%	61%	58%	56%	55%	55%	56%	57%	55%
JD27_DD11YOX311201511123-T2-1_Blattodea	44%	27%	22%	20%	9%	9%	9%	0%	0%		0%	57%	52%	50%	50%	52%	49%	68%	62%	51%	65%	51%	65%	61%	58%	58%	55%	55%	56%	56%	57%
JD52_GO3YJ180720151124-T1-4_Blattodea	39%	27%	22%	20%	10%	10%	10%	0%	0%	0%		57%	52%	50%	50%	52%	49%	68%	62%	58%	65%	52%	65%	61%	58%	56%	55%	55%	56%	57%	55%
00431_LN34133 Blattodea HopeDowns	46%	59%	51%	48%	55%	55%	55%	57%	57%	57%	57%		7%	7%	7%	7%	7%	21%	23%	22%	22%	22%	22%	22%	11%	11%	11%	11%	11%	11%	11%
00373_LN33372 Blattodea HopeDowns	50%	55%	55%	44%	53%	53%	53%	52%	52%	52%	52%	7%		1%	1%	1%	0%	22%	23%	22%	22%	22%	22%	22%	9%	9%	9%	9%	10%	9%	9%
00426_LN33532 Blattodea HopeDowns	51%	52%	46%	46%	55%	55%	55%	50%	50%	50%	50%	7%	1%		1%	0%	1%	22%	23%	22%	22%	22%	22%	21%	9%	9%	9%	9%	9%	9%	8%
00432_LN34509 Blattodea HopeDowns	56%	53%	54%	45%	52%	52%	52%	50%	50%	50%	50%	7%	1%	1%		1%	1%	22%	23%	23%	23%	23%	23%	22%	9%	9%	9%	9%	10%	9%	9%
00435_LN37718 Blattodea HopeDowns	48%	46%	51%	47%	57%	57%	57%	52%	52%	52%	52%	7%	1%	0%	1%		1%	22%	23%	22%	22%	22%	22%	22%	9%	9%	9%	9%	9%	8%	8%
00497_LN36536 Blattodea HopeDowns	50%	55%	43%	44%	59%	59%	59%	49%	49%	49%	49%	7%	0%	1%	1%	1%		22%	23%	22%	22%	22%	22%	22%	9%	10%	9%	9%	10%	9%	9%
00374_LN36582 Blattodea HopeDowns	47%	53%	55%	58%	53%	53%	53%	68%	68%	68%	68%	21%	22%	22%	22%	22%	22%		2%	2%	2%	2%	2%	0%	20%	20%	20%	20%	20%	21%	19%
00376_LN37412 Blattodea HopeDowns	43%	60%	53%	53%	61%	61%	61%	62%	62%	62%	62%	23%	23%	23%	23%	23%	23%	2%		3%	3%	3%	2%	2%	21%	21%	21%	21%	22%	22%	21%
00425_LN36514 Blattodea HopeDowns	48%	57%	54%	51%	54%	54%	54%	58%	58%	51%	58%	22%	22%	22%	23%	22%	22%	2%	3%		0%	0%	0%	2%	21%	22%	21%	21%	22%	21%	21%
00427_LN33514 Blattodea HopeDowns	52%	55%	57%	56%	52%	52%	52%	65%	65%	65%	65%	22%	22%	22%	23%	22%	22%	2%	3%	0%		0%	0%	2%	20%	21%	21%	21%	21%	21%	20%
00428_LN39408 Blattodea HopeDowns	52%	55%	54%	51%	54%	54%	54%	52%	52%	51%	52%	22%	22%	22%	23%	22%	22%	2%	3%	0%	0%		0%	2%	20%	21%	21%	21%	21%	21%	21%
00437_LN35535 Blattodea HopeDowns	63%	57%	57%	56%	55%	55%	55%	65%	65%	65%	65%	22%	22%	22%	23%	22%	22%	2%	2%	0%	0%	0%		2%	20%	21%	21%	21%	21%	21%	20%
00493_LN33574 Blattodea HopeDowns	47%	53%	56%	56%	53%	53%	53%	61%	61%	61%	61%	22%	22%	21%	22%	22%	22%	0%	2%	2%	2%	2%	2%		20%	20%	20%	20%	20%	21%	19%
00377_LN35427 Blattodea HopeDowns	59%	51%	43%	51%	46%	46%	46%	58%	58%	58%	58%	11%	9%	9%	9%	9%	9%	20%	21%	21%	20%	20%	20%	20%		1%	1%	1%	1%	0%	1%
00424_LN33391 Blattodea HopeDowns	59%	49%	48%	52%	47%	47%	47%	56%	56%	58%	56%	11%	9%	9%	9%	9%	10%	20%	21%	22%	21%	21%	21%	20%	1%		0%	0%	0%	1%	0%
00429_LN37424 Blattodea HopeDowns	58%	47%	47%	51%	46%	46%	46%	55%	55%	55%	55%	11%	9%	9%	9%	9%	9%	20%	21%	21%	21%	21%	21%	20%	1%	0%		0%	0%	1%	0%
00430_LN38726 Blattodea HopeDowns	59%	49%	57%	52%	47%	47%	47%	55%	55%	55%	55%	11%	9%	9%	9%	9%	9%	20%	21%	21%	21%	21%	21%	20%	1%	0%	0%		0%	1%	0%
00433_LN37717 Blattodea HopeDowns	59%	50%	48%	51%	46%	46%	46%	56%	56%	56%	56%	11%	10%	9%	10%	9%	10%	20%	22%	22%	21%	21%	21%	20%	1%	0%	0%	0%		1%	0%
00434_LN34142 Blattodea HopeDowns	61%	54%	47%	52%	46%	46%	46%	57%	57%	56%	57%	11%	9%	9%	9%	8%	9%	21%	22%	21%	21%	21%	21%	21%	0%	1%	1%	1%	1%		1%
00485_LN38585 Blattodea HopeDowns	59%	49%	48%	52%	46%	46%	46%	55%	55%	57%	55%	11%	9%	8%	9%	8%	9%	19%	21%	21%	20%	21%	20%	19%	1%	0%	0%	0%	0%	1%	

Appendix 3. Distance matrix of Chilopoda haplotypes included in the analysis

COI divergence of Chilopoda (regional comparisons)	KR705664	IV139	IV140	IV141	BMR00489	WAMT145918	WAM132678	JU04	MEGDC0057A	IV143	WAMT144196	WAMT145916	WAMT144180	WAMT144184	WAMT144179	WAMT144183	WAMT144744	WAMT144745
KR705664 Scolopendra morsitans CUMZ00344		28%	28%	28%	31%	32%	36%	26%	29%	29%	25%	26%	29%	30%	22%	23%	23%	22%
IV139_DD14MRR0004T1-01_Chilopoda	28%		0%	0%	28%	27%	33%	28%	29%	28%	30%	30%	28%	31%	27%	27%	28%	27%
IV140_DD14MRR0004T1-01_Chilopoda	28%	0%		0%	28%	27%	33%	28%	29%	28%	30%	30%	28%	31%	27%	27%	28%	27%
IV141_DD14MRR0005-T1-04_Chilopoda	28%	0%	0%		28%	27%	33%	28%	29%	28%	30%	30%	28%	31%	27%	27%	28%	27%
BMR00489_ LN37426 Chilopoda HopeDowns (reversed)	31%	28%	28%	28%		21%	25%	26%	31%	28%	27%	27%	24%	25%	28%	27%	27%	28%
RT48_WAMT145918_WAM-CRYP006	32%	27%	27%	27%	21%		22%	24%	29%	28%	27%	23%	26%	26%	27%	26%	27%	27%
WAM132678_COBRC0001_Chilopoda_HelixCHI022	36%	33%	33%	33%	25%	22%		26%	29%	30%	28%	30%	29%	28%	29%	29%	28%	29%
JU04_RC14MEH0388.20160628.T2-2_Scolopendrida	26%	28%	28%	28%	26%	24%	26%		17%	25%	24%	21%	20%	21%	20%	20%	20%	20%
WAM120191_MEGDC0057A_Chilopoda_HelixCHI021	29%	29%	29%	29%	31%	29%	29%	17%		27%	24%	27%	26%	25%	25%	25%	24%	25%
IV143_MEARC4383-20151001-T2-01_Chilopoda	29%	28%	28%	28%	28%	28%	30%	25%	27%		9%	25%	23%	24%	23%	23%	23%	23%
RT24_WAMT144196_RC15MEB0020_WAM-CRYP004	25%	30%	30%	30%	27%	27%	28%	24%	24%	9%		21%	21%	22%	22%	21%	21%	22%
RT48_WAMT145916_WAM-CRYP005	26%	30%	30%	30%	27%	23%	30%	21%	27%	25%	21%		18%	16%	20%	20%	19%	20%
RT24_WAMT144180_RC14MEB0150_WAM-CRYP001	29%	28%	28%	28%	24%	26%	29%	20%	26%	23%	21%	18%		10%	22%	22%	20%	22%
RT24_WAMT144184_GR15MEC0015_WAM-CRYP002	30%	31%	31%	31%	25%	26%	28%	21%	25%	24%	22%	16%	10%		21%	21%	21%	21%
RT24_WAMT144179_RC16MEC0188_WAM-CRYP003	22%	27%	27%	27%	28%	27%	29%	20%	25%	23%	22%	20%	22%	21%		0%	2%	0%
RT24_WAMT144183_RC16HWY0112_WAM-CRYP003	23%	27%	27%	27%	27%	26%	29%	20%	25%	23%	21%	20%	22%	21%	0%		2%	0%
RT31_WAMT144744_GR15MEB0018_WAM-CRYP003	23%	28%	28%	28%	27%	27%	28%	20%	24%	23%	21%	19%	20%	21%	2%	2%		2%
RT31_WAMT144745_RC16HWY0112_WAM-CRYP003	22%	27%	27%	27%	28%	27%	29%	20%	25%	23%	22%	20%	22%	21%	0%	0%	2%	

Appendix 4. Distance matrix of Diplura sequences/ lineages included in the analysis

COI divergence of Diplura (regional comparisons)	RT27	JU02	RT27	IV154	IV155	MO06	IV157	IV159	ML31	IV248	IV245	IV160	RT48	RT48	RT48	ML39	RT48	RT48	IV156	JQ 79664	JQ 79664	JQ 79664	JQ 79664	JQ 79664	00490	RT56	JC18	RT53	LI30	RT53	RT53	RT48	RT53	RT53
RT27_WAME34031_Mesa_K_Ptiliidae_CPT003		32%	31%	35%	35%	35%	34%	35%	33%	34%	31%	46%	38%	34%	34%	36%	36%	36%	36%	32%	34%	32%	31%	31%	33%	34%	36%	37%	36%	34%	37%	36%	36%	33%
JU02_GR15MEH0032.20160628.T3-2_Diplura	32%		30%	35%	33%	33%	32%	32%	31%	26%	27%	44%	35%	32%	34%	36%	36%	36%	30%	30%	30%	30%	30%	30%	28%	28%	31%	31%	33%	31%	30%	31%	31%	30%
RT27_WAME34029_Mesa_K_Diplura	31%	30%		23%	25%	25%	24%	25%	24%	33%	30%	37%	34%	30%	36%	33%	33%	33%	35%	30%	29%	30%	29%	30%	33%	29%	31%	32%	30%	30%	31%	30%	29%	28%
IV154_DD11MEB001T1-01_Diplura	35%	35%	23%		16%	16%	18%	18%	17%	33%	35%	39%	36%	33%	39%	36%	36%	36%	30%	33%	34%	34%	33%	34%	31%	31%	32%	29%	32%	30%	32%	30%	29%	29%
IV155_DD11MEB001T1-01_Diplura	35%	33%	25%	16%		0%	6%	5%	5%	32%	34%	35%	37%	35%	39%	38%	38%	38%	31%	31%	31%	32%	31%	32%	28%	30%	31%	29%	34%	30%	30%	30%	30%	28%
MO06_RC15MEB0036-20170902-T1-03_Diplura	35%	33%	25%	16%	0%		5%	5%	5%	31%	34%	35%	37%	35%	39%	38%	39%	39%	31%	31%	31%	32%	31%	32%	29%	30%	32%	28%	34%	30%	30%	30%	30%	28%
IV157_DD14MEB0005-20151001-T3-02_Diplura	34%	32%	24%	18%	6%	5%		1%	1%	29%	32%	33%	36%	35%	38%	37%	37%	37%	29%	31%	31%	31%	31%	32%	29%	29%	31%	27%	32%	28%	29%	28%	30%	27%
IV159_RC14MEB0101-20151001-T2-01_Diplura	35%	32%	25%	18%	5%	5%	1%		1%	29%	32%	34%	35%	35%	38%	37%	38%	38%	29%	31%	31%	31%	31%	31%	28%	29%	31%	27%	32%	28%	29%	28%	30%	27%
ML31_RC14MEB0150-20170711-T1-02_Diplura	33%	31%	24%	17%	5%	5%	1%	1%		29%	32%	33%	35%	35%	38%	37%	38%	38%	29%	31%	31%	31%	31%	31%	28%	30%	31%	27%	32%	28%	29%	29%	30%	27%
IV248_RC15MEC0192-20160316-T1-01_Diplura	34%	26%	33%	33%	32%	31%	29%	29%	29%		14%	38%	31%	28%	30%	28%	28%	28%	23%	26%	27%	27%	27%	27%	25%	24%	28%	26%	26%	25%	24%	24%	24%	24%
IV245_RC15MEB0171-20160317-T1-01_Diplura	31%	27%	30%	35%	34%	34%	32%	32%	32%	14%		38%	30%	31%	33%	31%	31%	31%	23%	25%	25%	25%	25%	24%	28%	25%	27%	28%	25%	26%	28%	27%	25%	25%
IV160_MEARC3790-20150807-T2-03_Diplura	46%	44%	37%	39%	35%	35%	33%	34%	33%	38%	38%		37%	40%	39%	38%	38%	38%	35%	35%	34%	35%	35%	35%	34%	37%	35%	30%	33%	34%	35%	33%	35%	34%
RT48_WAME98601_Diplura_COI	38%	35%	34%	36%	37%	37%	36%	35%	35%	31%	30%	37%		20%	19%	18%	18%	18%	31%	29%	29%	30%	29%	29%	29%	26%	26%	27%	29%	28%	30%	28%	26%	25%
RT48_WAME98600_Diplura_COI	34%	32%	30%	33%	35%	35%	35%	35%	35%	28%	31%	40%	20%		21%	17%	17%	17%	33%	28%	27%	27%	28%	28%	26%	27%	30%	31%	32%	30%	31%	31%	29%	30%
RT48_WAME98609_Diplura_COI	34%	34%	36%	39%	39%	39%	38%	38%	38%	30%	33%	39%	19%	21%		16%	16%	16%	31%	32%	33%	32%	32%	32%	29%	27%	28%	27%	31%	29%	27%	27%	27%	27%
ML39_RC15MEC0095-20170712-T3-01_Diplura	36%	36%	33%	36%	38%	38%	37%	37%	37%	28%	31%	38%	18%	17%	16%		0%	0%	31%	31%	32%	30%	31%	31%	30%	26%	27%	30%	28%	30%	32%	31%	28%	30%
RT48_WAME98617_Japygidae_COI	36%	36%	33%	36%	38%	39%	37%	38%	38%	28%	31%	38%	18%	17%	16%	0%		0%	32%	31%	32%	30%	31%	31%	30%	26%	27%	30%	28%	30%	32%	31%	28%	30%
RT48_WAME98618_Diplura_COI	36%	36%	33%	36%	38%	39%	37%	38%	38%	28%	31%	38%	18%	17%	16%	0%	0%		32%	31%	32%	30%	31%	31%	30%	26%	27%	30%	28%	30%	32%	31%	28%	30%
IV156_DD11MEC0005-02_Diplura	36%	30%	35%	30%	31%	31%	29%	29%	29%	23%	23%	35%	31%	33%	31%	31%	32%	32%		21%	22%	22%	22%	22%	24%	22%	24%	22%	23%	21%	21%	19%	21%	20%
JQ796642 (reversed)	32%	30%	30%	33%	31%	31%	31%	31%	31%	26%	25%	35%	29%	28%	32%	31%	31%	31%	21%		3%	2%	1%	1%	20%	20%	24%	21%	22%	20%	20%	19%	21%	20%
JQ796644 (reversed)	34%	30%	29%	34%	31%	31%	31%	31%	31%	27%	25%	34%	29%	27%	33%	32%	32%	32%	22%	3%		2%	3%	3%	20%	21%	25%	21%	22%	20%	20%	19%	20%	19%
JQ796645 (reversed)	32%	30%	30%	34%	32%	32%	31%	31%	31%	27%	25%	35%	30%	27%	32%	30%	30%	30%	22%	2%	2%		2%	2%	20%	20%	24%	21%	22%	20%	21%	20%	21%	20%
JQ796646 (reversed)	31%	30%	29%	33%	31%	31%	31%	31%	31%	27%	25%	35%	29%	28%	32%	31%	31%	31%	22%	1%	3%	2%		2%	19%	21%	24%	20%	22%	20%	21%	20%	21%	20%
JQ796647 (reversed)	31%	30%	30%	34%	32%	32%	32%	31%	31%	27%	24%	35%	29%	28%	32%	31%	31%	31%	22%	1%	3%	2%	2%		19%	20%	24%	21%	22%	20%	20%	20%	21%	20%
BMR00490_LN33785 Diplura HopeDowns (reversed)	**33%**	**28%**	**33%**	**31%**	**28%**	**29%**	**29%**	**28%**	**28%**	**25%**	**28%**	**34%**	**29%**	**26%**	**29%**	**30%**	**30%**	**30%**	**24%**	**20%**	**20%**	**20%**	**19%**	**19%**		**18%**	**20%**	**18%**	**22%**	**20%**	**20%**	**20%**	**16%**	**17%**
RT56_WAME98666_Diplura?_2	34%	28%	29%	31%	30%	30%	29%	29%	30%	24%	25%	37%	26%	27%	27%	26%	26%	26%	22%	20%	21%	20%	21%	20%	**18%**		15%	19%	18%	17%	18%	17%	16%	16%
JC18_RC14BS4004-20151125-T2-01_Diplura	36%	31%	31%	32%	31%	32%	31%	31%	31%	28%	27%	35%	26%	30%	28%	27%	27%	27%	24%	24%	25%	24%	24%	24%	**20%**	15%		20%	18%	19%	22%	21%	18%	18%
RT53_WAME98649_WAM-DPLJ006	37%	31%	32%	29%	29%	28%	27%	27%	27%	26%	28%	30%	27%	31%	27%	30%	30%	30%	22%	21%	21%	21%	20%	21%	**18%**	19%	20%		12%	17%	19%	17%	17%	18%
LI30_MEAWO4088-20170307-01_Diplura	36%	33%	30%	32%	34%	34%	32%	32%	32%	26%	25%	33%	29%	32%	31%	28%	28%	28%	23%	22%	22%	22%	22%	22%	**22%**	18%	18%	12%		19%	21%	19%	19%	19%
RT53_WAME98647_Diplura_WAM-DPLJ002	34%	31%	30%	30%	30%	30%	28%	28%	28%	25%	26%	34%	28%	30%	29%	30%	30%	30%	21%	20%	20%	20%	20%	20%	**20%**	17%	19%	17%	19%		10%	10%	11%	9%
RT53_WAME98654_Diplura_WAM-DPLJ004	37%	30%	31%	32%	30%	30%	29%	29%	29%	24%	28%	35%	30%	31%	27%	32%	32%	32%	21%	20%	20%	21%	21%	20%	**20%**	18%	22%	19%	21%	10%		7%	7%	7%
RT48_WAME98598_Japygidae_COI	36%	31%	30%	30%	30%	30%	28%	28%	29%	24%	27%	33%	28%	31%	27%	31%	31%	31%	19%	19%	19%	20%	20%	20%	**20%**	17%	21%	17%	19%	10%	7%		8%	8%
RT53_WAME98651_Diplura_WAM-DPLJ001-A	36%	31%	29%	29%	30%	30%	30%	30%	30%	24%	25%	35%	26%	29%	27%	28%	28%	28%	21%	21%	20%	21%	21%	21%	**16%**	16%	18%	17%	19%	11%	7%	8%		4%
RT53_WAME98650_Diplura_WAM-DPLJ001	33%	30%	28%	29%	28%	28%	27%	27%	27%	24%	25%	34%	25%	30%	27%	30%	30%	30%	20%	20%	19%	20%	20%	20%	**17%**	16%	18%	18%	19%	9%	7%	8%	4%	

Appendix 5 . Distance matrix of Hemiptera sequences/ lineages included in the analysis

COI divergence of Hemiptera (regional comparisons)	WAME34031	BMR00436	BMR00487	BMR00486	WAME98571	WAME98656	WAME98671	BMR00553	WAME98535	WAME98587	WAME98594	WAME98657	WAME98678	JY19_2139	JY20_2356
RT27_WAME34031_Mesa_K_Ptiliidae_Helix_CPT003		41%	41%	44%	45%	44%	45%	41%	41%	42%	42%	41%	42%	42%	42%
BMR00436_LN36535 Hemiptera HopeDowns (reversed)	41%		0%	27%	25%	25%	25%	26%	28%	27%	25%	27%	26%	27%	27%
BMR00487_LN33789 Hemiptera HopeDowns (reversed)	41%	0%		27%	25%	25%	25%	26%	28%	27%	26%	28%	27%	27%	27%
BMR00486_LN33774 Hemiptera HopeDowns (reversed)	44%	27%	27%		11%	12%	11%	17%	17%	16%	16%	17%	17%	17%	17%
RT43_WAME98571_Phaconeura_WAM-PHAC002	45%	25%	25%	11%		1%	0%	19%	18%	17%	18%	17%	17%	17%	17%
RT53_WAME98656_Phaconeura_WAM-PHAC002	44%	25%	25%	12%	1%		1%	19%	18%	17%	17%	17%	17%	17%	17%
RT56_WAME98671_Phaconeura_WAM-PHAC002	45%	25%	25%	11%	0%	1%		19%	18%	17%	18%	17%	17%	17%	17%
BMR00553_LN35120 Hemiptera HopeDowns (reversed)	41%	26%	26%	17%	19%	19%	19%		14%	13%	14%	14%	13%	13%	13%
RT43_WAME98535_Phaconeura_WAM-PHAC001	41%	28%	28%	17%	18%	18%	18%	14%		2%	2%	1%	2%	2%	2%
RT45_WAME98594_Phaconeura_WAM-PHAC001	42%	25%	26%	16%	18%	17%	18%	14%	2%	0%		2%	0%	0%	0%
RT46_WAME98587_Phaconeura_WAM-PHAC001	42%	27%	27%	16%	17%	17%	17%	13%	2%		0%	2%	0%	0%	0%
RT53_WAME98657_Phaconeura_WAM-PHAC001	41%	27%	28%	17%	17%	17%	17%	14%	1%	2%	2%		2%	2%	2%
RT56_WAME98678_Phaconeura_WAM-PHAC001	42%	26%	27%	17%	17%	17%	17%	13%	2%	0%	0%	2%		0%	0%
JY19_2139_Meenoplidae_WAN	42%	27%	27%	17%	17%	17%	17%	13%	2%	0%	0%	2%	0%		0%
JY20_2356_Meenoplidae_WAN	42%	27%	27%	17%	17%	17%	17%	13%	2%	0%	0%	2%	0%	0%	

Appendix 6 Distance matrix of Palpigradi sequences/ lineages included in the analysis

COI divergence of Palpigradi (regional comparisons)	KJ744691	HM13	00707	RT43_PALE002	RT43_PALE001
KJ744691 (Araneae)		23%	66%	50%	51%
HM13_M20130912_Araneae_HD	23%		43%	45%	46%
00707_LN39264 Palpigradi HopeDowns	66%	43%		63%	55%
RT43_WAMT145439_Eukoenenia_WAM-PALE002	50%	45%	63%		30%
RT43_WAMT145442_Eukoenenia_WAM-PALE001	51%	46%	55%	30%	

Appendix 7. Distance matrix of Polyxenida sequences/ lineages included in the analysis

COI divergence of Diplopoda (regional comparisons)	P7	BMR00492	S45	S12	S31	P3	P1	P51	P52	P4	P11	P5	S23	P12	S27	S30	S34	P67	S53	S55	P6	S18	S25	S11	S46	S49
P7_RC08SILV0141PIT1-4_Polyxenida		29%	28%	27%	27%	29%	27%	28%	28%	22%	23%	26%	28%	26%	27%	28%	28%	28%	30%	30%	26%	27%	28%	29%	29%	29%
BMR00492_ LN38435 Diplopoda HopeDowns	29%		11%	9%	9%	10%	8%	9%	9%	5%	7%	12%	12%	11%	11%	12%	12%	11%	12%	12%	10%	11%	11%	11%	11%	11%
S45_RHWRC0250P2T3-3_Polyxenida_Hmstd-Namm-Silv	28%	11%		6%	6%	11%	10%	10%	10%	7%	9%	12%	14%	13%	12%	13%	13%	12%	13%	13%	10%	11%	12%	11%	12%	12%
S12_CGBRC0293P2T2-2_Polyxenida_Hmstd-Namm-Silv	27%	9%	6%		0%	9%	8%	9%	9%	6%	8%	12%	13%	13%	12%	13%	13%	12%	12%	12%	10%	12%	12%	12%	12%	12%
S31_CGBRC0285P2T2-2_Polyxenida_Hmstd-Namm-Silv	27%	9%	6%	0%		9%	8%	8%	8%	6%	7%	12%	12%	12%	12%	12%	12%	11%	11%	11%	10%	11%	12%	11%	11%	11%
P3_RC08SILV0796PIT1-2_Polyxenida (reversed)	29%	10%	11%	9%	9%		5%	5%	5%	4%	6%	13%	13%	13%	12%	13%	13%	12%	13%	13%	11%	12%	13%	12%	12%	12%
P1_DD08SILV09PIT1-1_Polyxenida (reversed)	27%	8%	10%	8%	8%	5%		2%	2%	5%	6%	12%	13%	12%	12%	13%	13%	12%	13%	13%	10%	12%	12%	12%	12%	12%
P51_RC03WR096P1T1-3A_Polyxenida (reversed)	28%	9%	10%	9%	8%	5%	2%		0%	4%	6%	12%	13%	13%	12%	13%	13%	12%	13%	13%	11%	12%	12%	11%	11%	11%
P52_RC03WR096P1T1-3B_Polyxenida (reversed)	28%	9%	10%	9%	8%	5%	2%	0%		4%	6%	13%	13%	13%	12%	13%	13%	13%	13%	13%	11%	12%	12%	12%	12%	12%
P4_RC08SILV0795PIT1-3_Polyxenida	22%	5%	7%	6%	6%	4%	5%	4%	4%		0%	1%	1%	2%	2%	2%	2%	3%	3%	2%	1%	3%	3%	2%	2%	2%
P11_RC08SILV0795PIT3-3_Polyxenida	23%	7%	9%	8%	7%	6%	6%	6%	6%	0%		0%	0%	1%	1%	2%	2%	2%	3%	3%	2%	3%	3%	3%	3%	3%
P5_RC08SILV0919PIT1-3_Polyxenida (reversed)	26%	12%	12%	12%	12%	13%	12%	12%	13%	1%	0%		0%	2%	2%	2%	2%	3%	4%	4%	4%	4%	4%	4%	4%	4%
S23_RC09SV023P2T1-3_Polyxenida_Hmstd-Namm-Silv	28%	12%	14%	13%	12%	13%	13%	13%	13%	1%	0%	0%		2%	2%	2%	2%	3%	4%	4%	4%	4%	4%	4%	4%	4%
P12_RC07S10B259P1T3-1_Polyxenida (reversed)	26%	11%	13%	13%	12%	13%	12%	13%	13%	2%	1%	2%	2%		2%	2%	2%	3%	3%	3%	3%	4%	4%	4%	4%	4%
S27_RC05MTS003P2T1-2_Polyxenida_Hmstd-Namm-Silv	27%	11%	12%	12%	12%	12%	12%	12%	12%	2%	1%	2%	2%	2%		0%	0%	4%	4%	4%	3%	4%	4%	4%	4%	4%
S30_RC05MTS003P2T1-2_Polyxenida_Hmstd-Namm-Silv	28%	12%	13%	13%	12%	13%	13%	13%	13%	2%	2%	2%	2%	2%	0%		0%	4%	4%	4%	3%	4%	4%	4%	4%	4%
S34_RC05MTS003P2T2-3_Polyxenida_Hmstd-Namm-Silv	28%	12%	13%	13%	12%	13%	13%	13%	13%	2%	2%	2%	2%	2%	0%	0%		4%	4%	4%	3%	4%	4%	4%	4%	4%
P67_RC05RH0040P1T1-1B_T96109B_Polyxenida (reversed)	28%	11%	12%	12%	11%	12%	12%	12%	13%	3%	2%	3%	3%	3%	4%	4%	4%		0%	0%	1%	2%	2%	2%	2%	2%
S53_RC08NAM389P2T1-2_Polyxenida_Hmstd-Namm-Silv	30%	12%	13%	12%	11%	13%	13%	13%	13%	3%	3%	4%	4%	3%	4%	4%	4%	0%		0%	1%	2%	2%	2%	2%	2%
S55_RC08NAM389P2T3-2_Polyxenida_Hmstd-Namm-Silv	30%	12%	13%	12%	11%	13%	13%	13%	13%	2%	3%	4%	4%	3%	4%	4%	4%	0%	0%		1%	2%	2%	2%	2%	2%
P6_RC08SILVPIT1-3_Polyxenida	26%	10%	10%	10%	10%	11%	10%	11%	11%	1%	2%	4%	4%	3%	3%	3%	3%	1%	1%	1%		1%	1%	1%	1%	1%
S18_CGBRC0285T2-2_Polyxenida_Hmstd-Namm-Silv	27%	11%	11%	12%	11%	12%	12%	12%	12%	3%	3%	4%	4%	4%	4%	4%	4%	2%	2%	2%	1%		0%	0%	0%	0%
S25_CGBRC0285P2T1-2_Polyxenida_Hmstd-Namm-Silv	28%	11%	12%	12%	12%	13%	12%	12%	12%	3%	3%	4%	4%	4%	4%	4%	4%	2%	2%	2%	1%	0%		0%	0%	0%
S11_RHWRC0273P2T2-4_Polyxenida_Hmstd-Namm-Silv	29%	11%	11%	12%	11%	12%	12%	11%	12%	2%	3%	4%	4%	4%	4%	4%	4%	2%	2%	2%	1%	0%	0%		0%	0%
S46_RHWRC0303P2T2-3_Polyxenida_Hmstd-Namm-Silv	29%	11%	12%	12%	11%	12%	12%	11%	12%	2%	3%	4%	4%	4%	4%	4%	4%	2%	2%	2%	1%	0%	0%	0%		0%
S49_RHWRC0303P2T3-3_Polyxenida_Hmstd-Namm-Silv	29%	11%	12%	12%	11%	12%	12%	11%	12%	2%	3%	4%	4%	4%	4%	4%	4%	2%	2%	2%	1%	0%	0%	0%	0%	

Appendix 8. Distance matrix of Pseudoscorpiones sequences/ lineages included in the analysis

COI divergence of Pseudoscorpiones (regional comparisons)	KJ744691	WAMT145889	JN018171	MK453588	00779	EU559513	WAMT146605	WAMT146291	WAMT146294	WAMT145809	WAMT145843	WAMT145849	WAMT145830	WAMT145831	WAMT145803	WAMT145875	WAMT145888	WAMT145847	WAMT145816	WAMT145887
KJ744691 Aname MYG213		37%	34%	36%	41%	43%	42%	43%	38%	42%	45%	42%	41%	40%	36%	37%	39%	41%	40%	41%
RT48 WAMT145889 Olpiidae WAM-OLPI001	37%		29%	30%	31%	29%	30%	30%	29%	31%	30%	30%	31%	30%	27%	28%	28%	31%	31%	31%
JN018171 Chthonius dacnodes	34%	29%		18%	19%	19%	21%	21%	20%	22%	22%	19%	24%	23%	22%	24%	22%	24%	24%	23%
MK453588 Pseudotyrannochthonius	36%	30%	18%		22%	21%	24%	22%	23%	20%	21%	20%	22%	22%	25%	26%	25%	27%	28%	27%
00779 LN35130 Pseudoscorpion HopeDowns (reversed)	**41%**	**31%**	**19%**	**22%**		**21%**	**20%**	**20%**	**22%**	**21%**	**23%**	**21%**	**25%**	**24%**	**22%**	**23%**	**22%**	**25%**	**22%**	**22%**
EU559513 Austrochthonius	43%	29%	19%	21%	21%		19%	21%	22%	21%	22%	19%	21%	21%	21%	21%	21%	23%	22%	22%
RT56 WAMT146605 Tyrannochthonius WAM-CHTH002	42%	30%	21%	24%	20%	19%		21%	22%	21%	21%	19%	19%	20%	21%	22%	21%	24%	23%	23%
RT53 WAMT146291 Tyrannochthonius Helix PC048	43%	30%	21%	22%	20%	21%	21%		11%	17%	17%	14%	18%	18%	19%	20%	19%	19%	19%	19%
RT53 WAMT146294 Tyrannochthonius Helix PC051	38%	29%	20%	23%	22%	22%	22%	11%		16%	16%	15%	17%	17%	19%	19%	18%	19%	18%	18%
RT48 WAMT145809 Tyrannochthonius WAM-CHTH005	42%	31%	22%	20%	21%	21%	21%	17%	16%		9%	6%	17%	17%	19%	18%	18%	22%	21%	21%
RT48 WAMT145843 Tyrannochthonius WAM-CHTH005	45%	30%	22%	21%	23%	22%	21%	17%	16%	9%		9%	17%	17%	20%	20%	19%	21%	22%	22%
RT48 WAMT145849 Tyrannochthonius WAM-CHTH005	42%	30%	19%	20%	21%	19%	19%	14%	15%	6%	9%		16%	16%	19%	17%	17%	20%	21%	21%
RT48 WAMT145830 Tyrannochthonius WAM-CHTH006	41%	31%	24%	22%	25%	21%	19%	18%	17%	17%	17%	16%		0%	17%	17%	15%	19%	20%	19%
RT48 WAMT145831 Tyrannochthonius WAM-CHTH006	40%	30%	23%	22%	24%	21%	20%	18%	17%	17%	17%	16%	0%		18%	17%	16%	19%	20%	19%
RT48 WAMT145803 Tyrannochthonius basme	36%	27%	22%	25%	22%	21%	21%	19%	19%	19%	20%	19%	17%	18%		4%	4%	13%	11%	11%
RT48 WAMT145875 Tyrannochthonius basme	37%	28%	24%	26%	23%	21%	22%	20%	19%	18%	20%	17%	17%	17%	4%		3%	14%	13%	13%
RT48 WAMT145888 Tyrannochthonius basme	39%	28%	22%	25%	22%	21%	21%	19%	18%	18%	19%	17%	15%	16%	4%	3%		13%	12%	12%
RT48 WAMT145847 Tyrannochthonius WAM-CHTH003	41%	31%	24%	27%	25%	23%	24%	19%	19%	22%	21%	20%	19%	19%	13%	14%	13%		9%	9%
RT48 WAMT145816 Tyrannochthonius WAM-CHTH003-A	40%	31%	24%	28%	22%	22%	23%	19%	18%	21%	22%	21%	20%	20%	11%	13%	12%	9%		0%
RT48 WAMT145887 Tyrannochthonius WAM-CHTH003-A	41%	31%	23%	27%	22%	22%	23%	19%	18%	21%	22%	21%	19%	19%	11%	13%	12%	9%	0%	

Appendix 9. Distance matrix of Schizomida sequences/ lineages included in the analysis

COI divergence of Schizomida (regional comparisons)	FZ4	JC06	CY1	DN2	GO90	HM1	BMR00648	BMR00708	BMR00775	BMR00776	BMR00777	MN020279	MN020275	MN020276	MN020280	MN020281	BMR00528	BMR00588	BMR00778
FZ4_Schizomida_RC11KOOD0018P7T1-1_Koodaideri		15%	11%	12%	11%	14%	16%	16%	16%	16%	16%	14%	15%	15%	15%	16%	16%	15%	16%
JC06_T138610_SchizomidaBrockman_Syncline	15%		16%	14%	15%	19%	19%	20%	19%	19%	19%	19%	20%	21%	20%	21%	20%	20%	20%
CY1_DD03KOOD003P3T2-1A_T126477_Schizomida_Koodaideri	11%	16%		7%	15%	15%	16%	16%	16%	16%	15%	17%	16%	17%	16%	17%	17%	17%	17%
DN2_RC12KOOD1374P5T1-2_Schizomida_Koodaideri	12%	14%	7%		15%	15%	16%	16%	17%	16%	16%	17%	15%	15%	15%	16%	16%	15%	16%
GO90_RC13YBR0038_Draculoides_sp_WeeliWolli	11%	15%	15%	15%		14%	14%	14%	14%	14%	14%	13%	15%	14%	15%	14%	14%	14%	14%
HM1_RC12H1SW0026P1T1-1_Schizomida_HD_SCH067	14%	19%	15%	15%	14%		8%	7%	8%	8%	8%	10%	10%	9%	10%	10%	10%	10%	10%
BMR00648 _LN35582_Schizomida_HopeDowns (reversed)	16%	19%	16%	16%	14%	8%		1%	1%	1%	0%	9%	8%	7%	8%	7%	7%	7%	7%
BMR00708 _LN38567_Schizomida_HopeDowns (reversed)	16%	20%	16%	16%	14%	7%	1%		1%	0%	1%	8%	7%	6%	7%	6%	6%	7%	7%
BMR00775 _LN33570_Schizomida_HopeDowns (reversed)	16%	19%	16%	17%	14%	8%	1%	1%		0%	1%	9%	7%	7%	7%	7%	7%	7%	7%
BMR00776 _LN33590_Schizomida_HopeDowns (reversed)	16%	19%	16%	16%	14%	8%	1%	0%	0%		1%	8%	7%	7%	7%	6%	7%	7%	7%
BMR00777 _LN35572_Schizomida_HopeDowns (reversed)	16%	19%	15%	16%	14%	8%	0%	1%	1%	1%		9%	7%	7%	7%	6%	7%	7%	7%
MN020279_Draculoides sp. SCH068 WAMT138602	14%	19%	17%	17%	13%	10%	9%	8%	9%	8%	9%		7%	6%	7%	7%	7%	7%	7%
MN020275_Draculoides sp. SCH068 WAMT135989	15%	20%	16%	15%	15%	10%	8%	7%	7%	7%	7%	7%		3%	0%	3%	4%	4%	4%
MN020276_Draculoides sp. SCH068 WAMT138599	15%	21%	17%	15%	14%	9%	7%	6%	7%	7%	7%	6%	3%		3%	3%	3%	3%	3%
MN020280_Draculoides sp. SCH068 WAMT138603	15%	20%	16%	15%	15%	10%	8%	7%	7%	7%	7%	7%	0%	3%		3%	4%	4%	4%
MN020281_Draculoides sp. SCH068 WAMT138604	16%	21%	17%	16%	14%	10%	7%	6%	7%	6%	6%	7%	3%	3%	3%		2%	2%	2%
BMR00528 _LN37569_Schizomida_HopeDowns (reversed)	16%	20%	17%	16%	14%	10%	7%	6%	7%	7%	7%	7%	4%	3%	4%	2%		0%	0%
BMR00588 _LN38573_Schizomida_HopeDowns (reversed)	15%	20%	17%	15%	14%	10%	7%	7%	7%	7%	7%	7%	4%	3%	4%	2%	0%		0%
BMR00778_LN36580_Schizomida_HopeDowns (reversed)	16%	20%	17%	16%	14%	10%	7%	7%	7%	7%	7%	7%	4%	3%	4%	2%	0%	0%	

Appendix 10. Distance matrix of Zygentoma sequences/ lineages included in the analysis

12S divergence of Zygentoma (regional comparisons)	WAME98619	IV228	IV229	BMR00555	WAME98579	WAME98581	WAME98679	WAME98680	WAME98681	WAME98688	WAME98559	WAME98547	WAME98551	WAME98687	FL3	FL4	IV227	IV333	IV334	IV338	IV339
RT48_WAME98619_Nicoletiidae_JIM_WAM-ZYGN001		43%	43%	38%	34%	36%	36%	35%	35%	43%	45%	43%	46%	45%	42%	42%	44%	43%	46%	44%	45%
IV228_RC14MEB0060_Thysanura	43%		0%	19%	19%	18%	18%	18%	17%	46%	42%	43%	50%	42%	43%	43%	45%	44%	48%	48%	48%
IV229_RC14MEB0060_Thysanura	43%	0%		20%	19%	18%	19%	18%	18%	46%	42%	43%	50%	42%	45%	45%	48%	47%	52%	51%	50%
BMR00555_LN39280_Zygentoma_R_12S	38%	19%	20%		8%	8%	8%	9%	10%	44%	45%	43%	47%	44%	45%	45%	43%	40%	48%	47%	46%
RT43_WAME98579_Dodecastyla_WAM_-ZYGA001	34%	19%	19%	8%		2%	2%	2%	5%	38%	43%	41%	44%	41%	42%	42%	44%	42%	45%	44%	44%
RT43_WAME98581_Dodecastyla_WAM_-ZYGA001	36%	18%	18%	8%	2%		0%	0%	5%	38%	43%	42%	46%	42%	42%	42%	44%	42%	45%	45%	45%
RT56_WAME98679_Dodecastyla_WAM-ZYGA001	36%	18%	19%	8%	2%	0%		1%	5%	39%	44%	43%	48%	41%	43%	43%	45%	43%	48%	45%	45%
RT56_WAME98680_Dodecastyla_WAM-ZYGA001	35%	18%	18%	9%	2%	0%	1%		4%	38%	45%	42%	46%	41%	43%	43%	46%	45%	48%	47%	47%
RT56_WAME98681_Dodecastyla_WAM-ZYGA001	35%	17%	18%	10%	5%	5%	5%	4%		40%	46%	43%	46%	42%	43%	43%	46%	46%	49%	48%	48%
RT56_WAME98688_Trinemura_WAM-ZYGS001	43%	46%	46%	44%	38%	38%	39%	38%	40%		14%	12%	14%	12%	13%	13%	17%	15%	17%	14%	14%
RT43_WAME98559_Trinemura_WAM-ZYGS002	45%	42%	42%	45%	43%	43%	44%	45%	46%	14%		13%	12%	13%	11%	11%	14%	15%	18%	15%	14%
RT43_WAME98547_Trinemura_WAM-ZYGS004	43%	43%	43%	43%	41%	42%	43%	42%	43%	12%	13%		10%	10%	12%	12%	11%	13%	17%	13%	13%
RT43_WAME98551_Trinemura_WAM-ZYGS003	46%	50%	50%	47%	44%	46%	48%	46%	46%	14%	12%	10%		13%	14%	14%	14%	15%	17%	13%	13%
RT56_WAME98687_Trinemura_WAM-ZYGS005	45%	42%	42%	44%	41%	42%	41%	41%	42%	12%	13%	10%	13%		9%	9%	12%	12%	16%	11%	12%
FL3_TOBRC0011PIT2-1_A	42%	43%	45%	45%	42%	42%	43%	43%	43%	13%	11%	12%	14%	9%		0%	11%	11%	14%	10%	9%
FL4_TOBRC0011PIT2-1_B	42%	43%	45%	45%	42%	42%	43%	43%	43%	13%	11%	12%	14%	9%	0%		11%	11%	14%	10%	9%
IV227_MEARC4383_Thysanura	44%	45%	48%	43%	44%	44%	45%	46%	46%	17%	14%	11%	14%	12%	11%	11%		3%	15%	14%	14%
IV333_MEBRC0020T1-20_Thysanura	43%	44%	47%	40%	42%	42%	43%	45%	46%	15%	15%	13%	15%	12%	11%	11%	3%		14%	14%	13%
IV334_M2ERC0057T1-21_Thysanura	46%	48%	52%	48%	45%	45%	48%	48%	49%	17%	18%	17%	17%	16%	14%	14%	15%	14%		14%	14%
IV338_GR15MEC0001-20160316-T2-06_Thysanura	44%	48%	51%	47%	44%	45%	45%	47%	48%	14%	15%	13%	13%	11%	10%	10%	14%	14%	14%		2%
IV339_RC15MEC0197-20160316-T2-01_Thysanura	45%	48%	50%	46%	44%	45%	45%	47%	48%	14%	14%	13%	13%	12%	9%	9%	14%	13%	14%	2%	

Appendix 11. Table of lineages/ species results from the analysis

Area	Site Name	Higher taxon	Taxon ID	Lot No. (LN)	BMR Code	Biologic Lineage name	Local alignment (species level)	Regional alignment (species level)
BBH	MB16SW0006	Amphipoda	*Pilbarus* nr_*millsi*_OES12	LN35584	BMR00484	AMPH001	Biologic-AMPH001 (<0.1%)	No (>26%)
BBH	MB16HD1SW0006	Amphipoda	Amphipoda	LN35145	BMR00488	AMPH001	Biologic-AMPH001 (<0.1%)	No (>26%)
BHT	RC18BHT0334	Blattodea	*Nocticola* OES13	LN33372	BMR00373	BLAT002	Biologic-BLAT002 (<2%)	No (>43%)
BHT	RC18BHT0254	Blattodea	*Nocticola* OES13	LN36582	BMR00374	BLAT003	Biologic-BLAT003 (<3%)	No (>43%)
BHT	DD17BHT0020	Blattodea	*Nocticola* OES13	LN37412	BMR00376	BLAT003	Biologic-BLAT003 (<3%)	No (>43%)
BHT	RC18BHT0016	Blattodea	*Nocticola* OES12	LN35427	BMR00377	BLAT004	Biologic-BLAT004 (<1%)	No (>43%)
BHT	RC18BHT0001	Blattodea	*Nocticola* OES12	LN33391	BMR00424	BLAT004	Biologic-BLAT004 (<1%)	No (>43%)
HD2	RC16HD20174	Blattodea	*Nocticola* OES13	LN36514	BMR00425	BLAT003	Biologic-BLAT003 (<3%)	No (>43%)
BHT	RC18BHT0224	Blattodea	*Nocticola* OES13	LN33532	BMR00426	BLAT002	Biologic-BLAT002 (<2%)	No (>43%)
HD2	RC17HD20011	Blattodea	*Nocticola* OES13	LN33514	BMR00427	BLAT003	Biologic-BLAT003 (<3%)	No (>43%)
HD2	GD18HD20009	Blattodea	*Nocticola* OES13	LN39408	BMR00428	BLAT003	Biologic-BLAT003 (<3%)	No (>43%)
BHT	RC18BHT0258	Blattodea	*Nocticola* OES12	LN37424	BMR00429	BLAT004	Biologic-BLAT004 (<1%)	No (>43%)
BHT	RC18BHT0099	Blattodea	*Nocticola* OES12	LN38726	BMR00430	BLAT004	Biologic-BLAT004 (<1%)	No (>43%)
HD2	RC18HD20171	Blattodea	*Nocticola* OES12	LN34133	BMR00431	BLAT001	No (>7%)	No (>43%)
BHT	RC18BHT0308	Blattodea	*Nocticola* OES13	LN34509	BMR00432	BLAT002	Biologic-BLAT002 (<2%)	No (>43%)
BHT	RC18BHT0026	Blattodea	*Nocticola* OES12	LN37717	BMR00433	BLAT004	Biologic-BLAT004 (<1%)	No (>43%)
BHT	RC18BHT0016	Blattodea	*Nocticola* OES13	LN34142	BMR00434	BLAT004	Biologic-BLAT004 (<1%)	No (>43%)
BHT	RC18BHT0248	Blattodea	*Nocticola* OES13	LN37718	BMR00435	BLAT002	Biologic-BLAT002 (<2%)	No (>43%)
HD2	DD18HD20001	Blattodea	*Nocticola* OES13	LN35535	BMR00437	BLAT003	Biologic-BLAT003 (<3%)	No (>43%)
BHT	RC16BHT0291	Blattodea	*Nocticola* OES13	LN38585	BMR00485	BLAT004	Biologic-BLAT004 (<1%)	No (>43%)
BHT	RC18BHT0254	Blattodea	*Nocticola* OES13	LN33574	BMR00493	BLAT003	Biologic-BLAT003 (<3%)	No (>43%)
BHT	RC15BHT0267	Blattodea	*Nocticola* OES13	LN36536	BMR00497	BLAT002	Biologic-BLAT002 (<2%)	No (>43%)
HD2	DD18HD20005	Chilopoda	Scolopendromorpha	LN37426	BMR00489	CHIL001	No	No (>21%)
HD2	RC17HD20234	Diplura	*Indjapx* OES7	LN33785	BMR00490	DIPL001	No	No (>16%)
BHT	DD17BHT0020	Hemiptera	*Nisia* OES16	LN35425	BMR00375	Failed	n/a	n/a
BHT	RC15BHT0267	Hemiptera	*Nisia* OES16	LN36535	BMR00436	HEMI001	Biologic-HEMI001 (<0.1%)	No (>13%)
BHT	RC16HD10193	Hemiptera	*Phaconeura* OES15	LN33774	BMR00486	HEMI002	No (>18%)	No (>13%)
BHT	RC16BHT0222	Hemiptera	*Nisia* OES16	LN33789	BMR00487	HEMI001	Biologic-HEMI001 (<0.1%)	No (>13%)
BBH	RC14HD10072	Hemiptera	*Phaconeura* OES15	LN35120	BMR00553	HEMI003	No (>18%)	No (>13%)
BHT	RC18BHT0030	Hemiptera	*Phaconeura* indet	LN32758	BMR00554	Failed	n/a	n/a
HD2	RC18HD20120	Palpigradi	*Eukoenenia* OES2	LN39264	BMR00707	PALP001	No	No (>55%)
BHT	RC16BHT0141	Palpigradi	*Eukoenenia* OES2	LN39263	BMR00780	Failed	n/a	n/a
BHT	RC18BHT0100	Pauropoda	Pauropoda	LN35790	BMR00491	Failed	n/a	n/a
BHT	RC18BHT0258	Polyxenida	Lophoproctidae	LN38435	BMR00492	POLX001	No	No (>9%)
BHT	RC18BHT0248	Pseudoscorpiones	*Tyrannochthonius* OES20	LN35130	BMR00779	PSEU001	No	No (>19%)
BHT	RC15BHT0267	Schizomida	*Draculoides* ?BHD4/ BHD5	LN37569	BMR00528	n/a	Within lineage (<7%)	*Draculoides* SCH068 (<7%)
BHT	RC15BHT0267	Schizomida	*Draculoides* ?BHD4/ BHD5	LN38573	BMR00588	n/a	Within lineage (<7%)	*Draculoides* SCH068 (<7%)
BHT	DD17BHT0020	Schizomida	*Draculoides* ?BHD4/ BHD5	LN35582	BMR00648	n/a	Within lineage (<7%)	*Draculoides* SCH068 (<9%)
BHT	RC18BHT0026	Schizomida	*Draculoides* ?BHD4/ BHD5	LN38567	BMR00708	n/a	Within lineage (<7%)	*Draculoides* SCH068 (<8%)
BHT	RC16HD10193	Schizomida	*Draculoides* ?BHD4/ BHD5	LN33570	BMR00775	n/a	Within lineage (<7%)	*Draculoides* SCH068 (<9%)
BHT	RC16HD10193	Schizomida	*Draculoides* ?BHD4/ BHD5	LN33590	BMR00776	n/a	Within lineage (<7%)	*Draculoides* SCH068 (<8%)
BHT	DD17BHT0020	Schizomida	*Draculoides* ?BHD4/ BHD5	LN35572	BMR00777	n/a	Within lineage (<7%)	*Draculoides* SCH068 (<9%)
BHT	RC15BHT0267	Schizomida	*Draculoides* ?BHD4/ BHD5	LN36580	BMR00778	n/a	Within lineage (<7%)	*Draculoides* SCH068 (<7%)
BHT	RC15BHT0267	Zygentoma	Ateluridae indet.	LN39280	BMR00555	ZYGE001	No	No (>8% 12S)

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APPENDIX E INLAND WATERS

E.1: Assessment of Surface Water Impacts on Sensitive Receptors in the Weeli Wolli Creek Catchment

RioTinto

RTIO Water Resource Evaluation

Hope Downs 2 & Bedded Hilltop

Assessment of surface water impacts on sensitive receptors in the Weeli Wolli Creek catchment

May 2022

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EXECUTIVE SUMMARY

This report presents an assessment of the potential impacts on surface water quantity and quality at Weeli Wolli Spring and Ben's Oasis from mining infrastructure proposed for the HD2 Proposal which includes deposits at Bedded Hilltop (BHT) and Hope Downs 2 (HD2). Weeli Wolli Spring and Ben's Oasis are located within the Weeli Wolli Creek catchment and are referred to as sensitive receptors due to their Aboriginal heritage and environmental significance.

A two-dimensional (2D) hydraulic model was developed to characterise the surface water flow regime of Weeli Wolli Creek and Pebble Mouse Creek (a major tributary of Weeli Wolli Creek) in their existing conditions. This regional model was used to quantify the total volume and peak flows estimated at the sensitive receptors. An operational mining scenario was also modelled to simulate estimated surface water flows once HD2 and BHT mining infrastructure had been constructed. Comparison of results from the two scenarios highlighted areas within Weeli Wolli Creek and Pebble Mouse Creek that experienced a change in maximum water depths due to mining infrastructure, in particular the addition of diversion drains at HD2 and a haul road crossing at Pebble Mouse Creek.

The water quality component of the assessment considered the potential for sediments at the Pebble Mouse Creek haul road crossing to be transported 14 km downstream and impacting Weeli Wolli Spring. A refined, localised 2D hydraulic model was developed focusing on flows within Pebble Mouse Creek at the location of the floodway crossing as well as the HD1 rail crossing (consisting of multiple culverts and located 4 km downstream of the floodway). Evaluation of velocities at these crossings and assumptions of sediment transport behaviour formed the basis of the water quality analysis.

Results from the regional model indicated that mining operations associated with the HD2 Proposal (including pits, dumps and drainage infrastructure) truncated approximately 3.5% of the total catchment reporting to Weeli Wolli Spring. This resulted in the loss of 1 % of the total runoff volume at the Spring and a reduction of the peak flow by 1.4 %, based on the 1:100 annual exceedance probability (AEP) 24 hour rainfall event. At Ben's Oasis, the catchment reporting to this location was truncated by 0.2 %, which resulted in a reduction to peak flow of 1.1%.

Results from the localised model indicated that during frequent (1:5 AEP) and rare (1:100 AEP) rainfall events, flood depths are increased on the upstream side of the floodway and rail culverts due to the attenuation and backwater impacts of these structures. Velocities modelled at these locations are observed to be lower on the upstream side as flow is throttled by the crossing obstruction, with a distinct increase in velocity at and immediately downstream of the crossing as flow is concentrated through the floodway or culvert.

The slight loss of runoff demonstrated through the regional modelling is expected to have little effect on the flow regime at either sensitive receptor and is therefore expected to have insignificant impact of the environmental and heritage values of Weeli Wolli Spring or Ben's Oasis. This is further reinforced by the fact that water levels in Weeli Wolli Spring are supplemented by Hope Downs 1 dewatering discharge and Ben's Oasis is a groundwater sustained system.

High flood depths and low velocities observed on the upstream side of the rail crossing in results from the local model support the increased deposition of sediment at the rail culvert inlets and most likely poor transport of sediment through the culverts. Therefore, sediment transported from haul road crossings over Pebble Mouse Creek is considered unlikely to impact water quality at Weeli Wolli Spring.

1. INTRODUCTION

The purpose of this report is to assess the potential surface water impacts to the sensitive receptors, Weeli Wolli Spring and Ben's Oasis, within the Weeli Wolli Creek catchment from the mining infrastructure proposed for the HD2 Proposal which includes deposits at Bedded Hilltop (BHT) and Hope Downs 2 (HD2).

The cumulative effects of mining and interventions resulting from the HD2 Proposal in the Weeli Wolli Creek catchment have the potential to alter the flooding characteristics and flooding frequency of the creek system. Activities such as construction of diversion structures and haul/access road crossings can potentially modify the existing surface flow regimes. Existing pits at HD1 and development of future pits for the HD2 Proposal may also truncate local catchments thus reducing flow contribution to Weeli Wolli Creek and its tributaries. These changes in surface flow regime may result in reductions to peak and total flow volumes, with the potential to impact water quality through a change in sediment loading.

Two-dimensional hydraulic modelling has been utilised to characterise the surface flow regime in Weeli Wolli Creek and assess the changes in surface water quantity and quality, in particular at Weeli Wolli Spring and Ben's Oasis.

2. REGIONAL HYDROLOGY

HD2 and BHT deposits are located within the upper reaches of the Weeli Wolli Creek catchment that forms part of the Fortescue River Region (BoM, 2021). Weeli Wolli Creek has a total catchment area of approximately 4,770 km^2 to Waterloo Bore gauging station and drains north to the Fortescue Marsh.

The upper reaches of the Weeli Wolli Creek catchment include Pebble Mouse Creek, a major tributary of Weeli Wolli Creek, which has a catchment area of 340 km^2. HD2 and BHT deposits are bisected by the Pebble Mouse Creek and Weeli Wolli Creek catchment divide and do not interact with the flood plains of either creek.

The Tarina gauging station (operated by DWER) is the closest stream flow gauge to the study area and is located on Weeli Wolli Creek, about 7 km downstream of Weeli Wolli Spring. The Weeli Wolli Creek catchment area reporting to the Tarina gauge is about 1,530 km^2 and this area is illustrated in Figure 1.

Table 1: Catchment areas of Weeli Wolli Creek

Catchment	Area	Downstream Location
Weeli Wolli Creek	4,770 km^2	Fortescue Marsh
Weeli Wolli Creek	1,530 km^2	Tarina gauging station
Weeli Wolli Creek	1,340 km^2	Weeli Wolli Spring
Weeli Wolli Creek	420 km^2	Ben's Oasis
Pebble Mouse Creek	340 km^2	Confluence with Weeli Wolli Creek

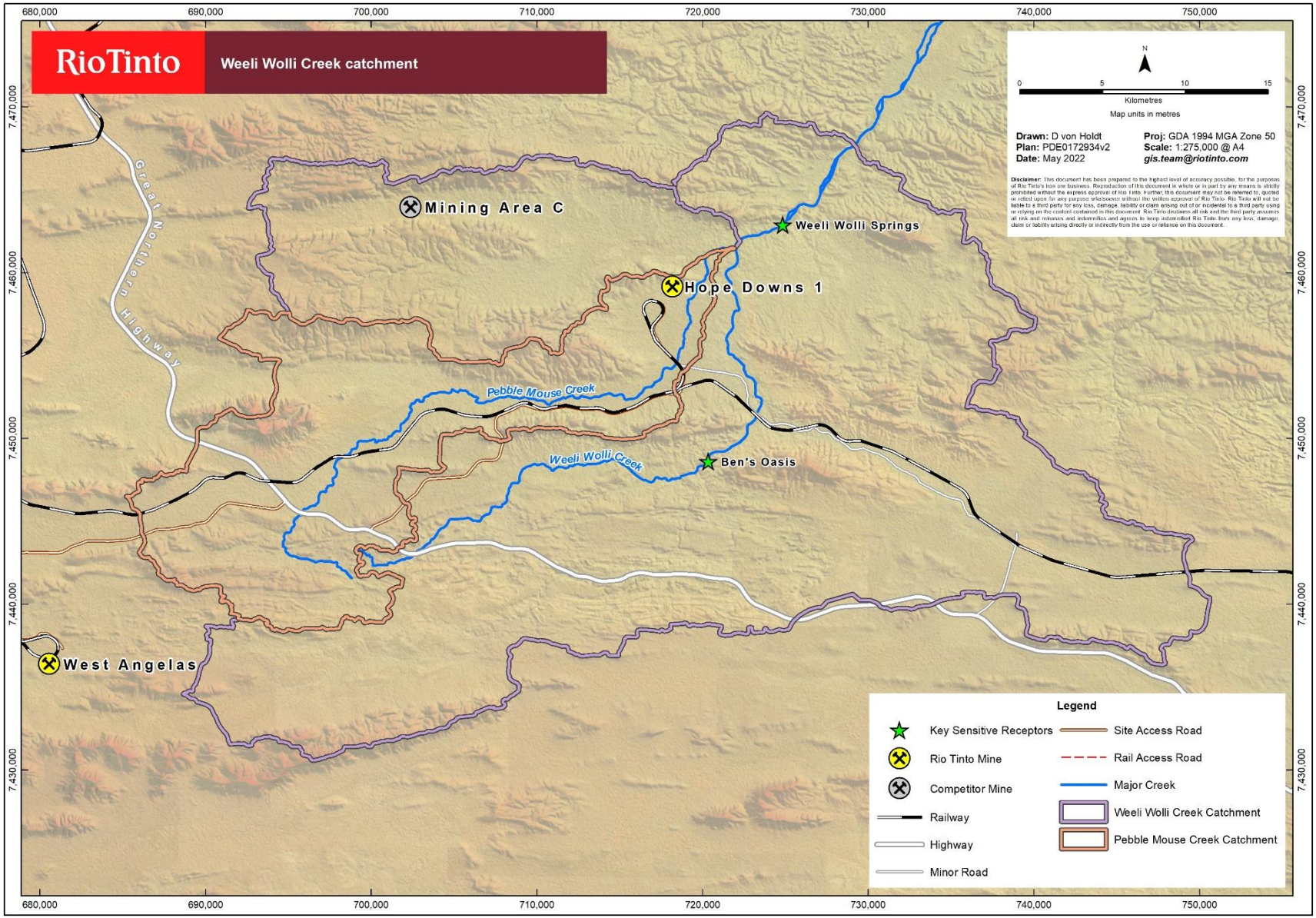

Figure 1: Weeli Wolli Creek catchment

3. MINING INFRASTRUCTURE

The proposed mine layout for HD2 and BHT is shown in Figure 2.

This report focused on the drainage infrastructure proposed to assist with surface water management at the HD2 and BHT pits, in particular the Pebble Mouse Creek Haul Road crossing, the Pebble Mouse Creek Road Train crossing and the diversion drains at HD2 as highlighted in Figure 2.

Consideration of additional waterway crossings proposed are also provided in this report. These crossings are associated with alternative transport options being explored as part of the study and include: the realignment of Great Northern Highway (GNH); an alternative mine access road; and an overland conveyor from HD2 to HD1.

Preliminary engineering designs for most of the infrastructure have been included in the hydraulic modelling undertaken for this report's analysis.

3.1. Pebble Mouse Creek Haul Road Crossing

Pebble Mouse Creek is a significant waterway separating the existing mining facilities at HD1 and the deposits of BHT and HD2. It is proposed that the haul road connecting the BHT deposit to the HD1 processing infrastructure will cross Pebble Mouse Creek. An engineered crossing will be constructed to manage flood risk and allow continuity of production. The width of Pebble Mouse Creek bed at the proposed crossing location is approximately 350 m, as shown in Figure 3**Error! Reference source not found.**.

During the development of the proposed engineered solution for the creek crossing a haul road with culverts was defined, and three different concept design options, providing varying levels of flood serviceability, were evaluated. These options along with their design criteria are summarised in Table 2.

Table 2: Pebble Mouse Creek haul road crossing design options

Option	Design AEP	Design flow rate	Crossing structure
1	1% (1:100)	827.3 m^3/s	41 x DN2700 culverts
2	5% (1:20)	257.7 m^3/s	13 x DN2700 culverts
3	Low flow (assumed 50%, 1:2)	Not specified	4 X DN900 relief culverts

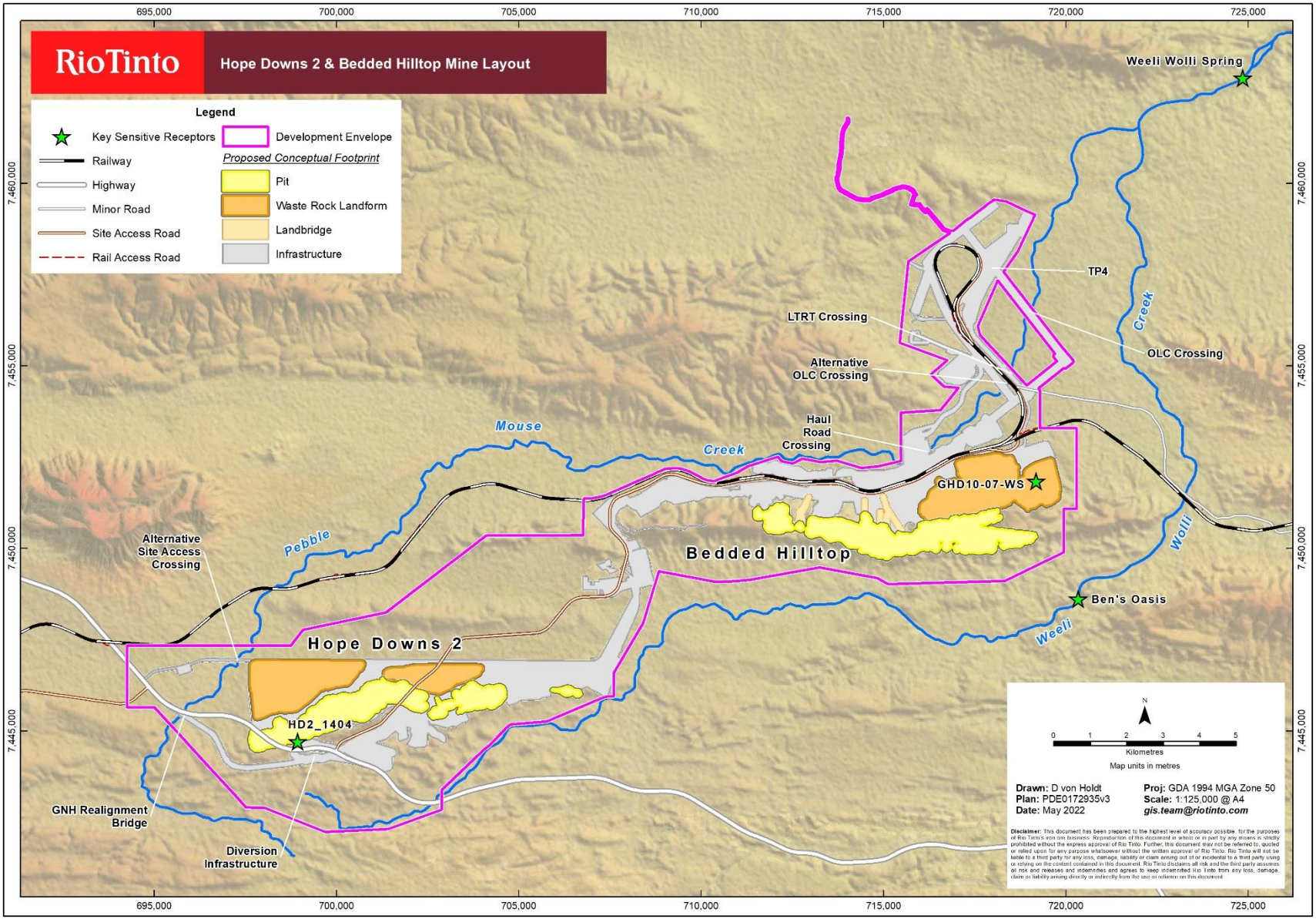

Figure 2: Hope Downs 2 & Bedded Hilltop Mine Layout

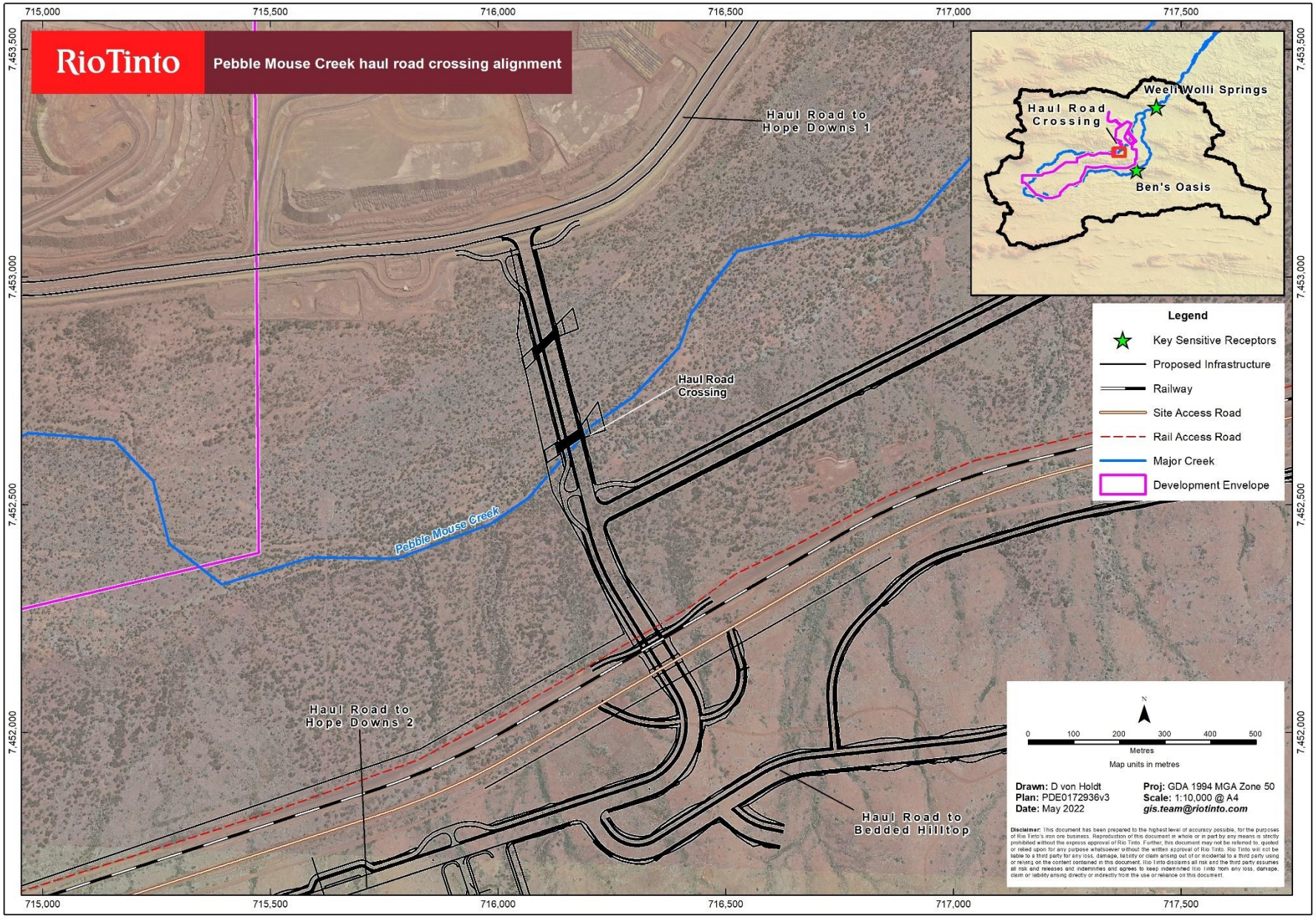

Figure 3: Pebble Mouse Creek haul road crossing alignment

3.2. HD2 Diversion Levee and Drains

Diversion infrastructure have been proposed at HD2 to manage the surface water flow around the pit. Several options were evaluated with the final design consisting of a levee (DL03) and two drains, referred to as DD01 and DD03. The drain configuration aims to divert flow from a tributary of Pebble Mouse Creek, that originally travelled north, towards Weeli Wolli Creek in the southeast. The levee and drains have been designed to convey the 1:100 AEP event. Proposed alignments of these structures are shown in Figure 4.

3.3. Pebble Mouse Creek Road Train Crossing

Long term road trains (LTRT) have been identified as the preferred ore transport option by the Prefeasibility Study (PFS). The proposed LTRT haul road will consist of a sealed road extending 27 km from HD2 to HD1 north crusher. Several options for the road alignment have been investigated and all options include a crossing over Pebble Mouse Creek, directly downstream of the existing rail line crossing.

LTRT Option 1 design includes multiple large culverts (aligned similarly to the existing railway culverts) at the creek crossing, designed to convey the 1:100 AEP flow rates. A transfer pad (TP4) will be located at the end of the haul road, close to the HD1 north crusher. Placement of TP4 has been restricted to be outside the 1% AEP flood extent of Pebble Mouse Creek.

Figure 5 includes the LTRT Option 1 road alignment and associated infrastructure (TP4).

3.4. Optional Waterway Crossings

3.4.1. Great Northern Highway Realignment

Due to the extent of the HD2 ore body, realignment of the GNH has been proposed to allow access to the ore currently situated under a section of the existing highway. Subsequently, to prevent the construction of road infrastructure that would ultimately become redundant once the GNH is realigned, an alternative mine access road has also been proposed. The GNH crossing will require a bridge structure, whereas the alternative mine access road crossing will require culverts. At this stage, preliminary designs are not available to model however the existing bridge along GNH currently crossing PMC provides the minimum design criteria expected for the new bridge on GNH. Austroads (1994) and Main Roads WA (MRWA, 2003) standard design guidelines dictate the design criteria for bridges along a main public highway, which include a serviceability design of 1% AEP and a survivability design of 1:2000 AEP.

3.4.2. Overland Conveyor (OLC)

An overland conveyor transport option was investigated, extending from HD2 to the HD1 north, as an alternative to the extensive haulage route required from HD2. The conveyor alignment requires a crossing over Pebble Mouse Creek. Several alignments were assessed including:

1. The OLC directly upstream of the existing HD1 rail line, running parallel to the rail crossing.
2. The OLC about 2 km downstream from the rail line.

The proposed design consists of an earth embankment with pipe culverts designed to convey the 1% AEP flow rates.

Figure 5 includes the OLC alignment positioned directly upstream of the rail line.

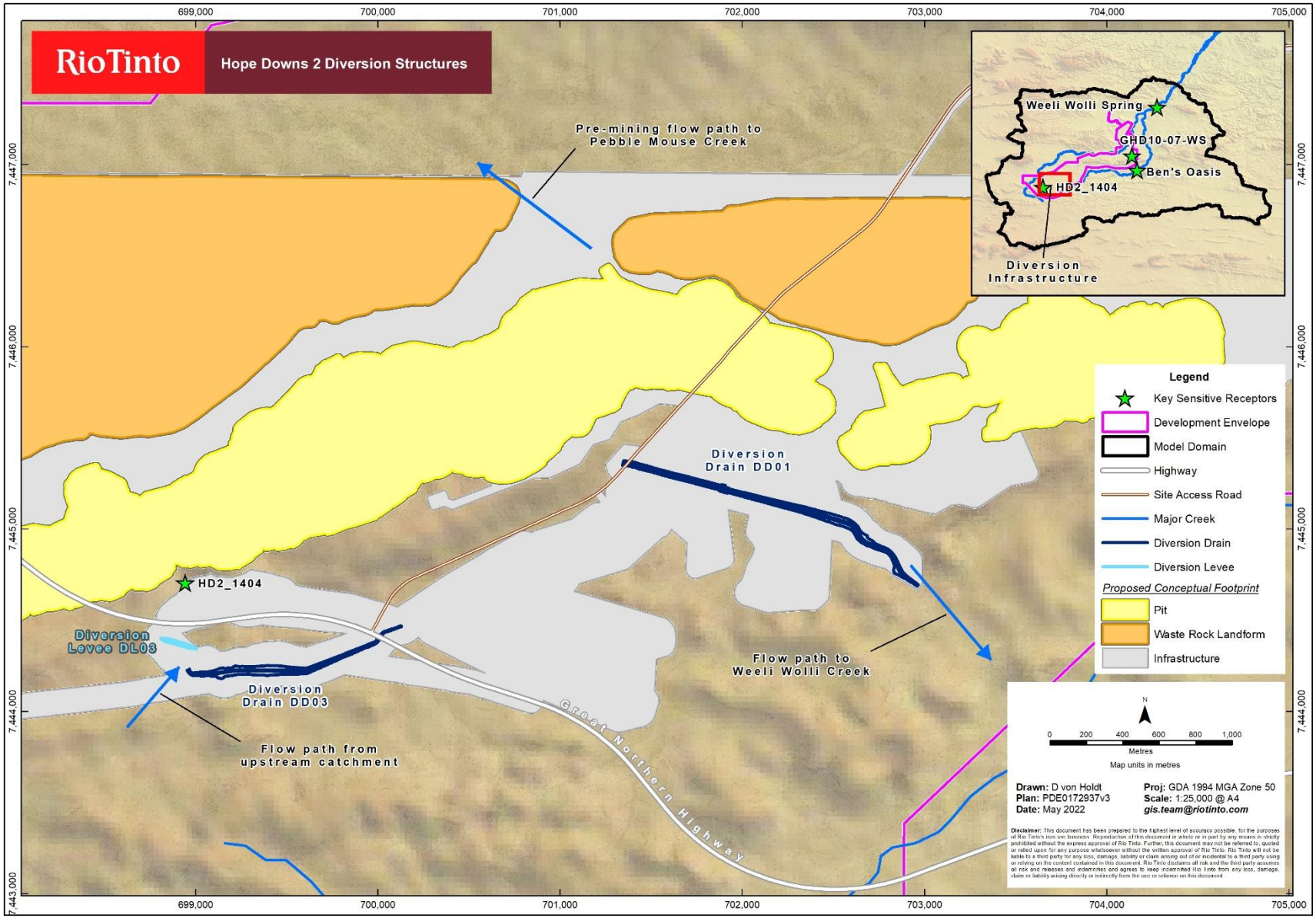

Figure 4: Hope Downs 2 diversion structures

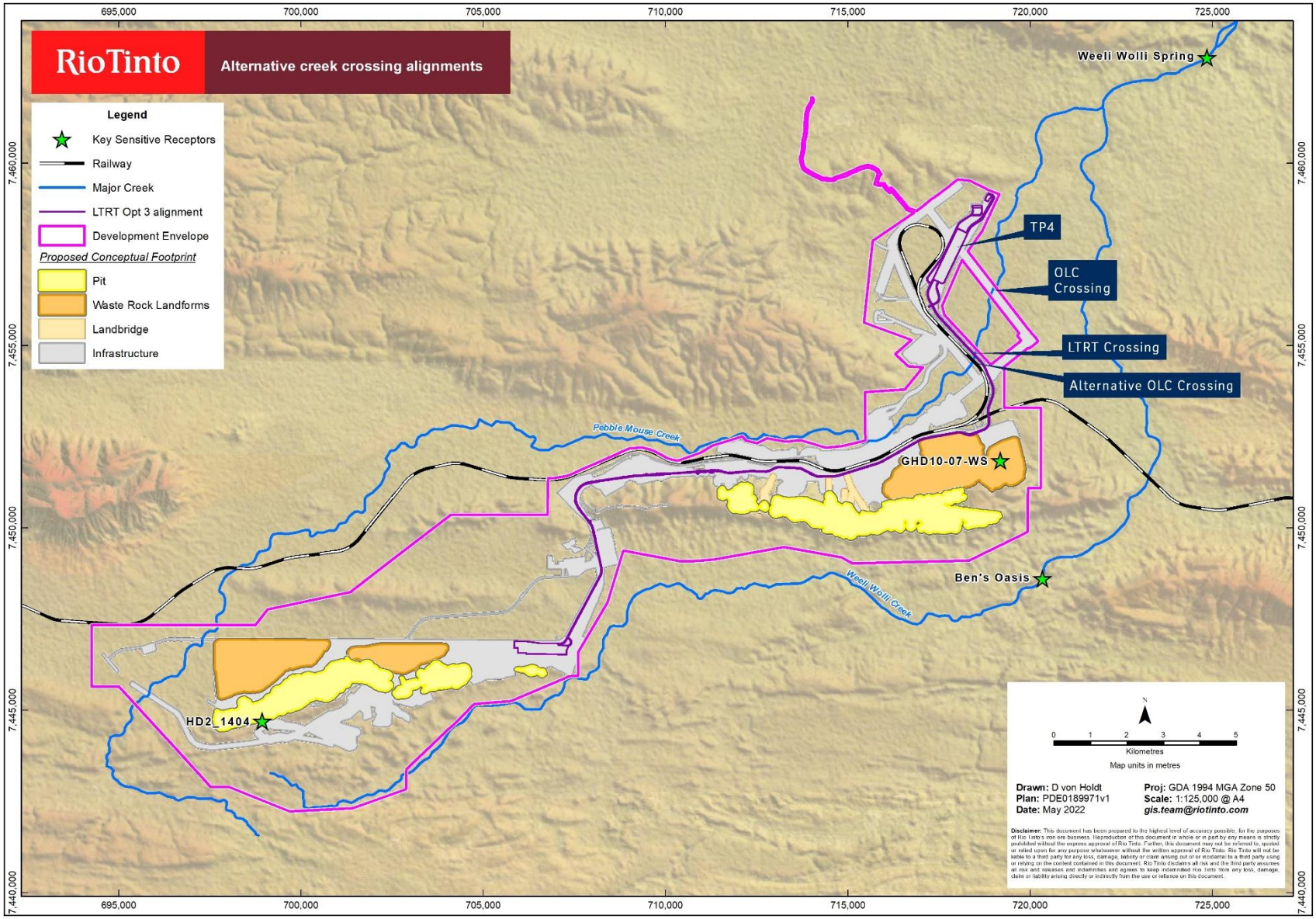

Figure 5: Alternative creek crossing alignments

4. KEY SENSITIVE RECEPTORS

Locations with heritage or environmental significance are referred to as sensitive areas or receptors. These locations require special consideration of the direct and potentially cumulative impact of all mining activities due to their high heritage or environmental value.

Regarding surface water, sensitive receptors may be impacted where modifications to the creek morphology or hydrologic regime adversely influence the heritage or environmental value of the site. The sensitive environmental receptors that have been identified as part of the HD2 Proposal are Weeli Wolli Spring and Ben's Oasis, and two waterholes situated within the Development Envelope. Locations for these sites are shown in Figure 2. The hydraulic modelling presented in this report was completed to assess the potential surface water impact on these receptors.

4.1. Weeli Wolli Spring

Weeli Wolli Spring is located approximately 7 km downstream of the confluence of Pebble Mouse Creek and Weeli Wolli Creek to the north-east of the study area. It is protected under the *Aboriginal Heritage Act 1972* and the riparian vegetation supported by the spring is categorised as a Priority 1 Ecological Community. The Spring was naturally groundwater controlled (pre-mining) and is currently maintained by discharge of surplus water from dewatering from HD1, which has occurred since 2007. Upstream of the permanent flowing portion of the Spring are several permanent and semi-permanent pools scattered over a distance of 2 km as illustrated in Figure 7.



Figure 6: Weeli Wolli Spring (photographed in October 2020)

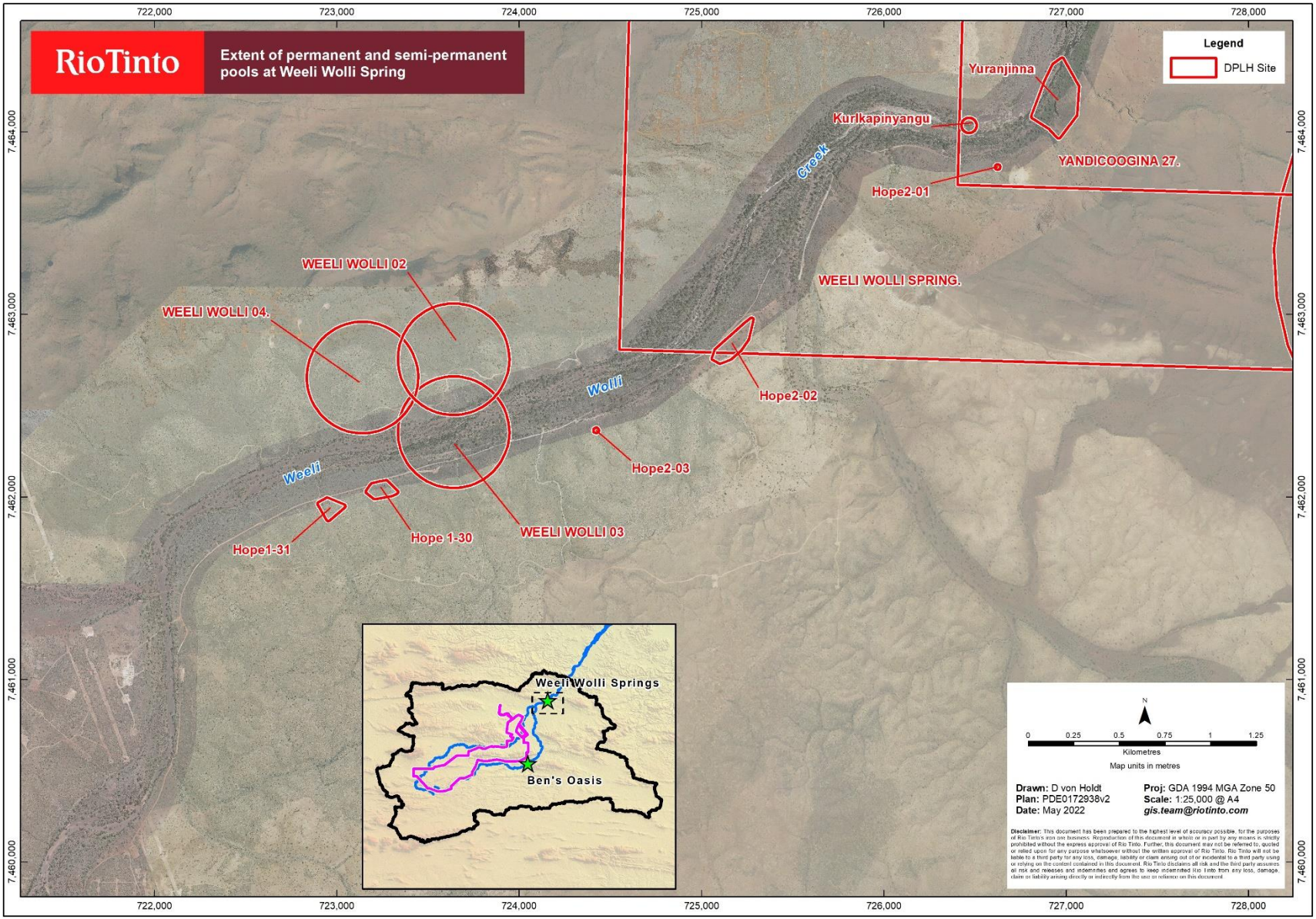

Figure 7: Extent of permanent and semi-permanent pools at Weeli Wolli Spring

Table 3 summarises the area reduction of the catchment reporting to Weeli Wolli Spring due to mining operations at both HD2 and BHT. The catchment area reduction incurred from mining the HD2 and BHT deposits will be approximately 45 km^2 based on the proposed pits and the placement of dumps provided in the current mine layouts. This area is equivalent to 3.5 % of the contributing catchment area to Weeli Wolli Spring. A catchment reduction of 3.5 % is considered relatively negligible and is therefore unlikely to impact the hydrological regime of this key sensitive receptor. Further validation of this assumption is provided in Section 6 where an impact assessment of peak flows and volumes is also discussed.

Table 3: Area reduction of catchment reporting to Weeli Wolli Spring

Mining Factor Affecting Catchment	Total Catchment Area (km^2)	Operational mining Catchment Area (km^2)	Area Reduction (km^2)	Difference (%)
HD2 & BHT pits, dumps	1,340	1,295	- 45	- 3.5

4.2. Ben's Oasis

Ben's Oasis is a significant environmental feature on Weeli Wolli Creek. Ben's Oasis is similar in function to Weeli Wolli Spring in that it is supported via groundwater expression as opposed to surface water.



Figure 8: Ben's Oasis (photographed in Jan 2019)

Table 4 summarises the area reduction of the catchment reporting to Ben's Oasis. The catchment area will be impacted by mining operations at only HD2. Proposed pits and dumps will result in approximately

6 km^2 catchment area reduction. However, this will be largely offset by the proposed HD2 diversion which would contribute an additional 5 km^2 of catchment reporting to Ben's Oasis. Therefore, the net contributing catchment area is reduced by 1 km^2, equivalent to 0.2 % of the total catchment. This is considered negligible and will have negligible impact to the flow regime at Ben's Oasis. This is discussed further in Section 6.

Table 4: Area reduction of catchment reporting to Ben's Oasis

Mining Factor Affecting Catchment	Total Catchment Area (km2)	Operational mining Catchment Area (km^2)	Area Reduction (km2)	Difference (%)
HD pits, dumps	420	414	- 6	- 1.4
HD2 diversion drains	420	425	+ 5	+1.2
	Net Changes	419	-1	- 0.2

4.3. Pebble Mouse Creek

Pebble Mouse Creek is considered to have cultural heritage significance, stemming from its use as a water source for people, plants, and animals and because it is a major tributary feeding into Weeli Wolli Creek. More consultation work is to be undertaken to completely understand the specific cultural heritage values and concerns associated with works impacting Pebble Mouse Creek.

Table 5 summarises the area reduction to Pebble Mouse Creek. About 8 % of this catchment will be reduced due to the proposed HD2 and BHT mining areas.

Table 5: Area reduction of the Pebble Mouse Creek catchment

Mining Factor Affecting Catchment	Total Catchment Area (km^2)	Operational mining Catchment Area (km^2)	Area Reduction (km^2)	Difference (%)
HD2 & BHT pits, dumps and diversion drains	340	26	314	- 7.6

4.4. Identified waterholes

Two water sources or waterholes are identified within the proposed Development Envelope: HD2_1404 and GHD19-07-WS. Their locations are shown in Figure 2.

HD2_1404 is in very close proximity to the HD2 deposit and has been described as a water source of ethnographic interest. The waterhole is 12 m by 17 m and is at least 1 m deep. The site was visited as part of the November 2021 Nyiyaparli Social Surroundings site visit. The waterhole was observed to be holding an indeterminate amount of water as shown in Figure 9.



Figure 9: Waterhole HD2_1404 (photographed in November 2021)

GHD19-17-WS is in relative proximity to the eastern end of the BHT deposit. The site is a series of five waterholes within a minor creek and measures 11 m by 17 m (covering 187 m^2). The site was also visited during the November 2021 Nyiyaparli Social Surroundings site visit. Two of the five waterholes were observed to be holding small amounts of water as shown in Figure 10.



Figure 10: Waterhole GHD19-07-WS (photographed in November 2021)

5. HYDRAULIC MODELLING

A two-dimensional hydraulic model was developed, using TUFLOW (build 2018-03-AB-iSP-w64 HPC), in order to characterise the surface water flow regime of Weeli Wolli Creek and Pebble Mouse Creek and assess potential impacts on water quantity at the sensitive receptors. The methodology and results are discussed below.

5.1. Methodology

A whole-of-catchment rain-on-grid hydraulic model was constructed for Weeli Wolli Creek, including the Pebble Mouse Creek catchment, to a downstream location of the Tarina gauge. An ensemble of simulations has been run with varying rainfall durations and temporal patterns for comparison with previous and updated rainfall-runoff model (RORB) results. However, for the purpose of this analysis, the adopted scenarios run for pre- and post-mining comparisons were the critical durations for the 1:5 and 1:100 AEP events.

The following input parameters were adopted for this assessment:

- Digital elevation model (DEM) – various LIDAR datasets mosaicked to cover the full model area
- Grid size – 20 m x 20 m, a coarse resolution was chosen to allow the full catchment to be adopted as the model domain, but limit model run times.
- Boundary conditions – height-flow (HQ) boundary downstream of Weeli Wolli Spring
- Roughness coefficient Manning's n – uniform 0.04
- Losses – initial loss of 35 mm/hr and continuing loss of 9 mm/hr (calibrated to match RORB peak flows)
- Scenarios run – pre-mining conditions and post-mining conditions including HD2 and BHT pits, haul roads, diversions and creek crossing
- Rainfall events – 1:5 AEP 12 hr TP04 and 1:100 AEP 24 hr TP02

Figure 11 illustrates the hydraulic model extent and downstream boundary location.

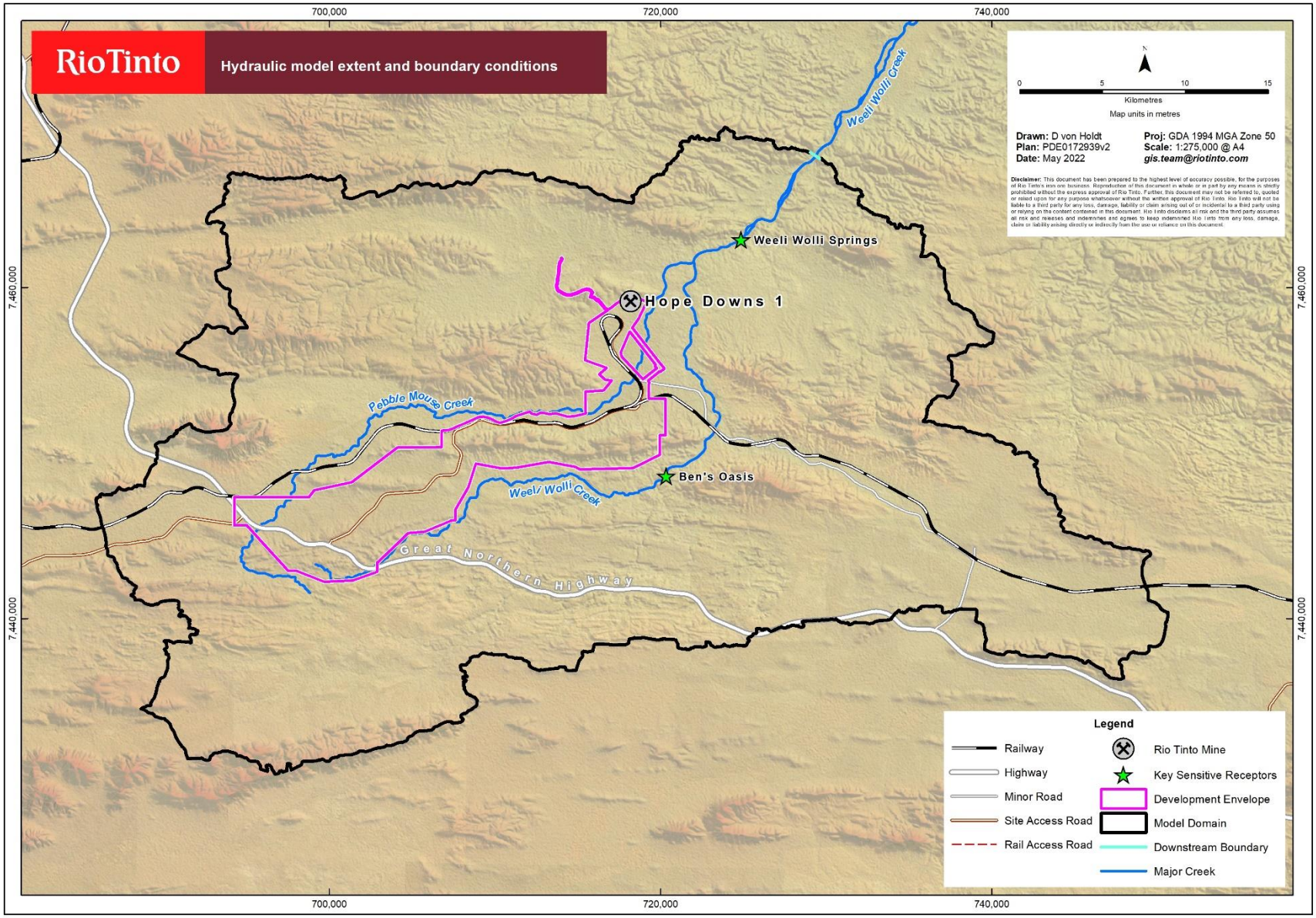

Figure 11: Hydraulic model extent and boundary conditions

5.2. Hydraulic Model Results

Results for the 1% AEP flood depths for pre mining, operational mining and a difference map are presented in Figure 12 to Figure 14. The difference map shows river reaches where modelled flood depths changed because of mining impacts.

Similar results for the 20% AEP flood depths are presented in Figure 15 to Figure 17.

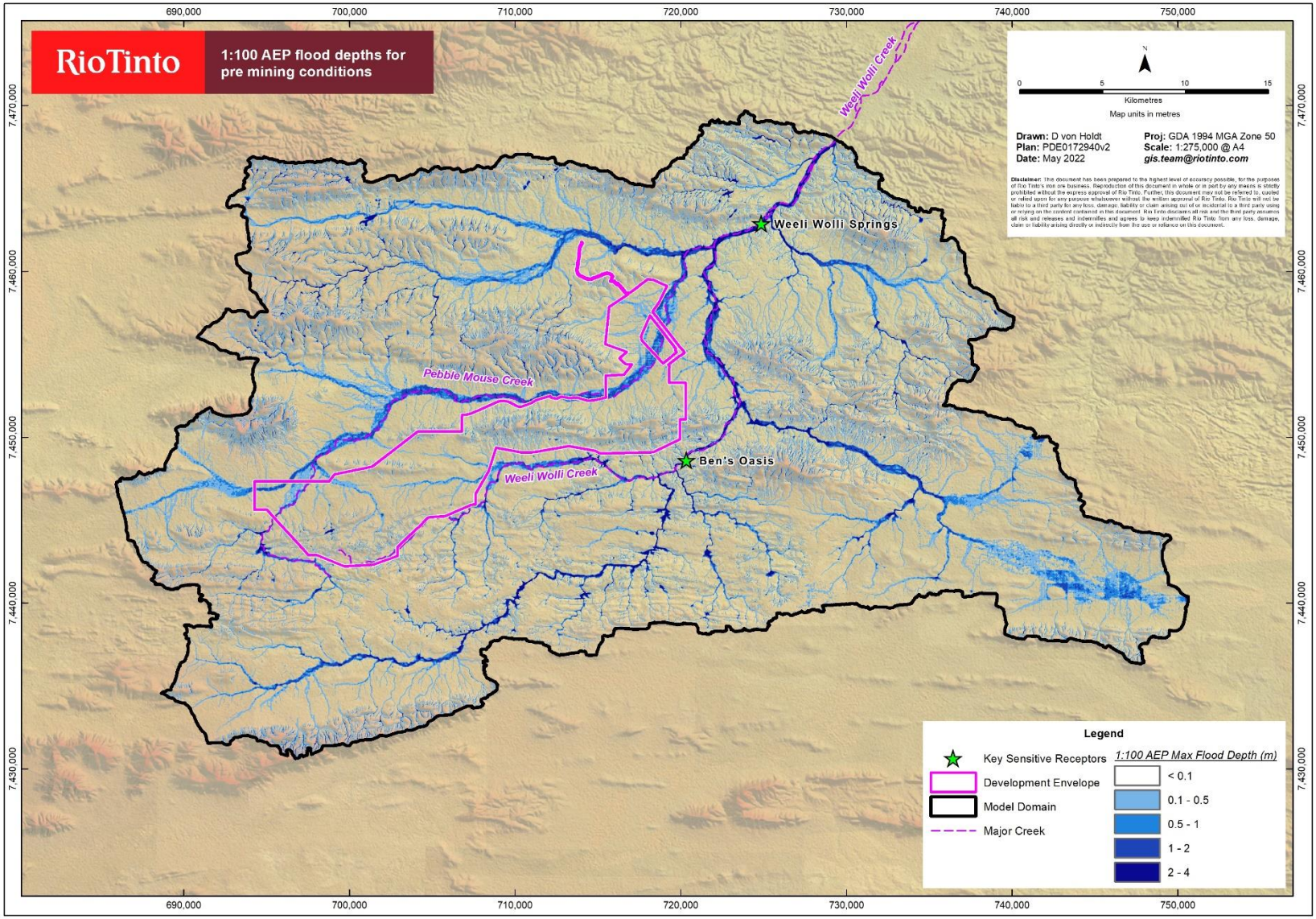

Figure 12: 1:100 AEP flood depths for pre mining conditions

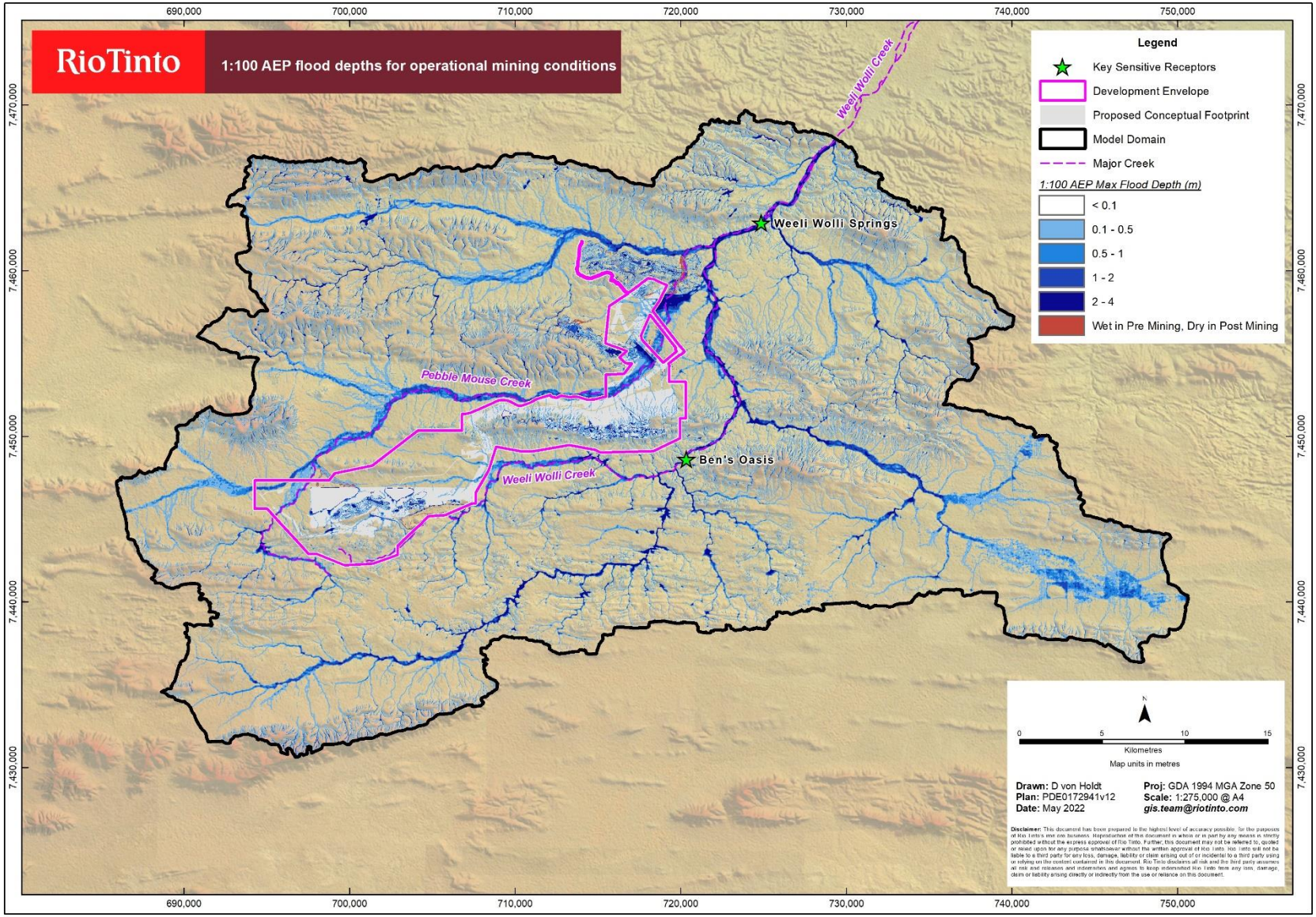

Figure 13: 1:100 AEP flood depths for operational mining conditions

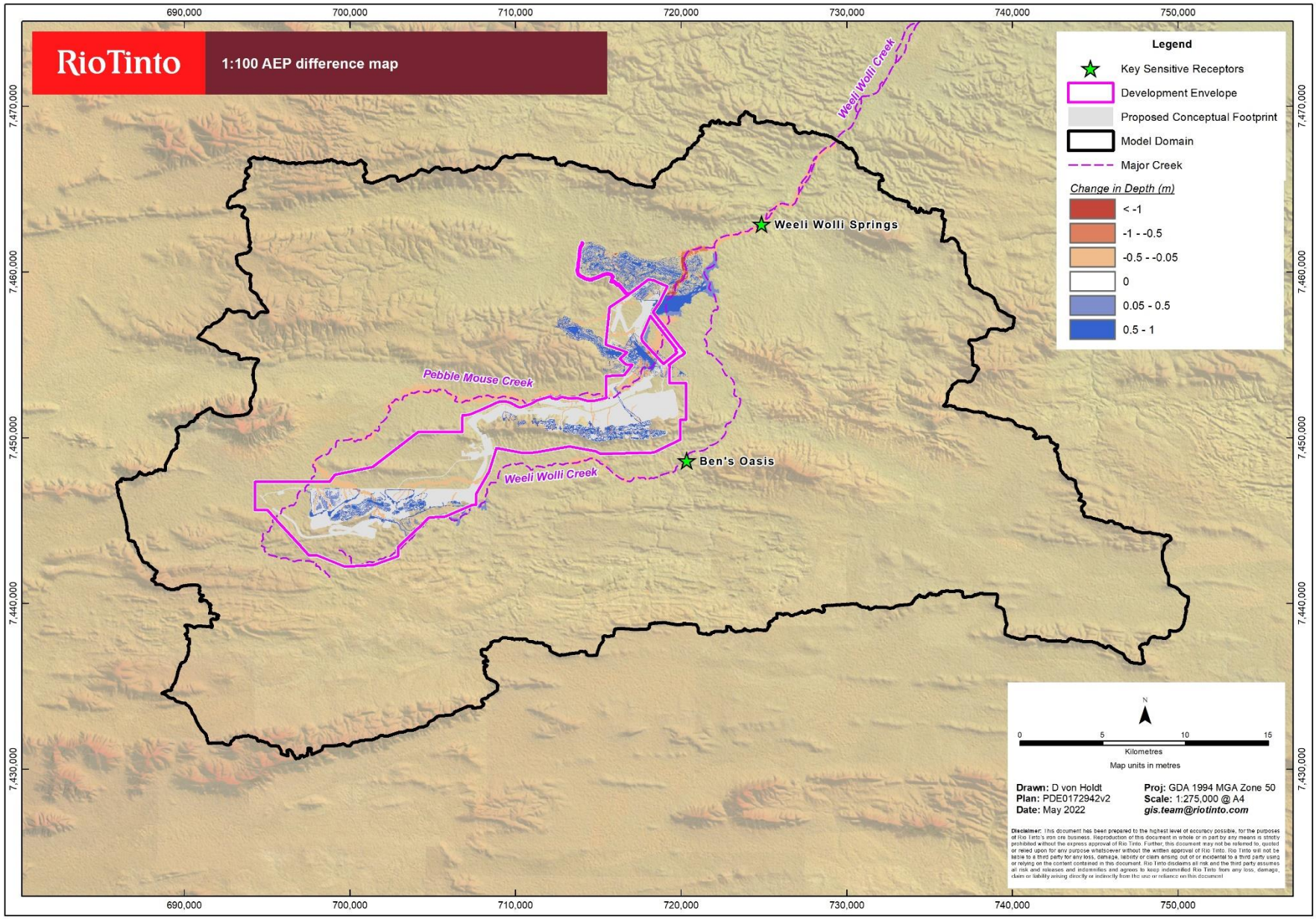

Figure 14: 1:100 AEP difference map

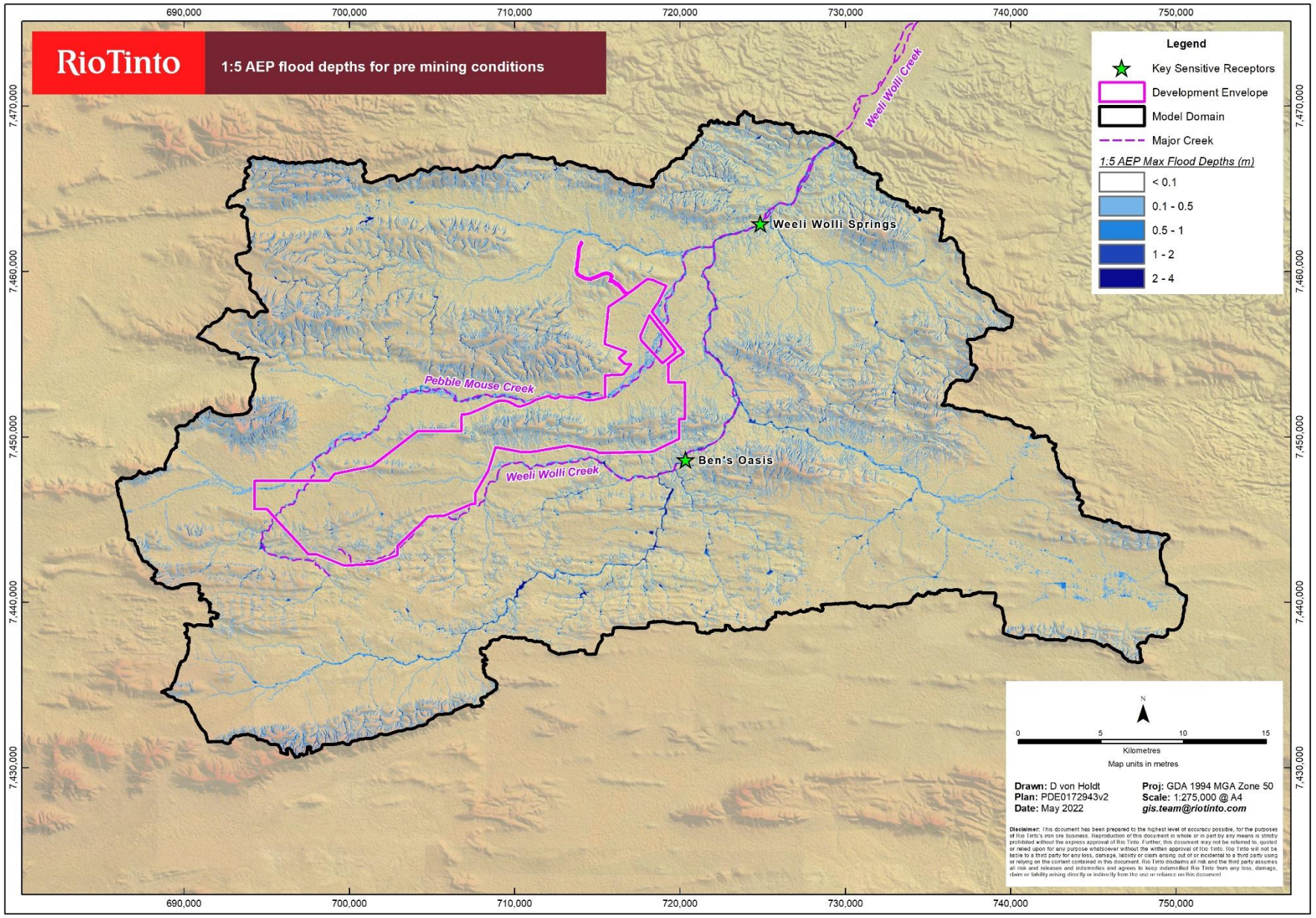

Figure 15: 1:5 AEP flood depths for pre mining conditions

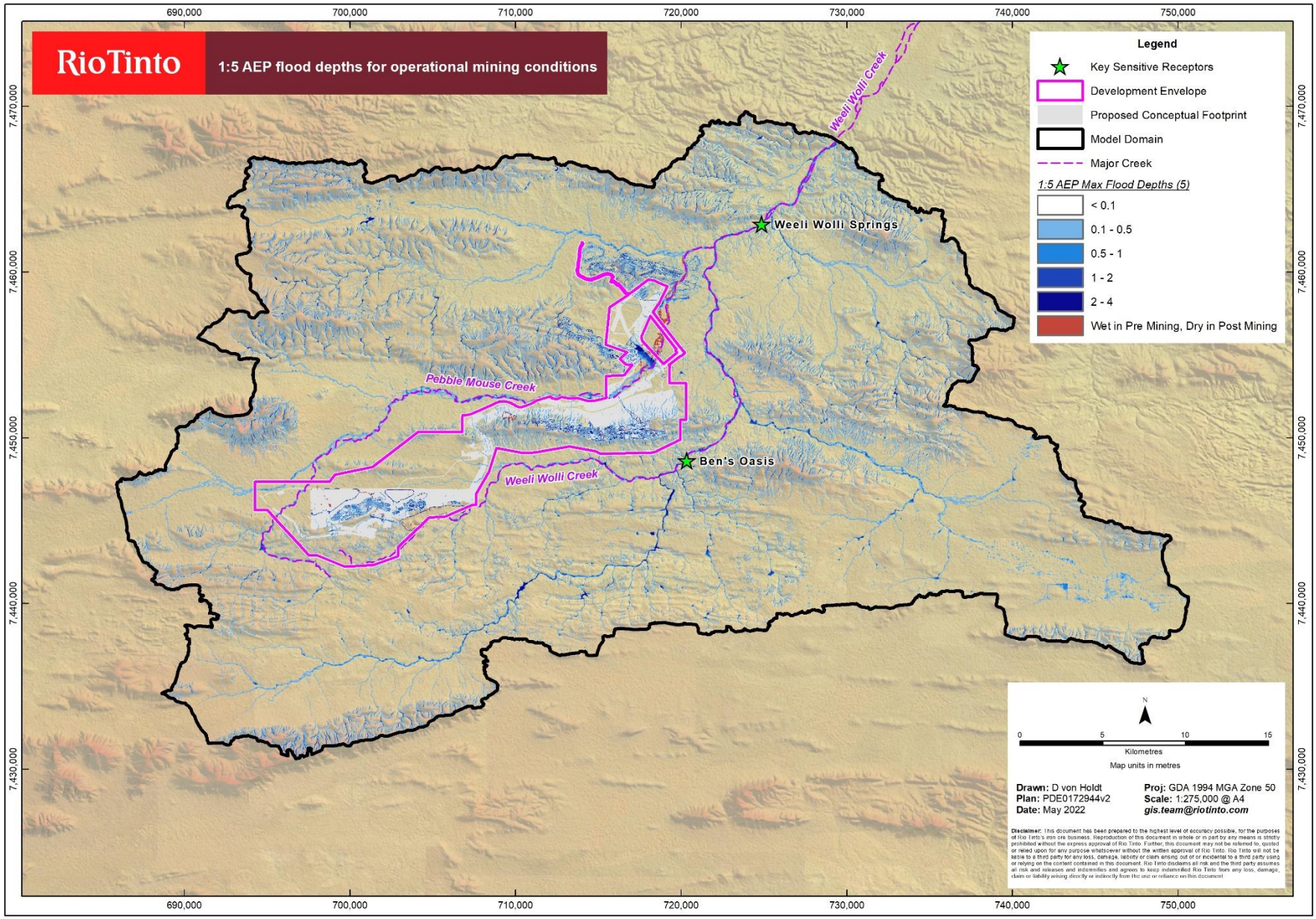

Figure 16: 1:5 AEP flood depths for operational mining conditions

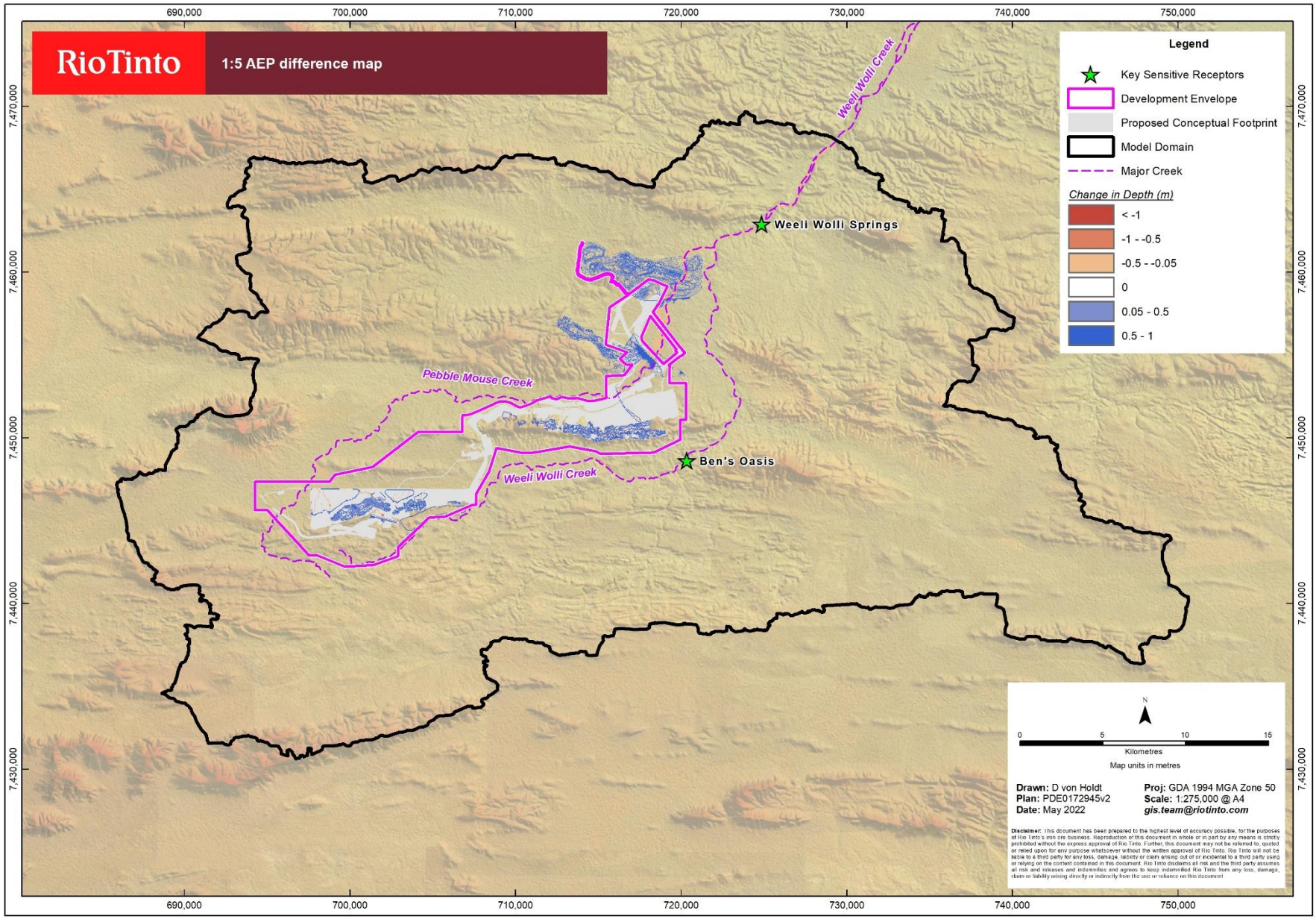

Figure 17: 1:5 AEP difference map

6. SURFACE WATER FLOW IMPACTS

6.1. Regional catchment

Difference mapping (discussed above) has highlighted the areas within Pebble Mouse Creek and Weeli Wolli Creek that are likely to experience a change in maximum surface water depths in the operational mining scenario. As expected, depths have increased at the location of HD2 diversion drains, which is predicted to result in a reduction to depths by less than 0.1 m in Pebble Mouse Creek directly north of the HD2 pits. The attenuation of surface water upstream of the Pebble Mouse Creek haul road crossing is predicted to result in an increase of depths in this area of up to 1 m. Depths downstream of the crossing appear to be impacted only slightly, with the difference map indicating a maximum decrease of 0.1 m for the 1:100 AEP.

6.2. Key sensitive receptors

A comparison of peak flows modelled, for critical duration storms at the key sensitive receptors for pre- and operational mining conditions. is provided in Table 5 and total volumes are compared in Table 6.

Table 5: Peak flows at the key sensitive receptors

Location	Event	Pre mining (m^3/s)	Operational mining (m^3/s)	Difference (m^3/s)	Difference (%)
Weeli Wolli Spring	1:100 AEP 24 hr	2,474	2,438	- 36	- 1.4
	1:5 AEP 12 hr	148	135	- 12	- 8.1
Ben's Oasis	1:100 AEP 24 hr	921	911	- 10	- 1.1
	1:5 AEP 12 hr	55	53	- 2	- 3.6

Table 6: Total modelled volumes at the key sensitive receptors

Location	Event	Pre mining (GL)	Operational mining (GL)	Difference (GL)	Difference (%)
Weeli Wolli Spring	1:100 AEP 24 hr	25.2	24.7	- 0.5	- 2
	1:5 AEP 12 hr	0.8	0.6	- 0.2	- 25
Ben's Oasis	1:100 AEP 24 hr	7.1	7.0	- 0.1	- 2
	1:5 AEP 12 hr	0.33	0.31	- 0.02	- 7

As previously discussed in Section 4.1, mining operations at HD2 and BHT (including proposed dumps) will truncate approximate 45 km^2 of the total catchment reporting to Weeli Wolli Spring. This equates to a reduction of 3.5 % in the catchment reporting to Weeli Wolli Spring. Modelling has shown that the truncation will result in the loss of approximately 2 % of the total runoff volume at the spring for the 1:100 AEP 24 hour flow event of Weeli Wolli Creek. Peak flows at the spring for this event will decrease by 36 m^3/s, equivalent to a 1.4 % reduction. Modelled flow reductions for the 1:5 AEP event is slightly higher, with an

estimated 8.1 % reduction in flow. It should be noted that this reduction is not only the result of the changes due to the proposed HD2 mining activities but a cumulative impact from both HD1 and HD2 mining activities. Water levels (and therefore volumes) at Weeli Wolli Spring are supplemented by dewatering discharge from a series of spur lines running off the main discharge pipe to Weeli Wolli Creek. There are several monitoring locations in this area used to ensure water levels at the Spring are maintained. This discharge to the creek and the spur lines will continue for the operating life of HD2 therefore the modelled reduction to flows at the Spring is unlikely to be observed and the environmental and heritage values associated with the Spring are expected to be maintained.

Regarding Ben's Oasis, the total net change to the catchment reporting to this location is a reduction of approximately 1 km^2. Modelling indicates this will result in a reduction to the peak flow at Ben's Oasis by approximately 10 m^3/s or 1.1 % during a 1:100 AEP. Flow (volume) reduction observed for the 1:5 AEP is equivalent to a 3.6 % reduction. This limited loss of runoff is not expected to impact the environmental value of Ben's Oasis as the main source of water at this location is sustained by the groundwater aquifer.

6.3. Waterholes

Although the physical location of the HD2 waterhole (HD2_1404) will remain during the operational mining period, flows to this location will be impacted. The HD2 diversion levee is directly upstream of HD2_1404 and will reduce flow rates and volumes experienced at the waterhole. Modelling results indicate that during a 1:5 AEP rainfall event, maximum flows at the waterhole are reduced by 28 %. During a 1:100 AEP event, maximum flows are reduced by 59 %.

Reductions to flow rates experienced at waterholes is not the only factor to consider when commenting on potential adverse impact. The capacity of the pool compared to the catchment yield volume is important to understand. Typically, waterholes of this size in the Pilbara will have relatively large upstream catchments contributing to the volume of water present in them. Direct rainfall onto the pool during heavy rainfall can have the ability to completely fill a small waterhole, with flow from the upstream catchment overtopping the pool and continuing to flow downstream. Analysis of multiple pools located in the Western Ranges, near Paraburdoo, using a long-term rainfall data set, demonstrated that, pending the size of catchment and capacity of waterhole, a pool can lose 80 – 85% of its upstream catchment and remain functioning in a wetting and drying cycle similar to historically cycles (undisturbed by mining activities). Therefore, similar modelling of HD2_1404 is recommended to understand the extent of impact it may experience due to the proposed HD2 mining activities. This worked is planned for the next study phase.

The BHT waterhole (GHD19-17-WS) will be directly impacted by proposed mining activities. The site is in the middle of a proposed waste dump; therefore, the waterhole will no longer exist.

Social, cultural and environmental values of both waterholes have been discussed with Traditional Owners through the Social Surroundings consultations. Significant work relating to pit and dump designs will be required if these sites are to remain unaffected by the proposed mining activities. These discussions are ongoing at the time of writing this report.

7. WATER QUALITY IMPACTS

Water quality in naturally occurring pools across the Pilbara can be highly variable due to the following factors: water supply (rainfall, creek flow, alluvial groundwater or groundwater structure); the preceding climate (drought/flood history, recent groundwater recharge); and interaction with livestock.

Furthermore, erosion is a naturally occurring process in Pilbara watercourses. This is indicated by the fact that the Pilbara ephemeral creeks typically have high sediment bed loads in their natural state and is further reflected by the range of turbidity values in water quality data collected in the region. Table 7 summarises the historic Department of Water and Regulation (DWER) water quality data collected across all Pilbara water courses. Figure 15 illustrates natural turbidity observed in Weeli Wolli Creek following rain event.

Table 7: Surface water quality values recorded across the Pilbara

	Pilbara Wide (DWER)	
	Minimum	Maximum
pH	5.2	9.4
EC (us/cm)	3	6090
Turbidity (NTU)	0.1	3200
TDS (mg/L)	22	3932



Figure 18: Examples of natural turbidity within Weeli Wolli Creek

7.1. Water quality assessment

The primary source of potential water quality impact to the key sensitive receptors is liberation of additional sediment load to the watercourse. The biggest risk is associated with the proposed haul road crossing of Pebble Mouse Creek, given waste dumps are located further away from the main creeks. Liberation of sediment could occur in the unlikely event that a haul road crossing is washed out during a heavy rainfall event. The pathway from this source to the key receptors is a significant distance of ephemeral creek line – the proposed Pebble Mouse Creek haul road crossing is 14 km upstream of the Weeli Wolli Spring; the proposed road train crossing is 11 km upstream; and the proposed transfer pad and creek diversion levee is 7 km. These distances provide significant opportunity for sediments to be captured within creek and floodplain prior to reaching Weeli Wolli Spring, therefore reducing sediment load expected to reach the Spring.

It is considered unlikely that water quality at the key sensitive receptors identified in this study will be impacted by mining development at HD2 and BHT. To assess the credibility of this potential risk, a qualitative analysis of potential sediment transport from the Pebble Mouse Creek haul road and road train crossings to Weeli Wolli Spring is presented here.

7.2. Sediment transport in ephemeral creeks

Sediment transport in ephemeral creeks generally occurs as a pulse in response to runoff generated by the short duration, high intensity rainfall events (typically rare rainfall events) (Levick et al. 2008). Due to the common presence of bed armouring in ephemeral creeks, in particular channels formed in unconsolidated alluvium comprised of sands and gravel, the bulk of sediment transported generally comprise of the channel bed material (made available for transport once the armour layer has been mobilised) and sediments stored in alluvial plains and floodplains.

Once the armour layer has been mobilised and bed flushing occurs, flows generated by high intensity rainfall events are more likely to contain heavy sediment loads with the potential to move large amounts of coarse sediment through the system. Two consequences of this occurring during such events include large transmission losses and decreasing discharge in the downstream direction, both of which promote the stepwise movement, deposition, and storage of sediment. The effect is a pulsing style of sediment movement that can be remobilised during the next flow (Levick et al. 2008).

This style of sediment movement is likely to be a characteristic of Pebble Mouse Creek in its pre mining condition. The application of this concept to the washout of an engineered crossing and mobilisation of significant loads, in addition to natural sediment loads, may be relevant due to the large amount of coarse material likely to be used in the construction of the crossing. However, it should be noted that rock armouring is likely to also feature in the construction of the crossing.

7.3. Factors affecting the Pebble Mouse Creek flow path

An important factor to consider when assessing the likelihood of sediment loading from the haul road and road train crossings impacting Weeli Wolli Spring is the flow path from the source to the receptor and existing infrastructure. The 14 km reach of Pebble Mouse Creek between the haul road crossing and Weeli Wolli Spring is intersected initially by the HD1 rail line; then the road train crossing directly downstream of the rail line; and then diverted by the HD1N levee (known as the “100 year levee”) before flowing to its confluence with Weeli Wolli Creek.

The HD1 rail line crossing is approximately 3 km downstream of the haul road crossing, consisting of 28 DN2700 culverts with projecting inlets. Experiments conducted by Faqiri (2014) found that, while projecting inlets typically provide a lower culvert capacity compared to winged wall or cut inlets, these culverts are

still capable of transporting sediment downstream. However, the inlet geometry is not the only factor affecting sediment transport through culverts. The flow condition directly upstream of the culvert (the area referred to as the expansion section) is also a determining factor. Low velocity, deeper flows were found to result in an increase of sediment deposition at the culvert expansion section compared to high velocity flows, mainly because of low velocities allowing sediments to drop out and settle. Hence, for sediment to be effectively transported through culvert barrels, flow regimes with high velocities and low depths are required. The HD1 rail line crossing is expected to reduce flow velocities, resulting in some sediment deposition upstream of and at the rail culverts, with reduced sediment loads carried downstream of the rail crossing.

The inclusion of the road train crossing (with culverts) directly downstream of the rail line presents an additional expansion section and compounds the effect of sediment deposition upstream of the culverts. Therefore, having a second set of culverts at this location would further reduce sediment loads carried downstream.

7.4. Hydraulic modelling

Hydraulic modelling has been used to assess the flow regime along Pebble Mouse Creek focussing on the characteristics of flow observed at the haul road crossing as well as the HD1 rail crossing. Using similar hydrological inputs to the regional model previously discussed, a refined model domain was adopted for this assessment as well as a higher resolution grid size (5 m). Pre and operational mining scenarios were run for the 1:5 and 1:100 AEP events.

Operational mining infrastructure included the Pebble Mouse Creek haul road crossing low flow design as this was considered the most credible scenario, compared to the other options, to release a source of increased sediment load to the creek system following a crossing failure.

A separate modelling scenario was run to assess the inclusion of the LTRT Option 3 alignment and its impact to flows in Pebble Mouse Creek.

Figure 19 illustrates the model extent and downstream boundary location of the refined model domain.

7.5. Results

Results of the maximum depths and velocities modelled at the haul road crossing and HD1 rail crossing for the 1:100 AEP and 1:5 AEP are shown in Figure 20-21 and Figure 22-23, respectively.

Results of the maximum depths and velocities modelled at the LTRT Option 3 creek crossing and transfer pad (TP4) for the 1:100 AEP are shown in Figures 24 and 25.

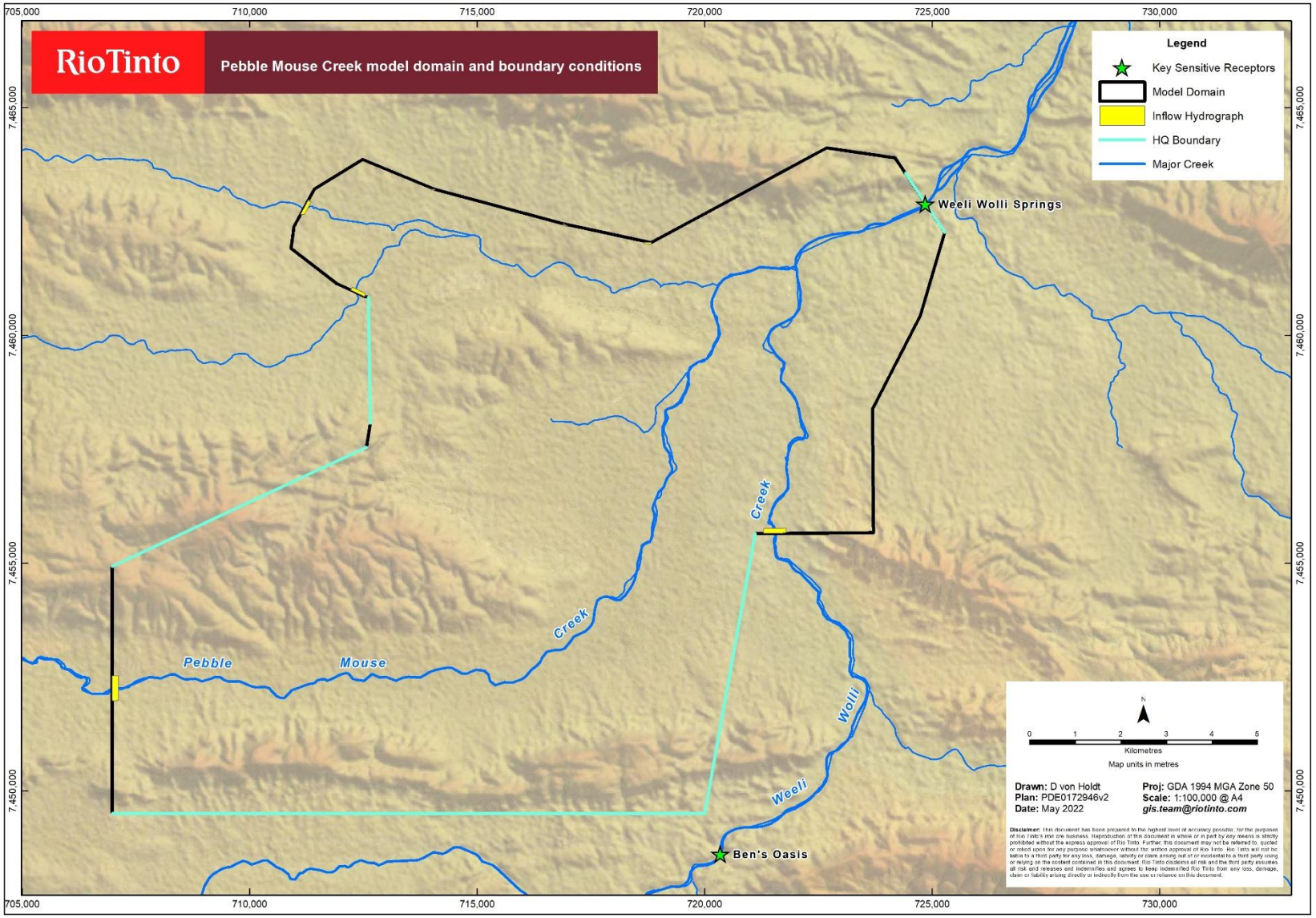

Figure 19: Pebble Mouse Creek model domain and boundary conditions

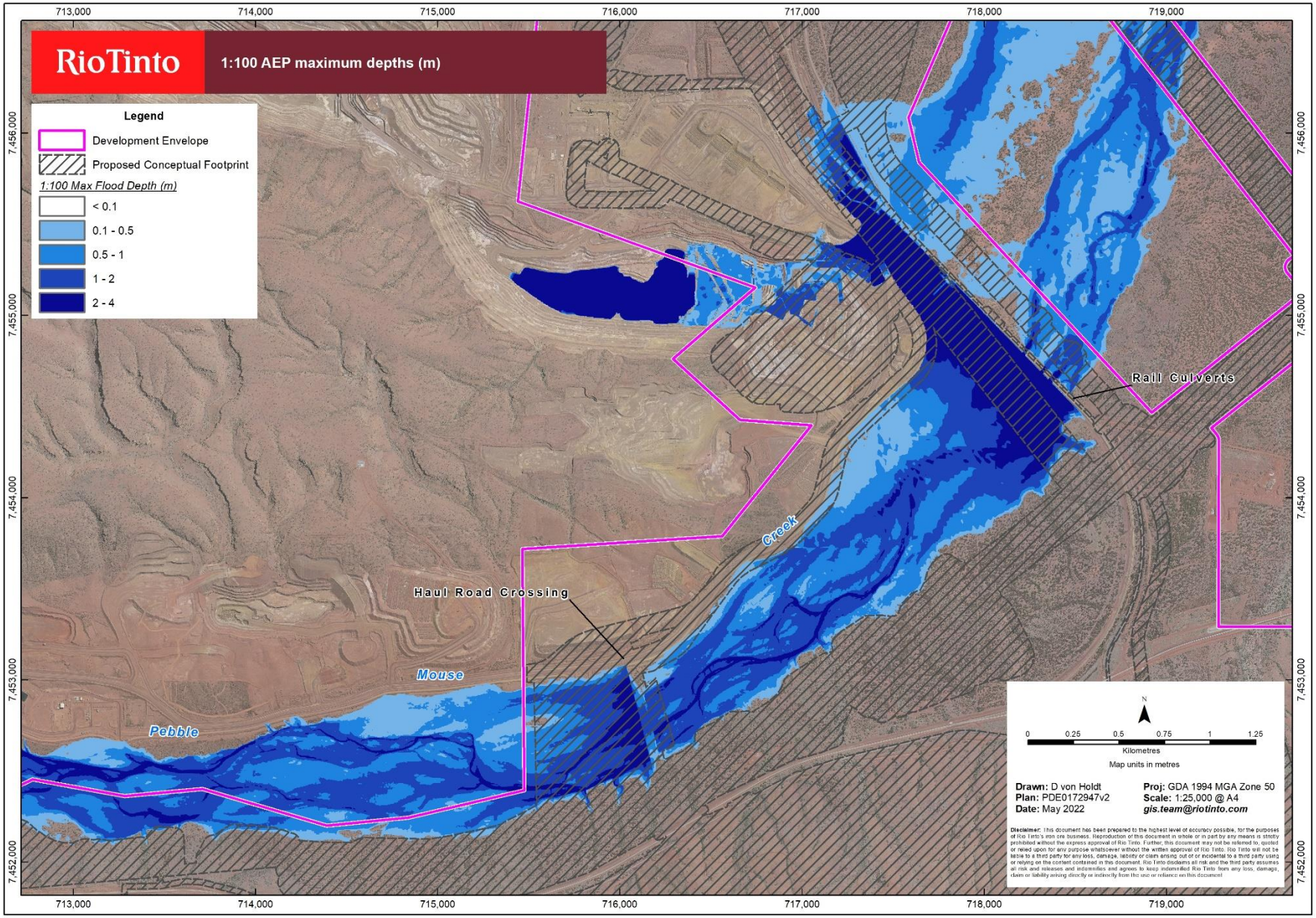

Figure 20: 1:100 AEP maximum depths (haul road crossing

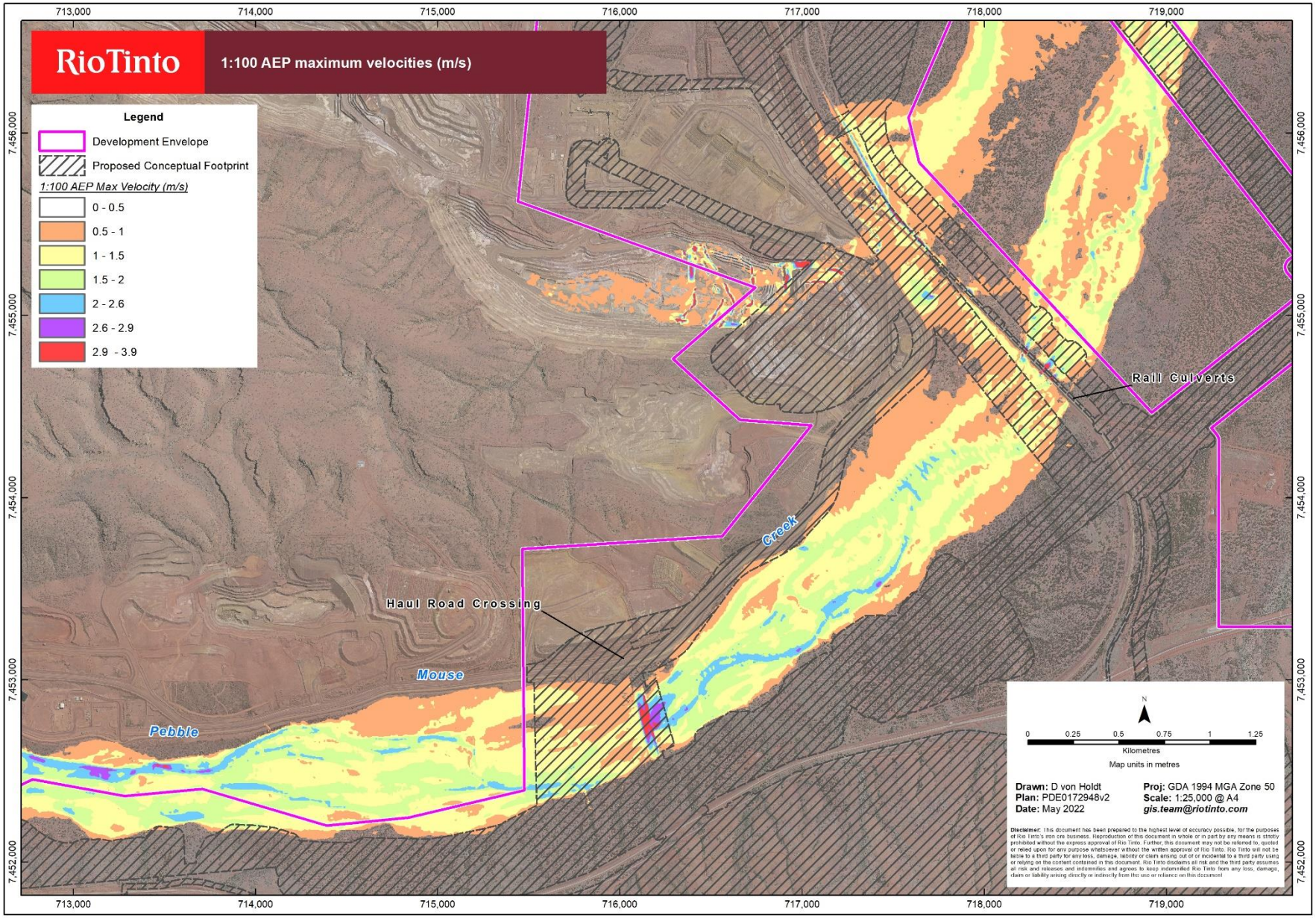

Figure 21: 1:100 AEP maximum velocities (haul road crossing)

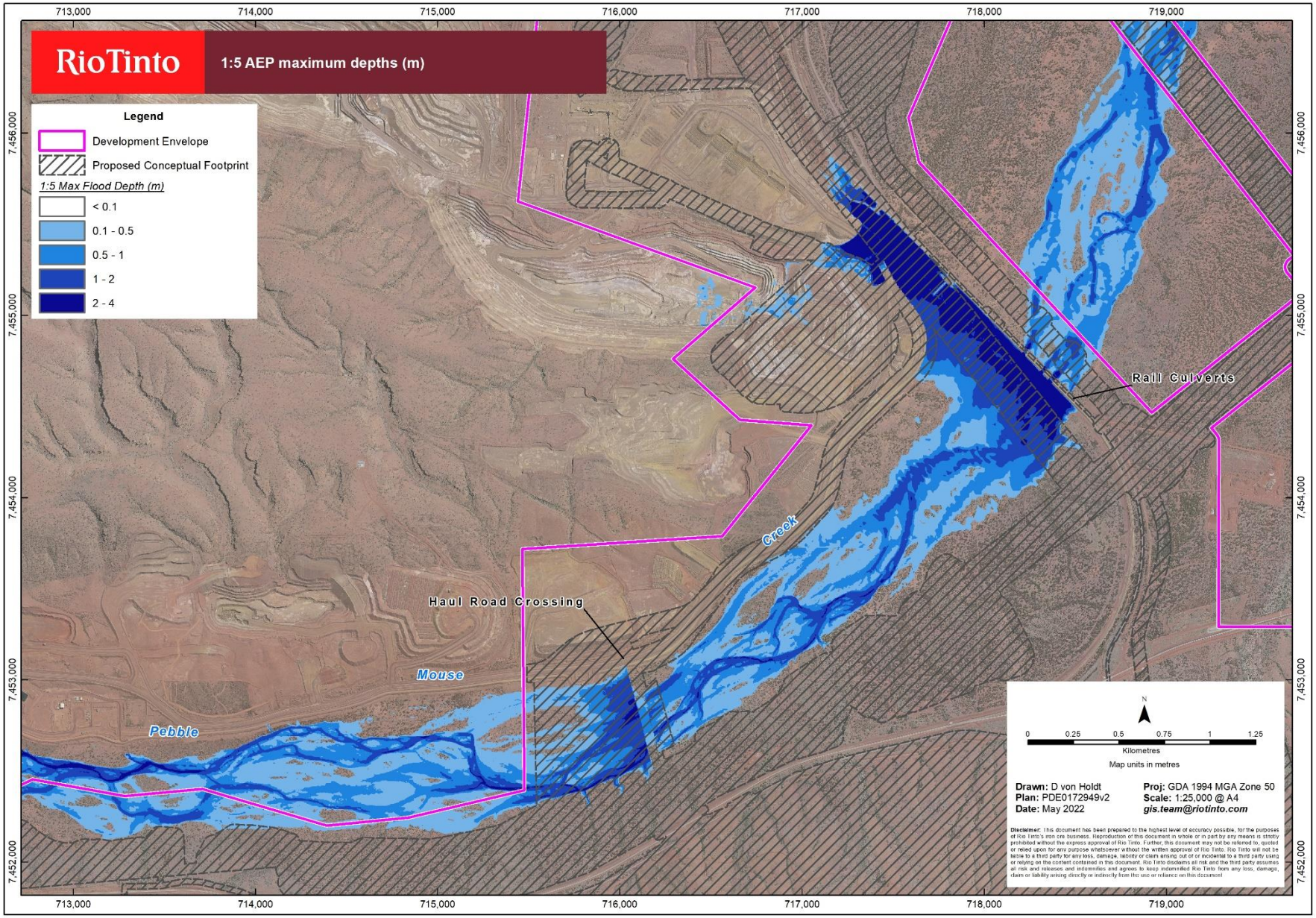

Figure 22: 1:5 AEP maximum flood depths (haul road crossing)

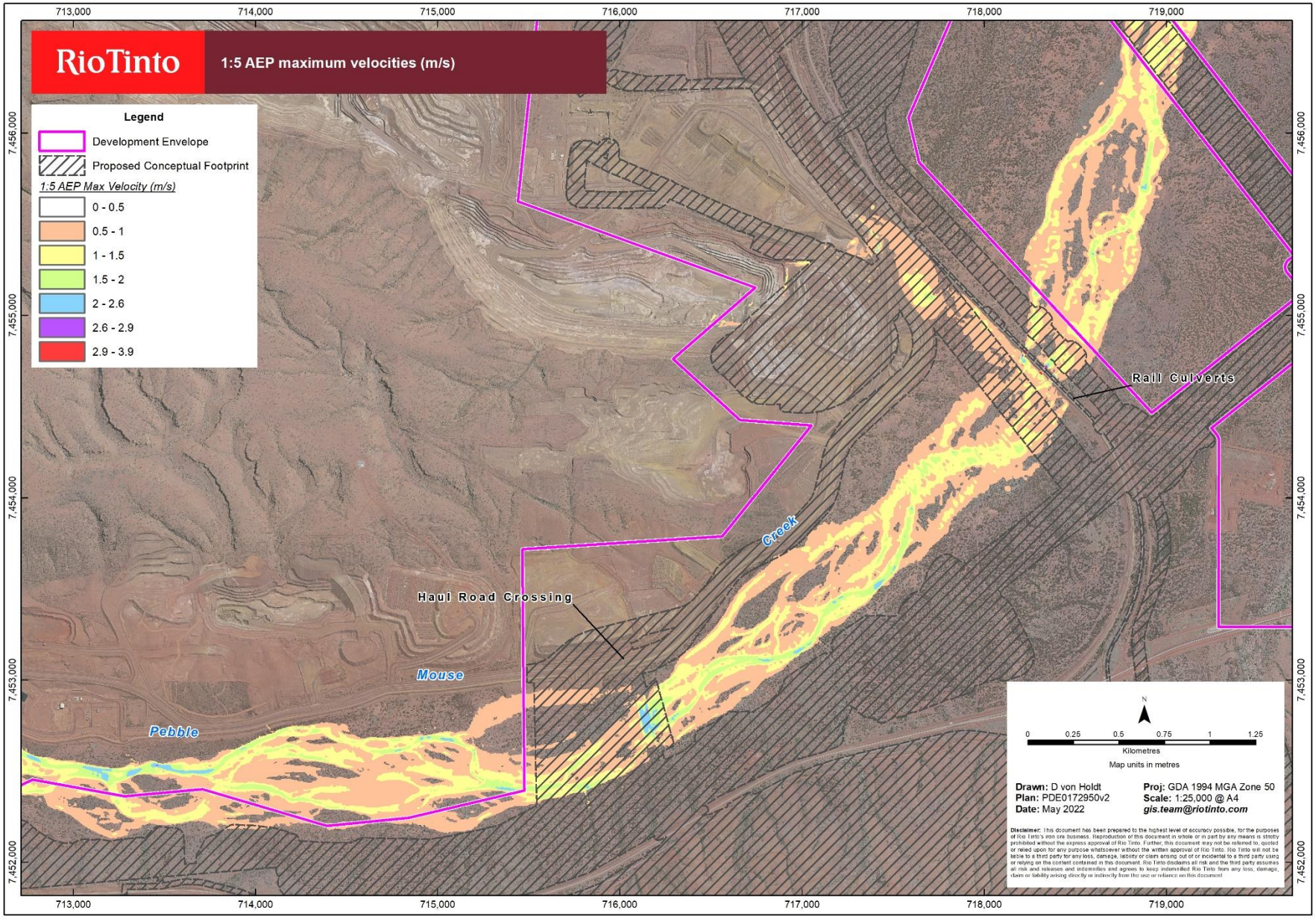

Figure 23: 1:5 AEP maximum velocities (haul road crossing)

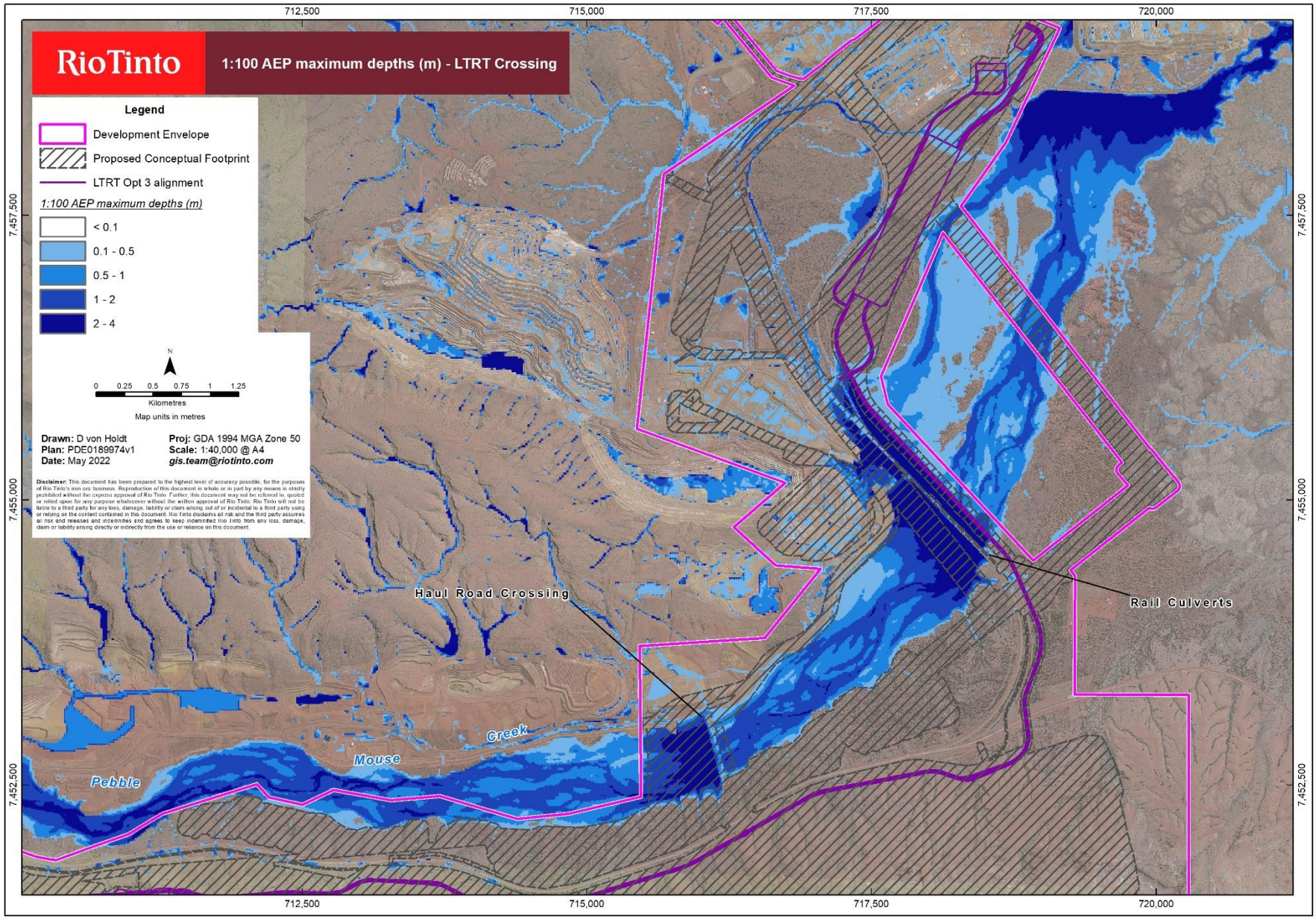

Figure 24: 1:100 AEP maximum depths (LTRT Crossing)

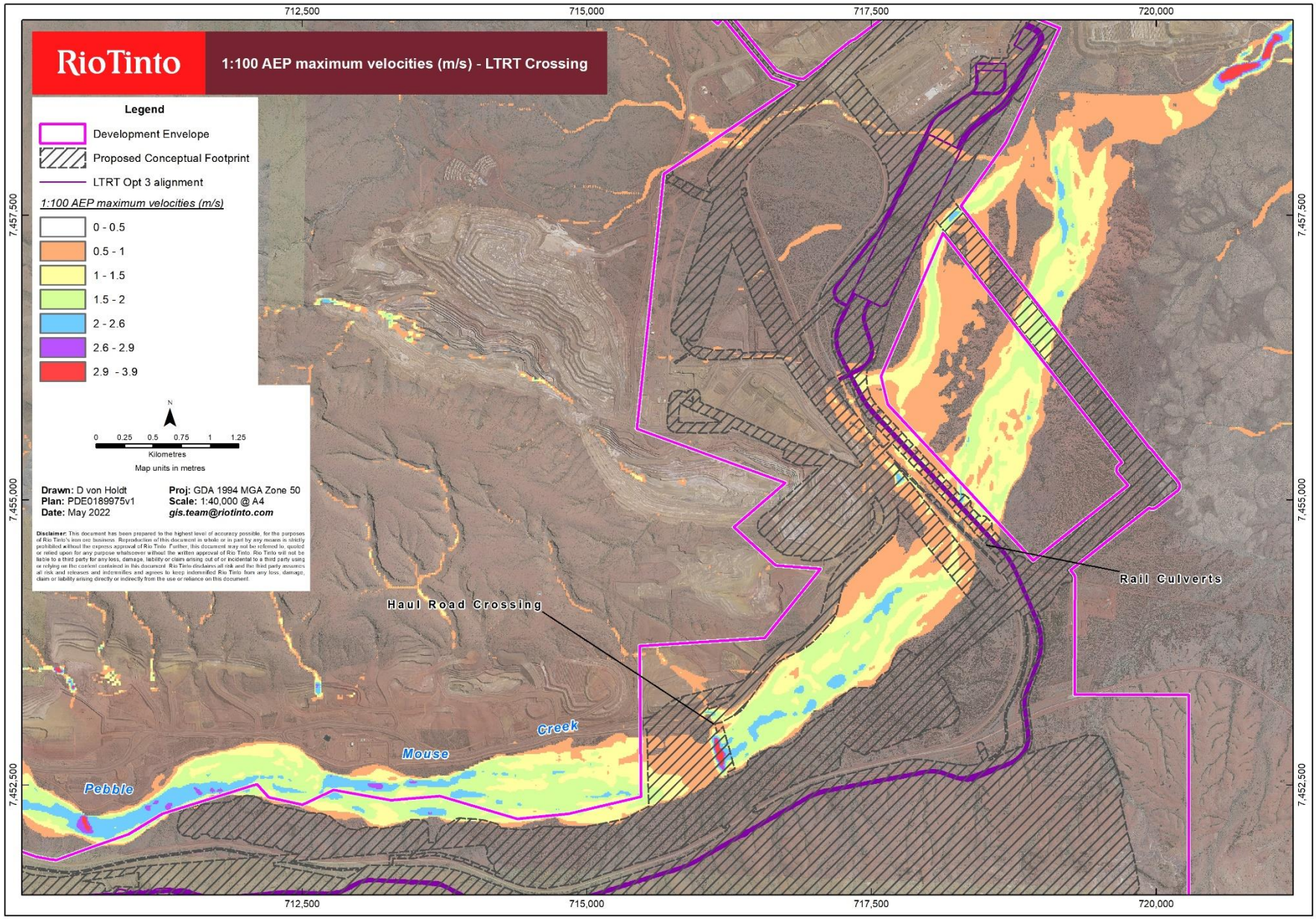

Figure 25: 1:100 AEP maximum velocities (LTRT Crossing)

7.6. Discussion

Hydraulic modelling indicates that during both frequent (1:5 AEP) and rare (1:100 AEP) events, maximum flow depths are observed upstream of the Pebble Mouse Creek haul road crossing as well as upstream of the rail line. This is expected due to the attenuation and backwater impacts of these structures. Velocity regimes at the crossing locations are typically characterised by a reduction in energy at the upstream side as flow is throttled by the crossing obstruction, with a distinct increase in the velocity at and immediately downstream of the crossing as flow is concentrated through the floodway or culvert.

Flow regimes at the crossing are likely to promote the mobilisation of sediment however it is difficult to comment on the extent of downstream sediment deposition without a detailed understanding of the crossing and bed load materials. Frequent event modelled velocities may have sufficient energy to overcome the shear stress of sediment directly at the crossing thus increasing erosion rates. Given the reduced flow velocities in the reach downstream of the crossing, the downstream flow regime is however unlikely to support the sediment loading for long distances, with sediment likely to start dropping out as flow velocities reduce. A crossing washout is more likely under a rare event, with increased velocities and higher energy potentially resulting in sediments transported over longer distances compared to frequent events.

The high flood depths and low velocities observed on the upstream side of the rail crossing supports the increased deposition of sediment at the culvert inlets and most likely poor transport of sediment through the culverts. Therefore, blockages are likely to occur at these culverts because of sediment transport from an upstream source thus reducing the culvert capacities and impacting downstream surface water flow regimes.

Based on this assessment it can be assumed that sediment transported from a potential washout of the Pebble Mouse Creek haul road crossing will most likely be because of a rare rainfall event, with sediments more likely to be deposited at / upstream of the rail crossing, causing some blockage of the culverts at this location. It is therefore considered unlikely that this sediment would have any significant impact on the water quality of Weeli Wolli Spring which is located 14 km downstream of the crossing (and 10 km downstream of the rail culverts).

A similar conclusion can be drawn regarding the LTRT Option 3 creek crossing. With the alignment running parallel to the existing rail line crossing and the culverts being identical (or bigger) than the existing culverts, the flow regime is not expected to change much downstream of the crossing.

Therefore, it is considered unlikely the LTRT Option 3 infrastructure will adversely impact the water quality of Weeli Wolli Spring, located 11 km downstream from the creek crossing and 7 km downstream of TP4.

7.7. Frequency analysis of Pebble Mouse Creek rainfall data

To qualitatively assess the likelihood of frequent and rare rainfall events occurring during the operational life of the Pebble Mouse Creek haul road crossing, a frequency analysis was undertaken. The long term flow data recorded at the DWER Tarina gauging station (located on Weeli Wolli Creek downstream of Weeli Wolli Spring) was used for the analysis. The flow rates measured at Tarina station are based on the Weeli Wolli Creek catchment (1,530 km^2) however the rainfall patterns and streamflow responses observed within this catchment are considered like that observed within the Pebble Mouse Creek catchment. Therefore, the Tarina gauge dataset was scaled to apply to Pebble Mouse Creek using a scaling factor of

0.46. The scaling factor was calculated using the ratio of the two catchment areas to the power of 0.7 (Grayson et al, 2004).

Using peak design flow rates for various AEP events, previously calculated as part of the RORB hydrological modelling, the dataset was interrogated to identify periods of flow at Pebble Mouse Creek responding to frequent to rare rainfall events.

The frequency analysis identified 18 rainfall events characterised as equal to or greater than the 1:5 AEP event occurring over the 30-year period of the dataset. Majority of events were in the 1:5 to 1:10 AEP range, with two 1:20 AEP events and one event greater than the 1:100 AEP.

If mainly rare events have the potential to mobilise significant bed load in a creek and demonstrating that Pebble Mouse Creek has only experienced five rare events over 30 years, the risk of the haul road crossing impacting a key sensitive receptor 14 km downstream of the washout site is considered unlikely to occur.

7.8. Consideration of optional waterway crossings

Based on the alignment of the overland conveyor crossing, environmental flow volumes (lower magnitude than a 1:5 AEP event) in Pebble Mouse Creek will not be impeded. There is potential for flow regimes during the rare events (1:100 AEP event and above) to be altered at the crossing location. However, engineering design of the conveyor crossing will ensure full conveyance of design flows and provide the appropriate level of scour protection downstream. Typical design solutions under consideration, as described in Section 3.4, are expected to result in negligible change from the baseline depth and velocity values and any changes should be confined to those areas a short distance up and downstream of the crossings. Overall flow volume and flow rates are typically unchanged for at-grade crossings and culvert installations. Therefore, given that appropriate scour protection will be provided it is considered unlikely that any sediment movement associated with this crossing would have any significant impact on the water quality of Weeli Wolli Spring, which is located 14 km downstream.

The bridges proposed at GNH and the alternative mine access road are approximately 34 km upstream of Weeli Wolli Springs. Modelling results presented in Section 7.5 indicated that a crossing 14 km upstream from the sensitive receptor would not significantly impact its water quality. Therefore, the addition of both these bridges will have no additional impact on Weeli Wolli Springs over and above those previously stated for the Pebble Mouse Creek haul road crossing.

8. CONCLUSIONS

Hydraulic modelling has shown that mining infrastructure related to the HD2 and BHT deposits will result in minor reductions to peak flows at the key sensitive receptors. The slight loss of runoff is expected to have little effect on the flow regime at Weeli Wolli Spring or Ben's Oasis and therefore is not expected to impact the environmental and heritage values of these areas.

A qualitative assessment of the potential for sediment transport from the Pebble Mouse Creek haul road crossing was undertaken to highlight the potential impacts on water quality at Weeli Wolli Spring. Hydraulic modelling demonstrated that velocities required to mobilise sediment load from the haul road crossing were more likely to be experienced during rare rainfall events. During the frequent events, sediment loading is unlikely to move far downstream due to the low energy estimated downstream of the haul road crossing. The significant distance between the sediment source and key sensitive receptor suggested it was unlikely that water quality would be impacted. This was further supported by the positioning of the HD1 rail line culvert crossing downstream of the haul road crossing through which sediment transport would be poor.

9. References

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E.2: Hydrogeological Assessment of the Hope Downs 2 and Bedded Hilltop Deposits

Rio Tinto

Hope Downs 2 Proposal



Resource Development, Water Resource Evaluation

Hydrogeological Assessment of the Hope Downs 2 and Bedded Hilltop Deposits

April 2022

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EXECUTIVE SUMMARY

Rio Tinto is proposing above water table (AWT) mining of the Hope Downs 2 (HD2) and Bedded Hilltop (BHT) iron ore deposits (the Proposal). The project area is located in the Pilbara region of Western Australia, approximately 80 km northwest of Newman in the Shire of East Pilbara on the traditional lands of the Nyiyaparli people, with smaller portions located on land held by the Banjima and Ngarlawangga people. The project is an unincorporated joint venture (50:50) between Hope Downs Iron Ore Pty Ltd (a member of Hancock Prospecting Group) and Hamersley WA Pty Ltd (a member of the Rio Tinto Group). The Hope Downs JV (HDJV) is managed by Hamersley HMS Pty Ltd (HHMS), a Rio Tinto Group company.

Water for the project will be required to support the construction and operational mining phases for each deposit. Subject to approval, ore from the HD2 and BHT deposits will mined using open-cut, load and haul methods, processed on-site and then transported to the Hope Downs 1 (HD1) mine for mineral processing and transportation by rail to port. The Proposal's construction phase is expected to be carried out over an approximate 2-to 3-year period and mining operations are expected to extend over a 7-to10-year period. Annual water demand has been calculated based on construction, dust management, ore processing and potable water requirements and is expected to be approximately 3 GL per year.

This report describes the hydrogeology of the project area, summarises the proposed water supply options, and presents predicted groundwater drawdown that may occur due to the project's proposed groundwater consumption. Dewatering of the ore body for the purpose of dry-mining is not considered herein as the Proposal is to mine only AWT ore bodies.

Rio Tinto has undertaken work to assess water sources that are in-line with the company's water strategy and are:

Source 1: Use the water currently abstracted at HD1 for mine dewatering which will minimise water volumes released to the environment and minimise use of additional groundwater resources; and

Source 2: Establish a borefield local to HD2 to meet any shortfalls of Source 1 (noting that HD1 mine dewatering diminishes towards the end of mining at HD1 and a local supply will likely be required).

Source 3: Establish a borefield local to BHT to meet small local demands (i.e. office/crib room potable supply and/or small construction supply).

The assessments show that:

Use of HD1 Mine dewatering (Source 1) - will be sufficient for initial periods of mining at HD2/BHT however an additional source of water may be required both during commissioning and when water availability at HD1 is limited post 2033. Drawdowns from abstraction at HD1, due to this proposal, are in line with previously reported assessments (PER, 2002).

A borefield at HD2 (Source 2) - is expected to provide a sustainable supply sufficient to meet demand for the combined HD2/BHT mine life. Drawdowns from abstraction at HD2 are not expected to propagate towards any existing users or environmental receptors (namely, Ben's Oasis or Weeli Wolli Spring).

The supply potential of BHT (Source 3) - is limited due to the small aquifer extent; only minor supplies are likely to be obtained.

1 Introduction

1.1 Project Summary

Mining of the Hope Downs 2 (HD2) and Bedded Hilltop (BHT) iron ore deposits has been proposed and, subject to approval, is expected to include the following:

- AWT mining and movement of iron ore;
- Construction and operation of a transport route, including landbridges, creek crossings and ore transfer pads;
- Construction and operation of crib rooms, administration and ancillary facilities;
- Ore processing at existing facilities;
- Ore transport along existing rail lines; and
- Construction and operation of a power and water supply.

HD2 is located southwest of the Hope Downs 1 (HD1) mining village and is ~30 km from the nearest crusher at HD1. The deposit has a northeast-southwest strike extending up to 9 km. BHT is a hilly, high terrain deposit located about 7 km south of the Hope Downs 1 Southwest (HD1SW) pit and is relatively close to the current processing infrastructure located at the HD1 minesite. BHT has an east-west strike extending up to 9 km. Mining operations are expected to extend over a 7-to10-year period.

A location map is provided in Figure 1.

1.2 Ownership & Tenure

The Proposal (which includes both the HD2 and BHT deposits) is an unincorporated joint venture (50:50) between Hope Downs Iron Ore Pty Ltd (a member of Hancock Prospecting Group) and Hamersley WA Pty Ltd (a member of the Rio Tinto Group). The Hope Downs JV (HDJV) is managed by Hamersley HMS Pty Ltd (HHMS), a Rio Tinto Group company. The tenure associated with the project has been issued on Unallocated Crown Land (UCL). There is no pastoral activity in the immediate vicinity of the mine, with Marillana Station (N050368) the nearest pastoral station lease. Marillana Station lease is owned and operated by BHP.

1.3 Existing Licensed Groundwater Users

The HD2 deposit is situated in DWER's Pilbara groundwater licensing area; sub-area East Pilbara. There is available allocation from the licensed Hamersley - Fractured Rock aquifer; with the Wittenoom - Wittenoom aquifer reported as fully allocated. A groundwater licence search on DWER's Water Register, within a 10 km radius of the HD2 deposit, reports 13 licences are held in the fully allocated Wittenoom aquifer (including HD1's groundwater licence) and 119 licences held in the Hamersley - Fractured Rock aquifer; however it should be noted that while licences are held in this vicinity abstraction does not necessarily occur within the 10 km radius as licensees are able to attach multiple and geographically distant tenements on a single licence. The main, proximal licensees are:

- Rio Tinto, who hold GWL (groundwater licence) 161141 which permits 40.15 GL per annum of abstraction for the dewatering of the HD1 deposit (Wittenoom aquifer), GWL 161143 which permits 0.5 GL per annum

of abstraction from the HD1 Village for potable supply, GWL 98740 which permits abstraction of 14 GL per annum from Rio Tinto's West Angelas (WANG) Mine, inclusive of Deposit B, GWL 172872 which permits 23 GL of abstraction from Rio Tinto's Hope Downs 4 operation and numerous small volume 5C licences held for ad hoc abstraction along the Rio Tinto' rail corridor; and

- BHP Iron Ore Pty Ltd holds a total of 27 licences; the largest and most proximal to the HD2 project area are GWL 166389, which permits the abstraction of 21.9 GL per annum (Wittenoom aquifer), and GWL 110044, which permits the abstraction of 36.5 GL per annum. It is understood that these licences are attached to BHP's Mining Area C and are used for mine dewatering.
- Additional licensees, holding licences with allocations of less than 0.5 GL, include the Main Roads, Ascot Resources Ltd, Wonmunna Iron Ore Pty Ltd and Fortescue Metals Group Limited.

1.4 Regional Setting

The project is located in the Pilbara region of Western Australia, approximately 80 km northwest of Newman, within the Shire of East Pilbara (Fig. 1).

and lies predominantly on the traditional land of the Nyiyaparli people, with smaller portions located on land held by the Banjima and Ngarlawangga people (Figure 2).

The Great Northern Highway intersects the southern end of the project area, providing public access between the towns of Newman and Port Hedland and tourist access to Karijini National Park, approximately 30 km to the west of the HD2 deposit (Fig. 1).

Large groundwater users in the vicinity of the project (Figure 3) are current mining projects:

- Rio Tinto – HD1 Iron Ore Mine (including Baby Hope/HD1SW), immediately north;
- Rio Tinto – West Angelas (WANG) Iron Ore Mine, approximately 10 km southwest;
- BHP – Area C and South Flank Iron Ore Mine, approximately 12 km north-northwest; and
- Rio Tinto – Hope Downs 4 (HD4) Iron Ore Mine, approximately 42 km southeast.

1.5 Previous Work

The HD1 region has been the subject to numerous hydrogeological investigations dating back to the mid 1990's. Early hydrogeological conceptualisation assumed an extensive lateral extent of the groundwater system across the HD1 area. Subsequent investigations based on long-term pumping of the HD1 aquifer for mine dewatering and aquifer injection at neighbouring operations (i.e. BHP's Mining Area C) have allowed the HD1 aquifer boundaries to become well defined. It is now understood that the HD1 aquifer is notably much smaller than initially thought, and the HD1 aquifer is hydraulically disconnected from the groundwater system at both HD2 and BHT (see Section 2.5).

More recently, the HD2 and BHT areas have been investigated for the purpose of mining and water supply.

1.5.1 Field Investigations

Hydrogeological field investigations (drilling and test pumping of bores) have been undertaken in and around the location of each deposit in the Proposal since 2013. The information obtained from field investigation, along with local hydrogeological knowledge, and subsequent groundwater modelling has been used herein to assess available groundwater volumes.

At HD2 field investigations were undertaken between 2015 and 2022 and in the surrounding areas as early as 2006. Work has included the installation of 29 monitoring bores, 4 test production bores and several supply bores used for rail construction and maintenance (LHRP series).

At BHT, field investigations were undertaken between 2013 and 2018 and in the surrounding areas as early as 2006. Hydrogeological drilling carried out at the BHT deposit included the installation of 9 monitoring bores and 2 test production bores.

Bore construction data are provided in Appendix I.

1.6 Sensitive Receptors

Locations with heritage or environmental significance are referred to as sensitive areas or receptors. These locations require special consideration of the direct, indirect and potential cumulative impact of all mining activities due to their high heritage or environmental value.

Surface water sensitive receptors are not specifically considered in this report unless there is a known or perceived groundwater contribution to the surface water receptor and are herein referred to as sensitive groundwater receptors. Sensitive groundwater receptors may support fauna (including sub-surface fauna) and vegetation and/or provide cultural and/or social value through direct use (i.e. swimming, fishing, camping) or cultural connection.

The sensitive groundwater receptors that have been identified as part of the Proposal are Weeli Wolli Spring PEC (inclusive of Ben's Oasis), with locations shown in Figure 3. Although Pebble Mouse Creek is also considered to hold cultural, social and heritage significance, it has not been considered a key sensitive receptor as there are no known permanent water bodies along the creek, indicating that groundwater contributions to the creek are negligible to non-existent.

Further detail on sensitive groundwater receptors is given in Section 3.1.

2 Hydrogeological Setting

2.1 Climate & Rainfall

The Hope Downs area is a semi-arid to arid environment (Koppen-Geiger classification), characterised by hot summers and warm winters. The region experiences climate extremes, where severe droughts and major floods can follow in close succession.

The long-term annual rainfall for the region is approximately 324 mm and at HD1 the average annual rainfall received since 2008 is 313 mm (Table 1). Rainfall is highly variant, falling mainly in the summer months from January to March. This is generally a result of scattered thunderstorms producing heavy localised falls and/or tropical lows originating off the Pilbara coast bringing widespread rain to the area.

Rainfall events of more than 60 mm in 24 hours are estimated to occur on average once each year. Analysis of gridded rainfall and streamflow data from the Tarina streamflow gauge located on Weeli Wolli Creek and operated by the Department of Water and Regulation (DWER) indicates the study area experiences on average two rainfall events 35 mm per day or greater per year. This analysis suggests that the minimum amount of rainfall required to generate flow in the catchment is approximately 35 mm per day. The average annual evaporation rate for the region is 1900 mm (sheltered free water surface) and the average annual pan evaporation is approximately 3400 mm, an order of magnitude larger than mean annual rainfall.

Table 1: Rainfall – HD1 Weather Station and Newman Averages (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Hope Downs 1 Weather Station Average (2008 to 2021)	106	45	44	14	19	49	14	6	6	4	47	27	313
Newman* Average (1971 to 2021)	68	72	41	22	18	16	14	6	4	6	12	35	324

*Newman Aero Station 007176

2.2 Hydrology

The HD2 and BHT deposits are located within the upper reaches of the Weeli Wolli Creek catchment that forms part of the Fortescue River Region. Weeli Wolli Creek has a total catchment area of approximately 4,770 km^2 to Waterloo Bore gauging station and drains north into the Fortescue Marsh.

The upper reaches of the Weeli Wolli Creek catchment include Pebble Mouse Creek, a major tributary of Weeli Wolli Creek, which has a catchment area of 340 km^2. The HD2 and BHT deposits are bisected by the Pebble Mouse Creek and Weeli Wolli Creek catchment divide and do not interact with the flood plains of either creek. Locations of these catchments are shown in Figure 3.

2.3 Geology

The Hope Downs area is situated at the south-eastern corner of the Pilbara Craton, in the Ophthalmia region, within the eastern area of the Hamersley Basin. The cratonic basement comprises Archean granite-greenstone and is overlain by the Archean-Proterozoic rocks of the Hamersley Basin. These rocks can be divided into three stratigraphic groups: the Fortescue, Hamersley and Turee Creek groups, with the Hamersley Group forming the outcrop in the area. The Hamersley Group is a thick sedimentary sequence comprising banded iron formations (BIF), shales and dolomites, with minor felsic volcanic and extensive dolerite dykes and sills. The group contains the Brockman Iron Formation and the Marra Mamba Iron Formation which together, host most of the known major iron ore deposits in the Pilbara.

The lower-most formations of the Hamersley Group occur within the project area and include (youngest to oldest):

- Brockman Formation
- Mount McRae Shale
- Mount Sylvia Formation
- Wittenoom Formation:
    - Bee Gorge Member (calcareous shale and dolomite)
    - Paraburdoo Member (dolomite)
    - West Angela Member (magnesium-rich shale with minor BIF and chert bands)
- Marra Mamba Iron Formation:
    - Mount Newman Member (BIF with thin shale bands – includes the HD1N and HD1S orebodies)
    - MacLeod Member (BIF with extensive interbedded shales and “podded” BIF horizons)
    - Nammuldi Member (cherty BIF with occasional shale bands)

The HD2 deposit lies on the Northern limb of the Wonmunna Anticline. The Wonmunna Anticline is a W-E trending, shallowly plunging antiform. HD2 is a Marra Mamba Iron Formation and detrital deposit, with high grade bedded mineralisation mostly located in the Mt Newman Member, and with low grade mineralisation found at the base of the West Angela, MacLeod and Nammuldi Members. The deposit lies predominantly under detrital cover, typically unmineralised clay and immature detritals with some zones of mature detritals, limonites and red ochre detritals. Mineralisation in the deposit is predominantly martite-goethite.

The BHT is a Brockman Iron Formation derived deposit which lies as a major syncline between the Weeli Wolli Anticline and the Wonmunna Anticline. The deposit is located on an E-W striking Brockman ridge. The geology is typically flat throughout the hilltop with some gentle folding. Mineralisation in the deposit is predominantly martite-goethite mineralogy and occurs primarily within the Dales Gorge Member of the high phosphorous Brockman Iron Formation.

2.4 Regional Hydrogeology

The dominant aquifer within the regional groundwater system is the Paraburdoo Member of the Wittenoom Formation which occurs in the strike orientated valley floors between ridges of the Brockman and Marra Mamba Iron formations. The dolomite of the Paraburdoo Member can show extensive karstification. Secondary permeability is commonly formed within ore bodies as a part of the mineralisation process leading to areas of higher

permeability. These zones are often hydraulically connected to the overlying Tertiary detritals and the underlying, upper Marra Mamba Iron Formation (that being the Mt Newman Member where mineralised).

Overlying the regional aquifer are Mt Sylvia and Mt McRae Shale formations which comprise low permeability shale and can be usually be considered as aquitards. The lower, low permeability members of the Marra Mamba Formation (the MacLeod and Nammuldi members) form the base of the aquifer. Local and/or regional dolerite intrusive and faulting act to bound, or compartmentalise, the groundwater system.

2.5 Local Hydrogeology

There are 3 distinct local aquifers relevant to the Proposal: the HD1, HD2 and BHT aquifers. The HD1 aquifer is considered to be more extensive aquifer but hydraulically disconnected from HD2 and BHT. At HD2 groundwater availability is primarily limited by the vertical extent (thickness) of the aquifer and low permeability units that bound or compartmentalise the aquifer. At BHT the aquifer is bounded, and 'bathtub-like' at BHT. Figure 4 maps the lateral extents of the 3 aquifers.

There are 2 main units that comprise the aquifers:

1. Wittenoom Formation, occurring at HD1 and HD2, comprising the often karstic dolomite within the Bee Gorge and Paraburdoo Members of the Wittenoom Formation and the mineralised and/or fractured zones of the underlying Mt Newman Member of the Marra Mamba Iron Formation.
2. Brockman Iron Formation, occurring at BHT, and comprising the mineralised zones of the Dales Gorge Member and Joffre Member where fractures are encountered.

Surficial sediments (Tertiary age detritals and chemical sediments including calcrete) occur locally and may be saturated and are often in hydraulic connection with underlying units.

Valleys and associated surface drainage features overlie regional aquifers and groundwater generally flows in a similar direction to surface water. Aquifer recharge may occur following large rainfall and subsequent stream flow events causing infiltration through surface drainage features such are major creeks, minor tributaries and bedrock runoff at valley margins. Actual recharge volumes are unknown, however they are expected to be localised and a relatively small component of rainfall volumes with evaporation significantly exceeding rainfall throughout the year; except during the short periods of intense rainfall.

2.5.1 HD1

Groundwater occurrence

The iron ore mineralisation at HD1 occurs within the Marra Mamba Iron Formation. Groundwater occurs at HD1 within Surficial sediments (comprising Tertiary age detritals including surface calcrete), the Wittenoom Formation (comprising weathered dolomite, mainly within the Paraburdoo and the West Angela member), and the underlying Mount Newman Member (of the Marra Mamba Iron Formation).

The aquifer extends over an area of around 206 km^2 (Figure 4). Vertically, the aquifer is in the order of 160 m thick in the vicinity of the north pit, reducing to 120 m in the south pit, and thinner again (~80 m) between the north pit and south pits. Towards Weeli Wolli Creek, the aquifer thins substantially to just 7 m in thickness along the creek.

Regionally, groundwater over the HD1 area is fresh with total dissolved solids less than 700 mg/L. Major ion concentrations show no dominant species type, although all samples are hard to very hard which is attributed to mineral dissolution within dolomite aquifer units. As expected, surface water samples collected along Weeli Wolli Creek contain a very similar major ion composition to regional groundwater.
Groundwater recharge occurs directly from incident rainfall and indirectly from infiltration of streamflow.

Aquifer boundaries

The lower units of the Marra Mamba Iron Formation (the MacLeod and Nammuldi members) are significantly less permeable than the above Newman Member and Wittenoom Formation and therefore effectively form the hydraulic basement of the aquifer system. Due to the northerly dip of the geological structures in this region, the contact with these low permeability units is immediately to the south of both the HD1N and HD1S ore deposits. Additionally, geological structures and dykes form effective groundwater barriers between HD1S and the HD1SW (Baby Hope) deposit and bound the HD1 aquifer northwest of HD1N, effectively separating HD1 from neighbouring mining operations. Boundaries can be confirmed by field observations (i.e. diminished drawdown responses across barriers) and groundwater levels across the sites.

Groundwater Discharge -Weeli Wolli Spring

Pre-mining groundwater levels in the area ranged from 620 mAHD (metres above Australian Height Datum) in the upper catchment areas to around 547 m AHD at Weeli Wolli Spring, where, pre-mining, groundwater discharged at the surface of the Weeli Wolli Creek at Weeli Wolli Spring. Weeli Wolli Spring (detailed in Section 3.1.1), is located 7.5 km down-gradient of the HD1 actively mined and dewatered pits. It is a groundwater dependent ecosystem comprising stygofauna habitat, a riparian vegetation area of phreatophytes and was a perennial (pre-mining) spring. Dewatering of the HD1N and HD1S ore bodies has altered the natural spring flow at Weeli Wolli Spring, and as such, spring flow has been artificially maintained since December 2006 via surface irrigation via a series of off-take spurs lines.

The groundwater system underlying Weeli Wolli Creek essentially consists of a single aquifer unit: detritals/alluvium and weathered Paraburdoo Member of the Wittenoom Formation which are in hydraulic connection, forming an unconfined aquifer. Where the aquifer underlies Weeli Wolli Creek it is thin. The bottom of the aquifer is bound primarily by fresh Wittenoom Formation but also the unmineralised Brockman Iron Formation (low permeability), and groundwater expression at the Spring pools occurs as groundwater is forced to the surface where the aquifer pinches out above these lower permeability units.

At the conclusion of mining Rio Tinto is required to re-instate the HD1 aquifer so that the Weeli Wolli Spring pools return to self-sustaining (permanent) water features.

Groundwater Chemisity

Regionally groundwater over the HD1 area is fresh with TDS (total dissolved solids) less than 700 mg/L. Major ion concentrations show no dominant species type, although all samples are hard to very hard, attributed to mineral

dissolution within the dolomite aquifer. As expected, surface water samples collected along Weeli Wolli Creek reflect regional groundwater, very similar major ion composition.

2.5.2 HD2

The assumed extent of the HD2 aquifer is shown in Figure 4 and in Figure 5 with current water levels, as recorded in 2020, which at the HD2 deposit approximate 626 mAHD. A hydrogeological cross-section across the HD2 deposit is shown in Figure 6, bore locations are shown in Figure 7. Water level data are shown in Figure 8 and included in Appendix II.

Hydrogeological properties are summarised in Table 2.

Groundwater occurrence

The HD2 orebody is located within both the Marra Mamba Iron Formation and the overlying detrital deposits. In the HD2 area, the Marra Mamba Iron Formation abuts the regionally extensive Wittenoom Formation and is underlain by the Fortescue Group (Figs. 5 and 6).

The groundwater table in the HD2 area is located within both the Marra Mamba Iron Formation and Wittenoom Formation and is generally below the base of the detrital deposits. The water is hosted by secondary permeability structures associated with mineralisation and fractures within the Mt Newman Member of the Marra Mamba Iron Formation and overlying West Angela Member of the Wittenoom Formation, and by secondary porosity within the weathered Bee Gorge and Paraburdoo Member (Wittenoom Formation). The lower members of the Marra Mamba Iron Formation (the MacLeod and Nammuldi members) are significantly less permeable than the Mt Newman Member and are most likely the basal unit of the aquifer system, yielding only negligible volumes of groundwater. Groundwater in the upper Marra Mamba Iron Formation is in hydraulic connection with the overlying Wittenoom Formation, effectively forming a single aquifer unit. It is a fractured rock aquifer, channel like in geometry at the HD2 deposit extending east-west along strike for approximately 40 km (Fig. 6). Although the Wittenoom Formation is a known regional and extensive aquifer, at HD2 it is bounded in the east making it a local, somewhat compartmentalised aquifer.
Water yielded during drilling in the upper Marra Mamba Iron Formation (Mt Newman Member) and/or Wittenoom Formation at HD2 is typically low (under 5 L/s) with some higher yields of about 15 L/s encountered. The groundwater is fresh; with a salinity of generally less than 1000 µS/cm Electrical Conductivity (EC)

Table 2: Hydro-stratigraphic Units and Aquifer Characteristics – HD2

Deposit	Aquifer	Hydro-stratigraphic unit	Lithology	Typical characteristics	Distribution, local characteristics
HD2	HD2 Wittenoom aquifer	Wittenoom Formation	Weathered/altered dolomite, shale with minor BIF and chert bands.	Often associated with drainage valleys and saturated Tertiary cover. Major yields where dolomite is karstic (Paraburdoo Member) and from mineralised Mount Newman Member (yields from 40 to 100 L/s), high hydraulic conductivity.	Main aquifer at HD2; average thickness of 85m. Compartmentalised by cross-cutting dykes and abutting low permeability lithologies (ie fresh/massive dolomite) , channel like geometry. Yields of 5 to 15 L/s. EC ~1000 uS/cm. Saturated detritals present along drainage lines. Known connection to the aquifer at Deposit B at West Angelas (evident from abstraction at Deposit B drawing down water levels at HD2).
		Marra Mamba Iron Formation – upper member	BIF with thin shale bands.		
	aquitard	Marra Mamba Iron Formation – lower members	BIF, chert with extensive interbedded and/or extensive bands of shales with 'podded' BIF horizons.	Comprises low permeability, lower members of the Marra Mamba Iron Formation (MacLeod and Nammuldi) and the upper Fortescue Group. Generally poor yielding and forms no flow boundaries to Marra Mamba ore bodies (unless mineralised). Yields of ~10L/s can be encountered if fractured or weathered.	Underlies or abuts Wittenoom aquifer at HD2. Low to negligible yields. EC ~3000 uS/cm.
		Jeerinah Formation	Shale, sandstone, siltstone, mudstone, dolomite, local micro banded chert, jaspilite, thin basalt/dolerite and andesitic basalt flows.		

Aquifer boundaries

The lateral extent of the Wittenoom aquifer is shown in Figure 4 and Figure 5; the boundaries are:

- Outcropping unmineralised Marra Mamba Iron Formation to the north,
- The Fortescue Group to the south,
- A regionally extensive south-west to north-east trending dyke to the west, and
- Two separate eastern boundaries of the aquifer;
    - A folded zone of low permeability silica which forms the north-eastern boundary and separates HD2 from HD1SW
    - A change in lithology resulting in reduced permeability in the south-eastern area to the east and south of the HD1 Village;
    - It is noted that an additional potential barrier may also exist in the vicinity of the HD1 Village that aligns with a fault that extends from west of the HD1 Village and extends south-east to south of Ben's Oasis.

Evidence of these boundaries are as follows, and when realised by water levels, are shown in the hydrographs (Fig. 8):

- There is a discontinuity of groundwater flow to the north where unmineralised Marra Mamba Iron Formation outcrops;
- The north-eastern boundary of the aquifer is indicated by a 24 m head difference which occurs across a low permeability high silica zone (MB15H1SW0001 – 596 mAHD, MB17H1SW0025 – 621 mAHD);
- The south-eastern boundary of the aquifer is formed by the outcrop of fresh dolomite with absence of secondary permeability. Evidence of an inactive aquifer zone is provided by absence of any water strikes during drilling and the extended periods of water level recovery post-water sampling. Within this inactive aquifer zone there is evidence of faulting in the vicinity of the HD1 Village, where some anomalous water levels have been recorded, and a barrier (possible dyke) to the east. Water levels indicate that there is likely local compartmentalisation within the broader inactive aquifer zone.
- There is a 65 m head difference across the southern boundary between the Wittenoom aquifer and the Fortescue Group. Groundwater levels in the Fortescue Group range between 735 and 691 mAHD (MB18HD20012 – 691 mAHD). Monitoring bore MB18HD20012 is located approximately 500 m from the HD2 deposit. Additionally, the groundwater salinity at MB18HD20012 is much higher than at HD2 (EC is approximately 3000 µS/cm at MB18HD20012 compared to around 1000 µS/cm at HD2), and
- The regional dyke which forms the western boundary of the aquifer is located west of Deposit B WANG. Deposit B is therefore interpreted to be located within the same aquifer as the HD2 deposit. A 38 m difference in pre mining groundwater levels was identified either side of this dyke indicating that the dyke forms an impermeable barrier to groundwater flow in the area (LHRP11 – 667 mAHD to the west and LHRP2, LHRP9 and LHRP12 – 627 mAHD to the east). This dyke forms the western boundary of the aquifer across a distance of approximately 38 km and possibly extends as far north as BHP's Mining Area C. Groundwater level data at the northern extent of this dyke are not available and therefore it is not known whether a similar head difference exists ubiquitously along the dyke (as indicated in the WANG area).

The vertical extent of the aquifer averages about 85 m in thickness. The base of the aquifer corresponds to the low permeability members of the Marra Mamba Iron Formation. South of HD2 and underlying the Marra Mamba Iron Formation is the Fortescue Group, which is composed of mafic volcanics – basaltic, andesitic lavas and siliciclastic sedimentary rocks; it is hydraulically disconnected to the overlying and abutting Wittenoom aquifer, and is interpreted to be effectively impermeable to groundwater flow.

Groundwater Levels

Bore locations and hydrographs are shown in Figure 7 and Figure 8, respectively.

Pre-mining groundwater levels fall from around 630 mAHD near Deposit B (WANG) to 621 mAHD in the north-east and to 623 mAHD in the east. The depth to water below ground surface ranges between approximately 90 and 40 m respectively. The shallowest depth to groundwater is along Weeli Wolli Creek and Pebble Mouse Creek where the creeks cross the eastern boundaries of the aquifer.

Hydrographs show a water level decline in the eastern part of HD2 that is attributed to groundwater abstraction at Deposit B; this confirms aquifer continuity between the HD2 and Deposit B (Fig. 8).

Groundwater Inflow and Outflow

The general direction of groundwater flow is from south-west to north-east, generally following the surface water drainage system. Groundwater abstraction from bores near the HD1 Village has increased the hydraulic gradient between HD2 and the Village and reversed the flow direction from Wonmunna north to the Village.

Groundwater inflow and outflow is expected to be limited given the shallow gradient (0.0001 to 0.0003). Recharge may occur through streambed leakage following episodic large rainfall and stream flow events and/or direct rainfall recharge, however it is likely to be rare and/or small in volume.

Groundwater Chemisity

In general groundwater at HD2 is fresh; with a salinity of generally less than 1000 µS/cm, recorded as Electrical Conductivity (EC), and is near neutral. Data obtained from the 2016, 2018/2019 and 2021 hydrostratigraphic drilling programs are included in Appendix II and shown in Figure 9 and show:

- Salinity (as EC) ranges from approximately 650 to 1,250 µS/cm, excluding higher salinity bore MB18HD20012;
- pH ranges from 6.6 to 7.6; a pH of 8.8 has been recorded in bore WB18HD20002 on 3 occasions, and a low pH (<6) has been recorded in MB18HD20012 on 4 occasions;
- Total nitrogen was only recorded in 2 bores, concentration ranged from 0.8 to 3.8 mg/L;
- Iron concertation ranges from <0.05 to 1.5 mg/L (and as high as 20 mg/L in bore MB18HD20012); and
- Water from MB18HD20012 notably varies in composition, including elevated salinity, upwards of 2,500 µS/cm, low pH and elevated metals (iron, manganese, nickel and zinc). This bore is constructed into the Fortescue Formation, and located to the south of the HD2 deposit, outside of the assumed HD2 groundwater system.

2.5.3 BHT

Aquifer boundaries and water levels (2020) are shown in Figure 10. A hydrogeological cross-section for BHT is shown in Figure 11, bore locations are shown in Figure 12, and water level data are shown in Figure 13 and included in Appendix II.

Hydrogeological properties are summarised in Table 3.

Groundwater occurrence

The BHT orebody is located within the mineralised Dales Gorge Member of the Brockman Iron Formation. A localised aquifer is present within the Brockman Iron Formation where the orebody mineralisation extends below the local groundwater table.

The BHT aquifer is interpreted as being predominantly isolated from the surrounding regional Wittenoom aquifer due to the presence of the underlying Mt McRae Shale (Fig. 10 and 11). The Mt McRae Shale generally outcrops at surface (or subcrops above the elevation of the groundwater table) and surrounds the orebody. Due to the low permeability of the shale bands, the Mount McRae Shale almost completely encapsulates the aquifer with the exception of a small area in the central portion of the deposit (Fig. 10). In this area, the BHT aquifer is interpreted as being in connection to the Wittenoom aquifer. Moderate groundwater yields of between 10 and 20 L/s have been obtained during drilling at BHT and the groundwater is fresh (EC <1500 µS/cm).

To the north of the BHT deposit groundwater is within both the Marra Mamba Iron Formation and Wittenoom Formation (Wittenoom aquifer). This aquifer is analogous to, and a geological continuation of, the Wittenoom aquifer in which the HD2 deposit sits. However, up gradient of BHT groundwater flow from the HD2 aquifer is interrupted by the zone of low permeability silica referred to above.

A sequence of detritals (comprised of alluvium/colluvium, clay, pisolite and calcrete) overlies the Brockman Iron Formation at BHT and extends north across Pebble Mouse Creek to HD1SW where it is underlain by the Wittenoom Formation. The detritals are typically partially saturated over intervals that range in thickness from <10 m up to 90 m and extend along the length of Pebble Mouse Creek (Fig. 11).

Table 3: Hydro-stratigraphic Units and Aquifer Characteristics – BHT

Deposit	Aquifer	Hydro-stratigraphic unit	Lithology	Typical characteristics	Distribution, local characteristics
BHT	BHT Brockman aquifer	surficial sediments (detritals)	surficial sediments (gravelly clays, thick clays, chemical sediments-calcrete/silcrete, high Fe detritals).	Heterogeneous and varying in thickness, can be perched or in hydraulic connection with underlying units. Variable permeability, high storage, recharged by rainfall and surface flows.	Associated with topographic lows and drainage lines. Extends from water table and ranges from <10 up to 90m in thickness. Negligible to no water yield is often encountered during drilling; bore yields vary up to ~30 L/s .EC <1000 uS/cm.
		Brockman Iron Formation	BIF with shale and chert.	Where BIF is mineralised forms a significant, moderate to high yielding aquifer, high conductivity and storage. Where BIF is unmineralised permeability, storage (and yields) are low.	Main aquifer at BHT (not present at HD2). Bounded aquifer. Typical yield 10 to 20 L/s. EC <1500 uS/cm.
		Wittenoom Formation	Weathered/altered dolomite, shale with minor BIF and chert bands.	Major yields where dolomite is karstic (Paraburdoo Member) and from mineralised Mount Newman Member (yields from 40 to 100 L/s), high hydraulic conductivity.	Hydraulically connected with Brockman Iron Formation over a small area; evident from the equal groundwater level elevations within both the Brockman deposit and adjacent Wittenoom Fm.
	aquitard	Mount McRae Shale / Mount Sylvia Formation	thin bedded shale and chert with some dolomite and BIF.	Minor groundwater resource, permeability is typically low and the unit acts as a barrier to flow and confines underlying aquifer. Individual beds may be permeable and yield low to moderate flows and fracturing can produce hydraulic connections.	Underlies and bounds the Brockman aquifer at BHT.

The interpreted, lateral extent of the BHT aquifer (BHT Brockman aquifer and Wittenoom aquifer) is shown in Figure 4 and Figure 10, boundaries to the aquifer are formed by:

- Outcropping unmineralised Marra Mamba Iron Formation to the north (MacLeod and Nammuldi members);
- Outcropping Mount McRae Shale to the south;
- A folded zone of low permeability silica which forms the western boundary and separates the BHT aquifer from the HD2 aquifer, and
- A north west – south east trending dyke located to the east separating the BHT aquifer from the HD1 aquifer.

Evidence of these boundaries are as follow:

- The eastern boundary of the aquifer is indicated by a 45 m head difference which occurs across a pair of dykes located to the east of the HD1SW (MB17HD1S0002 – 594 mAHD, MB18HD1S0002 – 549 mAHD). The groundwater level on the eastern side of these dykes has been influenced by dewatering of the HD1 deposits, with water levels having decreased about 20 m (from 570 mAHD to 550 mAHD), whilst groundwater levels on the BHT side of the dyke have remained unchanged since monitoring commenced (Fig. 13).

Groundwater Levels

Bore locations are shown in Figure 12 water level data are shown in Figure 13 and data tabulated in Appendix II.

Groundwater levels across both the BHT Brockman and Wittenoom aquifers are consistently around 594 mAHD. The lack of a distinct groundwater gradient across these aquifers indicates there is very little to no groundwater flow. Depth to groundwater ranges from around 25 to 100 m bgl. The large range in depths to groundwater is a reflection of the large variation in surface elevations and not the local groundwater gradient. The shallowest groundwater levels occur along Pebble Mouse Creek and range between 30 m bgl in the west to 25 m bgl in the east. The water level at RC18BHT0221 (552 mAHD) suggests this bore is within the HD1 aquifer and impacted by the dewatering of the HD1 mine.

Given groundwater levels recorded within both the BHT deposit and adjacent Wittenoom aquifer are the same (~594 mAHD) and the Mount McRae Shale does not extend above the groundwater table, the BHT Brockman ore body and Wittenoom formation are interpreted to be hydraulically connected, albeit over a small area.

Groundwater Inflow and Outflow

The interpreted aquifer boundaries surrounding the BHT aquifer suggests that there is very little to no groundwater inflow or outflow. If any outflow from this groundwater system occurs, it is likely to be negligible and occur by either groundwater overtopping or flowing through the very low permeability dykes present along the eastern boundary.

The aquifers present in the BHT area are considered to be compartmentalised from the surrounding regional aquifers and as such behave as a predominantly isolated system.

Groundwater Chemisity

The groundwater is fresh; with salinity ~~is~~ typically about 1000 µS/cm EC, and slightly alkaline. Water quality data obtained from groundwater sampling and laboratory analyses are included in Appendix II and show:

- Salinity (as EC) ranges from approximately 650 to 1,250 µS/cm,

- pH ranges from 7.4 to 8.2;
- Total nitrogen was recorded at concentrations of less than 0.4 mg/L;
- Iron concentration ranges from 0.4 to 4.2 mg/L; and
- Arsenic concentrations of 0.011 and 0.017 mg/L, slightly exceeding Australian Drinking Water Guideline value for arsenic of 0.01mg/L (NHMRC, NRMMC, 2011), have been recorded, and
- Manganese concentrations of up to 0.7 mg/L have been recorded, also slightly exceeding Australian Drinking Water Guideline value for arsenic manganese of 0.5 mg/L (NHMRC, NRMMC, 2011).

3 Groundwater Supply Assessment

The Proposal is seeking to have 2 approved major water supply sources - that being the existing groundwater abstraction from HD1 and a proposed groundwater abstraction from HD2. Either of these sources are sufficient to provide the full water demand for the Proposal; however a combination of the 2 sources is likely to provide the most practicable solution due to location and timing of works. For example:

- abstraction of water at HD2 to provide the supply during early construction at HD2 whilst pipelines from HD1 are established,
- provision of water from HD1 to provide the supply for construction at BHT (potentially supplemented by a minor, short-term draw of groundwater at BHT),
- provision of water from HD1 to provide the supply during final construction at HD2 and during mining operations, and
- abstraction of water at HD2 at the conclusion, or reduction of, abstraction of water at HD1.

Potential groundwater availability from HD2 and BHT has been assessed via field investigations, groundwater modelling and assessment of sensitive receptors. Initial results showed that only a small volume of water (less than 3 ML/d) is likely to be available from BHT and that groundwater abstraction solely from BHT would likely be insufficient to meet the Proposal's total water demand. As such, the option of groundwater abstraction from BHT is not considered further and abstraction from BHT is not recommended except for in small volumes for a potable water supply or short-term construction supply.

3.1 Sensitive Receptors

3.1.1 Weeli Wolli Spring

Weeli Wolli Spring is located approximately 7 km downstream of the confluence of Pebble Mouse Creek and Weeli Wolli Creek to the north east of the HD1 mining area. It is protected under the *Aboriginal Heritage Act 1972* and the riparian vegetation supported by the spring is categorised as a Priority 1 Ecological Community (PEC). The Spring was naturally groundwater fed (pre-mining) and is currently maintained by discharge of water from the dewatering of the HD1 mine, which has occurred since 2007. Water is discharged to Weeli Wolli Creek at both the gabion structure located just downstream of the Spring, and into the pool area via dedicated off-shoot lines (referred to as the spurs). The total discharge generates a permanent flowing section of the creek downstream. The wetting front (that being the area of creek-line under permanent inundation) in 2021 approximated 16 km, extending as far as Rio Tinto's Yandicoogina mine site. Upstream of the permanent flowing portion of the Spring, Weeli Wolli Creek remains ephemeral. The Spring, under irrigation, is shown in Figure 14.

Pre-mining, the recharge to the Weeli Wolli Spring was via direct infiltration and concentrated stream-bed leakage (during episodic stream flow events) within the confines of the currently known aquifer extents.

3.1.2 Ben's Oasis

Ben's Oasis is a system of designated PEC surface water pools located along a 200 m reach of Weeli Wolli Creek situated approximately 5 km southeast of BHT and 15 km east of the HD2 deposit. The pools persist throughout the dry season and it is expected that Ben's Oasis is similar in function to Weeli Wolli Spring in that it is supported via groundwater expression in addition to surface water.

The current conceptualisation is that groundwater is expressed at surface at Ben's Oasis due to a flow constraint, currently understood to be the tight, impermeable dolomite of the Wittenoom Formation. At the location of Ben's Oasis and surrounds the dolomite outcrop is massive (Fig. 15) and shows no properties of a typical aquifer (i.e. the rock does not hold or allow flow through of water). The direction of groundwater flow to Ben's Oasis is inferred to be from the south where, about 2 km south of the creek, water level responses to rainfall events provide evidence of direct rainfall recharge. It is assumed that here, the dolomite is locally fractured with recharge occurring along drainage lines during flood events (Fig. 16). In addition to the groundwater flow from the south, a small contribution to the flow sustaining the pools may result from release of bank storage (where surface water is temporarily held locally along the creek line following flood events) and natural throughflow in the streambed alluvials.

Ben's Oasis is located to the west of a known set of dykes that bound the HD1 aquifer (Fig. 4) so that the main pools of Weeli Wolli Spring and Ben's Oasis are effectively hydrogeologically separated and the dewatering operations undertaken at HD1 do not impact upon Ben's Oasis.

Separation of Ben's Oasis from the HD2 aquifer is also evident by groundwater levels and groundwater recovery signatures recorded in the area to the west of Ben's Oasis that indicate a low permeability area (equivalent to a 'non-active aquifer'). This low permeability area, as mentioned above, located to the south and east of the HD1 Village and between the HD2 deposit and Ben's Oasis, is an effective hydraulic divide that would prohibit groundwater flow from HD2 towards Ben's Oasis, so that groundwater contributions from the HD2 aquifer to Ben's Oasis are considered to have a low to non-existent potential. In addition to this lithological barrier to flow, there is evidence of compartmentalisation within the non-active aquifer. Water levels lower than those recorded at Ben's Oasis have been recorded between the HD2 eastern boundary and the Oasis indicating existence of an effective hydraulic barrier (possible dyke) and the impossibility of eastward groundwater flow from the HD2 aquifer.

The dolomite exposure at Ben's Oasis is shown in Figure 15. A hydrograph and bore location map of the area to the south of Ben's Oasis is presented in Figure 16 (showing the potential for rainfall recharge to drive the persistence of the pools) and the location of Ben's Oasis in respect to the groundwater systems across HD1, HD2 and BHT is shown in Figure 4.

Water level data available for Ben's Oasis and surrounds are included in Appendix II.

3.2 Aquifer Parameters

Test pumping of 3 test production bores at HD2 has been undertaken to determine suitable abstraction rates from the bore and to calculate the aquifer's hydraulic parameters. Expected yields are as follow:

- WB16HD20001 –1.4 ML/day = (0.5 GL/a)
- WB18HD20001 –1.7 ML/day (0.6 GL/a)
- WB18HD20002 –0.7 ML/day (0.3 GL/a)
- WB18HD20003 –1.6 ML/day (0.6 GL/a)
- **Total yield 4.7 ML/day (2.0 GL/a)**

Test details and results for HD2 are summarised in Table 4 and included in Appendix I.

Table 4: Test Pumping Summary – HD2

Pumping Bore	Test Duration (days)	Pumping rate (L/s)	Total drawdown in pumping bore (m)	Aquifer Thickness (m)	Adopted T (m2/day)	K range (m/day)	Specific Storage (1/m)
WB16HD20001	7	22	29	90	65	0.7 to 1.7	0.003
WB18HD20001	7	25	43	85	105	0.9 to 1.2	0.001
WB18HD20001	7	25	43	85	105	0.9 to 1.2	0.001
WB18HD20003	6	18	41	120	119	1.1 to 2.1	0.019

3.3 Groundwater Modelling

To assess the impacts of groundwater abstraction at HD2, an analytical groundwater model was developed using AnAqSim, an aquifer simulator software package. The model was run under steady state and then transient conditions to replicate abstraction and predict groundwater drawdown as a consequence of abstraction.

The model domain, boundaries and hydrogeological inputs were generated from the current conceptual understanding which has been developed from geological information, hydrogeological field investigations, groundwater level data and neighbouring operating mine site data and information.

Based on the results of the analytical modelling, further work was undertaken by consultants IGS (IGS, 2022). Work included the construction of a numerical model and scrutiny of model sensitivities in respect to varied hydraulic parameters.

3.3.1 Model Boundaries

The IGS HD2 model consisted of a single domain layer (180m in thickness) with grid cells ranging from 40 to 320 m in size.

Aquifer extent and model boundaries were determined using the hydrogeological barriers described in Section 2.5.2. All boundaries were assigned as normal flux (no flow) with the exception of the south west boundary represented by West Angelas Deposit B and the north east boundary. A specified head was applied to mimic the West Angelas Deposit B boundary, set inwards of the conceptual aquifer boundary to limit the spatial extent of the model, and a head-dependent normal flux was assigned to the north eastern boundary (the area separating HD2 and HD1SW).

3.3.2 Model Parameters

The Wittenoom, BIF and mineralisation represents the single layer aquifer which have their respective hydraulic parameters assigned as per Table 5. The fresh dolomite and outcrops represent the low permeability zones which are not considered a productive aquifer. These zones were incorporated to best simulate the conceptual hydrogeological system and were assigned with very low hydraulic parameters resulting in poor hydraulic connection to the aquifer system (for example the area between the HD2 mineral deposit and the HD1 Village).

Table 5: Adopted model parameters (after IGS, 2022)

Unit	Upper bound	Lower bound
Regional hydraulic conductivity (m/day)	10	0.01
Orebody hydraulic conductivity (m/day)	15	0.1
Regional specific yield	0.12	0.005
Orebody specific yield	0.15	0.05

3.3.3 Model Results

Groundwater abstraction was simulated over a period of 13 years (representing 3 years of construction and 10 years of mining). A total, combined volume of 38 GL was abstracted (i.e. 3 GL per year), with combined daily abstraction ranging from 3.7 to 9.5 ML/d which allows demand to be met with contingency for larger demands (see Section 3.4); plus an additional 4.9 ML/d was abstracted from the HD1 Village, each year, to simulate meeting Village's potable water demand (Table 6).

Results of the modelled abstraction (based on the lowest SRMS-case, IGS 2022) at the end of 13 years show a predicted drawdown of 29 m in the immediate areas of the proposed HD2 borefield. The extent of groundwater drawdown is expected to be relatively localised and mostly remain within the proposed borefield area. Drawdowns of about 2 m were produced at a distance of 10 km to the west of the centre of the HD2 deposit and borefield area, and drawdowns of about 18 m were produced at a distance of 6 km to the east. Drawdown did not extend beyond aquifer boundaries, most notably, there is no drawdown propagation into the Fortescue Group, nor at Ben's Oasis. Groundwater drawdown is therefore not expected to have any influence on surrounding GDE's or extend beyond the extent of the aquifer.

Groundwater level drawdown contours, after 13 of pumping, are shown in Figure 17.

Table 6: Modelled Pumping Bores (existing and planned bores) at HD2 and Pumping Rates in ML/day

Bore ID	Coordinates		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
	mE	mN													
WB16HD2 0001	701688	7446168	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
WB18HD2 0001	701187	7446708	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
WB18HD2 0002	704867	7446605	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
WB18HD2 0003	704024	7446140	0.0	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
planned 0001	702163	7446555	0.0	0.0	0.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
planned 0002	705787	7446755	0.0	0.0	0.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
planned 0003	707014	7446831	0.0	0.0	0.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
planned 0004	698495	7446936	0.0	0.0	0.0	0.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
planned 0005	703918	7446714	0.0	0.0	0.0	0.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Total (ML/d)			3.7	5	5	7.7	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
Total (GL/a)			1.36	1.83	1.83	2.77	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4

in addition 4.8 ML/d is abstracted from the HD1 Village

3.4 Water Demand

Water will be required during construction and operation. Water volumes presented that are required for construction (Table 7) are based on a 21-month construction period for HD2 and a 14-month, possibly concurrent, construction period for BHT. Operational water demand volumes presented are based on a 10-year mining period (Table 8); demand also includes the expected 10-year water demand for the HD1 operation; relevant to show that water is available from HD1 to supply the Proposal (see section 3.5.1). Demands have been calculated based on construction inputs (product additive volumes and dust suppression) and operational inputs (process plant and ore movement based on expected ore and waste rock tonnages and dust suppression requirements based on transport routes and methods). Based on these estimates the total expected water demand is 24.4 GL.

Table 7: Estimated Construction Water Demand (over 2 to 3-year period)

Deposit	Est. construction period	Unit	Volume
HD2	21 months	ML/d	2.3
		GL	1.36
BHT	14 months	ML/d	1.6
		GL	0.62

Table 8: Estimated Operational Water Demand (over 10-year period)

Deposit/Project Operational Year	ML/day										GL
	1	2	3	4	5	6	7	8	9	10	total
BHT	0.6	1.6	3.5	3.3	2.1	2.5	2.2	2.3	1.8	2.1	8.03
HD2	0	0.4	2.3	3	3.6	3.1	3.2	2.9	3.2	3.2	9.09
Rehandle	0.7	0.7	1.5	1.6	1.7	1.5	1.5	1.7	1.8	1.9	5.33
Total HD2 Proposal	**1.3**	**2.7**	**7.3**	**7.9**	**7.4**	**7.1**	**6.9**	**6.9**	**6.8**	**7.2**	**22.45**
HD1 operations	*21.3*	*20.7*	*21.2*	*21.2*	*20.6*	*20.4*	*20.2*	*20.0*	*20.0*	*20.0*	*75.04*

3.4.1 Potable Demand

A potable supply of 400 L per day per person will be required (equivalent to 0.1 GL per annum), and could be sourced locally from either HD2 or BHT and/or from the existing HD1 Mine Village.

Currently, the potable water for the HD1 Village is abstracted under GWL 161143, utilising 2 production bores (HDVP1 and HDVP2; Figure 7) that are located approximately 2.5 km north of the closest part of the HD2 deposit and target the same aquifer. Abstraction from the village bores commenced in late 2006, the total annual abstraction is generally close to the annual licence allocation of 500,000 kL. This equates to an average combined abstraction rate of around 16 L/s (Fig. 18).

3.4.2 Dewatering Demand

Dewatering is not required to access AWT ore and therefore no work has been carried out on determining dewatering rates.

It is noted that groundwater abstracted for supply produces a modelled drawdown across the HD2 aquifer which is equivalent to (partial) orebody dewatering (i.e. water levels are predicted to drawdown almost 30 m below the AWT pit floor in some locations at HD2).

3.5 Water Supply Forecast

Water balance forecasts have been compiled for 2 supply sources (HD1 and HD2) using the Proposal's water demands during construction and operations (Tables 7 and 8, respectively), the expected future discharge volumes from HD1 and the modelled pumping rates for a borefield local to HD2, noting that the modelled abstraction rates for HD2 are on average 25% higher than demand estimates so to assess the impacts of increased demands.

Supply sources are:

Supply Source 1: uses HD1 discharge water.

Supply Source 2: uses the HD2 local aquifer for supply.

3.5.1 HD1 Supply Forecast

Groundwater is currently abstracted for potable supply at the HD1 mine village (under GWL 161143) and significant volumes (up to 40.15 GL/yr) are licensed at HD1 (under GWL 161141) which could be made available to service the Proposal's potable demand, dust suppression demands and/or processing requirements, given approval.

The existing HD1 Village potable supply network currently includes 2 abstraction bores and the aquifer is expected to be able to support increased abstraction, if required, and subject to approval of an increase in allocation for GWL 161143 or a receipt of a new GWL for potable supply. Groundwater level drawdown at the HD1 mine village, recorded since abstraction commenced, is shown in Figure 18 and indicate that a licensed allocation is available to support the HD2 Proposal's potable demand.

The HD1 dewatering network comprises 3 borefields; the HD1N, HD1S and HD1SW. The maximum allowable annual abstraction is 40.15 GL, noting that to-date that no abstraction has occurred from the HD1SW borefield. Abstraction volumes are expected to reduce at a rate of ~10% per year as mining and dewatering of the HD1 deposit moves towards mine closure and aquifer volumes deplete (i.e. as dewatering reduces the thickness and storage of the aquifer and the pit void area reduces in lateral extent resulting in the volume of required dewatering diminishing over time).

At HD1 abstracted groundwater is used primarily to fill local demands (i.e. dust suppression and processing) with a dedicated component used to maintain permanent pools at Weeli Wolli Spring via irrigation. Water not used on site or discharged via irrigation is discharged to Weeli Wolli Spring down-stream of the Spring at 'the gabion', HD1's licensed discharge point. Pipelines are currently configured to send dewatering volumes to a collector dam north of HD1N pit with discharge directed away from that location. To make this supply source available, reconfiguration of the pipe network and ongoing assessment of the availability of volumes over time would need to be undertaken.

Reduction in the flow from the gabion discharge point would occur if HD1 supplies water to the Proposal. Based on predicted, future dewatering volumes, water usage at HD1 (inclusive of continued supplementation of the Weeli Wolli Spring pools) and subsequent future discharge volumes the percentage of reduction would reduce by 5% at the commencement of the Proposal (i.e. during construction) and then increasing to almost 50% after 10 years of supplying the Proposal. Figure 19 shows the predicted discharge volumes from HD1 into the creek from 2024 to 2035, and compares discharge volumes with and without HD1 supplying water to the Proposal. Accounting for the water requirements of HD1 (i.e. maintaining all HD1 expected water demands) the HD2 Proposal's water demand can be met until 2033 (Fig. 19).

While it is noted that if HD1 supplies the Proposal with water the discharge volume into Weeli Wolli Creek at the gabion outlet will reduce, the reduction in volume is small when compared to seasonal surface water flow in the creek, and as the gabion discharge point is located down-stream from the Weeli Wooli Creek pools flow at the pools will not be impacted upon by reducing discharge at the gabion. Down-stream of the gabion, surface water flow, recorded at the DWER's Tarina gauging station located approximately 5 km downstream of the HD1 discharge point, has been collected since 1985. Data are presented in Figure 20 and summarised in Table 9 and show that flow, pre-2007, occurred seasonally. Post 2007 (i.e. since HD1 has been discharging water into the creek) flow at Tarina has been continual with a minimum flow of 0.6 cubic metres per second and typical continual flow that fluctuates between 0.8 and 1.4 cubic metres per second (Fig. 20). In comparison, seasonal peak flows range from about 50 up to over 500 cubic metres per second; equating to a median total volume of 33 GL per year (Table 9). A reduction in continual flow of 0.1 cubic metres per second (equalling 3 GL per annum) can be expected if the HD1 operation provides supplies the Proposal's water requirement.

Table 9: Tarina Gauging Station Flow Data

Gauging station	Tarina
Period	1985 -2019
Number of years of no flow	6 (all pre-1996)
Median flow volume (GL/annum)	36
Maximum flow volume (GL/annum)	311
Volume required for HD2 Proposal (GL/annum)	3

3.5.2 HD2 Local Supply Forecast

It is proposed that a borefield is established at the HD2 deposit. Investigative drilling has included the drilling and construction of 4 test production bores (details provided in Table 10 and Appendix I) that produce an expected yield of approximately 4.7 ML/day; just over half the required water demand. An additional 4 to 5 bores can be constructed, and the test bores converted to production bores to meet the full water demand Section 3.3 details the simulated results of abstracting the total supply (which includes an allowance for a contingency volume – i.e. the peak demand volume is 6.9 ML/d and the peak modelled abstraction volume is 9.5 ML/d), and shows that the water demand can be met by groundwater abstraction at HD2.

Table 10: Existing Production Bores – HD2

Deposit	Bore ID	mE	mN	Top of casing (mAHD)	Bore depth (m)	Construction date	Screened interval	Casing diameter (ND) (mm)	Screened across (FM / lithology)	Initial yield (est.) (ML/d)	Combined Final yield (est.) ML/d
HD2	WB16HD20001	701688	7446168	713.39	163	Feb-16	126-162	254	ANG BIF	1.4	4.7
	WB18HD20001	701187	7446708	708.36	200	Apr-18	96-198	305	Wittenoom FormationDolomite	1.7	
	WB18HD20002	704867	7446605	694.01	156	Apr-18	114-150	305	PD Dolomite	0.7	
	WB18HD20003	704024	7446140	701.44	188	Oct-18	102-180	305	ANG BIF	1.6	

3.6 Risk to Sensitive Receptors and Contingent Supply

The HD2 aquifer intended as a supply source for the proposal is well isolated from the Bens Oasis Spring groundwater system as has been described above.

A large data set of groundwater level response from abstraction at HD1 shows that HD2 is separated from the HD1 aquifer (Figs. 4 and 8), and as such it is considered that abstraction from HD2 poses no risk to the Weeli Wolli Spring pools, located downstream from the HD1 mine and outside of the HD2 groundwater system.

In the event of insufficient supply to meet demand, several opportunities exist that will need to be employed. Those being:

1. Partnership with nearby operations to source and convey water from existing dewatering (BHP South Flank/ Mining Area C, West Angelas);
2. A focus upon water efficiency in the ongoing proposed operations to reduce the demand for water, or
3. An increased network (spread) of bores within the HD2 aquifer.

4 Summary and Conclusion

A groundwater assessment has been undertaken with the intent to support the HD2 Proposal in securing a water supply for a period of about 13 years. The assessment has been based on hydrogeological investigations, regional hydrogeological knowledge, water demand forecasts and availability of water outside of the Proposal. The largest, local, water source available to meet the Proposal is the groundwater currently abstracted from the HD1 operation under GWL 161141. Alternatively a suitable local groundwater supply is available at HD2. At BHT the long-term supply is likely to be small and most suited to provision of a small potable supply or short-term construction water supply.

Findings of the water supply assessment for the Proposal are:

1. Water demand for the Proposal has been calculated to be between 2 to 3 GL per annum.
2. The Proposal considers AWT mining only and investigation into ore dewatering has not been undertaken in this assessment.
3. The pre-mining water table approximates 626 mAHD at HD2 and 594 mAHD at BHT.
4. Groundwater at both HD2 and BHT is fresh and is held within compartmentalised or isolated aquifers which are typically bounded by low permeability units or structures.
5. Regional and local groundwater flow mimic surface drainage, and flow is predominantly south-west to north-east.
6. The groundwater systems at HD1, HD2 and BHT are isolated from one another.
7. Modelled abstraction from HD2 at rates of up to 9.5 ML/day (or 3 GL/yr) over a 13-year period (totalling 38 GL) resulted in a reduction in water levels of 29 m in the vicinity of the borefield and a 2 m water level drawdown propagated 10 km to the west of the borefield, and a 18 m water level drawdown propagated 6 km to the east.
8. It is noted that the simulated abstraction volumes from HD2 are higher than the estimated water demand and, if water is sourced from HD1 for all, or a portion of the project, abstraction volumes would in reality be much less, consequently modelled drawdown is likely to be over estimated
9. The depth to groundwater across the HD2 and BHT aquifers is greater than would typically support groundwater dependent vegetation (i.e. >15 m below ground level). The 2 known sensitive groundwater (Ben's Oasis and Weeli Wolli Spring, located on Weeli Wolli Creek) receptors are not within the aquifers where the proposed abstraction for the Proposal would occur.
10. Ben's Oasis has been interpreted as a groundwater dependent surface water feature sustained largely by groundwater flow from the south. The Oasis is isolated from HD2 with eastward groundwater flow from HD2 impeded and/or precluded by a combination of lithological hydraulic barriers and groundwater compartmentalisation.
11. Weeli Wolli Spring is currently supplemented by dewatering discharge from the HD1 operations. A south east trending dyke, located to the east of BHT, effectively bounds the HD1 aquifer and abstraction from outside of the HD1 aquifer (i.e. the proposed abstraction at HD2) is not expected to impact Weeli Wolli Spring.
12. Supplementation of the Weeli Wolli Spring pools will continue under the proposed supply option which sees HD1 dewatering supplying water to the Proposal. The volume of water required to

maintain pool water levels are excluded from any future available water forecasts (i.e. water cannot be provided to the Proposal at the detriment of Weeli Wolli Spring supplementation).

13. Discharge into the creek, downstream of the Weeli Wolli Spring pools, would reduce by ~3 GL per year if the HD1 operation supplied water to the Proposal. The reduced discharge is in-line with Rio Tinto's water efficiency strategy to reduce environmental discharge; it is noted that the volume of reduction is small in comparison to seasonal flow volumes (about 10% of the median flow volume as recorded from 1985 to 2019).

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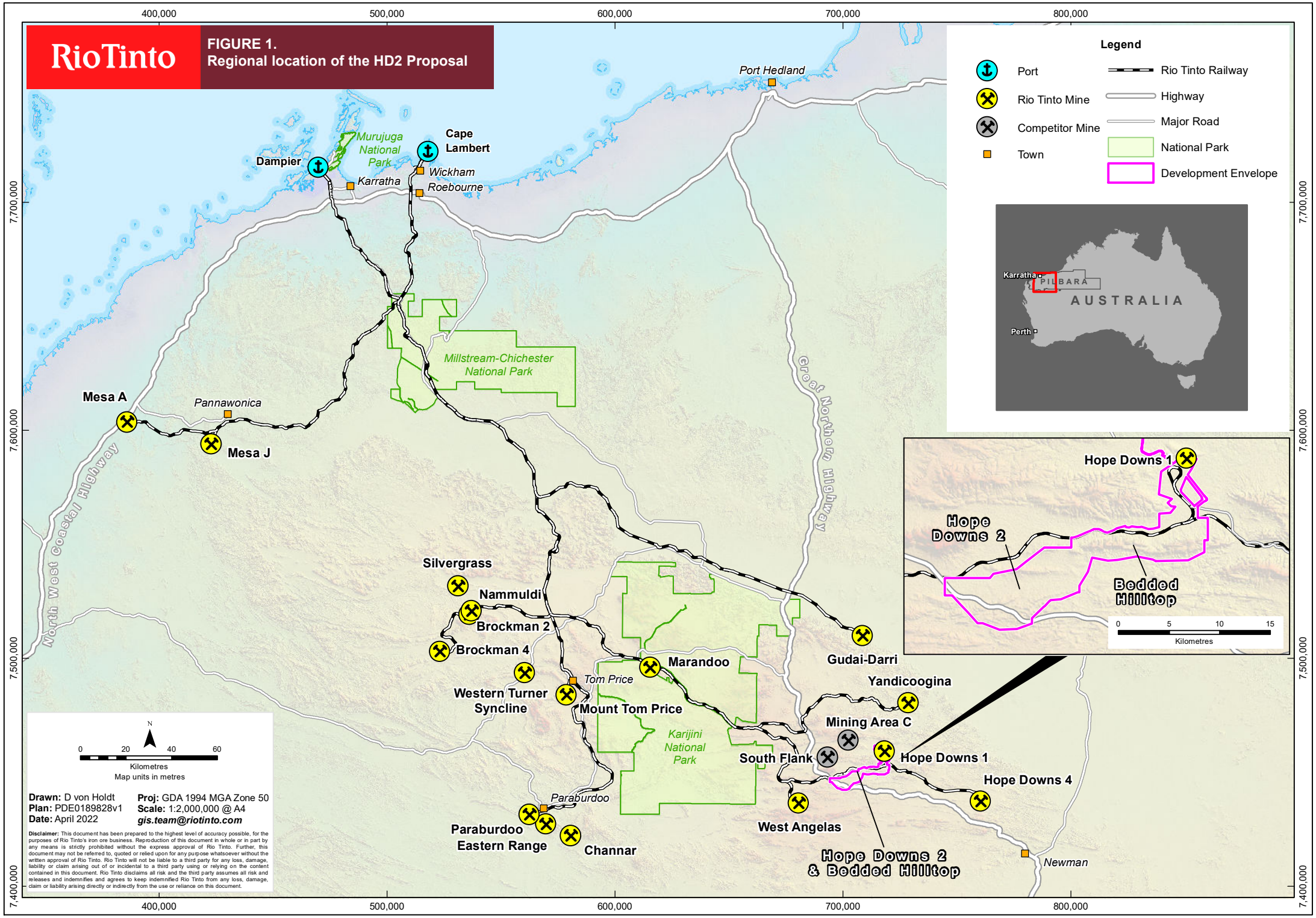
FIGURES


RioTinto
FIGURE 1.
Regional location of the HD2 Proposal
Legend
Port
Rio Tinto Railway
Rio Tinto Mine
Highway
Competitor Mine
Major Road
Town
National Park
Development Envelope
Karratha
PILBARA
AUSTRALIA
Perth
Port Hedland
Cape Lambert
Dampier
Murujuga National Park
Wickham
Roebourne
Karratha
Millstream-Chichester National Park
Great Northern Highway
North West Coastal Highway
Mesa A
Pannawonica
Mesa J
Silvergrass
Nammuldi
Brockman 2
Brockman 4
Western Turner Syncline
Tom Price
Marandoo
Mount Tom Price
Gudai-Darri
Yandicoogina
Mining Area C
South Flank
Hope Downs 1
Hope Downs 4
Karijini National Park
Paraburdoo
Paraburdoo Eastern Range
Channar
West Angelas
Hope Downs 2 & Bedded Hilltop
Newman
Hope Downs 1
Hope Downs 2
Bedded Hilltop
0 5 10 15
Kilometres
N
0 20 40 60
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: PDE0189828v1
Date: April 2022
Proj: GDA 1994 MGA Zone 50
Scale: 1:2,000,000 @ A4
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500,000
600,000
700,000
800,000
7,700,000
7,600,000
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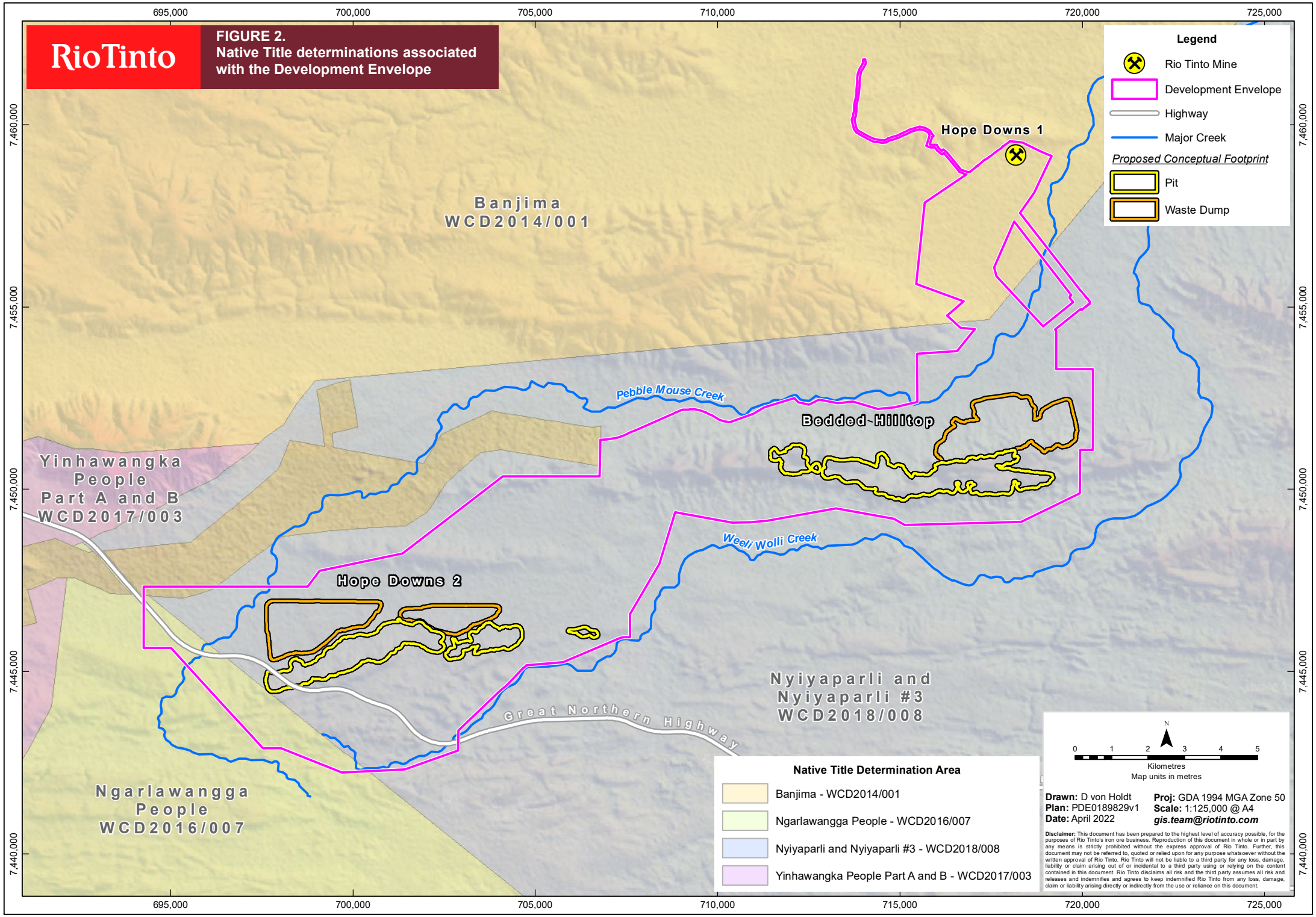
7,400,000


RioTinto
FIGURE 2.
Native Title determinations associated with the Development Envelope
695,000
700,000
705,000
710,000
715,000
720,000
725,000
7,460,000
7,455,000
7,450,000
7,445,000
7,440,000
Legend
Rio Tinto Mine
Development Envelope
Highway
Major Creek
Proposed Conceptual Footprint
Pit
Waste Dump
Hope Downs 1
Banjima
WCD2014/001
Pebble Mouse Creek
Bedded-Hilltop
Yinhawangka
People
Part A and B
WCD2017/003
Weeli Wolli Creek
Hope Downs 2
Great Northern Highway
Nyiyaparli and
Nyiyaparli #3
WCD2018/008
Ngarlawangga
People
WCD2016/007
Native Title Determination Area
Banjima - WCD2014/001
Ngarlawangga People - WCD2016/007
Nyiyaparli and Nyiyaparli #3 - WCD2018/008
Yinhawangka People Part A and B - WCD2017/003
N
0 1 2 3 4 5
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: PDE0189829v1
Date: April 2022
Proj: GDA 1994 MGA Zone 50
Scale: 1:125,000 @ A4
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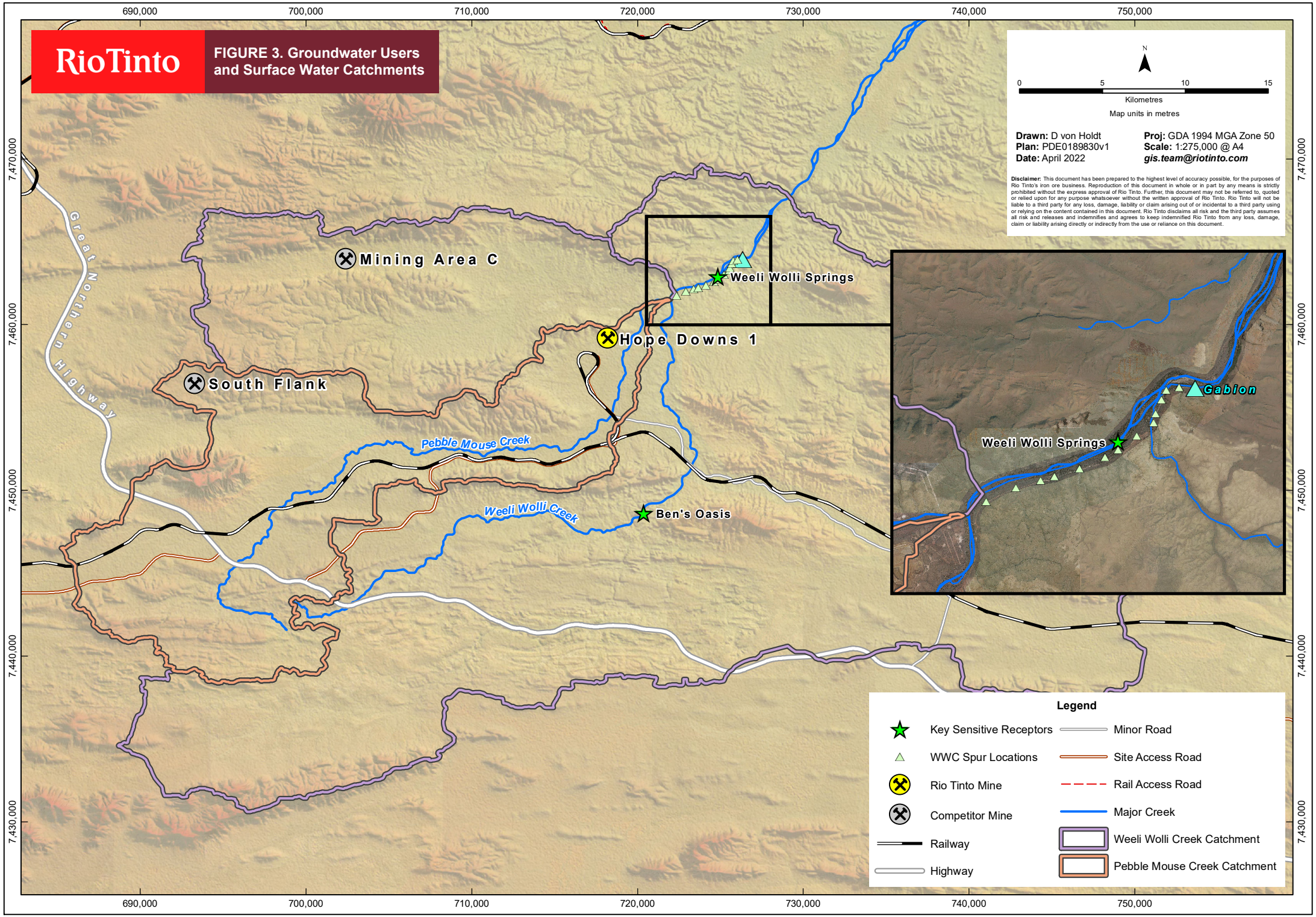
RioTinto
FIGURE 3. Groundwater Users and Surface Water Catchments
690,000
700,000
710,000
720,000
730,000
740,000
750,000
7,470,000
7,460,000
7,450,000
7,440,000
7,430,000
N
0
5
10
15
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: PDE0189830v1
Date: April 2022
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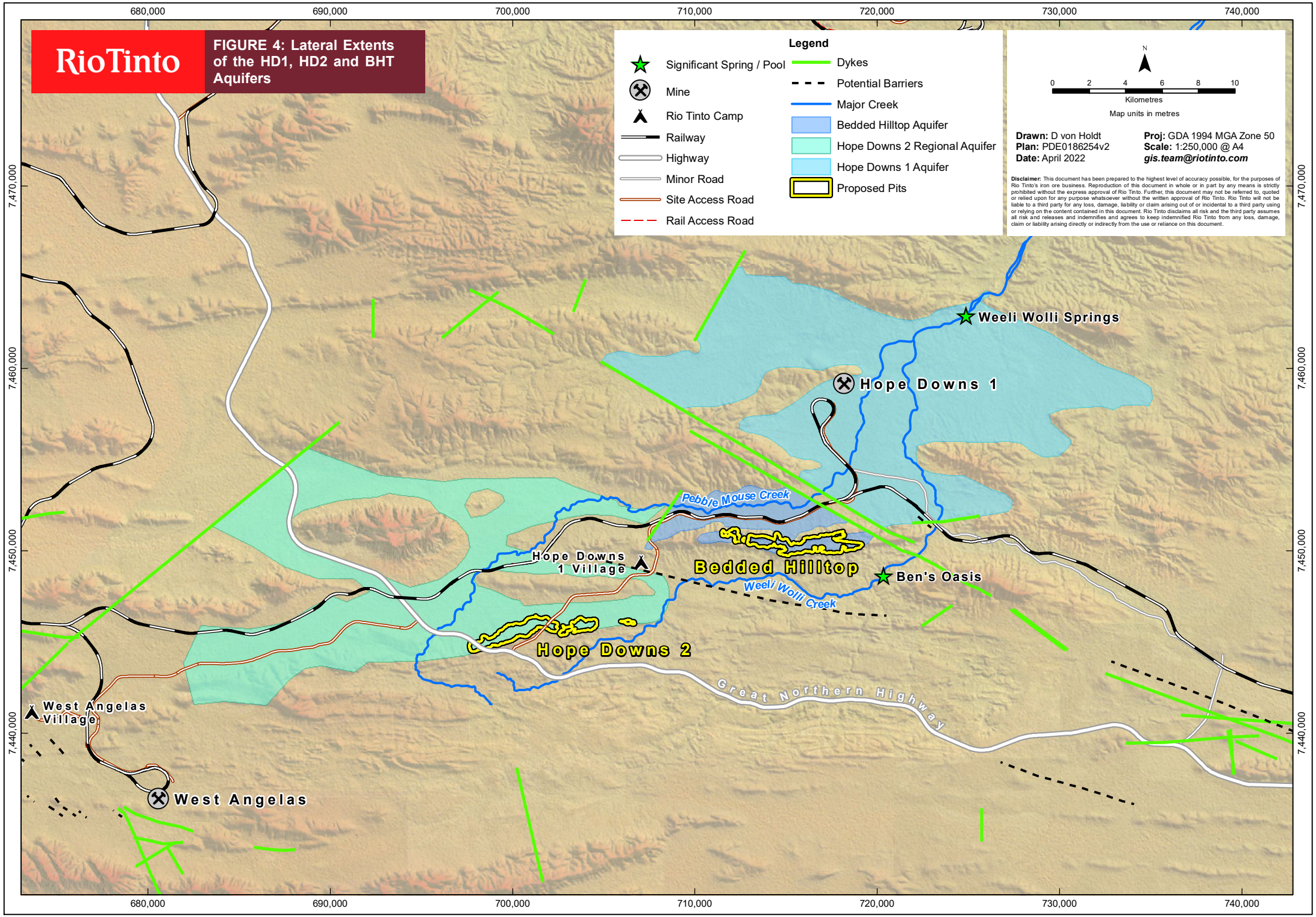
Mining Area C
Hope Downs 1
South Flank
Great Northern Highway
Weeli Wolli Springs
Pebble Mouse Creek
Weeli Wolli Creek
Ben's Oasis
Gabion
Legend
Key Sensitive Receptors
WWC Spur Locations
Rio Tinto Mine
Competitor Mine
Railway
Highway
Minor Road
Site Access Road
Rail Access Road
Major Creek
Weeli Wolli Creek Catchment
Pebble Mouse Creek Catchment


RioTinto
FIGURE 4: Lateral Extents of the HD1, HD2 and BHT Aquifers
Legend
Significant Spring / Pool
Mine
Rio Tinto Camp
Railway
Highway
Minor Road
Site Access Road
Rail Access Road
Dykes
Potential Barriers
Major Creek
Bedded Hilltop Aquifer
Hope Downs 2 Regional Aquifer
Hope Downs 1 Aquifer
Proposed Pits
N
0 2 4 6 8 10
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: PDE0186254v2
Date: April 2022
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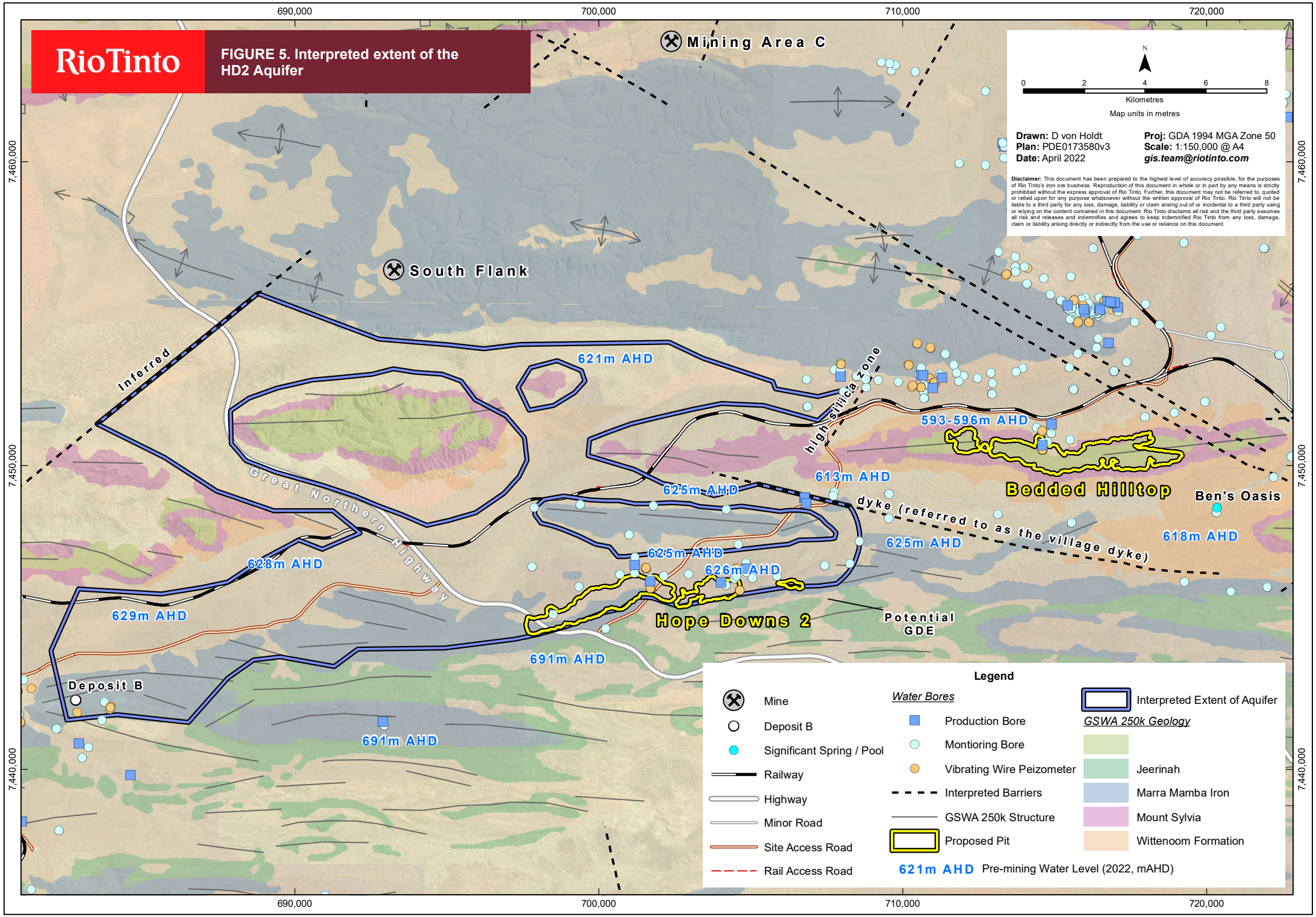
680,000
690,000
700,000
710,000
720,000
730,000
740,000
7,470,000
7,460,000
7,450,000
7,440,000
Weeli Wolli Springs
Hope Downs 1
Pebble Mouse Creek
Hope Downs 1 Village
Bedded Hilltop
Ben's Oasis
Weeli Wolli Creek
Hope Downs 2
Great Northern Highway
West Angelas Village
West Angelas


RioTinto
FIGURE 5. Interpreted extent of the HD2 Aquifer
690,000
700,000
710,000
720,000
7,460,000
7,450,000
7,440,000
Mining Area C
South Flank
Inferred
621m AHD
high Silica zone
593-596m AHD
613m AHD
625m AHD
Bedded Hilltop
Ben's Oasis
dyke (referred to as the village dyke)
625m AHD
618m AHD
625m AHD
626m AHD
628m AHD
Great Northern Highway
629m AHD
Hope Downs 2
Potential GDE
691m AHD
Deposit B
691m AHD
N
0 2 4 6 8
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: PDE0173580v3
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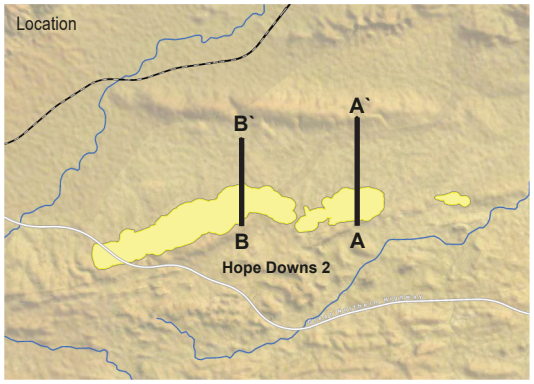
Legend
Mine
Deposit B
Significant Spring / Pool
Railway
Highway
Minor Road
Site Access Road
Rail Access Road
Water Bores
Production Bore
Montioring Bore
Vibrating Wire Peizometer
Interpreted Barriers
GSWA 250k Structure
Proposed Pit
Interpreted Extent of Aquifer
GSWA 250k Geology
Jeerinah
Marra Mamba Iron
Mount Sylvia
Wittenoom Formation
621m AHD Pre-mining Water Level (2022, mAHD)

RioTinto

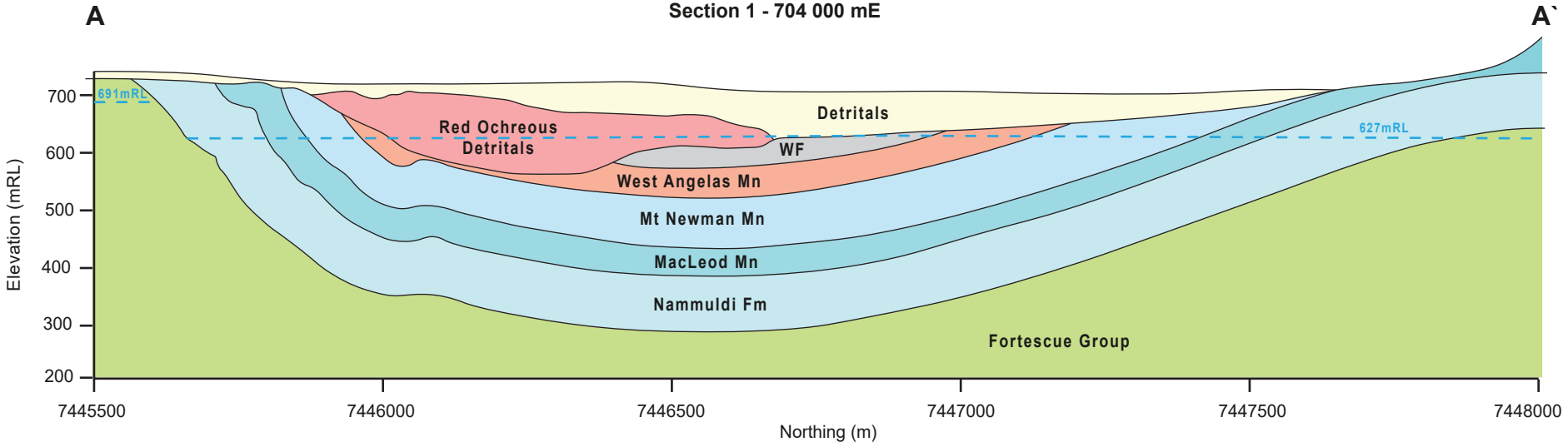
FIGURE 6: HD2 Hydrogeological Cross Section

Legend

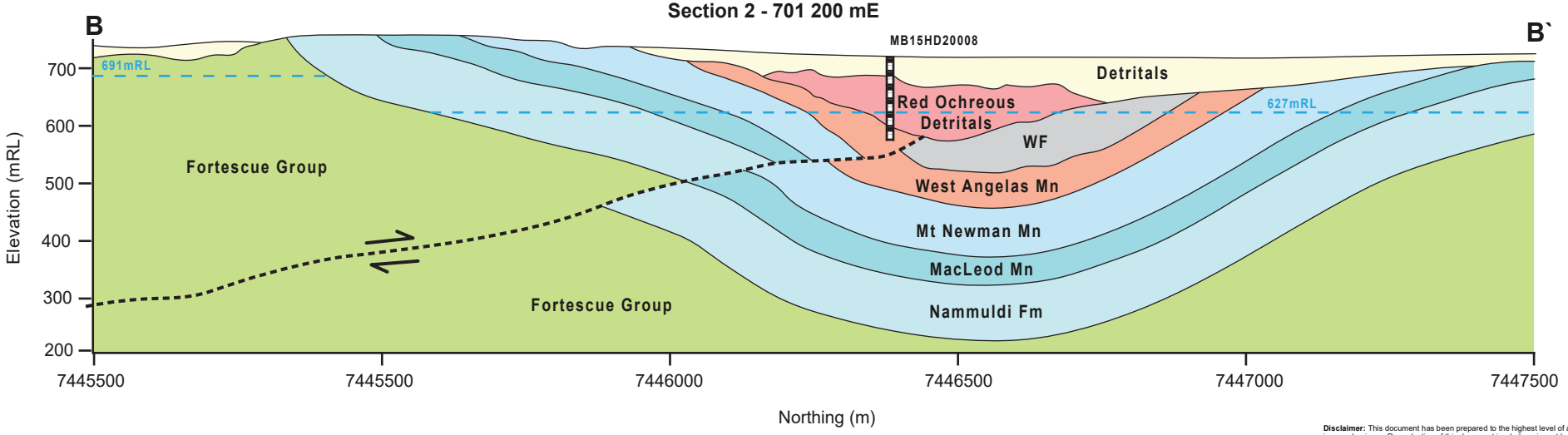
- Detritals
- Red Ochreous Detritals
- Wittenoom Fm (undifferentiated)
- West Angelas Mn (Wittenoom Fm)
- Mt Newman Mn (Marra Mamba Iron Fm)
- MacLeod Mn (Marra Mamba Iron Fm)
- Nammuldi Mn (Marra Mamba Iron Fm)
- Fortescue Group



Section 1 - 704 000 mE



Section 2 - 701 200 mE



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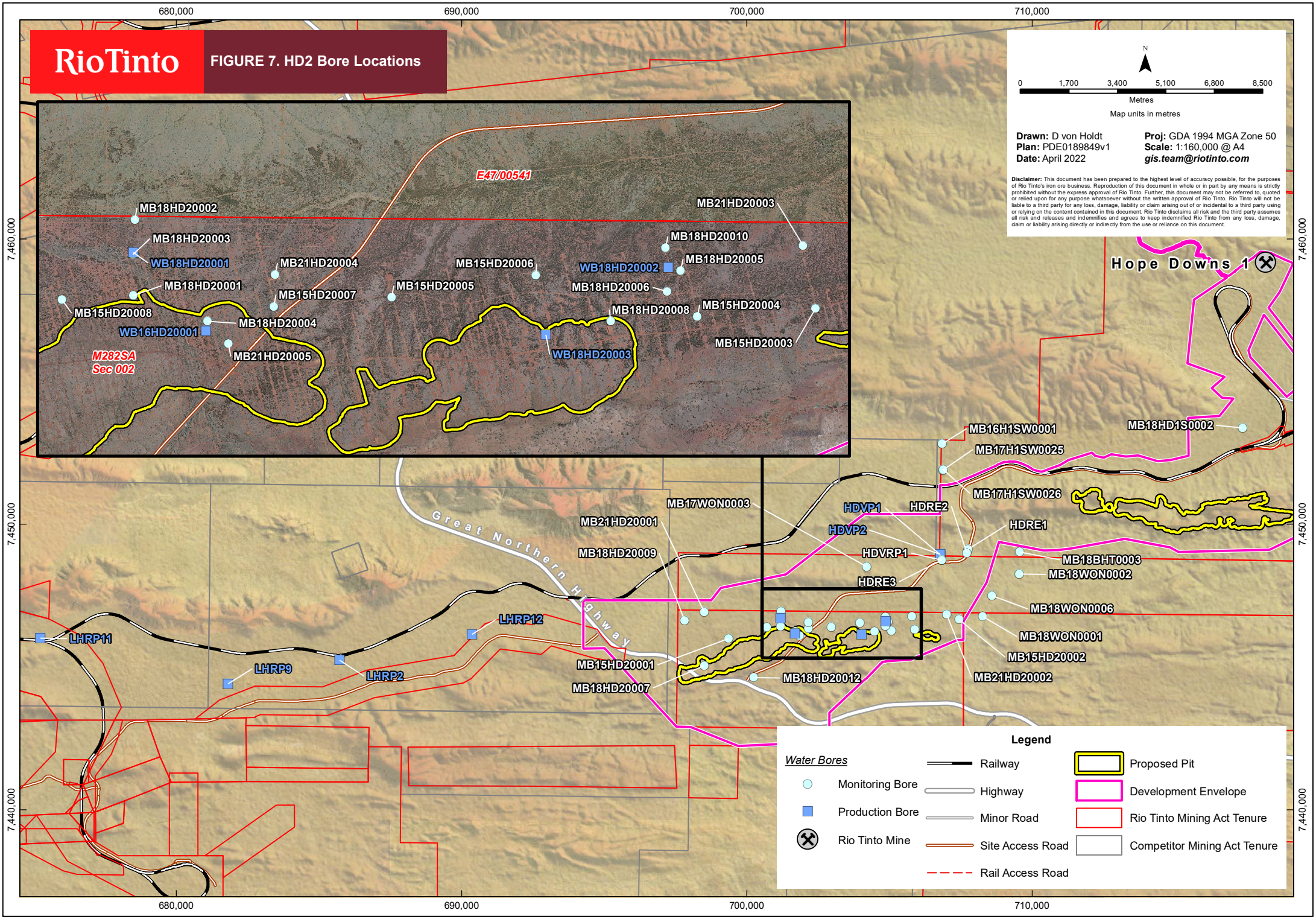
RioTinto
FIGURE 7. HD2 Bore Locations
680,000
690,000
700,000
710,000
7,460,000
7,450,000
7,440,000
N
0 1,700 3,400 5,100 6,800 8,500
Metres
Map units in metres
Drawn: D von Holdt
Plan: PDE0189849v1
Date: April 2022
Proj: GDA 1994 MGA Zone 50
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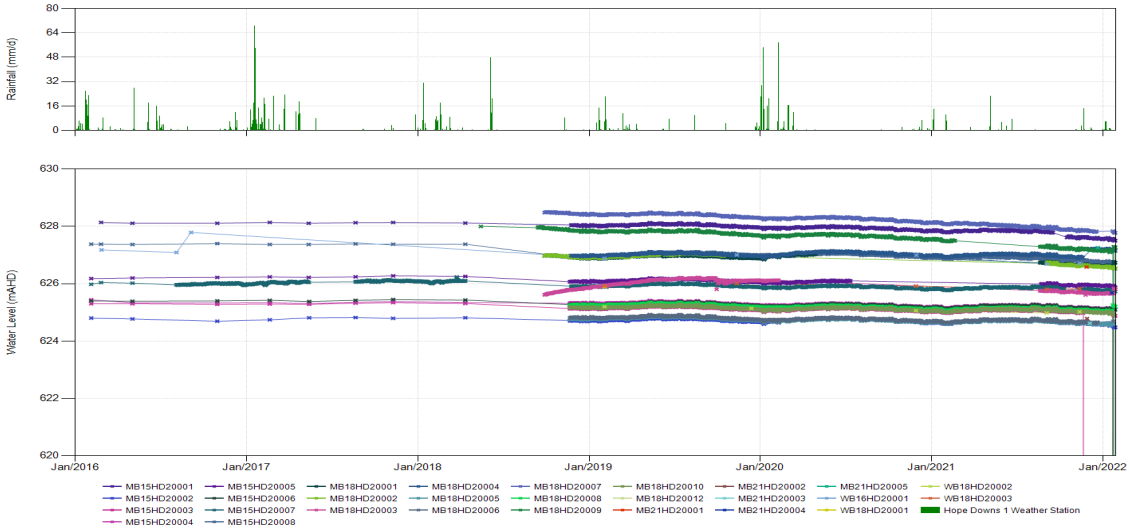
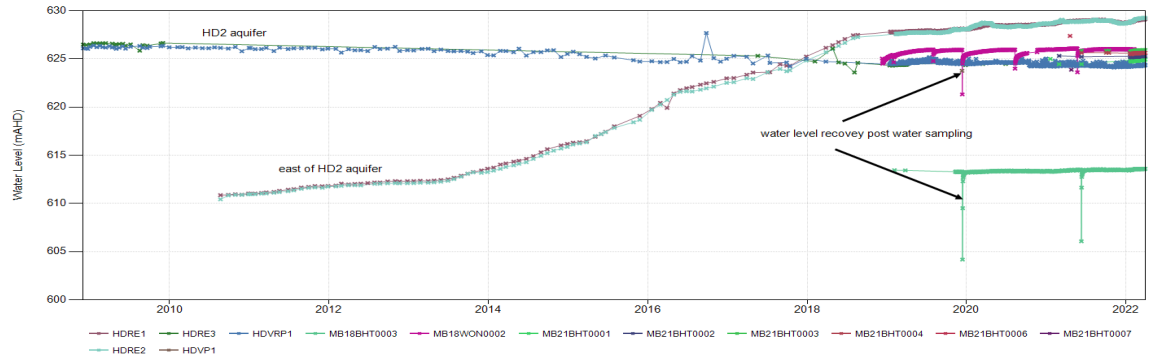
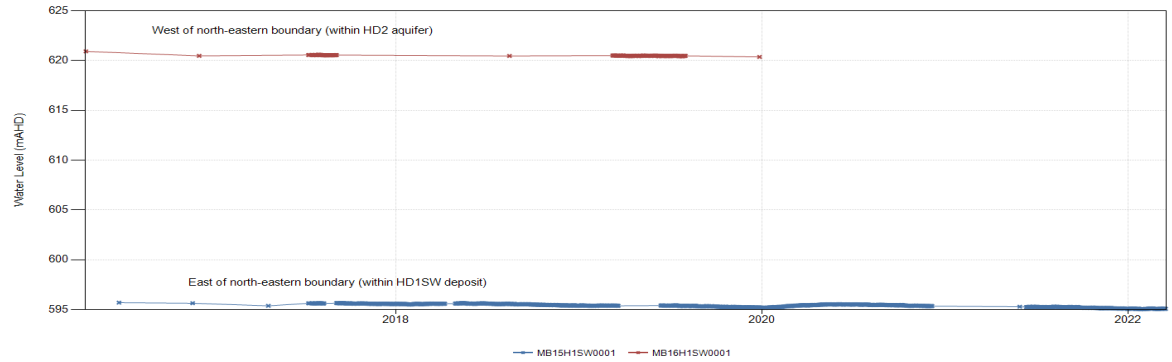
E47/00541
M282SA
Sec 002
MB18HD20002
MB18HD20003
WB18HD20001
MB18HD20001
MB15HD20008
WB16HD20001
MB18HD20004
MB21HD20005
MB21HD20004
MB15HD20007
MB15HD20005
MB15HD20006
WB18HD20002
MB18HD20006
MB18HD20008
WB18HD20003
MB21HD20003
MB18HD20010
MB18HD20005
MB15HD20004
MB15HD20003
Hope Downs 1
MB16H1SW0001
MB17H1SW0025
MB18HD1S0002
MB17H1SW0026
HDVP1
HDRE2
HDVP2
HDRE1
HDVRP1
HDRE3
MB18BHT0003
MB18WON0002
MB18WON0006
MB18WON0001
MB15HD20002
MB21HD20002
MB17WON0003
MB21HD20001
MB18HD20009
Great Northern Highway
LHRP12
LHRP11
LHRP9
LHRP2
MB15HD20001
MB18HD20007
MB18HD20012
Legend
Water Bores
Monitoring Bore
Production Bore
Rio Tinto Mine
Railway
Highway
Minor Road
Site Access Road
Rail Access Road
Proposed Pit
Development Envelope
Rio Tinto Mining Act Tenure
Competitor Mining Act Tenure

Water levels across HD2 deposit and HD1 rainfall data



Water levels across eastern boundaries of HD2 aquifer





Water levels across western boundary of HD2 aquifer

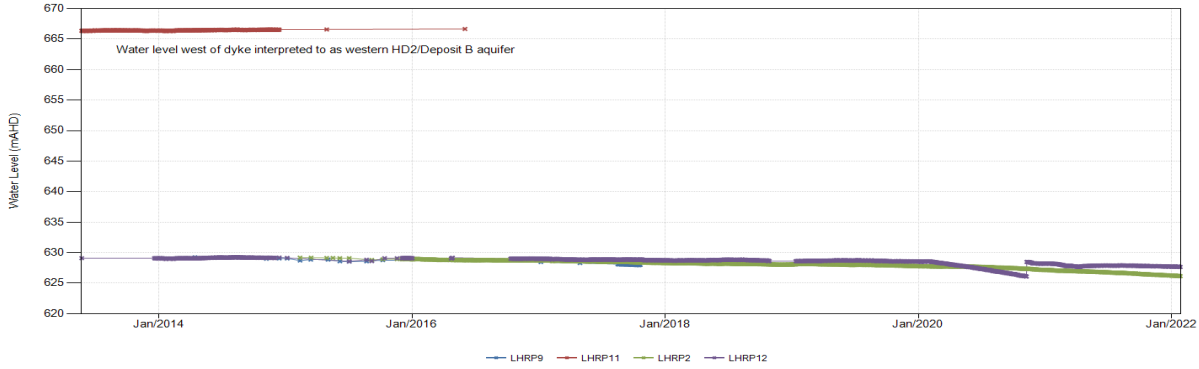
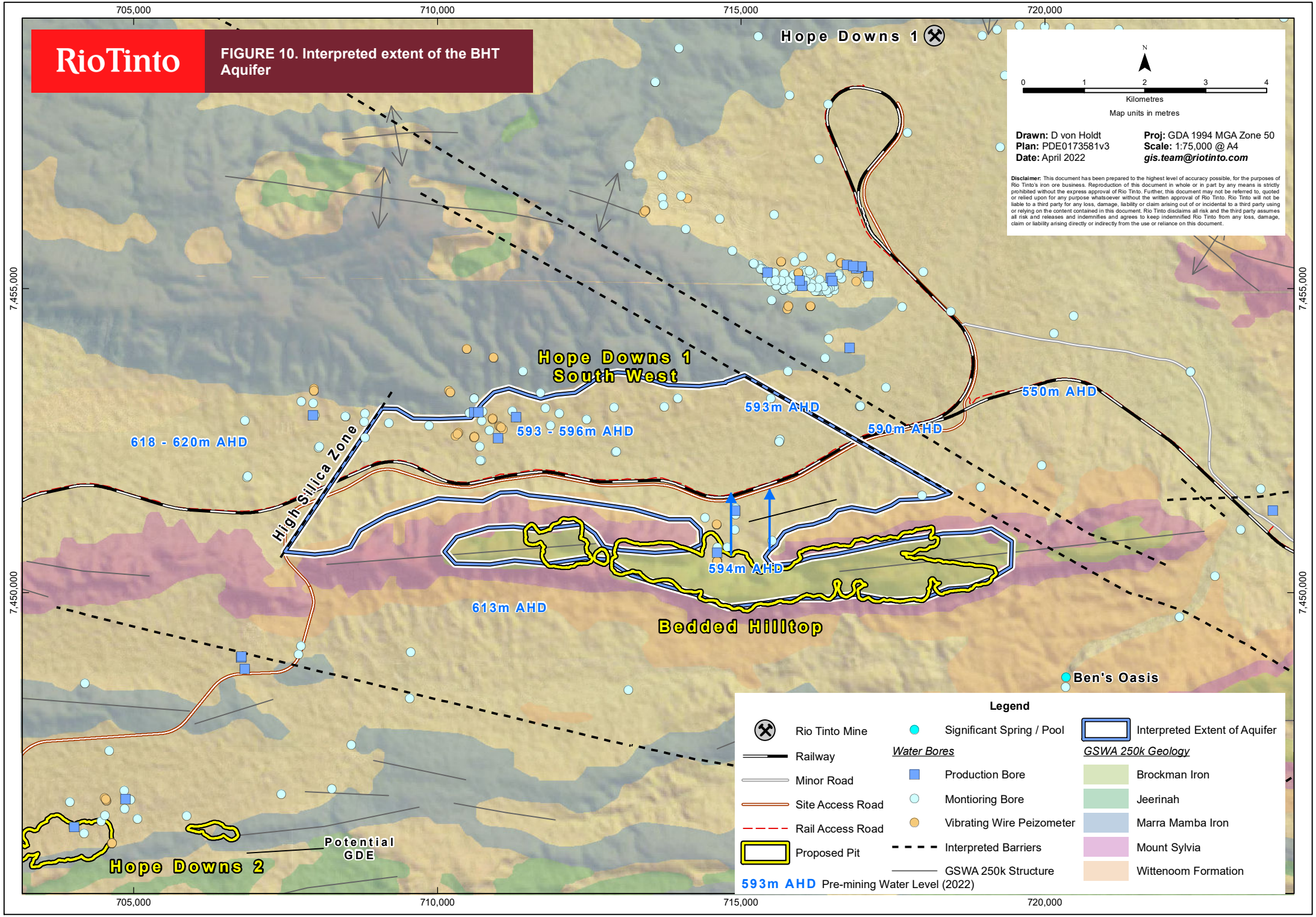


Figure 8: HD2 Hydrographs (Jan 2016 to Jan 2022, mAHD)



Figure 9: HD2 Field Water Chemistry Data (Jan 2016 to Dec 2021; EC and pH)


RioTinto
FIGURE 10. Interpreted extent of the BHT Aquifer
705,000
710,000
715,000
720,000
7,455,000
7,450,000
Hope Downs 1
Hope Downs 1 South West
618 - 620m AHD
593 - 596m AHD
593m AHD
590m AHD
550m AHD
High Silica Zone
594m AHD
613m AHD
Bedded Hilltop
Ben's Oasis
Hope Downs 2
Potential GDE
N
0 1 2 3 4
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: PDE0173581v3
Date: April 2022
Proj: GDA 1994 MGA Zone 50
Scale: 1:75,000 @ A4
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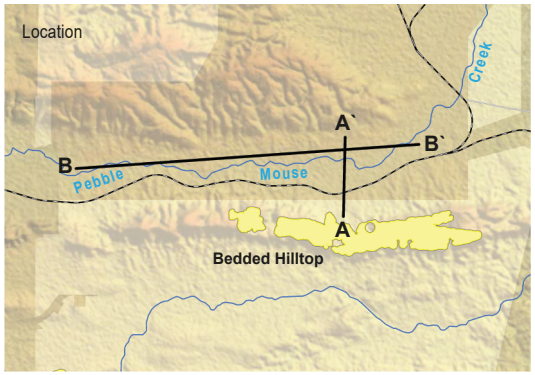
Legend
Rio Tinto Mine
Railway
Minor Road
Site Access Road
Rail Access Road
Proposed Pit
593m AHD Pre-mining Water Level (2022)
Significant Spring / Pool
Water Bores
Production Bore
Montioring Bore
Vibrating Wire Peizometer
Interpreted Barriers
GSWA 250k Structure
Interpreted Extent of Aquifer
GSWA 250k Geology
Brockman Iron
Jeerinah
Marra Mamba Iron
Mount Sylvia
Wittenoom Formation

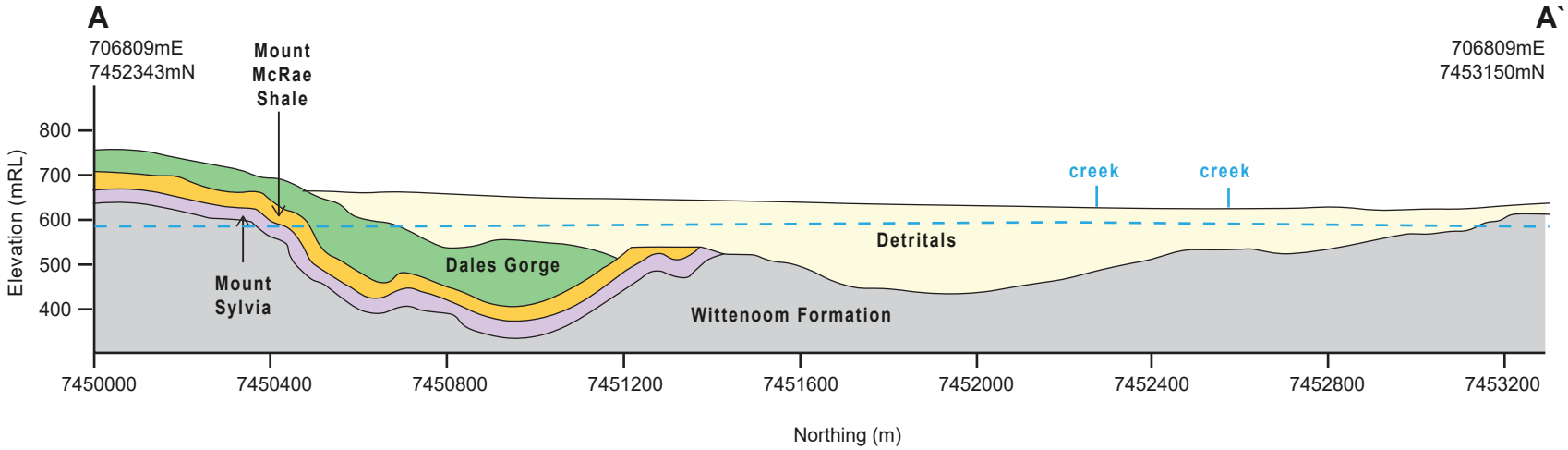
RioTinto

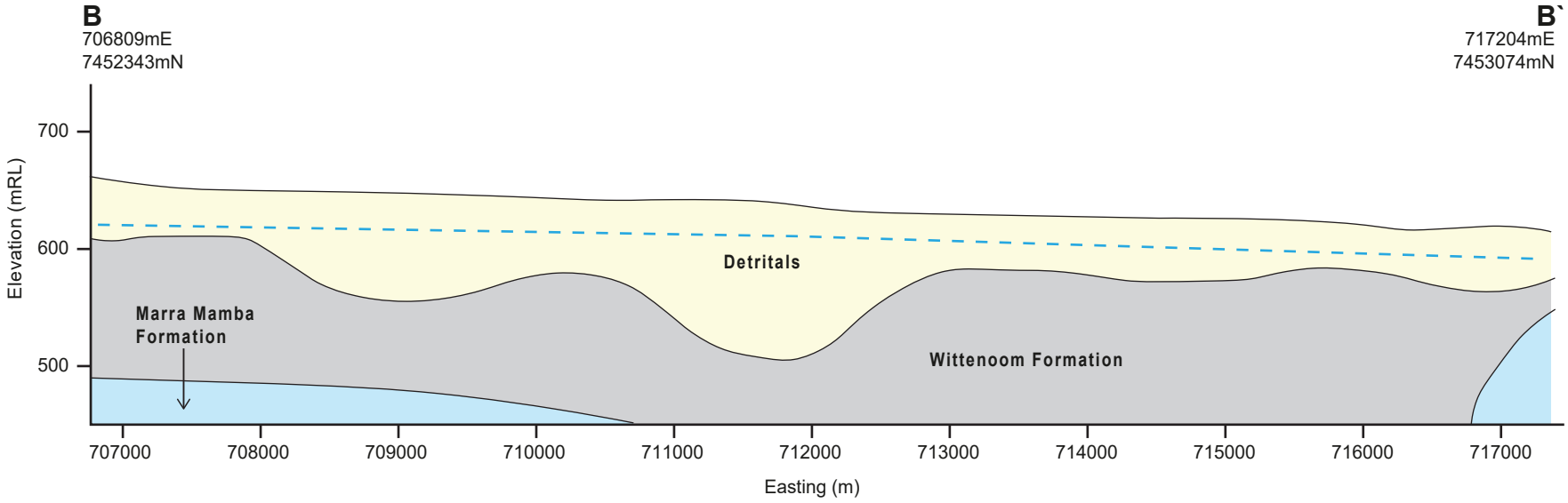
FIGURE 11: BHT Hydrogeological Cross Section

Legend

- DETRITALS (alluvium, clay, pisolite, calcrete)
- DALES GORGE (Brockman Fm)
- Mount McRae Shale
- Mount Sylvia Fm
- Wittenoom Fm (undifferentiated)
- Marra Mamba Fm (undifferentiated)







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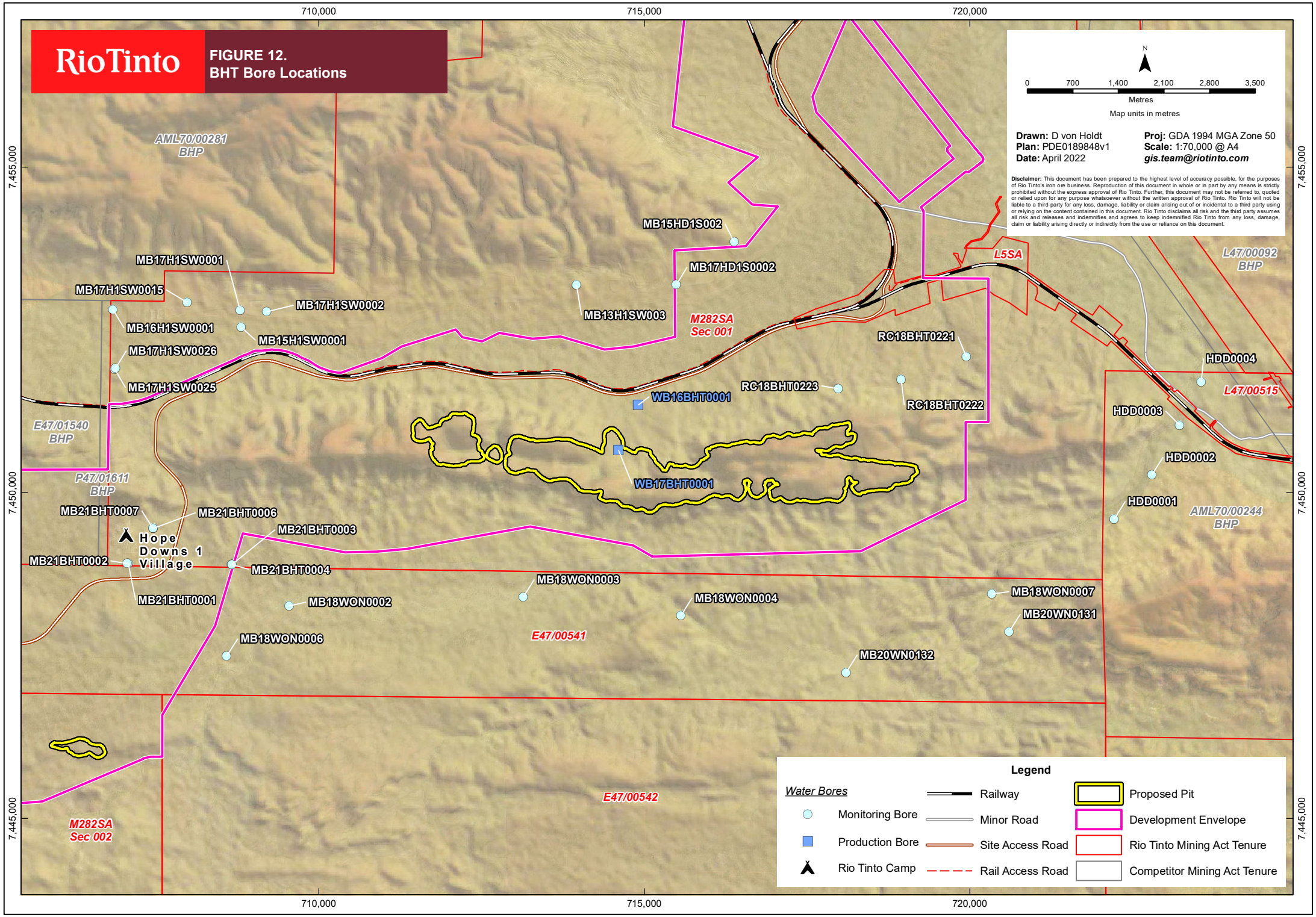
RioTinto
FIGURE 12.
BHT Bore Locations
710,000
715,000
720,000
7,455,000
7,450,000
7,445,000
N
0 700 1,400 2,100 2,800 3,500
Metres
Map units in metres
Drawn: D von Holdt
Plan: PDE0189848v1
Date: April 2022
Proj: GDA 1994 MGA Zone 50
Scale: 1:70,000 @ A4
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AML70/00281 BHP
MB15HD1S002
MB17H1SW0001
MB17HD1S0002
MB17H1SW0015
MB17H1SW0002
MB13H1SW003
MB16H1SW0001
MB15H1SW0001
M282SA Sec 001
L5SA
L47/00092 BHP
RC18BHT0221
MB17H1SW0026
HDD0004
RC18BHT0223
MB17H1SW0025
WB16BHT0001
RC18BHT0222
L47/00515
HDD0003
E47/01540 BHP
HDD0002
WB17BHT0001
P47/01611 BHP
HDD0001
MB21BHT0007
MB21BHT0006
AML70/00244 BHP
MB21BHT0003
Hope Downs 1 Village
MB21BHT0002
MB21BHT0004
MB18WON0003
MB18WON0007
MB21BHT0001
MB18WON0002
MB18WON0004
MB20WN0131
E47/00541
MB18WON0006
MB20WN0132
E47/00542
M282SA Sec 002
Legend
Water Bores
Monitoring Bore
Production Bore
Rio Tinto Camp
Railway
Minor Road
Site Access Road
Rail Access Road
Proposed Pit
Development Envelope
Rio Tinto Mining Act Tenure
Competitor Mining Act Tenure

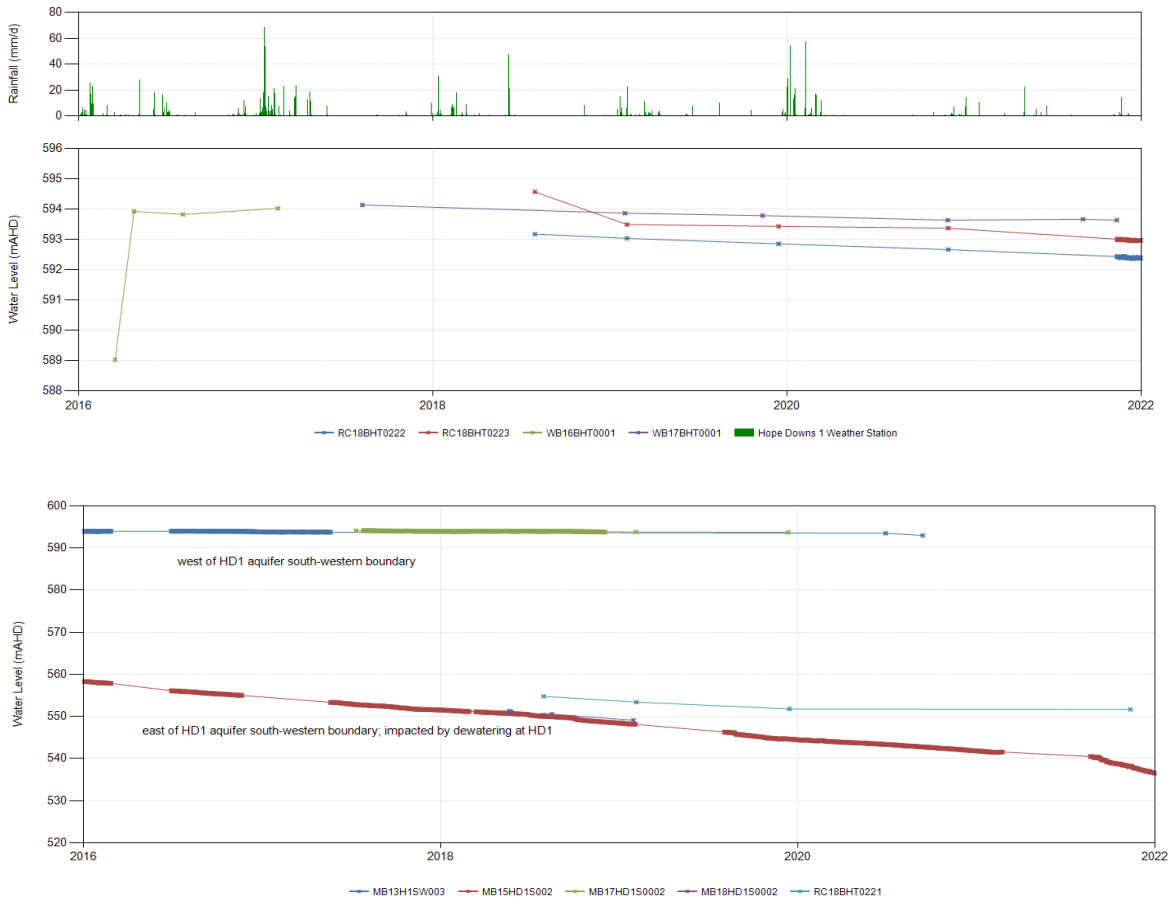

Figure13: BHT Hydrographs (Aug 2017 to Jan 2022, mAHD)



Figure14: Photograph of Weeli Wolli Spring



Figure15: Photograph of Dolomite Outcrop at Ben's Oasis

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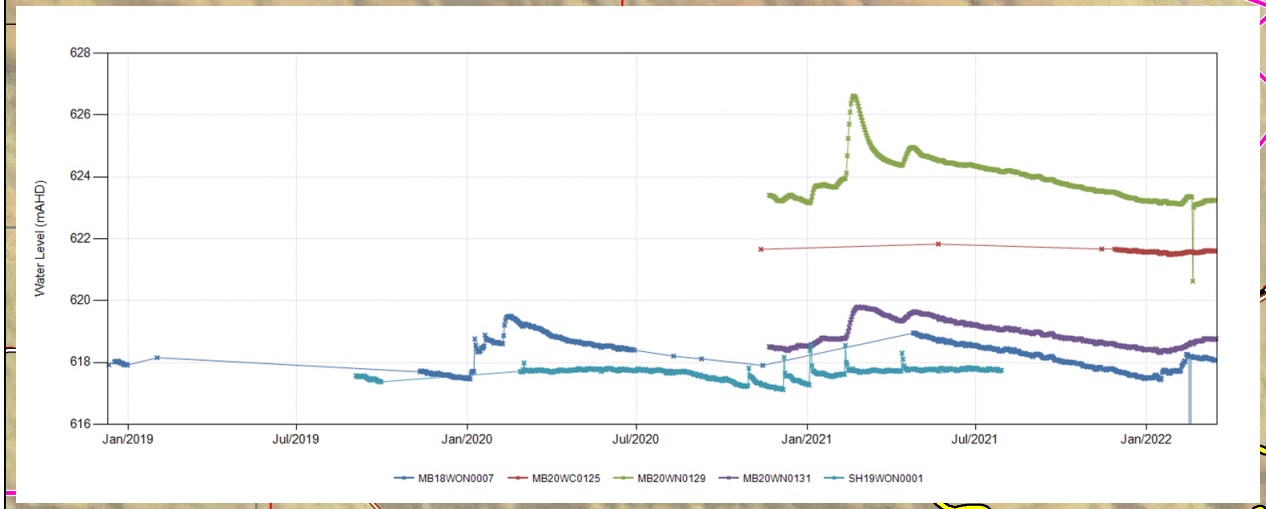
FIGURE 16. Ben's Oasis Bore Locations



N

0 0.5 1 1.5

Kilometres

Map units in metres

Drawn: D von Holdt
Plan: PDE0189848v1
Date: May 2022

Proj: GDA 1994 MGA Zone 50
Scale: 1:75,000 @ A4
gis.team@riotinto.com

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705,000 710,000 715,000 720,000 725,000

7,455,000 7,450,000 7,445,000

M282SA Sec 001

HDD0004
HDD0003
HDD0002
HDD0001

AML70/00244 BHP

Hope Downs 1 Village

SH19WON0001
MB18WON0007
MB18WON0003
MB18WON0002
MB18WON0004
E47/00541
MB20WN0131
MB18WON0006
MB20WN0132
MB20WN0129
MB18WON0001
MB18WON0005
MB20WC0123
RC18WON0127
RC18WON0126
MB20WC0125

E47/00622

M282SA Sec 002

E47/00542

Great Northern Highway

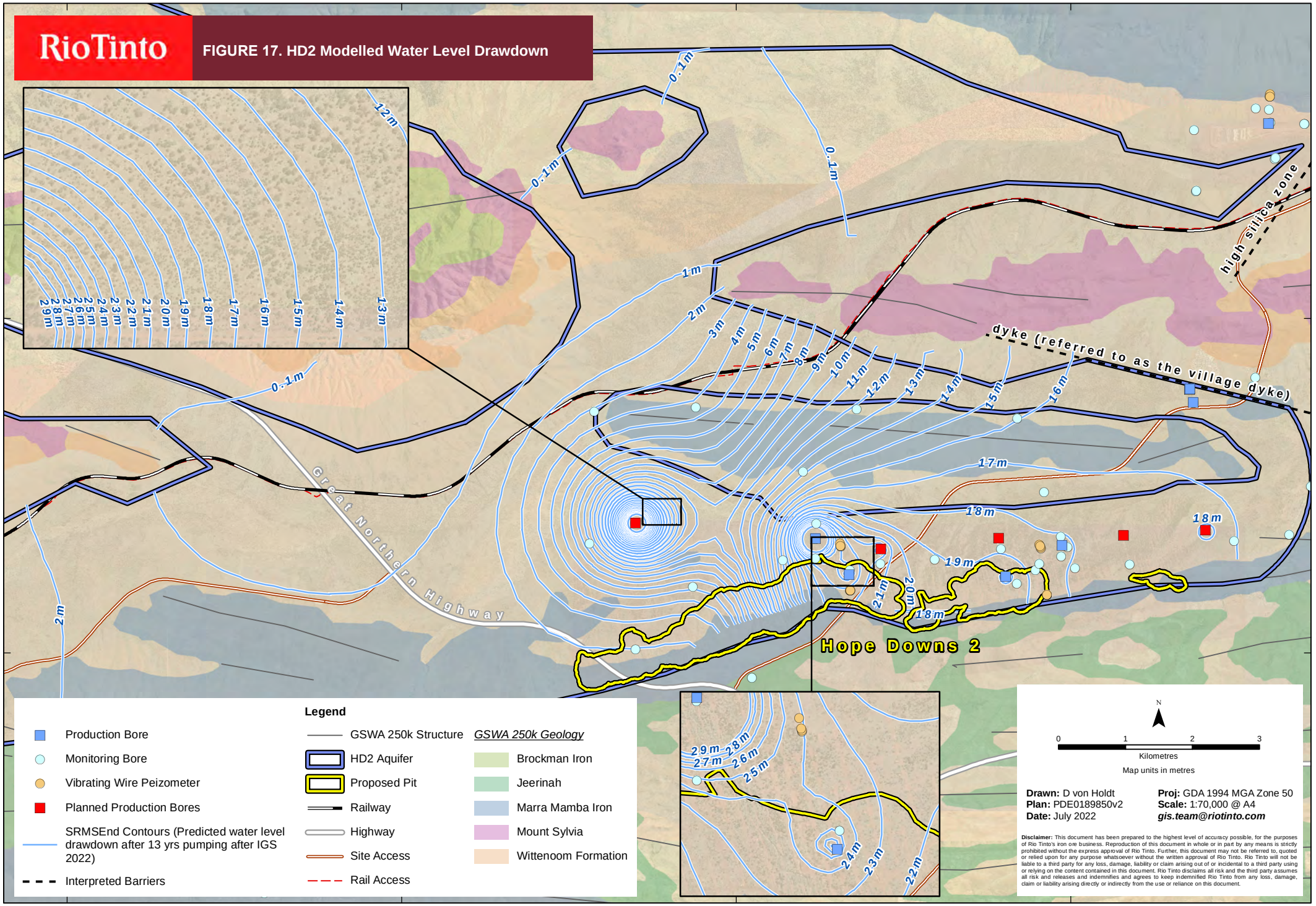
L47/00726 OTHER

Legend

- Monitoring Bore
- Rio Tinto Camp
- Railway
- Highway
- Minor Road
- Site Access Road
- Rail Access Road
- Proposed Pit
- Development Envelope
- Rio Tinto Mining Act Tenure
- Competitor Mining Act Tenure

RioTinto

FIGURE 17. HD2 Modelled Water Level Drawdown



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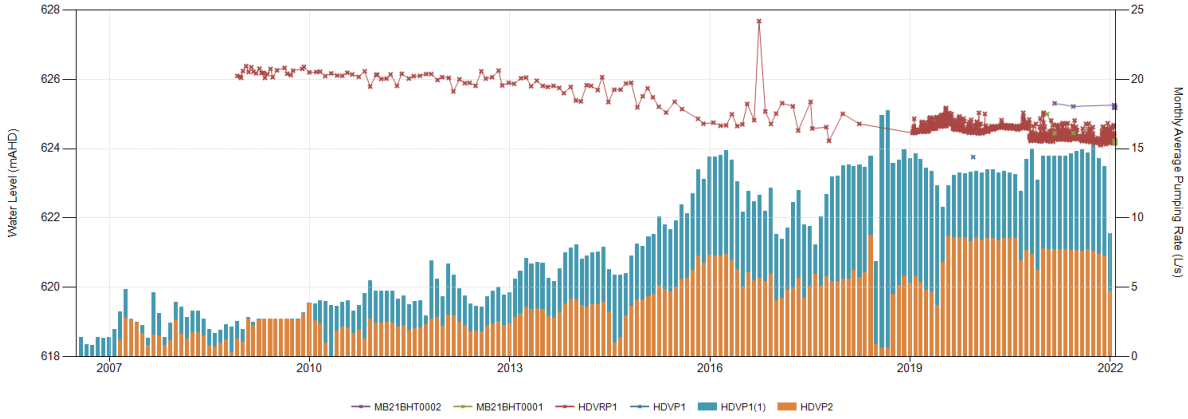

Figure 18: Abstraction from HD1 Village bores and local water levels (2007 to 2022)

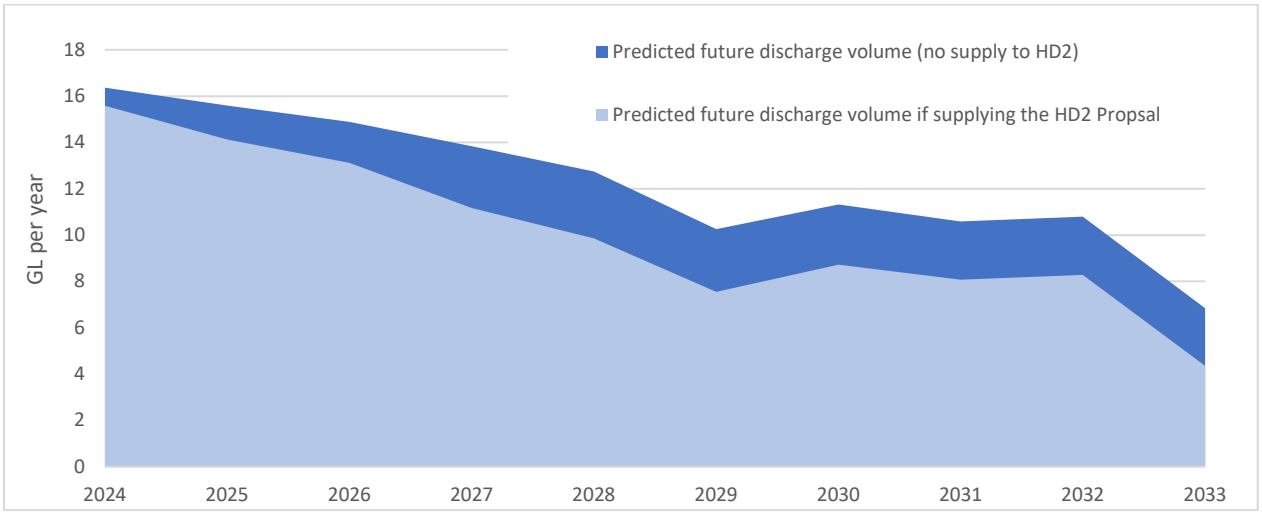

Figure 19: Predicted Discharge Volumes into Weeli Wolli Creek at HD1 Discharge Point

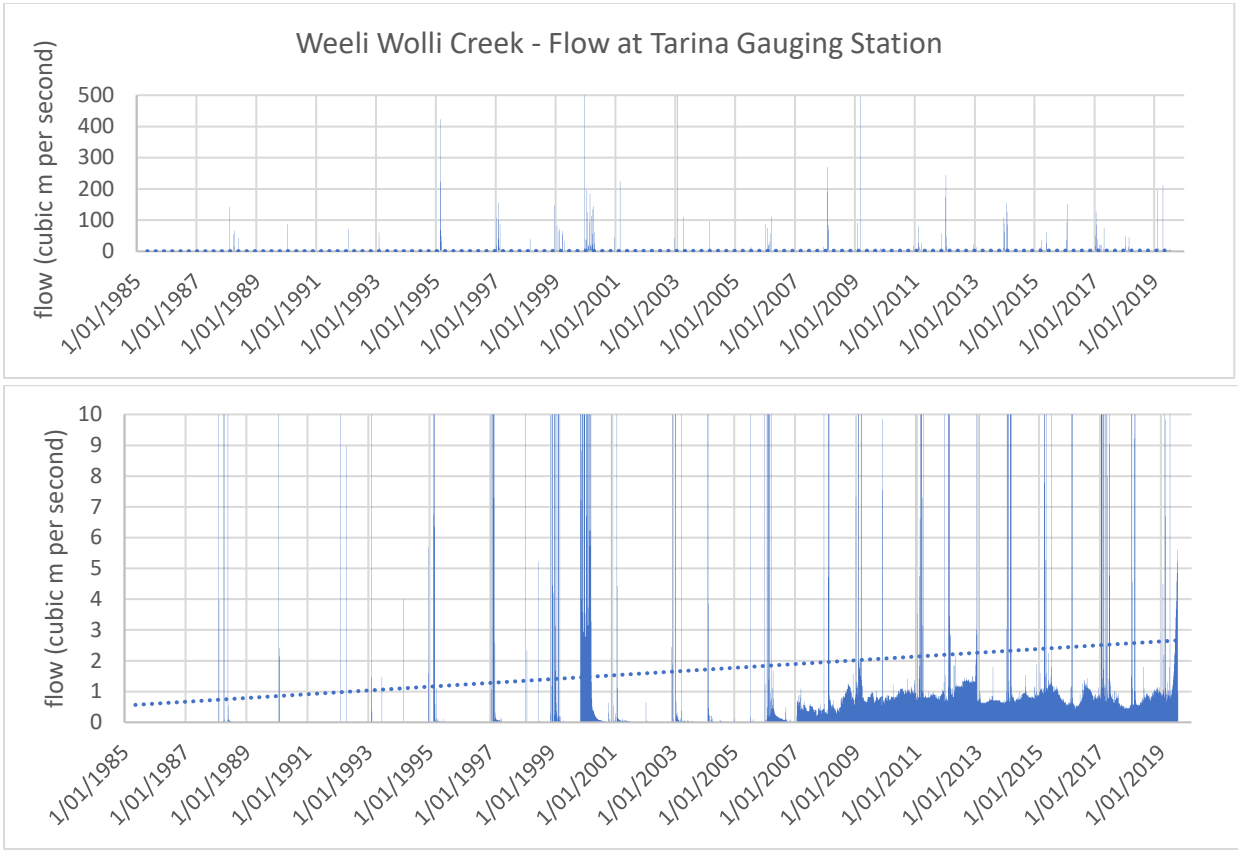

Figure 20: Weeli Wolli Creek Flow at Tarina Gauging Station (1985 to 2019)

APPENDICES

APPENDIX I

Bore Details

Appendix I - Bore data (construction details)

ID	mE	mN	Elevation (mAHD)	Initial Water Depth (mAHD)	Initial Water Depth (mbgl)	Initial Water Date	Construction Date	Slotted interval (from mAHD)	Slotted interval (to mAHD)	Aquifer (Formation screened)
HDD0001	722216	7449593	622.1	584.2	37.9	Oct-16	Oct-16	607.1	577.1	WF
HDD0002	722796	7450274	612.5	566.8	45.7	Oct-16	Oct-16	603.5	561.5	WF
HDD0003	723225	7451037	607.8	579.1	28.7	Oct-16	Oct-16	574.8	556.8	WF
HDD0004	723555	7451700	606.9	577.6	29.3	Oct-16	Oct-16	597.9	549.9	DET
HDRE1	707756	7449119	679.3	610.8	68.5	Jun-06	Jun-06	611.3	479.3	WF
HDRE2	707716	7448987	678.9	610.3	68.6	Sep-06	Sep-06	open hole	-	WF
HDRE3	706829	7448734	684.1	626.2	57.9	Dec-06	Dec-06	open hole	-	WF
HDVP1	706773	7448933	686.2	626.0	60.1	Sep-06	Jul-06	623.2	509.2	WF
HDVP2	706781	7448944	686.5	625.9	60.7	Sep-06	Aug-06	590.5	506.5	WF
HDVRP1	706834	7448738	684.5	625.9	58.7	Sep-06	Jan-07	624.5	550.5	WF
LHRP11	675234	7446005	720.9	665.7	55.2	Dec-06	Dec-06	668.9	626.9	NR
LHRP12	690371	7446138	724.6	628.5	96.1	Jan-07	Dec-06	629.6	593.6	WF
LHRP2	685717	7445238	731.1	629.1	102.0	Aug-06	Aug-06	620.1	560.1	WF
LHRP9	681808	7444405	724.5	628.5	96.0	Dec-06	Dec-06	623.5	576.5	WF
MB15H1SW0001	708813	7452541	645.4	645.4	0.0	Jan-00	Oct-15	627.4	545.4	DET
MB15HD20001	699353	7445984	714.9	627.2	87.6	Feb-16	Oct-15	690.9	596.9	DET
MB15HD20002	707435	7446673	683.8	623.9	59.9	Feb-16	Oct-15	671.8	607.8	WF
MB15HD20003	705878	7446322	688.4	624.3	64.1	Feb-16	Oct-15	676.4	540.4	WF
MB15HD20004	705065	7446267	694.2	624.6	69.6	Feb-16	Oct-15	676.2	474.2	DET
MB15HD20005	702964	7446398	704.4	625.2	79.1	Feb-16	Oct-15	686.4	586.4	DET
MB15HD20006	703956	7446550	702.1	624.5	77.6	Feb-16	Oct-15	684.1	590.1	DET
MB15HD20007	702153	7446336	712.8	625.2	87.6	Feb-16	Oct-15	694.8	600.8	DET
MB15HD20008	700697	7446383	710.3	626.5	83.8	Feb-16	Oct-15	686.3	568.3	DET
MB16H1SW0001	706837	7452815	658.6	620.1	38.6	Apr-16	Apr-16	588.6	558.6	WF
MB17H1SW0001	708795	7452801	658.7	NR	NR	NR	Apr-17	582.7	538.7	DET
MB17H1SW0002	709203	7452776	648.4	NR	NR	NR	Apr-17	588.4	570.4	WF
MB17H1SW0015	707982	7452921	663.0	616.8	46.3	Jun-17	May-17	609.0	543.0	WF
MB17H1SW0025	706866	7451896	656.2	621.3	34.9	Jul-17	Jul-17	624.2	618.2	DET
MB17H1SW0026	706877	7451907	656.4	NR	NR	NR	Jul-17	584.4	578.4	WF
MB17HD1S0002	715490	7453193	626.5	593.3	33.2	May-17	May-17	559.5	517.5	MM
MB17WON0003	704200	7448507	715.8	624.3	91.5	May-17	Mar-17	613.8	595.8	MM
MB18BHT0003	709563	7449018	680.8	612.1	68.7	Nov-18	Nov-18	606.3	594.3	WF
MB18HD1S0002	717381	7453370	613.4	550.6	62.9	May-18	Mar-18	558.4	546.4	MM
MB18HD20001	701187	7446413	709.4	626.2	83.1	Mar-18	Mar-18	621.4	583.4	DET
MB18HD20002	701197	7446934	710.5	627.3	83.2	Mar-18	Mar-18	644.5	584.5	WF
MB18HD20003	701185	7446695	707.9	625.0	82.8	Apr-18	Mar-18	607.9	523.9	WF
MB18HD20004	701697	7446234	713.4	626.2	87.2	Mar-18	Mar-18	663.4	603.4	DET
MB18HD20005	704952	7446583	692.9	624.7	68.2	Apr-18	Apr-18	624.9	516.9	WF
MB18HD20006	704857	7446440	696.0	638.6	57.4	Apr-18	Apr-18	600.0	552.0	WF
MB18HD20007	698498	7445049	725.8	627.5	98.3	Apr-18	Apr-18	613.8	595.8	MM
MB18HD20008	704470	7446235	705.9	624.7	81.2	Apr-18	Apr-18	617.9	503.9	DET
MB18HD20009	697807	7446628	702.5	626.8	75.6	Apr-18	Apr-18	601.5	571.5	MM
MB18HD20010	704848	7446738	693.4	625.8	67.5	Apr-18	Apr-18	637.4	619.4	WF
MB18HD20012	700235	7444622	729.6	690.7	38.9	Nov-18	Nov-18	656.6	614.6	FOR
MB18WON0001	708262	7446765	672.1	623.8	48.3	Oct-18	Oct-18	619.1	607.1	MM
MB18WON0002	709546	7448257	664.6	622.8	41.8	Nov-18	Oct-18	614.6	596.6	WF
MB18WON0003	713142	7448396	652.6	594.0	58.6	Nov-18	Nov-18	610.6	592.6	WF
MB18WON0004	715565	7448109	677.4	614.5	62.9	Nov-18	Nov-18	608.4	590.4	MM
MB18WON0005	719283	7446159	636.1	621.2	14.8	Nov-18	Nov-18	616.1	598.1	WF
MB18WON0006	708587	7447487	670.7	623.3	47.4	Oct-18	Oct-18	620.7	602.7	MM
MB18WON0007	720340	7448441	631.3	616.3	14.9	Nov-18	Nov-18	593.3	575.3	WF
MB20WC0123	717913	7446157	677.8	620.6	57.2	Nov-20	Nov-20	621.8	525.8	MM
MB20WC0125	721643	7445951	696.4	620.8	75.6	Nov-20	Oct-20	636.4	570.4	MM
MB20WN0129	721005	7446864	651.1	622.6	28.5	Nov-20	Dec-20	597.1	567.1	WF
MB20WN0131	720607	7447863	644.0	617.6	26.4	Nov-20	Nov-20	614.0	590.0	WF
MB20WN0132	718098	7447236	642.0	620.1	21.9	Nov-20	Nov-20	614.9	588.0	WF
MB21BHT0001	707073	7448908	687.3	623.7	63.6	Mar-21	Feb-21	574.8	514.8	WF
MB21BHT0002	707060	7448909	687.2	624.5	62.8	Mar-21	Feb-21	636.2	612.2	WF
MB21BHT0003	708660	7448892	675.0	625.0	50.0	Mar-21	Mar-21	611.7	533.7	WF
MB21BHT0004	708670	7448892	674.9	625.0	49.8	Mar-21	Mar-21	638.9	620.9	WF
MB21BHT0006	707460	7449451	685.1	626.5	58.6	May-21	Apr-21	568.1	563.1	WF
MB21BHT0007	707452	7449452	685.2	623.1	62.1	May-21	Apr-21	601.2	583.2	WF
MB21HD20001	698500	7446908	700.0	625.8	74.2	Nov-21	Nov-21	560.0	524.0	WF
MB21HD20002	707007	7446835	678.3	604.1	74.2	Nov-21	Nov-21	584.5	548.5	MM
MB21HD20003	705792	7446756	688.5	623.9	64.6	Dec-21	Dec-21	534.5	510.5	WF
MB21HD20004	702162	7446557	708.1	624.9	83.2	Jan-22	Dec-21	591.1	531.1	WF
MB21HD20005	701841	7446080	716.0	625.8	90.2	Dec-21	Dec-21	593.0	569.0	MM
RC18BHT0221	719948	7452085	629.0	629.0	0.0	Jan-00	Mar-18	569.2	551.2	WF
RC18BHT0222	718946	7451735	648.4	648.4	0.0	Jan-00	Mar-18	589.4	571.4	WF
RC18BHT0223	717979	7451595	661.8	661.8	0.0	Jan-00	Apr-18	595.8	571.8	WF
RC18WON0126	721998	7445996	698.6	698.6	0.0	Jan-00	Aug-18	614.6	598.6	MM
RC18WON0127	720799	7445847	641.3	641.3	0.0	Jan-00	Aug-18	601.3	583.3	MM
WB16BHT0001	714905	7451345	637.8	588.6	49.2	Mar-16	Feb-16	535.8	487.8	MTS
WB16HD20001	701688	7446168	712.8	626.6	86.2	Feb-16	Feb-16	586.8	550.8	WF
WB17BHT0001	714602	7450651	650.9	593.6	57.3	Jul-17	Jul-17	570.6	460.0	DG
WB18HD20001	701187	7446708	707.9	625.2	82.7	Apr-18	Apr-18	611.9	509.9	WF
WB18HD20002	704867	7446605	693.5	624.1	69.4	May-18	Apr-18	579.5	543.5	WF
WB18HD20003	704024	7446140	701.0	625.5	75.6	Oct-18	Oct-18	599.0	521.0	WF

NR = not recorded

Appendix I - Bore data (test pumping results)

Deposit	Pumping Bore	Test Duration (days)	Pumping rate (L/s)	Total drawdown in pumping bore (m)	Monitoring point	Aquifer Screened	Aquifer Thickness (m)	Total Drawdown (m)	Distance from pumping bore (m)	Adopted T (m2/day)	Specific Storage
HD2	WB16HD20001	7	22	29	MB15HD20008	DET/WANG	90	0.3	1,015	65	0.003
					VW18HD20004	MAC	90	0.16	237		
					VW18HD20005	NAM/MAC	90	0.11	237		
					VW18HD20006	MAC	90	0.11	237		
					MB18HD20004	DET		-	68		
					MB15HD20005	DET		-	1,298		
					MB15HD20007	DET		-	495		
	WB18HD20001	7	25	43	MB18HD20003	WF and Shale	85	16	13	105	0.001
					MB18HD20002	WANG	85	0.23	223		
					VW18HD20007	WF	85		372		
					VW18HD20008	WF	85		372		
					VW18HD20009	WF/ROD	85		372		
	WB18HD20002	7	11	38	MB18HD20005	WF	120	0.5	85	35	0.005
					MB18HD20006	WF	120	0.265	164		
					MB15HD20004	DET	120	-	396		
					MB18HD20008	DET	120	-	539		
					MB15HD20006	DET	120	-	911		
	WB18HD20003	6	18	41	MB18HD20011	N2U,WANG, DET	120	8.86	12	119	0.019
					MB15HD20006	WF, DET	120	-	409		
					MB18HD20008	DET	120	-	456		
					RC18HD20319	DET	120	-	194		
					MB18HD20006	WF, DET	120	-	877		

abbreviation	unit
DET	detritals
DGS	Dales Gorge Member
FOR	Fortescue Formation
MAC	MacLeod Member
MCS	Mount McRae Shale
N2U	Mount Newman Member
NAM	Nammuldi Member
ROD	red ochre detritals
WANG	West Angles Member
WF	Wittenoom Formation

APPENDIX II

Water Level and Water Chemistry Data

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDRE1	3/03/2022	629.0	50.3
HDRE1	2/03/2022	629.0	50.3
HDRE1	1/03/2022	629.0	50.3
HDRE1	28/02/2022	629.0	50.3
HDRE1	27/02/2022	629.0	50.3
HDRE1	26/02/2022	629.0	50.3
HDRE1	25/02/2022	629.0	50.3
HDRE1	24/02/2022	629.0	50.3
HDRE1	23/02/2022	629.0	50.3
HDRE1	22/02/2022	629.0	50.3
HDRE1	21/02/2022	629.0	50.3
HDRE1	20/02/2022	629.0	50.3
HDRE1	19/02/2022	629.0	50.3
HDRE1	18/02/2022	629.0	50.3
HDRE1	17/02/2022	629.0	50.3
HDRE1	16/02/2022	629.0	50.3
HDRE1	15/02/2022	629.0	50.3
HDRE1	14/02/2022	629.0	50.3
HDRE1	13/02/2022	629.0	50.3
HDRE1	12/02/2022	629.0	50.3
HDRE1	11/02/2022	629.0	50.3
HDRE1	10/02/2022	628.9	50.4
HDRE1	9/02/2022	628.9	50.4
HDRE1	8/02/2022	628.9	50.4
HDRE1	7/02/2022	628.9	50.4
HDRE1	6/02/2022	628.9	50.4
HDRE1	5/02/2022	628.9	50.4
HDRE1	4/02/2022	628.9	50.4
HDRE1	3/02/2022	628.9	50.4
HDRE1	2/02/2022	628.9	50.4
HDRE1	1/02/2022	628.9	50.4
HDRE1	31/01/2022	628.8	50.5
HDRE1	30/01/2022	628.8	50.5
HDRE1	29/01/2022	628.9	50.4
HDRE1	28/01/2022	628.8	50.5
HDRE1	27/01/2022	628.8	50.5
HDRE1	26/01/2022	628.8	50.5
HDRE1	25/01/2022	628.8	50.5
HDRE1	24/01/2022	628.8	50.5
HDRE1	23/01/2022	628.8	50.5
HDRE1	22/01/2022	628.8	50.5
HDRE1	21/01/2022	628.8	50.5
HDRE1	20/01/2022	628.8	50.5
HDRE1	19/01/2022	628.8	50.5
HDRE1	18/01/2022	628.8	50.5
HDRE1	17/01/2022	628.8	50.5
HDRE1	16/01/2022	628.8	50.5
HDRE1	15/01/2022	628.8	50.5
HDRE1	14/01/2022	628.8	50.5
HDRE1	13/01/2022	628.8	50.5
HDRE1	12/01/2022	628.8	50.5
HDRE1	11/01/2022	628.8	50.5
HDRE1	10/01/2022	628.8	50.5
HDRE1	9/01/2022	628.7	50.5
HDRE1	8/01/2022	628.8	50.5
HDRE1	7/01/2022	628.8	50.5
HDRE1	6/01/2022	628.8	50.5
HDRE1	5/01/2022	628.8	50.5
HDRE1	4/01/2022	628.8	50.5
HDRE1	3/01/2022	628.8	50.5
HDRE1	2/01/2022	628.8	50.5
HDRE1	1/01/2022	628.8	50.5
HDRE1	31/12/2021	628.7	50.6
HDRE1	30/12/2021	628.7	50.6
HDRE1	26/12/2021	628.7	50.6
HDRE1	25/12/2021	628.7	50.6
HDRE1	24/12/2021	628.7	50.6
HDRE1	23/12/2021	628.7	50.6
HDRE1	22/12/2021	628.7	50.6
HDRE1	21/12/2021	628.7	50.6
HDRE1	20/12/2021	628.8	50.5
HDRE1	19/12/2021	628.8	50.5
HDRE1	18/12/2021	628.8	50.5
HDRE1	17/12/2021	628.7	50.5
HDRE1	16/12/2021	628.7	50.6
HDRE1	15/12/2021	628.7	50.6
HDRE1	14/12/2021	628.7	50.6
HDRE1	13/12/2021	628.7	50.6
HDRE1	12/12/2021	628.7	50.6
HDRE1	11/12/2021	628.7	50.6
HDRE1	10/12/2021	628.7	50.6
HDRE1	9/12/2021	628.7	50.6
HDRE1	8/12/2021	628.7	50.6
HDRE1	7/12/2021	628.7	50.6
HDRE1	6/12/2021	628.8	50.5
HDRE1	5/12/2021	628.8	50.5
HDRE1	4/12/2021	628.7	50.6
HDRE1	3/12/2021	628.8	50.5
HDRE1	2/12/2021	628.8	50.5
HDRE1	1/12/2021	628.8	50.5
HDRE1	30/11/2021	628.8	50.5
HDRE1	29/11/2021	628.8	50.5
HDRE1	28/11/2021	628.8	50.5
HDRE1	27/11/2021	628.8	50.5
HDRE1	26/11/2021	628.8	50.5
HDRE1	25/11/2021	628.8	50.5
HDRE1	24/11/2021	628.8	50.5
HDRE1	23/11/2021	628.8	50.5
HDRE1	22/11/2021	628.8	50.5
HDRE1	21/11/2021	628.8	50.5
HDRE1	20/11/2021	628.8	50.5
HDRE1	19/11/2021	628.8	50.5
HDRE1	18/11/2021	628.8	50.5
HDRE1	17/11/2021	628.9	50.4
HDRE1	16/11/2021	628.8	50.5
HDRE1	15/11/2021	628.8	50.5
HDRE1	14/11/2021	628.8	50.4
HDRE1	13/11/2021	628.8	50.5
HDRE1	12/11/2021	628.9	50.4
HDRE1	11/11/2021	628.8	50.5
HDRE1	10/11/2021	628.8	50.5
HDRE1	9/11/2021	628.8	50.5
HDRE1	7/11/2021	628.8	50.5
HDRE1	6/11/2021	628.9	50.4
HDRE1	5/11/2021	628.9	50.4
HDRE1	4/11/2021	628.9	50.4
HDRE1	3/11/2021	628.9	50.4
HDRE1	2/11/2021	628.9	50.4
HDRE1	1/11/2021	628.9	50.4
HDRE1	28/10/2021	628.9	50.4
HDRE1	27/10/2021	628.9	50.4
HDRE1	26/10/2021	628.9	50.4
HDRE1	25/10/2021	628.9	50.4
HDRE1	24/10/2021	628.9	50.4
HDRE1	23/10/2021	629.0	50.3
HDRE1	22/10/2021	629.0	50.3
HDRE1	21/10/2021	629.0	50.3
HDRE1	20/10/2021	629.0	50.3
HDRE1	19/10/2021	629.0	50.3
HDRE1	18/10/2021	629.0	50.3
HDRE1	17/10/2021	628.9	50.4
HDRE1	16/10/2021	628.9	50.4
HDRE1	15/10/2021	628.9	50.4
HDRE1	14/10/2021	628.9	50.4
HDRE1	13/10/2021	629.0	50.3
HDRE1	12/10/2021	629.0	50.3

ID	Date	WL mAHD	WL mbgl
HDVP2	17/05/2010	0.6	685.9
HDVP2	16/05/2010	0.6	685.9
HDVP2	15/05/2010	0.6	685.9
HDVP2	14/05/2010	0.6	685.9
HDVP2	13/05/2010	0.6	685.9
HDVP2	12/05/2010	0.6	685.9
HDVP2	11/05/2010	0.6	685.9
HDVP2	10/05/2010	0.6	685.9
HDVP2	9/05/2010	0.6	685.9
HDVP2	8/05/2010	0.6	685.9
HDVP2	7/05/2010	0.6	685.9
HDVP2	6/05/2010	0.6	685.9
HDVP2	5/05/2010	0.6	685.9
HDVP2	4/05/2010	0.6	685.9
HDVP2	3/05/2010	0.6	685.9
HDVP2	2/05/2010	0.6	685.9
HDVP2	1/05/2010	0.6	685.9
HDVP2	30/04/2010	84.7	601.9
HDVP2	29/04/2010	84.7	601.9
HDVP2	28/04/2010	84.7	601.9
HDVP2	27/04/2010	84.7	601.9
HDVP2	26/04/2010	84.7	601.9
HDVP2	25/04/2010	84.7	601.9
HDVP2	24/04/2010	84.7	601.9
HDVP2	23/04/2010	84.7	601.9
HDVP2	22/04/2010	84.7	601.9
HDVP2	21/04/2010	84.7	601.9
HDVP2	20/04/2010	84.7	601.9
HDVP2	19/04/2010	84.7	601.9
HDVP2	18/04/2010	84.7	601.9
HDVP2	17/04/2010	84.7	601.9
HDVP2	16/04/2010	84.7	601.9
HDVP2	15/04/2010	84.7	601.9
HDVP2	14/04/2010	84.7	601.9
HDVP2	13/04/2010	84.7	601.9
HDVP2	12/04/2010	84.7	601.9
HDVP2	11/04/2010	84.7	601.9
HDVP2	10/04/2010	84.7	601.9
HDVP2	9/04/2010	84.7	601.9
HDVP2	8/04/2010	84.7	601.9
HDVP2	7/04/2010	84.7	601.9
HDVP2	6/04/2010	84.7	601.9
HDVP2	5/04/2010	84.7	601.9
HDVP2	4/04/2010	84.7	601.9
HDVP2	3/04/2010	84.7	601.9
HDVP2	2/04/2010	84.7	601.9
HDVP2	1/04/2010	84.7	601.9
HDVP2	31/03/2010	84.7	601.9
HDVP2	30/03/2010	84.7	601.9
HDVP2	29/03/2010	211.6	474.9
HDVP2	28/03/2010	211.6	474.9
HDVP2	27/03/2010	211.6	474.9
HDVP2	26/03/2010	211.6	474.9
HDVP2	25/03/2010	211.6	474.9
HDVP2	24/03/2010	211.6	474.9
HDVP2	23/03/2010	211.6	474.9
HDVP2	22/03/2010	211.6	474.9
HDVP2	21/03/2010	211.6	474.9
HDVP2	20/03/2010	211.6	474.9
HDVP2	19/03/2010	211.6	474.9
HDVP2	18/03/2010	211.6	474.9
HDVP2	17/03/2010	211.6	474.9
HDVP2	16/03/2010	211.6	474.9
HDVP2	15/03/2010	211.6	474.9
HDVP2	14/03/2010	211.6	474.9
HDVP2	13/03/2010	211.6	474.9
HDVP2	12/03/2010	211.6	474.9
HDVP2	11/03/2010	211.6	474.9
HDVP2	10/03/2010	211.6	474.9
HDVP2	9/03/2010	211.6	474.9
HDVP2	8/03/2010	211.6	474.9
HDVP2	7/03/2010	211.6	474.9
HDVP2	6/03/2010	211.6	474.9
HDVP2	5/03/2010	211.6	474.9
HDVP2	4/03/2010	211.6	474.9
HDVP2	3/03/2010	211.6	474.9
HDVP2	2/03/2010	211.6	474.9
HDVP2	1/03/2010	211.6	474.9
HDVP2	28/02/2010	188.8	497.8
HDVP2	27/02/2010	188.8	497.8
HDVP2	26/02/2010	188.8	497.8
HDVP2	25/02/2010	188.8	497.8
HDVP2	24/02/2010	188.8	497.8
HDVP2	23/02/2010	188.8	497.8
HDVP2	22/02/2010	188.8	497.8
HDVP2	21/02/2010	188.8	497.8
HDVP2	20/02/2010	188.8	497.8
HDVP2	19/02/2010	188.8	497.8
HDVP2	18/02/2010	188.8	497.8
HDVP2	17/02/2010	188.8	497.8
HDVP2	16/02/2010	188.8	497.8
HDVP2	15/02/2010	188.8	497.8
HDVP2	14/02/2010	188.8	497.8
HDVP2	13/02/2010	188.8	497.8
HDVP2	12/02/2010	188.8	497.8
HDVP2	11/02/2010	188.8	497.8
HDVP2	10/02/2010	188.8	497.8
HDVP2	9/02/2010	188.8	497.8
HDVP2	8/02/2010	188.8	497.8
HDVP2	7/02/2010	328.4	358.1
HDVP2	6/02/2010	328.4	358.1
HDVP2	5/02/2010	328.4	358.1
HDVP2	4/02/2010	328.4	358.1
HDVP2	3/02/2010	328.4	358.1
HDVP2	2/02/2010	328.4	358.1
HDVP2	1/02/2010	328.4	358.1
HDVP2	31/01/2010	328.4	358.1
HDVP2	30/01/2010	328.4	358.1
HDVP2	29/01/2010	328.4	358.1
HDVP2	28/01/2010	328.4	358.1
HDVP2	27/01/2010	328.4	358.1
HDVP2	26/01/2010	328.4	358.1
HDVP2	25/01/2010	328.4	358.1
HDVP2	24/01/2010	328.4	358.1
HDVP2	23/01/2010	328.4	358.1
HDVP2	22/01/2010	328.4	358.1
HDVP2	21/01/2010	328.4	358.1
HDVP2	20/01/2010	328.4	358.1
HDVP2	19/01/2010	328.4	358.1
HDVP2	18/01/2010	328.4	358.1
HDVP2	17/01/2010	328.4	358.1
HDVP2	16/01/2010	328.4	358.1
HDVP2	15/01/2010	328.4	358.1
HDVP2	14/01/2010	328.4	358.1
HDVP2	13/01/2010	328.4	358.1
HDVP2	12/01/2010	328.4	358.1
HDVP2	11/01/2010	328.4	358.1
HDVP2	10/01/2010	328.4	358.1
HDVP2	9/01/2010	328.4	358.1
HDVP2	8/01/2010	328.4	358.1
HDVP2	7/01/2010	328.4	358.1
HDVP2	6/01/2010	328.4	358.1
HDVP2	5/01/2010	328.4	358.1
HDVP2	4/01/2010	328.4	358.1
HDVP2	3/01/2010	328.4	358.1
HDVP2	2/01/2010	328.4	358.1

ID	Date	WL mAHD	WL mbgl
MB18WON0005	24/01/2019	621.3	14.8
MB18WON0005	23/01/2019	621.3	14.8
MB18WON0005	22/01/2019	621.3	14.8
MB18WON0005	21/01/2019	621.3	14.8
MB18WON0005	20/01/2019	621.3	14.8
MB18WON0005	19/01/2019	621.3	14.8
MB18WON0005	18/01/2019	621.3	14.8
MB18WON0005	17/01/2019	621.3	14.7
MB18WON0005	16/01/2019	621.3	14.8
MB18WON0005	15/01/2019	621.3	14.8
MB18WON0005	14/01/2019	621.3	14.8
MB18WON0005	13/01/2019	621.3	14.8
MB18WON0005	12/01/2019	621.3	14.8
MB18WON0005	11/01/2019	621.3	14.8
MB18WON0005	10/01/2019	621.3	14.8
MB18WON0005	9/01/2019	621.3	14.8
MB18WON0005	8/01/2019	621.4	14.7
MB18WON0005	7/01/2019	621.4	14.7
MB18WON0005	6/01/2019	621.4	14.7
MB18WON0005	5/01/2019	621.4	14.7
MB18WON0005	4/01/2019	621.3	14.7
MB18WON0005	3/01/2019	621.3	14.8
MB18WON0005	2/01/2019	621.3	14.8
MB18WON0005	1/01/2019	621.3	14.8
MB18WON0005	31/12/2018	621.3	14.8
MB18WON0005	30/12/2018	621.3	14.8
MB18WON0005	29/12/2018	621.3	14.8
MB18WON0005	28/12/2018	621.3	14.8
MB18WON0005	27/12/2018	621.3	14.8
MB18WON0005	26/12/2018	621.3	14.7
MB18WON0005	25/12/2018	621.4	14.7
MB18WON0005	24/12/2018	621.4	14.7
MB18WON0005	23/12/2018	621.4	14.7
MB18WON0005	22/12/2018	621.4	14.7
MB18WON0005	21/12/2018	621.4	14.7
MB18WON0005	20/12/2018	621.4	14.7
MB18WON0005	19/12/2018	621.4	14.7
MB18WON0005	18/12/2018	621.4	14.7
MB18WON0005	17/12/2018	621.4	14.7
MB18WON0005	12/12/2018	621.4	14.7
MB18WON0006	2/03/2022	623.8	46.8
MB18WON0006	1/03/2022	623.9	46.8
MB18WON0006	28/02/2022	623.8	46.8
MB18WON0006	27/02/2022	623.8	46.8
MB18WON0006	26/02/2022	623.9	46.8
MB18WON0006	25/02/2022	623.9	46.8
MB18WON0006	24/02/2022	623.9	46.8
MB18WON0006	23/02/2022	623.9	46.8
MB18WON0006	22/02/2022	623.9	46.8
MB18WON0006	21/02/2022	623.9	46.8
MB18WON0006	20/02/2022	623.9	46.8
MB18WON0006	19/02/2022	623.9	46.8
MB18WON0006	18/02/2022	623.9	46.8
MB18WON0006	17/02/2022	623.9	46.8
MB18WON0006	16/02/2022	623.9	46.8
MB18WON0006	15/02/2022	623.9	46.8
MB18WON0006	14/02/2022	623.9	46.8
MB18WON0006	13/02/2022	623.9	46.8
MB18WON0006	12/02/2022	623.9	46.8
MB18WON0006	11/02/2022	623.9	46.8
MB18WON0006	10/02/2022	623.9	46.8
MB18WON0006	9/02/2022	623.9	46.8
MB18WON0006	8/02/2022	623.8	46.8
MB18WON0006	7/02/2022	623.8	46.8
MB18WON0006	6/02/2022	623.8	46.9
MB18WON0006	5/02/2022	623.8	46.8
MB18WON0006	4/02/2022	623.8	46.8
MB18WON0006	3/02/2022	623.8	46.8
MB18WON0006	2/02/2022	623.8	46.8
MB18WON0006	1/02/2022	623.8	46.9
MB18WON0006	31/01/2022	623.8	46.9
MB18WON0006	30/01/2022	623.8	46.9
MB18WON0006	29/01/2022	623.8	46.8
MB18WON0006	28/01/2022	623.8	46.9
MB18WON0006	27/01/2022	623.8	46.9
MB18WON0006	26/01/2022	623.8	46.9
MB18WON0006	25/01/2022	623.8	46.9
MB18WON0006	24/01/2022	623.8	46.9
MB18WON0006	23/01/2022	623.8	46.9
MB18WON0006	22/01/2022	623.9	46.8
MB18WON0006	21/01/2022	623.9	46.8
MB18WON0006	20/01/2022	623.9	46.8
MB18WON0006	19/01/2022	623.9	46.8
MB18WON0006	18/01/2022	623.9	46.8
MB18WON0006	17/01/2022	623.8	46.9
MB18WON0006	16/01/2022	623.8	46.9
MB18WON0006	15/01/2022	623.8	46.9
MB18WON0006	14/01/2022	623.8	46.9
MB18WON0006	13/01/2022	623.9	46.8
MB18WON0006	12/01/2022	623.9	46.8
MB18WON0006	11/01/2022	623.9	46.8
MB18WON0006	10/01/2022	623.9	46.8
MB18WON0006	9/01/2022	623.9	46.8
MB18WON0006	8/01/2022	623.9	46.8
MB18WON0006	7/01/2022	623.9	46.8
MB18WON0006	6/01/2022	623.9	46.8
MB18WON0006	5/01/2022	623.9	46.8
MB18WON0006	4/01/2022	623.9	46.8
MB18WON0006	3/01/2022	623.9	46.8
MB18WON0006	2/01/2022	623.9	46.8
MB18WON0006	1/01/2022	623.9	46.8
MB18WON0006	31/12/2021	623.8	46.9
MB18WON0006	30/12/2021	623.8	46.9
MB18WON0006	29/12/2021	623.8	46.8
MB18WON0006	28/12/2021	623.9	46.8
MB18WON0006	27/12/2021	623.9	46.8
MB18WON0006	26/12/2021	623.9	46.8
MB18WON0006	25/12/2021	623.9	46.8
MB18WON0006	24/12/2021	623.9	46.8
MB18WON0006	23/12/2021	623.8	46.8
MB18WON0006	22/12/2021	623.9	46.8
MB18WON0006	21/12/2021	623.9	46.8
MB18WON0006	20/12/2021	623.9	46.8
MB18WON0006	19/12/2021	623.9	46.8
MB18WON0006	18/12/2021	623.9	46.8
MB18WON0006	17/12/2021	623.9	46.8
MB18WON0006	16/12/2021	623.9	46.8
MB18WON0006	15/12/2021	623.9	46.8
MB18WON0006	14/12/2021	623.9	46.8
MB18WON0006	13/12/2021	623.8	46.8
MB18WON0006	12/12/2021	623.9	46.8
MB18WON0006	11/12/2021	623.9	46.8
MB18WON0006	10/12/2021	623.9	46.8
MB18WON0006	9/12/2021	623.9	46.8
MB18WON0006	8/12/2021	623.9	46.8
MB18WON0006	7/12/2021	623.9	46.8
MB18WON0006	6/12/2021	623.9	46.8
MB18WON0006	5/12/2021	623.9	46.8
MB18WON0006	4/12/2021	623.9	46.8
MB18WON0006	3/12/2021	623.9	46.8
MB18WON0006	2/12/2021	623.9	46.8
MB18WON0006	1/12/2021	623.9	46.8
MB18WON0006	30/11/2021	623.9	46.8
MB18WON0006	29/11/2021	623.9	46.8
MB18WON0006	28/11/2021	623.9	46.8
MB18WON0006	27/11/2021	623.9	46.7

ID	Date	WL mAHD	WL mbgl
MB15HD20007	1/02/2022	625.7	87.1
MB15HD20007	2/02/2022	625.7	87.1
MB15HD20007	3/02/2022	625.8	87.0
MB15HD20007	4/02/2022	625.8	87.0
MB15HD20007	5/02/2022	625.8	87.0
MB15HD20007	6/02/2022	625.8	87.0
MB15HD20007	7/02/2022	625.8	87.0
MB15HD20007	8/02/2022	625.8	87.0
MB15HD20007	9/02/2022	625.8	87.0
MB15HD20007	10/02/2022	625.8	87.0
MB15HD20007	11/02/2022	625.8	87.0
MB15HD20007	12/02/2022	625.8	87.0
MB15HD20007	13/02/2022	625.8	87.0
MB15HD20007	14/02/2022	625.8	87.0
MB15HD20007	15/02/2022	625.8	87.0
MB15HD20007	16/02/2022	625.8	87.0
MB15HD20007	17/02/2022	625.8	87.0
MB15HD20007	18/02/2022	625.8	87.0
MB15HD20007	19/02/2022	625.8	87.0
MB15HD20007	20/02/2022	625.8	87.0
MB15HD20007	21/02/2022	625.8	87.0
MB15HD20007	22/02/2022	625.8	87.0
MB15HD20007	23/02/2022	625.8	87.0
MB15HD20007	24/02/2022	625.8	87.0
MB15HD20007	25/02/2022	625.8	87.0
MB15HD20007	26/02/2022	625.8	87.0
MB15HD20007	27/02/2022	625.8	87.0
MB15HD20007	28/02/2022	625.8	87.0
MB15HD20007	1/03/2022	625.8	87.0
MB15HD20007	2/03/2022	625.7	87.0
MB15HD20007	3/03/2022	625.7	87.1
MB15HD20007	4/03/2022	625.7	87.1
MB15HD20007	5/03/2022	625.7	87.1
MB15HD20007	6/03/2022	625.7	87.1
MB15HD20007	7/03/2022	625.8	87.0
MB15HD20007	8/03/2022	625.8	87.0
MB15HD20007	9/03/2022	625.8	87.0
MB15HD20007	10/03/2022	625.8	87.0
MB15HD20007	11/03/2022	625.8	87.0
MB15HD20007	12/03/2022	625.8	87.0
MB15HD20007	13/03/2022	625.8	87.0
MB15HD20007	14/03/2022	625.8	87.0
MB15HD20007	15/03/2022	625.8	87.0
MB15HD20007	16/03/2022	625.8	87.0
MB15HD20008	4/02/2016	627.4	83.0
MB15HD20008	25/02/2016	627.4	83.0
MB15HD20008	2/05/2016	627.4	83.0
MB15HD20008	30/10/2016	627.4	82.9
MB15HD20008	19/02/2017	627.4	83.0
MB15HD20008	13/05/2017	627.4	83.0
MB15HD20008	21/08/2017	627.4	82.9
MB15HD20008	9/11/2017	627.4	83.0
MB15HD20008	12/04/2018	627.4	83.0
MB15HD20008	24/11/2018	626.9	83.4
MB15HD20008	25/11/2018	626.9	83.4
MB15HD20008	26/11/2018	626.9	83.4
MB15HD20008	27/11/2018	626.9	83.4
MB15HD20008	28/11/2018	626.9	83.4
MB15HD20008	29/11/2018	626.9	83.4
MB15HD20008	30/11/2018	626.9	83.4
MB15HD20008	1/12/2018	626.9	83.4
MB15HD20008	2/12/2018	627.0	83.4
MB15HD20008	3/12/2018	627.0	83.4
MB15HD20008	4/12/2018	627.0	83.4
MB15HD20008	5/12/2018	626.9	83.4
MB15HD20008	6/12/2018	626.9	83.4
MB15HD20008	7/12/2018	626.9	83.4
MB15HD20008	8/12/2018	626.9	83.4
MB15HD20008	9/12/2018	626.9	83.4
MB15HD20008	10/12/2018	626.9	83.4
MB15HD20008	11/12/2018	626.9	83.4
MB15HD20008	12/12/2018	626.9	83.4
MB15HD20008	13/12/2018	627.0	83.4
MB15HD20008	14/12/2018	626.9	83.4
MB15HD20008	15/12/2018	626.9	83.4
MB15HD20008	16/12/2018	626.9	83.4
MB15HD20008	17/12/2018	627.0	83.4
MB15HD20008	18/12/2018	627.0	83.4
MB15HD20008	19/12/2018	627.0	83.4
MB15HD20008	20/12/2018	627.0	83.4
MB15HD20008	21/12/2018	627.0	83.4
MB15HD20008	22/12/2018	627.0	83.4
MB15HD20008	23/12/2018	626.9	83.4
MB15HD20008	24/12/2018	626.9	83.4
MB15HD20008	25/12/2018	627.0	83.4
MB15HD20008	26/12/2018	627.0	83.4
MB15HD20008	27/12/2018	626.9	83.4
MB15HD20008	28/12/2018	626.9	83.4
MB15HD20008	29/12/2018	627.0	83.4
MB15HD20008	30/12/2018	627.0	83.4
MB15HD20008	31/12/2018	627.0	83.4
MB15HD20008	1/01/2019	627.0	83.4
MB15HD20008	2/01/2019	627.0	83.4
MB15HD20008	3/01/2019	627.0	83.4
MB15HD20008	4/01/2019	627.0	83.4
MB15HD20008	5/01/2019	627.0	83.4
MB15HD20008	6/01/2019	627.0	83.4
MB15HD20008	7/01/2019	627.0	83.4
MB15HD20008	8/01/2019	627.0	83.4
MB15HD20008	9/01/2019	627.0	83.4
MB15HD20008	10/01/2019	627.0	83.4
MB15HD20008	11/01/2019	627.0	83.4
MB15HD20008	12/01/2019	627.0	83.4
MB15HD20008	13/01/2019	627.0	83.4
MB15H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDRE1	11/10/2021	628.9	50.4
HDRE1	10/10/2021	629.0	50.3
HDRE1	9/10/2021	629.0	50.3
HDRE1	8/10/2021	629.0	50.3
HDRE1	7/10/2021	629.0	50.3
HDRE1	6/10/2021	629.0	50.3
HDRE1	5/10/2021	629.0	50.3
HDRE1	4/10/2021	629.0	50.3
HDRE1	3/10/2021	629.0	50.3
HDRE1	2/10/2021	629.0	50.3
HDRE1	1/10/2021	628.9	50.4
HDRE1	30/09/2021	629.0	50.3
HDRE1	29/09/2021	629.0	50.3
HDRE1	28/09/2021	629.0	50.3
HDRE1	27/09/2021	629.0	50.3
HDRE1	26/09/2021	629.0	50.3
HDRE1	25/09/2021	629.0	50.3
HDRE1	24/09/2021	629.0	50.3
HDRE1	23/09/2021	629.0	50.3
HDRE1	22/09/2021	629.1	50.2
HDRE1	21/09/2021	629.1	50.2
HDRE1	20/09/2021	629.1	50.2
HDRE1	19/09/2021	629.0	50.3
HDRE1	18/09/2021	629.0	50.3
HDRE1	17/09/2021	629.0	50.3
HDRE1	16/09/2021	629.0	50.3
HDRE1	15/09/2021	629.0	50.3
HDRE1	14/09/2021	629.0	50.3
HDRE1	13/09/2021	629.0	50.3
HDRE1	12/09/2021	629.0	50.3
HDRE1	11/09/2021	629.0	50.3
HDRE1	10/09/2021	629.0	50.3
HDRE1	9/09/2021	629.1	50.2
HDRE1	8/09/2021	629.1	50.2
HDRE1	7/09/2021	629.1	50.2
HDRE1	6/09/2021	629.1	50.2
HDRE1	5/09/2021	629.1	50.2
HDRE1	4/09/2021	629.1	50.2
HDRE1	3/09/2021	629.0	50.3
HDRE1	2/09/2021	629.0	50.3
HDRE1	1/09/2021	629.0	50.3
HDRE1	31/08/2021	629.0	50.3
HDRE1	30/08/2021	629.0	50.3
HDRE1	29/08/2021	629.0	50.3
HDRE1	28/08/2021	629.0	50.3
HDRE1	27/08/2021	629.0	50.3
HDRE1	26/08/2021	629.0	50.3
HDRE1	25/08/2021	629.0	50.3
HDRE1	24/08/2021	629.1	50.2
HDRE1	23/08/2021	629.1	50.2
HDRE1	22/08/2021	629.1	50.2
HDRE1	21/08/2021	629.0	50.2
HDRE1	20/08/2021	629.1	50.2
HDRE1	19/08/2021	629.0	50.3
HDRE1	18/08/2021	629.0	50.3
HDRE1	17/08/2021	629.0	50.2
HDRE1	16/08/2021	629.1	50.2
HDRE1	15/08/2021	629.0	50.2
HDRE1	14/08/2021	629.0	50.3
HDRE1	13/08/2021	629.0	50.3
HDRE1	12/08/2021	629.1	50.2
HDRE1	11/08/2021	629.1	50.2
HDRE1	10/08/2021	629.0	50.3
HDRE1	9/08/2021	629.0	50.3
HDRE1	8/08/2021	629.0	50.3
HDRE1	7/08/2021	629.0	50.3
HDRE1	6/08/2021	629.0	50.3
HDRE1	5/08/2021	629.0	50.3
HDRE1	4/08/2021	629.0	50.3
HDRE1	3/08/2021	629.0	50.3
HDRE1	2/08/2021	629.0	50.3
HDRE1	1/08/2021	629.0	50.3
HDRE1	31/07/2021	629.0	50.3
HDRE1	30/07/2021	628.9	50.4
HDRE1	29/07/2021	628.9	50.3
HDRE1	28/07/2021	628.9	50.3
HDRE1	27/07/2021	629.0	50.3
HDRE1	26/07/2021	629.0	50.3
HDRE1	25/07/2021	629.0	50.3
HDRE1	24/07/2021	629.0	50.3
HDRE1	23/07/2021	629.0	50.3
HDRE1	22/07/2021	629.0	50.3
HDRE1	21/07/2021	629.0	50.3
HDRE1	20/07/2021	629.0	50.3
HDRE1	19/07/2021	629.0	50.3
HDRE1	18/07/2021	628.9	50.4
HDRE1	17/07/2021	629.0	50.3
HDRE1	16/07/2021	629.0	50.3
HDRE1	15/07/2021	629.0	50.3
HDRE1	14/07/2021	628.9	50.4
HDRE1	13/07/2021	629.0	50.3
HDRE1	12/07/2021	629.0	50.3
HDRE1	11/07/2021	629.0	50.3
HDRE1	10/07/2021	629.0	50.3
HDRE1	9/07/2021	629.0	50.3
HDRE1	8/07/2021	629.0	50.3
HDRE1	7/07/2021	629.0	50.3
HDRE1	6/07/2021	629.0	50.3
HDRE1	5/07/2021	629.0	50.3
HDRE1	4/07/2021	629.0	50.3
HDRE1	3/07/2021	629.0	50.3
HDRE1	2/07/2021	629.0	50.3
HDRE1	1/07/2021	629.0	50.3
HDRE1	30/06/2021	629.0	50.3
HDRE1	29/06/2021	629.0	50.3
HDRE1	28/06/2021	629.0	50.3
HDRE1	27/06/2021	629.0	50.3
HDRE1	26/06/2021	629.0	50.3
HDRE1	25/06/2021	629.0	50.3
HDRE1	24/06/2021	629.0	50.3
HDRE1	23/06/2021	629.0	50.3
HDRE1	22/06/2021	629.0	50.3
HDRE1	21/06/2021	628.9	50.4
HDRE1	20/06/2021	628.9	50.4
HDRE1	19/06/2021	629.0	50.3
HDRE1	18/06/2021	629.0	50.3
HDRE1	17/06/2021	629.0	50.3
HDRE1	16/06/2021	629.0	50.3
HDRE1	15/06/2021	628.9	50.4
HDRE1	14/06/2021	628.9	50.4
HDRE1	13/06/2021	628.9	50.3
HDRE1	12/06/2021	628.9	50.4
HDRE1	11/06/2021	628.9	50.4
HDRE1	10/06/2021	628.9	50.4
HDRE1	9/06/2021	629.0	50.3
HDRE1	8/06/2021	629.0	50.3
HDRE1	7/06/2021	629.0	50.3
HDRE1	6/06/2021	628.9	50.3
HDRE1	5/06/2021	628.9	50.4
HDRE1	4/06/2021	629.0	50.3
HDRE1	3/06/2021	629.0	50.3
HDRE1	2/06/2021	628.9	50.4
HDRE1	1/06/2021	628.9	50.4
HDRE1	31/05/2021	628.9	50.4
HDRE1	30/05/2021	628.9	50.4
HDRE1	29/05/2021	629.0	50.3

ID	Date	WL mAHD	WL mbgl
HDVP2	1/01/2010	328.4	358.1
HDVP2	31/12/2009	328.4	358.1
HDVP2	30/12/2009	273.0	413.5
HDVP2	29/12/2009	273.0	413.5
HDVP2	28/12/2009	273.0	413.5
HDVP2	27/12/2009	273.0	413.5
HDVP2	26/12/2009	273.0	413.5
HDVP2	25/12/2009	273.0	413.5
HDVP2	24/12/2009	273.0	413.5
HDVP2	23/12/2009	273.0	413.5
HDVP2	22/12/2009	273.0	413.5
HDVP2	21/12/2009	273.0	413.5
HDVP2	20/12/2009	273.0	413.5
HDVP2	19/12/2009	273.0	413.5
HDVP2	18/12/2009	273.0	413.5
HDVP2	17/12/2009	273.0	413.5
HDVP2	16/12/2009	273.0	413.5
HDVP2	15/12/2009	273.0	413.5
HDVP2	14/12/2009	273.0	413.5
HDVP2	13/12/2009	273.0	413.5
HDVP2	12/12/2009	273.0	413.5
HDVP2	11/12/2009	273.0	413.5
HDVP2	10/12/2009	273.0	413.5
HDVP2	9/12/2009	273.0	413.5
HDVP2	8/12/2009	273.0	413.5
HDVP2	7/12/2009	273.0	413.5
HDVP2	6/12/2009	273.0	413.5
HDVP2	5/12/2009	273.0	413.5
HDVP2	4/12/2009	273.0	413.5
HDVP2	3/12/2009	273.0	413.5
HDVP2	2/12/2009	273.0	413.5
HDVP2	1/12/2009	232.9	453.7
HDVP2	30/11/2009	232.9	453.7
HDVP2	29/11/2009	232.9	453.7
HDVP2	28/11/2009	232.9	453.7
HDVP2	27/11/2009	232.9	453.7
HDVP2	26/11/2009	232.9	453.7
HDVP2	25/11/2009	232.9	453.7
HDVP2	24/11/2009	232.9	453.7
HDVP2	23/11/2009	232.9	453.7
HDVP2	22/11/2009	232.9	453.7
HDVP2	21/11/2009	232.9	453.7
HDVP2	20/11/2009	232.9	453.7
HDVP2	19/11/2009	232.9	453.7
HDVP2	18/11/2009	232.9	453.7
HDVP2	17/11/2009	232.9	453.7
HDVP2	16/11/2009	232.9	453.7
HDVP2	15/11/2009	232.9	453.7
HDVP2	14/11/2009	232.9	453.7
HDVP2	13/11/2009	232.9	453.7
HDVP2	12/11/2009	232.9	453.7
HDVP2	11/11/2009	232.9	453.7
HDVP2	10/11/2009	232.9	453.7
HDVP2	9/11/2009	232.9	453.7
HDVP2	8/11/2009	232.9	453.7
HDVP2	7/11/2009	232.9	453.7
HDVP2	6/11/2009	232.9	453.7
HDVP2	5/11/2009	232.9	453.7
HDVP2	4/11/2009	232.9	453.7
HDVP2	3/11/2009	232.9	453.7
HDVP2	2/11/2009	232.9	453.7
HDVP2	1/11/2009	232.9	453.7
HDVP2	31/10/2009	232.9	453.7
HDVP2	30/10/2009	232.9	453.7
HDVP2	29/10/2009	232.9	453.7
HDVP2	28/10/2009	232.9	453.7
HDVP2	27/10/2009	232.9	453.7
HDVP2	26/10/2009	232.9	453.7
HDVP2	25/10/2009	232.9	453.7
HDVP2	24/10/2009	232.9	453.7
HDVP2	23/10/2009	232.9	453.7
HDVP2	22/10/2009	232.9	453.7
HDVP2	21/10/2009	232.9	453.7
HDVP2	20/10/2009	232.9	453.7
HDVP2	19/10/2009	232.9	453.7
HDVP2	18/10/2009	232.9	453.7
HDVP2	17/10/2009	232.9	453.7
HDVP2	16/10/2009	232.9	453.7
HDVP2	15/10/2009	232.9	453.7
HDVP2	14/10/2009	232.9	453.7
HDVP2	13/10/2009	232.9	453.7
HDVP2	12/10/2009	232.9	453.7
HDVP2	11/10/2009	232.9	453.7
HDVP2	10/10/2009	232.9	453.7
HDVP2	9/10/2009	232.9	453.7
HDVP2	8/10/2009	232.9	453.7
HDVP2	7/10/2009	232.9	453.7
HDVP2	6/10/2009	232.9	453.7
HDVP2	5/10/2009	232.9	453.7
HDVP2	4/10/2009	232.9	453.7
HDVP2	3/10/2009	232.9	453.7
HDVP2	2/10/2009	232.9	453.7
HDVP2	1/10/2009	232.9	453.7
HDVP2	30/09/2009	232.9	453.7
HDVP2	29/09/2009	232.9	453.7
HDVP2	28/09/2009	232.9	453.7
HDVP2	27/09/2009	232.9	453.7
HDVP2	26/09/2009	232.9	453.7
HDVP2	25/09/2009	232.9	453.7
HDVP2	24/09/2009	232.9	453.7
HDVP2	23/09/2009	232.9	453.7
HDVP2	22/09/2009	232.9	453.7
HDVP2	21/09/2009	232.9	453.7
HDVP2	20/09/2009	232.9	453.7
HDVP2	19/09/2009	232.9	453.7
HDVP2	18/09/2009	232.9	453.7
HDVP2	17/09/2009	232.9	453.7
HDVP2	16/09/2009	232.9	453.7
HDVP2	15/09/2009	232.9	453.7
HDVP2	14/09/2009	232.9	453.7
HDVP2	13/09/2009	232.9	453.7
HDVP2	12/09/2009	232.9	453.7
HDVP2	11/09/2009	232.9	453.7
HDVP2	10/09/2009	232.9	453.7
HDVP2	9/09/2009	232.9	453.7
HDVP2	8/09/2009	232.9	453.7
HDVP2	7/09/2009	232.9	453.7
HDVP2	6/09/2009	232.9	453.7
HDVP2	5/09/2009	232.9	453.7
HDVP2	4/09/2009	232.9	453.7
HDVP2	3/09/2009	232.9	453.7
HDVP2	2/09/2009	232.9	453.7
HDVP2	1/09/2009	232.9	453.7
HDVP2	31/08/2009	232.9	453.7
HDVP2	30/08/2009	232.9	453.7
HDVP2	29/08/2009	232.9	453.7
HDVP2	28/08/2009	232.9	453.7
HDVP2	27/08/2009	232.9	453.7
HDVP2	26/08/2009	232.9	453.7
HDVP2	25/08/2009	232.9	453.7
HDVP2	24/08/2009	232.9	453.7
HDVP2	23/08/2009	232.9	453.7
HDVP2	22/08/2009	232.9	453.7
HDVP2	21/08/2009	232.9	453.7
HDVP2	20/08/2009	232.9	453.7
HDVP2	19/08/2009	232.9	453.7

ID	Date	WL mAHD	WL mbgl
MB18WON0006	26/11/2021	623.9	46.8
MB18WON0006	25/11/2021	623.9	46.8
MB18WON0006	24/11/2021	623.9	46.8
MB18WON0006	23/11/2021	623.9	46.8
MB18WON0006	22/11/2021	623.9	46.8
MB18WON0006	21/11/2021	623.9	46.8
MB18WON0006	20/11/2021	623.9	46.8
MB18WON0006	19/11/2021	623.9	46.8
MB18WON0006	18/11/2021	623.9	46.8
MB18WON0006	17/11/2021	623.9	46.8
MB18WON0006	16/11/2021	623.9	46.8
MB18WON0006	15/11/2021	623.9	46.8
MB18WON0006	13/11/2021	623.9	46.8
MB18WON0006	12/11/2021	623.9	46.8
MB18WON0006	11/11/2021	623.9	46.8
MB18WON0006	10/11/2021	623.9	46.8
MB18WON0006	9/11/2021	623.9	46.8
MB18WON0006	7/11/2021	623.9	46.8
MB18WON0006	6/11/2021	623.9	46.8
MB18WON0006	5/11/2021	623.9	46.8
MB18WON0006	4/11/2021	623.9	46.8
MB18WON0006	3/11/2021	623.9	46.8
MB18WON0006	2/11/2021	623.9	46.8
MB18WON0006	1/11/2021	623.9	46.8
MB18WON0006	31/10/2021	623.9	46.8
MB18WON0006	30/10/2021	623.9	46.8
MB18WON0006	29/10/2021	623.9	46.8
MB18WON0006	28/10/2021	623.9	46.8
MB18WON0006	27/10/2021	623.9	46.8
MB18WON0006	26/10/2021	623.9	46.8
MB18WON0006	25/10/2021	623.9	46.8
MB18WON0006	24/10/2021	623.9	46.8
MB18WON0006	23/10/2021	624.0	46.7
MB18WON0006	22/10/2021	624.0	46.7
MB18WON0006	21/10/2021	624.0	46.7
MB18WON0006	20/10/2021	623.9	46.7
MB18WON0006	19/10/2021	623.9	46.8
MB18WON0006	18/10/2021	623.9	46.8
MB18WON0006	17/10/2021	623.9	46.8
MB18WON0006	16/10/2021	623.9	46.8
MB18WON0006	15/10/2021	623.9	46.8
MB18WON0006	14/10/2021	623.9	46.8
MB18WON0006	13/10/2021	623.9	46.7
MB18WON0006	12/10/2021	623.9	46.8
MB18WON0006	11/10/2021	623.9	46.8
MB18WON0006	10/10/2021	623.9	46.7
MB18WON0006	9/10/2021	623.9	46.8
MB18WON0006	8/10/2021	623.9	46.8
MB18WON0006	7/10/2021	623.9	46.8
MB18WON0006	6/10/2021	623.9	46.8
MB18WON0006	5/10/2021	623.9	46.8
MB18WON0006	4/10/2021	623.9	46.8
MB18WON0006	3/10/2021	623.9	46.8
MB18WON0006	2/10/2021	623.9	46.8
MB18WON0006	1/10/2021	623.9	46.8
MB18WON0006	30/09/2021	623.9	46.8
MB18WON0006	29/09/2021	623.9	46.7
MB18WON0006	28/09/2021	623.9	46.7
MB18WON0006	27/09/2021	623.9	46.7
MB18WON0006	26/09/2021	623.9	46.8
MB18WON0006	25/09/2021	623.9	46.8
MB18WON0006	24/09/2021	624.0	46.7
MB18WON0006	23/09/2021	624.0	46.7
MB18WON0006	22/09/2021	624.0	46.7
MB18WON0006	21/09/2021	624.0	46.7
MB18WON0006	20/09/2021	624.0	46.7
MB18WON0006	19/09/2021	624.0	46.7
MB18WON0006	18/09/2021	624.0	46.7
MB18WON0006	17/09/2021	624.0	46.7
MB18WON0006	16/09/2021	624.0	46.7
MB18WON0006	15/09/2021	624.0	46.7
MB18WON0006	14/09/2021	624.0	46.7
MB18WON0006	13/09/2021	624.0	46.7
MB18WON0006	12/09/2021	623.9	46.7
MB18WON0006	11/09/2021	624.0	46.7
MB18WON0006	10/09/2021	624.0	46.7
MB18WON0006	9/09/2021	624.0	46.7
MB18WON0006	8/09/2021	624.0	46.7
MB18WON0006	7/09/2021	624.0	46.7
MB18WON0006	6/09/2021	624.0	46.7
MB18WON0006	5/09/2021	624.0	46.7
MB18WON0006	4/09/2021	624.0	46.7
MB18WON0006	3/09/2021	624.0	46.7
MB18WON0006	2/09/2021	624.0	46.7
MB18WON0006	1/09/2021	623.9	46.7
MB18WON0006	31/08/2021	624.0	46.7
MB18WON0006	30/08/2021	624.0	46.7
MB18WON0006	29/08/2021	624.0	46.7
MB18WON0006	28/08/2021	624.0	46.7
MB18WON0006	27/08/2021	624.0	46.7
MB18WON0006	26/08/2021	624.0	46.7
MB18WON0006	25/08/2021	624.0	46.7
MB18WON0006	24/08/2021	624.0	46.7
MB18WON0006	23/08/2021	624.0	46.7
MB18WON0006	22/08/2021	624.0	46.7
MB18WON0006	21/08/2021	624.0	46.7
MB18WON0006	20/08/2021	624.0	46.7
MB18WON0006	19/08/2021	624.0	46.7
MB18WON0006	18/08/2021	624.0	46.7
MB18WON0006	17/08/2021	624.0	46.7
MB18WON0006	16/08/2021	624.0	46.7
MB18WON0006	15/08/2021	624.0	46.7
MB18WON0006	14/08/2021	624.0	46.7
MB18WON0006	13/08/2021	624.0	46.7
MB18WON0006	12/08/2021	624.1	46.6
MB18WON0006	11/08/2021	624.1	46.6
MB18WON0006	10/08/2021	624.0	46.7
MB18WON0006	9/08/2021	624.0	46.7
MB18WON0006	8/08/2021	624.0	46.7
MB18WON0006	7/08/2021	624.0	46.7
MB18WON0006	6/08/2021	624.0	46.6
MB18WON0006	5/08/2021	624.1	46.6
MB18WON0006	4/08/2021	624.1	46.6
MB18WON0006	3/08/2021	624.0	46.7
MB18WON0006	2/08/2021	624.0	46.7
MB18WON0006	1/08/2021	624.0	46.7
MB18WON0006	31/07/2021	624.0	46.7
MB18WON0006	30/07/2021	624.0	46.7
MB18WON0006	29/07/2021	624.0	46.7
MB18WON0006	28/07/2021	624.0	46.7
MB18WON0006	27/07/2021	624.0	46.7
MB18WON0006	26/07/2021	624.0	46.7
MB18WON0006	25/07/2021	624.0	46.7
MB18WON0006	24/07/2021	624.0	46.7
MB18WON0006	23/07/2021	624.0	46.7
MB18WON0006	22/07/2021	624.0	46.7
MB18WON0006	21/07/2021	624.0	46.7
MB18WON0006	20/07/2021	624.0	46.7
MB18WON0006	19/07/2021	624.0	46.7
MB18WON0006	18/07/2021	624.0	46.7
MB18WON0006	17/07/2021	624.0	46.7
MB18WON0006	16/07/2021	624.0	46.7
MB18WON0006	15/07/2021	624.0	46.7
MB18WON0006	14/07/2021	624.0	46.7
MB18WON0006	13/07/2021	624.0	46.7
MB18WON0006	12/07/2021	624.0	46.7

ID	Date	WL mAHD	WL mbgl
MB15HD20008	15/02/2019	627.0	83.3
MB15HD20008	16/02/2019	627.0	83.3
MB15HD20008	17/02/2019	627.0	83.3
MB15HD20008	18/02/2019	627.0	83.4
MB15HD20008	19/02/2019	627.0	83.3
MB15HD20008	20/02/2019	627.0	83.4
MB15HD20008	21/02/2019	627.0	83.3
MB15HD20008	22/02/2019	627.0	83.3
MB15HD20008	23/02/2019	627.0	83.3
MB15HD20008	24/02/2019	627.0	83.3
MB15HD20008	25/02/2019	627.0	83.3
MB15HD20008	26/02/2019	627.0	83.3
MB15HD20008	27/02/2019	627.0	83.3
MB15HD20008	28/02/2019	627.0	83.3
MB15HD20008	1/03/2019	627.0	83.3
MB15HD20008	2/03/2019	627.0	83.3
MB15HD20008	3/03/2019	627.0	83.3
MB15HD20008	4/03/2019	627.0	83.3
MB15HD20008	5/03/2019	627.0	83.3
MB15HD20008	6/03/2019	627.0	83.3
MB15HD20008	7/03/2019	627.0	83.3
MB15HD20008	8/03/2019	627.0	83.3
MB15HD20008	9/03/2019	627.0	83.3
MB15HD20008	10/03/2019	627.0	83.3
MB15HD20008	11/03/2019	627.0	83.3
MB15HD20008	12/03/2019	627.0	83.3
MB15HD20008	13/03/2019	627.0	83.3
MB15HD20008	14/03/2019	627.0	83.3
MB15HD20008	15/03/2019	627.0	83.3
MB15HD20008	16/03/2019	627.0	83.3
MB15HD20008	17/03/2019	627.0	83.3
MB15HD20008	18/03/2019	627.0	83.3
MB15HD20008	19/03/2019	627.0	83.3
MB15HD20008	20/03/2019	627.0	83.3
MB15HD20008	21/03/2019	627.0	83.3
MB15HD20008	22/03/2019	627.0	83.4
MB15HD20008	23/03/2019	627.0	83.4
MB15HD20008	24/03/2019	627.0	83.4
MB15HD20008	25/03/2019	627.0	83.3
MB15HD20008	26/03/2019	627.0	83.3
MB15HD20008	27/03/2019	627.0	83.3
MB15HD20008	28/03/2019	627.0	83.3
MB15HD20008	29/03/2019	627.0	83.3
MB15HD20008	30/03/2019	627.0	83.3
MB15HD20008	31/03/2019	627.0	83.3
MB15HD20008	1/04/2019	627.0	83.3
MB15HD20008	2/04/2019	627.0	83.3
MB15HD20008	3/04/2019	627.0	83.3
MB15HD20008	4/04/2019	627.0	83.3
MB15HD20008	5/04/2019	627.0	83.3
MB15HD20008	6/04/2019	627.0	83.3
MB15HD20008	7/04/2019	627.0	83.3
MB15HD20008	8/04/2019	627.0	83.3
MB15HD20008	9/04/2019	627.0	83.3
MB15HD20008	10/04/2019	627.0	83.3
MB15HD20008	11/04/2019	627.0	83.3
MB15HD20008	12/04/2019	627.1	83.3
MB15HD20008	13/04/2019	627.1	83.3
MB15HD20008	14/04/2019	627.0	83.3
MB15HD20008	15/04/2019	627.0	83.3
MB15HD20008	16/04/2019	627.0	83.3
MB15HD20008	17/04/2019	627.0	83.3
MB15HD20008	18/04/2019	627.0	83.3
MB15HD20008	19/04/2019	627.0	83.3
MB15HD20008	20/04/2019	627.0	83.3
MB15HD20008	21/04/2019	627.1	83.3
MB15HD20008	22/04/2019	627.1	83.3
MB15HD20008	23/04/2019	627.1	83.3
MB15HD20008	24/04/2019	627.1	83.3
MB15HD20008	25/04/2019	627.1	83.3
MB15HD20008	26/04/2019	627.1	83.3
MB15HD20008	27/04/2019	627.1	83.3
MB15HD20008	28/04/2019	627.1	83.3
MB15HD20008	29/04/2019	627.1	83.3
MB15HD20008	30/04/2019	627.1	83.3
MB15HD20008	1/05/2019	627.0	83.3
MB15HD20008	2/05/2019	627.1	83.3
MB15HD20008	3/05/2019	627.1	83.3
MB15HD20008	4/05/2019	627.1	83.3
MB15HD20008	5/05/2019	627.1	83.3
MB15HD20008	6/05/2019	627.1	83.3
MB15HD20008	7/05/2019	627.1	83.3
MB15HD20008	8/05/2019	627.1	83.3
MB15HD20008	9/05/2019	627.1	83.2
MB15HD20008	10/05/2019	627.1	83.2
MB15HD20008	11/05/2019	627.1	83.2
MB15HD20008	12/05/2019	627.1	83.2
MB15HD20008	13/05/2019	627.1	83.2
MB15HD20008	14/05/2019	627.1	83.2
MB15HD20008	15/05/2019	627.1	83.2
MB15HD20008	16/05/2019	627.1	83.3
MB15HD20008	17/05/2019	627.1	83.3
MB15HD20008	18/05/2019	627.1	83.3
MB15HD20008	19/05/2019	627.1	83.3
MB15HD20008	20/05/2019	627.1	83.3
MB15HD20008	21/05/2019	627.1	83.3
MB15HD20008	22/05/2019	627.1	83.2
MB15HD20008	23/05/2019	627.1	83.2
MB15HD20008	24/05/2019	627.1	83.2
MB15HD20008	25/05/2019	627.1	83.2
MB15HD20008	26/05/2019	627.1	83.2
MB15HD20008	27/05/2019	627.1	83.2
MB15HD20008	28/05/2019	627.1	83.2
MB15HD20008	29/05/2019	627.1	83.2
MB15H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDRE1	28/05/2021	629.0	50.3
HDRE1	27/05/2021	629.0	50.3
HDRE1	26/05/2021	629.0	50.3
HDRE1	25/05/2021	629.0	50.3
HDRE1	24/05/2021	629.0	50.3
HDRE1	23/05/2021	628.9	50.4
HDRE1	22/05/2021	628.9	50.4
HDRE1	21/05/2021	628.9	50.4
HDRE1	20/05/2021	628.9	50.4
HDRE1	19/05/2021	628.9	50.4
HDRE1	18/05/2021	628.9	50.4
HDRE1	17/05/2021	628.9	50.4
HDRE1	16/05/2021	628.9	50.4
HDRE1	15/05/2021	628.9	50.3
HDRE1	14/05/2021	629.0	50.3
HDRE1	13/05/2021	629.0	50.3
HDRE1	12/05/2021	629.0	50.3
HDRE1	11/05/2021	629.0	50.3
HDRE1	10/05/2021	629.0	50.3
HDRE1	9/05/2021	628.9	50.4
HDRE1	8/05/2021	628.9	50.4
HDRE1	7/05/2021	628.9	50.4
HDRE1	6/05/2021	628.9	50.4
HDRE1	5/05/2021	628.9	50.4
HDRE1	4/05/2021	628.9	50.4
HDRE1	3/05/2021	628.9	50.4
HDRE1	2/05/2021	628.9	50.4
HDRE1	1/05/2021	628.9	50.4
HDRE1	30/04/2021	628.9	50.4
HDRE1	29/04/2021	628.9	50.4
HDRE1	28/04/2021	629.0	50.3
HDRE1	27/04/2021	629.0	50.3
HDRE1	26/04/2021	628.9	50.3
HDRE1	25/04/2021	628.9	50.4
HDRE1	24/04/2021	628.9	50.4
HDRE1	23/04/2021	628.9	50.4
HDRE1	22/04/2021	628.9	50.4
HDRE1	21/04/2021	628.9	50.4
HDRE1	20/04/2021	628.9	50.4
HDRE1	19/04/2021	628.9	50.4
HDRE1	18/04/2021	628.9	50.4
HDRE1	17/04/2021	628.9	50.4
HDRE1	16/04/2021	628.9	50.4
HDRE1	15/04/2021	628.9	50.4
HDRE1	14/04/2021	628.9	50.4
HDRE1	13/04/2021	628.9	50.4
HDRE1	12/04/2021	628.9	50.4
HDRE1	11/04/2021	628.9	50.4
HDRE1	10/04/2021	628.9	50.4
HDRE1	9/04/2021	628.9	50.4
HDRE1	8/04/2021	628.8	50.5
HDRE1	7/04/2021	628.9	50.4
HDRE1	6/04/2021	628.9	50.4
HDRE1	5/04/2021	628.9	50.4
HDRE1	4/04/2021	628.9	50.4
HDRE1	3/04/2021	628.9	50.4
HDRE1	2/04/2021	628.9	50.4
HDRE1	1/04/2021	628.9	50.4
HDRE1	31/03/2021	628.9	50.4
HDRE1	30/03/2021	628.9	50.4
HDRE1	29/03/2021	628.9	50.4
HDRE1	28/03/2021	628.9	50.4
HDRE1	27/03/2021	628.9	50.4
HDRE1	26/03/2021	628.9	50.4
HDRE1	25/03/2021	628.8	50.5
HDRE1	24/03/2021	628.8	50.5
HDRE1	23/03/2021	628.8	50.5
HDRE1	22/03/2021	628.8	50.5
HDRE1	21/03/2021	628.8	50.5
HDRE1	20/03/2021	628.8	50.5
HDRE1	19/03/2021	628.9	50.4
HDRE1	18/03/2021	628.9	50.4
HDRE1	17/03/2021	628.9	50.4
HDRE1	16/03/2021	628.9	50.4
HDRE1	15/03/2021	628.9	50.4
HDRE1	14/03/2021	628.9	50.4
HDRE1	13/03/2021	628.9	50.4
HDRE1	12/03/2021	628.9	50.4
HDRE1	11/03/2021	628.9	50.4
HDRE1	10/03/2021	628.8	50.5
HDRE1	9/03/2021	628.8	50.5
HDRE1	8/03/2021	628.8	50.5
HDRE1	7/03/2021	628.8	50.5
HDRE1	6/03/2021	628.8	50.5
HDRE1	5/03/2021	628.8	50.5
HDRE1	4/03/2021	628.8	50.5
HDRE1	3/03/2021	628.8	50.5
HDRE1	2/03/2021	628.8	50.5
HDRE1	1/03/2021	628.8	50.5
HDRE1	28/02/2021	628.8	50.5
HDRE1	27/02/2021	628.8	50.5
HDRE1	26/02/2021	628.8	50.5
HDRE1	25/02/2021	628.8	50.5
HDRE1	24/02/2021	628.8	50.5
HDRE1	23/02/2021	628.8	50.5
HDRE1	22/02/2021	628.7	50.6
HDRE1	21/02/2021	628.7	50.6
HDRE1	20/02/2021	628.7	50.6
HDRE1	19/02/2021	628.7	50.6
HDRE1	18/02/2021	628.7	50.6
HDRE1	17/02/2021	628.7	50.6
HDRE1	16/02/2021	628.7	50.6
HDRE1	15/02/2021	628.7	50.6
HDRE1	14/02/2021	628.7	50.6
HDRE1	13/02/2021	628.7	50.6
HDRE1	12/02/2021	628.7	50.6
HDRE1	11/02/2021	628.7	50.6
HDRE1	10/02/2021	628.7	50.6
HDRE1	9/02/2021	628.7	50.6
HDRE1	8/02/2021	628.7	50.6
HDRE1	7/02/2021	628.6	50.7
HDRE1	6/02/2021	628.6	50.7
HDRE1	5/02/2021	628.6	50.7
HDRE1	4/02/2021	628.6	50.7
HDRE1	3/02/2021	628.6	50.7
HDRE1	2/02/2021	628.6	50.7
HDRE1	1/02/2021	628.6	50.7
HDRE1	31/01/2021	628.6	50.7
HDRE1	30/01/2021	628.6	50.7
HDRE1	29/01/2021	628.6	50.7
HDRE1	28/01/2021	628.6	50.7
HDRE1	27/01/2021	628.6	50.7
HDRE1	26/01/2021	628.6	50.7
HDRE1	25/01/2021	628.6	50.7
HDRE1	24/01/2021	628.6	50.7
HDRE1	23/01/2021	628.6	50.7
HDRE1	22/01/2021	628.6	50.7
HDRE1	21/01/2021	628.6	50.7
HDRE1	20/01/2021	628.6	50.7
HDRE1	19/01/2021	628.6	50.7
HDRE1	18/01/2021	628.6	50.7
HDRE1	17/01/2021	628.6	50.7
HDRE1	16/01/2021	628.6	50.7
HDRE1	15/01/2021	628.6	50.7
HDRE1	14/01/2021	628.6	50.7
HDRE1	13/01/2021	628.6	50.7

ID	Date	WL mAHD	WL mbgl
HDVP2	18/08/2009	232.9	453.7
HDVP2	17/08/2009	232.9	453.7
HDVP2	16/08/2009	232.9	453.7
HDVP2	15/08/2009	232.9	453.7
HDVP2	14/08/2009	232.9	453.7
HDVP2	13/08/2009	232.9	453.7
HDVP2	12/08/2009	232.9	453.7
HDVP2	11/08/2009	232.9	453.7
HDVP2	10/08/2009	232.9	453.7
HDVP2	9/08/2009	232.9	453.7
HDVP2	8/08/2009	232.9	453.7
HDVP2	7/08/2009	232.9	453.7
HDVP2	6/08/2009	232.9	453.7
HDVP2	5/08/2009	232.9	453.7
HDVP2	4/08/2009	232.9	453.7
HDVP2	3/08/2009	232.9	453.7
HDVP2	2/08/2009	232.9	453.7
HDVP2	1/08/2009	232.9	453.7
HDVP2	31/07/2009	232.9	453.7
HDVP2	30/07/2009	232.9	453.7
HDVP2	29/07/2009	232.9	453.7
HDVP2	28/07/2009	232.9	453.7
HDVP2	27/07/2009	232.9	453.7
HDVP2	26/07/2009	232.9	453.7
HDVP2	25/07/2009	232.9	453.7
HDVP2	24/07/2009	232.9	453.7
HDVP2	23/07/2009	232.9	453.7
HDVP2	22/07/2009	232.9	453.7
HDVP2	21/07/2009	232.9	453.7
HDVP2	20/07/2009	232.9	453.7
HDVP2	19/07/2009	232.9	453.7
HDVP2	18/07/2009	232.9	453.7
HDVP2	17/07/2009	232.9	453.7
HDVP2	16/07/2009	232.9	453.7
HDVP2	15/07/2009	232.9	453.7
HDVP2	14/07/2009	232.9	453.7
HDVP2	13/07/2009	232.9	453.7
HDVP2	12/07/2009	232.9	453.7
HDVP2	11/07/2009	232.9	453.7
HDVP2	10/07/2009	232.9	453.7
HDVP2	9/07/2009	232.9	453.7
HDVP2	8/07/2009	232.9	453.7
HDVP2	7/07/2009	232.9	453.7
HDVP2	6/07/2009	232.9	453.7
HDVP2	5/07/2009	232.9	453.7
HDVP2	4/07/2009	232.9	453.7
HDVP2	3/07/2009	232.9	453.7
HDVP2	2/07/2009	232.9	453.7
HDVP2	1/07/2009	232.9	453.7
HDVP2	30/06/2009	232.9	453.7
HDVP2	29/06/2009	232.9	453.7
HDVP2	28/06/2009	232.9	453.7
HDVP2	27/06/2009	232.9	453.7
HDVP2	26/06/2009	232.9	453.7
HDVP2	25/06/2009	232.9	453.7
HDVP2	24/06/2009	232.9	453.7
HDVP2	23/06/2009	232.9	453.7
HDVP2	22/06/2009	232.9	453.7
HDVP2	21/06/2009	232.9	453.7
HDVP2	20/06/2009	232.9	453.7
HDVP2	19/06/2009	232.9	453.7
HDVP2	18/06/2009	232.9	453.7
HDVP2	17/06/2009	232.9	453.7
HDVP2	16/06/2009	232.9	453.7
HDVP2	15/06/2009	232.9	453.7
HDVP2	14/06/2009	232.9	453.7
HDVP2	13/06/2009	232.9	453.7
HDVP2	12/06/2009	232.9	453.7
HDVP2	11/06/2009	232.9	453.7
HDVP2	10/06/2009	232.9	453.7
HDVP2	9/06/2009	232.9	453.7
HDVP2	8/06/2009	232.9	453.7
HDVP2	7/06/2009	232.9	453.7
HDVP2	6/06/2009	232.9	453.7
HDVP2	5/06/2009	232.9	453.7
HDVP2	4/06/2009	232.9	453.7
HDVP2	3/06/2009	232.9	453.7
HDVP2	2/06/2009	232.9	453.7
HDVP2	1/06/2009	232.9	453.7
HDVP2	31/05/2009	232.9	453.7
HDVP2	30/05/2009	232.9	453.7
HDVP2	29/05/2009	232.9	453.7
HDVP2	28/05/2009	232.9	453.7
HDVP2	27/05/2009	232.9	453.7
HDVP2	26/05/2009	232.9	453.7
HDVP2	25/05/2009	232.9	453.7
HDVP2	24/05/2009	232.9	453.7
HDVP2	23/05/2009	232.9	453.7
HDVP2	22/05/2009	232.9	453.7
HDVP2	21/05/2009	232.9	453.7
HDVP2	20/05/2009	232.9	453.7
HDVP2	19/05/2009	232.9	453.7
HDVP2	18/05/2009	232.9	453.7
HDVP2	17/05/2009	232.9	453.7
HDVP2	16/05/2009	232.9	453.7
HDVP2	15/05/2009	232.9	453.7
HDVP2	14/05/2009	232.9	453.7
HDVP2	13/05/2009	232.9	453.7
HDVP2	12/05/2009	232.9	453.7
HDVP2	11/05/2009	232.9	453.7
HDVP2	10/05/2009	232.9	453.7
HDVP2	9/05/2009	232.9	453.7
HDVP2	8/05/2009	232.9	453.7
HDVP2	7/05/2009	232.9	453.7
HDVP2	6/05/2009	232.9	453.7
HDVP2	5/05/2009	232.9	453.7
HDVP2	4/05/2009	232.9	453.7
HDVP2	3/05/2009	232.9	453.7
HDVP2	2/05/2009	232.9	453.7
HDVP2	1/05/2009	232.9	453.7
HDVP2	30/04/2009	232.9	453.7
HDVP2	29/04/2009	232.9	453.7
HDVP2	28/04/2009	232.9	453.7
HDVP2	27/04/2009	232.9	453.7
HDVP2	26/04/2009	232.9	453.7
HDVP2	25/04/2009	232.9	453.7
HDVP2	24/04/2009	232.9	453.7
HDVP2	23/04/2009	232.9	453.7
HDVP2	22/04/2009	232.9	453.7
HDVP2	21/04/2009	232.9	453.7
HDVP2	20/04/2009	232.9	453.7
HDVP2	19/04/2009	232.9	453.7
HDVP2	18/04/2009	232.9	453.7
HDVP2	17/04/2009	232.9	453.7
HDVP2	16/04/2009	232.9	453.7
HDVP2	15/04/2009	232.9	453.7
HDVP2	14/04/2009	232.9	453.7
HDVP2	13/04/2009	232.9	453.7
HDVP2	12/04/2009	232.9	453.7
HDVP2	11/04/2009	232.9	453.7
HDVP2	10/04/2009	232.9	453.7
HDVP2	9/04/2009	232.9	453.7
HDVP2	8/04/2009	232.9	453.7
HDVP2	7/04/2009	232.9	453.7
HDVP2	6/04/2009	232.9	453.7
HDVP2	5/04/2009	232.9	453.7

ID	Date	WL mAHD	WL mbgl
MB18WON0006	11/07/2021	624.0	46.7
MB18WON0006	10/07/2021	624.0	46.7
MB18WON0006	9/07/2021	624.0	46.7
MB18WON0006	8/07/2021	624.0	46.7
MB18WON0006	7/07/2021	624.0	46.7
MB18WON0006	6/07/2021	624.0	46.7
MB18WON0006	5/07/2021	624.0	46.7
MB18WON0006	4/07/2021	624.0	46.7
MB18WON0006	3/07/2021	624.0	46.7
MB18WON0006	2/07/2021	624.0	46.7
MB18WON0006	1/07/2021	624.0	46.7
MB18WON0006	30/06/2021	624.0	46.7
MB18WON0006	29/06/2021	624.0	46.7
MB18WON0006	28/06/2021	624.0	46.7
MB18WON0006	27/06/2021	624.0	46.7
MB18WON0006	26/06/2021	624.0	46.7
MB18WON0006	25/06/2021	624.0	46.7
MB18WON0006	24/06/2021	624.0	46.7
MB18WON0006	23/06/2021	624.0	46.7
MB18WON0006	22/06/2021	624.0	46.7
MB18WON0006	21/06/2021	624.0	46.7
MB18WON0006	20/06/2021	624.0	46.7
MB18WON0006	19/06/2021	624.0	46.7
MB18WON0006	18/06/2021	624.0	46.6
MB18WON0006	17/06/2021	624.0	46.6
MB18WON0006	16/06/2021	624.0	46.7
MB18WON0006	15/06/2021	624.0	46.7
MB18WON0006	14/06/2021	624.0	46.7
MB18WON0006	13/06/2021	624.0	46.7
MB18WON0006	12/06/2021	624.0	46.7
MB18WON0006	11/06/2021	624.0	46.7
MB18WON0006	10/06/2021	624.0	46.7
MB18WON0006	9/06/2021	624.0	46.7
MB18WON0006	8/06/2021	624.0	46.7
MB18WON0006	7/06/2021	624.0	46.7
MB18WON0006	6/06/2021	624.0	46.7
MB18WON0006	5/06/2021	624.0	46.7
MB18WON0006	4/06/2021	624.0	46.7
MB18WON0006	3/06/2021	624.0	46.7
MB18WON0006	2/06/2021	624.0	46.7
MB18WON0006	1/06/2021	624.0	46.7
MB18WON0006	31/05/2021	624.0	46.7
MB18WON0006	30/05/2021	624.0	46.7
MB18WON0006	29/05/2021	624.0	46.7
MB18WON0006	28/05/2021	624.0	46.7
MB18WON0006	27/05/2021	624.0	46.7
MB18WON0006	26/05/2021	624.0	46.7
MB18WON0006	25/05/2021	624.0	46.7
MB18WON0006	24/05/2021	624.0	46.7
MB18WON0006	23/05/2021	624.0	46.7
MB18WON0006	22/05/2021	624.0	46.7
MB18WON0006	21/05/2021	624.0	46.7
MB18WON0006	20/05/2021	624.0	46.7
MB18WON0006	19/05/2021	624.0	46.7
MB18WON0006	18/05/2021	624.0	46.7
MB18WON0006	17/05/2021	624.0	46.7
MB18WON0006	16/05/2021	624.0	46.7
MB18WON0006	15/05/2021	624.0	46.7
MB18WON0006	14/05/2021	624.0	46.7
MB18WON0006	13/05/2021	624.0	46.7
MB18WON0006	12/05/2021	624.0	46.7
MB18WON0006	11/05/2021	624.0	46.7
MB18WON0006	10/05/2021	624.0	46.7
MB18WON0006	9/05/2021	624.0	46.7
MB18WON0006	8/05/2021	624.0	46.7
MB18WON0006	7/05/2021	624.0	46.7
MB18WON0006	6/05/2021	624.0	46.7
MB18WON0006	5/05/2021	624.0	46.7
MB18WON0006	4/05/2021	624.0	46.7
MB18WON0006	3/05/2021	624.0	46.7
MB18WON0006	2/05/2021	624.0	46.7
MB18WON0006	1/05/2021	624.0	46.7
MB18WON0006	30/04/2021	624.0	46.7
MB18WON0006	29/04/2021	624.0	46.7
MB18WON0006	28/04/2021	624.0	46.7
MB18WON0006	27/04/2021	624.0	46.7
MB18WON0006	26/04/2021	624.0	46.7
MB18WON0006	25/04/2021	624.0	46.7
MB18WON0006	24/04/2021	624.0	46.7
MB18WON0006	23/04/2021	624.0	46.7
MB18WON0006	22/04/2021	624.0	46.7
MB18WON0006	21/04/2021	624.0	46.7
MB18WON0006	20/04/2021	624.0	46.7
MB18WON0006	19/04/2021	624.0	46.7
MB18WON0006	18/04/2021	624.0	46.7
MB18WON0006	17/04/2021	624.0	46.7
MB18WON0006	16/04/2021	624.0	46.7
MB18WON0006	15/04/2021	624.0	46.7
MB18WON0006	14/04/2021	624.0	46.7
MB18WON0006	13/04/2021	624.0	46.7
MB18WON0006	12/04/2021	624.0	46.7
MB18WON0006	11/04/2021	624.0	46.7
MB18WON0006	10/04/2021	624.0	46.7
MB18WON0006	9/04/2021	623.9	46.7
MB18WON0006	8/04/2021	623.9	46.8
MB18WON0006	7/04/2021	624.0	46.7
MB18WON0006	6/04/2021	624.0	46.7
MB18WON0006	5/04/2021	624.0	46.7
MB18WON0006	4/04/2021	624.0	46.7
MB18WON0006	3/04/2021	624.0	46.7
MB18WON0006	2/04/2021	624.0	46.7
MB18WON0006	1/04/2021	624.0	46.7
MB18WON0006	31/03/2021	624.0	46.7
MB18WON0006	30/03/2021	624.0	46.7
MB18WON0006	29/03/2021	624.0	46.7
MB18WON0006	28/03/2021	624.0	46.7
MB18WON0006	27/03/2021	623.9	46.8
MB18WON0006	26/03/2021	623.9	46.8
MB18WON0006	25/03/2021	623.9	46.8
MB18WON0006	24/03/2021	623.9	46.8
MB18WON0006	23/03/2021	623.9	46.8
MB18WON0006	22/03/2021	623.9	46.7
MB18WON0006	21/03/2021	623.9	46.8
MB18WON0006	20/03/2021	623.9	46.8
MB18WON0006	19/03/2021	624.0	46.7
MB18WON0006	18/03/2021	624.0	46.7
MB18WON0006	17/03/2021	624.0	46.7
MB18WON0006	16/03/2021	624.0	46.7
MB18WON0006	15/03/2021	624.0	46.7
MB18WON0006	14/03/2021	624.0	46.7
MB18WON0006	13/03/2021	624.0	46.7
MB18WON0006	12/03/2021	624.0	46.7
MB18WON0006	11/03/2021	623.9	46.7
MB18WON0006	10/03/2021	623.9	46.8
MB18WON0006	9/03/2021	623.9	46.8
MB18WON0006	8/03/2021	623.9	46.8
MB18WON0006	7/03/2021	623.9	46.8
MB18WON0006	6/03/2021	623.9	46.8
MB18WON0006	5/03/2021	623.9	46.8
MB18WON0006	4/03/2021	623.9	46.8
MB18WON0006	3/03/2021	623.9	46.8
MB18WON0006	2/03/2021	623.9	46.8
MB18WON0006	1/03/2021	623.9	46.8
MB18WON0006	28/02/2021	623.9	46.8
MB18WON0006	27/02/2021	623.9	46.8
MB18WON0006	26/02/2021	623.9	46.8

ID	Date	WL mAHD	WL mbgl
MB15HD20008	1/07/2019	627.1	83.3
MB15HD20008	2/07/2019	627.1	83.3
MB15HD20008	3/07/2019	627.1	83.3
MB15HD20008	4/07/2019	627.1	83.3
MB15HD20008	5/07/2019	627.1	83.3
MB15HD20008	6/07/2019	627.1	83.3
MB15HD20008	7/07/2019	627.1	83.2
MB15HD20008	8/07/2019	627.1	83.2
MB15HD20008	9/07/2019	627.1	83.2
MB15HD20008	10/07/2019	627.1	83.2
MB15HD20008	11/07/2019	627.1	83.2
MB15HD20008	12/07/2019	627.1	83.2
MB15HD20008	13/07/2019	627.1	83.2
MB15HD20008	14/07/2019	627.1	83.2
MB15HD20008	15/07/2019	627.1	83.2
MB15HD20008	16/07/2019	627.1	83.2
MB15HD20008	17/07/2019	627.1	83.2
MB15HD20008	18/07/2019	627.1	83.3
MB15HD20008	19/07/2019	627.1	83.3
MB15HD20008	20/07/2019	627.1	83.3
MB15HD20008	21/07/2019	627.1	83.3
MB15HD20008	22/07/2019	627.1	83.3
MB15HD20008	23/07/2019	627.1	83.2
MB15HD20008	24/07/2019	627.1	83.2
MB15HD20008	25/07/2019	627.1	83.2
MB15HD20008	26/07/2019	627.1	83.2
MB15HD20008	27/07/2019	627.1	83.3
MB15HD20008	28/07/2019	627.1	83.2
MB15HD20008	29/07/2019	627.1	83.3
MB15HD20008	30/07/2019	627.1	83.2
MB15HD20008	31/07/2019	627.1	83.2
MB15HD20008	1/08/2019	627.1	83.2
MB15HD20008	2/08/2019	627.1	83.2
MB15HD20008	3/08/2019	627.1	83.2
MB15HD20008	4/08/2019	627.1	83.2
MB15HD20008	5/08/2019	627.1	83.3
MB15HD20008	6/08/2019	627.1	83.3
MB15HD20008	7/08/2019	627.1	83.2
MB15HD20008	8/08/2019	627.1	83.2
MB15HD20008	9/08/2019	627.1	83.2
MB15HD20008	10/08/2019	627.1	83.2
MB15HD20008	11/08/2019	627.1	83.2
MB15HD20008	12/08/2019	627.1	83.2
MB15HD20008	13/08/2019	627.1	83.2
MB15HD20008	14/08/2019	627.1	83.3
MB15HD20008	15/08/2019	627.1	83.3
MB15HD20008	16/08/2019	627.1	83.3
MB15HD20008	17/08/2019	627.1	83.3
MB15HD20008	18/08/2019	627.1	83.2
MB15HD20008	19/08/2019	627.1	83.2
MB15HD20008	20/08/2019	627.1	83.2
MB15HD20008	21/08/2019	627.1	83.2
MB15HD20008	22/08/2019	627.1	83.2
MB15HD20008	23/08/2019	627.1	83.2
MB15HD20008	24/08/2019	627.1	83.2
MB15HD20008	25/08/2019	627.1	83.3
MB15HD20008	26/08/2019	627.1	83.3
MB15HD20008	27/08/2019	627.1	83.3
MB15HD20008	28/08/2019	627.1	83.3
MB15HD20008	29/08/2019	627.1	83.3
MB15HD20008	30/08/2019	627.1	83.3
MB15HD20008	31/08/2019	627.0	83.3
MB15HD20008	1/09/2019	627.1	83.3
MB15HD20008	2/09/2019	627.1	83.3
MB15HD20008	3/09/2019	627.0	83.3
MB15HD20008	4/09/2019	627.0	83.3
MB15HD20008	5/09/2019	627.1	83.3
MB15HD20008	6/09/2019	627.1	83.3
MB15HD20008	7/09/2019	627.1	83.3
MB15HD20008	8/09/2019	627.1	83.3
MB15HD20008	9/09/2019	627.1	83.3
MB15HD20008	10/09/2019	627.1	83.3
MB15HD20008	11/09/2019	627.1	83.2
MB15HD20008	12/09/2019	627.1	83.2
MB15HD20008	13/09/2019	627.1	83.3
MB15HD20008	14/09/2019	627.1	83.3
MB15HD20008	15/09/2019	627.1	83.3
MB15HD20008	16/09/2019	627.1	83.3
MB15HD20008	17/09/2019	627.1	83.3
MB15HD20008	18/09/2019	627.1	83.3
MB15HD20008	19/09/2019	627.0	83.3
MB15HD20008	20/09/2019	627.1	83.3
MB15HD20008	21/09/2019	627.1	83.3
MB15HD20008	22/09/2019	627.1	83.2
MB15HD20008	23/09/2019	627.1	83.2
MB15HD20008	24/09/2019	627.1	83.2
MB15HD20008	25/09/2019	627.1	83.2
MB15HD20008	26/09/2019	627.1	83.3
MB15HD20008	27/09/2019	627.1	83.3
MB15HD20008	28/09/2019	627.1	83.3
MB15HD20008	29/09/2019	627.1	83.3
MB15HD20008	30/09/2019	627.0	83.3
MB15HD20008	1/10/2019	627.1	83.3
MB15HD20008	2/10/2019	627.1	83.3
MB15HD20008	3/10/2019	627.1	83.3
MB15HD20008	4/10/2019	627.1	83.3
MB15HD20008	5/10/2019	627.1	83.3
MB15HD20008	6/10/2019	627.1	83.3
MB15HD20008	7/10/2019	627.1	83.3
MB15HD20008	8/10/2019	627.1	83.3
MB15HD20008	9/10/2019	627.1	83.3
MB15HD20008	10/10/2019	627.1	83.3
MB15HD20008	11/10/2019	627.1	83.3
MB15HD20008	12/10/2019	627.0	83.3
MB15H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDRE1	12/01/2021	628.6	50.7
HDRE1	11/01/2021	628.6	50.7
HDRE1	10/01/2021	628.6	50.7
HDRE1	9/01/2021	628.6	50.7
HDRE1	8/01/2021	628.6	50.7
HDRE1	7/01/2021	628.6	50.7
HDRE1	6/01/2021	628.6	50.7
HDRE1	5/01/2021	628.6	50.7
HDRE1	4/01/2021	628.6	50.7
HDRE1	3/01/2021	628.6	50.7
HDRE1	2/01/2021	628.6	50.7
HDRE1	1/01/2021	628.6	50.7
HDRE1	31/12/2020	628.6	50.7
HDRE1	30/12/2020	628.6	50.7
HDRE1	29/12/2020	628.6	50.7
HDRE1	28/12/2020	628.6	50.7
HDRE1	27/12/2020	628.6	50.7
HDRE1	26/12/2020	628.6	50.7
HDRE1	25/12/2020	628.6	50.7
HDRE1	24/12/2020	628.6	50.7
HDRE1	23/12/2020	628.6	50.7
HDRE1	22/12/2020	628.6	50.7
HDRE1	21/12/2020	628.6	50.7
HDRE1	20/12/2020	628.5	50.8
HDRE1	19/12/2020	628.5	50.8
HDRE1	18/12/2020	628.6	50.7
HDRE1	17/12/2020	628.6	50.7
HDRE1	16/12/2020	628.6	50.7
HDRE1	15/12/2020	628.6	50.7
HDRE1	14/12/2020	628.6	50.7
HDRE1	13/12/2020	628.6	50.7
HDRE1	12/12/2020	628.6	50.7
HDRE1	11/12/2020	628.6	50.7
HDRE1	10/12/2020	628.6	50.7
HDRE1	9/12/2020	628.5	50.8
HDRE1	8/12/2020	628.6	50.7
HDRE1	7/12/2020	628.6	50.7
HDRE1	6/12/2020	628.6	50.7
HDRE1	5/12/2020	628.6	50.7
HDRE1	4/12/2020	628.6	50.7
HDRE1	3/12/2020	628.6	50.7
HDRE1	2/12/2020	628.6	50.7
HDRE1	1/12/2020	628.6	50.7
HDRE1	30/11/2020	628.6	50.7
HDRE1	29/11/2020	628.6	50.7
HDRE1	28/11/2020	628.6	50.7
HDRE1	27/11/2020	628.6	50.7
HDRE1	26/11/2020	628.6	50.7
HDRE1	25/11/2020	628.6	50.7
HDRE1	24/11/2020	628.6	50.7
HDRE1	23/11/2020	628.5	50.7
HDRE1	22/11/2020	628.5	50.8
HDRE1	21/11/2020	628.5	50.8
HDRE1	20/11/2020	628.5	50.8
HDRE1	19/11/2020	628.5	50.7
HDRE1	18/11/2020	628.6	50.7
HDRE1	17/11/2020	628.6	50.7
HDRE1	16/11/2020	628.6	50.7
HDRE1	15/11/2020	628.6	50.7
HDRE1	14/11/2020	628.6	50.7
HDRE1	13/11/2020	628.6	50.7
HDRE1	12/11/2020	628.6	50.7
HDRE1	11/11/2020	628.6	50.7
HDRE1	10/11/2020	628.5	50.8
HDRE1	9/11/2020	628.5	50.8
HDRE1	8/11/2020	628.5	50.8
HDRE1	7/11/2020	628.5	50.8
HDRE1	6/11/2020	628.5	50.8
HDRE1	5/11/2020	628.6	50.7
HDRE1	4/11/2020	628.6	50.7
HDRE1	3/11/2020	628.6	50.7
HDRE1	2/11/2020	628.6	50.7
HDRE1	1/11/2020	628.5	50.8
HDRE1	31/10/2020	628.5	50.8
HDRE1	30/10/2020	628.6	50.7
HDRE1	29/10/2020	628.6	50.7
HDRE1	28/10/2020	628.5	50.8
HDRE1	27/10/2020	628.5	50.8
HDRE1	26/10/2020	628.5	50.8
HDRE1	25/10/2020	628.5	50.8
HDRE1	24/10/2020	628.5	50.8
HDRE1	23/10/2020	628.5	50.8
HDRE1	22/10/2020	628.5	50.8
HDRE1	21/10/2020	628.5	50.8
HDRE1	20/10/2020	628.5	50.8
HDRE1	19/10/2020	628.5	50.8
HDRE1	18/10/2020	628.5	50.8
HDRE1	17/10/2020	628.5	50.8
HDRE1	16/10/2020	628.5	50.8
HDRE1	15/10/2020	628.5	50.8
HDRE1	14/10/2020	628.5	50.8
HDRE1	13/10/2020	628.5	50.8
HDRE1	12/10/2020	628.5	50.8
HDRE1	11/10/2020	628.5	50.8
HDRE1	10/10/2020	628.5	50.8
HDRE1	9/10/2020	628.5	50.8
HDRE1	8/10/2020	628.5	50.8
HDRE1	7/10/2020	628.5	50.8
HDRE1	6/10/2020	628.5	50.8
HDRE1	5/10/2020	628.5	50.7
HDRE1	4/10/2020	628.5	50.8
HDRE1	3/10/2020	628.5	50.8
HDRE1	2/10/2020	628.5	50.8
HDRE1	1/10/2020	628.5	50.8
HDRE1	30/09/2020	628.5	50.8
HDRE1	29/09/2020	628.5	50.8
HDRE1	28/09/2020	628.5	50.8
HDRE1	27/09/2020	628.5	50.8
HDRE1	26/09/2020	628.5	50.8
HDRE1	25/09/2020	628.5	50.8
HDRE1	24/09/2020	628.5	50.8
HDRE1	23/09/2020	628.5	50.8
HDRE1	22/09/2020	628.5	50.8
HDRE1	21/09/2020	628.5	50.8
HDRE1	20/09/2020	628.5	50.8
HDRE1	19/09/2020	628.5	50.8
HDRE1	18/09/2020	628.5	50.8
HDRE1	17/09/2020	628.5	50.8
HDRE1	16/09/2020	628.5	50.8
HDRE1	15/09/2020	628.5	50.8
HDRE1	14/09/2020	628.5	50.8
HDRE1	13/09/2020	628.5	50.8
HDRE1	12/09/2020	628.5	50.8
HDRE1	11/09/2020	628.5	50.8
HDRE1	10/09/2020	628.5	50.8
HDRE1	9/09/2020	628.5	50.8
HDRE1	8/09/2020	628.5	50.8
HDRE1	7/09/2020	628.5	50.8
HDRE1	6/09/2020	628.5	50.8
HDRE1	5/09/2020	628.5	50.8
HDRE1	4/09/2020	628.5	50.8
HDRE1	3/09/2020	628.5	50.8
HDRE1	2/09/2020	628.5	50.8
HDRE1	1/09/2020	628.5	50.8
HDRE1	31/08/2020	628.5	50.8
HDRE1	30/08/2020	628.5	50.8

ID	Date	WL mAHD	WL mbgl
HDVP2	4/04/2009	232.9	453.7
HDVP2	3/04/2009	232.9	453.7
HDVP2	2/04/2009	232.9	453.7
HDVP2	1/04/2009	202.4	484.2
HDVP2	31/03/2009	202.4	484.2
HDVP2	30/03/2009	202.4	484.2
HDVP2	29/03/2009	202.4	484.2
HDVP2	28/03/2009	202.4	484.2
HDVP2	27/03/2009	202.4	484.2
HDVP2	26/03/2009	202.4	484.2
HDVP2	25/03/2009	202.4	484.2
HDVP2	24/03/2009	202.4	484.2
HDVP2	23/03/2009	202.4	484.2
HDVP2	22/03/2009	202.4	484.2
HDVP2	21/03/2009	202.4	484.2
HDVP2	20/03/2009	202.4	484.2
HDVP2	19/03/2009	202.4	484.2
HDVP2	18/03/2009	202.4	484.2
HDVP2	17/03/2009	202.4	484.2
HDVP2	16/03/2009	202.4	484.2
HDVP2	15/03/2009	202.4	484.2
HDVP2	14/03/2009	183.4	503.2
HDVP2	13/03/2009	183.4	503.2
HDVP2	12/03/2009	183.4	503.2
HDVP2	11/03/2009	183.4	503.2
HDVP2	10/03/2009	183.4	503.2
HDVP2	9/03/2009	183.4	503.2
HDVP2	8/03/2009	183.4	503.2
HDVP2	7/03/2009	183.4	503.2
HDVP2	6/03/2009	183.4	503.2
HDVP2	5/03/2009	183.4	503.2
HDVP2	4/03/2009	183.4	503.2
HDVP2	3/03/2009	183.4	503.2
HDVP2	2/03/2009	183.4	503.2
HDVP2	1/03/2009	183.4	503.2
HDVP2	28/02/2009	311.7	374.9
HDVP2	27/02/2009	311.7	374.9
HDVP2	26/02/2009	311.7	374.9
HDVP2	25/02/2009	311.7	374.9
HDVP2	24/02/2009	311.7	374.9
HDVP2	23/02/2009	311.7	374.9
HDVP2	22/02/2009	311.7	374.9
HDVP2	21/02/2009	311.7	374.9
HDVP2	20/02/2009	311.7	374.9
HDVP2	19/02/2009	311.7	374.9
HDVP2	18/02/2009	311.7	374.9
HDVP2	17/02/2009	311.7	374.9
HDVP2	16/02/2009	182.9	503.7
HDVP2	15/02/2009	182.9	503.7
HDVP2	14/02/2009	182.9	503.7
HDVP2	13/02/2009	182.9	503.7
HDVP2	12/02/2009	182.9	503.7
HDVP2	11/02/2009	182.9	503.7
HDVP2	10/02/2009	182.9	503.7
HDVP2	9/02/2009	182.9	503.7
HDVP2	8/02/2009	182.9	503.7
HDVP2	7/02/2009	182.9	503.7
HDVP2	6/02/2009	182.9	503.7
HDVP2	5/02/2009	182.9	503.7
HDVP2	4/02/2009	182.9	503.7
HDVP2	3/02/2009	182.9	503.7
HDVP2	2/02/2009	182.9	503.7
HDVP2	1/02/2009	109.4	577.1
HDVP2	31/01/2009	109.4	577.1
HDVP2	30/01/2009	109.4	577.1
HDVP2	29/01/2009	109.4	577.1
HDVP2	28/01/2009	109.4	577.1
HDVP2	27/01/2009	109.4	577.1
HDVP2	26/01/2009	109.4	577.1
HDVP2	25/01/2009	109.4	577.1
HDVP2	24/01/2009	109.4	577.1
HDVP2	23/01/2009	109.4	577.1
HDVP2	22/01/2009	109.4	577.1
HDVP2	21/01/2009	109.4	577.1
HDVP2	20/01/2009	109.4	577.1
HDVP2	19/01/2009	109.4	577.1
HDVP2	18/01/2009	70.4	616.1
HDVP2	17/01/2009	70.4	616.1
HDVP2	16/01/2009	70.4	616.1
HDVP2	15/01/2009	70.4	616.1
HDVP2	14/01/2009	70.4	616.1
HDVP2	13/01/2009	70.4	616.1
HDVP2	12/01/2009	70.4	616.1
HDVP2	11/01/2009	70.4	616.1
HDVP2	10/01/2009	70.4	616.1
HDVP2	9/01/2009	70.4	616.1
HDVP2	8/01/2009	70.4	616.1
HDVP2	7/01/2009	70.4	616.1
HDVP2	6/01/2009	70.4	616.1
HDVP2	5/01/2009	70.4	616.1
HDVP2	4/01/2009	70.4	616.1
HDVP2	3/01/2009	70.4	616.1
HDVP2	2/01/2009	70.4	616.1
HDVP2	1/01/2009	88.2	598.4
HDVP2	31/12/2008	88.2	598.4
HDVP2	30/12/2008	88.2	598.4
HDVP2	29/12/2008	88.2	598.4
HDVP2	28/12/2008	88.2	598.4
HDVP2	27/12/2008	88.2	598.4
HDVP2	26/12/2008	88.2	598.4
HDVP2	25/12/2008	88.2	598.4
HDVP2	24/12/2008	88.2	598.4
HDVP2	23/12/2008	88.2	598.4
HDVP2	22/12/2008	88.2	598.4
HDVP2	21/12/2008	101.3	585.3
HDVP2	20/12/2008	101.3	585.3
HDVP2	19/12/2008	101.3	585.3
HDVP2	18/12/2008	101.3	585.3
HDVP2	17/12/2008	101.3	585.3
HDVP2	16/12/2008	101.3	585.3
HDVP2	15/12/2008	101.3	585.3
HDVP2	14/12/2008	129.7	556.9
HDVP2	13/12/2008	129.7	556.9
HDVP2	12/12/2008	129.7	556.9
HDVP2	11/12/2008	129.7	556.9
HDVP2	10/12/2008	129.7	556.9
HDVP2	9/12/2008	129.7	556.9
HDVP2	8/12/2008	129.7	556.9
HDVP2	7/12/2008	129.7	556.9
HDVP2	6/12/2008	129.7	556.9
HDVP2	5/12/2008	129.7	556.9
HDVP2	4/12/2008	129.7	556.9
HDVP2	3/12/2008	129.7	556.9
HDVP2	2/12/2008	129.7	556.9
HDVP2	1/12/2008	108.2	578.3
HDVP2	30/11/2008	108.2	578.3
HDVP2	29/11/2008	108.2	578.3
HDVP2	28/11/2008	108.2	578.3
HDVP2	27/11/2008	0.0	686.5
HDVP2	26/11/2008	0.0	686.5
HDVP2	25/11/2008	0.0	686.5
HDVP2	24/11/2008	0.0	686.5
HDVP2	23/11/2008	0.0	686.5
HDVP2	22/11/2008	0.0	686.5
HDVP2	21/11/2008	0.0	686.5
HDVP2	20/11/2008	0.0	686.5

ID	Date	WL mAHD	WL mbgl
MB18WON0006	25/02/2021	623.9	46.8
MB18WON0006	24/02/2021	623.9	46.8
MB18WON0006	23/02/2021	623.9	46.8
MB18WON0006	22/02/2021	623.9	46.8
MB18WON0006	21/02/2021	623.9	46.8
MB18WON0006	20/02/2021	623.9	46.8
MB18WON0006	19/02/2021	623.9	46.8
MB18WON0006	18/02/2021	623.9	46.8
MB18WON0006	17/02/2021	623.9	46.8
MB18WON0006	16/02/2021	623.9	46.8
MB18WON0006	15/02/2021	623.9	46.8
MB18WON0006	14/02/2021	623.9	46.8
MB18WON0006	13/02/2021	623.9	46.8
MB18WON0006	12/02/2021	623.9	46.8
MB18WON0006	11/02/2021	623.9	46.8
MB18WON0006	10/02/2021	623.8	46.8
MB18WON0006	9/02/2021	623.9	46.8
MB18WON0006	8/02/2021	623.9	46.8
MB18WON0006	7/02/2021	623.9	46.8
MB18WON0006	6/02/2021	623.9	46.8
MB18WON0006	5/02/2021	623.9	46.8
MB18WON0006	4/02/2021	623.8	46.8
MB18WON0006	3/02/2021	623.9	46.8
MB18WON0006	2/02/2021	623.9	46.8
MB18WON0006	1/02/2021	623.9	46.8
MB18WON0006	31/01/2021	623.9	46.8
MB18WON0006	30/01/2021	623.9	46.8
MB18WON0006	29/01/2021	623.9	46.8
MB18WON0006	28/01/2021	623.9	46.8
MB18WON0006	27/01/2021	623.9	46.8
MB18WON0006	26/01/2021	623.9	46.8
MB18WON0006	25/01/2021	623.9	46.8
MB18WON0006	24/01/2021	623.9	46.8
MB18WON0006	23/01/2021	623.9	46.8
MB18WON0006	22/01/2021	623.9	46.8
MB18WON0006	21/01/2021	623.9	46.8
MB18WON0006	20/01/2021	623.9	46.8
MB18WON0006	19/01/2021	623.9	46.8
MB18WON0006	18/01/2021	623.9	46.8
MB18WON0006	17/01/2021	623.9	46.8
MB18WON0006	16/01/2021	623.9	46.8
MB18WON0006	15/01/2021	623.9	46.8
MB18WON0006	14/01/2021	623.9	46.8
MB18WON0006	13/01/2021	623.9	46.8
MB18WON0006	12/01/2021	623.9	46.8
MB18WON0006	11/01/2021	623.9	46.8
MB18WON0006	10/01/2021	623.9	46.8
MB18WON0006	9/01/2021	623.9	46.8
MB18WON0006	8/01/2021	623.9	46.8
MB18WON0006	7/01/2021	623.9	46.8
MB18WON0006	6/01/2021	623.9	46.8
MB18WON0006	5/01/2021	624.0	46.7
MB18WON0006	4/01/2021	623.9	46.8
MB18WON0006	3/01/2021	623.9	46.8
MB18WON0006	2/01/2021	623.9	46.8
MB18WON0006	1/01/2021	623.9	46.8
MB18WON0006	31/12/2020	623.9	46.8
MB18WON0006	30/12/2020	623.9	46.8
MB18WON0006	29/12/2020	623.9	46.8
MB18WON0006	28/12/2020	623.9	46.8
MB18WON0006	27/12/2020	623.9	46.8
MB18WON0006	26/12/2020	623.9	46.8
MB18WON0006	25/12/2020	623.9	46.8
MB18WON0006	24/12/2020	623.9	46.8
MB18WON0006	23/12/2020	623.9	46.8
MB18WON0006	22/12/2020	623.9	46.8
MB18WON0006	21/12/2020	623.9	46.8
MB18WON0006	20/12/2020	623.9	46.8
MB18WON0006	19/12/2020	623.9	46.8
MB18WON0006	18/12/2020	623.9	46.8
MB18WON0006	17/12/2020	623.9	46.8
MB18WON0006	16/12/2020	623.9	46.8
MB18WON0006	15/12/2020	623.9	46.8
MB18WON0006	14/12/2020	623.9	46.8
MB18WON0006	13/12/2020	623.9	46.8
MB18WON0006	12/12/2020	623.9	46.8
MB18WON0006	11/12/2020	623.9	46.8
MB18WON0006	10/12/2020	623.9	46.8
MB18WON0006	9/12/2020	623.9	46.8
MB18WON0006	8/12/2020	623.9	46.8
MB18WON0006	7/12/2020	623.9	46.7
MB18WON0006	6/12/2020	623.9	46.8
MB18WON0006	5/12/2020	623.9	46.8
MB18WON0006	4/12/2020	623.9	46.8
MB18WON0006	3/12/2020	623.9	46.8
MB18WON0006	2/12/2020	623.9	46.8
MB18WON0006	1/12/2020	623.9	46.7
MB18WON0006	30/11/2020	623.9	46.8
MB18WON0006	29/11/2020	623.9	46.8
MB18WON0006	28/11/2020	623.9	46.8
MB18WON0006	27/11/2020	623.9	46.8
MB18WON0006	26/11/2020	623.9	46.8
MB18WON0006	25/11/2020	623.9	46.8
MB18WON0006	24/11/2020	624.0	46.7
MB18WON0006	23/11/2020	624.0	46.7
MB18WON0006	22/11/2020	623.9	46.8
MB18WON0006	21/11/2020	623.9	46.8
MB18WON0006	20/11/2020	623.9	46.8
MB18WON0006	19/11/2020	623.9	46.8
MB18WON0006	18/11/2020	624.0	46.7
MB18WON0006	17/11/2020	623.9	46.7
MB18WON0006	16/11/2020	624.0	46.7
MB18WON0006	15/11/2020	624.0	46.7
MB18WON0006	14/11/2020	623.9	46.8
MB18WON0006	13/11/2020	623.9	46.8
MB18WON0006	12/11/2020	624.0	46.7
MB18WON0006	11/11/2020	624.0	46.7
MB18WON0006	10/11/2020	624.0	46.7
MB18WON0006	9/11/2020	623.9	46.7
MB18WON0006	8/11/2020	623.9	46.8
MB18WON0006	7/11/2020	623.9	46.7
MB18WON0006	6/11/2020	624.0	46.7
MB18WON0006	5/11/2020	624.0	46.7
MB18WON0006	4/11/2020	624.0	46.7
MB18WON0006	3/11/2020	624.0	46.7
MB18WON0006	2/11/2020	624.0	46.7
MB18WON0006	1/11/2020	623.9	46.8
MB18WON0006	31/10/2020	623.9	46.7
MB18WON0006	30/10/2020	624.0	46.7
MB18WON0006	29/10/2020	624.0	46.7
MB18WON0006	28/10/2020	624.0	46.7
MB18WON0006	27/10/2020	623.9	46.7
MB18WON0006	26/10/2020	623.9	46.8
MB18WON0006	25/10/2020	623.9	46.8
MB18WON0006	24/10/2020	623.9	46.8
MB18WON0006	23/10/2020	623.9	46.8
MB18WON0006	22/10/2020	623.9	46.7
MB18WON0006	21/10/2020	623.9	46.8
MB18WON0006	20/10/2020	624.0	46.7
MB18WON0006	19/10/2020	624.0	46.7
MB18WON0006	18/10/2020	623.9	46.8
MB18WON0006	17/10/2020	623.9	46.8
MB18WON0006	16/10/2020	623.9	46.8
MB18WON0006	15/10/2020	624.0	46.7
MB18WON0006	14/10/2020	624.0	46.7
MB18WON0006	13/10/2020	624.0	46.7

ID	Date	WL mAHD	WL mbgl
MB15HD20008	14/11/2019	627.0	83.3
MB15HD20008	15/11/2019	627.0	83.3
MB15HD20008	16/11/2019	627.0	83.3
MB15HD20008	17/11/2019	627.0	83.3
MB15HD20008	18/11/2019	627.0	83.3
MB15HD20008	19/11/2019	627.0	83.3
MB15HD20008	20/11/2019	627.0	83.3
MB15HD20008	21/11/2019	627.0	83.3
MB15HD20008	22/11/2019	627.0	83.3
MB15HD20008	23/11/2019	627.0	83.3
MB15HD20008	24/11/2019	627.0	83.3
MB15HD20008	25/11/2019	627.0	83.3
MB15HD20008	26/11/2019	627.0	83.4
MB15HD20008	27/11/2019	627.0	83.4
MB15HD20008	28/11/2019	627.0	83.4
MB15HD20008	29/11/2019	627.0	83.4
MB15HD20008	30/11/2019	627.0	83.3
MB15HD20008	1/12/2019	627.0	83.3
MB15HD20008	2/12/2019	627.0	83.3
MB15HD20008	3/12/2019	627.0	83.3
MB15HD20008	4/12/2019	627.0	83.3
MB15HD20008	5/12/2019	627.0	83.3
MB15HD20008	6/12/2019	627.0	83.3
MB15HD20008	7/12/2019	627.0	83.3
MB15HD20008	8/12/2019	627.0	83.3
MB15HD20008	9/12/2019	627.0	83.3
MB15HD20008	10/12/2019	627.0	83.3
MB15HD20008	11/12/2019	627.0	83.3
MB15HD20008	12/12/2019	627.0	83.3
MB15HD20008	13/12/2019	627.0	83.3
MB15HD20008	14/12/2019	627.0	83.4
MB15HD20008	15/12/2019	627.0	83.4
MB15HD20008	16/12/2019	627.0	83.3
MB15HD20008	17/12/2019	627.0	83.3
MB15HD20008	18/12/2019	627.0	83.3
MB15HD20008	19/12/2019	627.0	83.3
MB15HD20008	20/12/2019	627.0	83.3
MB15HD20008	21/12/2019	627.0	83.3
MB15HD20008	22/12/2019	627.0	83.3
MB15HD20008	23/12/2019	627.0	83.3
MB15HD20008	24/12/2019	627.0	83.3
MB15HD20008	25/12/2019	627.0	83.3
MB15HD20008	26/12/2019	627.0	83.4
MB15HD20008	27/12/2019	627.0	83.4
MB15HD20008	28/12/2019	627.0	83.4
MB15HD20008	29/12/2019	627.0	83.4
MB15HD20008	30/12/2019	627.0	83.4
MB15HD20008	31/12/2019	627.0	83.4
MB15HD20008	1/01/2020	627.0	83.3
MB15HD20008	2/01/2020	627.0	83.3
MB15HD20008	3/01/2020	627.0	83.3
MB15HD20008	4/01/2020	627.0	83.3
MB15HD20008	5/01/2020	627.0	83.3
MB15HD20008	6/01/2020	627.0	83.3
MB15HD20008	7/01/2020	627.0	83.4
MB15HD20008	8/01/2020	627.0	83.4
MB15HD20008	9/01/2020	627.0	83.4
MB15HD20008	10/01/2020	627.0	83.3
MB15HD20008	11/01/2020	627.0	83.3
MB15HD20008	12/01/2020	627.0	83.4
MB15HD20008	13/01/2020	627.0	83.4
MB15HD20008	14/01/2020	627.0	83.3
MB15HD20008	15/01/2020	627.0	83.3
MB15HD20008	16/01/2020	627.0	83.3
MB15HD20008	17/01/2020	627.0	83.3
MB15HD20008	18/01/2020	627.0	83.3
MB15HD20008	19/01/2020	627.0	83.3
MB15HD20008	20/01/2020	627.0	83.3
MB15HD20008	21/01/2020	627.0	83.3
MB15HD20008	22/01/2020	627.0	83.4
MB15HD20008	23/01/2020	627.0	83.4
MB15HD20008	24/01/2020	627.0	83.4
MB15HD20008	25/01/2020	627.0	83.4
MB15HD20008	26/01/2020	627.0	83.4
MB15HD20008	27/01/2020	627.0	83.4
MB15HD20008	28/01/2020	627.0	83.4
MB15HD20008	29/01/2020	627.0	83.4
MB15HD20008	30/01/2020	627.0	83.4
MB15HD20008	31/01/2020	627.0	83.4
MB15HD20008	1/02/2020	627.0	83.4
MB15HD20008	2/02/2020	627.0	83.3
MB15HD20008	3/02/2020	627.0	83.3
MB15HD20008	4/02/2020	627.0	83.3
MB15HD20008	5/02/2020	627.0	83.4
MB15HD20008	6/02/2020	627.0	83.4
MB15HD20008	7/02/2020	627.0	83.4
MB15HD20008	8/02/2020	627.0	83.4
MB15HD20008	9/02/2020	627.0	83.4
MB15HD20008	10/02/2020	627.0	83.4
MB15HD20008	11/02/2020	627.0	83.4
MB15HD20008	12/02/2020	627.0	83.3
MB15HD20008	13/02/2020	627.0	83.3
MB15HD20008	14/02/2020	627.0	83.3
MB15HD20008	15/02/2020	627.0	83.3
MB15HD20008	16/02/2020	627.0	83.3
MB15HD20008	17/02/2020	627.0	83.3
MB15HD20008	18/02/2020	627.0	83.3
MB15HD20008	19/02/2020	627.0	83.3
MB15HD20008	20/02/2020	627.0	83.4
MB15HD20008	21/02/2020	627.0	83.4
MB15HD20008	22/02/2020	627.0	83.4
MB15HD20008	23/02/2020	627.0	83.4
MB15HD20008	24/02/2020	627.0	83.4
MB15HD20008	25/02/2020	627.0	83.4
MB15H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDRE1	29/08/2020	628.5	50.8
HDRE1	28/08/2020	628.5	50.8
HDRE1	27/08/2020	628.5	50.8
HDRE1	26/08/2020	628.5	50.8
HDRE1	25/08/2020	628.5	50.8
HDRE1	24/08/2020	628.5	50.8
HDRE1	23/08/2020	628.5	50.8
HDRE1	22/08/2020	628.5	50.8
HDRE1	21/08/2020	628.5	50.8
HDRE1	20/08/2020	628.5	50.8
HDRE1	19/08/2020	628.5	50.8
HDRE1	18/08/2020	628.5	50.8
HDRE1	17/08/2020	628.5	50.8
HDRE1	16/08/2020	628.5	50.8
HDRE1	15/08/2020	628.5	50.8
HDRE1	14/08/2020	628.5	50.8
HDRE1	13/08/2020	628.5	50.8
HDRE1	12/08/2020	628.5	50.8
HDRE1	11/08/2020	628.5	50.8
HDRE1	10/08/2020	628.4	50.8
HDRE1	9/08/2020	628.4	50.9
HDRE1	8/08/2020	628.5	50.8
HDRE1	7/08/2020	628.5	50.8
HDRE1	6/08/2020	628.5	50.8
HDRE1	5/08/2020	628.5	50.8
HDRE1	4/08/2020	628.5	50.8
HDRE1	3/08/2020	628.4	50.9
HDRE1	2/08/2020	628.5	50.8
HDRE1	1/08/2020	628.5	50.8
HDRE1	31/07/2020	628.5	50.8
HDRE1	30/07/2020	628.5	50.8
HDRE1	29/07/2020	628.5	50.8
HDRE1	28/07/2020	628.5	50.8
HDRE1	27/07/2020	628.5	50.8
HDRE1	26/07/2020	628.5	50.8
HDRE1	25/07/2020	628.5	50.8
HDRE1	24/07/2020	628.5	50.8
HDRE1	23/07/2020	628.5	50.8
HDRE1	22/07/2020	628.5	50.8
HDRE1	21/07/2020	628.5	50.8
HDRE1	20/07/2020	628.5	50.8
HDRE1	19/07/2020	628.5	50.8
HDRE1	18/07/2020	628.4	50.9
HDRE1	17/07/2020	628.4	50.9
HDRE1	16/07/2020	628.4	50.9
HDRE1	15/07/2020	628.4	50.9
HDRE1	14/07/2020	628.4	50.9
HDRE1	13/07/2020	628.4	50.9
HDRE1	12/07/2020	628.4	50.8
HDRE1	11/07/2020	628.5	50.8
HDRE1	10/07/2020	628.5	50.8
HDRE1	9/07/2020	628.5	50.8
HDRE1	8/07/2020	628.5	50.8
HDRE1	7/07/2020	628.5	50.8
HDRE1	6/07/2020	628.5	50.8
HDRE1	5/07/2020	628.5	50.8
HDRE1	4/07/2020	628.5	50.8
HDRE1	3/07/2020	628.5	50.8
HDRE1	2/07/2020	628.5	50.8
HDRE1	1/07/2020	628.4	50.9
HDRE1	30/06/2020	628.4	50.9
HDRE1	29/06/2020	628.4	50.9
HDRE1	28/06/2020	628.4	50.9
HDRE1	27/06/2020	628.4	50.9
HDRE1	26/06/2020	628.4	50.9
HDRE1	25/06/2020	628.4	50.9
HDRE1	24/06/2020	628.4	50.9
HDRE1	23/06/2020	628.4	50.8
HDRE1	22/06/2020	628.4	50.8
HDRE1	21/06/2020	628.5	50.8
HDRE1	20/06/2020	628.5	50.8
HDRE1	19/06/2020	628.5	50.8
HDRE1	18/06/2020	628.5	50.8
HDRE1	17/06/2020	628.4	50.9
HDRE1	16/06/2020	628.4	50.9
HDRE1	15/06/2020	628.5	50.8
HDRE1	14/06/2020	628.5	50.8
HDRE1	13/06/2020	628.4	50.9
HDRE1	12/06/2020	628.4	50.9
HDRE1	11/06/2020	628.4	50.9
HDRE1	10/06/2020	628.5	50.8
HDRE1	9/06/2020	628.5	50.8
HDRE1	8/06/2020	628.5	50.8
HDRE1	7/06/2020	628.5	50.8
HDRE1	6/06/2020	628.5	50.8
HDRE1	5/06/2020	628.5	50.8
HDRE1	4/06/2020	628.5	50.8
HDRE1	3/06/2020	628.5	50.8
HDRE1	2/06/2020	628.5	50.8
HDRE1	1/06/2020	628.5	50.8
HDRE1	31/05/2020	628.5	50.8
HDRE1	30/05/2020	628.5	50.8
HDRE1	29/05/2020	628.4	50.9
HDRE1	28/05/2020	628.5	50.8
HDRE1	27/05/2020	628.5	50.8
HDRE1	26/05/2020	628.5	50.8
HDRE1	25/05/2020	628.4	50.9
HDRE1	24/05/2020	628.5	50.8
HDRE1	23/05/2020	628.5	50.8
HDRE1	22/05/2020	628.5	50.8
HDRE1	21/05/2020	628.5	50.8
HDRE1	20/05/2020	628.5	50.8
HDRE1	19/05/2020	628.5	50.8
HDRE1	18/05/2020	628.5	50.8
HDRE1	17/05/2020	628.5	50.8
HDRE1	16/05/2020	628.5	50.8
HDRE1	15/05/2020	628.5	50.8
HDRE1	14/05/2020	628.5	50.8
HDRE1	13/05/2020	628.5	50.8
HDRE1	12/05/2020	628.5	50.8
HDRE1	11/05/2020	628.5	50.8
HDRE1	10/05/2020	628.5	50.8
HDRE1	9/05/2020	628.5	50.8
HDRE1	8/05/2020	628.5	50.8
HDRE1	7/05/2020	628.5	50.8
HDRE1	6/05/2020	628.5	50.8
HDRE1	5/05/2020	628.5	50.8
HDRE1	4/05/2020	628.5	50.8
HDRE1	3/05/2020	628.5	50.8
HDRE1	2/05/2020	628.5	50.8
HDRE1	1/05/2020	628.5	50.8
HDRE1	30/04/2020	628.5	50.8
HDRE1	29/04/2020	628.5	50.8
HDRE1	28/04/2020	628.5	50.8
HDRE1	27/04/2020	628.5	50.8
HDRE1	26/04/2020	628.5	50.8
HDRE1	25/04/2020	628.6	50.7
HDRE1	24/04/2020	628.5	50.8
HDRE1	23/04/2020	628.6	50.7
HDRE1	22/04/2020	628.6	50.7
HDRE1	21/04/2020	628.5	50.8
HDRE1	20/04/2020	628.5	50.8
HDRE1	19/04/2020	628.5	50.8
HDRE1	18/04/2020	628.5	50.8
HDRE1	17/04/2020	628.5	50.8
HDRE1	16/04/2020	628.5	50.8

ID	Date	WL mAHD	WL mbgl
HDVP2	19/11/2008	0.0	686.5
HDVP2	18/11/2008	0.0	686.5
HDVP2	17/11/2008	0.0	686.5
HDVP2	16/11/2008	0.0	686.5
HDVP2	15/11/2008	0.0	686.5
HDVP2	14/11/2008	0.0	686.5
HDVP2	13/11/2008	0.0	686.5
HDVP2	12/11/2008	0.0	686.5
HDVP2	11/11/2008	0.0	686.5
HDVP2	10/11/2008	0.0	686.5
HDVP2	9/11/2008	34.7	651.9
HDVP2	8/11/2008	34.7	651.9
HDVP2	7/11/2008	34.7	651.9
HDVP2	6/11/2008	34.7	651.9
HDVP2	5/11/2008	34.7	651.9
HDVP2	4/11/2008	34.7	651.9
HDVP2	3/11/2008	34.7	651.9
HDVP2	2/11/2008	34.7	651.9
HDVP2	1/11/2008	89.2	597.4
HDVP2	31/10/2008	89.2	597.4
HDVP2	30/10/2008	89.2	597.4
HDVP2	29/10/2008	89.2	597.4
HDVP2	28/10/2008	89.2	597.4
HDVP2	27/10/2008	89.2	597.4
HDVP2	26/10/2008	89.2	597.4
HDVP2	25/10/2008	89.2	597.4
HDVP2	24/10/2008	89.2	597.4
HDVP2	23/10/2008	89.2	597.4
HDVP2	22/10/2008	89.2	597.4
HDVP2	21/10/2008	123.0	563.6
HDVP2	20/10/2008	123.0	563.6
HDVP2	19/10/2008	123.0	563.6
HDVP2	18/10/2008	123.0	563.6
HDVP2	17/10/2008	123.0	563.6
HDVP2	16/10/2008	123.0	563.6
HDVP2	15/10/2008	123.0	563.6
HDVP2	14/10/2008	123.0	563.6
HDVP2	13/10/2008	123.0	563.6
HDVP2	12/10/2008	97.3	589.2
HDVP2	11/10/2008	97.3	589.2
HDVP2	10/10/2008	97.3	589.2
HDVP2	9/10/2008	97.3	589.2
HDVP2	8/10/2008	97.3	589.2
HDVP2	7/10/2008	97.3	589.2
HDVP2	6/10/2008	97.3	589.2
HDVP2	5/10/2008	97.3	589.2
HDVP2	4/10/2008	97.3	589.2
HDVP2	3/10/2008	97.3	589.2
HDVP2	2/10/2008	97.3	589.2
HDVP2	1/10/2008	95.2	591.4
HDVP2	30/09/2008	95.2	591.4
HDVP2	29/09/2008	95.2	591.4
HDVP2	28/09/2008	95.2	591.4
HDVP2	27/09/2008	95.2	591.4
HDVP2	26/09/2008	95.2	591.4
HDVP2	25/09/2008	95.2	591.4
HDVP2	24/09/2008	95.2	591.4
HDVP2	23/09/2008	95.2	591.4
HDVP2	22/09/2008	82.9	603.7
HDVP2	21/09/2008	82.9	603.7
HDVP2	20/09/2008	82.9	603.7
HDVP2	19/09/2008	82.9	603.7
HDVP2	18/09/2008	82.9	603.7
HDVP2	17/09/2008	82.9	603.7
HDVP2	16/09/2008	82.9	603.7
HDVP2	15/09/2008	82.9	603.7
HDVP2	14/09/2008	82.9	603.7
HDVP2	13/09/2008	80.2	606.4
HDVP2	12/09/2008	80.2	606.4
HDVP2	11/09/2008	80.2	606.4
HDVP2	10/09/2008	80.2	606.4
HDVP2	9/09/2008	80.2	606.4
HDVP2	8/09/2008	80.2	606.4
HDVP2	7/09/2008	80.2	606.4
HDVP2	6/09/2008	80.2	606.4
HDVP2	5/09/2008	80.2	606.4
HDVP2	4/09/2008	80.2	606.4
HDVP2	3/09/2008	80.2	606.4
HDVP2	2/09/2008	80.2	606.4
HDVP2	1/09/2008	80.2	606.4
HDVP2	31/08/2008	65.0	621.5
HDVP2	30/08/2008	65.0	621.5
HDVP2	29/08/2008	65.0	621.5
HDVP2	28/08/2008	65.0	621.5
HDVP2	27/08/2008	65.0	621.5
HDVP2	26/08/2008	65.0	621.5
HDVP2	25/08/2008	65.0	621.5
HDVP2	24/08/2008	84.7	601.8
HDVP2	23/08/2008	84.7	601.8
HDVP2	22/08/2008	84.7	601.8
HDVP2	21/08/2008	84.7	601.8
HDVP2	20/08/2008	84.7	601.8
HDVP2	19/08/2008	46.6	639.9
HDVP2	18/08/2008	46.6	639.9
HDVP2	17/08/2008	46.6	639.9
HDVP2	16/08/2008	46.6	639.9
HDVP2	15/08/2008	46.6	639.9
HDVP2	14/08/2008	46.6	639.9
HDVP2	13/08/2008	46.6	639.9
HDVP2	12/08/2008	46.6	639.9
HDVP2	11/08/2008	46.6	639.9
HDVP2	10/08/2008	46.6	639.9
HDVP2	9/08/2008	46.6	639.9
HDVP2	8/08/2008	46.6	639.9
HDVP2	7/08/2008	46.6	639.9
HDVP2	6/08/2008	46.6	639.9
HDVP2	5/08/2008	46.6	639.9
HDVP2	4/08/2008	46.6	639.9
HDVP2	3/08/2008	65.4	621.1
HDVP2	2/08/2008	65.4	621.1
HDVP2	1/08/2008	65.4	621.1
HDVP2	31/07/2008	65.4	621.1
HDVP2	30/07/2008	65.4	621.1
HDVP2	29/07/2008	65.4	621.1
HDVP2	28/07/2008	65.4	621.1
HDVP2	27/07/2008	65.4	621.1
HDVP2	26/07/2008	65.4	621.1
HDVP2	25/07/2008	65.4	621.1
HDVP2	24/07/2008	65.4	621.1
HDVP2	23/07/2008	65.4	621.1
HDVP2	22/07/2008	65.4	621.1
HDVP2	21/07/2008	65.4	621.1
HDVP2	20/07/2008	65.4	621.1
HDVP2	19/07/2008	65.4	621.1
HDVP2	18/07/2008	65.4	621.1
HDVP2	17/07/2008	65.4	621.1
HDVP2	16/07/2008	65.4	621.1
HDVP2	15/07/2008	65.4	621.1
HDVP2	14/07/2008	65.4	621.1
HDVP2	13/07/2008	65.4	621.1
HDVP2	12/07/2008	65.4	621.1
HDVP2	11/07/2008	65.4	621.1
HDVP2	10/07/2008	65.4	621.1
HDVP2	9/07/2008	65.4	621.1
HDVP2	8/07/2008	65.4	621.1
HDVP2	7/07/2008	65.4	621.1

ID	Date	WL mAHD	WL mbgl
MB18WON0006	12/10/2020	624.0	46.7
MB18WON0006	11/10/2020	624.0	46.7
MB18WON0006	10/10/2020	624.0	46.7
MB18WON0006	9/10/2020	624.0	46.7
MB18WON0006	8/10/2020	624.0	46.7
MB18WON0006	7/10/2020	624.0	46.7
MB18WON0006	6/10/2020	624.0	46.7
MB18WON0006	5/10/2020	624.0	46.6
MB18WON0006	4/10/2020	624.0	46.7
MB18WON0006	3/10/2020	624.0	46.7
MB18WON0006	2/10/2020	624.0	46.7
MB18WON0006	1/10/2020	624.0	46.7
MB18WON0006	30/09/2020	624.0	46.7
MB18WON0006	29/09/2020	624.0	46.7
MB18WON0006	28/09/2020	624.0	46.7
MB18WON0006	27/09/2020	624.0	46.7
MB18WON0006	26/09/2020	624.0	46.7
MB18WON0006	25/09/2020	624.0	46.7
MB18WON0006	24/09/2020	624.0	46.7
MB18WON0006	23/09/2020	624.0	46.7
MB18WON0006	22/09/2020	624.0	46.7
MB18WON0006	21/09/2020	624.0	46.7
MB18WON0006	20/09/2020	624.0	46.7
MB18WON0006	19/09/2020	624.0	46.7
MB18WON0006	18/09/2020	624.0	46.7
MB18WON0006	17/09/2020	624.0	46.7
MB18WON0006	16/09/2020	624.0	46.7
MB18WON0006	15/09/2020	624.0	46.7
MB18WON0006	14/09/2020	624.0	46.7
MB18WON0006	13/09/2020	624.0	46.7
MB18WON0006	12/09/2020	624.0	46.7
MB18WON0006	11/09/2020	624.0	46.7
MB18WON0006	10/09/2020	624.0	46.7
MB18WON0006	9/09/2020	624.0	46.7
MB18WON0006	8/09/2020	624.0	46.7
MB18WON0006	7/09/2020	624.0	46.7
MB18WON0006	6/09/2020	624.0	46.7
MB18WON0006	5/09/2020	624.0	46.7
MB18WON0006	4/09/2020	624.0	46.7
MB18WON0006	3/09/2020	624.0	46.7
MB18WON0006	2/09/2020	624.0	46.7
MB18WON0006	1/09/2020	624.0	46.7
MB18WON0006	31/08/2020	624.0	46.7
MB18WON0006	30/08/2020	624.0	46.6
MB18WON0006	29/08/2020	624.0	46.7
MB18WON0006	28/08/2020	624.0	46.7
MB18WON0006	27/08/2020	624.0	46.7
MB18WON0006	26/08/2020	624.0	46.6
MB18WON0006	25/08/2020	624.0	46.7
MB18WON0006	24/08/2020	624.0	46.7
MB18WON0006	23/08/2020	624.0	46.7
MB18WON0006	22/08/2020	624.1	46.6
MB18WON0006	21/08/2020	624.1	46.6
MB18WON0006	20/08/2020	624.0	46.7
MB18WON0006	19/08/2020	624.0	46.7
MB18WON0006	18/08/2020	624.0	46.7
MB18WON0006	17/08/2020	624.0	46.7
MB18WON0006	16/08/2020	624.0	46.7
MB18WON0006	15/08/2020	624.0	46.7
MB18WON0006	14/08/2020	624.0	46.7
MB18WON0006	13/08/2020	624.0	46.7
MB18WON0006	12/08/2020	624.0	46.7
MB18WON0006	11/08/2020	624.0	46.7
MB18WON0006	31/05/2020	624.2	46.5
MB18WON0006	30/05/2020	624.2	46.5
MB18WON0006	29/05/2020	624.2	46.5
MB18WON0006	28/05/2020	624.2	46.5
MB18WON0006	27/05/2020	624.2	46.5
MB18WON0006	26/05/2020	624.2	46.5
MB18WON0006	25/05/2020	624.1	46.6
MB18WON0006	24/05/2020	624.1	46.6
MB18WON0006	23/05/2020	624.2	46.5
MB18WON0006	22/05/2020	624.2	46.5
MB18WON0006	21/05/2020	624.2	46.5
MB18WON0006	20/05/2020	624.2	46.5
MB18WON0006	19/05/2020	624.2	46.5
MB18WON0006	18/05/2020	624.2	46.5
MB18WON0006	17/05/2020	624.2	46.5
MB18WON0006	16/05/2020	624.2	46.5
MB18WON0006	15/05/2020	624.2	46.5
MB18WON0006	14/05/2020	624.2	46.5
MB18WON0006	13/05/2020	624.2	46.5
MB18WON0006	12/05/2020	624.2	46.5
MB18WON0006	11/05/2020	624.2	46.5
MB18WON0006	10/05/2020	624.2	46.5
MB18WON0006	9/05/2020	624.2	46.5
MB18WON0006	8/05/2020	624.2	46.5
MB18WON0006	7/05/2020	624.2	46.5
MB18WON0006	6/05/2020	624.1	46.5
MB18WON0006	5/05/2020	624.2	46.5
MB18WON0006	4/05/2020	624.2	46.5
MB18WON0006	3/05/2020	624.2	46.5
MB18WON0006	2/05/2020	624.2	46.5
MB18WON0006	1/05/2020	624.2	46.5
MB18WON0006	30/04/2020	624.2	46.5
MB18WON0006	29/04/2020	624.2	46.5
MB18WON0006	28/04/2020	624.1	46.5
MB18WON0006	27/04/2020	624.2	46.5
MB18WON0006	26/04/2020	624.2	46.5
MB18WON0006	25/04/2020	624.2	46.5
MB18WON0006	24/04/2020	624.1	46.5
MB18WON0006	23/04/2020	624.2	46.5
MB18WON0006	22/04/2020	624.2	46.5
MB18WON0006	21/04/2020	624.1	46.5
MB18WON0006	20/04/2020	624.1	46.6
MB18WON0006	19/04/2020	624.1	46.6
MB18WON0006	18/04/2020	624.1	46.6
MB18WON0006	17/04/2020	624.2	46.5
MB18WON0006	16/04/2020	624.1	46.5
MB18WON0006	15/04/2020	624.1	46.5
MB18WON0006	14/04/2020	624.1	46.5
MB18WON0006	13/04/2020	624.1	46.5
MB18WON0006	12/04/2020	624.2	46.5
MB18WON0006	11/04/2020	624.2	46.5
MB18WON0006	10/04/2020	624.2	46.5
MB18WON0006	9/04/2020	624.2	46.5
MB18WON0006	8/04/2020	624.1	46.6
MB18WON0006	7/04/2020	624.1	46.6
MB18WON0006	6/04/2020	624.1	46.6
MB18WON0006	5/04/2020	624.1	46.6
MB18WON0006	4/04/2020	624.1	46.5
MB18WON0006	3/04/2020	624.1	46.6
MB18WON0006	2/04/2020	624.1	46.6
MB18WON0006	1/04/2020	624.1	46.6
MB18WON0006	31/03/2020	624.1	46.6
MB18WON0006	30/03/2020	624.1	46.6
MB18WON0006	29/03/2020	624.1	46.6
MB18WON0006	28/03/2020	624.1	46.6
MB18WON0006	27/03/2020	624.2	46.5
MB18WON0006	26/03/2020	624.1	46.5
MB18WON0006	25/03/2020	624.1	46.5
MB18WON0006	24/03/2020	624.1	46.6
MB18WON0006	23/03/2020	624.1	46.6
MB18WON0006	22/03/2020	624.1	46.5
MB18WON0006	21/03/2020	624.2	46.5
MB18WON0006	20/03/2020	624.2	46.5

ID	Date	WL mAHD	WL mbgl
MB15HD20008	29/03/2020	627.0	83.3
MB15HD20008	30/03/2020	627.0	83.3
MB15HD20008	31/03/2020	627.0	83.3
MB15HD20008	1/04/2020	627.0	83.3
MB15HD20008	2/04/2020	627.0	83.3
MB15HD20008	3/04/2020	627.0	83.3
MB15HD20008	4/04/2020	627.0	83.3
MB15HD20008	5/04/2020	627.0	83.3
MB15HD20008	6/04/2020	627.0	83.3
MB15HD20008	7/04/2020	627.0	83.3
MB15HD20008	8/04/2020	627.0	83.3
MB15HD20008	9/04/2020	627.0	83.3
MB15HD20008	10/04/2020	627.0	83.3
MB15HD20008	11/04/2020	627.0	83.3
MB15HD20008	12/04/2020	627.0	83.3
MB15HD20008	13/04/2020	627.0	83.3
MB15HD20008	14/04/2020	627.0	83.3
MB15HD20008	15/04/2020	627.0	83.3
MB15HD20008	16/04/2020	627.0	83.3
MB15HD20008	17/04/2020	627.0	83.3
MB15HD20008	18/04/2020	627.0	83.3
MB15HD20008	19/04/2020	627.0	83.3
MB15HD20008	20/04/2020	627.0	83.3
MB15HD20008	21/04/2020	627.0	83.3
MB15HD20008	22/04/2020	627.0	83.3
MB15HD20008	23/04/2020	627.0	83.3
MB15HD20008	24/04/2020	627.0	83.3
MB15HD20008	25/04/2020	627.0	83.3
MB15HD20008	26/04/2020	627.0	83.3
MB15HD20008	27/04/2020	627.0	83.3
MB15HD20008	28/04/2020	627.0	83.3
MB15HD20008	29/04/2020	627.0	83.3
MB15HD20008	30/04/2020	627.1	83.3
MB15HD20008	1/05/2020	627.1	83.3
MB15HD20008	2/05/2020	627.1	83.3
MB15HD20008	3/05/2020	627.1	83.3
MB15HD20008	4/05/2020	627.0	83.3
MB15HD20008	5/05/2020	627.0	83.3
MB15HD20008	6/05/2020	627.0	83.3
MB15HD20008	7/05/2020	627.0	83.3
MB15HD20008	8/05/2020	627.0	83.3
MB15HD20008	9/05/2020	627.0	83.3
MB15HD20008	10/05/2020	627.1	83.3
MB15HD20008	11/05/2020	627.1	83.3
MB15HD20008	12/05/2020	627.1	83.3
MB15HD20008	13/05/2020	627.1	83.3
MB15HD20008	14/05/2020	627.1	83.3
MB15HD20008	15/05/2020	627.1	83.3
MB15HD20008	16/05/2020	627.1	83.3
MB15HD20008	17/05/2020	627.1	83.3
MB15HD20008	18/05/2020	627.1	83.3
MB15HD20008	19/05/2020	627.1	83.3
MB15HD20008	20/05/2020	627.1	83.3
MB15HD20008	21/05/2020	627.1	83.3
MB15HD20008	22/05/2020	627.1	83.3
MB15HD20008	23/05/2020	627.0	83.3
MB15HD20008	24/05/2020	627.0	83.3
MB15HD20008	25/05/2020	627.0	83.3
MB15HD20008	26/05/2020	627.0	83.3
MB15HD20008	27/05/2020	627.1	83.3
MB15HD20008	28/05/2020	627.1	83.3
MB15HD20008	29/05/2020	627.1	83.3
MB15HD20008	30/05/2020	627.1	83.3
MB15HD20008	31/05/2020	627.1	83.3
MB15HD20008	1/06/2020	627.1	83.3
MB15HD20008	2/06/2020	627.1	83.3
MB15HD20008	3/06/2020	627.1	83.3
MB15HD20008	4/06/2020	627.1	83.3
MB15HD20008	5/06/2020	627.1	83.3
MB15HD20008	6/06/2020	627.1	83.3
MB15HD20008	7/06/2020	627.0	83.3
MB15HD20008	8/06/2020	627.0	83.3
MB15HD20008	9/06/2020	627.1	83.3
MB15HD20008	10/06/2020	627.1	83.3
MB15HD20008	11/06/2020	627.0	83.3
MB15HD20008	12/06/2020	627.0	83.3
MB15HD20008	13/06/2020	627.1	83.3
MB15HD20008	14/06/2020	627.1	83.3
MB15HD20008	15/06/2020	627.1	83.3
MB15HD20008	16/06/2020	627.1	83.3
MB15HD20008	17/06/2020	627.1	83.3
MB15HD20008	18/06/2020	627.1	83.3
MB15HD20008	19/06/2020	627.1	83.3
MB15HD20008	20/06/2020	627.1	83.3
MB15HD20008	21/06/2020	627.1	83.3
MB15HD20008	22/06/2020	627.0	83.3
MB15HD20008	23/06/2020	627.0	83.3
MB15HD20008	24/06/2020	627.0	83.3
MB15HD20008	25/06/2020	627.1	83.3
MB15HD20008	26/06/2020	627.0	83.3
MB15HD20008	27/06/2020	627.1	83.3
MB15HD20008	28/06/2020	627.1	83.3
MB15HD20008	29/06/2020	627.1	83.3
MB15HD20008	30/06/2020	627.0	83.3
MB15HD20008	1/07/2020	627.1	83.3
MB15HD20008	2/07/2020	627.1	83.3
MB15HD20008	3/07/2020	627.1	83.3
MB15HD20008	4/07/2020	627.1	83.3
MB15HD20008	5/07/2020	627.1	83.3
MB15HD20008	6/07/2020	627.1	83.3
MB15HD20008	7/07/2020	627.1	83.3
MB15HD20008	8/07/2020	627.0	83.3
MB15HD20008	9/07/2020	627.0	83.3
MB15HD20008	10/07/2020	627.1	83.3
MB15H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDRE1	15/04/2020	628.5	50.8
HDRE1	14/04/2020	628.5	50.8
HDRE1	13/04/2020	628.5	50.8
HDRE1	12/04/2020	628.5	50.8
HDRE1	11/04/2020	628.5	50.8
HDRE1	10/04/2020	628.5	50.8
HDRE1	9/04/2020	628.5	50.8
HDRE1	8/04/2020	628.5	50.8
HDRE1	7/04/2020	628.5	50.8
HDRE1	6/04/2020	628.5	50.8
HDRE1	5/04/2020	628.5	50.8
HDRE1	4/04/2020	628.5	50.8
HDRE1	3/04/2020	628.5	50.8
HDRE1	2/04/2020	628.4	50.9
HDRE1	1/04/2020	628.4	50.9
HDRE1	31/03/2020	628.4	50.9
HDRE1	30/03/2020	628.5	50.8
HDRE1	29/03/2020	628.5	50.8
HDRE1	28/03/2020	628.5	50.8
HDRE1	27/03/2020	628.5	50.8
HDRE1	26/03/2020	628.5	50.8
HDRE1	25/03/2020	628.5	50.8
HDRE1	24/03/2020	628.5	50.8
HDRE1	23/03/2020	628.5	50.8
HDRE1	22/03/2020	628.5	50.8
HDRE1	21/03/2020	628.5	50.8
HDRE1	20/03/2020	628.5	50.8
HDRE1	19/03/2020	628.5	50.8
HDRE1	18/03/2020	628.4	50.9
HDRE1	17/03/2020	628.4	50.9
HDRE1	16/03/2020	628.4	50.9
HDRE1	15/03/2020	628.4	50.9
HDRE1	14/03/2020	628.4	50.9
HDRE1	13/03/2020	628.4	50.9
HDRE1	12/03/2020	628.4	50.9
HDRE1	11/03/2020	628.4	50.9
HDRE1	10/03/2020	628.4	50.9
HDRE1	9/03/2020	628.4	50.9
HDRE1	8/03/2020	628.4	50.9
HDRE1	7/03/2020	628.4	50.9
HDRE1	6/03/2020	628.4	50.9
HDRE1	5/03/2020	628.3	51.0
HDRE1	4/03/2020	628.3	51.0
HDRE1	3/03/2020	628.3	51.0
HDRE1	2/03/2020	628.3	51.0
HDRE1	1/03/2020	628.3	51.0
HDRE1	29/02/2020	628.3	51.0
HDRE1	28/02/2020	628.3	51.0
HDRE1	27/02/2020	628.3	51.0
HDRE1	26/02/2020	628.3	51.0
HDRE1	25/02/2020	628.3	51.0
HDRE1	24/02/2020	628.3	51.0
HDRE1	23/02/2020	628.3	51.0
HDRE1	22/02/2020	628.3	51.0
HDRE1	21/02/2020	628.3	51.0
HDRE1	20/02/2020	628.3	51.0
HDRE1	19/02/2020	628.3	51.0
HDRE1	18/02/2020	628.3	51.0
HDRE1	17/02/2020	628.3	51.0
HDRE1	16/02/2020	628.2	51.1
HDRE1	15/02/2020	628.2	51.1
HDRE1	14/02/2020	628.2	51.1
HDRE1	13/02/2020	628.2	51.1
HDRE1	12/02/2020	628.2	51.1
HDRE1	11/02/2020	628.2	51.1
HDRE1	10/02/2020	628.2	51.1
HDRE1	9/02/2020	628.2	51.1
HDRE1	8/02/2020	628.2	51.1
HDRE1	7/02/2020	628.2	51.1
HDRE1	6/02/2020	628.2	51.1
HDRE1	5/02/2020	628.2	51.1
HDRE1	4/02/2020	628.2	51.1
HDRE1	3/02/2020	628.2	51.1
HDRE1	2/02/2020	628.2	51.1
HDRE1	1/02/2020	628.2	51.1
HDRE1	31/01/2020	628.1	51.1
HDRE1	30/01/2020	628.1	51.2
HDRE1	29/01/2020	628.2	51.1
HDRE1	28/01/2020	628.2	51.1
HDRE1	27/01/2020	628.2	51.1
HDRE1	26/01/2020	628.2	51.1
HDRE1	25/01/2020	628.2	51.1
HDRE1	24/01/2020	628.2	51.1
HDRE1	23/01/2020	628.2	51.1
HDRE1	22/01/2020	628.1	51.2
HDRE1	21/01/2020	628.1	51.2
HDRE1	20/01/2020	628.1	51.2
HDRE1	19/01/2020	628.1	51.2
HDRE1	18/01/2020	628.1	51.2
HDRE1	17/01/2020	628.1	51.2
HDRE1	16/01/2020	628.1	51.2
HDRE1	15/01/2020	628.1	51.2
HDRE1	14/01/2020	628.1	51.2
HDRE1	13/01/2020	628.1	51.2
HDRE1	12/01/2020	628.1	51.2
HDRE1	11/01/2020	628.1	51.2
HDRE1	10/01/2020	628.1	51.2
HDRE1	9/01/2020	628.1	51.2
HDRE1	8/01/2020	628.1	51.2
HDRE1	7/01/2020	628.1	51.2
HDRE1	6/01/2020	628.1	51.2
HDRE1	5/01/2020	628.1	51.2
HDRE1	4/01/2020	628.1	51.2
HDRE1	3/01/2020	628.1	51.2
HDRE1	2/01/2020	628.1	51.2
HDRE1	1/01/2020	628.1	51.2
HDRE1	31/12/2019	628.1	51.2
HDRE1	30/12/2019	628.1	51.2
HDRE1	29/12/2019	628.1	51.2
HDRE1	28/12/2019	628.1	51.2
HDRE1	27/12/2019	628.1	51.2
HDRE1	26/12/2019	628.1	51.2
HDRE1	25/12/2019	628.1	51.2
HDRE1	24/12/2019	628.1	51.2
HDRE1	23/12/2019	628.1	51.2
HDRE1	22/12/2019	628.1	51.2
HDRE1	21/12/2019	628.1	51.2
HDRE1	20/12/2019	628.1	51.2
HDRE1	19/12/2019	628.1	51.2
HDRE1	18/12/2019	628.1	51.2
HDRE1	17/12/2019	628.1	51.2
HDRE1	16/12/2019	628.1	51.2
HDRE1	15/12/2019	628.1	51.2
HDRE1	14/12/2019	628.1	51.2
HDRE1	13/12/2019	628.1	51.2
HDRE1	12/12/2019	628.1	51.2
HDRE1	11/12/2019	628.1	51.2
HDRE1	10/12/2019	628.1	51.2
HDRE1	9/12/2019	628.1	51.2
HDRE1	8/12/2019	628.1	51.2
HDRE1	7/12/2019	628.1	51.2
HDRE1	6/12/2019	628.1	51.2
HDRE1	5/12/2019	628.1	51.2
HDRE1	4/12/2019	628.1	51.2
HDRE1	3/12/2019	628.1	51.2
HDRE1	2/12/2019	628.1	51.2

ID	Date	WL mAHD	WL mbgl
HDVP2	6/07/2008	65.4	621.1
HDVP2	5/07/2008	65.4	621.1
HDVP2	4/07/2008	65.4	621.1
HDVP2	3/07/2008	65.4	621.1
HDVP2	2/07/2008	65.4	621.1
HDVP2	1/07/2008	65.4	621.1
HDVP2	30/06/2008	125.8	560.8
HDVP2	29/06/2008	125.8	560.8
HDVP2	28/06/2008	125.8	560.8
HDVP2	27/06/2008	125.8	560.8
HDVP2	26/06/2008	125.8	560.8
HDVP2	25/06/2008	125.8	560.8
HDVP2	24/06/2008	125.8	560.8
HDVP2	23/06/2008	125.8	560.8
HDVP2	22/06/2008	125.8	560.8
HDVP2	21/06/2008	125.8	560.8
HDVP2	20/06/2008	125.8	560.8
HDVP2	19/06/2008	125.8	560.8
HDVP2	18/06/2008	125.8	560.8
HDVP2	17/06/2008	125.8	560.8
HDVP2	16/06/2008	125.8	560.8
HDVP2	15/06/2008	125.8	560.8
HDVP2	14/06/2008	125.8	560.8
HDVP2	13/06/2008	125.8	560.8
HDVP2	12/06/2008	125.8	560.8
HDVP2	11/06/2008	125.8	560.8
HDVP2	10/06/2008	125.8	560.8
HDVP2	8/06/2008	147.3	539.3
HDVP2	7/06/2008	147.3	539.3
HDVP2	6/06/2008	147.3	539.3
HDVP2	5/06/2008	147.3	539.3
HDVP2	4/06/2008	147.3	539.3
HDVP2	3/06/2008	147.3	539.3
HDVP2	2/06/2008	147.3	539.3
HDVP2	1/06/2008	147.3	539.3
HDVP2	31/05/2008	147.3	539.3
HDVP2	30/05/2008	147.3	539.3
HDVP2	29/05/2008	147.3	539.3
HDVP2	28/05/2008	147.3	539.3
HDVP2	27/05/2008	147.3	539.3
HDVP2	26/05/2008	147.3	539.3
HDVP2	25/05/2008	147.3	539.3
HDVP2	24/05/2008	147.3	539.3
HDVP2	23/05/2008	147.3	539.3
HDVP2	22/05/2008	147.3	539.3
HDVP2	21/05/2008	147.3	539.3
HDVP2	20/05/2008	147.3	539.3
HDVP2	19/05/2008	147.3	539.3
HDVP2	18/05/2008	147.3	539.3
HDVP2	17/05/2008	147.3	539.3
HDVP2	16/05/2008	147.3	539.3
HDVP2	15/05/2008	147.3	539.3
HDVP2	14/05/2008	147.3	539.3
HDVP2	13/05/2008	147.3	539.3
HDVP2	12/05/2008	147.3	539.3
HDVP2	11/05/2008	147.3	539.3
HDVP2	10/05/2008	147.3	539.3
HDVP2	9/05/2008	147.3	539.3
HDVP2	8/05/2008	147.3	539.3
HDVP2	7/05/2008	147.3	539.3
HDVP2	6/05/2008	147.3	539.3
HDVP2	5/05/2008	147.3	539.3
HDVP2	4/05/2008	147.3	539.3
HDVP2	3/05/2008	147.3	539.3
HDVP2	2/05/2008	147.3	539.3
HDVP2	1/05/2008	147.3	539.3
HDVP2	30/04/2008	147.3	539.3
HDVP2	29/04/2008	147.3	539.3
HDVP2	28/04/2008	147.3	539.3
HDVP2	27/04/2008	147.3	539.3
HDVP2	26/04/2008	147.3	539.3
HDVP2	25/04/2008	147.3	539.3
HDVP2	24/04/2008	147.3	539.3
HDVP2	23/04/2008	147.3	539.3
HDVP2	22/04/2008	147.3	539.3
HDVP2	21/04/2008	147.3	539.3
HDVP2	20/04/2008	147.3	539.3
HDVP2	19/04/2008	147.3	539.3
HDVP2	18/04/2008	147.3	539.3
HDVP2	17/04/2008	147.3	539.3
HDVP2	16/04/2008	147.3	539.3
HDVP2	15/04/2008	147.3	539.3
HDVP2	14/04/2008	147.3	539.3
HDVP2	13/04/2008	147.3	539.3
HDVP2	12/04/2008	147.3	539.3
HDVP2	11/04/2008	147.3	539.3
HDVP2	10/04/2008	147.3	539.3
HDVP2	9/04/2008	147.3	539.3
HDVP2	8/04/2008	147.3	539.3
HDVP2	7/04/2008	147.3	539.3
HDVP2	6/04/2008	147.3	539.3
HDVP2	5/04/2008	147.3	539.3
HDVP2	4/04/2008	147.3	539.3
HDVP2	3/04/2008	147.3	539.3
HDVP2	2/04/2008	147.3	539.3
HDVP2	1/04/2008	147.3	539.3
HDVP2	31/03/2008	108.8	577.7
HDVP2	30/03/2008	108.8	577.7
HDVP2	29/03/2008	108.8	577.7
HDVP2	28/03/2008	108.8	577.7
HDVP2	27/03/2008	108.8	577.7
HDVP2	26/03/2008	108.8	577.7
HDVP2	25/03/2008	108.8	577.7
HDVP2	24/03/2008	108.8	577.7
HDVP2	23/03/2008	108.8	577.7
HDVP2	22/03/2008	108.8	577.7
HDVP2	21/03/2008	108.8	577.7
HDVP2	20/03/2008	108.8	577.7
HDVP2	19/03/2008	108.8	577.7
HDVP2	18/03/2008	108.8	577.7
HDVP2	17/03/2008	108.8	577.7
HDVP2	16/03/2008	108.8	577.7
HDVP2	15/03/2008	108.8	577.7
HDVP2	14/03/2008	108.8	577.7
HDVP2	13/03/2008	108.8	577.7
HDVP2	12/03/2008	108.8	577.7
HDVP2	11/03/2008	108.8	577.7
HDVP2	10/03/2008	108.8	577.7
HDVP2	9/03/2008	108.8	577.7
HDVP2	8/03/2008	108.8	577.7
HDVP2	7/03/2008	108.8	577.7
HDVP2	6/03/2008	108.8	577.7
HDVP2	5/03/2008	108.8	577.7
HDVP2	4/03/2008	108.8	577.7
HDVP2	3/03/2008	108.8	577.7
HDVP2	2/03/2008	108.8	577.7
HDVP2	1/03/2008	108.8	577.7
HDVP2	29/02/2008	138.2	548.3
HDVP2	28/02/2008	138.2	548.3
HDVP2	27/02/2008	138.2	548.3
HDVP2	26/02/2008	138.2	548.3
HDVP2	25/02/2008	138.2	548.3
HDVP2	24/02/2008	138.2	548.3
HDVP2	23/02/2008	138.2	548.3
HDVP2	22/02/2008	138.2	548.3
HDVP2	21/02/2008	138.2	548.3

ID	Date	WL mAHD	WL mbgl
MB18WON0006	19/03/2020	624.2	46.5
MB18WON0006	18/03/2020	624.1	46.5
MB18WON0006	17/03/2020	624.1	46.6
MB18WON0006	16/03/2020	624.1	46.6
MB18WON0006	15/03/2020	624.1	46.6
MB18WON0006	14/03/2020	624.1	46.6
MB18WON0006	13/03/2020	624.1	46.6
MB18WON0006	12/03/2020	624.1	46.6
MB18WON0006	11/03/2020	624.1	46.6
MB18WON0006	10/03/2020	624.1	46.6
MB18WON0006	9/03/2020	624.1	46.6
MB18WON0006	8/03/2020	624.1	46.6
MB18WON0006	7/03/2020	624.1	46.6
MB18WON0006	6/03/2020	624.1	46.6
MB18WON0006	5/03/2020	624.1	46.6
MB18WON0006	4/03/2020	624.1	46.6
MB18WON0006	3/03/2020	624.1	46.6
MB18WON0006	2/03/2020	624.1	46.6
MB18WON0006	1/03/2020	624.1	46.6
MB18WON0006	29/02/2020	624.1	46.6
MB18WON0006	28/02/2020	624.1	46.6
MB18WON0006	27/02/2020	624.1	46.6
MB18WON0006	26/02/2020	624.1	46.6
MB18WON0006	25/02/2020	624.1	46.6
MB18WON0006	24/02/2020	624.1	46.6
MB18WON0006	23/02/2020	624.1	46.6
MB18WON0006	22/02/2020	624.1	46.6
MB18WON0006	21/02/2020	624.1	46.6
MB18WON0006	20/02/2020	624.1	46.6
MB18WON0006	19/02/2020	624.1	46.6
MB18WON0006	18/02/2020	624.1	46.6
MB18WON0006	17/02/2020	624.1	46.6
MB18WON0006	16/02/2020	624.1	46.6
MB18WON0006	15/02/2020	624.1	46.6
MB18WON0006	14/02/2020	624.1	46.6
MB18WON0006	13/02/2020	624.1	46.6
MB18WON0006	12/02/2020	624.1	46.6
MB18WON0006	11/02/2020	624.1	46.6
MB18WON0006	10/02/2020	624.0	46.7
MB18WON0006	9/02/2020	624.1	46.6
MB18WON0006	8/02/2020	624.0	46.7
MB18WON0006	7/02/2020	624.0	46.6
MB18WON0006	6/02/2020	624.0	46.6
MB18WON0006	5/02/2020	624.0	46.6
MB18WON0006	4/02/2020	624.1	46.6
MB18WON0006	3/02/2020	624.1	46.6
MB18WON0006	2/02/2020	624.1	46.6
MB18WON0006	1/02/2020	624.0	46.7
MB18WON0006	31/01/2020	624.0	46.7
MB18WON0006	30/01/2020	624.0	46.7
MB18WON0006	29/01/2020	624.0	46.7
MB18WON0006	28/01/2020	624.0	46.6
MB18WON0006	27/01/2020	624.1	46.6
MB18WON0006	26/01/2020	624.1	46.6
MB18WON0006	25/01/2020	624.0	46.6
MB18WON0006	24/01/2020	624.0	46.6
MB18WON0006	23/01/2020	624.0	46.7
MB18WON0006	22/01/2020	624.0	46.7
MB18WON0006	21/01/2020	624.0	46.7
MB18WON0006	20/01/2020	624.0	46.7
MB18WON0006	19/01/2020	624.0	46.7
MB18WON0006	18/01/2020	624.0	46.7
MB18WON0006	17/01/2020	624.0	46.7
MB18WON0006	16/01/2020	624.0	46.7
MB18WON0006	15/01/2020	624.0	46.7
MB18WON0006	14/01/2020	624.0	46.7
MB18WON0006	13/01/2020	624.0	46.7
MB18WON0006	12/01/2020	624.0	46.7
MB18WON0006	11/01/2020	624.0	46.7
MB18WON0006	10/01/2020	624.0	46.7
MB18WON0006	9/01/2020	623.9	46.8
MB18WON0006	8/01/2020	623.9	46.8
MB18WON0006	7/01/2020	624.0	46.7
MB18WON0006	6/01/2020	624.0	46.7
MB18WON0006	5/01/2020	624.0	46.7
MB18WON0006	4/01/2020	624.0	46.7
MB18WON0006	3/01/2020	624.0	46.7
MB18WON0006	2/01/2020	624.0	46.7
MB18WON0006	1/01/2020	624.0	46.7
MB18WON0006	31/12/2019	624.0	46.7
MB18WON0006	30/12/2019	624.0	46.7
MB18WON0006	29/12/2019	624.0	46.7
MB18WON0006	28/12/2019	624.0	46.7
MB18WON0006	27/12/2019	624.0	46.7
MB18WON0006	26/12/2019	624.0	46.7
MB18WON0006	25/12/2019	624.0	46.7
MB18WON0006	24/12/2019	624.0	46.7
MB18WON0006	23/12/2019	624.0	46.7
MB18WON0006	22/12/2019	624.0	46.7
MB18WON0006	21/12/2019	624.0	46.7
MB18WON0006	20/12/2019	624.0	46.7
MB18WON0006	19/12/2019	624.0	46.7
MB18WON0006	18/12/2019	624.0	46.7
MB18WON0006	17/12/2019	624.0	46.7
MB18WON0006	16/12/2019	624.0	46.7
MB18WON0006	15/12/2019	624.0	46.7
MB18WON0006	14/12/2019	624.0	46.7
MB18WON0006	13/12/2019	624.0	46.7
MB18WON0006	12/12/2019	624.0	46.7
MB18WON0006	11/12/2019	623.5	47.2
MB18WON0006	10/12/2019	623.5	47.2
MB18WON0006	9/12/2019	623.2	47.5
MB18WON0006	8/12/2019	623.2	47.5
MB18WON0006	7/12/2019	623.2	47.5
MB18WON0006	6/12/2019	623.2	47.5
MB18WON0006	5/12/2019	623.2	47.5
MB18WON0006	4/12/2019	623.2	47.5
MB18WON0006	3/12/2019	623.2	47.5
MB18WON0006	2/12/2019	623.2	47.5
MB18WON0006	2/02/2019	623.8	46.9
MB18WON0006	12/12/2018	623.8	46.9
MB18WON0007	2/03/2022	618.1	13.1
MB18WON0007	1/03/2022	618.1	13.1
MB18WON0007	28/02/2022	618.1	13.1
MB18WON0007	27/02/2022	618.1	13.1
MB18WON0007	26/02/2022	618.1	13.1
MB18WON0007	25/02/2022	618.2	13.1
MB18WON0007	24/02/2022	618.2	13.1
MB18WON0007	23/02/2022	618.2	13.1
MB18WON0007	22/02/2022	618.2	13.1
MB18WON0007	21/02/2022	618.2	13.1
MB18WON0007	20/02/2022	618.2	13.1
MB18WON0007	19/02/2022	618.2	13.1
MB18WON0007	18/02/2022	618.2	13.1
MB18WON0007	17/02/2022	247.7	383.5
MB18WON0007	16/02/2022	618.2	13.1
MB18WON0007	15/02/2022	618.2	13.0
MB18WON0007	14/02/2022	618.3	13.0
MB18WON0007	13/02/2022	618.3	13.0
MB18WON0007	12/02/2022	618.0	13.2
MB18WON0007	11/02/2022	618.1	13.2
MB18WON0007	10/02/2022	618.0	13.3
MB18WON0007	9/02/2022	617.9	13.3
MB18WON0007	8/02/2022	617.9	13.4
MB18WON0007	7/02/2022	617.7	13.5
MB18WON0007	6/02/2022	617.7	13.6

ID	Date	WL mAHD	WL mbgl
MB15HD20008	12/08/2020	627.0	83.3
MB15HD20008	13/08/2020	627.0	83.3
MB15HD20008	14/08/2020	627.0	83.3
MB15HD20008	15/08/2020	627.0	83.3
MB15HD20008	16/08/2020	627.0	83.3
MB15HD20008	17/08/2020	627.0	83.3
MB15HD20008	18/08/2020	627.0	83.3
MB15HD20008	19/08/2020	627.0	83.3
MB15HD20008	20/08/2020	627.0	83.3
MB15HD20008	21/08/2020	627.0	83.3
MB15HD20008	22/08/2020	627.0	83.3
MB15HD20008	23/08/2020	627.0	83.3
MB15HD20008	24/08/2020	627.0	83.3
MB15HD20008	25/08/2020	627.0	83.3
MB15HD20008	26/08/2020	627.0	83.3
MB15HD20008	27/08/2020	627.0	83.3
MB15HD20008	28/08/2020	627.0	83.3
MB15HD20008	29/08/2020	627.0	83.3
MB15HD20008	30/08/2020	627.0	83.3
MB15HD20008	31/08/2020	627.0	83.3
MB15HD20008	1/09/2020	627.0	83.3
MB15HD20008	2/09/2020	627.0	83.3
MB15HD20008	3/09/2020	627.0	83.3
MB15HD20008	4/09/2020	627.0	83.3
MB15HD20008	5/09/2020	627.0	83.3
MB15HD20008	6/09/2020	627.0	83.4
MB15HD20008	7/09/2020	627.0	83.3
MB15HD20008	8/09/2020	627.0	83.3
MB15HD20008	9/09/2020	627.0	83.3
MB15HD20008	10/09/2020	627.0	83.3
MB15HD20008	11/09/2020	627.0	83.3
MB15HD20008	12/09/2020	627.0	83.3
MB15HD20008	13/09/2020	627.0	83.3
MB15HD20008	14/09/2020	627.0	83.3
MB15HD20008	15/09/2020	627.0	83.3
MB15HD20008	16/09/2020	627.0	83.3
MB15HD20008	17/09/2020	627.0	83.3
MB15HD20008	18/09/2020	627.0	83.4
MB15HD20008	19/09/2020	627.0	83.4
MB15HD20008	20/09/2020	627.0	83.4
MB15HD20008	21/09/2020	627.0	83.3
MB15HD20008	22/09/2020	627.0	83.3
MB15HD20008	23/09/2020	627.0	83.3
MB15HD20008	24/09/2020	627.0	83.3
MB15HD20008	25/09/2020	627.0	83.3
MB15HD20008	26/09/2020	627.0	83.3
MB15HD20008	27/09/2020	627.0	83.3
MB15HD20008	28/09/2020	627.0	83.3
MB15HD20008	29/09/2020	627.0	83.3
MB15HD20008	30/09/2020	627.0	83.3
MB15HD20008	1/10/2020	627.0	83.4
MB15HD20008	2/10/2020	627.0	83.4
MB15HD20008	3/10/2020	627.0	83.4
MB15HD20008	4/10/2020	627.0	83.3
MB15HD20008	5/10/2020	627.0	83.3
MB15HD20008	6/10/2020	627.0	83.3
MB15HD20008	7/10/2020	627.0	83.3
MB15HD20008	8/10/2020	627.0	83.3
MB15HD20008	9/10/2020	627.0	83.3
MB15HD20008	10/10/2020	627.0	83.3
MB15HD20008	11/10/2020	627.0	83.3
MB15HD20008	12/10/2020	627.0	83.3
MB15HD20008	13/10/2020	627.0	83.3
MB15HD20008	14/10/2020	627.0	83.3
MB15HD20008	15/10/2020	627.0	83.4
MB15HD20008	16/10/2020	626.9	83.4
MB15HD20008	17/10/2020	626.9	83.4
MB15HD20008	18/10/2020	626.9	83.4
MB15HD20008	19/10/2020	626.9	83.4
MB15HD20008	20/10/2020	626.9	83.4
MB15HD20008	21/10/2020	626.9	83.4
MB15HD20008	22/10/2020	627.0	83.4
MB15HD20008	23/10/2020	627.0	83.4
MB15HD20008	24/10/2020	627.0	83.4
MB15HD20008	25/10/2020	627.0	83.4
MB15HD20008	26/10/2020	627.0	83.4
MB15HD20008	27/10/2020	627.0	83.4
MB15HD20008	28/10/2020	627.0	83.4
MB15HD20008	29/10/2020	627.0	83.4
MB15HD20008	30/10/2020	627.0	83.4
MB15HD20008	31/10/2020	626.9	83.4
MB15HD20008	1/11/2020	626.9	83.4
MB15HD20008	2/11/2020	626.9	83.4
MB15HD20008	3/11/2020	627.0	83.4
MB15HD20008	4/11/2020	627.0	83.4
MB15HD20008	5/11/2020	627.0	83.4
MB15HD20008	6/11/2020	627.0	83.4
MB15HD20008	7/11/2020	627.0	83.4
MB15HD20008	8/11/2020	627.0	83.4
MB15HD20008	9/11/2020	627.0	83.4
MB15HD20008	10/11/2020	627.0	83.4
MB15HD20008	11/11/2020	627.0	83.4
MB15HD20008	12/11/2020	627.0	83.4
MB15HD20008	13/11/2020	626.9	83.4
MB15HD20008	14/11/2020	626.9	83.4
MB15HD20008	15/11/2020	626.9	83.4
MB15HD20008	16/11/2020	626.9	83.4
MB15HD20008	17/11/2020	626.9	83.4
MB15HD20008	18/11/2020	626.9	83.4
MB15HD20008	19/11/2020	626.9	83.4
MB15HD20008	20/11/2020	626.9	83.4
MB15HD20008	21/11/2020	627.0	83.4
MB15HD20008	22/11/2020	627.0	83.4
MB15HD20008	23/11/2020	627.0	83.4
MB15H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDRE1	1/12/2019	628.1	51.2
HDRE1	30/11/2019	628.1	51.2
HDRE1	29/11/2019	628.1	51.2
HDRE1	28/11/2019	628.1	51.2
HDRE1	27/11/2019	628.1	51.2
HDRE1	26/11/2019	628.1	51.2
HDRE1	25/11/2019	628.1	51.2
HDRE1	24/11/2019	628.1	51.2
HDRE1	23/11/2019	628.1	51.2
HDRE1	22/11/2019	628.1	51.2
HDRE1	21/11/2019	628.1	51.2
HDRE1	20/11/2019	628.1	51.2
HDRE1	19/11/2019	628.0	51.3
HDRE1	18/11/2019	628.1	51.2
HDRE1	17/11/2019	628.1	51.2
HDRE1	16/11/2019	628.1	51.2
HDRE1	15/11/2019	628.1	51.2
HDRE1	14/11/2019	628.1	51.2
HDRE1	13/11/2019	628.1	51.2
HDRE1	12/11/2019	628.1	51.2
HDRE1	11/11/2019	628.1	51.2
HDRE1	10/11/2019	628.1	51.2
HDRE1	9/11/2019	628.1	51.2
HDRE1	8/11/2019	628.1	51.2
HDRE1	7/11/2019	628.1	51.2
HDRE1	6/11/2019	628.1	51.2
HDRE1	5/11/2019	628.1	51.2
HDRE1	4/11/2019	628.1	51.2
HDRE1	3/11/2019	628.1	51.2
HDRE1	2/11/2019	628.0	51.3
HDRE1	1/11/2019	628.0	51.3
HDRE1	31/10/2019	628.0	51.3
HDRE1	30/10/2019	628.0	51.3
HDRE1	29/10/2019	628.0	51.3
HDRE1	28/10/2019	628.0	51.2
HDRE1	27/10/2019	628.0	51.3
HDRE1	26/10/2019	628.0	51.3
HDRE1	25/10/2019	628.0	51.3
HDRE1	24/10/2019	628.0	51.3
HDRE1	23/10/2019	628.0	51.3
HDRE1	22/10/2019	628.0	51.3
HDRE1	21/10/2019	628.0	51.3
HDRE1	20/10/2019	628.0	51.3
HDRE1	19/10/2019	628.0	51.3
HDRE1	18/10/2019	628.0	51.3
HDRE1	17/10/2019	628.0	51.3
HDRE1	16/10/2019	628.0	51.3
HDRE1	15/10/2019	628.0	51.3
HDRE1	14/10/2019	628.0	51.3
HDRE1	13/10/2019	628.0	51.3
HDRE1	12/10/2019	628.0	51.3
HDRE1	11/10/2019	628.0	51.3
HDRE1	10/10/2019	628.0	51.3
HDRE1	9/10/2019	628.0	51.3
HDRE1	8/10/2019	627.9	51.4
HDRE1	7/10/2019	627.9	51.4
HDRE1	6/10/2019	627.9	51.4
HDRE1	5/10/2019	627.9	51.4
HDRE1	4/10/2019	627.9	51.4
HDRE1	3/10/2019	627.9	51.4
HDRE1	2/10/2019	627.9	51.4
HDRE1	1/10/2019	627.9	51.4
HDRE1	30/09/2019	627.9	51.4
HDRE1	29/09/2019	628.0	51.3
HDRE1	28/09/2019	628.0	51.3
HDRE1	27/09/2019	627.9	51.4
HDRE1	26/09/2019	627.9	51.4
HDRE1	25/09/2019	627.9	51.4
HDRE1	24/09/2019	627.9	51.4
HDRE1	23/09/2019	627.9	51.4
HDRE1	22/09/2019	627.9	51.4
HDRE1	21/09/2019	627.9	51.4
HDRE1	20/09/2019	627.9	51.4
HDRE1	19/09/2019	627.9	51.4
HDRE1	18/09/2019	627.9	51.4
HDRE1	17/09/2019	627.9	51.4
HDRE1	16/09/2019	627.9	51.4
HDRE1	15/09/2019	627.9	51.4
HDRE1	14/09/2019	627.9	51.4
HDRE1	13/09/2019	627.9	51.4
HDRE1	12/09/2019	627.9	51.4
HDRE1	11/09/2019	627.9	51.4
HDRE1	10/09/2019	627.9	51.4
HDRE1	9/09/2019	627.9	51.4
HDRE1	8/09/2019	627.9	51.4
HDRE1	7/09/2019	627.8	51.4
HDRE1	6/09/2019	627.8	51.5
HDRE1	5/09/2019	627.8	51.5
HDRE1	4/09/2019	627.8	51.5
HDRE1	3/09/2019	627.8	51.5
HDRE1	2/09/2019	627.9	51.4
HDRE1	1/09/2019	627.9	51.4
HDRE1	31/08/2019	627.9	51.4
HDRE1	30/08/2019	627.9	51.4
HDRE1	29/08/2019	627.9	51.4
HDRE1	28/08/2019	627.9	51.4
HDRE1	27/08/2019	627.9	51.4
HDRE1	26/08/2019	627.8	51.5
HDRE1	25/08/2019	627.8	51.5
HDRE1	24/08/2019	627.8	51.5
HDRE1	23/08/2019	627.8	51.5
HDRE1	22/08/2019	627.9	51.4
HDRE1	21/08/2019	627.9	51.4
HDRE1	20/08/2019	627.9	51.4
HDRE1	19/08/2019	627.9	51.4
HDRE1	18/08/2019	627.9	51.4
HDRE1	17/08/2019	627.9	51.4
HDRE1	16/08/2019	627.9	51.4
HDRE1	15/08/2019	627.9	51.4
HDRE1	14/08/2019	627.9	51.4
HDRE1	13/08/2019	627.9	51.4
HDRE1	12/08/2019	627.9	51.4
HDRE1	11/08/2019	627.9	51.4
HDRE1	10/08/2019	627.9	51.4
HDRE1	9/08/2019	627.9	51.4
HDRE1	8/08/2019	627.9	51.4
HDRE1	7/08/2019	627.9	51.4
HDRE1	6/08/2019	627.8	51.5
HDRE1	5/08/2019	627.9	51.4
HDRE1	4/08/2019	627.9	51.4
HDRE1	3/08/2019	627.9	51.4
HDRE1	2/08/2019	627.9	51.4
HDRE1	1/08/2019	627.9	51.4
HDRE1	31/07/2019	627.9	51.4
HDRE1	30/07/2019	627.9	51.4
HDRE1	29/07/2019	627.9	51.4
HDRE1	28/07/2019	627.9	51.4
HDRE1	27/07/2019	627.9	51.4
HDRE1	26/07/2019	627.9	51.4
HDRE1	25/07/2019	627.9	51.4
HDRE1	24/07/2019	627.9	51.4
HDRE1	23/07/2019	627.9	51.4
HDRE1	22/07/2019	627.9	51.4
HDRE1	21/07/2019	627.9	51.4
HDRE1	20/07/2019	627.9	51.4
HDRE1	19/07/2019	627.9	51.4

ID	Date	WL mAHD	WL mbgl
HDVP2	20/02/2008	138.2	548.3
HDVP2	19/02/2008	138.2	548.3
HDVP2	18/02/2008	138.2	548.3
HDVP2	17/02/2008	138.2	548.3
HDVP2	16/02/2008	138.2	548.3
HDVP2	15/02/2008	138.2	548.3
HDVP2	14/02/2008	138.2	548.3
HDVP2	13/02/2008	138.2	548.3
HDVP2	12/02/2008	138.2	548.3
HDVP2	11/02/2008	138.2	548.3
HDVP2	10/02/2008	138.2	548.3
HDVP2	9/02/2008	138.2	548.3
HDVP2	8/02/2008	138.2	548.3
HDVP2	7/02/2008	138.2	548.3
HDVP2	6/02/2008	138.2	548.3
HDVP2	5/02/2008	138.2	548.3
HDVP2	4/02/2008	138.2	548.3
HDVP2	3/02/2008	138.2	548.3
HDVP2	2/02/2008	138.2	548.3
HDVP2	1/02/2008	138.2	548.3
HDVP2	31/01/2008	229.3	457.2
HDVP2	30/01/2008	229.3	457.2
HDVP2	29/01/2008	229.3	457.2
HDVP2	28/01/2008	229.3	457.2
HDVP2	27/01/2008	229.3	457.2
HDVP2	26/01/2008	229.3	457.2
HDVP2	25/01/2008	229.3	457.2
HDVP2	24/01/2008	229.3	457.2
HDVP2	23/01/2008	229.3	457.2
HDVP2	22/01/2008	229.3	457.2
HDVP2	21/01/2008	229.3	457.2
HDVP2	20/01/2008	229.3	457.2
HDVP2	19/01/2008	229.3	457.2
HDVP2	18/01/2008	229.3	457.2
HDVP2	17/01/2008	229.3	457.2
HDVP2	16/01/2008	229.3	457.2
HDVP2	15/01/2008	229.3	457.2
HDVP2	14/01/2008	229.3	457.2
HDVP2	13/01/2008	229.3	457.2
HDVP2	12/01/2008	229.3	457.2
HDVP2	11/01/2008	229.3	457.2
HDVP2	10/01/2008	229.3	457.2
HDVP2	9/01/2008	229.3	457.2
HDVP2	8/01/2008	229.3	457.2
HDVP2	7/01/2008	229.3	457.2
HDVP2	6/01/2008	229.3	457.2
HDVP2	5/01/2008	229.3	457.2
HDVP2	4/01/2008	229.3	457.2
HDVP2	3/01/2008	229.3	457.2
HDVP2	2/01/2008	229.3	457.2
HDVP2	1/01/2008	229.3	457.2
HDVP2	31/12/2007	99.8	586.7
HDVP2	30/12/2007	99.8	586.7
HDVP2	29/12/2007	99.8	586.7
HDVP2	28/12/2007	99.8	586.7
HDVP2	27/12/2007	99.8	586.7
HDVP2	26/12/2007	99.8	586.7
HDVP2	25/12/2007	99.8	586.7
HDVP2	24/12/2007	99.8	586.7
HDVP2	23/12/2007	99.8	586.7
HDVP2	22/12/2007	99.8	586.7
HDVP2	21/12/2007	99.8	586.7
HDVP2	20/12/2007	99.8	586.7
HDVP2	19/12/2007	99.8	586.7
HDVP2	18/12/2007	99.8	586.7
HDVP2	17/12/2007	99.8	586.7
HDVP2	16/12/2007	99.8	586.7
HDVP2	15/12/2007	99.8	586.7
HDVP2	14/12/2007	99.8	586.7
HDVP2	13/12/2007	99.8	586.7
HDVP2	12/12/2007	99.8	586.7
HDVP2	11/12/2007	99.8	586.7
HDVP2	10/12/2007	99.8	586.7
HDVP2	9/12/2007	99.8	586.7
HDVP2	8/12/2007	99.8	586.7
HDVP2	7/12/2007	99.8	586.7
HDVP2	6/12/2007	99.8	586.7
HDVP2	5/12/2007	99.8	586.7
HDVP2	4/12/2007	99.8	586.7
HDVP2	3/12/2007	99.8	586.7
HDVP2	2/12/2007	99.8	586.7
HDVP2	1/12/2007	99.8	586.7
HDVP2	30/11/2007	71.5	615.1
HDVP2	29/11/2007	71.5	615.1
HDVP2	28/11/2007	71.5	615.1
HDVP2	27/11/2007	71.5	615.1
HDVP2	26/11/2007	71.5	615.1
HDVP2	25/11/2007	71.5	615.1
HDVP2	24/11/2007	71.5	615.1
HDVP2	23/11/2007	71.5	615.1
HDVP2	22/11/2007	71.5	615.1
HDVP2	21/11/2007	71.5	615.1
HDVP2	20/11/2007	71.5	615.1
HDVP2	19/11/2007	71.5	615.1
HDVP2	18/11/2007	71.5	615.1
HDVP2	17/11/2007	71.5	615.1
HDVP2	16/11/2007	71.5	615.1
HDVP2	15/11/2007	71.5	615.1
HDVP2	14/11/2007	71.5	615.1
HDVP2	13/11/2007	71.5	615.1
HDVP2	12/11/2007	71.5	615.1
HDVP2	11/11/2007	71.5	615.1
HDVP2	10/11/2007	71.5	615.1
HDVP2	9/11/2007	71.5	615.1
HDVP2	8/11/2007	71.5	615.1
HDVP2	7/11/2007	71.5	615.1
HDVP2	6/11/2007	71.5	615.1
HDVP2	5/11/2007	71.5	615.1
HDVP2	4/11/2007	71.5	615.1
HDVP2	3/11/2007	71.5	615.1
HDVP2	2/11/2007	71.5	615.1
HDVP2	1/11/2007	71.5	615.1
HDVP2	31/10/2007	130.9	555.6
HDVP2	30/10/2007	130.9	555.6
HDVP2	29/10/2007	130.9	555.6
HDVP2	28/10/2007	130.9	555.6
HDVP2	27/10/2007	130.9	555.6
HDVP2	26/10/2007	130.9	555.6
HDVP2	25/10/2007	130.9	555.6
HDVP2	24/10/2007	130.9	555.6
HDVP2	23/10/2007	130.9	555.6
HDVP2	22/10/2007	130.9	555.6
HDVP2	21/10/2007	130.9	555.6
HDVP2	20/10/2007	130.9	555.6
HDVP2	19/10/2007	130.9	555.6
HDVP2	18/10/2007	130.9	555.6
HDVP2	17/10/2007	130.9	555.6
HDVP2	16/10/2007	130.9	555.6
HDVP2	15/10/2007	130.9	555.6
HDVP2	14/10/2007	130.9	555.6
HDVP2	13/10/2007	130.9	555.6
HDVP2	12/10/2007	130.9	555.6
HDVP2	11/10/2007	130.9	555.6
HDVP2	10/10/2007	130.9	555.6
HDVP2	9/10/2007	130.9	555.6
HDVP2	8/10/2007	130.9	555.6

ID	Date	WL mAHD	WL mbgl
MB18WON0007	5/02/2022	617.7	13.5
MB18WON0007	4/02/2022	617.7	13.5
MB18WON0007	3/02/2022	617.7	13.5
MB18WON0007	2/02/2022	617.7	13.5
MB18WON0007	1/02/2022	617.7	13.5
MB18WON0007	31/01/2022	617.7	13.6
MB18WON0007	30/01/2022	617.7	13.5
MB18WON0007	29/01/2022	617.7	13.5
MB18WON0007	28/01/2022	617.7	13.6
MB18WON0007	27/01/2022	617.7	13.6
MB18WON0007	26/01/2022	617.7	13.6
MB18WON0007	25/01/2022	617.6	13.6
MB18WON0007	24/01/2022	617.7	13.6
MB18WON0007	23/01/2022	617.7	13.5
MB18WON0007	22/01/2022	617.7	13.5
MB18WON0007	21/01/2022	617.8	13.5
MB18WON0007	20/01/2022	617.8	13.5
MB18WON0007	19/01/2022	617.7	13.5
MB18WON0007	18/01/2022	617.7	13.6
MB18WON0007	17/01/2022	617.5	13.8
MB18WON0007	16/01/2022	617.4	13.8
MB18WON0007	15/01/2022	617.5	13.8
MB18WON0007	14/01/2022	617.5	13.8
MB18WON0007	13/01/2022	617.5	13.7
MB18WON0007	12/01/2022	617.6	13.7
MB18WON0007	11/01/2022	617.6	13.7
MB18WON0007	10/01/2022	617.6	13.7
MB18WON0007	9/01/2022	617.5	13.7
MB18WON0007	8/01/2022	617.5	13.8
MB18WON0007	7/01/2022	617.5	13.8
MB18WON0007	6/01/2022	617.5	13.8
MB18WON0007	5/01/2022	617.5	13.8
MB18WON0007	4/01/2022	617.5	13.8
MB18WON0007	3/01/2022	617.5	13.8
MB18WON0007	2/01/2022	617.5	13.8
MB18WON0007	1/01/2022	617.5	13.7
MB18WON0007	31/12/2021	617.5	13.8
MB18WON0007	30/12/2021	617.5	13.8
MB18WON0007	29/12/2021	617.5	13.8
MB18WON0007	28/12/2021	617.5	13.7
MB18WON0007	27/12/2021	617.5	13.7
MB18WON0007	26/12/2021	617.5	13.7
MB18WON0007	25/12/2021	617.5	13.7
MB18WON0007	24/12/2021	617.5	13.7
MB18WON0007	23/12/2021	617.5	13.7
MB18WON0007	22/12/2021	617.5	13.7
MB18WON0007	21/12/2021	617.6	13.7
MB18WON0007	20/12/2021	617.6	13.7
MB18WON0007	19/12/2021	617.6	13.7
MB18WON0007	18/12/2021	617.6	13.7
MB18WON0007	17/12/2021	617.6	13.7
MB18WON0007	16/12/2021	617.6	13.7
MB18WON0007	15/12/2021	617.6	13.7
MB18WON0007	14/12/2021	617.6	13.7
MB18WON0007	13/12/2021	617.6	13.7
MB18WON0007	12/12/2021	617.6	13.6
MB18WON0007	11/12/2021	617.6	13.6
MB18WON0007	10/12/2021	617.6	13.6
MB18WON0007	9/12/2021	617.7	13.6
MB18WON0007	8/12/2021	617.7	13.6
MB18WON0007	7/12/2021	617.7	13.6
MB18WON0007	6/12/2021	617.7	13.6
MB18WON0007	5/12/2021	617.7	13.6
MB18WON0007	4/12/2021	617.7	13.6
MB18WON0007	3/12/2021	617.7	13.6
MB18WON0007	2/12/2021	617.7	13.6
MB18WON0007	1/12/2021	617.7	13.6
MB18WON0007	30/11/2021	617.7	13.6
MB18WON0007	29/11/2021	617.7	13.5
MB18WON0007	28/11/2021	617.8	13.5
MB18WON0007	27/11/2021	617.8	13.5
MB18WON0007	26/11/2021	617.8	13.5
MB18WON0007	25/11/2021	617.8	13.5
MB18WON0007	24/11/2021	617.8	13.5
MB18WON0007	23/11/2021	617.8	13.5
MB18WON0007	22/11/2021	617.8	13.5
MB18WON0007	21/11/2021	617.8	13.5
MB18WON0007	20/11/2021	617.8	13.5
MB18WON0007	19/11/2021	617.8	13.5
MB18WON0007	18/11/2021	617.8	13.5
MB18WON0007	16/11/2021	617.8	13.5
MB18WON0007	15/11/2021	617.8	13.5
MB18WON0007	13/11/2021	617.8	13.4
MB18WON0007	12/11/2021	617.8	13.4
MB18WON0007	11/11/2021	617.8	13.4
MB18WON0007	10/11/2021	617.8	13.4
MB18WON0007	9/11/2021	617.8	13.5
MB18WON0007	8/11/2021	617.8	13.5
MB18WON0007	7/11/2021	617.8	13.5
MB18WON0007	6/11/2021	617.8	13.4
MB18WON0007	5/11/2021	617.8	13.4
MB18WON0007	4/11/2021	617.9	13.4
MB18WON0007	3/11/2021	617.9	13.4
MB18WON0007	2/11/2021	617.9	13.4
MB18WON0007	1/11/2021	617.9	13.4
MB18WON0007	31/10/2021	617.9	13.4
MB18WON0007	30/10/2021	617.9	13.4
MB18WON0007	29/10/2021	617.9	13.4
MB18WON0007	28/10/2021	617.9	13.4
MB18WON0007	26/10/2021	617.9	13.4
MB18WON0007	25/10/2021	617.9	13.4
MB18WON0007	24/10/2021	617.9	13.3
MB18WON0007	23/10/2021	618.0	13.3
MB18WON0007	22/10/2021	618.0	13.3
MB18WON0007	21/10/2021	618.0	13.3
MB18WON0007	20/10/2021	618.0	13.3
MB18WON0007	19/10/2021	618.0	13.3
MB18WON0007	15/10/2021	618.0	13.3
MB18WON0007	14/10/2021	618.0	13.3
MB18WON0007	13/10/2021	618.0	13.3
MB18WON0007	12/10/2021	618.0	13.3
MB18WON0007	11/10/2021	618.0	13.3
MB18WON0007	10/10/2021	618.0	13.2
MB18WON0007	9/10/2021	618.0	13.2
MB18WON0007	8/10/2021	618.0	13.3
MB18WON0007	7/10/2021	618.0	13.2
MB18WON0007	6/10/2021	618.0	13.2
MB18WON0007	5/10/2021	618.0	13.3
MB18WON0007	4/10/2021	618.0	13.2
MB18WON0007	3/10/2021	618.0	13.2
MB18WON0007	2/10/2021	618.0	13.2
MB18WON0007	1/10/2021	618.0	13.2
MB18WON0007	30/09/2021	618.1	13.2
MB18WON0007	29/09/2021	618.1	13.2
MB18WON0007	28/09/2021	618.1	13.2
MB18WON0007	27/09/2021	618.1	13.2
MB18WON0007	26/09/2021	618.1	13.2
MB18WON0007	25/09/2021	618.1	13.2
MB18WON0007	24/09/2021	618.1	13.2
MB18WON0007	23/09/2021	618.1	13.1
MB18WON0007	22/09/2021	618.2	13.1
MB18WON0007	21/09/2021	618.2	13.1
MB18WON0007	20/09/2021	618.2	13.1
MB18WON0007	19/09/2021	618.2	13.1
MB18WON0007	18/09/2021	618.2	13.1
MB18WON0007	17/09/2021	618.2	13.1

ID	Date	WL mAHD	WL mbgl
MB15HD20008	26/12/2020	626.9	83.4
MB15HD20008	27/12/2020	626.9	83.4
MB15HD20008	28/12/2020	626.9	83.4
MB15HD20008	29/12/2020	626.9	83.4
MB15HD20008	30/12/2020	626.9	83.4
MB15HD20008	31/12/2020	626.9	83.4
MB15HD20008	1/01/2021	626.9	83.4
MB15HD20008	2/01/2021	626.9	83.4
MB15HD20008	3/01/2021	626.9	83.4
MB15HD20008	4/01/2021	626.9	83.4
MB15HD20008	5/01/2021	627.0	83.4
MB15HD20008	6/01/2021	627.0	83.4
MB15HD20008	7/01/2021	627.0	83.4
MB15HD20008	8/01/2021	627.0	83.4
MB15HD20008	9/01/2021	627.0	83.4
MB15HD20008	10/01/2021	626.9	83.4
MB15HD20008	11/01/2021	626.9	83.4
MB15HD20008	12/01/2021	626.9	83.4
MB15HD20008	13/01/2021	626.9	83.4
MB15HD20008	14/01/2021	626.9	83.4
MB15HD20008	15/01/2021	626.9	83.4
MB15HD20008	16/01/2021	626.9	83.4
MB15HD20008	17/01/2021	626.9	83.4
MB15HD20008	18/01/2021	626.9	83.4
MB15HD20008	19/01/2021	626.9	83.4
MB15HD20008	20/01/2021	626.9	83.4
MB15HD20008	21/01/2021	626.9	83.4
MB15HD20008	22/01/2021	626.9	83.4
MB15HD20008	23/01/2021	626.9	83.4
MB15HD20008	24/01/2021	626.9	83.4
MB15HD20008	25/01/2021	626.9	83.4
MB15HD20008	26/01/2021	626.9	83.5
MB15HD20008	27/01/2021	626.9	83.5
MB15HD20008	28/01/2021	626.9	83.5
MB15HD20008	29/01/2021	626.9	83.5
MB15HD20008	30/01/2021	626.9	83.5
MB15HD20008	31/01/2021	626.9	83.5
MB15HD20008	1/02/2021	626.9	83.5
MB15HD20008	2/02/2021	626.9	83.4
MB15HD20008	3/02/2021	626.9	83.4
MB15HD20008	4/02/2021	626.9	83.4
MB15HD20008	5/02/2021	626.9	83.5
MB15HD20008	6/02/2021	626.9	83.4
MB15HD20008	7/02/2021	626.9	83.4
MB15HD20008	8/02/2021	626.9	83.4
MB15HD20008	9/02/2021	626.9	83.5
MB15HD20008	10/02/2021	626.9	83.5
MB15HD20008	11/02/2021	626.9	83.5
MB15HD20008	12/02/2021	626.9	83.5
MB15HD20008	13/02/2021	626.9	83.4
MB15HD20008	14/02/2021	626.9	83.4
MB15HD20008	15/02/2021	626.9	83.4
MB15HD20008	16/02/2021	626.9	83.4
MB15HD20008	17/02/2021	626.9	83.4
MB15HD20008	18/02/2021	626.9	83.4
MB15HD20008	19/02/2021	626.9	83.4
MB15HD20008	20/02/2021	626.9	83.4
MB15HD20008	21/02/2021	626.9	83.4
MB15HD20008	22/02/2021	626.9	83.4
MB15HD20008	23/02/2021	626.9	83.4
MB15HD20008	24/02/2021	626.9	83.4
MB15HD20008	25/02/2021	626.9	83.4
MB15HD20008	26/02/2021	626.9	83.5
MB15HD20008	27/02/2021	626.9	83.5
MB15HD20008	28/02/2021	626.9	83.5
MB15HD20008	1/03/2021	626.9	83.4
MB15HD20008	2/03/2021	626.9	83.4
MB15HD20008	3/03/2021	626.9	83.4
MB15HD20008	4/03/2021	626.9	83.4
MB15HD20008	5/03/2021	626.9	83.4
MB15HD20008	6/03/2021	626.9	83.4
MB15HD20008	7/03/2021	626.9	83.4
MB15HD20008	8/03/2021	626.9	83.4
MB15HD20008	9/03/2021	626.9	83.4
MB15HD20008	10/03/2021	626.9	83.4
MB15HD20008	11/03/2021	626.9	83.4
MB15HD20008	12/03/2021	626.9	83.4
MB15HD20008	13/03/2021	626.9	83.4
MB15HD20008	14/03/2021	626.9	83.4
MB15HD20008	15/03/2021	626.9	83.4
MB15HD20008	16/03/2021	626.9	83.4
MB15HD20008	17/03/2021	626.9	83.4
MB15HD20008	18/03/2021	626.9	83.4
MB15HD20008	19/03/2021	626.9	83.4
MB15HD20008	20/03/2021	626.9	83.4
MB15HD20008	21/03/2021	626.9	83.4
MB15HD20008	22/03/2021	626.9	83.4
MB15HD20008	23/03/2021	626.9	83.4
MB15HD20008	24/03/2021	626.9	83.4
MB15HD20008	25/03/2021	626.9	83.4
MB15HD20008	26/03/2021	626.9	83.4
MB15HD20008	27/03/2021	626.9	83.4
MB15HD20008	28/03/2021	626.9	83.4
MB15HD20008	29/03/2021	626.9	83.4
MB15HD20008	30/03/2021	626.9	83.4
MB15HD20008	31/03/2021	626.9	83.4
MB15HD20008	1/04/2021	626.9	83.4
MB15HD20008	2/04/2021	626.9	83.4
MB15HD20008	3/04/2021	626.9	83.4
MB15HD20008	4/04/2021	626.9	83.4
MB15HD20008	5/04/2021	626.9	83.4
MB15HD20008	6/04/2021	626.9	83.4
MB15HD20008	7/04/2021	626.9	83.4
MB15HD20008	8/04/2021	626.9	83.4
MB15H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDRE1	18/07/2019	627.9	51.4
HDRE1	17/07/2019	627.9	51.4
HDRE1	16/07/2019	627.9	51.4
HDRE1	15/07/2019	627.9	51.4
HDRE1	14/07/2019	627.9	51.4
HDRE1	13/07/2019	628.0	51.3
HDRE1	12/07/2019	628.0	51.3
HDRE1	11/07/2019	628.0	51.3
HDRE1	10/07/2019	627.9	51.4
HDRE1	9/07/2019	627.9	51.4
HDRE1	8/07/2019	627.9	51.4
HDRE1	7/07/2019	627.9	51.4
HDRE1	6/07/2019	627.9	51.4
HDRE1	5/07/2019	627.9	51.4
HDRE1	4/07/2019	627.9	51.4
HDRE1	3/07/2019	628.0	51.3
HDRE1	2/07/2019	627.9	51.4
HDRE1	1/07/2019	627.9	51.4
HDRE1	30/06/2019	627.9	51.4
HDRE1	29/06/2019	627.9	51.4
HDRE1	28/06/2019	627.9	51.4
HDRE1	27/06/2019	627.9	51.4
HDRE1	26/06/2019	627.9	51.4
HDRE1	25/06/2019	627.9	51.4
HDRE1	24/06/2019	627.9	51.4
HDRE1	23/06/2019	627.9	51.4
HDRE1	22/06/2019	627.9	51.4
HDRE1	21/06/2019	627.9	51.4
HDRE1	20/06/2019	627.9	51.4
HDRE1	19/06/2019	627.9	51.4
HDRE1	18/06/2019	627.9	51.4
HDRE1	17/06/2019	627.9	51.4
HDRE1	16/06/2019	627.9	51.4
HDRE1	15/06/2019	627.9	51.4
HDRE1	14/06/2019	627.9	51.4
HDRE1	13/06/2019	627.9	51.4
HDRE1	12/06/2019	627.9	51.4
HDRE1	11/06/2019	627.9	51.4
HDRE1	10/06/2019	627.8	51.5
HDRE1	9/06/2019	627.9	51.4
HDRE1	8/06/2019	627.9	51.4
HDRE1	7/06/2019	627.9	51.4
HDRE1	6/06/2019	627.9	51.4
HDRE1	5/06/2019	627.9	51.4
HDRE1	4/06/2019	627.9	51.4
HDRE1	3/06/2019	627.9	51.4
HDRE1	2/06/2019	627.9	51.4
HDRE1	1/06/2019	627.9	51.4
HDRE1	31/05/2019	627.9	51.4
HDRE1	30/05/2019	627.9	51.4
HDRE1	29/05/2019	627.9	51.4
HDRE1	28/05/2019	627.9	51.4
HDRE1	27/05/2019	627.9	51.4
HDRE1	26/05/2019	627.9	51.4
HDRE1	25/05/2019	627.9	51.4
HDRE1	24/05/2019	627.9	51.4
HDRE1	23/05/2019	627.9	51.4
HDRE1	22/05/2019	627.9	51.4
HDRE1	21/05/2019	627.9	51.4
HDRE1	20/05/2019	627.9	51.4
HDRE1	19/05/2019	627.9	51.4
HDRE1	18/05/2019	627.9	51.4
HDRE1	17/05/2019	627.9	51.4
HDRE1	16/05/2019	627.9	51.4
HDRE1	15/05/2019	627.9	51.4
HDRE1	14/05/2019	627.9	51.4
HDRE1	13/05/2019	627.9	51.4
HDRE1	12/05/2019	627.9	51.4
HDRE1	11/05/2019	627.9	51.4
HDRE1	10/05/2019	627.9	51.4
HDRE1	9/05/2019	627.9	51.4
HDRE1	8/05/2019	627.9	51.4
HDRE1	7/05/2019	627.9	51.4
HDRE1	6/05/2019	627.9	51.4
HDRE1	5/05/2019	627.9	51.4
HDRE1	4/05/2019	627.9	51.4
HDRE1	3/05/2019	627.9	51.4
HDRE1	2/05/2019	627.9	51.4
HDRE1	1/05/2019	627.9	51.4
HDRE1	30/04/2019	627.9	51.4
HDRE1	29/04/2019	627.9	51.4
HDRE1	28/04/2019	627.9	51.4
HDRE1	27/04/2019	627.9	51.4
HDRE1	26/04/2019	627.9	51.4
HDRE1	25/04/2019	627.9	51.4
HDRE1	24/04/2019	627.9	51.4
HDRE1	23/04/2019	627.9	51.4
HDRE1	22/04/2019	627.9	51.4
HDRE1	21/04/2019	627.9	51.4
HDRE1	20/04/2019	627.9	51.4
HDRE1	19/04/2019	627.9	51.4
HDRE1	18/04/2019	627.9	51.4
HDRE1	17/04/2019	627.9	51.4
HDRE1	16/04/2019	627.9	51.4
HDRE1	15/04/2019	627.9	51.4
HDRE1	14/04/2019	627.8	51.5
HDRE1	13/04/2019	627.9	51.4
HDRE1	12/04/2019	627.9	51.4
HDRE1	11/04/2019	627.8	51.5
HDRE1	10/04/2019	627.8	51.4
HDRE1	9/04/2019	627.8	51.5
HDRE1	8/04/2019	627.8	51.5
HDRE1	7/04/2019	627.8	51.5
HDRE1	6/04/2019	627.9	51.4
HDRE1	5/04/2019	627.9	51.4
HDRE1	4/04/2019	627.9	51.4
HDRE1	3/04/2019	627.8	51.4
HDRE1	2/04/2019	627.8	51.5
HDRE1	1/04/2019	627.8	51.5
HDRE1	31/03/2019	627.8	51.5
HDRE1	30/03/2019	627.8	51.5
HDRE1	29/03/2019	627.8	51.5
HDRE1	28/03/2019	627.8	51.5
HDRE1	27/03/2019	627.8	51.5
HDRE1	26/03/2019	627.8	51.5
HDRE1	25/03/2019	627.8	51.5
HDRE1	24/03/2019	627.8	51.5
HDRE1	23/03/2019	627.8	51.5
HDRE1	22/03/2019	627.8	51.5
HDRE1	21/03/2019	627.8	51.5
HDRE1	20/03/2019	627.8	51.5
HDRE1	19/03/2019	627.8	51.5
HDRE1	18/03/2019	627.8	51.5
HDRE1	17/03/2019	627.8	51.5
HDRE1	16/03/2019	627.8	51.5
HDRE1	15/03/2019	627.8	51.5
HDRE1	14/03/2019	627.8	51.5
HDRE1	13/03/2019	627.8	51.5
HDRE1	12/03/2019	627.8	51.5
HDRE1	11/03/2019	627.8	51.5
HDRE1	10/03/2019	627.8	51.5
HDRE1	9/03/2019	627.8	51.5
HDRE1	8/03/2019	627.8	51.5
HDRE1	7/03/2019	627.8	51.5
HDRE1	6/03/2019	627.8	51.5
HDRE1	5/03/2019	627.8	51.5

ID	Date	WL mAHD	WL mbgl
HDVP2	7/10/2007	130.9	555.6
HDVP2	6/10/2007	130.9	555.6
HDVP2	5/10/2007	130.9	555.6
HDVP2	4/10/2007	130.9	555.6
HDVP2	3/10/2007	130.9	555.6
HDVP2	2/10/2007	130.9	555.6
HDVP2	1/10/2007	130.9	555.6
HDVP2	30/09/2007	134.3	552.2
HDVP2	29/09/2007	134.3	552.2
HDVP2	28/09/2007	134.3	552.2
HDVP2	27/09/2007	134.3	552.2
HDVP2	26/09/2007	134.3	552.2
HDVP2	25/09/2007	134.3	552.2
HDVP2	24/09/2007	134.3	552.2
HDVP2	23/09/2007	134.3	552.2
HDVP2	22/09/2007	134.3	552.2
HDVP2	21/09/2007	134.3	552.2
HDVP2	20/09/2007	134.3	552.2
HDVP2	19/09/2007	134.3	552.2
HDVP2	18/09/2007	134.3	552.2
HDVP2	17/09/2007	134.3	552.2
HDVP2	16/09/2007	134.3	552.2
HDVP2	15/09/2007	134.3	552.2
HDVP2	14/09/2007	134.3	552.2
HDVP2	13/09/2007	134.3	552.2
HDVP2	12/09/2007	134.3	552.2
HDVP2	11/09/2007	134.3	552.2
HDVP2	10/09/2007	134.3	552.2
HDVP2	9/09/2007	134.3	552.2
HDVP2	8/09/2007	134.3	552.2
HDVP2	7/09/2007	134.3	552.2
HDVP2	6/09/2007	134.3	552.2
HDVP2	5/09/2007	134.3	552.2
HDVP2	4/09/2007	134.3	552.2
HDVP2	3/09/2007	134.3	552.2
HDVP2	2/09/2007	134.3	552.2
HDVP2	1/09/2007	134.3	552.2
HDVP2	31/08/2007	66.8	619.7
HDVP2	30/08/2007	66.8	619.7
HDVP2	29/08/2007	66.8	619.7
HDVP2	28/08/2007	66.8	619.7
HDVP2	27/08/2007	66.8	619.7
HDVP2	26/08/2007	66.8	619.7
HDVP2	25/08/2007	66.8	619.7
HDVP2	24/08/2007	66.8	619.7
HDVP2	23/08/2007	66.8	619.7
HDVP2	22/08/2007	66.8	619.7
HDVP2	21/08/2007	66.8	619.7
HDVP2	20/08/2007	66.8	619.7
HDVP2	19/08/2007	66.8	619.7
HDVP2	18/08/2007	66.8	619.7
HDVP2	17/08/2007	66.8	619.7
HDVP2	16/08/2007	66.8	619.7
HDVP2	15/08/2007	66.8	619.7
HDVP2	14/08/2007	66.8	619.7
HDVP2	13/08/2007	66.8	619.7
HDVP2	12/08/2007	66.8	619.7
HDVP2	11/08/2007	66.8	619.7
HDVP2	10/08/2007	66.8	619.7
HDVP2	9/08/2007	66.8	619.7
HDVP2	8/08/2007	66.8	619.7
HDVP2	7/08/2007	66.8	619.7
HDVP2	6/08/2007	66.8	619.7
HDVP2	5/08/2007	66.8	619.7
HDVP2	4/08/2007	66.8	619.7
HDVP2	3/08/2007	66.8	619.7
HDVP2	2/08/2007	66.8	619.7
HDVP2	1/08/2007	66.8	619.7
HDVP2	31/07/2007	145.1	541.4
HDVP2	30/07/2007	145.1	541.4
HDVP2	29/07/2007	145.1	541.4
HDVP2	28/07/2007	145.1	541.4
HDVP2	27/07/2007	145.1	541.4
HDVP2	26/07/2007	145.1	541.4
HDVP2	25/07/2007	145.1	541.4
HDVP2	24/07/2007	145.1	541.4
HDVP2	23/07/2007	145.1	541.4
HDVP2	22/07/2007	145.1	541.4
HDVP2	21/07/2007	145.1	541.4
HDVP2	20/07/2007	145.1	541.4
HDVP2	19/07/2007	145.1	541.4
HDVP2	18/07/2007	145.1	541.4
HDVP2	17/07/2007	145.1	541.4
HDVP2	16/07/2007	145.1	541.4
HDVP2	15/07/2007	145.1	541.4
HDVP2	14/07/2007	145.1	541.4
HDVP2	13/07/2007	145.1	541.4
HDVP2	12/07/2007	145.1	541.4
HDVP2	11/07/2007	145.1	541.4
HDVP2	10/07/2007	145.1	541.4
HDVP2	9/07/2007	145.1	541.4
HDVP2	8/07/2007	145.1	541.4
HDVP2	7/07/2007	145.1	541.4
HDVP2	6/07/2007	145.1	541.4
HDVP2	5/07/2007	145.1	541.4
HDVP2	4/07/2007	145.1	541.4
HDVP2	3/07/2007	145.1	541.4
HDVP2	2/07/2007	145.1	541.4
HDVP2	1/07/2007	145.1	541.4
HDVP2	30/06/2007	214.1	472.5
HDVP2	29/06/2007	214.1	472.5
HDVP2	28/06/2007	214.1	472.5
HDVP2	27/06/2007	214.1	472.5
HDVP2	26/06/2007	214.1	472.5
HDVP2	25/06/2007	214.1	472.5
HDVP2	24/06/2007	214.1	472.5
HDVP2	23/06/2007	214.1	472.5
HDVP2	22/06/2007	214.1	472.5
HDVP2	21/06/2007	214.1	472.5
HDVP2	20/06/2007	214.1	472.5
HDVP2	19/06/2007	214.1	472.5
HDVP2	18/06/2007	214.1	472.5
HDVP2	17/06/2007	214.1	472.5
HDVP2	16/06/2007	214.1	472.5
HDVP2	15/06/2007	214.1	472.5
HDVP2	14/06/2007	214.1	472.5
HDVP2	13/06/2007	214.1	472.5
HDVP2	12/06/2007	214.1	472.5
HDVP2	11/06/2007	214.1	472.5
HDVP2	10/06/2007	214.1	472.5
HDVP2	9/06/2007	214.1	472.5
HDVP2	8/06/2007	214.1	472.5
HDVP2	7/06/2007	214.1	472.5
HDVP2	6/06/2007	214.1	472.5
HDVP2	5/06/2007	214.1	472.5
HDVP2	4/06/2007	214.1	472.5
HDVP2	3/06/2007	214.1	472.5
HDVP2	2/06/2007	214.1	472.5
HDVP2	1/06/2007	214.1	472.5
HDVP2	31/05/2007	232.3	454.3
HDVP2	30/05/2007	232.3	454.3
HDVP2	29/05/2007	232.3	454.3
HDVP2	28/05/2007	232.3	454.3
HDVP2	27/05/2007	232.3	454.3
HDVP2	26/05/2007	232.3	454.3
HDVP2	25/05/2007	232.3	454.3

ID	Date	WL mAHD	WL mbgl
MB18WON0007	16/09/2021	618.1	13.1
MB18WON0007	15/09/2021	618.1	13.1
MB18WON0007	14/09/2021	618.2	13.1
MB18WON0007	13/09/2021	618.2	13.1
MB18WON0007	12/09/2021	618.1	13.1
MB18WON0007	11/09/2021	618.2	13.1
MB18WON0007	10/09/2021	618.2	13.1
MB18WON0007	9/09/2021	618.2	13.0
MB18WON0007	8/09/2021	618.2	13.0
MB18WON0007	7/09/2021	618.3	13.0
MB18WON0007	6/09/2021	618.3	13.0
MB18WON0007	5/09/2021	618.3	13.0
MB18WON0007	4/09/2021	618.3	13.0
MB18WON0007	3/09/2021	618.2	13.0
MB18WON0007	2/09/2021	618.2	13.0
MB18WON0007	1/09/2021	618.2	13.1
MB18WON0007	31/08/2021	618.2	13.0
MB18WON0007	30/08/2021	618.2	13.0
MB18WON0007	29/08/2021	618.2	13.0
MB18WON0007	28/08/2021	618.3	13.0
MB18WON0007	27/08/2021	618.3	13.0
MB18WON0007	26/08/2021	618.2	13.0
MB18WON0007	25/08/2021	618.3	13.0
MB18WON0007	24/08/2021	618.3	13.0
MB18WON0007	23/08/2021	618.3	13.0
MB18WON0007	22/08/2021	618.3	13.0
MB18WON0007	21/08/2021	618.3	13.0
MB18WON0007	20/08/2021	618.3	13.0
MB18WON0007	19/08/2021	618.3	13.0
MB18WON0007	18/08/2021	618.3	13.0
MB18WON0007	17/08/2021	618.3	12.9
MB18WON0007	16/08/2021	618.4	12.9
MB18WON0007	15/08/2021	618.4	12.9
MB18WON0007	14/08/2021	618.3	12.9
MB18WON0007	13/08/2021	618.3	12.9
MB18WON0007	12/08/2021	618.4	12.9
MB18WON0007	11/08/2021	618.4	12.8
MB18WON0007	10/08/2021	618.4	12.9
MB18WON0007	9/08/2021	618.3	12.9
MB18WON0007	8/08/2021	618.4	12.9
MB18WON0007	7/08/2021	618.4	12.9
MB18WON0007	6/08/2021	618.4	12.8
MB18WON0007	5/08/2021	618.4	12.8
MB18WON0007	4/08/2021	618.4	12.8
MB18WON0007	3/08/2021	618.4	12.8
MB18WON0007	2/08/2021	618.4	12.8
MB18WON0007	1/08/2021	618.4	12.9
MB18WON0007	31/07/2021	618.4	12.9
MB18WON0007	30/07/2021	618.4	12.9
MB18WON0007	29/07/2021	618.4	12.9
MB18WON0007	28/07/2021	618.4	12.9
MB18WON0007	27/07/2021	618.4	12.9
MB18WON0007	26/07/2021	618.4	12.9
MB18WON0007	25/07/2021	618.4	12.8
MB18WON0007	24/07/2021	618.4	12.8
MB18WON0007	23/07/2021	618.4	12.8
MB18WON0007	22/07/2021	618.4	12.8
MB18WON0007	21/07/2021	618.4	12.8
MB18WON0007	20/07/2021	618.4	12.8
MB18WON0007	19/07/2021	618.5	12.8
MB18WON0007	18/07/2021	618.5	12.8
MB18WON0007	17/07/2021	618.5	12.8
MB18WON0007	16/07/2021	618.5	12.8
MB18WON0007	15/07/2021	618.5	12.8
MB18WON0007	14/07/2021	618.5	12.8
MB18WON0007	13/07/2021	618.5	12.8
MB18WON0007	12/07/2021	618.5	12.8
MB18WON0007	11/07/2021	618.5	12.8
MB18WON0007	10/07/2021	618.5	12.8
MB18WON0007	9/07/2021	618.5	12.8
MB18WON0007	8/07/2021	618.5	12.8
MB18WON0007	7/07/2021	618.5	12.8
MB18WON0007	6/07/2021	618.5	12.8
MB18WON0007	5/07/2021	618.5	12.8
MB18WON0007	4/07/2021	618.5	12.7
MB18WON0007	3/07/2021	618.5	12.7
MB18WON0007	2/07/2021	618.6	12.7
MB18WON0007	1/07/2021	618.6	12.7
MB18WON0007	30/06/2021	618.6	12.7
MB18WON0007	29/06/2021	618.5	12.7
MB18WON0007	28/06/2021	618.5	12.7
MB18WON0007	27/06/2021	618.5	12.7
MB18WON0007	26/06/2021	618.6	12.7
MB18WON0007	25/06/2021	618.6	12.7
MB18WON0007	24/06/2021	618.6	12.7
MB18WON0007	23/06/2021	618.6	12.7
MB18WON0007	22/06/2021	618.6	12.7
MB18WON0007	21/06/2021	618.5	12.7
MB18WON0007	20/06/2021	618.5	12.7
MB18WON0007	19/06/2021	618.6	12.7
MB18WON0007	18/06/2021	618.6	12.6
MB18WON0007	17/06/2021	618.6	12.6
MB18WON0007	16/06/2021	618.6	12.6
MB18WON0007	15/06/2021	618.6	12.7
MB18WON0007	14/06/2021	618.6	12.7
MB18WON0007	13/06/2021	618.6	12.7
MB18WON0007	12/06/2021	618.6	12.7
MB18WON0007	11/06/2021	618.6	12.7
MB18WON0007	10/06/2021	618.6	12.7
MB18WON0007	9/06/2021	618.6	12.6
MB18WON0007	8/06/2021	618.6	12.6
MB18WON0007	7/06/2021	618.6	12.6
MB18WON0007	6/06/2021	618.6	12.6
MB18WON0007	5/06/2021	618.7	12.6
MB18WON0007	4/06/2021	618.7	12.6
MB18WON0007	3/06/2021	618.7	12.6
MB18WON0007	2/06/2021	618.7	12.6
MB18WON0007	1/06/2021	618.7	12.6
MB18WON0007	31/05/2021	618.6	12.6
MB18WON0007	30/05/2021	618.7	12.6
MB18WON0007	29/05/2021	618.7	12.6
MB18WON0007	28/05/2021	618.7	12.5
MB18WON0007	27/05/2021	618.7	12.5
MB18WON0007	26/05/2021	618.7	12.5
MB18WON0007	25/05/2021	618.8	12.5
MB18WON0007	24/05/2021	618.7	12.5
MB18WON0007	23/05/2021	618.7	12.6
MB18WON0007	22/05/2021	618.7	12.6
MB18WON0007	21/05/2021	618.7	12.5
MB18WON0007	20/05/2021	618.8	12.5
MB18WON0007	19/05/2021	618.7	12.5
MB18WON0007	18/05/2021	618.7	12.5
MB18WON0007	17/05/2021	618.8	12.5
MB18WON0007	16/05/2021	618.8	12.5
MB18WON0007	15/05/2021	618.8	12.5
MB18WON0007	14/05/2021	618.8	12.5
MB18WON0007	13/05/2021	618.8	12.5
MB18WON0007	12/05/2021	618.8	12.4
MB18WON0007	11/05/2021	618.8	12.4
MB18WON0007	10/05/2021	618.9	12.4
MB18WON0007	9/05/2021	618.9	12.4
MB18WON0007	8/05/2021	618.8	12.4
MB18WON0007	7/05/2021	618.9	12.4
MB18WON0007	6/05/2021	618.8	12.4
MB18WON0007	5/05/2021	618.8	12.4
MB18WON0007	4/05/2021	618.8	12.4

ID	Date	WL mAHD	WL mbgl
MB15HD20008	11/05/2021	626.9	83.4
MB15HD20008	12/05/2021	626.9	83.4
MB15HD20008	13/05/2021	626.9	83.4
MB15HD20008	14/05/2021	626.9	83.4
MB15HD20008	15/05/2021	626.9	83.4
MB15HD20008	16/05/2021	626.9	83.4
MB15HD20008	17/05/2021	626.9	83.4
MB15HD20008	18/05/2021	626.9	83.4
MB15HD20008	19/05/2021	626.9	83.4
MB15HD20008	20/05/2021	626.9	83.4
MB15HD20008	21/05/2021	626.9	83.4
MB15HD20008	22/05/2021	626.9	83.4
MB15HD20008	23/05/2021	626.9	83.4
MB15HD20008	24/05/2021	626.9	83.4
MB15HD20008	25/05/2021	626.9	83.4
MB15HD20008	26/05/2021	626.9	83.4
MB15HD20008	27/05/2021	626.9	83.4
MB15HD20008	28/05/2021	626.9	83.4
MB15HD20008	29/05/2021	626.9	83.4
MB15HD20008	30/05/2021	626.9	83.4
MB15HD20008	31/05/2021	626.9	83.4
MB15HD20008	1/06/2021	626.9	83.4
MB15HD20008	2/06/2021	626.9	83.4
MB15HD20008	3/06/2021	626.9	83.4
MB15HD20008	4/06/2021	626.9	83.4
MB15HD20008	5/06/2021	626.9	83.4
MB15HD20008	6/06/2021	626.9	83.4
MB15HD20008	7/06/2021	626.9	83.4
MB15HD20008	8/06/2021	626.9	83.4
MB15HD20008	9/06/2021	626.9	83.4
MB15HD20008	10/06/2021	626.9	83.4
MB15HD20008	11/06/2021	626.9	83.4
MB15HD20008	12/06/2021	626.9	83.4
MB15HD20008	13/06/2021	626.9	83.4
MB15HD20008	14/06/2021	626.9	83.4
MB15HD20008	15/06/2021	626.9	83.4
MB15HD20008	16/06/2021	626.9	83.4
MB15HD20008	17/06/2021	626.9	83.4
MB15HD20008	18/06/2021	626.9	83.4
MB15HD20008	19/06/2021	626.9	83.4
MB15HD20008	20/06/2021	626.9	83.4
MB15HD20008	21/06/2021	626.9	83.4
MB15HD20008	22/06/2021	626.9	83.4
MB15HD20008	23/06/2021	626.9	83.4
MB15HD20008	24/06/2021	626.9	83.4
MB15HD20008	25/06/2021	626.9	83.4
MB15HD20008	26/06/2021	626.9	83.4
MB15HD20008	27/06/2021	626.9	83.4
MB15HD20008	28/06/2021	626.9	83.4
MB15HD20008	29/06/2021	626.9	83.4
MB15HD20008	30/06/2021	626.9	83.4
MB15HD20008	1/07/2021	626.9	83.4
MB15HD20008	2/07/2021	626.9	83.4
MB15HD20008	3/07/2021	626.9	83.4
MB15HD20008	4/07/2021	626.9	83.4
MB15HD20008	5/07/2021	626.9	83.4
MB15HD20008	6/07/2021	626.9	83.4
MB15HD20008	7/07/2021	626.9	83.4
MB15HD20008	8/07/2021	626.9	83.4
MB15HD20008	9/07/2021	626.9	83.4
MB15HD20008	10/07/2021	626.9	83.5
MB15HD20008	11/07/2021	626.9	83.5
MB15HD20008	12/07/2021	626.9	83.5
MB15HD20008	13/07/2021	626.9	83.5
MB15HD20008	14/07/2021	626.9	83.5
MB15HD20008	15/07/2021	626.9	83.4
MB15HD20008	16/07/2021	626.9	83.4
MB15HD20008	17/07/2021	626.9	83.4
MB15HD20008	18/07/2021	626.9	83.4
MB15HD20008	19/07/2021	626.9	83.4
MB15HD20008	20/07/2021	626.9	83.4
MB15HD20008	21/07/2021	626.9	83.4
MB15HD20008	22/07/2021	626.9	83.5
MB15HD20008	23/07/2021	626.9	83.5
MB15HD20008	24/07/2021	626.9	83.4
MB15HD20008	25/07/2021	626.9	83.4
MB15HD20008	26/07/2021	626.9	83.5
MB15HD20008	27/07/2021	626.9	83.5
MB15HD20008	28/07/2021	626.9	83.5
MB15HD20008	29/07/2021	626.9	83.5
MB15HD20008	30/07/2021	626.9	83.5
MB15HD20008	31/07/2021	626.9	83.5
MB15HD20008	1/08/2021	626.9	83.4
MB15HD20008	2/08/2021	626.9	83.4
MB15HD20008	3/08/2021	626.9	83.4
MB15HD20008	4/08/2021	626.9	83.4
MB15HD20008	5/08/2021	626.9	83.4
MB15HD20008	6/08/2021	626.9	83.4
MB15HD20008	7/08/2021	626.9	83.4
MB15HD20008	8/08/2021	626.9	83.4
MB15HD20008	9/08/2021	626.9	83.5
MB15HD20008	10/08/2021	626.9	83.4
MB15HD20008	11/08/2021	626.9	83.4
MB15HD20008	12/08/2021	626.9	83.4
MB15HD20008	13/08/2021	626.9	83.4
MB15HD20008	14/08/2021	626.9	83.4
MB15HD20008	15/08/2021	626.9	83.4
MB15HD20008	16/08/2021	626.9	83.4
MB15HD20008	17/08/2021	626.9	83.4
MB15HD20008	18/08/2021	626.9	83.4
MB15HD20008	19/08/2021	626.9	83.4
MB15HD20008	20/08/2021	626.9	83.5
MB15HD20008	21/08/2021	626.9	83.5
MB15HD20008	22/08/2021	626.9	83.5
MB15H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDRE1	4/03/2019	627.8	51.5
HDRE1	3/03/2019	627.8	51.5
HDRE1	2/03/2019	627.8	51.5
HDRE1	1/03/2019	627.8	51.5
HDRE1	28/02/2019	627.8	51.5
HDRE1	27/02/2019	627.8	51.5
HDRE1	26/02/2019	627.8	51.5
HDRE1	25/02/2019	627.8	51.5
HDRE1	24/02/2019	627.8	51.5
HDRE1	23/02/2019	627.8	51.5
HDRE1	22/02/2019	627.8	51.5
HDRE1	21/02/2019	627.8	51.5
HDRE1	20/02/2019	627.8	51.5
HDRE1	19/02/2019	627.8	51.5
HDRE1	18/02/2019	627.8	51.5
HDRE1	17/02/2019	627.8	51.5
HDRE1	16/02/2019	627.8	51.5
HDRE1	15/02/2019	627.8	51.5
HDRE1	14/02/2019	627.8	51.5
HDRE1	13/02/2019	627.8	51.5
HDRE1	12/02/2019	627.8	51.5
HDRE1	11/02/2019	627.8	51.5
HDRE1	10/02/2019	627.8	51.5
HDRE1	9/02/2019	627.8	51.5
HDRE1	8/02/2019	627.8	51.5
HDRE1	7/02/2019	627.8	51.5
HDRE1	6/02/2019	627.8	51.5
HDRE1	5/02/2019	627.8	51.5
HDRE1	4/02/2019	627.8	51.5
HDRE1	3/02/2019	627.8	51.5
HDRE1	2/02/2019	627.8	51.5
HDRE1	1/02/2019	627.8	51.5
HDRE1	31/01/2019	627.8	51.5
HDRE1	30/01/2019	627.8	51.5
HDRE1	29/01/2019	627.8	51.5
HDRE1	28/01/2019	627.8	51.5
HDRE1	27/01/2019	627.8	51.5
HDRE1	26/01/2019	627.7	51.6
HDRE1	25/01/2019	627.7	51.6
HDRE1	24/01/2019	627.8	51.5
HDRE1	23/01/2019	627.8	51.5
HDRE1	22/01/2019	627.8	51.5
HDRE1	21/01/2019	627.8	51.5
HDRE1	20/01/2019	627.8	51.5
HDRE1	19/01/2019	627.8	51.5
HDRE1	18/01/2019	627.8	51.5
HDRE1	21/08/2018	627.5	51.8
HDRE1	31/07/2018	627.4	51.9
HDRE1	23/06/2018	627.1	52.2
HDRE1	25/05/2018	626.7	52.6
HDRE1	28/04/2018	626.4	52.9
HDRE1	28/03/2018	626.1	53.2
HDRE1	28/12/2017	625.2	54.1
HDRE1	14/10/2017	624.3	55.0
HDRE1	29/09/2017	624.3	55.0
HDRE1	30/08/2017	624.4	54.9
HDRE1	14/07/2017	623.6	55.7
HDRE1	5/07/2017	623.6	55.7
HDRE1	28/04/2017	623.6	55.7
HDRE1	30/03/2017	623.4	55.9
HDRE1	30/01/2017	623.0	56.3
HDRE1	28/12/2016	623.0	56.3
HDRE1	30/10/2016	622.6	56.7
HDRE1	26/09/2016	622.5	56.8
HDRE1	30/08/2016	622.3	57.0
HDRE1	23/07/2016	622.1	57.2
HDRE1	27/06/2016	622.0	57.3
HDRE1	29/05/2016	621.8	57.5
HDRE1	30/04/2016	621.4	57.9
HDRE1	30/03/2016	619.9	59.4
HDRE1	28/02/2016	620.4	58.9
HDRE1	20/01/2016	619.8	59.5
HDRE1	26/11/2015	619.1	60.2
HDRE1	1/08/2015	618.0	61.3
HDRE1	22/06/2015	617.4	61.9
HDRE1	2/06/2015	617.2	62.1
HDRE1	6/05/2015	616.9	62.4
HDRE1	27/03/2015	616.5	62.8
HDRE1	23/02/2015	616.4	62.9
HDRE1	24/01/2015	616.3	63.0
HDRE1	29/12/2014	616.2	63.1
HDRE1	30/11/2014	616.0	63.3
HDRE1	28/09/2014	615.6	63.7
HDRE1	30/08/2014	615.3	64.0
HDRE1	26/07/2014	614.9	64.4
HDRE1	24/06/2014	614.6	64.7
HDRE1	21/05/2014	614.4	64.9
HDRE1	27/04/2014	614.3	65.0
HDRE1	22/03/2014	614.1	65.2
HDRE1	25/02/2014	614.0	65.3
HDRE1	25/01/2014	613.7	65.6
HDRE1	28/12/2013	613.6	65.7
HDRE1	30/11/2013	613.4	65.9
HDRE1	23/10/2013	613.3	66.0
HDRE1	28/09/2013	613.1	66.2
HDRE1	29/08/2013	612.9	66.4
HDRE1	27/07/2013	612.7	66.6
HDRE1	30/06/2013	612.5	66.8
HDRE1	28/05/2013	612.4	66.9
HDRE1	27/04/2013	612.4	66.9
HDRE1	31/03/2013	612.3	67.0
HDRE1	23/02/2013	612.4	66.9
HDRE1	24/01/2013	612.3	67.0
HDRE1	26/12/2012	612.3	67.0
HDRE1	20/11/2012	612.3	67.0
HDRE1	31/10/2012	612.3	67.0
HDRE1	26/09/2012	612.3	67.0
HDRE1	22/08/2012	612.2	67.1
HDRE1	28/07/2012	612.2	67.1
HDRE1	27/06/2012	612.1	67.2
HDRE1	26/05/2012	612.1	67.2
HDRE1	29/04/2012	612.0	67.3
HDRE1	31/03/2012	612.0	67.3
HDRE1	27/02/2012	612.1	67.2
HDRE1	2/02/2012	611.9	67.4
HDRE1	28/12/2011	611.8	67.5
HDRE1	1/12/2011	611.8	67.5
HDRE1	29/10/2011	611.8	67.5
HDRE1	30/09/2011	611.7	67.6
HDRE1	27/08/2011	611.7	67.6
HDRE1	24/07/2011	611.5	67.8
HDRE1	28/06/2011	611.4	67.9
HDRE1	19/05/2011	611.3	68.0
HDRE1	24/04/2011	611.2	68.1
HDRE1	20/03/2011	611.1	68.2
HDRE1	26/02/2011	611.1	68.2
HDRE1	28/01/2011	611.0	68.3
HDRE1	6/01/2011	611.0	68.3
HDRE1	28/12/2010	611.0	68.3
HDRE1	28/11/2010	610.9	68.4
HDRE1	29/10/2010	611.0	68.3
HDRE1	27/09/2010	610.9	68.4
HDRE1	22/08/2010	610.9	68.4
HDRE2	3/03/2022	629.2	49.7
HDRE2	2/03/2022	629.2	49.7
HDRE2	1/03/2022	629.2	49.7

ID	Date	WL mAHD	WL mbgl
HDVP2	24/05/2007	232.3	454.3
HDVP2	23/05/2007	232.3	454.3
HDVP2	22/05/2007	232.3	454.3
HDVP2	21/05/2007	232.3	454.3
HDVP2	20/05/2007	232.3	454.3
HDVP2	19/05/2007	232.3	454.3
HDVP2	18/05/2007	232.3	454.3
HDVP2	17/05/2007	232.3	454.3
HDVP2	16/05/2007	232.3	454.3
HDVP2	15/05/2007	232.3	454.3
HDVP2	14/05/2007	232.3	454.3
HDVP2	13/05/2007	232.3	454.3
HDVP2	12/05/2007	232.3	454.3
HDVP2	11/05/2007	232.3	454.3
HDVP2	10/05/2007	232.3	454.3
HDVP2	9/05/2007	232.3	454.3
HDVP2	8/05/2007	232.3	454.3
HDVP2	7/05/2007	232.3	454.3
HDVP2	6/05/2007	232.3	454.3
HDVP2	5/05/2007	232.3	454.3
HDVP2	4/05/2007	232.3	454.3
HDVP2	3/05/2007	232.3	454.3
HDVP2	2/05/2007	232.3	454.3
HDVP2	1/05/2007	232.3	454.3
HDVP2	30/04/2007	239.9	446.6
HDVP2	29/04/2007	239.9	446.6
HDVP2	28/04/2007	239.9	446.6
HDVP2	27/04/2007	239.9	446.6
HDVP2	26/04/2007	239.9	446.6
HDVP2	25/04/2007	239.9	446.6
HDVP2	24/04/2007	239.9	446.6
HDVP2	23/04/2007	239.9	446.6
HDVP2	22/04/2007	239.9	446.6
HDVP2	21/04/2007	239.9	446.6
HDVP2	20/04/2007	239.9	446.6
HDVP2	19/04/2007	239.9	446.6
HDVP2	18/04/2007	239.9	446.6
HDVP2	17/04/2007	239.9	446.6
HDVP2	16/04/2007	239.9	446.6
HDVP2	15/04/2007	239.9	446.6
HDVP2	14/04/2007	239.9	446.6
HDVP2	13/04/2007	239.9	446.6
HDVP2	12/04/2007	239.9	446.6
HDVP2	11/04/2007	239.9	446.6
HDVP2	10/04/2007	239.9	446.6
HDVP2	9/04/2007	239.9	446.6
HDVP2	8/04/2007	239.9	446.6
HDVP2	7/04/2007	239.9	446.6
HDVP2	6/04/2007	239.9	446.6
HDVP2	5/04/2007	239.9	446.6
HDVP2	4/04/2007	239.9	446.6
HDVP2	3/04/2007	239.9	446.6
HDVP2	2/04/2007	239.9	446.6
HDVP2	1/04/2007	239.9	446.6
HDVP2	31/03/2007	105.0	581.5
HDVP2	30/03/2007	105.0	581.5
HDVP2	29/03/2007	105.0	581.5
HDVP2	28/03/2007	105.0	581.5
HDVP2	27/03/2007	105.0	581.5
HDVP2	26/03/2007	105.0	581.5
HDVP2	25/03/2007	105.0	581.5
HDVP2	24/03/2007	105.0	581.5
HDVP2	23/03/2007	105.0	581.5
HDVP2	22/03/2007	105.0	581.5
HDVP2	21/03/2007	105.0	581.5
HDVP2	20/03/2007	105.0	581.5
HDVP2	19/03/2007	105.0	581.5
HDVP2	18/03/2007	105.0	581.5
HDVP2	17/03/2007	105.0	581.5
HDVP2	16/03/2007	105.0	581.5
HDVP2	15/03/2007	105.0	581.5
HDVP2	14/03/2007	105.0	581.5
HDVP2	13/03/2007	105.0	581.5
HDVP2	12/03/2007	105.0	581.5
HDVP2	11/03/2007	105.0	581.5
HDVP2	10/03/2007	105.0	581.5
HDVP2	9/03/2007	105.0	581.5
HDVP2	8/03/2007	105.0	581.5
HDVP2	7/03/2007	105.0	581.5
HDVP2	6/03/2007	105.0	581.5
HDVP2	5/03/2007	105.0	581.5
HDVP2	4/03/2007	105.0	581.5
HDVP2	3/03/2007	105.0	581.5
HDVP2	2/03/2007	105.0	581.5
HDVP2	1/03/2007	105.0	581.5
HDVP2	28/02/2007	0.0	686.5
HDVP2	27/02/2007	0.0	686.5
HDVP2	26/02/2007	0.0	686.5
HDVP2	25/02/2007	0.0	686.5
HDVP2	24/02/2007	0.0	686.5
HDVP2	23/02/2007	0.0	686.5
HDVP2	22/02/2007	0.0	686.5
HDVP2	21/02/2007	0.0	686.5
HDVP2	20/02/2007	0.0	686.5
HDVP2	19/02/2007	0.0	686.5
HDVP2	18/02/2007	0.0	686.5
HDVP2	17/02/2007	0.0	686.5
HDVP2	16/02/2007	0.0	686.5
HDVP2	15/02/2007	0.0	686.5
HDVP2	14/02/2007	0.0	686.5
HDVP2	13/02/2007	0.0	686.5
HDVP2	12/02/2007	0.0	686.5
HDVP2	11/02/2007	0.0	686.5
HDVP2	10/02/2007	0.0	686.5
HDVP2	9/02/2007	0.0	686.5
HDVP2	8/02/2007	0.0	686.5
HDVP2	7/02/2007	0.0	686.5
HDVP2	6/02/2007	0.0	686.5
HDVP2	5/02/2007	0.0	686.5
HDVP2	4/02/2007	0.0	686.5
HDVP2	3/02/2007	0.0	686.5
HDVP2	2/02/2007	0.0	686.5
HDVP2	1/02/2007	0.0	686.5
HDVP2	31/01/2007	0.0	686.5
HDVP2	30/01/2007	0.0	686.5
HDVP2	29/01/2007	0.0	686.5
HDVP2	28/01/2007	0.0	686.5
HDVP2	27/01/2007	0.0	686.5
HDVP2	26/01/2007	0.0	686.5
HDVP2	25/01/2007	0.0	686.5
HDVP2	24/01/2007	0.0	686.5
HDVP2	23/01/2007	0.0	686.5
HDVP2	22/01/2007	0.0	686.5
HDVP2	21/01/2007	0.0	686.5
HDVP2	20/01/2007	0.0	686.5
HDVP2	19/01/2007	0.0	686.5
HDVP2	18/01/2007	0.0	686.5
HDVP2	17/01/2007	0.0	686.5
HDVP2	16/01/2007	0.0	686.5
HDVP2	15/01/2007	0.0	686.5
HDVP2	14/01/2007	0.0	686.5
HDVP2	13/01/2007	0.0	686.5
HDVP2	12/01/2007	0.0	686.5
HDVP2	11/01/2007	0.0	686.5
HDVP2	10/01/2007	0.0	686.5
HDVP2	9/01/2007	0.0	686.5

ID	Date	WL mAHD	WL mbgl
MB18WON0007	3/05/2021	618.9	12.4
MB18WON0007	2/05/2021	618.9	12.4
MB18WON0007	1/05/2021	618.9	12.4
MB18WON0007	30/04/2021	618.9	12.4
MB18WON0007	29/04/2021	618.9	12.3
MB18WON0007	28/04/2021	618.9	12.3
MB18WON0007	27/04/2021	619.0	12.3
MB18WON0007	26/04/2021	619.0	12.3
MB18WON0007	25/04/2021	619.0	12.3
MB18WON0007	14/11/2020	617.9	13.4
MB18WON0007	9/09/2020	618.1	13.1
MB18WON0007	10/08/2020	618.2	13.1
MB18WON0007	29/06/2020	618.4	12.9
MB18WON0007	27/06/2020	618.4	12.8
MB18WON0007	26/06/2020	618.4	12.9
MB18WON0007	25/06/2020	618.4	12.8
MB18WON0007	24/06/2020	618.4	12.9
MB18WON0007	23/06/2020	618.4	12.9
MB18WON0007	22/06/2020	618.4	12.8
MB18WON0007	21/06/2020	618.4	12.8
MB18WON0007	20/06/2020	618.5	12.8
MB18WON0007	19/06/2020	618.5	12.8
MB18WON0007	18/06/2020	618.4	12.8
MB18WON0007	17/06/2020	618.4	12.8
MB18WON0007	16/06/2020	618.4	12.8
MB18WON0007	15/06/2020	618.5	12.8
MB18WON0007	14/06/2020	618.5	12.8
MB18WON0007	13/06/2020	618.5	12.8
MB18WON0007	12/06/2020	618.4	12.8
MB18WON0007	11/06/2020	618.4	12.8
MB18WON0007	10/06/2020	618.5	12.8
MB18WON0007	9/06/2020	618.5	12.8
MB18WON0007	8/06/2020	618.5	12.8
MB18WON0007	7/06/2020	618.5	12.8
MB18WON0007	6/06/2020	618.5	12.8
MB18WON0007	5/06/2020	618.5	12.7
MB18WON0007	4/06/2020	618.5	12.7
MB18WON0007	3/06/2020	618.5	12.7
MB18WON0007	2/06/2020	618.5	12.7
MB18WON0007	1/06/2020	618.5	12.7
MB18WON0007	31/05/2020	618.5	12.7
MB18WON0007	30/05/2020	618.5	12.7
MB18WON0007	29/05/2020	618.5	12.7
MB18WON0007	28/05/2020	618.5	12.7
MB18WON0007	27/05/2020	618.5	12.7
MB18WON0007	26/05/2020	618.5	12.7
MB18WON0007	25/05/2020	618.5	12.8
MB18WON0007	24/05/2020	618.5	12.8
MB18WON0007	23/05/2020	618.5	12.7
MB18WON0007	22/05/2020	618.5	12.7
MB18WON0007	21/05/2020	618.6	12.7
MB18WON0007	20/05/2020	618.6	12.7
MB18WON0007	19/05/2020	618.6	12.7
MB18WON0007	18/05/2020	618.5	12.7
MB18WON0007	17/05/2020	618.5	12.7
MB18WON0007	16/05/2020	618.6	12.7
MB18WON0007	15/05/2020	618.6	12.7
MB18WON0007	14/05/2020	618.6	12.7
MB18WON0007	13/05/2020	618.6	12.7
MB18WON0007	12/05/2020	618.6	12.7
MB18WON0007	11/05/2020	618.6	12.7
MB18WON0007	10/05/2020	618.6	12.6
MB18WON0007	9/05/2020	618.6	12.6
MB18WON0007	8/05/2020	618.6	12.7
MB18WON0007	7/05/2020	618.6	12.7
MB18WON0007	6/05/2020	618.6	12.7
MB18WON0007	5/05/2020	618.6	12.7
MB18WON0007	4/05/2020	618.6	12.6
MB18WON0007	3/05/2020	618.6	12.6
MB18WON0007	2/05/2020	618.6	12.6
MB18WON0007	1/05/2020	618.7	12.6
MB18WON0007	30/04/2020	618.7	12.6
MB18WON0007	29/04/2020	618.7	12.6
MB18WON0007	28/04/2020	618.6	12.6
MB18WON0007	27/04/2020	618.7	12.6
MB18WON0007	26/04/2020	618.7	12.6
MB18WON0007	25/04/2020	618.7	12.6
MB18WON0007	24/04/2020	618.7	12.6
MB18WON0007	23/04/2020	618.7	12.6
MB18WON0007	22/04/2020	618.7	12.6
MB18WON0007	21/04/2020	618.7	12.6
MB18WON0007	20/04/2020	618.7	12.6
MB18WON0007	19/04/2020	618.7	12.6
MB18WON0007	18/04/2020	618.7	12.6
MB18WON0007	17/04/2020	618.7	12.5
MB18WON0007	16/04/2020	618.7	12.5
MB18WON0007	15/04/2020	618.7	12.5
MB18WON0007	14/04/2020	618.8	12.5
MB18WON0007	13/04/2020	618.8	12.5
MB18WON0007	12/04/2020	618.8	12.5
MB18WON0007	11/04/2020	618.8	12.5
MB18WON0007	10/04/2020	618.8	12.4
MB18WON0007	9/04/2020	618.8	12.4
MB18WON0007	8/04/2020	618.8	12.4
MB18WON0007	7/04/2020	618.8	12.5
MB18WON0007	6/04/2020	618.8	12.4
MB18WON0007	5/04/2020	618.8	12.4
MB18WON0007	4/04/2020	618.9	12.4
MB18WON0007	3/04/2020	618.8	12.4
MB18WON0007	2/04/2020	618.8	12.4
MB18WON0007	1/04/2020	618.8	12.4
MB18WON0007	31/03/2020	618.9	12.4
MB18WON0007	30/03/2020	618.9	12.4
MB18WON0007	29/03/2020	618.9	12.3
MB18WON0007	28/03/2020	618.9	12.3
MB18WON0007	27/03/2020	619.0	12.3
MB18WON0007	26/03/2020	619.0	12.3
MB18WON0007	25/03/2020	619.0	12.3
MB18WON0007	24/03/2020	619.0	12.3
MB18WON0007	23/03/2020	619.0	12.2
MB18WON0007	22/03/2020	619.0	12.2
MB18WON0007	21/03/2020	619.1	12.2
MB18WON0007	20/03/2020	619.1	12.2
MB18WON0007	19/03/2020	619.1	12.2
MB18WON0007	18/03/2020	619.1	12.2
MB18WON0007	17/03/2020	619.1	12.2
MB18WON0007	16/03/2020	619.1	12.1
MB18WON0007	15/03/2020	619.1	12.2
MB18WON0007	14/03/2020	619.1	12.1
MB18WON0007	13/03/2020	619.1	12.1
MB18WON0007	12/03/2020	619.2	12.1
MB18WON0007	11/03/2020	619.2	12.1
MB18WON0007	10/03/2020	619.1	12.1
MB18WON0007	9/03/2020	619.2	12.1
MB18WON0007	8/03/2020	619.2	12.1
MB18WON0007	7/03/2020	619.2	12.0
MB18WON0007	6/03/2020	619.2	12.0
MB18WON0007	5/03/2020	619.2	12.1
MB18WON0007	4/03/2020	619.2	12.0
MB18WON0007	3/03/2020	619.3	12.0
MB18WON0007	2/03/2020	619.2	12.0
MB18WON0007	1/03/2020	619.2	12.1
MB18WON0007	29/02/2020	619.2	12.1
MB18WON0007	28/02/2020	619.2	12.0
MB18WON0007	27/02/2020	619.2	12.0
MB18WON0007	26/02/2020	619.3	12.0

ID	Date	WL mAHD	WL mbgl
MB15HD20008	24/09/2021	626.9	83.5
MB15HD20008	25/09/2021	626.9	83.5
MB15HD20008	26/09/2021	626.9	83.5
MB15HD20008	27/09/2021	626.8	83.5
MB15HD20008	28/09/2021	626.8	83.5
MB15HD20008	29/09/2021	626.8	83.5
MB15HD20008	30/09/2021	626.8	83.5
MB15HD20008	1/10/2021	626.8	83.5
MB15HD20008	2/10/2021	626.8	83.5
MB15HD20008	3/10/2021	626.8	83.5
MB15HD20008	4/10/2021	626.8	83.5
MB15HD20008	5/10/2021	626.8	83.5
MB15HD20008	6/10/2021	626.8	83.5
MB15HD20008	7/10/2021	626.8	83.5
MB15HD20008	8/10/2021	626.8	83.5
MB15HD20008	9/10/2021	626.8	83.5
MB15HD20008	10/10/2021	626.8	83.5
MB15HD20008	11/10/2021	626.8	83.5
MB15HD20008	12/10/2021	626.8	83.5
MB15HD20008	13/10/2021	626.8	83.5
MB15HD20008	14/10/2021	626.8	83.5
MB15HD20008	15/10/2021	626.8	83.5
MB15HD20008	16/10/2021	626.8	83.5
MB15HD20008	17/10/2021	626.8	83.5
MB15HD20008	18/10/2021	626.8	83.5
MB15HD20008	19/10/2021	626.8	83.5
MB15HD20008	20/10/2021	626.8	83.5
MB15HD20008	21/10/2021	626.9	83.5
MB15HD20008	22/10/2021	626.9	83.5
MB15HD20008	23/10/2021	626.9	83.5
MB15HD20008	24/10/2021	626.8	83.5
MB15HD20008	25/10/2021	626.8	83.5
MB15HD20008	26/10/2021	626.8	83.5
MB15HD20008	27/10/2021	626.8	83.5
MB15HD20008	28/10/2021	626.8	83.5
MB15HD20008	1/11/2021	626.8	83.5
MB15HD20008	2/11/2021	626.8	83.5
MB15HD20008	3/11/2021	626.8	83.5
MB15HD20008	4/11/2021	626.8	83.5
MB15HD20008	5/11/2021	626.8	83.5
MB15HD20008	6/11/2021	626.8	83.5
MB15HD20008	7/11/2021	626.7	83.6
MB15HD20008	9/11/2021	626.8	83.6
MB15HD20008	10/11/2021	626.8	83.5
MB15HD20008	11/11/2021	626.8	83.5
MB15HD20008	12/11/2021	626.8	83.5
MB15HD20008	13/11/2021	626.8	83.5
MB15HD20008	14/11/2021	626.8	83.5
MB15HD20008	15/11/2021	626.8	83.5
MB15HD20008	16/11/2021	626.8	83.5
MB15HD20008	17/11/2021	626.8	83.5
MB15HD20008	18/11/2021	626.8	83.5
MB15HD20008	19/11/2021	626.8	83.5
MB15HD20008	20/11/2021	626.8	83.5
MB15HD20008	21/11/2021	626.8	83.5
MB15HD20008	22/11/2021	626.8	83.5
MB15HD20008	23/11/2021	626.8	83.5
MB15HD20008	24/11/2021	626.8	83.5
MB15HD20008	25/11/2021	626.8	83.5
MB15HD20008	26/11/2021	626.8	83.5
MB15HD20008	27/11/2021	626.8	83.5
MB15HD20008	28/11/2021	626.8	83.5
MB15HD20008	29/11/2021	626.8	83.5
MB15HD20008	30/11/2021	626.8	83.6
MB15HD20008	1/12/2021	626.8	83.5
MB15HD20008	2/12/2021	626.8	83.5
MB15HD20008	3/12/2021	626.8	83.5
MB15HD20008	4/12/2021	626.8	83.5
MB15HD20008	5/12/2021	626.8	83.5
MB15HD20008	6/12/2021	626.8	83.6
MB15HD20008	7/12/2021	626.8	83.5
MB15HD20008	8/12/2021	626.8	83.5
MB15HD20008	9/12/2021	626.8	83.6
MB15HD20008	10/12/2021	626.8	83.6
MB15HD20008	11/12/2021	626.8	83.6
MB15HD20008	12/12/2021	626.8	83.6
MB15HD20008	13/12/2021	626.8	83.6
MB15HD20008	14/12/2021	626.8	83.6
MB15HD20008	15/12/2021	626.8	83.6
MB15HD20008	16/12/2021	626.8	83.6
MB15HD20008	17/12/2021	626.8	83.6
MB15HD20008	18/12/2021	626.8	83.5
MB15HD20008	19/12/2021	626.8	83.5
MB15HD20008	20/12/2021	626.8	83.5
MB15HD20008	21/12/2021	626.8	83.6
MB15HD20008	22/12/2021	626.8	83.6
MB15HD20008	23/12/2021	626.8	83.6
MB15HD20008	24/12/2021	626.8	83.6
MB15HD20008	25/12/2021	626.8	83.6
MB15HD20008	26/12/2021	626.8	83.6
MB15HD20008	30/12/2021	626.7	83.6
MB15HD20008	31/12/2021	626.7	83.6
MB15HD20008	1/01/2022	626.8	83.6
MB15HD20008	2/01/2022	626.8	83.6
MB15HD20008	3/01/2022	626.8	83.6
MB15HD20008	4/01/2022	626.8	83.6
MB15HD20008	5/01/2022	626.8	83.6
MB15HD20008	6/01/2022	626.8	83.6
MB15HD20008	7/01/2022	626.8	83.6
MB15HD20008	8/01/2022	626.8	83.6
MB15HD20008	9/01/2022	626.7	83.6
MB15HD20008	10/01/2022	626.8	83.6
MB15HD20008	11/01/2022	626.8	83.5
MB15HD20008	12/01/2022	626.8	83.5
MB15H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDRE2	28/02/2022	629.1	49.7
HDRE2	27/02/2022	629.1	49.7
HDRE2	26/02/2022	629.2	49.7
HDRE2	25/02/2022	629.2	49.7
HDRE2	24/02/2022	629.2	49.7
HDRE2	23/02/2022	629.1	49.7
HDRE2	22/02/2022	629.1	49.7
HDRE2	21/02/2022	629.1	49.7
HDRE2	20/02/2022	629.1	49.7
HDRE2	19/02/2022	629.1	49.7
HDRE2	18/02/2022	629.1	49.7
HDRE2	17/02/2022	629.1	49.7
HDRE2	16/02/2022	629.1	49.7
HDRE2	15/02/2022	629.1	49.8
HDRE2	14/02/2022	629.1	49.8
HDRE2	13/02/2022	629.1	49.8
HDRE2	12/02/2022	629.1	49.8
HDRE2	11/02/2022	629.1	49.8
HDRE2	10/02/2022	629.0	49.8
HDRE2	9/02/2022	629.0	49.9
HDRE2	8/02/2022	629.0	49.9
HDRE2	7/02/2022	629.0	49.9
HDRE2	6/02/2022	629.0	49.9
HDRE2	5/02/2022	628.9	49.9
HDRE2	4/02/2022	628.9	49.9
HDRE2	3/02/2022	628.9	49.9
HDRE2	2/02/2022	628.9	49.9
HDRE2	1/02/2022	628.9	50.0
HDRE2	31/01/2022	628.9	50.0
HDRE2	30/01/2022	628.9	50.0
HDRE2	29/01/2022	628.9	50.0
HDRE2	28/01/2022	628.9	50.0
HDRE2	27/01/2022	628.9	50.0
HDRE2	26/01/2022	628.9	50.0
HDRE2	25/01/2022	628.8	50.0
HDRE2	24/01/2022	628.9	50.0
HDRE2	23/01/2022	628.9	50.0
HDRE2	22/01/2022	628.9	50.0
HDRE2	21/01/2022	628.8	50.1
HDRE2	20/01/2022	628.8	50.1
HDRE2	19/01/2022	628.8	50.1
HDRE2	18/01/2022	628.8	50.1
HDRE2	17/01/2022	628.7	50.1
HDRE2	16/01/2022	628.7	50.1
HDRE2	15/01/2022	628.7	50.1
HDRE2	14/01/2022	628.7	50.1
HDRE2	13/01/2022	628.7	50.1
HDRE2	12/01/2022	628.8	50.1
HDRE2	11/01/2022	628.8	50.1
HDRE2	10/01/2022	628.7	50.1
HDRE2	9/01/2022	628.7	50.1
HDRE2	8/01/2022	628.7	50.1
HDRE2	7/01/2022	628.7	50.1
HDRE2	6/01/2022	628.7	50.1
HDRE2	5/01/2022	628.7	50.1
HDRE2	4/01/2022	628.7	50.1
HDRE2	3/01/2022	628.7	50.1
HDRE2	2/01/2022	628.7	50.2
HDRE2	1/01/2022	628.7	50.2
HDRE2	31/12/2021	628.7	50.2
HDRE2	30/12/2021	628.7	50.2
HDRE2	26/12/2021	628.7	50.2
HDRE2	25/12/2021	628.7	50.2
HDRE2	24/12/2021	628.7	50.2
HDRE2	23/12/2021	628.7	50.2
HDRE2	22/12/2021	628.7	50.2
HDRE2	21/12/2021	628.7	50.2
HDRE2	20/12/2021	628.7	50.2
HDRE2	19/12/2021	628.7	50.2
HDRE2	18/12/2021	628.7	50.2
HDRE2	17/12/2021	628.7	50.2
HDRE2	16/12/2021	628.7	50.2
HDRE2	15/12/2021	628.7	50.2
HDRE2	14/12/2021	628.7	50.2
HDRE2	13/12/2021	628.6	50.2
HDRE2	12/12/2021	628.7	50.2
HDRE2	11/12/2021	628.7	50.2
HDRE2	10/12/2021	628.7	50.2
HDRE2	9/12/2021	628.7	50.2
HDRE2	8/12/2021	628.7	50.2
HDRE2	7/12/2021	628.7	50.2
HDRE2	6/12/2021	628.7	50.2
HDRE2	5/12/2021	628.7	50.2
HDRE2	4/12/2021	628.7	50.2
HDRE2	3/12/2021	628.7	50.2
HDRE2	2/12/2021	628.7	50.2
HDRE2	1/12/2021	628.7	50.2
HDRE2	30/11/2021	628.7	50.2
HDRE2	29/11/2021	628.7	50.2
HDRE2	28/11/2021	628.7	50.1
HDRE2	27/11/2021	628.7	50.1
HDRE2	26/11/2021	628.7	50.1
HDRE2	25/11/2021	628.8	50.1
HDRE2	24/11/2021	628.8	50.1
HDRE2	23/11/2021	628.8	50.1
HDRE2	22/11/2021	628.8	50.1
HDRE2	21/11/2021	628.8	50.1
HDRE2	20/11/2021	628.8	50.1
HDRE2	19/11/2021	628.8	50.1
HDRE2	18/11/2021	628.8	50.1
HDRE2	17/11/2021	628.8	50.1
HDRE2	16/11/2021	628.8	50.1
HDRE2	15/11/2021	628.8	50.1
HDRE2	13/11/2021	628.8	50.0
HDRE2	12/11/2021	628.8	50.0
HDRE2	11/11/2021	628.8	50.0
HDRE2	10/11/2021	628.8	50.0
HDRE2	9/11/2021	628.8	50.1
HDRE2	7/11/2021	628.8	50.0
HDRE2	6/11/2021	628.8	50.0
HDRE2	5/11/2021	628.9	50.0
HDRE2	4/11/2021	628.9	50.0
HDRE2	3/11/2021	628.9	50.0
HDRE2	2/11/2021	628.9	49.9
HDRE2	1/11/2021	628.9	50.0
HDRE2	28/10/2021	629.0	49.9
HDRE2	27/10/2021	629.0	49.9
HDRE2	26/10/2021	629.0	49.9
HDRE2	25/10/2021	628.9	49.9
HDRE2	24/10/2021	629.0	49.9
HDRE2	23/10/2021	629.0	49.9
HDRE2	22/10/2021	629.0	49.9
HDRE2	21/10/2021	629.0	49.9
HDRE2	20/10/2021	629.0	49.9
HDRE2	19/10/2021	629.0	49.9
HDRE2	18/10/2021	629.0	49.9
HDRE2	17/10/2021	628.9	49.9
HDRE2	16/10/2021	629.0	49.9
HDRE2	15/10/2021	629.0	49.9
HDRE2	14/10/2021	629.0	49.9
HDRE2	13/10/2021	629.0	49.9
HDRE2	12/10/2021	629.0	49.9
HDRE2	11/10/2021	629.0	49.9
HDRE2	10/10/2021	629.0	49.9
HDRE2	9/10/2021	629.0	49.9
HDRE2	8/10/2021	629.0	49.9

ID	Date	WL mAHD	WL mbgl
HDVP2	8/01/2007	0.0	686.5
HDVP2	7/01/2007	0.0	686.5
HDVP2	6/01/2007	0.0	686.5
HDVP2	5/01/2007	0.0	686.5
HDVP2	4/01/2007	0.0	686.5
HDVP2	3/01/2007	0.0	686.5
HDVP2	2/01/2007	0.0	686.5
HDVP2	1/01/2007	0.0	686.5
HDVP2	31/12/2006	0.0	686.5
HDVP2	30/12/2006	0.0	686.5
HDVP2	29/12/2006	0.0	686.5
HDVP2	28/12/2006	0.0	686.5
HDVP2	27/12/2006	0.0	686.5
HDVP2	26/12/2006	0.0	686.5
HDVP2	25/12/2006	0.0	686.5
HDVP2	24/12/2006	0.0	686.5
HDVP2	23/12/2006	0.0	686.5
HDVP2	22/12/2006	0.0	686.5
HDVP2	21/12/2006	0.0	686.5
HDVP2	20/12/2006	0.0	686.5
HDVP2	19/12/2006	0.0	686.5
HDVP2	18/12/2006	0.0	686.5
HDVP2	17/12/2006	0.0	686.5
HDVP2	16/12/2006	0.0	686.5
HDVP2	15/12/2006	0.0	686.5
HDVP2	14/12/2006	0.0	686.5
HDVP2	13/12/2006	0.0	686.5
HDVP2	12/12/2006	0.0	686.5
HDVP2	11/12/2006	0.0	686.5
HDVP2	10/12/2006	0.0	686.5
HDVP2	9/12/2006	0.0	686.5
HDVP2	8/12/2006	0.0	686.5
HDVP2	7/12/2006	0.0	686.5
HDVP2	6/12/2006	0.0	686.5
HDVP2	5/12/2006	0.0	686.5
HDVP2	4/12/2006	0.0	686.5
HDVP2	3/12/2006	0.0	686.5
HDVP2	2/12/2006	0.0	686.5
HDVRP1	3/03/2022	624.3	60.3
HDVRP1	2/03/2022	624.3	60.3
HDVRP1	1/03/2022	624.3	60.2
HDVRP1	28/02/2022	624.6	59.9
HDVRP1	27/02/2022	624.2	60.3
HDVRP1	26/02/2022	624.2	60.3
HDVRP1	25/02/2022	624.2	60.3
HDVRP1	24/02/2022	624.2	60.3
HDVRP1	23/02/2022	624.2	60.3
HDVRP1	22/02/2022	624.3	60.3
HDVRP1	21/02/2022	624.5	60.0
HDVRP1	20/02/2022	624.3	60.2
HDVRP1	19/02/2022	624.3	60.2
HDVRP1	18/02/2022	624.3	60.2
HDVRP1	17/02/2022	624.3	60.2
HDVRP1	16/02/2022	624.3	60.2
HDVRP1	15/02/2022	624.3	60.2
HDVRP1	14/02/2022	624.3	60.2
HDVRP1	13/02/2022	624.3	60.2
HDVRP1	12/02/2022	624.3	60.3
HDVRP1	11/02/2022	624.3	60.3
HDVRP1	10/02/2022	624.2	60.3
HDVRP1	9/02/2022	624.2	60.3
HDVRP1	8/02/2022	624.2	60.3
HDVRP1	7/02/2022	624.2	60.3
HDVRP1	6/02/2022	624.2	60.3
HDVRP1	5/02/2022	624.2	60.3
HDVRP1	4/02/2022	624.2	60.3
HDVRP1	3/02/2022	624.3	60.3
HDVRP1	2/02/2022	624.3	60.3
HDVRP1	1/02/2022	624.2	60.3
HDVRP1	31/01/2022	624.2	60.3
HDVRP1	30/01/2022	624.3	60.3
HDVRP1	29/01/2022	624.3	60.3
HDVRP1	28/01/2022	624.2	60.3
HDVRP1	27/01/2022	624.2	60.3
HDVRP1	26/01/2022	624.2	60.3
HDVRP1	25/01/2022	624.2	60.3
HDVRP1	24/01/2022	624.2	60.3
HDVRP1	23/01/2022	624.3	60.3
HDVRP1	22/01/2022	624.4	60.1
HDVRP1	21/01/2022	624.2	60.3
HDVRP1	20/01/2022	624.4	60.1
HDVRP1	19/01/2022	624.7	59.8
HDVRP1	18/01/2022	624.6	59.9
HDVRP1	17/01/2022	624.3	60.3
HDVRP1	16/01/2022	624.2	60.4
HDVRP1	15/01/2022	624.2	60.3
HDVRP1	14/01/2022	624.2	60.3
HDVRP1	13/01/2022	624.2	60.3
HDVRP1	12/01/2022	624.2	60.3
HDVRP1	11/01/2022	624.4	60.1
HDVRP1	10/01/2022	624.3	60.2
HDVRP1	9/01/2022	624.2	60.3
HDVRP1	8/01/2022	624.3	60.2
HDVRP1	7/01/2022	624.6	59.9
HDVRP1	6/01/2022	624.2	60.3
HDVRP1	5/01/2022	624.2	60.3
HDVRP1	4/01/2022	624.2	60.3
HDVRP1	3/01/2022	624.4	60.1
HDVRP1	2/01/2022	624.6	59.9
HDVRP1	1/01/2022	624.2	60.3
HDVRP1	31/12/2021	624.4	60.1
HDVRP1	30/12/2021	624.2	60.4
HDVRP1	26/12/2021	624.3	60.2
HDVRP1	25/12/2021	624.6	60.0
HDVRP1	24/12/2021	624.2	60.3
HDVRP1	23/12/2021	624.5	60.0
HDVRP1	22/12/2021	624.2	60.3
HDVRP1	21/12/2021	624.2	60.3
HDVRP1	20/12/2021	624.2	60.3
HDVRP1	19/12/2021	624.3	60.3
HDVRP1	18/12/2021	624.4	60.1
HDVRP1	17/12/2021	624.7	59.8
HDVRP1	16/12/2021	624.3	60.3
HDVRP1	15/12/2021	624.2	60.3
HDVRP1	14/12/2021	624.2	60.3
HDVRP1	13/12/2021	624.5	60.1
HDVRP1	12/12/2021	624.2	60.3
HDVRP1	11/12/2021	624.2	60.3
HDVRP1	10/12/2021	624.3	60.2
HDVRP1	9/12/2021	624.6	59.9
HDVRP1	8/12/2021	624.2	60.3
HDVRP1	7/12/2021	624.6	59.9
HDVRP1	6/12/2021	624.1	60.4
HDVRP1	5/12/2021	624.2	60.3
HDVRP1	4/12/2021	624.4	60.1
HDVRP1	3/12/2021	624.5	60.0
HDVRP1	2/12/2021	624.2	60.3
HDVRP1	1/12/2021	624.4	60.2
HDVRP1	30/11/2021	624.2	60.3
HDVRP1	29/11/2021	624.2	60.3
HDVRP1	28/11/2021	624.2	60.3
HDVRP1	27/11/2021	624.5	60.0
HDVRP1	26/11/2021	624.4	60.2
HDVRP1	25/11/2021	624.2	60.3
HDVRP1	24/11/2021	624.4	60.1
HDVRP1	23/11/2021	624.6	59.9

ID	Date	WL mAHD	WL mbgl
MB18WON0007	25/02/2020	619.3	12.0
MB18WON0007	24/02/2020	619.3	11.9
MB18WON0007	23/02/2020	619.4	11.9
MB18WON0007	22/02/2020	619.4	11.9
MB18WON0007	21/02/2020	619.4	11.8
MB18WON0007	20/02/2020	619.4	11.8
MB18WON0007	19/02/2020	619.4	11.8
MB18WON0007	18/02/2020	619.5	11.8
MB18WON0007	17/02/2020	619.5	11.8
MB18WON0007	16/02/2020	619.5	11.8
MB18WON0007	15/02/2020	619.5	11.8
MB18WON0007	14/02/2020	619.5	11.8
MB18WON0007	13/02/2020	619.5	11.8
MB18WON0007	12/02/2020	619.4	11.8
MB18WON0007	11/02/2020	619.4	11.9
MB18WON0007	10/02/2020	619.2	12.1
MB18WON0007	9/02/2020	618.9	12.4
MB18WON0007	8/02/2020	618.6	12.7
MB18WON0007	7/02/2020	618.6	12.6
MB18WON0007	6/02/2020	618.6	12.7
MB18WON0007	5/02/2020	618.6	12.6
MB18WON0007	4/02/2020	618.6	12.6
MB18WON0007	3/02/2020	618.7	12.6
MB18WON0007	2/02/2020	618.7	12.6
MB18WON0007	1/02/2020	618.6	12.6
MB18WON0007	31/01/2020	618.6	12.6
MB18WON0007	30/01/2020	618.6	12.6
MB18WON0007	29/01/2020	618.6	12.6
MB18WON0007	28/01/2020	618.7	12.6
MB18WON0007	27/01/2020	618.7	12.6
MB18WON0007	26/01/2020	618.7	12.5
MB18WON0007	25/01/2020	618.7	12.5
MB18WON0007	24/01/2020	618.7	12.5
MB18WON0007	23/01/2020	618.7	12.5
MB18WON0007	22/01/2020	618.7	12.5
MB18WON0007	21/01/2020	618.8	12.5
MB18WON0007	20/01/2020	618.9	12.4
MB18WON0007	19/01/2020	618.5	12.7
MB18WON0007	18/01/2020	618.5	12.8
MB18WON0007	17/01/2020	618.4	12.8
MB18WON0007	16/01/2020	618.5	12.8
MB18WON0007	15/01/2020	618.4	12.9
MB18WON0007	14/01/2020	618.4	12.9
MB18WON0007	13/01/2020	618.3	12.9
MB18WON0007	12/01/2020	618.4	12.9
MB18WON0007	11/01/2020	618.4	12.8
MB18WON0007	10/01/2020	618.6	12.7
MB18WON0007	9/01/2020	618.8	12.5
MB18WON0007	8/01/2020	617.7	13.5
MB18WON0007	7/01/2020	617.7	13.6
MB18WON0007	6/01/2020	617.7	13.5
MB18WON0007	5/01/2020	617.7	13.6
MB18WON0007	4/01/2020	617.5	13.8
MB18WON0007	3/01/2020	617.5	13.8
MB18WON0007	2/01/2020	617.5	13.8
MB18WON0007	1/01/2020	617.5	13.8
MB18WON0007	31/12/2019	617.5	13.8
MB18WON0007	30/12/2019	617.5	13.8
MB18WON0007	29/12/2019	617.5	13.8
MB18WON0007	28/12/2019	617.5	13.8
MB18WON0007	27/12/2019	617.5	13.8
MB18WON0007	26/12/2019	617.5	13.8
MB18WON0007	25/12/2019	617.5	13.7
MB18WON0007	24/12/2019	617.5	13.7
MB18WON0007	23/12/2019	617.5	13.7
MB18WON0007	22/12/2019	617.5	13.7
MB18WON0007	21/12/2019	617.5	13.7
MB18WON0007	20/12/2019	617.5	13.7
MB18WON0007	19/12/2019	617.5	13.7
MB18WON0007	18/12/2019	617.5	13.7
MB18WON0007	17/12/2019	617.5	13.7
MB18WON0007	16/12/2019	617.5	13.7
MB18WON0007	15/12/2019	617.6	13.7
MB18WON0007	14/12/2019	617.6	13.7
MB18WON0007	13/12/2019	617.6	13.7
MB18WON0007	12/12/2019	617.6	13.7
MB18WON0007	11/12/2019	617.6	13.7
MB18WON0007	10/12/2019	617.6	13.7
MB18WON0007	9/12/2019	617.6	13.7
MB18WON0007	8/12/2019	617.6	13.7
MB18WON0007	7/12/2019	617.6	13.7
MB18WON0007	6/12/2019	617.6	13.7
MB18WON0007	5/12/2019	617.6	13.7
MB18WON0007	4/12/2019	617.6	13.6
MB18WON0007	3/12/2019	617.6	13.6
MB18WON0007	2/12/2019	617.6	13.6
MB18WON0007	1/12/2019	617.6	13.6
MB18WON0007	30/11/2019	617.7	13.6
MB18WON0007	29/11/2019	617.6	13.6
MB18WON0007	28/11/2019	617.6	13.6
MB18WON0007	27/11/2019	617.6	13.6
MB18WON0007	26/11/2019	617.6	13.6
MB18WON0007	25/11/2019	617.6	13.6
MB18WON0007	24/11/2019	617.6	13.6
MB18WON0007	23/11/2019	617.7	13.6
MB18WON0007	22/11/2019	617.7	13.6
MB18WON0007	21/11/2019	617.7	13.6
MB18WON0007	20/11/2019	617.7	13.6
MB18WON0007	19/11/2019	617.6	13.6
MB18WON0007	18/11/2019	617.7	13.6
MB18WON0007	17/11/2019	617.7	13.5
MB18WON0007	16/11/2019	617.7	13.6
MB18WON0007	15/11/2019	617.7	13.6
MB18WON0007	14/11/2019	617.7	13.6
MB18WON0007	13/11/2019	617.7	13.5
MB18WON0007	12/11/2019	617.7	13.5
MB18WON0007	11/11/2019	617.7	13.6
MB18WON0007	1/02/2019	618.2	13.1
MB18WON0007	31/12/2018	617.9	13.3
MB18WON0007	30/12/2018	617.9	13.3
MB18WON0007	29/12/2018	617.9	13.3
MB18WON0007	28/12/2018	617.9	13.3
MB18WON0007	27/12/2018	617.9	13.3
MB18WON0007	26/12/2018	618.0	13.3
MB18WON0007	25/12/2018	618.0	13.3
MB18WON0007	24/12/2018	618.0	13.3
MB18WON0007	23/12/2018	618.0	13.3
MB18WON0007	22/12/2018	618.0	13.2
MB18WON0007	21/12/2018	618.0	13.2
MB18WON0007	20/12/2018	618.0	13.2
MB18WON0007	19/12/2018	618.0	13.2
MB18WON0007	18/12/2018	618.0	13.2
MB18WON0007	17/12/2018	618.0	13.2
MB18WON0007	11/12/2018	617.9	13.3
MB20WC0123	1/03/2022	621.4	56.4
MB20WC0123	28/02/2022	621.4	56.4
MB20WC0123	27/02/2022	621.4	56.4
MB20WC0123	26/02/2022	621.4	56.4
MB20WC0123	25/02/2022	621.4	56.4
MB20WC0123	24/02/2022	621.4	56.4
MB20WC0123	23/02/2022	621.4	56.4
MB20WC0123	22/02/2022	621.4	56.4
MB20WC0123	21/02/2022	621.4	56.4
MB20WC0123	20/02/2022	621.4	56.4
MB20WC0123	19/02/2022	621.5	56.3
MB20WC0123	18/02/2022	621.5	56.3

ID	Date	WL mAHD	WL mbgl
MB15HD20008	14/02/2022	626.6	83.7
MB15HD20008	15/02/2022	626.6	83.7
MB15HD20008	16/02/2022	626.6	83.7
MB15HD20008	17/02/2022	626.6	83.7
MB15HD20008	18/02/2022	626.6	83.7
MB15HD20008	19/02/2022	626.6	83.7
MB15HD20008	20/02/2022	626.6	83.8
MB15HD20008	21/02/2022	626.6	83.8
MB15HD20008	22/02/2022	626.6	83.8
MB15HD20008	23/02/2022	626.6	83.8
MB15HD20008	24/02/2022	626.6	83.8
MB15HD20008	25/02/2022	626.6	83.8
MB15HD20008	26/02/2022	626.6	83.8
MB15HD20008	27/02/2022	626.6	83.8
MB15HD20008	28/02/2022	626.6	83.8
MB15HD20008	1/03/2022	626.6	83.8
MB15HD20008	2/03/2022	626.6	83.8
MB15HD20008	3/03/2022	626.6	83.8
MB15HD20008	4/03/2022	626.6	83.8
MB15HD20008	5/03/2022	626.6	83.8
MB15HD20008	6/03/2022	626.6	83.7
MB15HD20008	7/03/2022	626.6	83.8
MB15HD20008	8/03/2022	626.6	83.8
MB15HD20008	9/03/2022	626.6	83.8
MB15HD20008	10/03/2022	626.6	83.7
MB15HD20008	11/03/2022	626.6	83.7
MB15HD20008	12/03/2022	626.6	83.8
MB15HD20008	13/03/2022	626.6	83.7
MB15HD20008	14/03/2022	626.6	83.7
MB15HD20008	15/03/2022	626.6	83.8
MB15HD20008	16/03/2022	626.6	83.7
MB18HD20001	28/09/2018	627.0	82.4
MB18HD20001	29/09/2018	627.0	82.4
MB18HD20001	30/09/2018	627.0	82.4
MB18HD20001	1/10/2018	627.0	82.4
MB18HD20001	2/10/2018	627.0	82.4
MB18HD20001	3/10/2018	627.0	82.4
MB18HD20001	4/10/2018	627.0	82.4
MB18HD20001	5/10/2018	627.0	82.4
MB18HD20001	6/10/2018	627.0	82.4
MB18HD20001	7/10/2018	627.0	82.4
MB18HD20001	8/10/2018	627.0	82.4
MB18HD20001	9/10/2018	627.0	82.4
MB18HD20001	10/10/2018	627.0	82.4
MB18HD20001	11/10/2018	627.0	82.4
MB18HD20001	12/10/2018	627.0	82.4
MB18HD20001	13/10/2018	627.0	82.4
MB18HD20001	14/10/2018	627.0	82.4
MB18HD20001	15/10/2018	627.0	82.4
MB18HD20001	16/10/2018	627.0	82.4
MB18HD20001	17/10/2018	627.0	82.4
MB18HD20001	18/10/2018	627.0	82.4
MB18HD20001	20/10/2018	627.0	82.4
MB18HD20001	21/10/2018	627.0	82.4
MB18HD20001	22/10/2018	627.0	82.4
MB18HD20001	23/10/2018	627.0	82.4
MB18HD20001	24/10/2018	627.0	82.4
MB18HD20001	25/10/2018	627.0	82.4
MB18HD20001	26/10/2018	627.0	82.4
MB18HD20001	27/10/2018	627.0	82.4
MB18HD20001	28/10/2018	627.0	82.4
MB18HD20001	29/10/2018	627.0	82.4
MB18HD20001	30/10/2018	627.0	82.4
MB18HD20001	31/10/2018	627.0	82.4
MB18HD20001	1/11/2018	627.0	82.4
MB18HD20001	2/11/2018	627.0	82.4
MB18HD20001	3/11/2018	627.0	82.4
MB18HD20001	4/11/2018	627.0	82.4
MB18HD20001	5/11/2018	626.9	82.4
MB18HD20001	6/11/2018	626.9	82.4
MB18HD20001	7/11/2018	627.0	82.4
MB18HD20001	8/11/2018	626.9	82.4
MB18HD20001	9/11/2018	627.0	82.4
MB18HD20001	10/11/2018	627.0	82.4
MB18HD20001	12/11/2018	626.9	82.4
MB18HD20001	13/11/2018	626.9	82.4
MB18HD20001	14/11/2018	627.0	82.4
MB18HD20001	15/11/2018	627.0	82.4
MB18HD20001	16/11/2018	627.0	82.4
MB18HD20001	17/11/2018	627.0	82.4
MB18HD20001	18/11/2018	626.9	82.4
MB18HD20001	19/11/2018	626.9	82.4
MB18HD20001	20/11/2018	626.9	82.4
MB18HD20001	21/11/2018	626.9	82.4
MB18HD20001	22/11/2018	626.9	82.4
MB18HD20001	23/11/2018	626.9	82.4
MB18HD20001	24/11/2018	626.9	82.4
MB18HD20001	25/11/2018	626.9	82.4
MB18HD20001	26/11/2018	626.9	82.4
MB18HD20001	27/11/2018	626.9	82.4
MB18HD20001	28/11/2018	626.9	82.4
MB18HD20001	29/11/2018	626.9	82.4
MB18HD20001	30/11/2018	626.9	82.5
MB18HD20001	1/12/2018	626.9	82.5
MB18HD20001	2/12/2018	626.9	82.5
MB18HD20001	3/12/2018	626.9	82.4
MB18HD20001	4/12/2018	626.9	82.4
MB18HD20001	5/12/2018	626.9	82.4
MB18HD20001	6/12/2018	626.9	82.5
MB18HD20001	7/12/2018	626.9	82.5
MB18HD20001	8/12/2018	626.9	82.5
MB

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDRE2	7/10/2021	629.0	49.9
HDRE2	6/10/2021	629.0	49.9
HDRE2	5/10/2021	628.9	49.9
HDRE2	4/10/2021	629.0	49.9
HDRE2	3/10/2021	629.0	49.9
HDRE2	2/10/2021	629.0	49.9
HDRE2	1/10/2021	628.9	49.9
HDRE2	30/09/2021	629.0	49.9
HDRE2	29/09/2021	629.0	49.9
HDRE2	28/09/2021	629.0	49.9
HDRE2	27/09/2021	629.0	49.9
HDRE2	26/09/2021	629.0	49.9
HDRE2	25/09/2021	628.9	49.9
HDRE2	24/09/2021	629.0	49.9
HDRE2	23/09/2021	629.0	49.9
HDRE2	22/09/2021	629.0	49.9
HDRE2	21/09/2021	629.0	49.9
HDRE2	20/09/2021	629.0	49.9
HDRE2	19/09/2021	629.0	49.9
HDRE2	18/09/2021	629.0	49.9
HDRE2	17/09/2021	629.0	49.9
HDRE2	16/09/2021	628.9	49.9
HDRE2	15/09/2021	628.9	49.9
HDRE2	14/09/2021	628.9	49.9
HDRE2	13/09/2021	628.9	49.9
HDRE2	12/09/2021	628.9	49.9
HDRE2	11/09/2021	628.9	49.9
HDRE2	10/09/2021	629.0	49.9
HDRE2	9/09/2021	629.0	49.9
HDRE2	8/09/2021	629.0	49.9
HDRE2	7/09/2021	629.0	49.9
HDRE2	6/09/2021	629.0	49.9
HDRE2	5/09/2021	629.0	49.9
HDRE2	4/09/2021	629.0	49.9
HDRE2	3/09/2021	629.0	49.9
HDRE2	2/09/2021	629.0	49.9
HDRE2	1/09/2021	628.9	49.9
HDRE2	31/08/2021	628.9	49.9
HDRE2	30/08/2021	629.0	49.9
HDRE2	29/08/2021	629.0	49.9
HDRE2	28/08/2021	629.0	49.9
HDRE2	27/08/2021	629.0	49.9
HDRE2	26/08/2021	629.0	49.9
HDRE2	25/08/2021	629.0	49.9
HDRE2	24/08/2021	629.0	49.9
HDRE2	23/08/2021	629.0	49.9
HDRE2	22/08/2021	629.0	49.9
HDRE2	21/08/2021	629.0	49.9
HDRE2	20/08/2021	629.0	49.8
HDRE2	19/08/2021	629.0	49.8
HDRE2	18/08/2021	629.0	49.8
HDRE2	17/08/2021	629.1	49.8
HDRE2	16/08/2021	629.1	49.8
HDRE2	15/08/2021	629.1	49.8
HDRE2	14/08/2021	629.0	49.8
HDRE2	13/08/2021	629.0	49.8
HDRE2	12/08/2021	629.1	49.8
HDRE2	11/08/2021	629.1	49.8
HDRE2	10/08/2021	629.0	49.8
HDRE2	9/08/2021	629.0	49.9
HDRE2	8/08/2021	629.0	49.9
HDRE2	7/08/2021	629.0	49.8
HDRE2	6/08/2021	629.0	49.8
HDRE2	5/08/2021	629.0	49.8
HDRE2	4/08/2021	629.0	49.8
HDRE2	3/08/2021	629.0	49.9
HDRE2	2/08/2021	629.0	49.9
HDRE2	1/08/2021	629.0	49.9
HDRE2	31/07/2021	629.0	49.9
HDRE2	30/07/2021	628.9	49.9
HDRE2	29/07/2021	628.9	49.9
HDRE2	28/07/2021	628.9	49.9
HDRE2	27/07/2021	628.9	49.9
HDRE2	26/07/2021	628.9	49.9
HDRE2	25/07/2021	628.9	49.9
HDRE2	24/07/2021	628.9	49.9
HDRE2	23/07/2021	628.9	49.9
HDRE2	22/07/2021	628.9	49.9
HDRE2	21/07/2021	628.9	49.9
HDRE2	20/07/2021	628.9	49.9
HDRE2	19/07/2021	628.9	49.9
HDRE2	18/07/2021	628.9	49.9
HDRE2	17/07/2021	628.9	49.9
HDRE2	16/07/2021	628.9	49.9
HDRE2	15/07/2021	628.9	49.9
HDRE2	14/07/2021	628.9	50.0
HDRE2	13/07/2021	628.9	50.0
HDRE2	12/07/2021	628.9	50.0
HDRE2	11/07/2021	628.9	50.0
HDRE2	10/07/2021	628.9	50.0
HDRE2	9/07/2021	628.9	50.0
HDRE2	8/07/2021	628.9	49.9
HDRE2	7/07/2021	628.9	49.9
HDRE2	6/07/2021	628.9	49.9
HDRE2	5/07/2021	628.9	49.9
HDRE2	4/07/2021	628.9	49.9
HDRE2	3/07/2021	628.9	49.9
HDRE2	2/07/2021	628.9	49.9
HDRE2	1/07/2021	628.9	49.9
HDRE2	30/06/2021	628.9	49.9
HDRE2	29/06/2021	628.9	49.9
HDRE2	28/06/2021	628.9	50.0
HDRE2	27/06/2021	628.9	50.0
HDRE2	26/06/2021	628.9	49.9
HDRE2	25/06/2021	628.9	49.9
HDRE2	24/06/2021	628.9	49.9
HDRE2	23/06/2021	628.9	49.9
HDRE2	22/06/2021	628.9	50.0
HDRE2	21/06/2021	628.9	50.0
HDRE2	20/06/2021	628.9	50.0
HDRE2	19/06/2021	628.9	50.0
HDRE2	18/06/2021	628.9	50.0
HDRE2	17/06/2021	628.9	50.0
HDRE2	16/06/2021	628.9	50.0
HDRE2	15/06/2021	628.9	50.0
HDRE2	14/06/2021	628.9	50.0
HDRE2	13/06/2021	628.9	50.0
HDRE2	12/06/2021	628.9	50.0
HDRE2	11/06/2021	628.8	50.0
HDRE2	10/06/2021	628.8	50.0
HDRE2	9/06/2021	628.9	50.0
HDRE2	8/06/2021	628.9	50.0
HDRE2	7/06/2021	628.9	50.0
HDRE2	6/06/2021	628.9	50.0
HDRE2	5/06/2021	628.9	50.0
HDRE2	4/06/2021	628.9	50.0
HDRE2	3/06/2021	628.9	50.0
HDRE2	2/06/2021	628.9	50.0
HDRE2	1/06/2021	628.9	50.0
HDRE2	31/05/2021	628.8	50.0
HDRE2	30/05/2021	628.8	50.0
HDRE2	29/05/2021	628.9	50.0
HDRE2	28/05/2021	628.9	50.0
HDRE2	27/05/2021	628.9	50.0
HDRE2	26/05/2021	628.9	50.0
HDRE2	25/05/2021	628.9	50.0

ID	Date	WL mAHD	WL mbgl
HDVRP1	22/11/2021	624.2	60.3
HDVRP1	21/11/2021	624.4	60.1
HDVRP1	20/11/2021	624.6	59.9
HDVRP1	19/11/2021	624.2	60.3
HDVRP1	18/11/2021	624.2	60.3
HDVRP1	17/11/2021	624.2	60.3
HDVRP1	16/11/2021	624.4	60.2
HDVRP1	15/11/2021	624.5	60.0
HDVRP1	14/11/2021	624.2	60.3
HDVRP1	13/11/2021	624.2	60.3
HDVRP1	12/11/2021	624.2	60.3
HDVRP1	11/11/2021	624.2	60.4
HDVRP1	10/11/2021	624.1	60.4
HDVRP1	9/11/2021	624.1	60.4
HDVRP1	7/11/2021	624.1	60.4
HDVRP1	6/11/2021	624.2	60.3
HDVRP1	5/11/2021	624.2	60.3
HDVRP1	4/11/2021	624.2	60.3
HDVRP1	3/11/2021	624.2	60.3
HDVRP1	2/11/2021	624.2	60.4
HDVRP1	1/11/2021	624.2	60.3
HDVRP1	29/10/2021	624.2	60.3
HDVRP1	28/10/2021	624.2	60.3
HDVRP1	27/10/2021	624.2	60.3
HDVRP1	26/10/2021	624.2	60.3
HDVRP1	25/10/2021	624.2	60.3
HDVRP1	24/10/2021	624.3	60.2
HDVRP1	23/10/2021	624.2	60.3
HDVRP1	22/10/2021	624.3	60.3
HDVRP1	21/10/2021	624.2	60.3
HDVRP1	20/10/2021	624.2	60.3
HDVRP1	19/10/2021	624.2	60.3
HDVRP1	18/10/2021	624.2	60.3
HDVRP1	17/10/2021	624.2	60.3
HDVRP1	16/10/2021	624.2	60.3
HDVRP1	15/10/2021	624.3	60.3
HDVRP1	14/10/2021	624.2	60.3
HDVRP1	13/10/2021	624.2	60.3
HDVRP1	12/10/2021	624.2	60.3
HDVRP1	11/10/2021	624.2	60.3
HDVRP1	10/10/2021	624.2	60.3
HDVRP1	9/10/2021	624.2	60.3
HDVRP1	8/10/2021	624.2	60.3
HDVRP1	7/10/2021	624.2	60.3
HDVRP1	6/10/2021	624.2	60.3
HDVRP1	5/10/2021	624.2	60.3
HDVRP1	4/10/2021	624.2	60.3
HDVRP1	3/10/2021	624.2	60.3
HDVRP1	2/10/2021	624.2	60.3
HDVRP1	1/10/2021	624.2	60.3
HDVRP1	30/09/2021	624.2	60.3
HDVRP1	29/09/2021	624.2	60.3
HDVRP1	28/09/2021	624.4	60.1
HDVRP1	27/09/2021	624.6	59.9
HDVRP1	26/09/2021	624.2	60.3
HDVRP1	25/09/2021	624.3	60.2
HDVRP1	24/09/2021	624.3	60.2
HDVRP1	23/09/2021	624.3	60.2
HDVRP1	22/09/2021	624.3	60.2
HDVRP1	21/09/2021	624.3	60.2
HDVRP1	20/09/2021	624.3	60.2
HDVRP1	19/09/2021	624.3	60.2
HDVRP1	18/09/2021	624.3	60.3
HDVRP1	17/09/2021	624.2	60.3
HDVRP1	16/09/2021	624.2	60.3
HDVRP1	15/09/2021	624.4	60.1
HDVRP1	14/09/2021	624.6	60.0
HDVRP1	13/09/2021	624.2	60.3
HDVRP1	12/09/2021	624.2	60.3
HDVRP1	11/09/2021	624.6	59.9
HDVRP1	10/09/2021	624.3	60.2
HDVRP1	9/09/2021	624.3	60.2
HDVRP1	8/09/2021	624.6	59.9
HDVRP1	7/09/2021	624.4	60.1
HDVRP1	6/09/2021	624.5	60.0
HDVRP1	5/09/2021	624.7	59.8
HDVRP1	4/09/2021	624.3	60.2
HDVRP1	3/09/2021	624.3	60.2
HDVRP1	2/09/2021	624.4	60.1
HDVRP1	1/09/2021	624.4	60.1
HDVRP1	31/08/2021	624.2	60.3
HDVRP1	30/08/2021	624.2	60.3
HDVRP1	29/08/2021	624.2	60.3
HDVRP1	28/08/2021	624.4	60.2
HDVRP1	27/08/2021	624.4	60.1
HDVRP1	26/08/2021	624.2	60.3
HDVRP1	25/08/2021	624.3	60.2
HDVRP1	24/08/2021	624.3	60.2
HDVRP1	23/08/2021	624.3	60.2
HDVRP1	22/08/2021	624.3	60.2
HDVRP1	21/08/2021	624.3	60.2
HDVRP1	20/08/2021	624.7	59.8
HDVRP1	19/08/2021	624.2	60.3
HDVRP1	18/08/2021	624.2	60.3
HDVRP1	17/08/2021	624.2	60.3
HDVRP1	16/08/2021	624.2	60.3
HDVRP1	15/08/2021	624.2	60.3
HDVRP1	14/08/2021	624.2	60.3
HDVRP1	13/08/2021	624.3	60.2
HDVRP1	12/08/2021	624.3	60.2
HDVRP1	11/08/2021	624.3	60.2
HDVRP1	10/08/2021	624.3	60.2
HDVRP1	9/08/2021	624.3	60.2
HDVRP1	8/08/2021	624.3	60.2
HDVRP1	7/08/2021	624.3	60.2
HDVRP1	6/08/2021	624.3	60.2
HDVRP1	5/08/2021	624.3	60.2
HDVRP1	4/08/2021	624.4	60.1
HDVRP1	3/08/2021	624.6	59.9
HDVRP1	2/08/2021	624.2	60.3
HDVRP1	1/08/2021	624.2	60.3
HDVRP1	31/07/2021	624.2	60.3
HDVRP1	30/07/2021	624.2	60.3
HDVRP1	29/07/2021	624.4	60.2
HDVRP1	28/07/2021	624.3	60.2
HDVRP1	27/07/2021	624.2	60.3
HDVRP1	26/07/2021	624.3	60.3
HDVRP1	25/07/2021	624.3	60.2
HDVRP1	24/07/2021	624.3	60.2
HDVRP1	23/07/2021	624.3	60.2
HDVRP1	6/07/2021	624.3	60.2
HDVRP1	5/07/2021	624.3	60.2
HDVRP1	4/07/2021	624.3	60.2
HDVRP1	3/07/2021	624.5	60.0
HDVRP1	2/07/2021	624.4	60.2
HDVRP1	1/07/2021	624.3	60.2
HDVRP1	30/06/2021	624.3	60.2
HDVRP1	29/06/2021	624.3	60.2
HDVRP1	28/06/2021	624.3	60.2
HDVRP1	27/06/2021	624.6	59.9
HDVRP1	26/06/2021	624.5	60.0
HDVRP1	25/06/2021	624.3	60.2
HDVRP1	24/06/2021	624.3	60.2
HDVRP1	23/06/2021	624.3	60.2
HDVRP1	22/06/2021	624.3	60.2
HDVRP1	21/06/2021	624.3	60.2

ID	Date	WL mAHD	WL mbgl
MB20WC0123	17/02/2022	621.5	56.3
MB20WC0123	16/02/2022	621.4	56.4
MB20WC0123	15/02/2022	621.4	56.4
MB20WC0123	14/02/2022	621.4	56.4
MB20WC0123	13/02/2022	621.4	56.4
MB20WC0123	12/02/2022	621.4	56.4
MB20WC0123	11/02/2022	621.4	56.4
MB20WC0123	10/02/2022	621.4	56.4
MB20WC0123	9/02/2022	621.4	56.4
MB20WC0123	8/02/2022	621.4	56.4
MB20WC0123	7/02/2022	621.4	56.4
MB20WC0123	6/02/2022	621.3	56.5
MB20WC0123	5/02/2022	621.3	56.5
MB20WC0123	4/02/2022	621.4	56.4
MB20WC0123	3/02/2022	621.4	56.4
MB20WC0123	2/02/2022	621.4	56.4
MB20WC0123	1/02/2022	621.3	56.5
MB20WC0123	31/01/2022	621.3	56.5
MB20WC0123	30/01/2022	621.3	56.5
MB20WC0123	29/01/2022	621.3	56.5
MB20WC0123	28/01/2022	621.4	56.4
MB20WC0123	27/01/2022	621.3	56.5
MB20WC0123	26/01/2022	621.3	56.5
MB20WC0123	25/01/2022	621.3	56.5
MB20WC0123	24/01/2022	621.3	56.5
MB20WC0123	23/01/2022	621.3	56.5
MB20WC0123	22/01/2022	621.4	56.4
MB20WC0123	21/01/2022	621.4	56.4
MB20WC0123	20/01/2022	621.4	56.4
MB20WC0123	19/01/2022	621.4	56.4
MB20WC0123	18/01/2022	621.4	56.4
MB20WC0123	17/01/2022	621.4	56.4
MB20WC0123	16/01/2022	621.3	56.5
MB20WC0123	15/01/2022	621.3	56.5
MB20WC0123	14/01/2022	621.3	56.5
MB20WC0123	13/01/2022	621.4	56.4
MB20WC0123	12/01/2022	621.4	56.4
MB20WC0123	11/01/2022	621.4	56.4
MB20WC0123	10/01/2022	621.4	56.4
MB20WC0123	9/01/2022	621.4	56.4
MB20WC0123	8/01/2022	621.4	56.4
MB20WC0123	7/01/2022	621.4	56.4
MB20WC0123	6/01/2022	621.4	56.4
MB20WC0123	5/01/2022	621.4	56.4
MB20WC0123	4/01/2022	621.4	56.4
MB20WC0123	3/01/2022	621.4	56.4
MB20WC0123	2/01/2022	621.4	56.4
MB20WC0123	1/01/2022	621.4	56.4
MB20WC0123	31/12/2021	621.4	56.4
MB20WC0123	30/12/2021	621.4	56.4
MB20WC0123	29/12/2021	621.4	56.4
MB20WC0123	28/12/2021	621.4	56.4
MB20WC0123	27/12/2021	621.4	56.4
MB20WC0123	26/12/2021	621.4	56.4
MB20WC0123	25/12/2021	621.4	56.4
MB20WC0123	24/12/2021	621.4	56.4
MB20WC0123	23/12/2021	621.4	56.4
MB20WC0123	22/12/2021	621.4	56.4
MB20WC0123	21/12/2021	621.4	56.4
MB20WC0123	20/12/2021	621.5	56.3
MB20WC0123	19/12/2021	621.5	56.3
MB20WC0123	18/12/2021	621.5	56.3
MB20WC0123	17/12/2021	621.5	56.3
MB20WC0123	16/12/2021	621.4	56.4
MB20WC0123	15/12/2021	621.4	56.4
MB20WC0123	14/12/2021	621.4	56.4
MB20WC0123	13/12/2021	621.4	56.4
MB20WC0123	12/12/2021	621.4	56.4
MB20WC0123	11/12/2021	621.5	56.3
MB20WC0123	10/12/2021	621.5	56.3
MB20WC0123	9/12/2021	621.5	56.3
MB20WC0123	8/12/2021	621.5	56.3
MB20WC0123	7/12/2021	621.5	56.3
MB20WC0123	6/12/2021	621.5	56.3
MB20WC0123	5/12/2021	621.5	56.3
MB20WC0123	4/12/2021	621.5	56.3
MB20WC0123	3/12/2021	621.5	56.3
MB20WC0123	2/12/2021	621.5	56.3
MB20WC0123	1/12/2021	621.5	56.3
MB20WC0123	30/11/2021	621.5	56.3
MB20WC0123	29/11/2021	621.5	56.3
MB20WC0123	28/11/2021	621.5	56.3
MB20WC0123	27/11/2021	621.5	56.3
MB20WC0123	26/11/2021	621.5	56.3
MB20WC0123	25/11/2021	621.5	56.3
MB20WC0123	24/11/2021	621.5	56.3
MB20WC0123	23/11/2021	621.5	56.3
MB20WC0123	22/11/2021	621.5	56.3
MB20WC0123	21/11/2021	621.5	56.3
MB20WC0123	20/11/2021	621.5	56.3
MB20WC0123	19/11/2021	621.5	56.3
MB20WC0123	18/11/2021	621.5	56.3
MB20WC0123	17/11/2021	621.5	56.3
MB20WC0123	16/11/2021	621.5	56.3
MB20WC0123	15/11/2021	621.5	56.3
MB20WC0123	14/11/2021	621.6	56.2
MB20WC0123	13/11/2021	621.6	56.2
MB20WC0123	17/09/2021	621.5	56.3
MB20WC0123	17/08/2021	621.6	56.2
MB20WC0123	16/08/2021	621.7	56.1
MB20WC0123	15/08/2021	621.7	56.1
MB20WC0123	14/08/2021	621.6	56.2
MB20WC0123	13/08/2021	621.6	56.2
MB20WC0123	12/08/2021	621.7	56.1
MB20WC0123	11/08/2021	621.9	55.9
MB20WC0123	10/08/2021	622.6	55.2
MB20WC0123	9/08/2021	621.6	56.2
MB20WC0123	8/08/2021	621.6	56.2
MB20WC0123	7/08/2021	621.7	56.1
MB20WC0123	6/08/2021	621.7	56.1
MB20WC0123	5/08/2021	621.7	56.1
MB20WC0123	4/08/2021	621.7	56.1
MB20WC0123	3/08/2021	621.7	56.1
MB20WC0123	2/08/2021	621.7	56.1
MB20WC0123	1/08/2021	621.7	56.1
MB20WC0123	31/07/2021	621.6	56.2
MB20WC0123	30/07/2021	621.6	56.2
MB20WC0123	29/07/2021	621.6	56.2
MB20WC0123	28/07/2021	621.6	56.2
MB20WC0123	27/07/2021	621.6	56.2
MB20WC0123	26/07/2021	621.6	56.2
MB20WC0123	25/07/2021	621.6	56.2
MB20WC0123	24/07/2021	621.7	56.1
MB20WC0123	23/07/2021	621.7	56.1
MB20WC0123	22/07/2021	621.6	56.2
MB20WC0123	21/07/2021	621.6	56.2
MB20WC0123	20/07/2021	622.0	55.8
MB20WC0123	19/07/2021	621.7	56.1
MB20WC0123	18/07/2021	621.6	56.2
MB20WC0123	17/07/2021	621.7	56.1
MB20WC0123	16/07/2021	621.7	56.1
MB20WC0123	15/07/2021	621.7	56.1
MB20WC0123	14/07/2021	621.7	56.1
MB20WC0123	13/07/2021	621.6	56.2
MB20WC0123	12/07/2021	621.6	56.2
MB20WC0123	11/07/2021	621.7	56.1

ID	Date	WL mAHD	WL mbgl
MB18HD20001	13/01/2019	626.9	82.5
MB18HD20001	14/01/2019	626.9	82.5
MB18HD20001	15/01/2019	626.9	82.5
MB18HD20001	16/01/2019	626.9	82.5
MB18HD20001	17/01/2019	626.9	82.5
MB18HD20001	18/01/2019	626.9	82.5
MB18HD20001	19/01/2019	626.9	82.5
MB18HD20001	20/01/2019	626.9	82.5
MB18HD20001	21/01/2019	626.9	82.5
MB18HD20001	22/01/2019	626.9	82.5
MB18HD20001	23/01/2019	626.9	82.5
MB18HD20001	24/01/2019	626.9	82.5
MB18HD20001	25/01/2019	626.9	82.5
MB18HD20001	26/01/2019	626.9	82.5
MB18HD20001	27/01/2019	626.9	82.5
MB18HD20001	28/01/2019	626.9	82.5
MB18HD20001	29/01/2019	626.9	82.5
MB18HD20001	30/01/2019	626.9	82.5
MB18HD20001	31/01/2019	626.9	82.5
MB18HD20001	1/02/2019	626.9	82.5
MB18HD20001	2/02/2019	626.9	82.5
MB18HD20001	3/02/2019	626.9	82.5
MB18HD20001	4/02/2019	626.9	82.5
MB18HD20001	5/02/2019	626.9	82.5
MB18HD20001	6/02/2019	626.9	82.5
MB18HD20001	7/02/2019	626.9	82.5
MB18HD20001	8/02/2019	626.9	82.5
MB18HD20001	9/02/2019	626.9	82.5
MB18HD20001	10/02/2019	626.9	82.4
MB18HD20001	11/02/2019	626.9	82.4
MB18HD20001	12/02/2019	626.9	82.5
MB18HD20001	13/02/2019	626.9	82.5
MB18HD20001	14/02/2019	626.9	82.4
MB18HD20001	15/02/2019	626.9	82.4
MB18HD20001	16/02/2019	626.9	82.4
MB18HD20001	17/02/2019	626.9	82.4
MB18HD20001	18/02/2019	626.9	82.5
MB18HD20001	19/02/2019	626.9	82.5
MB18HD20001	20/02/2019	626.9	82.5
MB18HD20001	21/02/2019	626.9	82.4
MB18HD20001	22/02/2019	626.9	82.4
MB18HD20001	23/02/2019	626.9	82.4
MB18HD20001	24/02/2019	626.9	82.4
MB18HD20001	25/02/2019	626.9	82.4
MB18HD20001	26/02/2019	626.9	82.4
MB18HD20001	27/02/2019	626.9	82.4
MB18HD20001	28/02/2019	626.9	82.5
MB18HD20001	1/03/2019	626.9	82.5
MB18HD20001	2/03/2019	626.9	82.5
MB18HD20001	3/03/2019	626.9	82.4
MB18HD20001	4/03/2019	626.9	82.4
MB18HD20001	5/03/2019	626.9	82.4
MB18HD20001	6/03/2019	626.9	82.4
MB18HD20001	7/03/2019	626.9	82.5
MB18HD20001	8/03/2019	626.9	82.5
MB18HD20001	9/03/2019	626.9	82.4
MB18HD20001	10/03/2019	626.9	82.4
MB18HD20001	11/03/2019	626.9	82.4
MB18HD20001	12/03/2019	626.9	82.4
MB18HD20001	13/03/2019	626.9	82.4
MB18HD20001	14/03/2019	626.9	82.4
MB18HD20001	15/03/2019	626.9	82.4
MB18HD20001	16/03/2019	626.9	82.4
MB18HD20001	17/03/2019	626.9	82.5
MB18HD20001	18/03/2019	626.9	82.4
MB18HD20001	19/03/2019	626.9	82.4
MB18HD20001	20/03/2019	626.9	82.4
MB18HD20001	21/03/2019	626.9	82.4
MB18HD20001	22/03/2019	626.9	82.4
MB18HD20001	23/03/2019	626.9	82.4
MB18HD20001	24/03/2019	626.9	82.4
MB18HD20001	25/03/2019	626.9	82.4
MB18HD20001	26/03/2019	626.9	82.4
MB18HD20001	27/03/2019	627.0	82.4
MB18HD20001	28/03/2019	627.0	82.4
MB18HD20001	29/03/2019	627.0	82.4
MB18HD20001	30/03/2019	627.0	82.4
MB18HD20001	31/03/2019	627.0	82.4
MB18HD20001	1/04/2019	627.0	82.4
MB18HD20001	2/04/2019	627.0	82.4
MB18HD20001	3/04/2019	627.0	82.4
MB18HD20001	4/04/2019	627.0	82.4
MB18HD20001	5/04/2019	627.0	82.4
MB18HD20001	6/04/2019	627.0	82.4
MB18HD20001	7/04/2019	627.0	82.4
MB18HD20001	8/04/2019	626.9	82.4
MB18HD20001	9/04/2019	626.9	82.4
MB18HD20001	10/04/2019	627.0	82.4
MB18HD20001	11/04/2019	627.0	82.4
MB18HD20001	12/04/2019	627.0	82.4
MB18HD20001	13/04/2019	627.0	82.4
MB18HD20001	14/04/2019	627.0	82.4
MB18HD20001	15/04/2019	626.9	82.4
MB18HD20001	16/04/2019	626.9	82.4
MB18HD20001	17/04/2019	627.0	82.4
MB18HD20001	18/04/2019	627.0	82.4
MB18HD20001	19/04/2019	626.9	82.4
MB18HD20001	20/04/2019	627.0	82.4
MB18HD20001	21/04/2019	627.0	82.4
MB18HD20001	22/04/2019	627.0	82.4

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDRE2	24/05/2021	628.9	50.0
HDRE2	23/05/2021	628.8	50.0
HDRE2	22/05/2021	628.8	50.0
HDRE2	21/05/2021	628.9	50.0
HDRE2	20/05/2021	628.9	50.0
HDRE2	19/05/2021	628.9	50.0
HDRE2	18/05/2021	628.9	50.0
HDRE2	17/05/2021	628.9	50.0
HDRE2	16/05/2021	628.9	50.0
HDRE2	15/05/2021	628.9	50.0
HDRE2	14/05/2021	628.9	50.0
HDRE2	13/05/2021	628.9	50.0
HDRE2	12/05/2021	628.9	50.0
HDRE2	11/05/2021	628.9	50.0
HDRE2	10/05/2021	628.9	50.0
HDRE2	9/05/2021	628.9	50.0
HDRE2	8/05/2021	628.9	50.0
HDRE2	7/05/2021	628.9	50.0
HDRE2	6/05/2021	628.8	50.0
HDRE2	5/05/2021	628.8	50.0
HDRE2	4/05/2021	628.8	50.0
HDRE2	3/05/2021	628.8	50.0
HDRE2	2/05/2021	628.9	50.0
HDRE2	1/05/2021	628.9	50.0
HDRE2	30/04/2021	628.9	50.0
HDRE2	29/04/2021	628.9	50.0
HDRE2	28/04/2021	628.9	50.0
HDRE2	27/04/2021	628.9	50.0
HDRE2	26/04/2021	628.9	50.0
HDRE2	25/04/2021	628.9	50.0
HDRE2	24/04/2021	628.9	50.0
HDRE2	23/04/2021	628.9	50.0
HDRE2	22/04/2021	628.9	50.0
HDRE2	21/04/2021	628.9	50.0
HDRE2	20/04/2021	628.9	50.0
HDRE2	19/04/2021	628.8	50.0
HDRE2	18/04/2021	628.9	50.0
HDRE2	17/04/2021	628.9	50.0
HDRE2	16/04/2021	628.9	50.0
HDRE2	15/04/2021	628.9	50.0
HDRE2	14/04/2021	628.9	50.0
HDRE2	13/04/2021	628.9	50.0
HDRE2	12/04/2021	628.8	50.0
HDRE2	11/04/2021	628.8	50.0
HDRE2	10/04/2021	628.8	50.0
HDRE2	9/04/2021	628.8	50.0
HDRE2	8/04/2021	628.8	50.1
HDRE2	7/04/2021	628.8	50.0
HDRE2	6/04/2021	628.8	50.0
HDRE2	5/04/2021	628.8	50.0
HDRE2	4/04/2021	628.8	50.0
HDRE2	3/04/2021	628.8	50.0
HDRE2	2/04/2021	628.8	50.0
HDRE2	1/04/2021	628.8	50.0
HDRE2	31/03/2021	628.8	50.0
HDRE2	30/03/2021	628.8	50.0
HDRE2	29/03/2021	628.8	50.0
HDRE2	28/03/2021	628.8	50.0
HDRE2	27/03/2021	628.8	50.0
HDRE2	26/03/2021	628.8	50.0
HDRE2	25/03/2021	628.8	50.0
HDRE2	24/03/2021	628.8	50.0
HDRE2	23/03/2021	628.9	50.0
HDRE2	22/03/2021	628.9	50.0
HDRE2	21/03/2021	628.9	50.0
HDRE2	20/03/2021	628.9	50.0
HDRE2	19/03/2021	628.9	49.9
HDRE2	18/03/2021	628.9	49.9
HDRE2	17/03/2021	629.0	49.9
HDRE2	16/03/2021	629.0	49.9
HDRE2	15/03/2021	629.0	49.8
HDRE2	14/03/2021	629.1	49.8
HDRE2	13/03/2021	629.0	49.8
HDRE2	12/03/2021	629.0	49.8
HDRE2	11/03/2021	629.0	49.8
HDRE2	10/03/2021	629.0	49.9
HDRE2	9/03/2021	629.0	49.9
HDRE2	8/03/2021	628.9	49.9
HDRE2	7/03/2021	628.9	49.9
HDRE2	6/03/2021	628.9	50.0
HDRE2	5/03/2021	628.9	50.0
HDRE2	4/03/2021	628.9	50.0
HDRE2	3/03/2021	628.9	50.0
HDRE2	2/03/2021	628.8	50.0
HDRE2	1/03/2021	628.8	50.0
HDRE2	28/02/2021	628.8	50.0
HDRE2	27/02/2021	628.8	50.1
HDRE2	26/02/2021	628.8	50.1
HDRE2	25/02/2021	628.8	50.0
HDRE2	24/02/2021	628.8	50.0
HDRE2	23/02/2021	628.8	50.0
HDRE2	22/02/2021	628.8	50.0
HDRE2	21/02/2021	628.8	50.0
HDRE2	20/02/2021	628.8	50.0
HDRE2	19/02/2021	628.8	50.0
HDRE2	18/02/2021	628.8	50.1
HDRE2	17/02/2021	628.8	50.1
HDRE2	16/02/2021	628.8	50.1
HDRE2	15/02/2021	628.8	50.1
HDRE2	14/02/2021	628.8	50.1
HDRE2	13/02/2021	628.8	50.1
HDRE2	12/02/2021	628.8	50.1
HDRE2	11/02/2021	628.8	50.1
HDRE2	10/02/2021	628.7	50.1
HDRE2	9/02/2021	628.7	50.1
HDRE2	8/02/2021	628.7	50.1
HDRE2	7/02/2021	628.7	50.1
HDRE2	6/02/2021	628.7	50.1
HDRE2	5/02/2021	628.7	50.1
HDRE2	4/02/2021	628.7	50.2
HDRE2	3/02/2021	628.7	50.2
HDRE2	2/02/2021	628.7	50.2
HDRE2	1/02/2021	628.7	50.2
HDRE2	31/01/2021	628.7	50.2
HDRE2	30/01/2021	628.7	50.2
HDRE2	29/01/2021	628.7	50.2
HDRE2	28/01/2021	628.7	50.2
HDRE2	27/01/2021	628.7	50.2
HDRE2	26/01/2021	628.7	50.2
HDRE2	25/01/2021	628.7	50.2
HDRE2	24/01/2021	628.7	50.2
HDRE2	23/01/2021	628.7	50.2
HDRE2	22/01/2021	628.7	50.2
HDRE2	21/01/2021	628.7	50.2
HDRE2	20/01/2021	628.7	50.2
HDRE2	19/01/2021	628.7	50.2
HDRE2	18/01/2021	628.7	50.2
HDRE2	17/01/2021	628.7	50.2
HDRE2	16/01/2021	628.7	50.2
HDRE2	15/01/2021	628.6	50.2
HDRE2	14/01/2021	628.6	50.2
HDRE2	13/01/2021	628.6	50.2
HDRE2	12/01/2021	628.6	50.2
HDRE2	11/01/2021	628.6	50.2
HDRE2	10/01/2021	628.6	50.2
HDRE2	9/01/2021	628.6	50.2

ID	Date	WL mAHD	WL mbgl
HDVRP1	20/06/2021	624.4	60.1
HDVRP1	19/06/2021	624.8	59.7
HDVRP1	18/06/2021	624.3	60.2
HDVRP1	17/06/2021	624.5	60.0
HDVRP1	16/06/2021	624.3	60.2
HDVRP1	15/06/2021	624.3	60.2
HDVRP1	14/06/2021	624.3	60.2
HDVRP1	13/06/2021	624.3	60.2
HDVRP1	12/06/2021	624.3	60.2
HDVRP1	11/06/2021	624.3	60.2
HDVRP1	10/06/2021	624.7	59.9
HDVRP1	9/06/2021	624.6	59.9
HDVRP1	8/06/2021	624.3	60.2
HDVRP1	7/06/2021	624.5	60.1
HDVRP1	6/06/2021	624.5	60.0
HDVRP1	5/06/2021	624.4	60.1
HDVRP1	4/06/2021	624.4	60.1
HDVRP1	3/06/2021	624.3	60.2
HDVRP1	2/06/2021	624.4	60.1
HDVRP1	1/06/2021	624.3	60.2
HDVRP1	31/05/2021	624.5	60.0
HDVRP1	30/05/2021	624.4	60.2
HDVRP1	29/05/2021	624.3	60.2
HDVRP1	28/05/2021	624.3	60.2
HDVRP1	27/05/2021	624.3	60.2
HDVRP1	26/05/2021	624.3	60.2
HDVRP1	25/05/2021	624.3	60.2
HDVRP1	24/05/2021	624.3	60.2
HDVRP1	23/05/2021	624.2	60.3
HDVRP1	22/05/2021	624.3	60.3
HDVRP1	21/05/2021	624.3	60.2
HDVRP1	20/05/2021	624.3	60.2
HDVRP1	19/05/2021	624.3	60.2
HDVRP1	18/05/2021	624.3	60.2
HDVRP1	17/05/2021	624.3	60.2
HDVRP1	16/05/2021	624.3	60.2
HDVRP1	15/05/2021	624.3	60.2
HDVRP1	14/05/2021	624.5	60.0
HDVRP1	13/05/2021	624.7	59.8
HDVRP1	12/05/2021	624.3	60.2
HDVRP1	11/05/2021	624.3	60.2
HDVRP1	10/05/2021	624.5	60.0
HDVRP1	9/05/2021	624.5	60.0
HDVRP1	8/05/2021	624.3	60.2
HDVRP1	7/05/2021	624.3	60.2
HDVRP1	6/05/2021	624.3	60.3
HDVRP1	5/05/2021	624.3	60.3
HDVRP1	4/05/2021	624.3	60.3
HDVRP1	3/05/2021	624.3	60.2
HDVRP1	2/05/2021	624.5	60.1
HDVRP1	1/05/2021	624.7	59.8
HDVRP1	30/04/2021	624.3	60.2
HDVRP1	29/04/2021	624.3	60.2
HDVRP1	28/04/2021	624.4	60.2
HDVRP1	27/04/2021	624.4	60.1
HDVRP1	26/04/2021	624.5	60.0
HDVRP1	25/04/2021	624.6	60.0
HDVRP1	24/04/2021	624.3	60.2
HDVRP1	23/04/2021	624.3	60.2
HDVRP1	22/04/2021	624.5	60.1
HDVRP1	21/04/2021	624.4	60.2
HDVRP1	20/04/2021	624.3	60.2
HDVRP1	19/04/2021	624.5	60.0
HDVRP1	18/04/2021	624.7	59.8
HDVRP1	17/04/2021	624.3	60.2
HDVRP1	16/04/2021	624.4	60.1
HDVRP1	15/04/2021	624.7	59.8
HDVRP1	14/04/2021	624.6	59.9
HDVRP1	13/04/2021	624.3	60.2
HDVRP1	12/04/2021	624.3	60.2
HDVRP1	11/04/2021	624.3	60.2
HDVRP1	10/04/2021	624.5	60.1
HDVRP1	9/04/2021	624.7	59.8
HDVRP1	8/04/2021	624.3	60.2
HDVRP1	7/04/2021	624.3	60.2
HDVRP1	6/04/2021	624.4	60.1
HDVRP1	5/04/2021	624.4	60.1
HDVRP1	4/04/2021	624.3	60.3
HDVRP1	3/04/2021	624.3	60.2
HDVRP1	2/04/2021	624.3	60.2
HDVRP1	1/04/2021	624.5	60.0
HDVRP1	31/03/2021	624.5	60.0
HDVRP1	30/03/2021	624.3	60.2
HDVRP1	29/03/2021	624.3	60.2
HDVRP1	28/03/2021	624.3	60.2
HDVRP1	27/03/2021	624.3	60.2
HDVRP1	26/03/2021	624.3	60.2
HDVRP1	25/03/2021	624.3	60.2
HDVRP1	24/03/2021	624.4	60.1
HDVRP1	23/03/2021	624.6	59.9
HDVRP1	22/03/2021	624.3	60.2
HDVRP1	21/03/2021	624.3	60.2
HDVRP1	20/03/2021	624.3	60.2
HDVRP1	19/03/2021	624.4	60.1
HDVRP1	18/03/2021	624.6	59.9
HDVRP1	17/03/2021	624.5	60.0
HDVRP1	16/03/2021	624.3	60.2
HDVRP1	15/03/2021	624.3	60.2
HDVRP1	14/03/2021	624.3	60.2
HDVRP1	13/03/2021	624.4	60.1
HDVRP1	12/03/2021	624.7	59.8
HDVRP1	11/03/2021	624.5	60.0
HDVRP1	10/03/2021	624.3	60.2
HDVRP1	9/03/2021	624.3	60.2
HDVRP1	8/03/2021	624.3	60.2
HDVRP1	7/03/2021	624.3	60.3
HDVRP1	6/03/2021	624.3	60.3
HDVRP1	5/03/2021	624.3	60.2
HDVRP1	4/03/2021	624.3	60.2
HDVRP1	3/03/2021	624.3	60.2
HDVRP1	2/03/2021	624.3	60.2
HDVRP1	1/03/2021	624.3	60.2
HDVRP1	28/02/2021	624.3	60.2
HDVRP1	27/02/2021	624.5	60.0
HDVRP1	26/02/2021	624.4	60.1
HDVRP1	25/02/2021	624.7	59.8
HDVRP1	24/02/2021	624.3	60.2
HDVRP1	23/02/2021	624.3	60.2
HDVRP1	22/02/2021	624.3	60.2
HDVRP1	21/02/2021	624.2	60.3
HDVRP1	20/02/2021	624.3	60.2
HDVRP1	19/02/2021	624.5	60.0
HDVRP1	18/02/2021	624.2	60.3
HDVRP1	17/02/2021	624.2	60.3
HDVRP1	16/02/2021	624.3	60.2
HDVRP1	15/02/2021	624.3	60.2
HDVRP1	14/02/2021	624.3	60.2
HDVRP1	13/02/2021	624.3	60.2
HDVRP1	12/02/2021	624.5	60.0
HDVRP1	11/02/2021	624.8	59.7
HDVRP1	10/02/2021	624.2	60.3
HDVRP1	9/02/2021	624.3	60.2
HDVRP1	8/02/2021	624.4	60.1
HDVRP1	7/02/2021	624.3	60.2
HDVRP1	6/02/2021	624.2	60.3
HDVRP1	5/02/2021	624.2	60.3

ID	Date	WL mAHD	WL mbgl
MB20WC0123	10/07/2021	621.7	56.1
MB20WC0123	9/07/2021	621.7	56.1
MB20WC0123	8/07/2021	621.7	56.1
MB20WC0123	7/07/2021	621.7	56.1
MB20WC0123	6/07/2021	621.7	56.1
MB20WC0123	5/07/2021	621.7	56.1
MB20WC0123	4/07/2021	621.7	56.1
MB20WC0123	3/07/2021	621.7	56.1
MB20WC0123	2/07/2021	621.7	56.1
MB20WC0123	1/07/2021	621.7	56.1
MB20WC0123	30/06/2021	621.7	56.1
MB20WC0123	29/06/2021	621.7	56.1
MB20WC0123	28/06/2021	621.7	56.1
MB20WC0123	27/06/2021	621.7	56.1
MB20WC0123	26/06/2021	621.7	56.1
MB20WC0123	25/06/2021	621.7	56.1
MB20WC0123	24/06/2021	621.7	56.1
MB20WC0123	23/06/2021	621.7	56.1
MB20WC0123	22/06/2021	621.7	56.1
MB20WC0123	21/06/2021	621.7	56.1
MB20WC0123	20/06/2021	621.7	56.1
MB20WC0123	19/06/2021	621.7	56.1
MB20WC0123	18/06/2021	621.7	56.1
MB20WC0123	17/06/2021	621.8	56.0
MB20WC0123	16/06/2021	621.8	56.0
MB20WC0123	15/06/2021	621.7	56.1
MB20WC0123	14/06/2021	621.7	56.1
MB20WC0123	13/06/2021	621.7	56.1
MB20WC0123	12/06/2021	621.7	56.1
MB20WC0123	11/06/2021	621.7	56.1
MB20WC0123	10/06/2021	621.7	56.1
MB20WC0123	9/06/2021	621.7	56.1
MB20WC0123	8/06/2021	621.7	56.1
MB20WC0123	7/06/2021	621.7	56.1
MB20WC0123	6/06/2021	621.7	56.1
MB20WC0123	5/06/2021	621.7	56.1
MB20WC0123	4/06/2021	621.8	56.0
MB20WC0123	3/06/2021	621.8	56.0
MB20WC0123	2/06/2021	621.7	56.1
MB20WC0123	1/06/2021	621.7	56.1
MB20WC0123	31/05/2021	621.7	56.1
MB20WC0123	30/05/2021	621.8	56.0
MB20WC0123	29/05/2021	621.7	56.1
MB20WC0123	28/05/2021	621.8	56.0
MB20WC0123	27/05/2021	621.8	56.0
MB20WC0123	26/05/2021	621.8	56.0
MB20WC0123	25/05/2021	621.7	56.1
MB20WC0123	24/05/2021	621.7	56.1
MB20WC0123	23/05/2021	621.7	56.1
MB20WC0123	22/05/2021	621.7	56.1
MB20WC0123	21/05/2021	621.7	56.1
MB20WC0123	20/05/2021	621.7	56.1
MB20WC0123	19/05/2021	621.7	56.1
MB20WC0123	18/05/2021	621.7	56.1
MB20WC0123	17/05/2021	621.7	56.1
MB20WC0123	16/05/2021	621.7	56.1
MB20WC0123	15/05/2021	621.7	56.1
MB20WC0123	14/05/2021	621.7	56.1
MB20WC0123	13/05/2021	621.7	56.1
MB20WC0123	12/05/2021	621.7	56.1
MB20WC0123	11/05/2021	621.7	56.1
MB20WC0123	10/05/2021	621.7	56.1
MB20WC0123	9/05/2021	621.7	56.1
MB20WC0123	8/05/2021	621.7	56.1
MB20WC0123	7/05/2021	621.7	56.1
MB20WC0123	6/05/2021	621.7	56.1
MB20WC0123	5/05/2021	621.6	56.2
MB20WC0123	4/05/2021	621.7	56.1
MB20WC0123	3/05/2021	621.7	56.1
MB20WC0123	2/05/2021	621.7	56.1
MB20WC0123	1/05/2021	621.7	56.1
MB20WC0123	30/04/2021	621.7	56.1
MB20WC0123	29/04/2021	621.7	56.1
MB20WC0123	28/04/2021	621.7	56.1
MB20WC0123	27/04/2021	621.7	56.1
MB20WC0123	26/04/2021	621.8	56.0
MB20WC0123	12/11/2020	621.5	56.3
MB20WC0125	2/03/2022	621.6	74.8
MB20WC0125	1/03/2022	621.6	74.8
MB20WC0125	28/02/2022	621.6	74.8
MB20WC0125	27/02/2022	621.6	74.8
MB20WC0125	26/02/2022	621.5	74.8
MB20WC0125	25/02/2022	621.6	74.8
MB20WC0125	24/02/2022	621.5	74.8
MB20WC0125	23/02/2022	621.5	74.8
MB20WC0125	22/02/2022	621.5	74.8
MB20WC0125	21/02/2022	621.6	74.8
MB20WC0125	20/02/2022	621.6	74.8
MB20WC0125	19/02/2022	621.6	74.8
MB20WC0125	18/02/2022	621.6	74.8
MB20WC0125	17/02/2022	621.6	74.8
MB20WC0125	16/02/2022	621.6	74.8
MB20WC0125	15/02/2022	621.6	74.8
MB20WC0125	14/02/2022	621.6	74.8
MB20WC0125	13/02/2022	621.6	74.8
MB20WC0125	12/02/2022	621.5	74.8
MB20WC0125	11/02/2022	621.5	74.8
MB20WC0125	10/02/2022	621.5	74.9
MB20WC0125	9/02/2022	621.5	74.9
MB20WC0125	8/02/2022	621.5	74.9
MB20WC0125	7/02/2022	621.5	74.9
MB20WC0125	6/02/2022	621.5	74.9
MB20WC0125	5/02/2022	621.5	74.9
MB20WC0125	4/02/2022	621.5	74.9
MB20WC0125	3/02/2022	621.5	74.9
MB20WC0125	2/02/2022	621.5	74.9
MB20WC0125	1/02/2022	621.5	74.9
MB20WC0125	31/01/2022	621.5	74.9
MB20WC0125	30/01/2022	621.5	74.9
MB20WC0125	29/01/2022	621.5	74.9
MB20WC0125	28/01/2022	621.5	74.9
MB20WC0125	27/01/2022	621.5	74.9
MB20WC0125	26/01/2022	621.5	74.9
MB20WC0125	25/01/2022	621.5	74.9
MB20WC0125	24/01/2022	621.5	74.9
MB20WC0125	23/01/2022	621.5	74.9
MB20WC0125	22/01/2022	621.6	74.8
MB20WC0125	21/01/2022	621.6	74.8
MB20WC0125	20/01/2022	621.6	74.8
MB20WC0125	19/01/2022	621.5	74.8
MB20WC0125	18/01/2022	621.5	74.9
MB20WC0125	17/01/2022	621.5	74.9
MB20WC0125	16/01/2022	621.5	74.9
MB20WC0125	15/01/2022	621.5	74.9
MB20WC0125	14/01/2022	621.6	74.8
MB20WC0125	13/01/2022	621.6	74.8
MB20WC0125	12/01/2022	621.6	74.8
MB20WC0125	11/01/2022	621.6	74.8
MB20WC0125	10/01/2022	621.6	74.8
MB20WC0125	9/01/2022	621.6	74.8
MB20WC0125	8/01/2022	621.6	74.8
MB20WC0125	7/01/2022	621.6	74.8
MB20WC0125	6/01/2022	621.6	74.8
MB20WC0125	5/01/2022	621.6	74.8
MB20WC0125	4/01/2022	621.6	74.8
MB20WC0125	3/01/2022	621.6	74.8

ID	Date	WL mAHD	WL mbgl
MB18HD20001	30/05/2019	627.0	82.4
MB18HD20001	31/05/2019	627.0	82.4
MB18HD20001	1/06/2019	627.0	82.4
MB18HD20001	2/06/2019	627.0	82.4
MB18HD20001	3/06/2019	627.0	82.4
MB18HD20001	4/06/2019	627.0	82.4
MB18HD20001	5/06/2019	627.0	82.4
MB18HD20001	6/06/2019	627.0	82.4
MB18HD20001	7/06/2019	627.0	82.4
MB18HD20001	8/06/2019	627.0	82.4
MB18HD20001	9/06/2019	627.0	82.4
MB18HD20001	10/06/2019	627.0	82.4
MB18HD20001	11/06/2019	626.9	82.4
MB18HD20001	12/06/2019	627.0	82.4
MB18HD20001	13/06/2019	627.0	82.4
MB18HD20001	14/06/2019	627.0	82.4
MB18HD20001	15/06/2019	627.0	82.4
MB18HD20001	16/06/2019	627.0	82.4
MB18HD20001	17/06/2019	627.0	82.4
MB18HD20001	18/06/2019	627.0	82.4
MB18HD20001	19/06/2019	627.0	82.4
MB18HD20001	20/06/2019	627.0	82.4
MB18HD20001	21/06/2019	627.0	82.4
MB18HD20001	22/06/2019	627.0	82.4
MB18HD20001	23/06/2019	627.0	82.4
MB18HD20001	24/06/2019	627.0	82.4
MB18HD20001	25/06/2019	627.0	82.4
MB18HD20001	26/06/2019	627.0	82.4
MB18HD20001	27/06/2019	627.0	82.4
MB18HD20001	30/06/2019	627.0	82.4
MB18HD20001	2/07/2019	627.0	82.4
MB18HD20001	3/07/2019	627.0	82.4
MB18HD20001	4/07/2019	627.0	82.4
MB18HD20001	5/07/2019	627.0	82.4
MB18HD20001	6/07/2019	627.0	82.4
MB18HD20001	7/07/2019	627.0	82.4
MB18HD20001	8/07/2019	627.0	82.4
MB18HD20001	9/07/2019	627.0	82.4
MB18HD20001	10/07/2019	627.0	82.4
MB18HD20001	11/07/2019	627.0	82.4
MB18HD20001	12/07/2019	627.0	82.3
MB18HD20001	13/07/2019	627.0	82.3
MB18HD20001	14/07/2019	627.0	82.3
MB18HD20001	15/07/2019	627.0	82.3
MB18HD20001	17/07/2019	627.0	82.3
MB18HD20001	18/07/2019	627.0	82.4
MB18HD20001	19/07/2019	627.0	82.4
MB18HD20001	20/07/2019	627.0	82.4
MB18HD20001	21/07/2019	627.0	82.4
MB18HD20001	22/07/2019	627.0	82.4
MB18HD20001	23/07/2019	627.0	82.4
MB18HD20001	24/07/2019	627.0	82.4
MB18HD20001	25/07/2019	627.0	82.4
MB18HD20001	26/07/2019	627.0	82.4
MB18HD20001	27/07/2019	627.0	82.4
MB18HD20001	28/07/2019	627.0	82.4
MB18HD20001	29/07/2019	627.0	82.4
MB18HD20001	30/07/2019	627.0	82.4
MB18HD20001	31/07/2019	627.0	82.4
MB18HD20001	1/08/2019	627.0	82.4
MB18HD20001	2/08/2019	627.0	82.4
MB18HD20001	3/08/2019	627.0	82.3
MB18HD20001	4/08/2019	627.0	82.4
MB18HD20001	5/08/2019	627.0	82.4
MB18HD20001	6/08/2019	627.0	82.4
MB18HD20001	7/08/2019	627.0	82.4
MB18HD20001	8/08/2019	627.0	82.4
MB18HD20001	10/08/2019	627.0	82.4
MB18HD20001	11/08/2019	627.0	82.4
MB18HD20001	12/08/2019	627.0	82.4
MB18HD20001	13/08/2019	627.0	82.4
MB18HD20001	14/08/2019	627.0	82.4
MB18HD20001	15/08/2019	627.0	82.4
MB18HD20001	16/08/2019	627.0	82.4
MB18HD20001	17/08/2019	627.0	82.4
MB18HD20001	18/08/2019	627.0	82.4
MB18HD20001	19/08/2019	627.0	82.3
MB18HD20001	20/08/2019	627.0	82.3
MB18HD20001	22/08/2019	627.0	82.4
MB18HD20001	23/08/2019	627.0	82.4
MB18HD20001	24/08/2019	627.0	82.4
MB18HD20001	25/08/2019	627.0	82.4
MB18HD20001	26/08/2019	626.9	82.4
MB18HD20001	27/08/2019	627.0	82.4
MB18HD20001	28/08/2019	627.0	82.4
MB18HD20001	29/08/2019	627.0	82.4
MB18HD20001	30/08/2019	627.0	82.4
MB18HD20001	31/08/2019	627.0	82.4
MB18HD20001	1/09/2019	627.0	82.4
MB18HD20001	2/09/2019	627.0	82.4
MB18HD20001	3/09/2019	627.0	82.4
MB18HD20001	4/09/2019	626.9	82.4
MB18HD20001	5/09/2019	626.9	82.4
MB18HD20001	6/09/2019	626.9	82.4
MB18HD20001	7/09/2019	626.9	82.4
MB18HD20001	8/09/2019	627.0	82.4
MB18HD20001	9/09/2019	627.0	82.4
MB18HD20001	10/09/2019	627.0	82.4
MB18HD20001	11/09/2019	627.0	82.4
MB18HD20001	12/09/2019	627.0	82.4

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDRE2	8/01/2021	628.6	50.2
HDRE2	7/01/2021	628.6	50.2
HDRE2	6/01/2021	628.6	50.2
HDRE2	5/01/2021	628.7	50.2
HDRE2	4/01/2021	628.6	50.2
HDRE2	3/01/2021	628.6	50.2
HDRE2	2/01/2021	628.6	50.2
HDRE2	1/01/2021	628.7	50.2
HDRE2	31/12/2020	628.7	50.2
HDRE2	30/12/2020	628.7	50.2
HDRE2	29/12/2020	628.7	50.2
HDRE2	28/12/2020	628.7	50.2
HDRE2	27/12/2020	628.7	50.2
HDRE2	26/12/2020	628.7	50.2
HDRE2	25/12/2020	628.7	50.2
HDRE2	24/12/2020	628.7	50.2
HDRE2	23/12/2020	628.7	50.2
HDRE2	22/12/2020	628.7	50.2
HDRE2	21/12/2020	628.7	50.2
HDRE2	20/12/2020	628.6	50.2
HDRE2	19/12/2020	628.6	50.2
HDRE2	18/12/2020	628.7	50.2
HDRE2	17/12/2020	628.6	50.2
HDRE2	16/12/2020	628.6	50.2
HDRE2	15/12/2020	628.6	50.2
HDRE2	14/12/2020	628.6	50.2
HDRE2	13/12/2020	628.6	50.2
HDRE2	12/12/2020	628.6	50.3
HDRE2	11/12/2020	628.6	50.3
HDRE2	10/12/2020	628.6	50.2
HDRE2	9/12/2020	628.6	50.2
HDRE2	8/12/2020	628.6	50.2
HDRE2	7/12/2020	628.6	50.2
HDRE2	6/12/2020	628.6	50.2
HDRE2	5/12/2020	628.6	50.2
HDRE2	4/12/2020	628.6	50.2
HDRE2	3/12/2020	628.6	50.2
HDRE2	2/12/2020	628.6	50.3
HDRE2	1/12/2020	628.6	50.3
HDRE2	30/11/2020	628.6	50.3
HDRE2	29/11/2020	628.6	50.3
HDRE2	28/11/2020	628.6	50.3
HDRE2	27/11/2020	628.6	50.3
HDRE2	26/11/2020	628.6	50.3
HDRE2	25/11/2020	628.6	50.3
HDRE2	24/11/2020	628.6	50.3
HDRE2	23/11/2020	628.6	50.3
HDRE2	22/11/2020	628.5	50.3
HDRE2	21/11/2020	628.5	50.3
HDRE2	20/11/2020	628.5	50.3
HDRE2	19/11/2020	628.5	50.3
HDRE2	18/11/2020	628.5	50.3
HDRE2	17/11/2020	628.5	50.4
HDRE2	16/11/2020	628.5	50.3
HDRE2	15/11/2020	628.5	50.3
HDRE2	14/11/2020	628.5	50.4
HDRE2	13/11/2020	628.5	50.4
HDRE2	12/11/2020	628.5	50.4
HDRE2	11/11/2020	628.5	50.4
HDRE2	10/11/2020	628.5	50.4
HDRE2	9/11/2020	628.5	50.4
HDRE2	8/11/2020	628.5	50.4
HDRE2	7/11/2020	628.5	50.4
HDRE2	6/11/2020	628.5	50.4
HDRE2	5/11/2020	628.5	50.4
HDRE2	4/11/2020	628.5	50.4
HDRE2	3/11/2020	628.5	50.4
HDRE2	2/11/2020	628.5	50.4
HDRE2	1/11/2020	628.4	50.4
HDRE2	31/10/2020	628.4	50.4
HDRE2	30/10/2020	628.5	50.4
HDRE2	29/10/2020	628.5	50.4
HDRE2	28/10/2020	628.4	50.4
HDRE2	27/10/2020	628.4	50.4
HDRE2	26/10/2020	628.4	50.4
HDRE2	25/10/2020	628.4	50.4
HDRE2	24/10/2020	628.4	50.5
HDRE2	23/10/2020	628.4	50.5
HDRE2	22/10/2020	628.4	50.5
HDRE2	21/10/2020	628.4	50.5
HDRE2	20/10/2020	628.4	50.5
HDRE2	19/10/2020	628.4	50.5
HDRE2	18/10/2020	628.4	50.5
HDRE2	17/10/2020	628.4	50.5
HDRE2	16/10/2020	628.4	50.5
HDRE2	15/10/2020	628.4	50.5
HDRE2	14/10/2020	628.4	50.5
HDRE2	13/10/2020	628.4	50.5
HDRE2	12/10/2020	628.4	50.5
HDRE2	11/10/2020	628.4	50.5
HDRE2	10/10/2020	628.4	50.5
HDRE2	9/10/2020	628.4	50.5
HDRE2	8/10/2020	628.4	50.5
HDRE2	7/10/2020	628.4	50.5
HDRE2	6/10/2020	628.4	50.5
HDRE2	5/10/2020	628.4	50.5
HDRE2	4/10/2020	628.4	50.5
HDRE2	3/10/2020	628.4	50.5
HDRE2	2/10/2020	628.3	50.5
HDRE2	1/10/2020	628.3	50.5
HDRE2	30/09/2020	628.3	50.5
HDRE2	29/09/2020	628.4	50.5
HDRE2	28/09/2020	628.3	50.5
HDRE2	27/09/2020	628.3	50.5
HDRE2	26/09/2020	628.3	50.5
HDRE2	25/09/2020	628.3	50.5
HDRE2	24/09/2020	628.4	50.5
HDRE2	23/09/2020	628.4	50.5
HDRE2	22/09/2020	628.4	50.5
HDRE2	21/09/2020	628.4	50.5
HDRE2	20/09/2020	628.4	50.5
HDRE2	19/09/2020	628.3	50.5
HDRE2	18/09/2020	628.3	50.5
HDRE2	17/09/2020	628.4	50.5
HDRE2	16/09/2020	628.4	50.5
HDRE2	15/09/2020	628.4	50.5
HDRE2	14/09/2020	628.4	50.5
HDRE2	13/09/2020	628.4	50.5
HDRE2	12/09/2020	628.4	50.5
HDRE2	11/09/2020	628.4	50.5
HDRE2	10/09/2020	628.4	50.5
HDRE2	9/09/2020	628.4	50.5
HDRE2	8/09/2020	628.4	50.5
HDRE2	7/09/2020	628.4	50.5
HDRE2	6/09/2020	628.4	50.5
HDRE2	5/09/2020	628.4	50.5
HDRE2	4/09/2020	628.4	50.5
HDRE2	3/09/2020	628.4	50.4
HDRE2	2/09/2020	628.4	50.5
HDRE2	1/09/2020	628.4	50.5
HDRE2	31/08/2020	628.4	50.4
HDRE2	30/08/2020	628.4	50.4
HDRE2	29/08/2020	628.4	50.4
HDRE2	28/08/2020	628.4	50.4
HDRE2	27/08/2020	628.4	50.4
HDRE2	26/08/2020	628.4	50.4

ID	Date	WL mAHD	WL mbgl
HDVRP1	4/02/2021	624.5	60.0
HDVRP1	3/02/2021	624.2	60.3
HDVRP1	2/02/2021	624.5	60.0
HDVRP1	1/02/2021	624.2	60.3
HDVRP1	31/01/2021	624.3	60.2
HDVRP1	30/01/2021	624.2	60.3
HDVRP1	29/01/2021	624.3	60.3
HDVRP1	28/01/2021	624.3	60.2
HDVRP1	27/01/2021	624.2	60.3
HDVRP1	26/01/2021	624.3	60.2
HDVRP1	25/01/2021	624.2	60.3
HDVRP1	24/01/2021	624.2	60.3
HDVRP1	23/01/2021	624.3	60.2
HDVRP1	22/01/2021	624.2	60.3
HDVRP1	21/01/2021	624.2	60.3
HDVRP1	20/01/2021	624.4	60.2
HDVRP1	19/01/2021	624.3	60.3
HDVRP1	18/01/2021	624.4	60.2
HDVRP1	17/01/2021	624.3	60.2
HDVRP1	16/01/2021	624.4	60.1
HDVRP1	15/01/2021	624.3	60.2
HDVRP1	14/01/2021	624.4	60.1
HDVRP1	13/01/2021	624.3	60.2
HDVRP1	12/01/2021	624.4	60.1
HDVRP1	11/01/2021	624.4	60.1
HDVRP1	10/01/2021	624.4	60.1
HDVRP1	9/01/2021	624.4	60.1
HDVRP1	8/01/2021	624.5	60.1
HDVRP1	7/01/2021	624.6	59.9
HDVRP1	6/01/2021	624.3	60.3
HDVRP1	5/01/2021	624.3	60.2
HDVRP1	4/01/2021	624.2	60.3
HDVRP1	3/01/2021	624.3	60.2
HDVRP1	2/01/2021	624.4	60.2
HDVRP1	1/01/2021	625.0	59.5
HDVRP1	31/12/2020	624.7	59.8
HDVRP1	30/12/2020	624.6	59.9
HDVRP1	29/12/2020	625.0	59.5
HDVRP1	28/12/2020	624.4	60.1
HDVRP1	27/12/2020	624.3	60.2
HDVRP1	26/12/2020	624.4	60.1
HDVRP1	25/12/2020	624.3	60.2
HDVRP1	24/12/2020	624.4	60.1
HDVRP1	23/12/2020	624.2	60.3
HDVRP1	22/12/2020	624.4	60.1
HDVRP1	21/12/2020	624.2	60.3
HDVRP1	20/12/2020	624.3	60.2
HDVRP1	19/12/2020	624.2	60.3
HDVRP1	18/12/2020	624.3	60.2
HDVRP1	17/12/2020	624.3	60.2
HDVRP1	16/12/2020	624.3	60.2
HDVRP1	15/12/2020	624.5	60.0
HDVRP1	14/12/2020	624.3	60.2
HDVRP1	13/12/2020	624.9	59.6
HDVRP1	12/12/2020	624.3	60.2
HDVRP1	11/12/2020	624.6	59.9
HDVRP1	10/12/2020	624.2	60.3
HDVRP1	9/12/2020	624.2	60.3
HDVRP1	8/12/2020	624.3	60.2
HDVRP1	7/12/2020	624.2	60.3
HDVRP1	6/12/2020	624.2	60.3
HDVRP1	5/12/2020	624.2	60.3
HDVRP1	4/12/2020	624.3	60.2
HDVRP1	3/12/2020	624.4	60.1
HDVRP1	2/12/2020	624.3	60.2
HDVRP1	1/12/2020	624.3	60.2
HDVRP1	30/11/2020	624.3	60.2
HDVRP1	29/11/2020	624.4	60.1
HDVRP1	28/11/2020	624.3	60.3
HDVRP1	27/11/2020	624.3	60.2
HDVRP1	26/11/2020	624.4	60.1
HDVRP1	25/11/2020	624.3	60.3
HDVRP1	24/11/2020	624.4	60.1
HDVRP1	23/11/2020	624.3	60.3
HDVRP1	22/11/2020	624.4	60.2
HDVRP1	21/11/2020	624.2	60.3
HDVRP1	20/11/2020	624.3	60.2
HDVRP1	19/11/2020	624.7	59.8
HDVRP1	18/11/2020	624.3	60.2
HDVRP1	17/11/2020	624.4	60.1
HDVRP1	16/11/2020	624.3	60.2
HDVRP1	15/11/2020	624.3	60.2
HDVRP1	14/11/2020	624.4	60.1
HDVRP1	13/11/2020	624.3	60.2
HDVRP1	12/11/2020	624.3	60.2
HDVRP1	11/11/2020	624.4	60.1
HDVRP1	10/11/2020	624.2	60.3
HDVRP1	9/11/2020	624.2	60.3
HDVRP1	8/11/2020	624.4	60.2
HDVRP1	7/11/2020	624.2	60.3
HDVRP1	6/11/2020	624.3	60.2
HDVRP1	5/11/2020	624.4	60.2
HDVRP1	4/11/2020	624.7	59.9
HDVRP1	3/11/2020	624.3	60.2
HDVRP1	2/11/2020	624.5	60.1
HDVRP1	1/11/2020	624.4	60.1
HDVRP1	31/10/2020	624.3	60.2
HDVRP1	30/10/2020	624.3	60.2
HDVRP1	29/10/2020	624.3	60.2
HDVRP1	28/10/2020	624.3	60.2
HDVRP1	27/10/2020	624.2	60.3
HDVRP1	26/10/2020	624.3	60.3
HDVRP1	25/10/2020	624.4	60.1
HDVRP1	24/10/2020	624.5	60.0
HDVRP1	23/10/2020	624.2	60.3
HDVRP1	22/10/2020	624.2	60.3
HDVRP1	21/10/2020	624.2	60.3
HDVRP1	20/10/2020	624.3	60.2
HDVRP1	19/10/2020	624.3	60.2
HDVRP1	18/10/2020	624.3	60.2
HDVRP1	17/10/2020	624.3	60.2
HDVRP1	16/10/2020	624.3	60.2
HDVRP1	15/10/2020	624.4	60.2
HDVRP1	14/10/2020	624.7	59.8
HDVRP1	13/10/2020	624.8	59.7
HDVRP1	12/10/2020	624.6	59.9
HDVRP1	11/10/2020	624.6	59.9
HDVRP1	10/10/2020	624.6	59.9
HDVRP1	9/10/2020	624.6	59.9
HDVRP1	8/10/2020	624.6	59.9
HDVRP1	7/10/2020	624.6	59.9
HDVRP1	6/10/2020	624.7	59.8
HDVRP1	5/10/2020	624.7	59.8
HDVRP1	4/10/2020	624.7	59.8
HDVRP1	3/10/2020	624.7	59.8
HDVRP1	2/10/2020	624.7	59.9
HDVRP1	1/10/2020	624.8	59.7
HDVRP1	30/09/2020	624.7	59.8
HDVRP1	29/09/2020	624.6	59.9
HDVRP1	28/09/2020	624.7	59.8
HDVRP1	27/09/2020	624.6	59.9
HDVRP1	26/09/2020	624.6	59.9
HDVRP1	25/09/2020	624.6	59.9
HDVRP1	24/09/2020	624.6	59.9
HDVRP1	23/09/2020	624.6	59.9
HDVRP1	22/09/2020	624.7	59.9

ID	Date	WL mAHD	WL mbgl
MB20WC0125	2/01/2022	621.6	74.8
MB20WC0125	1/01/2022	621.6	74.8
MB20WC0125	31/12/2021	621.6	74.8
MB20WC0125	30/12/2021	621.6	74.8
MB20WC0125	29/12/2021	621.6	74.8
MB20WC0125	28/12/2021	621.6	74.8
MB20WC0125	27/12/2021	621.6	74.8
MB20WC0125	26/12/2021	621.6	74.8
MB20WC0125	25/12/2021	621.6	74.8
MB20WC0125	24/12/2021	621.6	74.8
MB20WC0125	23/12/2021	621.6	74.8
MB20WC0125	22/12/2021	621.6	74.8
MB20WC0125	21/12/2021	621.6	74.8
MB20WC0125	20/12/2021	621.6	74.8
MB20WC0125	19/12/2021	621.6	74.8
MB20WC0125	18/12/2021	621.6	74.8
MB20WC0125	17/12/2021	621.6	74.8
MB20WC0125	16/12/2021	621.6	74.8
MB20WC0125	15/12/2021	621.6	74.8
MB20WC0125	14/12/2021	621.6	74.8
MB20WC0125	13/12/2021	621.6	74.8
MB20WC0125	12/12/2021	621.6	74.8
MB20WC0125	11/12/2021	621.6	74.8
MB20WC0125	10/12/2021	621.6	74.8
MB20WC0125	9/12/2021	621.6	74.8
MB20WC0125	8/12/2021	621.6	74.8
MB20WC0125	7/12/2021	621.6	74.8
MB20WC0125	6/12/2021	621.6	74.8
MB20WC0125	5/12/2021	621.6	74.8
MB20WC0125	4/12/2021	621.6	74.8
MB20WC0125	3/12/2021	621.6	74.8
MB20WC0125	2/12/2021	621.6	74.8
MB20WC0125	1/12/2021	621.6	74.8
MB20WC0125	30/11/2021	621.6	74.7
MB20WC0125	28/11/2021	621.7	74.7
MB20WC0125	14/11/2021	621.7	74.7
MB20WC0125	22/05/2021	621.8	74.6
MB20WC0125	12/11/2020	621.7	74.7
MB20WN0129	2/03/2022	623.2	27.9
MB20WN0129	1/03/2022	623.2	27.9
MB20WN0129	28/02/2022	623.1	28.0
MB20WN0129	27/02/2022	623.1	28.0
MB20WN0129	26/02/2022	623.1	28.0
MB20WN0129	25/02/2022	623.1	28.0
MB20WN0129	24/02/2022	623.1	28.0
MB20WN0129	23/02/2022	623.1	28.0
MB20WN0129	22/02/2022	623.1	28.0
MB20WN0129	21/02/2022	623.0	28.1
MB20WN0129	20/02/2022	620.6	30.5
MB20WN0129	19/02/2022	623.3	27.8
MB20WN0129	18/02/2022	623.4	27.7
MB20WN0129	17/02/2022	623.4	27.7
MB20WN0129	16/02/2022	623.4	27.7
MB20WN0129	15/02/2022	623.4	27.7
MB20WN0129	14/02/2022	623.4	27.7
MB20WN0129	13/02/2022	623.3	27.8
MB20WN0129	12/02/2022	623.3	27.8
MB20WN0129	11/02/2022	623.2	27.9
MB20WN0129	10/02/2022	623.2	27.9
MB20WN0129	9/02/2022	623.2	27.9
MB20WN0129	8/02/2022	623.1	28.0
MB20WN0129	7/02/2022	623.1	28.0
MB20WN0129	6/02/2022	623.1	28.0
MB20WN0129	5/02/2022	623.1	28.0
MB20WN0129	4/02/2022	623.1	28.0
MB20WN0129	3/02/2022	623.1	28.0
MB20WN0129	2/02/2022	623.1	28.0
MB20WN0129	1/02/2022	623.1	28.0
MB20WN0129	31/01/2022	623.1	28.0
MB20WN0129	30/01/2022	623.2	27.9
MB20WN0129	29/01/2022	623.2	27.9
MB20WN0129	28/01/2022	623.2	27.9
MB20WN0129	27/01/2022	623.1	28.0
MB20WN0129	26/01/2022	623.1	28.0
MB20WN0129	25/01/2022	623.1	28.0
MB20WN0129	24/01/2022	623.2	27.9
MB20WN0129	23/01/2022	623.2	27.9
MB20WN0129	22/01/2022	623.2	27.9
MB20WN0129	21/01/2022	623.2	27.9
MB20WN0129	20/01/2022	623.2	27.9
MB20WN0129	19/01/2022	623.2	27.9
MB20WN0129	18/01/2022	623.2	27.9
MB20WN0129	17/01/2022	623.2	27.9
MB20WN0129	16/01/2022	623.1	28.0
MB20WN0129	15/01/2022	623.2	27.9
MB20WN0129	14/01/2022	623.2	27.9
MB20WN0129	13/01/2022	623.2	27.9
MB20WN0129	12/01/2022	623.2	27.9
MB20WN0129	11/01/2022	623.2	27.9
MB20WN0129	10/01/2022	623.2	27.9
MB20WN0129	9/01/2022	623.2	27.9
MB20WN0129	8/01/2022	623.2	27.9
MB20WN0129	7/01/2022	623.2	27.9
MB20WN0129	6/01/2022	623.2	27.9
MB20WN0129	5/01/2022	623.2	27.9
MB20WN0129	4/01/2022	623.2	27.9
MB20WN0129	3/01/2022	623.2	27.9
MB20WN0129	2/01/2022	623.2	27.9
MB20WN0129	1/01/2022	623.2	27.9
MB20WN0129	31/12/2021	623.2	27.9
MB20WN0129	30/12/2021	623.2	27.9
MB20WN0129	29/12/2021	623.2	27.9
MB20WN0129	28/12/2021	623.2	27.9
MB20WN0129	27/12/2021	623.2	27.9
MB20WN0129	26/12/2021	623.2	27.9
MB20WN0129	25/12/2021	623.2	27.9
MB20WN0129	24/12/2021	623.2	27.9
MB20WN0129	23/12/2021	623.3	27.8
MB20WN0129	22/12/2021	623.3	27.8
MB20WN0129	21/12/2021	623.3	27.8
MB20WN0129	20/12/2021	623.3	27.8
MB20WN0129	19/12/2021	623.3	27.8
MB20WN0129	18/12/2021	623.3	27.8
MB20WN0129	17/12/2021	623.3	27.8
MB20WN0129	16/12/2021	623.3	27.8
MB20WN0129	15/12/2021	623.3	27.8
MB20WN0129	14/12/2021	623.3	27.8
MB20WN0129	13/12/2021	623.3	27.8
MB20WN0129	12/12/2021	623.3	27.8
MB20WN0129	11/12/2021	623.3	27.8
MB20WN0129	10/12/2021	623.4	27.7
MB20WN0129	9/12/2021	623.4	27.7
MB20WN0129	8/12/2021	623.4	27.7
MB20WN0129	7/12/2021	623.4	27.7
MB20WN0129	6/12/2021	623.4	27.7
MB20WN0129	5/12/2021	623.4	27.7
MB20WN0129	4/12/2021	623.4	27.7
MB20WN0129	3/12/2021	623.4	27.7
MB20WN0129	2/12/2021	623.5	27.6
MB20WN0129	1/12/2021	623.5	27.6
MB20WN0129	30/11/2021	623.5	27.6
MB20WN0129	29/11/2021	623.5	27.6
MB20WN0129	28/11/2021	623.5	27.6
MB20WN0129	27/11/2021	623.5	27.6
MB20WN0129	26/11/2021	623.5	27.6
MB20WN0129	25/11/2021	623.5	27.6

ID	Date	WL mAHD	WL mbgl
MB18HD20001	19/10/2019	626.9	82.4
MB18HD20001	20/10/2019	626.9	82.4
MB18HD20001	21/10/2019	626.9	82.4
MB18HD20001	22/10/2019	627.0	82.4
MB18HD20001	23/10/2019	626.9	82.4
MB18HD20001	24/10/2019	626.9	82.4
MB18HD20001	25/10/2019	626.9	82.4
MB18HD20001	26/10/2019	626.9	82.4
MB18HD20001	27/10/2019	626.9	82.4
MB18HD20001	28/10/2019	626.9	82.4
MB18HD20001	29/10/2019	626.9	82.4
MB18HD20001	30/10/2019	626.9	82.4
MB18HD20001	31/10/2019	626.9	82.5
MB18HD20001	1/11/2019	626.9	82.5
MB18HD20001	2/11/2019	626.9	82.5
MB18HD20001	3/11/2019	626.9	82.4
MB18HD20001	4/11/2019	627.0	82.4
MB18HD20001	5/11/2019	627.0	82.4
MB18HD20001	6/11/2019	626.9	82.4
MB18HD20001	7/11/2019	626.9	82.4
MB18HD20001	8/11/2019	626.9	82.4
MB18HD20001	9/11/2019	626.9	82.4
MB18HD20001	10/11/2019	626.9	82.4
MB18HD20001	11/11/2019	626.9	82.5
MB18HD20001	12/11/2019	626.9	82.5
MB18HD20001	13/11/2019	626.9	82.4
MB18HD20001	14/11/2019	626.9	82.4
MB18HD20001	15/11/2019	626.9	82.4
MB18HD20001	16/11/2019	626.9	82.4
MB18HD20001	17/11/2019	626.9	82.4
MB18HD20001	18/11/2019	626.9	82.4
MB18HD20001	19/11/2019	626.9	82.5
MB18HD20001	20/11/2019	626.9	82.5
MB18HD20001	21/11/2019	626.9	82.5
MB18HD20001	22/11/2019	626.9	82.5
MB18HD20001	23/11/2019	626.9	82.5
MB18HD20001	24/11/2019	626.9	82.5
MB18HD20001	25/11/2019	626.9	82.5
MB18HD20001	26/11/2019	626.9	82.5
MB18HD20001	27/11/2019	626.9	82.5
MB18HD20001	28/11/2019	626.9	82.5
MB18HD20001	29/11/2019	626.9	82.5
MB18HD20001	30/11/2019	626.9	82.5
MB18HD20001	1/12/2019	626.9	82.4
MB18HD20001	2/12/2019	626.9	82.4
MB18HD20001	3/12/2019	626.9	82.4
MB18HD20001	4/12/2019	626.9	82.5
MB18HD20001	5/12/2019	626.9	82.5
MB18HD20001	6/12/2019	626.9	82.5
MB18HD20001	7/12/2019	626.9	82.5
MB18HD20001	8/12/2019	626.9	82.5
MB18HD20001	9/12/2019	626.9	82.5
MB18HD20001	10/12/2019	626.9	82.5
MB18HD20001	11/12/2019	626.9	82.5
MB18HD20001	12/12/2019	626.9	82.5
MB18HD20001	13/12/2019	626.9	82.4
MB18HD20001	14/12/2019	626.9	82.5
MB18HD20001	15/12/2019	626.9	82.5
MB18HD20001	16/12/2019	626.9	82.5
MB18HD20001	17/12/2019	626.9	82.5
MB18HD20001	18/12/2019	626.9	82.5
MB18HD20001	19/12/2019	626.9	82.5
MB18HD20001	20/12/2019	626.9	82.5
MB18HD20001	21/12/2019	626.9	82.5
MB18HD20001	22/12/2019	626.9	82.5
MB18HD20001	23/12/2019	626.9	82.5
MB18HD20001	24/12/2019	626.9	82.5
MB18HD20001	25/12/2019	626.9	82.5
MB18HD20001	26/12/2019	626.9	82.5
MB18HD20001	27/12/2019	626.9	82.5
MB18HD20001	28/12/2019	626.9	82.5
MB18HD20001	29/12/2019	626.9	82.5
MB18HD20001	30/12/2019	626.9	82.5
MB18HD20001	31/12/2019	626.9	82.5
MB18HD20001	1/01/2020	626.9	82.5
MB18HD20001	2/01/2020	626.9	82.5
MB18HD20001	3/01/2020	626.9	82.5
MB18HD20001	4/01/2020	626.9	82.5
MB18HD20001	5/01/2020	626.9	82.5
MB18HD20001	6/01/2020	626.9	82.5
MB18HD20001	7/01/2020	626.9	82.5
MB18HD20001	8/01/2020	626.9	82.5
MB18HD20001	9/01/2020	626.8	82.5
MB18HD20001	10/01/2020	626.9	82.5
MB18HD20001	11/01/2020	626.9	82.5
MB18HD20001	12/01/2020	626.9	82.4
MB18HD20001	13/01/2020	626.9	82.5
MB18HD20001	14/01/2020	626.9	82.4
MB18HD20001	15/01/2020	626.9	82.4
MB18HD20001	16/01/2020	627.0	82.4
MB18HD20001	17/01/2020	626.9	82.4
MB18HD20001	18/01/2020	626.9	82.4
MB18HD20001	19/01/2020	626.9	82.4
MB18HD20001	20/01/2020	627.0	82.4
MB18HD20001	21/01/2020	627.0	82.4
MB18HD20001	22/01/2020	627.0	82.4
MB18HD20001	23/01/2020	627.0	82.4
MB18HD20001	24/01/2020	627.0	82.4
MB18HD20001	25/01/2020	627.0	82.4
MB18HD20001	26/01/2020	627.0	82.4

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDRE2	25/08/2020	628.4	50.4
HDRE2	24/08/2020	628.4	50.4
HDRE2	23/08/2020	628.4	50.4
HDRE2	22/08/2020	628.4	50.4
HDRE2	21/08/2020	628.4	50.4
HDRE2	20/08/2020	628.4	50.4
HDRE2	19/08/2020	628.4	50.5
HDRE2	18/08/2020	628.4	50.5
HDRE2	17/08/2020	628.4	50.5
HDRE2	16/08/2020	628.4	50.5
HDRE2	15/08/2020	628.4	50.5
HDRE2	14/08/2020	628.4	50.5
HDRE2	13/08/2020	628.4	50.5
HDRE2	12/08/2020	628.4	50.5
HDRE2	11/08/2020	628.4	50.5
HDRE2	10/08/2020	628.4	50.5
HDRE2	9/08/2020	628.3	50.5
HDRE2	8/08/2020	628.4	50.5
HDRE2	7/08/2020	628.4	50.5
HDRE2	6/08/2020	628.4	50.5
HDRE2	5/08/2020	628.3	50.5
HDRE2	4/08/2020	628.3	50.5
HDRE2	3/08/2020	628.3	50.5
HDRE2	2/08/2020	628.3	50.5
HDRE2	1/08/2020	628.4	50.5
HDRE2	31/07/2020	628.4	50.5
HDRE2	30/07/2020	628.4	50.5
HDRE2	29/07/2020	628.4	50.5
HDRE2	28/07/2020	628.3	50.5
HDRE2	27/07/2020	628.3	50.5
HDRE2	26/07/2020	628.4	50.5
HDRE2	25/07/2020	628.4	50.5
HDRE2	24/07/2020	628.3	50.5
HDRE2	23/07/2020	628.3	50.5
HDRE2	22/07/2020	628.3	50.5
HDRE2	21/07/2020	628.3	50.6
HDRE2	20/07/2020	628.3	50.6
HDRE2	19/07/2020	628.3	50.6
HDRE2	18/07/2020	628.3	50.6
HDRE2	17/07/2020	628.3	50.6
HDRE2	16/07/2020	628.3	50.6
HDRE2	15/07/2020	628.3	50.6
HDRE2	14/07/2020	628.3	50.6
HDRE2	13/07/2020	628.3	50.6
HDRE2	12/07/2020	628.3	50.6
HDRE2	11/07/2020	628.3	50.5
HDRE2	10/07/2020	628.3	50.5
HDRE2	9/07/2020	628.3	50.6
HDRE2	8/07/2020	628.3	50.5
HDRE2	7/07/2020	628.3	50.5
HDRE2	6/07/2020	628.3	50.5
HDRE2	5/07/2020	628.3	50.5
HDRE2	4/07/2020	628.3	50.5
HDRE2	3/07/2020	628.3	50.5
HDRE2	2/07/2020	628.3	50.5
HDRE2	1/07/2020	628.3	50.6
HDRE2	30/06/2020	628.3	50.6
HDRE2	29/06/2020	628.3	50.6
HDRE2	28/06/2020	628.3	50.6
HDRE2	27/06/2020	628.3	50.6
HDRE2	26/06/2020	628.3	50.6
HDRE2	25/06/2020	628.3	50.5
HDRE2	24/06/2020	628.3	50.5
HDRE2	23/06/2020	628.3	50.5
HDRE2	22/06/2020	628.3	50.5
HDRE2	21/06/2020	628.3	50.5
HDRE2	20/06/2020	628.3	50.5
HDRE2	19/06/2020	628.3	50.5
HDRE2	18/06/2020	628.3	50.5
HDRE2	17/06/2020	628.3	50.5
HDRE2	16/06/2020	628.3	50.5
HDRE2	15/06/2020	628.4	50.5
HDRE2	14/06/2020	628.4	50.5
HDRE2	13/06/2020	628.3	50.5
HDRE2	12/06/2020	628.3	50.5
HDRE2	11/06/2020	628.3	50.5
HDRE2	10/06/2020	628.4	50.5
HDRE2	9/06/2020	628.4	50.5
HDRE2	8/06/2020	628.3	50.5
HDRE2	7/06/2020	628.3	50.5
HDRE2	6/06/2020	628.4	50.5
HDRE2	5/06/2020	628.4	50.5
HDRE2	4/06/2020	628.4	50.5
HDRE2	3/06/2020	628.4	50.5
HDRE2	2/06/2020	628.4	50.5
HDRE2	1/06/2020	628.4	50.5
HDRE2	31/05/2020	628.4	50.5
HDRE2	30/05/2020	628.4	50.5
HDRE2	29/05/2020	628.4	50.5
HDRE2	28/05/2020	628.4	50.5
HDRE2	27/05/2020	628.4	50.5
HDRE2	26/05/2020	628.4	50.5
HDRE2	25/05/2020	628.3	50.5
HDRE2	24/05/2020	628.3	50.5
HDRE2	23/05/2020	628.4	50.5
HDRE2	22/05/2020	628.4	50.5
HDRE2	21/05/2020	628.4	50.5
HDRE2	20/05/2020	628.4	50.5
HDRE2	19/05/2020	628.4	50.5
HDRE2	18/05/2020	628.4	50.5
HDRE2	17/05/2020	628.4	50.5
HDRE2	16/05/2020	628.4	50.5
HDRE2	15/05/2020	628.4	50.5
HDRE2	14/05/2020	628.4	50.5
HDRE2	13/05/2020	628.4	50.5
HDRE2	12/05/2020	628.4	50.5
HDRE2	11/05/2020	628.4	50.5
HDRE2	10/05/2020	628.4	50.4
HDRE2	9/05/2020	628.4	50.4
HDRE2	8/05/2020	628.4	50.5
HDRE2	7/05/2020	628.4	50.5
HDRE2	6/05/2020	628.4	50.4
HDRE2	5/05/2020	628.4	50.4
HDRE2	4/05/2020	628.4	50.4
HDRE2	3/05/2020	628.5	50.4
HDRE2	2/05/2020	628.5	50.4
HDRE2	1/05/2020	628.5	50.4
HDRE2	30/04/2020	628.5	50.3
HDRE2	29/04/2020	628.6	50.3
HDRE2	28/04/2020	628.6	50.3
HDRE2	27/04/2020	628.6	50.3
HDRE2	26/04/2020	628.6	50.2
HDRE2	25/04/2020	628.7	50.2
HDRE2	24/04/2020	628.7	50.2
HDRE2	23/04/2020	628.7	50.2
HDRE2	22/04/2020	628.7	50.2
HDRE2	21/04/2020	628.7	50.2
HDRE2	20/04/2020	628.7	50.2
HDRE2	19/04/2020	628.7	50.2
HDRE2	18/04/2020	628.7	50.2
HDRE2	17/04/2020	628.7	50.1
HDRE2	16/04/2020	628.7	50.2
HDRE2	15/04/2020	628.7	50.2
HDRE2	14/04/2020	628.7	50.2
HDRE2	13/04/2020	628.7	50.2
HDRE2	12/04/2020	628.7	50.2

ID	Date	WL mAHD	WL mbgl
HDVRP1	21/09/2020	624.7	59.8
HDVRP1	20/09/2020	624.7	59.8
HDVRP1	19/09/2020	624.7	59.8
HDVRP1	18/09/2020	624.7	59.8
HDVRP1	17/09/2020	624.7	59.8
HDVRP1	16/09/2020	624.7	59.8
HDVRP1	15/09/2020	624.8	59.7
HDVRP1	14/09/2020	624.8	59.7
HDVRP1	13/09/2020	624.7	59.8
HDVRP1	12/09/2020	624.9	59.6
HDVRP1	11/09/2020	625.0	59.5
HDVRP1	10/09/2020	624.9	59.6
HDVRP1	9/09/2020	624.8	59.7
HDVRP1	8/09/2020	624.6	59.9
HDVRP1	7/09/2020	624.6	59.9
HDVRP1	6/09/2020	624.7	59.8
HDVRP1	5/09/2020	624.6	59.9
HDVRP1	4/09/2020	624.6	59.9
HDVRP1	3/09/2020	624.6	59.9
HDVRP1	2/09/2020	624.6	59.9
HDVRP1	1/09/2020	624.6	59.9
HDVRP1	31/08/2020	624.6	59.9
HDVRP1	30/08/2020	624.6	59.9
HDVRP1	29/08/2020	624.6	59.9
HDVRP1	28/08/2020	624.6	59.9
HDVRP1	27/08/2020	624.6	59.9
HDVRP1	26/08/2020	624.6	59.9
HDVRP1	25/08/2020	624.6	59.9
HDVRP1	24/08/2020	624.6	59.9
HDVRP1	23/08/2020	624.6	59.9
HDVRP1	22/08/2020	624.6	59.9
HDVRP1	21/08/2020	624.7	59.9
HDVRP1	20/08/2020	624.6	59.9
HDVRP1	19/08/2020	624.6	59.9
HDVRP1	18/08/2020	624.6	59.9
HDVRP1	17/08/2020	624.6	59.9
HDVRP1	16/08/2020	624.6	59.9
HDVRP1	15/08/2020	624.6	59.9
HDVRP1	14/08/2020	624.6	59.9
HDVRP1	13/08/2020	624.6	60.0
HDVRP1	12/08/2020	624.6	60.0
HDVRP1	11/08/2020	624.6	60.0
HDVRP1	10/08/2020	624.6	60.0
HDVRP1	9/08/2020	624.6	59.9
HDVRP1	8/08/2020	624.6	59.9
HDVRP1	7/08/2020	624.6	59.9
HDVRP1	6/08/2020	624.6	59.9
HDVRP1	5/08/2020	624.6	59.9
HDVRP1	4/08/2020	624.6	59.9
HDVRP1	3/08/2020	624.6	59.9
HDVRP1	2/08/2020	624.6	59.9
HDVRP1	1/08/2020	624.6	59.9
HDVRP1	31/07/2020	624.6	59.9
HDVRP1	30/07/2020	624.6	59.9
HDVRP1	29/07/2020	624.6	59.9
HDVRP1	28/07/2020	624.6	59.9
HDVRP1	27/07/2020	624.6	59.9
HDVRP1	26/07/2020	624.6	59.9
HDVRP1	25/07/2020	624.6	59.9
HDVRP1	24/07/2020	624.6	59.9
HDVRP1	23/07/2020	624.6	59.9
HDVRP1	22/07/2020	624.6	59.9
HDVRP1	21/07/2020	624.6	59.9
HDVRP1	20/07/2020	624.6	59.9
HDVRP1	19/07/2020	624.6	59.9
HDVRP1	18/07/2020	624.6	59.9
HDVRP1	17/07/2020	624.6	59.9
HDVRP1	16/07/2020	624.6	59.9
HDVRP1	15/07/2020	624.6	59.9
HDVRP1	14/07/2020	624.6	59.9
HDVRP1	13/07/2020	624.6	59.9
HDVRP1	12/07/2020	624.6	59.9
HDVRP1	11/07/2020	624.6	59.9
HDVRP1	10/07/2020	624.6	59.9
HDVRP1	9/07/2020	624.6	59.9
HDVRP1	8/07/2020	624.6	59.9
HDVRP1	7/07/2020	624.7	59.9
HDVRP1	6/07/2020	624.7	59.8
HDVRP1	5/07/2020	624.7	59.8
HDVRP1	4/07/2020	624.7	59.8
HDVRP1	3/07/2020	624.7	59.9
HDVRP1	2/07/2020	624.6	59.9
HDVRP1	1/07/2020	624.6	59.9
HDVRP1	30/06/2020	624.6	59.9
HDVRP1	29/06/2020	624.6	59.9
HDVRP1	28/06/2020	624.6	59.9
HDVRP1	27/06/2020	624.6	59.9
HDVRP1	26/06/2020	624.6	59.9
HDVRP1	25/06/2020	624.6	59.9
HDVRP1	24/06/2020	624.6	59.9
HDVRP1	23/06/2020	624.6	59.9
HDVRP1	22/06/2020	624.6	59.9
HDVRP1	21/06/2020	624.7	59.9
HDVRP1	20/06/2020	624.7	59.8
HDVRP1	19/06/2020	624.7	59.9
HDVRP1	18/06/2020	624.6	59.9
HDVRP1	17/06/2020	624.6	59.9
HDVRP1	16/06/2020	624.6	59.9
HDVRP1	15/06/2020	624.6	59.9
HDVRP1	14/06/2020	624.6	59.9
HDVRP1	13/06/2020	624.6	59.9
HDVRP1	12/06/2020	624.6	59.9
HDVRP1	11/06/2020	624.6	59.9
HDVRP1	10/06/2020	624.6	59.9
HDVRP1	9/06/2020	624.6	59.9
HDVRP1	8/06/2020	624.6	59.9
HDVRP1	7/06/2020	624.7	59.9
HDVRP1	6/06/2020	624.7	59.8
HDVRP1	5/06/2020	624.7	59.8
HDVRP1	4/06/2020	624.7	59.8
HDVRP1	3/06/2020	624.7	59.9
HDVRP1	2/06/2020	624.6	59.9
HDVRP1	1/06/2020	624.6	59.9
HDVRP1	31/05/2020	624.6	59.9
HDVRP1	30/05/2020	624.6	59.9
HDVRP1	29/05/2020	624.6	59.9
HDVRP1	28/05/2020	624.6	59.9
HDVRP1	27/05/2020	624.6	59.9
HDVRP1	26/05/2020	624.6	59.9
HDVRP1	25/05/2020	624.6	59.9
HDVRP1	24/05/2020	624.6	59.9
HDVRP1	23/05/2020	624.7	59.9
HDVRP1	22/05/2020	624.7	59.9
HDVRP1	21/05/2020	624.7	59.9
HDVRP1	20/05/2020	624.7	59.9
HDVRP1	19/05/2020	624.6	59.9
HDVRP1	18/05/2020	624.6	59.9
HDVRP1	17/05/2020	624.6	59.9
HDVRP1	16/05/2020	624.7	59.8
HDVRP1	15/05/2020	624.8	59.7
HDVRP1	14/05/2020	624.7	59.8
HDVRP1	13/05/2020	624.6	59.9
HDVRP1	12/05/2020	624.6	59.9
HDVRP1	11/05/2020	624.6	59.9
HDVRP1	10/05/2020	624.7	59.9
HDVRP1	9/05/2020	624.7	59.9

ID	Date	WL mAHD	WL mbgl
MB20WN0129	24/11/2021	623.5	27.6
MB20WN0129	23/11/2021	623.5	27.6
MB20WN0129	22/11/2021	623.5	27.6
MB20WN0129	21/11/2021	623.5	27.6
MB20WN0129	20/11/2021	623.5	27.6
MB20WN0129	19/11/2021	623.5	27.6
MB20WN0129	18/11/2021	623.5	27.6
MB20WN0129	17/11/2021	623.5	27.6
MB20WN0129	16/11/2021	623.5	27.6
MB20WN0129	15/11/2021	623.5	27.6
MB20WN0129	14/11/2021	623.5	27.6
MB20WN0129	13/11/2021	623.6	27.5
MB20WN0129	12/11/2021	623.5	27.6
MB20WN0129	11/11/2021	623.5	27.6
MB20WN0129	10/11/2021	623.5	27.6
MB20WN0129	9/11/2021	623.5	27.6
MB20WN0129	8/11/2021	623.5	27.6
MB20WN0129	7/11/2021	623.5	27.6
MB20WN0129	6/11/2021	623.6	27.5
MB20WN0129	5/11/2021	623.6	27.5
MB20WN0129	4/11/2021	623.6	27.5
MB20WN0129	3/11/2021	623.6	27.5
MB20WN0129	2/11/2021	623.6	27.5
MB20WN0129	1/11/2021	623.6	27.5
MB20WN0129	31/10/2021	623.6	27.5
MB20WN0129	30/10/2021	623.6	27.5
MB20WN0129	29/10/2021	623.6	27.5
MB20WN0129	28/10/2021	623.6	27.5
MB20WN0129	26/10/2021	623.6	27.5
MB20WN0129	25/10/2021	623.6	27.5
MB20WN0129	24/10/2021	623.7	27.4
MB20WN0129	23/10/2021	623.7	27.4
MB20WN0129	22/10/2021	623.7	27.4
MB20WN0129	21/10/2021	623.7	27.4
MB20WN0129	20/10/2021	623.7	27.4
MB20WN0129	19/10/2021	623.7	27.4
MB20WN0129	18/10/2021	623.7	27.4
MB20WN0129	17/10/2021	623.7	27.4
MB20WN0129	16/10/2021	623.7	27.4
MB20WN0129	15/10/2021	623.7	27.4
MB20WN0129	14/10/2021	623.7	27.4
MB20WN0129	13/10/2021	623.7	27.4
MB20WN0129	12/10/2021	623.7	27.4
MB20WN0129	11/10/2021	623.7	27.4
MB20WN0129	10/10/2021	623.7	27.4
MB20WN0129	9/10/2021	623.7	27.4
MB20WN0129	8/10/2021	623.7	27.4
MB20WN0129	7/10/2021	623.8	27.3
MB20WN0129	6/10/2021	623.8	27.3
MB20WN0129	5/10/2021	623.8	27.3
MB20WN0129	4/10/2021	623.8	27.3
MB20WN0129	3/10/2021	623.8	27.3
MB20WN0129	2/10/2021	623.8	27.3
MB20WN0129	1/10/2021	623.8	27.3
MB20WN0129	30/09/2021	623.8	27.3
MB20WN0129	29/09/2021	623.8	27.3
MB20WN0129	28/09/2021	623.8	27.3
MB20WN0129	27/09/2021	623.8	27.3
MB20WN0129	26/09/2021	623.8	27.3
MB20WN0129	25/09/2021	623.8	27.3
MB20WN0129	24/09/2021	623.9	27.2
MB20WN0129	23/09/2021	623.9	27.2
MB20WN0129	22/09/2021	623.9	27.2
MB20WN0129	21/09/2021	623.9	27.2
MB20WN0129	20/09/2021	623.9	27.2
MB20WN0129	19/09/2021	623.9	27.2
MB20WN0129	18/09/2021	623.9	27.2
MB20WN0129	17/09/2021	623.9	27.2
MB20WN0129	16/09/2021	623.9	27.2
MB20WN0129	15/09/2021	623.9	27.2
MB20WN0129	14/09/2021	623.9	27.2
MB20WN0129	13/09/2021	623.9	27.2
MB20WN0129	12/09/2021	623.9	27.2
MB20WN0129	11/09/2021	624.0	27.1
MB20WN0129	10/09/2021	624.0	27.1
MB20WN0129	9/09/2021	624.0	27.1
MB20WN0129	8/09/2021	624.0	27.1
MB20WN0129	7/09/2021	624.0	27.1
MB20WN0129	6/09/2021	624.0	27.1
MB20WN0129	5/09/2021	624.0	27.1
MB20WN0129	4/09/2021	624.0	27.1
MB20WN0129	3/09/2021	624.0	27.1
MB20WN0129	2/09/2021	624.0	27.1
MB20WN0129	1/09/2021	624.0	27.1
MB20WN0129	31/08/2021	624.0	27.1
MB20WN0129	30/08/2021	624.0	27.1
MB20WN0129	29/08/2021	624.0	27.1
MB20WN0129	28/08/2021	624.0	27.1
MB20WN0129	27/08/2021	624.0	27.1
MB20WN0129	26/08/2021	624.0	27.1
MB20WN0129	25/08/2021	624.0	27.1
MB20WN0129	24/08/2021	624.1	27.0
MB20WN0129	23/08/2021	624.1	27.0
MB20WN0129	22/08/2021	624.1	27.0
MB20WN0129	21/08/2021	624.1	27.0
MB20WN0129	20/08/2021	624.1	27.0
MB20WN0129	19/08/2021	624.1	27.0
MB20WN0129	16/08/2021	624.1	27.0
MB20WN0129	15/08/2021	624.1	27.0
MB20WN0129	14/08/2021	624.1	27.0
MB20WN0129	13/08/2021	624.2	26.9
MB20WN0129	12/08/2021	624.2	26.9
MB20WN0129	11/08/2021	624.2	26.9
MB20WN0129	10/08/2021	624.2	26.9
MB20WN0129	9/08/2021	624.2	26.9
MB20WN0129	8/08/2021	624.2	26.9
MB20WN0129	7/08/2021	624.2	26.9
MB20WN0129	6/08/2021	624.2	26.9
MB20WN0129	5/08/2021	624.2	26.9
MB20WN0129	4/08/2021	624.2	26.9
MB20WN0129	3/08/2021	624.2	26.9
MB20WN0129	2/08/2021	624.2	26.9
MB20WN0129	1/08/2021	624.2	26.9
MB20WN0129	31/07/2021	624.2	26.9
MB20WN0129	30/07/2021	624.2	26.9
MB20WN0129	29/07/2021	624.2	26.9
MB20WN0129	28/07/2021	624.2	26.9
MB20WN0129	27/07/2021	624.2	26.9
MB20WN0129	26/07/2021	624.2	26.9
MB20WN0129	25/07/2021	624.2	26.9
MB20WN0129	24/07/2021	624.2	26.9
MB20WN0129	23/07/2021	624.2	26.9
MB20WN0129	22/07/2021	624.2	26.9
MB20WN0129	21/07/2021	624.2	26.9
MB20WN0129	20/07/2021	624.2	26.9
MB20WN0129	19/07/2021	624.2	26.9
MB20WN0129	18/07/2021	624.2	26.9
MB20WN0129	17/07/2021	624.3	26.8
MB20WN0129	16/07/2021	624.3	26.8
MB20WN0129	15/07/2021	624.3	26.8
MB20WN0129	14/07/2021	624.2	26.9
MB20WN0129	13/07/2021	624.3	26.8
MB20WN0129	12/07/2021	624.3	26.8
MB20WN0129	11/07/2021	624.3	26.8
MB20WN0129	10/07/2021	624.3	26.8
MB20WN0129	9/07/2021	624.3	26.8

ID	Date	WL mAHD	WL mbgl
MB18HD20001	3/03/2020	627.0	82.4
MB18HD20001	4/03/2020	627.0	82.4
MB18HD20001	5/03/2020	627.0	82.4
MB18HD20001	6/03/2020	627.0	82.4
MB18HD20001	7/03/2020	627.0	82.3
MB18HD20001	8/03/2020	627.0	82.3
MB18HD20001	9/03/2020	627.0	82.4
MB18HD20001	10/03/2020	627.0	82.4
MB18HD20001	11/03/2020	627.0	82.4
MB18HD20001	12/03/2020	627.0	82.3
MB18HD20001	13/03/2020	627.0	82.3
MB18HD20001	14/03/2020	627.0	82.3
MB18HD20001	15/03/2020	627.0	82.4
MB18HD20001	16/03/2020	627.0	82.3
MB18HD20001	17/03/2020	627.0	82.3
MB18HD20001	18/03/2020	627.0	82.3
MB18HD20001	19/03/2020	627.0	82.3
MB18HD20001	20/03/2020	627.0	82.3
MB18HD20001	21/03/2020	627.0	82.3
MB18HD20001	22/03/2020	627.0	82.3
MB18HD20001	23/03/2020	627.0	82.3
MB18HD20001	24/03/2020	627.0	82.3
MB18HD20001	25/03/2020	627.0	82.3
MB18HD20001	26/03/2020	627.0	82.3
MB18HD20001	27/03/2020	627.0	82.3
MB18HD20001	28/03/2020	627.0	82.3
MB18HD20001	29/03/2020	627.0	82.3
MB18HD20001	30/03/2020	627.0	82.3
MB18HD20001	31/03/2020	627.0	82.4
MB18HD20001	1/04/2020	627.0	82.4
MB18HD20001	2/04/2020	627.0	82.4
MB18HD20001	3/04/2020	627.0	82.4
MB18HD20001	4/04/2020	627.0	82.4
MB18HD20001	5/04/2020	627.0	82.3
MB18HD20001	6/04/2020	627.0	82.3
MB18HD20001	7/04/2020	627.0	82.3
MB18HD20001	8/04/2020	627.0	82.3
MB18HD20001	9/04/2020	627.0	82.3
MB18HD20001	10/04/2020	627.0	82.3
MB18HD20001	11/04/2020	627.0	82.3
MB18HD20001	12/04/2020	627.0	82.3
MB18HD20001	13/04/2020	627.0	82.3
MB18HD20001	14/04/2020	627.0	82.3
MB18HD20001	15/04/2020	627.0	82.3
MB18HD20001	16/04/2020	627.0	82.3
MB18HD20001	17/04/2020	627.0	82.3
MB18HD20001	18/04/2020	627.0	82.3
MB18HD20001	19/04/2020	627.0	82.3
MB18HD20001	20/04/2020	627.0	82.3
MB18HD20001	21/04/2020	627.0	82.3
MB18HD20001	22/04/2020	627.0	82.3
MB18HD20001	23/04/2020	627.0	82.3
MB18HD20001	24/04/2020	627.0	82.3
MB18HD20001	25/04/2020	627.0	82.3
MB18HD20001	26/04/2020	627.0	82.3
MB18HD20001	27/04/2020	627.0	82.3
MB18HD20001	28/04/2020	627.0	82.3
MB18HD20001	20/08/2021	626.7	82.6
MB18HD20001	21/08/2021	626.7	82.6
MB18HD20001	22/08/2021	626.7	82.6
MB18HD20001	23/08/2021	626.7	82.6
MB18HD20001	24/08/2021	626.7	82.6
MB18HD20001	25/08/2021	626.7	82.6
MB18HD20001	26/08/2021	626.7	82.6
MB18HD20001	27/08/2021	626.7	82.6
MB18HD20001	28/08/2021	626.7	82.6
MB18HD20001	29/08/2021	626.7	82.6
MB18HD20001	30/08/2021	626.7	82.6
MB18HD20001	31/08/2021	626.7	82.6
MB18HD20001	1/09/2021	626.7	82.6
MB18HD20001	2/09/2021	626.7	82.7
MB18HD20001	5/09/2021	626.8	82.6
MB18HD20001	6/09/2021	626.8	82.6
MB18HD20001	7/09/2021	626.8	82.6
MB18HD20001	8/09/2021	626.8	82.6
MB18HD20001	9/09/2021	626.8	82.6
MB18HD20001	10/09/2021	626.8	82.6
MB18HD20001	11/09/2021	626.7	82.6
MB18HD20001	12/09/2021	626.7	82.7
MB18HD20001	13/09/2021	626.7	82.7
MB18HD20001	14/09/2021	626.7	82.7
MB18HD20001	15/09/2021	626.7	82.7
MB18HD20001	16/09/2021	626.7	82.7
MB18HD20001	17/09/2021	626.7	82.6
MB18HD20001	18/09/2021	626.7	82.6
MB18HD20001	19/09/2021	626.7	82.6
MB18HD20001	20/09/2021	626.8	82.6
MB18HD20001	21/09/2021	626.8	82.6
MB18HD20001	22/09/2021	626.8	82.6
MB18HD20001	23/09/2021	626.8	82.6
MB18HD20001	24/09/2021	626.7	82.6
MB18HD20001	25/09/2021	626.7	82.7
MB18HD20001	26/09/2021	626.7	82.7
MB18HD20001	27/09/2021	626.7	82.7
MB18HD20001	28/09/2021	626.7	82.7
MB18HD20001	29/09/2021	626.7	82.7
MB18HD20001	30/09/2021	626.7	82.7
MB18HD20001	1/10/2021	626.7	82.7
MB18HD20001	2/10/2021	626.7	82.7
MB18HD20001	3/10/2021	626.7	82.7

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDRE2	11/04/2020	628.7	50.2
HDRE2	10/04/2020	628.7	50.2
HDRE2	9/04/2020	628.7	50.2
HDRE2	8/04/2020	628.7	50.2
HDRE2	7/04/2020	628.7	50.2
HDRE2	6/04/2020	628.7	50.2
HDRE2	5/04/2020	628.7	50.2
HDRE2	4/04/2020	628.7	50.2
HDRE2	3/04/2020	628.7	50.2
HDRE2	2/04/2020	628.6	50.2
HDRE2	1/04/2020	628.6	50.2
HDRE2	31/03/2020	628.7	50.2
HDRE2	30/03/2020	628.7	50.2
HDRE2	29/03/2020	628.7	50.2
HDRE2	28/03/2020	628.7	50.2
HDRE2	27/03/2020	628.7	50.2
HDRE2	26/03/2020	628.7	50.2
HDRE2	25/03/2020	628.7	50.2
HDRE2	24/03/2020	628.7	50.2
HDRE2	23/03/2020	628.7	50.1
HDRE2	22/03/2020	628.7	50.1
HDRE2	21/03/2020	628.7	50.1
HDRE2	20/03/2020	628.8	50.1
HDRE2	19/03/2020	628.8	50.1
HDRE2	18/03/2020	628.8	50.1
HDRE2	17/03/2020	628.8	50.1
HDRE2	16/03/2020	628.7	50.1
HDRE2	15/03/2020	628.7	50.1
HDRE2	14/03/2020	628.7	50.1
HDRE2	13/03/2020	628.7	50.2
HDRE2	12/03/2020	628.7	50.2
HDRE2	11/03/2020	628.7	50.2
HDRE2	10/03/2020	628.7	50.2
HDRE2	9/03/2020	628.6	50.2
HDRE2	8/03/2020	628.6	50.2
HDRE2	7/03/2020	628.6	50.2
HDRE2	6/03/2020	628.6	50.2
HDRE2	5/03/2020	628.6	50.3
HDRE2	4/03/2020	628.6	50.3
HDRE2	3/03/2020	628.6	50.3
HDRE2	2/03/2020	628.6	50.3
HDRE2	1/03/2020	628.5	50.3
HDRE2	29/02/2020	628.5	50.3
HDRE2	28/02/2020	628.5	50.3
HDRE2	27/02/2020	628.5	50.3
HDRE2	26/02/2020	628.5	50.3
HDRE2	25/02/2020	628.5	50.3
HDRE2	24/02/2020	628.5	50.3
HDRE2	23/02/2020	628.5	50.3
HDRE2	22/02/2020	628.5	50.3
HDRE2	21/02/2020	628.5	50.3
HDRE2	20/02/2020	628.5	50.3
HDRE2	19/02/2020	628.5	50.4
HDRE2	18/02/2020	628.5	50.3
HDRE2	17/02/2020	628.5	50.3
HDRE2	16/02/2020	628.5	50.4
HDRE2	15/02/2020	628.5	50.4
HDRE2	14/02/2020	628.5	50.4
HDRE2	13/02/2020	628.5	50.4
HDRE2	12/02/2020	628.5	50.4
HDRE2	11/02/2020	628.4	50.4
HDRE2	10/02/2020	628.4	50.5
HDRE2	9/02/2020	628.4	50.5
HDRE2	8/02/2020	628.4	50.4
HDRE2	7/02/2020	628.4	50.4
HDRE2	6/02/2020	628.4	50.5
HDRE2	5/02/2020	628.4	50.5
HDRE2	4/02/2020	628.4	50.5
HDRE2	3/02/2020	628.4	50.5
HDRE2	2/02/2020	628.4	50.5
HDRE2	1/02/2020	628.4	50.5
HDRE2	31/01/2020	628.3	50.5
HDRE2	30/01/2020	628.3	50.5
HDRE2	29/01/2020	628.3	50.5
HDRE2	28/01/2020	628.3	50.5
HDRE2	27/01/2020	628.3	50.5
HDRE2	26/01/2020	628.3	50.5
HDRE2	25/01/2020	628.3	50.6
HDRE2	24/01/2020	628.3	50.6
HDRE2	23/01/2020	628.3	50.6
HDRE2	22/01/2020	628.2	50.6
HDRE2	21/01/2020	628.2	50.6
HDRE2	20/01/2020	628.2	50.6
HDRE2	19/01/2020	628.2	50.6
HDRE2	18/01/2020	628.2	50.7
HDRE2	17/01/2020	628.2	50.7
HDRE2	16/01/2020	628.2	50.7
HDRE2	15/01/2020	628.2	50.7
HDRE2	14/01/2020	628.2	50.7
HDRE2	13/01/2020	628.1	50.7
HDRE2	12/01/2020	628.1	50.7
HDRE2	11/01/2020	628.1	50.7
HDRE2	10/01/2020	628.1	50.7
HDRE2	9/01/2020	628.1	50.8
HDRE2	8/01/2020	628.1	50.8
HDRE2	7/01/2020	628.1	50.8
HDRE2	6/01/2020	628.1	50.8
HDRE2	5/01/2020	628.1	50.8
HDRE2	4/01/2020	628.1	50.8
HDRE2	3/01/2020	628.1	50.8
HDRE2	2/01/2020	628.1	50.8
HDRE2	1/01/2020	628.1	50.8
HDRE2	31/12/2019	628.1	50.8
HDRE2	30/12/2019	628.1	50.8
HDRE2	29/12/2019	628.1	50.8
HDRE2	28/12/2019	628.1	50.8
HDRE2	27/12/2019	628.1	50.8
HDRE2	26/12/2019	628.1	50.8
HDRE2	25/12/2019	628.1	50.8
HDRE2	24/12/2019	628.1	50.7
HDRE2	23/12/2019	628.1	50.7
HDRE2	22/12/2019	628.1	50.8
HDRE2	21/12/2019	628.1	50.8
HDRE2	20/12/2019	628.1	50.8
HDRE2	19/12/2019	628.1	50.8
HDRE2	18/12/2019	628.1	50.8
HDRE2	17/12/2019	628.1	50.8
HDRE2	16/12/2019	628.1	50.8
HDRE2	15/12/2019	628.1	50.8
HDRE2	14/12/2019	628.1	50.8
HDRE2	13/12/2019	628.1	50.8
HDRE2	12/12/2019	628.1	50.8
HDRE2	11/12/2019	628.1	50.8
HDRE2	10/12/2019	628.1	50.8
HDRE2	9/12/2019	628.0	50.8
HDRE2	8/12/2019	628.0	50.8
HDRE2	7/12/2019	628.0	50.8
HDRE2	6/12/2019	628.0	50.8
HDRE2	5/12/2019	628.0	50.8
HDRE2	4/12/2019	628.0	50.8
HDRE2	3/12/2019	628.0	50.8
HDRE2	2/12/2019	628.0	50.8
HDRE2	1/12/2019	628.0	50.8
HDRE2	30/11/2019	628.0	50.8
HDRE2	29/11/2019	628.0	50.9
HDRE2	28/11/2019	628.0	50.9

ID	Date	WL mAHD	WL mbgl
HDVRP1	8/05/2020	624.6	59.9
HDVRP1	7/05/2020	624.6	59.9
HDVRP1	6/05/2020	624.6	59.9
HDVRP1	5/05/2020	624.6	59.9
HDVRP1	4/05/2020	624.6	59.9
HDVRP1	3/05/2020	624.6	59.9
HDVRP1	2/05/2020	624.6	59.9
HDVRP1	1/05/2020	624.6	59.9
HDVRP1	30/04/2020	624.6	59.9
HDVRP1	29/04/2020	624.6	59.9
HDVRP1	28/04/2020	624.6	59.9
HDVRP1	27/04/2020	624.6	59.9
HDVRP1	26/04/2020	624.6	59.9
HDVRP1	25/04/2020	624.6	59.9
HDVRP1	24/04/2020	624.6	59.9
HDVRP1	23/04/2020	624.6	59.9
HDVRP1	22/04/2020	624.6	59.9
HDVRP1	21/04/2020	624.6	59.9
HDVRP1	20/04/2020	624.6	59.9
HDVRP1	19/04/2020	624.6	59.9
HDVRP1	18/04/2020	624.6	59.9
HDVRP1	17/04/2020	624.6	59.9
HDVRP1	16/04/2020	624.6	59.9
HDVRP1	15/04/2020	624.6	59.9
HDVRP1	14/04/2020	624.6	59.9
HDVRP1	13/04/2020	624.6	59.9
HDVRP1	12/04/2020	624.6	59.9
HDVRP1	11/04/2020	624.6	59.9
HDVRP1	10/04/2020	624.6	59.9
HDVRP1	9/04/2020	624.6	59.9
HDVRP1	8/04/2020	624.6	59.9
HDVRP1	7/04/2020	624.6	59.9
HDVRP1	6/04/2020	624.6	59.9
HDVRP1	5/04/2020	624.6	59.9
HDVRP1	4/04/2020	624.6	59.9
HDVRP1	3/04/2020	624.6	59.9
HDVRP1	2/04/2020	624.6	60.0
HDVRP1	1/04/2020	624.6	60.0
HDVRP1	31/03/2020	624.6	60.0
HDVRP1	30/03/2020	624.6	59.9
HDVRP1	29/03/2020	624.6	59.9
HDVRP1	28/03/2020	624.6	59.9
HDVRP1	27/03/2020	624.6	59.9
HDVRP1	26/03/2020	624.6	59.9
HDVRP1	25/03/2020	624.6	59.9
HDVRP1	24/03/2020	624.6	59.9
HDVRP1	23/03/2020	624.7	59.9
HDVRP1	22/03/2020	624.6	59.9
HDVRP1	21/03/2020	624.6	59.9
HDVRP1	20/03/2020	624.6	59.9
HDVRP1	19/03/2020	624.6	59.9
HDVRP1	18/03/2020	624.6	59.9
HDVRP1	17/03/2020	624.6	59.9
HDVRP1	16/03/2020	624.6	60.0
HDVRP1	15/03/2020	624.5	60.0
HDVRP1	14/03/2020	624.6	60.0
HDVRP1	13/03/2020	624.6	59.9
HDVRP1	12/03/2020	624.6	59.9
HDVRP1	11/03/2020	624.6	59.9
HDVRP1	10/03/2020	624.6	59.9
HDVRP1	9/03/2020	624.6	59.9
HDVRP1	8/03/2020	624.6	59.9
HDVRP1	7/03/2020	624.6	59.9
HDVRP1	6/03/2020	624.5	60.0
HDVRP1	5/03/2020	624.5	60.0
HDVRP1	4/03/2020	624.5	60.0
HDVRP1	3/03/2020	624.5	60.0
HDVRP1	2/03/2020	624.5	60.0
HDVRP1	1/03/2020	624.5	60.0
HDVRP1	29/02/2020	624.5	60.0
HDVRP1	28/02/2020	624.5	60.0
HDVRP1	27/02/2020	624.5	60.0
HDVRP1	26/02/2020	624.5	60.0
HDVRP1	25/02/2020	624.5	60.0
HDVRP1	24/02/2020	624.6	60.0
HDVRP1	23/02/2020	624.6	60.0
HDVRP1	22/02/2020	624.6	60.0
HDVRP1	21/02/2020	624.5	60.0
HDVRP1	20/02/2020	624.5	60.0
HDVRP1	19/02/2020	624.7	59.8
HDVRP1	18/02/2020	624.5	60.0
HDVRP1	17/02/2020	624.6	59.9
HDVRP1	16/02/2020	624.5	60.0
HDVRP1	15/02/2020	624.5	60.0
HDVRP1	14/02/2020	625.0	59.5
HDVRP1	13/02/2020	624.5	60.0
HDVRP1	12/02/2020	624.5	60.0
HDVRP1	11/02/2020	624.5	60.0
HDVRP1	10/02/2020	624.5	60.0
HDVRP1	9/02/2020	624.5	60.0
HDVRP1	8/02/2020	624.5	60.0
HDVRP1	7/02/2020	624.5	60.0
HDVRP1	6/02/2020	624.5	60.0
HDVRP1	5/02/2020	624.5	60.0
HDVRP1	4/02/2020	624.5	60.0
HDVRP1	3/02/2020	624.5	60.0
HDVRP1	2/02/2020	624.5	60.0
HDVRP1	1/02/2020	624.5	60.1
HDVRP1	31/01/2020	624.4	60.1
HDVRP1	30/01/2020	624.4	60.1
HDVRP1	29/01/2020	624.5	60.0
HDVRP1	28/01/2020	624.5	60.0
HDVRP1	27/01/2020	624.5	60.0
HDVRP1	26/01/2020	624.5	60.0
HDVRP1	25/01/2020	624.5	60.0
HDVRP1	24/01/2020	624.5	60.0
HDVRP1	23/01/2020	624.5	60.0
HDVRP1	22/01/2020	624.7	59.8
HDVRP1	21/01/2020	624.5	60.0
HDVRP1	20/01/2020	624.5	60.0
HDVRP1	19/01/2020	624.5	60.1
HDVRP1	18/01/2020	624.4	60.1
HDVRP1	17/01/2020	624.4	60.1
HDVRP1	16/01/2020	624.5	60.0
HDVRP1	15/01/2020	624.5	60.0
HDVRP1	14/01/2020	624.5	60.0
HDVRP1	13/01/2020	624.7	59.8
HDVRP1	12/01/2020	625.0	59.5
HDVRP1	11/01/2020	624.7	59.8
HDVRP1	10/01/2020	624.5	60.0
HDVRP1	9/01/2020	624.4	60.1
HDVRP1	8/01/2020	624.4	60.1
HDVRP1	7/01/2020	624.5	60.1
HDVRP1	6/01/2020	624.5	60.1
HDVRP1	5/01/2020	624.5	60.1
HDVRP1	4/01/2020	624.4	60.1
HDVRP1	3/01/2020	624.5	60.0
HDVRP1	2/01/2020	624.7	59.8
HDVRP1	1/01/2020	624.5	60.0
HDVRP1	31/12/2019	624.5	60.0
HDVRP1	30/12/2019	624.8	59.7
HDVRP1	29/12/2019	624.6	59.9
HDVRP1	28/12/2019	624.5	60.0
HDVRP1	27/12/2019	624.5	60.0
HDVRP1	26/12/2019	624.5	60.0
HDVRP1	25/12/2019	624.5	60.0

ID	Date	WL mAHD	WL mbgl
MB20WN0129	8/07/2021	624.3	26.8
MB20WN0129	7/07/2021	624.3	26.8
MB20WN0129	6/07/2021	624.3	26.8
MB20WN0129	5/07/2021	624.3	26.8
MB20WN0129	4/07/2021	624.3	26.8
MB20WN0129	3/07/2021	624.3	26.8
MB20WN0129	2/07/2021	624.3	26.8
MB20WN0129	1/07/2021	624.4	26.7
MB20WN0129	30/06/2021	624.4	26.7
MB20WN0129	29/06/2021	624.4	26.7
MB20WN0129	28/06/2021	624.4	26.7
MB20WN0129	27/06/2021	624.4	26.7
MB20WN0129	26/06/2021	624.4	26.7
MB20WN0129	25/06/2021	624.4	26.7
MB20WN0129	24/06/2021	624.4	26.7
MB20WN0129	23/06/2021	624.4	26.7
MB20WN0129	22/06/2021	624.4	26.7
MB20WN0129	21/06/2021	624.4	26.7
MB20WN0129	20/06/2021	624.4	26.7
MB20WN0129	19/06/2021	624.4	26.7
MB20WN0129	18/06/2021	624.4	26.7
MB20WN0129	17/06/2021	624.4	26.7
MB20WN0129	16/06/2021	624.4	26.7
MB20WN0129	15/06/2021	624.4	26.7
MB20WN0129	14/06/2021	624.4	26.7
MB20WN0129	13/06/2021	624.4	26.7
MB20WN0129	12/06/2021	624.4	26.7
MB20WN0129	11/06/2021	624.4	26.7
MB20WN0129	10/06/2021	624.4	26.7
MB20WN0129	9/06/2021	624.4	26.7
MB20WN0129	8/06/2021	624.4	26.7
MB20WN0129	7/06/2021	624.4	26.7
MB20WN0129	6/06/2021	624.4	26.7
MB20WN0129	5/06/2021	624.5	26.6
MB20WN0129	4/06/2021	624.5	26.6
MB20WN0129	3/06/2021	624.5	26.6
MB20WN0129	2/06/2021	624.5	26.6
MB20WN0129	1/06/2021	624.4	26.7
MB20WN0129	31/05/2021	624.5	26.6
MB20WN0129	30/05/2021	624.5	26.6
MB20WN0129	29/05/2021	624.5	26.6
MB20WN0129	28/05/2021	624.5	26.6
MB20WN0129	27/05/2021	624.5	26.6
MB20WN0129	26/05/2021	624.5	26.6
MB20WN0129	25/05/2021	624.5	26.6
MB20WN0129	24/05/2021	624.5	26.6
MB20WN0129	23/05/2021	624.5	26.6
MB20WN0129	22/05/2021	624.5	26.6
MB20WN0129	21/05/2021	624.5	26.6
MB20WN0129	20/05/2021	624.6	26.5
MB20WN0129	19/05/2021	624.6	26.5
MB20WN0129	18/05/2021	624.6	26.5
MB20WN0129	17/05/2021	624.6	26.5
MB20WN0129	16/05/2021	624.6	26.5
MB20WN0129	15/05/2021	624.6	26.5
MB20WN0129	14/05/2021	624.6	26.5
MB20WN0129	13/05/2021	624.6	26.5
MB20WN0129	12/05/2021	624.6	26.5
MB20WN0129	11/05/2021	624.7	26.4
MB20WN0129	10/05/2021	624.7	26.4
MB20WN0129	9/05/2021	624.7	26.4
MB20WN0129	8/05/2021	624.7	26.4
MB20WN0129	7/05/2021	624.7	26.4
MB20WN0129	6/05/2021	624.7	26.4
MB20WN0129	5/05/2021	624.7	26.4
MB20WN0129	4/05/2021	624.7	26.4
MB20WN0129	3/05/2021	624.7	26.4
MB20WN0129	2/05/2021	624.8	26.3
MB20WN0129	1/05/2021	624.8	26.3
MB20WN0129	30/04/2021	624.8	26.3
MB20WN0129	29/04/2021	624.9	26.2
MB20WN0129	28/04/2021	624.9	26.2
MB20WN0129	27/04/2021	624.9	26.2
MB20WN0129	26/04/2021	624.9	26.2
MB20WN0129	25/04/2021	625.0	26.1
MB20WN0129	24/04/2021	625.0	26.1
MB20WN0129	23/04/2021	624.9	26.2
MB20WN0129	22/04/2021	624.9	26.2
MB20WN0129	21/04/2021	624.9	26.2
MB20WN0129	20/04/2021	624.9	26.2
MB20WN0129	19/04/2021	624.8	26.3
MB20WN0129	18/04/2021	624.7	26.4
MB20WN0129	17/04/2021	624.7	26.4
MB20WN0129	16/04/2021	624.6	26.5
MB20WN0129	15/04/2021	624.5	26.6
MB20WN0129	14/04/2021	624.4	26.7
MB20WN0129	13/04/2021	624.4	26.7
MB20WN0129	12/04/2021	624.4	26.7
MB20WN0129	11/04/2021	624.4	26.7
MB20WN0129	10/04/2021	624.4	26.7
MB20WN0129	9/04/2021	624.4	26.7
MB20WN0129	8/04/2021	624.4	26.7
MB20WN0129	7/04/2021	624.4	26.7
MB20WN0129	6/04/2021	624.4	26.7
MB20WN0129	5/04/2021	624.4	26.7
MB20WN0129	4/04/2021	624.4	26.7
MB20WN0129	3/04/2021	624.5	26.6
MB20WN0129	1/04/2021	624.5	26.6
MB20WN0129	31/03/2021	624.5	26.6
MB20WN0129	30/03/2021	624.5	26.6
MB20WN0129	29/03/2021	624.5	26.6
MB20WN0129	28/03/2021	624.5	26.6
MB20WN0129	27/03/2021	624.5	26.6
MB20WN0129	26/03/2021	624.6	26.5
MB20WN0129	25/03/2021	624.6	26.5
MB20WN0129	24/03/2021	624.6	26.5
MB20WN0129	23/03/2021	624.6	26.5
MB20WN0129	22/03/2021	624.6	26.5
MB20WN0129	21/03/2021	624.6	26.5
MB20WN0129	20/03/2021	624.7	26.4
MB20WN0129	19/03/2021	624.7	26.4
MB20WN0129	18/03/2021	624.7	26.4
MB20WN0129	17/03/2021	624.7	26.4
MB20WN0129	16/03/2021	624.8	26.3
MB20WN0129	15/03/2021	624.8	26.3
MB20WN0129	14/03/2021	624.9	26.2
MB20WN0129	13/03/2021	624.9	26.2
MB20WN0129	12/03/2021	624.9	26.2
MB20WN0129	11/03/2021	625.0	26.1
MB20WN0129	10/03/2021	625.0	26.1
MB20WN0129	9/03/2021	625.1	26.0
MB20WN0129	8/03/2021	625.2	25.9
MB20WN0129	7/03/2021	625.2	25.9
MB20WN0129	6/03/2021	625.3	25.8
MB20WN0129	5/03/2021	625.4	25.7
MB20WN0129	4/03/2021	625.5	25.6
MB20WN0129	3/03/2021	625.6	25.5
MB20WN0129	2/03/2021	625.7	25.4
MB20WN0129	1/03/2021	625.8	25.3
MB20WN0129	28/02/2021	625.9	25.2
MB20WN0129	27/02/2021	626.0	25.1
MB20WN0129	26/02/2021	626.2	24.9
MB20WN0129	25/02/2021	626.3	24.8
MB20WN0129	24/02/2021	626.4	24.7
MB20WN0129	23/02/2021	626.5	24.6
MB20WN0129	22/02/2021	626.6	24.5

ID	Date	WL mAHD	WL mbgl
MB18HD20001	12/11/2021	626.7	82.7
MB18HD20001	13/11/2021	626.7	82.7
MB18HD20001	15/11/2021	626.7	82.7
MB18HD20001	16/11/2021	626.7	82.7
MB18HD20001	17/11/2021	626.7	82.7
MB18HD20001	18/11/2021	626.7	82.7
MB18HD20001	19/11/2021	626.6	82.7
MB18HD20001	20/11/2021	626.6	82.7
MB18HD20001	21/11/2021	626.7	82.7
MB18HD20001	22/11/2021	626.7	82.7
MB18HD20001	23/11/2021	626.7	82.7
MB18HD20001	24/11/2021	626.7	82.7
MB18HD20001	25/11/2021	626.7	82.7
MB18HD20001	26/11/2021	626.7	82.7
MB18HD20001	27/11/2021	626.7	82.7
MB18HD20001	28/11/2021	626.7	82.7
MB18HD20001	29/11/2021	626.7	82.7
MB18HD20001	30/11/2021	626.6	82.7
MB18HD20001	1/12/2021	626.6	82.7
MB18HD20001	2/12/2021	626.6	82.7
MB18HD20001	3/12/2021	626.6	82.7
MB18HD20001	4/12/2021	626.6	82.7
MB18HD20001	5/12/2021	626.6	82.7
MB18HD20001	6/12/2021	626.6	82.7
MB18HD20001	7/12/2021	626.6	82.7
MB18HD20001	8/12/2021	626.6	82.7
MB18HD20001	9/12/2021	626.6	82.7
MB18HD20001	10/12/2021	626.6	82.7
MB18HD20001	11/12/2021	626.6	82.7
MB18HD20001	12/12/2021	626.6	82.7
MB18HD20001	13/12/2021	626.6	82.7
MB18HD20001	14/12/2021	626.6	82.8
MB18HD20001	15/12/2021	626.6	82.8
MB18HD20001	16/12/2021	626.6	82.7
MB18HD20001	17/12/2021	626.6	82.7
MB18HD20001	18/12/2021	626.6	82.7
MB18HD20001	19/12/2021	626.6	82.7
MB18HD20001	20/12/2021	626.6	82.7
MB18HD20001	21/12/2021	626.6	82.7
MB18HD20001	22/12/2021	626.6	82.7
MB18HD20001	23/12/2021	626.6	82.8
MB18HD20001	24/12/2021	626.6	82.8
MB18HD20001	25/12/2021	626.6	82.7
MB18HD20001	26/12/2021	626.6	82.7
MB18HD20001	30/12/2021	626.6	82.8
MB18HD20001	31/12/2021	626.6	82.8
MB18HD20001	1/01/2022	626.6	82.8
MB18HD20001	2/01/2022	626.6	82.8
MB18HD20001	3/01/2022	626.6	82.7
MB18HD20001	4/01/2022	626.6	82.7
MB18HD20001	5/01/2022	626.6	82.7
MB18HD20001	6/01/2022	626.6	82.7
MB18HD20001	7/01/2022	626.6	82.7
MB18HD20001	8/01/2022	626.6	82.7
MB18HD20001	9/01/2022	626.6	82.7
MB18HD20001	10/01/2022	626.6	82.7
MB18HD20001	11/01/2022	626.6	82.7
MB18HD20001	12/01/2022	626.7	82.7
MB18HD20001	13/01/2022	626.6	82.7
MB18HD20001	14/01/2022	626.6	82.8
MB18HD20001	15/01/2022	626.6	82.8
MB18HD20001	16/01/2022	626.6	82.8
MB18HD20001	17/01/2022	626.6	82.8
MB18HD20001	18/01/2022	626.6	82.8
MB18HD20001	19/01/2022	626.6	82.7
MB18HD20001	20/01/2022	626.6	82.7
MB18HD20001	21/01/2022	626.6	82.7
MB18HD20001	22/01/2022	626.6	82.7
MB18HD20001	23/01/2022	626.6	82.8
MB18HD20001	24/01/2022	626.8	82.6
MB18HD20001	25/01/2022	626.7	82.6
MB18HD20001	26/01/2022	626.7	82.6
MB18HD20001	27/01/2022	626.7	82.6
MB18HD20001	28/01/2022	626.7	82.6
MB18HD20001	29/01/2022	626.8	82.6
MB18HD20001	30/01/2022	626.8	82.6
MB18HD20001	31/01/2022	626.7	82.6
MB18HD20001	1/02/2022	626.7	82.6
MB18HD20001	2/02/2022	626.8	82.6
MB18HD20001	3/02/2022	626.8	82.6
MB18HD20001	4/02/2022	626.8	82.6
MB18HD20001	5/02/2022	626.8	82.6
MB18HD20001	6/02/2022	626.8	82.6
MB18HD20001	7/02/2022	626.8	82.6
MB18HD20001	8/02/2022	626.8	82.6
MB18HD20001	9/02/2022	626.8	82.6
MB18HD20001	10/02/2022	626.8	82.6
MB18HD20001	11/02/2022	626.8	82.6
MB18HD20001	12/02/2022	626.8	82.6
MB18HD20001	13/02/2022	626.8	82.5
MB18HD20001	14/02/2022	626.8	82.5
MB18HD20001	15/02/2022	626.8	82.5
MB18HD20001	16/02/2022	626.8	82.5
MB18HD20001	17/02/2022	626.8	82.5
MB18HD20001	18/02/2022	626.8	82.5
MB18HD20001	19/02/2022	626.8	82.5
MB18HD20001	20/02/2022	626.8	82.5
MB18HD20001	21/02/2022	626.8	82.5
MB18HD20001	22/02/2022	626.8	82.6
MB18HD20001	23/02/2022	626.8	82.6

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDRE2	27/11/2019	628.0	50.9
HDRE2	26/11/2019	628.0	50.9
HDRE2	25/11/2019	628.0	50.9
HDRE2	24/11/2019	628.0	50.9
HDRE2	23/11/2019	628.0	50.9
HDRE2	22/11/2019	628.0	50.8
HDRE2	21/11/2019	628.0	50.8
HDRE2	20/11/2019	628.0	50.9
HDRE2	19/11/2019	628.0	50.9
HDRE2	18/11/2019	628.0	50.8
HDRE2	17/11/2019	628.1	50.8
HDRE2	16/11/2019	628.1	50.8
HDRE2	15/11/2019	628.1	50.8
HDRE2	14/11/2019	628.1	50.8
HDRE2	13/11/2019	628.1	50.8
HDRE2	12/11/2019	628.1	50.8
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HDRE2	9/11/2019	628.1	50.8
HDRE2	8/11/2019	628.1	50.8
HDRE2	7/11/2019	628.1	50.8
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HDRE2	20/10/2019	627.9	50.9
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HDRE2	17/10/2019	627.9	51.0
HDRE2	16/10/2019	627.8	51.0
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HDRE2	12/10/2019	627.8	51.1
HDRE2	11/10/2019	627.8	51.0
HDRE2	10/10/2019	627.8	51.0
HDRE2	9/10/2019	627.8	51.0
HDRE2	8/10/2019	627.8	51.1
HDRE2	7/10/2019	627.8	51.1
HDRE2	6/10/2019	627.8	51.1
HDRE2	5/10/2019	627.8	51.1
HDRE2	4/10/2019	627.8	51.1
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HDRE2	23/09/2019	627.8	51.1
HDRE2	22/09/2019	627.8	51.1
HDRE2	21/09/2019	627.8	51.1
HDRE2	20/09/2019	627.8	51.1
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HDRE2	17/09/2019	627.7	51.1
HDRE2	16/09/2019	627.7	51.1
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HDRE2	14/09/2019	627.7	51.1
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HDRE2	11/09/2019	627.8	51.1
HDRE2	10/09/2019	627.7	51.1
HDRE2	9/09/2019	627.7	51.1
HDRE2	8/09/2019	627.7	51.1
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HDRE2	6/09/2019	627.7	51.2
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HDRE2	2/09/2019	627.7	51.2
HDRE2	1/09/2019	627.7	51.2
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HDRE2	27/08/2019	627.7	51.2
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HDRE2	14/08/2019	627.7	51.2
HDRE2	13/08/2019	627.7	51.2
HDRE2	12/08/2019	627.7	51.2
HDRE2	11/08/2019	627.7	51.2
HDRE2	10/08/2019	627.7	51.1
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HDRE2	7/08/2019	627.7	51.2
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HDRE2	5/08/2019	627.7	51.2
HDRE2	4/08/2019	627.7	51.1
HDRE2	3/08/2019	627.8	51.1
HDRE2	2/08/2019	627.8	51.1
HDRE2	1/08/2019	627.8	51.1
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HDRE2	27/07/2019	627.7	51.1
HDRE2	26/07/2019	627.7	51.1
HDRE2	25/07/2019	627.8	51.1
HDRE2	24/07/2019	627.8	51.1
HDRE2	23/07/2019	627.8	51.1
HDRE2	22/07/2019	627.7	51.1
HDRE2	21/07/2019	627.7	51.1
HDRE2	20/07/2019	627.7	51.1
HDRE2	19/07/2019	627.7	51.1
HDRE2	18/07/2019	627.7	51.1
HDRE2	17/07/2019	627.8	51.1
HDRE2	16/07/2019	627.8	51.1
HDRE2	15/07/2019	627.8	51.1

ID	Date	WL mAHD	WL mbgl
HDVRP1	24/12/2019	624.5	60.0
HDVRP1	23/12/2019	624.5	60.0
HDVRP1	22/12/2019	624.5	60.0
HDVRP1	21/12/2019	624.5	60.0
HDVRP1	20/12/2019	624.5	60.1
HDVRP1	19/12/2019	624.5	60.1
HDVRP1	18/12/2019	624.5	60.0
HDVRP1	17/12/2019	624.7	59.8
HDVRP1	16/12/2019	624.5	60.1
HDVRP1	15/12/2019	624.5	60.0
HDVRP1	14/12/2019	624.5	60.0
HDVRP1	13/12/2019	624.5	60.0
HDVRP1	12/12/2019	624.5	60.0
HDVRP1	11/12/2019	624.5	60.0
HDVRP1	10/12/2019	624.5	60.0
HDVRP1	9/12/2019	624.5	60.0
HDVRP1	8/12/2019	624.5	60.0
HDVRP1	7/12/2019	624.5	60.0
HDVRP1	6/12/2019	624.5	60.0
HDVRP1	5/12/2019	624.6	60.0
HDVRP1	4/12/2019	624.5	60.0
HDVRP1	3/12/2019	624.5	60.0
HDVRP1	2/12/2019	624.5	60.0
HDVRP1	1/12/2019	624.8	59.7
HDVRP1	30/11/2019	624.6	59.9
HDVRP1	29/11/2019	624.8	59.8
HDVRP1	28/11/2019	624.5	60.0
HDVRP1	27/11/2019	624.5	60.0
HDVRP1	26/11/2019	624.6	59.9
HDVRP1	25/11/2019	624.5	60.0
HDVRP1	24/11/2019	624.5	60.0
HDVRP1	23/11/2019	624.5	60.0
HDVRP1	22/11/2019	624.8	59.7
HDVRP1	21/11/2019	624.5	60.0
HDVRP1	20/11/2019	624.5	60.1
HDVRP1	19/11/2019	624.5	60.1
HDVRP1	18/11/2019	624.5	60.0
HDVRP1	17/11/2019	624.5	60.0
HDVRP1	16/11/2019	624.6	59.9
HDVRP1	15/11/2019	624.7	59.8
HDVRP1	14/11/2019	624.6	59.9
HDVRP1	13/11/2019	624.6	60.0
HDVRP1	12/11/2019	624.5	60.0
HDVRP1	11/11/2019	624.5	60.0
HDVRP1	10/11/2019	624.5	60.0
HDVRP1	9/11/2019	624.5	60.0
HDVRP1	8/11/2019	624.5	60.0
HDVRP1	7/11/2019	624.5	60.0
HDVRP1	6/11/2019	624.5	60.0
HDVRP1	5/11/2019	624.5	60.0
HDVRP1	4/11/2019	624.5	60.0
HDVRP1	3/11/2019	624.5	60.0
HDVRP1	2/11/2019	624.5	60.0
HDVRP1	1/11/2019	624.5	60.0
HDVRP1	31/10/2019	624.5	60.0
HDVRP1	30/10/2019	624.6	60.0
HDVRP1	29/10/2019	624.5	60.0
HDVRP1	28/10/2019	624.6	60.0
HDVRP1	27/10/2019	624.6	60.0
HDVRP1	26/10/2019	624.5	60.0
HDVRP1	25/10/2019	624.5	60.0
HDVRP1	24/10/2019	624.8	59.7
HDVRP1	23/10/2019	624.5	60.0
HDVRP1	22/10/2019	624.5	60.0
HDVRP1	21/10/2019	624.9	59.6
HDVRP1	20/10/2019	624.5	60.0
HDVRP1	19/10/2019	624.5	60.0
HDVRP1	18/10/2019	624.6	59.9
HDVRP1	17/10/2019	624.7	59.8
HDVRP1	16/10/2019	624.5	60.0
HDVRP1	15/10/2019	624.5	60.0
HDVRP1	14/10/2019	624.6	60.0
HDVRP1	13/10/2019	624.6	59.9
HDVRP1	12/10/2019	624.7	59.8
HDVRP1	11/10/2019	624.6	60.0
HDVRP1	10/10/2019	624.6	60.0
HDVRP1	9/10/2019	624.6	59.9
HDVRP1	8/10/2019	624.7	59.8
HDVRP1	7/10/2019	624.5	60.0
HDVRP1	6/10/2019	624.5	60.0
HDVRP1	5/10/2019	624.8	59.7
HDVRP1	4/10/2019	624.5	60.0
HDVRP1	3/10/2019	624.6	59.9
HDVRP1	2/10/2019	624.6	59.9
HDVRP1	1/10/2019	624.6	59.9
HDVRP1	30/09/2019	624.8	59.7
HDVRP1	29/09/2019	624.6	59.9
HDVRP1	28/09/2019	624.9	59.6
HDVRP1	27/09/2019	624.6	59.9
HDVRP1	26/09/2019	624.9	59.6
HDVRP1	25/09/2019	624.6	59.9
HDVRP1	24/09/2019	624.9	59.6
HDVRP1	23/09/2019	624.6	59.9
HDVRP1	22/09/2019	624.7	59.9
HDVRP1	21/09/2019	624.8	59.7
HDVRP1	20/09/2019	624.7	59.9
HDVRP1	19/09/2019	624.5	60.0
HDVRP1	18/09/2019	624.6	59.9
HDVRP1	17/09/2019	624.6	59.9
HDVRP1	16/09/2019	624.6	59.9
HDVRP1	15/09/2019	624.6	59.9
HDVRP1	14/09/2019	624.6	59.9
HDVRP1	13/09/2019	624.8	59.8
HDVRP1	12/09/2019	624.6	59.9
HDVRP1	11/09/2019	624.6	59.9
HDVRP1	10/09/2019	624.8	59.7
HDVRP1	9/09/2019	624.6	59.9
HDVRP1	8/09/2019	624.6	60.0
HDVRP1	7/09/2019	624.6	60.0
HDVRP1	6/09/2019	624.7	59.8
HDVRP1	5/09/2019	624.6	60.0
HDVRP1	4/09/2019	624.5	60.0
HDVRP1	3/09/2019	624.6	59.9
HDVRP1	2/09/2019	624.6	59.9
HDVRP1	1/09/2019	624.7	59.8
HDVRP1	31/08/2019	624.6	59.9
HDVRP1	30/08/2019	624.7	59.8
HDVRP1	29/08/2019	624.6	59.9
HDVRP1	28/08/2019	624.6	59.9
HDVRP1	27/08/2019	624.6	59.9
HDVRP1	26/08/2019	624.6	60.0
HDVRP1	25/08/2019	624.6	59.9
HDVRP1	24/08/2019	624.6	59.9
HDVRP1	23/08/2019	624.6	59.9
HDVRP1	22/08/2019	624.7	59.8
HDVRP1	21/08/2019	624.8	59.7
HDVRP1	20/08/2019	624.8	59.8
HDVRP1	19/08/2019	624.8	59.7
HDVRP1	18/08/2019	624.8	59.7
HDVRP1	17/08/2019	624.8	59.7
HDVRP1	16/08/2019	624.7	59.8
HDVRP1	15/08/2019	625.0	59.5
HDVRP1	14/08/2019	624.8	59.8
HDVRP1	13/08/2019	624.9	59.6
HDVRP1	12/08/2019	625.0	59.5
HDVRP1	11/08/2019	624.7	59.8

ID	Date	WL mAHD	WL mbgl
MB20WN0129	21/02/2021	626.6	24.5
MB20WN0129	20/02/2021	626.6	24.5
MB20WN0129	19/02/2021	626.6	24.5
MB20WN0129	18/02/2021	626.5	24.6
MB20WN0129	17/02/2021	626.4	24.7
MB20WN0129	16/02/2021	626.1	25.0
MB20WN0129	15/02/2021	625.7	25.4
MB20WN0129	14/02/2021	625.2	25.9
MB20WN0129	13/02/2021	624.7	26.4
MB20WN0129	12/02/2021	624.1	27.0
MB20WN0129	11/02/2021	624.0	27.1
MB20WN0129	10/02/2021	623.9	27.2
MB20WN0129	9/02/2021	623.9	27.2
MB20WN0129	8/02/2021	623.9	27.2
MB20WN0129	7/02/2021	623.9	27.2
MB20WN0129	6/02/2021	623.9	27.2
MB20WN0129	5/02/2021	623.9	27.2
MB20WN0129	4/02/2021	623.8	27.3
MB20WN0129	3/02/2021	623.8	27.3
MB20WN0129	2/02/2021	623.7	27.4
MB20WN0129	1/02/2021	623.7	27.4
MB20WN0129	31/01/2021	623.7	27.4
MB20WN0129	30/01/2021	623.7	27.4
MB20WN0129	29/01/2021	623.7	27.4
MB20WN0129	28/01/2021	623.7	27.4
MB20WN0129	27/01/2021	623.7	27.4
MB20WN0129	26/01/2021	623.7	27.4
MB20WN0129	25/01/2021	623.7	27.4
MB20WN0129	24/01/2021	623.7	27.4
MB20WN0129	23/01/2021	623.7	27.4
MB20WN0129	22/01/2021	623.7	27.4
MB20WN0129	21/01/2021	623.7	27.4
MB20WN0129	20/01/2021	623.7	27.4
MB20WN0129	19/01/2021	623.8	27.3
MB20WN0129	18/01/2021	623.8	27.3
MB20WN0129	17/01/2021	623.7	27.4
MB20WN0129	16/01/2021	623.7	27.4
MB20WN0129	15/01/2021	623.7	27.4
MB20WN0129	14/01/2021	623.7	27.4
MB20WN0129	13/01/2021	623.7	27.4
MB20WN0129	12/01/2021	623.7	27.4
MB20WN0129	11/01/2021	623.7	27.4
MB20WN0129	10/01/2021	623.7	27.4
MB20WN0129	9/01/2021	623.7	27.4
MB20WN0129	8/01/2021	623.6	27.5
MB20WN0129	7/01/2021	623.5	27.6
MB20WN0129	6/01/2021	623.4	27.7
MB20WN0129	5/01/2021	623.2	27.9
MB20WN0129	4/01/2021	623.2	27.9
MB20WN0129	3/01/2021	623.2	27.9
MB20WN0129	2/01/2021	623.2	27.9
MB20WN0129	1/01/2021	623.2	27.9
MB20WN0129	31/12/2020	623.2	27.9
MB20WN0129	30/12/2020	623.2	27.9
MB20WN0129	29/12/2020	623.2	27.9
MB20WN0129	28/12/2020	623.2	27.9
MB20WN0129	27/12/2020	623.2	27.9
MB20WN0129	26/12/2020	623.3	27.8
MB20WN0129	25/12/2020	623.3	27.8
MB20WN0129	24/12/2020	623.3	27.8
MB20WN0129	23/12/2020	623.3	27.8
MB20WN0129	22/12/2020	623.3	27.8
MB20WN0129	21/12/2020	623.3	27.8
MB20WN0129	20/12/2020	623.3	27.8
MB20WN0129	19/12/2020	623.3	27.8
MB20WN0129	18/12/2020	623.4	27.7
MB20WN0129	17/12/2020	623.4	27.7
MB20WN0129	16/12/2020	623.4	27.7
MB20WN0129	15/12/2020	623.4	27.7
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MB20WN0129	13/12/2020	623.4	27.7
MB20WN0129	12/12/2020	623.4	27.7
MB20WN0129	11/12/2020	623.4	27.7
MB20WN0129	10/12/2020	623.3	27.8
MB20WN0129	9/12/2020	623.3	27.8
MB20WN0129	8/12/2020	623.3	27.8
MB20WN0129	7/12/2020	623.3	27.8
MB20WN0129	6/12/2020	623.2	27.9
MB20WN0129	5/12/2020	623.2	27.9
MB20WN0129	4/12/2020	623.2	27.9
MB20WN0129	3/12/2020	623.2	27.9
MB20WN0129	2/12/2020	623.2	27.9
MB20WN0129	1/12/2020	623.2	27.9
MB20WN0129	30/11/2020	623.2	27.9
MB20WN0129	29/11/2020	623.3	27.8
MB20WN0129	28/11/2020	623.3	27.8
MB20WN0129	27/11/2020	623.3	27.8
MB20WN0129	26/11/2020	623.4	27.7
MB20WN0129	25/11/2020	623.4	27.7
MB20WN0129	24/11/2020	623.4	27.7
MB20WN0129	23/11/2020	623.4	27.7
MB20WN0129	22/11/2020	623.4	27.7
MB20WN0129	21/11/2020	623.4	27.7
MB20WN0131	2/03/2022	618.7	25.3
MB20WN0131	1/03/2022	618.7	25.3
MB20WN0131	28/02/2022	618.7	25.3
MB20WN0131	27/02/2022	618.7	25.3
MB20WN0131	26/02/2022	618.7	25.3
MB20WN0131	25/02/2022	618.7	25.3
MB20WN0131	24/02/2022	618.7	25.3
MB20WN0131	23/02/2022	618.7	25.3
MB20WN0131	22/02/2022	618.7	25.4
MB20WN0131	21/02/2022	618.6	25.4
MB20WN0131	20/02/2022	618.6	25.4
MB20WN0131	19/02/2022	618.7	25.4
MB20WN0131	18/02/2022	618.6	25.4
MB20WN0131	17/02/2022	618.6	25.4
MB20WN0131	16/02/2022	618.6	25.4
MB20WN0131	15/02/2022	618.6	25.4
MB20WN0131	14/02/2022	618.6	25.5
MB20WN0131	13/02/2022	618.5	25.5
MB20WN0131	12/02/2022	618.5	25.5
MB20WN0131	11/02/2022	618.5	25.5
MB20WN0131	10/02/2022	618.5	25.5
MB20WN0131	9/02/2022	618.5	25.5
MB20WN0131	8/02/2022	618.5	25.6
MB20WN0131	7/02/2022	618.5	25.5
MB20WN0131	6/02/2022	618.4	25.6
MB20WN0131	5/02/2022	618.5	25.6
MB20WN0131	4/02/2022	618.5	25.6
MB20WN0131	3/02/2022	618.5	25.6
MB20WN0131	2/02/2022	618.5	25.6
MB20WN0131	1/02/2022	618.4	25.6
MB20WN0131	31/01/2022	618.4	25.6
MB20WN0131	30/01/2022	618.4	25.6
MB20WN0131	29/01/2022	618.4	25.6
MB20WN0131	28/01/2022	618.4	25.6
MB20WN0131	27/01/2022	618.4	25.6
MB20WN0131	26/01/2022	618.4	25.7
MB20WN0131	25/01/2022	618.3	25.7
MB20WN0131	24/01/2022	618.4	25.7
MB20WN0131	23/01/2022	618.4	25.6
MB20WN0131	22/01/2022	618.4	25.6
MB20WN0131	21/01/2022	618.4	25.6
MB20WN0131	20/01/2022	618.4	25.6
MB20WN0131	19/01/2022	618.4	25.6

ID	Date	WL mAHD	WL mbgl
MB18HD20002	13/10/2018	627.0	83.5
MB18HD20002	14/10/2018	627.0	83.5
MB18HD20002	15/10/2018	627.0	83.5
MB18HD20002	16/10/2018	627.0	83.5
MB18HD20002	18/10/2018	627.0	83.5
MB18HD20002	20/10/2018	627.0	83.5
MB18HD20002	21/10/2018	627.0	83.5
MB18HD20002	22/10/2018	627.0	83.5
MB18HD20002	23/10/2018	627.0	83.5
MB18HD20002	24/10/2018	627.0	83.5
MB18HD20002	25/10/2018	627.0	83.5
MB18HD20002	26/10/2018	627.0	83.5
MB18HD20002	27/10/2018	627.0	83.5
MB18HD20002	28/10/2018	627.0	83.5
MB18HD20002	29/10/2018	627.0	83.5
MB18HD20002	30/10/2018	627.0	83.5
MB18HD20002	31/10/2018	627.0	83.5
MB18HD20002	1/11/2018	627.0	83.6
MB18HD20002	2/11/2018	627.0	83.5
MB18HD20002	3/11/2018	627.0	83.5
MB18HD20002	4/11/2018	627.0	83.5
MB18HD20002	5/11/2018	627.0	83.6
MB18HD20002	6/11/2018	626.9	83.6
MB18HD20002	7/11/2018	627.0	83.6
MB18HD20002	8/11/2018	627.0	83.6
MB18HD20002	9/11/2018	627.0	83.6
MB18HD20002	10/11/2018	627.0	83.6
MB18HD20002	11/11/2018	626.9	83.6
MB18HD20002	13/11/2018	626.9	83.6
MB18HD20002	14/11/2018	627.0	83.6
MB18HD20002	15/11/2018	627.0	83.5
MB18HD20002	16/11/2018	627.0	83.5
MB18HD20002	17/11/2018	627.0	83.5
MB18HD20002	18/11/2018	627.0	83.6
MB18HD20002	19/11/2018	626.9	83.6
MB18HD20002	20/11/2018	626.9	83.6
MB18HD20002	21/11/2018	626.9	83.6
MB18HD20002	22/11/2018	626.9	83.6
MB18HD20002	23/11/2018	626.9	83.6
MB18HD20002	24/11/2018	626.9	83.6
MB18HD20002	25/11/2018	626.9	83.6
MB18HD20002	26/11/2018	626.9	83.6
MB18HD20002	27/11/2018	626.9	83.6
MB18HD20002	28/11/2018	626.9	83.6
MB18HD20002	29/11/2018	626.9	83.6
MB18HD20002	30/11/2018	626.9	83.6
MB18HD20002	1/12/2018	626.9	83.6
MB18HD20002	2/12/2018	626.9	83.6
MB18HD20002	3/12/2018	626.9	83.6
MB18HD20002	4/12/2018	626.9	83.6
MB18HD20002	5/12/2018	626.9	83.6
MB18HD20002	6/12/2018	626.9	83.6
MB18HD20002	7/12/2018	626.9	83.6
MB18HD20002	8/12/2018	626.9	83.6
MB18HD20002	9/12/2018	626.9	83.6
MB18HD20002	10/12/2018	626.9	83.6
MB18HD20002	11/12/2018	626.9	83.6
MB18HD20002	12/12/2018	626.9	83.6
MB18HD20002	13/12/2018	626.9	83.6
MB18HD20002	14/12/2018	626.9	83.6
MB18HD20002	15/12/2018	626.9	83.6
MB18HD20002	16/12/2018	626.9	83.6
MB18HD20002	17/12/2018	626.9	83.6
MB18HD20002	18/12/2018	626.9	83.6
MB18HD20002	19/12/2018	626.9	83.6
MB18HD20002	20/12/2018	626.9	83.6
MB18HD20002	21/12/2018	626.9	83.6
MB18HD20002	22/12/2018	626.9	83.6
MB18HD20002	23/12/2018	626.9	83.6
MB18HD20002	24/12/2018	626.9	83.6
MB18HD20002	25/12/2018	626.9	83.6
MB18HD20002	26/12/2018	626.9	83.6
MB18HD20002	27/12/2018	626.9	83.6
MB18HD20002	28/12/2018	626.9	83.6
MB18HD20002	29/12/2018	626.9	83.6
MB18HD20002	30/12/2018	626.9	83.6
MB18HD20002	31/12/2018	626.9	83.6
MB18HD20002	1/01/2019	626.9	83.6
MB18HD20002	2/01/2019	626.9	83.6
MB18HD20002	3/01/2019	626.9	83.6
MB18HD20002	4/01/2019	626.9	83.6
MB18HD20002	5/01/2019	626.9	83.6
MB18HD20002	6/01/2019	626.9	83.6
MB18HD20002	7/01/2019	626.9	83.6
MB18HD20002	8/01/2019	626.9	83.6
MB18HD20002	9/01/2019	626.9	83.6
MB18HD20002	10/01/2019	626.9	83.6
MB18HD20002	11/01/2019	626.9	83.6
MB18HD20002	12/01/2019	626.9	83.6
MB18HD20002	13/01/2019	626.9	83.6
MB18HD20002	14/01/2019	626.9	83.6
MB18HD20002	15/01/2019	626.9	83.6
MB18HD20002	16/01/2019	626.9	83.6
MB18HD20002	17/01/2019	626.9	83.6
MB18HD20002	18/01/2019	626.9	83.6
MB18HD20002	19/01/2019	626.9	83.6
MB18HD20002	20/01/2019	626.9	83.6
MB18HD20002	21/01/2019	626.9	83.6
MB18HD20002	22/01/2019	626.9	83.6
MB18HD20002	23/01/2019	626.9	83.6

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDRE2	14/07/2019	627.8	51.1
HDRE2	13/07/2019	627.8	51.1
HDRE2	12/07/2019	627.8	51.1
HDRE2	11/07/2019	627.8	51.1
HDRE2	10/07/2019	627.8	51.1
HDRE2	9/07/2019	627.8	51.1
HDRE2	8/07/2019	627.8	51.1
HDRE2	7/07/2019	627.8	51.1
HDRE2	6/07/2019	627.7	51.1
HDRE2	5/07/2019	627.7	51.1
HDRE2	4/07/2019	627.7	51.1
HDRE2	3/07/2019	627.7	51.1
HDRE2	2/07/2019	627.7	51.1
HDRE2	1/07/2019	627.7	51.1
HDRE2	30/06/2019	627.7	51.1
HDRE2	29/06/2019	627.7	51.1
HDRE2	28/06/2019	627.7	51.1
HDRE2	27/06/2019	627.7	51.1
HDRE2	26/06/2019	627.7	51.1
HDRE2	25/06/2019	627.7	51.1
HDRE2	24/06/2019	627.7	51.1
HDRE2	23/06/2019	627.7	51.1
HDRE2	22/06/2019	627.7	51.1
HDRE2	21/06/2019	627.7	51.1
HDRE2	20/06/2019	627.7	51.1
HDRE2	19/06/2019	627.7	51.2
HDRE2	18/06/2019	627.7	51.1
HDRE2	17/06/2019	627.7	51.1
HDRE2	16/06/2019	627.7	51.1
HDRE2	15/06/2019	627.7	51.1
HDRE2	14/06/2019	627.7	51.1
HDRE2	13/06/2019	627.7	51.1
HDRE2	12/06/2019	627.7	51.1
HDRE2	11/06/2019	627.7	51.1
HDRE2	10/06/2019	627.7	51.2
HDRE2	9/06/2019	627.7	51.2
HDRE2	8/06/2019	627.7	51.2
HDRE2	7/06/2019	627.7	51.1
HDRE2	6/06/2019	627.7	51.1
HDRE2	5/06/2019	627.7	51.1
HDRE2	4/06/2019	627.7	51.1
HDRE2	3/06/2019	627.8	51.1
HDRE2	2/06/2019	627.7	51.1
HDRE2	1/06/2019	627.8	51.1
HDRE2	31/05/2019	627.7	51.1
HDRE2	30/05/2019	627.7	51.1
HDRE2	29/05/2019	627.7	51.1
HDRE2	28/05/2019	627.7	51.1
HDRE2	27/05/2019	627.7	51.1
HDRE2	26/05/2019	627.7	51.1
HDRE2	25/05/2019	627.7	51.1
HDRE2	24/05/2019	627.7	51.1
HDRE2	23/05/2019	627.7	51.1
HDRE2	22/05/2019	627.7	51.1
HDRE2	21/05/2019	627.7	51.1
HDRE2	20/05/2019	627.7	51.1
HDRE2	19/05/2019	627.7	51.1
HDRE2	18/05/2019	627.7	51.1
HDRE2	17/05/2019	627.7	51.1
HDRE2	16/05/2019	627.7	51.1
HDRE2	15/05/2019	627.7	51.1
HDRE2	14/05/2019	627.7	51.1
HDRE2	13/05/2019	627.7	51.1
HDRE2	12/05/2019	627.7	51.1
HDRE2	11/05/2019	627.8	51.1
HDRE2	10/05/2019	627.8	51.1
HDRE2	9/05/2019	627.8	51.1
HDRE2	8/05/2019	627.7	51.1
HDRE2	7/05/2019	627.7	51.1
HDRE2	6/05/2019	627.7	51.1
HDRE2	5/05/2019	627.7	51.1
HDRE2	4/05/2019	627.7	51.1
HDRE2	3/05/2019	627.7	51.1
HDRE2	2/05/2019	627.7	51.1
HDRE2	1/05/2019	627.7	51.2
HDRE2	30/04/2019	627.7	51.2
HDRE2	29/04/2019	627.7	51.1
HDRE2	28/04/2019	627.7	51.1
HDRE2	27/04/2019	627.7	51.1
HDRE2	26/04/2019	627.7	51.1
HDRE2	25/04/2019	627.7	51.1
HDRE2	24/04/2019	627.7	51.1
HDRE2	23/04/2019	627.7	51.1
HDRE2	22/04/2019	627.7	51.1
HDRE2	21/04/2019	627.7	51.1
HDRE2	20/04/2019	627.7	51.1
HDRE2	19/04/2019	627.7	51.2
HDRE2	18/04/2019	627.7	51.2
HDRE2	17/04/2019	627.7	51.2
HDRE2	16/04/2019	627.7	51.2
HDRE2	15/04/2019	627.7	51.2
HDRE2	14/04/2019	627.7	51.2
HDRE2	13/04/2019	627.7	51.1
HDRE2	12/04/2019	627.7	51.1
HDRE2	11/04/2019	627.7	51.1
HDRE2	10/04/2019	627.7	51.1
HDRE2	9/04/2019	627.7	51.1
HDRE2	8/04/2019	627.7	51.2
HDRE2	7/04/2019	627.7	51.2
HDRE2	6/04/2019	627.7	51.1
HDRE2	5/04/2019	627.7	51.1
HDRE2	4/04/2019	627.7	51.2
HDRE2	3/04/2019	627.7	51.2
HDRE2	2/04/2019	627.7	51.2
HDRE2	1/04/2019	627.7	51.2
HDRE2	31/03/2019	627.7	51.2
HDRE2	30/03/2019	627.7	51.2
HDRE2	29/03/2019	627.7	51.2
HDRE2	28/03/2019	627.7	51.2
HDRE2	27/03/2019	627.7	51.2
HDRE2	26/03/2019	627.7	51.2
HDRE2	25/03/2019	627.7	51.2
HDRE2	24/03/2019	627.6	51.2
HDRE2	23/03/2019	627.6	51.2
HDRE2	22/03/2019	627.6	51.2
HDRE2	21/03/2019	627.6	51.2
HDRE2	20/03/2019	627.6	51.2
HDRE2	19/03/2019	627.6	51.2
HDRE2	18/03/2019	627.6	51.2
HDRE2	17/03/2019	627.6	51.2
HDRE2	16/03/2019	627.6	51.2
HDRE2	15/03/2019	627.6	51.2
HDRE2	14/03/2019	627.7	51.2
HDRE2	13/03/2019	627.6	51.2
HDRE2	12/03/2019	627.6	51.2
HDRE2	11/03/2019	627.6	51.2
HDRE2	10/03/2019	627.6	51.2
HDRE2	9/03/2019	627.6	51.2
HDRE2	8/03/2019	627.6	51.2
HDRE2	7/03/2019	627.6	51.2
HDRE2	6/03/2019	627.6	51.2
HDRE2	5/03/2019	627.6	51.2
HDRE2	4/03/2019	627.6	51.2
HDRE2	3/03/2019	627.6	51.2
HDRE2	2/03/2019	627.6	51.2
HDRE2	1/03/2019	627.6	51.3

ID	Date	WL mAHD	WL mbgl
HDVRP1	10/08/2019	625.0	59.5
HDVRP1	9/08/2019	624.7	59.8
HDVRP1	8/08/2019	625.0	59.6
HDVRP1	7/08/2019	624.7	59.8
HDVRP1	6/08/2019	624.8	59.7
HDVRP1	5/08/2019	625.0	59.5
HDVRP1	4/08/2019	624.8	59.7
HDVRP1	3/08/2019	625.0	59.5
HDVRP1	2/08/2019	624.8	59.7
HDVRP1	1/08/2019	625.0	59.5
HDVRP1	31/07/2019	624.8	59.8
HDVRP1	30/07/2019	625.0	59.5
HDVRP1	29/07/2019	624.7	59.8
HDVRP1	28/07/2019	624.8	59.7
HDVRP1	27/07/2019	625.0	59.6
HDVRP1	26/07/2019	624.8	59.7
HDVRP1	25/07/2019	624.9	59.6
HDVRP1	24/07/2019	624.9	59.6
HDVRP1	23/07/2019	625.0	59.5
HDVRP1	22/07/2019	624.9	59.7
HDVRP1	21/07/2019	625.0	59.5
HDVRP1	20/07/2019	625.0	59.5
HDVRP1	19/07/2019	624.7	59.9
HDVRP1	18/07/2019	624.7	59.8
HDVRP1	17/07/2019	624.9	59.6
HDVRP1	16/07/2019	625.2	59.3
HDVRP1	15/07/2019	625.2	59.4
HDVRP1	14/07/2019	625.1	59.4
HDVRP1	13/07/2019	625.0	59.6
HDVRP1	12/07/2019	624.7	59.8
HDVRP1	11/07/2019	625.0	59.5
HDVRP1	10/07/2019	624.7	59.9
HDVRP1	9/07/2019	624.9	59.6
HDVRP1	8/07/2019	624.7	59.8
HDVRP1	7/07/2019	624.9	59.6
HDVRP1	6/07/2019	624.8	59.7
HDVRP1	5/07/2019	624.8	59.7
HDVRP1	4/07/2019	625.0	59.6
HDVRP1	3/07/2019	624.7	59.8
HDVRP1	2/07/2019	625.0	59.5
HDVRP1	1/07/2019	624.6	59.9
HDVRP1	30/06/2019	624.9	59.7
HDVRP1	29/06/2019	624.7	59.8
HDVRP1	28/06/2019	624.7	59.8
HDVRP1	27/06/2019	624.8	59.7
HDVRP1	26/06/2019	624.7	59.8
HDVRP1	25/06/2019	625.0	59.6
HDVRP1	24/06/2019	624.7	59.8
HDVRP1	23/06/2019	625.0	59.6
HDVRP1	22/06/2019	624.7	59.9
HDVRP1	21/06/2019	625.0	59.5
HDVRP1	20/06/2019	624.6	59.9
HDVRP1	19/06/2019	624.9	59.6
HDVRP1	18/06/2019	624.7	59.8
HDVRP1	17/06/2019	624.9	59.7
HDVRP1	16/06/2019	624.8	59.8
HDVRP1	15/06/2019	624.9	59.6
HDVRP1	14/06/2019	624.7	59.8
HDVRP1	13/06/2019	624.9	59.7
HDVRP1	12/06/2019	624.8	59.7
HDVRP1	11/06/2019	624.8	59.7
HDVRP1	10/06/2019	624.8	59.7
HDVRP1	9/06/2019	624.8	59.7
HDVRP1	8/06/2019	624.8	59.7
HDVRP1	7/06/2019	624.9	59.7
HDVRP1	6/06/2019	624.8	59.7
HDVRP1	5/06/2019	624.7	59.8
HDVRP1	4/06/2019	624.7	59.9
HDVRP1	3/06/2019	624.7	59.8
HDVRP1	2/06/2019	624.8	59.7
HDVRP1	1/06/2019	624.8	59.7
HDVRP1	31/05/2019	624.7	59.8
HDVRP1	30/05/2019	624.8	59.7
HDVRP1	29/05/2019	624.7	59.8
HDVRP1	28/05/2019	624.9	59.6
HDVRP1	27/05/2019	624.7	59.9
HDVRP1	26/05/2019	624.9	59.6
HDVRP1	25/05/2019	624.7	59.8
HDVRP1	24/05/2019	624.8	59.8
HDVRP1	23/05/2019	624.6	59.9
HDVRP1	22/05/2019	624.6	59.9
HDVRP1	21/05/2019	624.6	59.9
HDVRP1	20/05/2019	624.6	59.9
HDVRP1	19/05/2019	624.6	59.9
HDVRP1	18/05/2019	624.6	59.9
HDVRP1	17/05/2019	624.6	59.9
HDVRP1	16/05/2019	624.7	59.8
HDVRP1	15/05/2019	624.6	59.9
HDVRP1	14/05/2019	624.6	59.9
HDVRP1	13/05/2019	624.7	59.9
HDVRP1	12/05/2019	624.6	59.9
HDVRP1	11/05/2019	624.6	59.9
HDVRP1	10/05/2019	624.7	59.8
HDVRP1	9/05/2019	624.6	59.9
HDVRP1	8/05/2019	624.6	59.9
HDVRP1	7/05/2019	624.9	59.6
HDVRP1	6/05/2019	624.6	59.9
HDVRP1	5/05/2019	624.6	59.9
HDVRP1	4/05/2019	624.8	59.7
HDVRP1	3/05/2019	624.6	59.9
HDVRP1	2/05/2019	624.6	59.9
HDVRP1	1/05/2019	624.6	59.9
HDVRP1	30/04/2019	624.6	59.9
HDVRP1	29/04/2019	624.6	59.9
HDVRP1	28/04/2019	624.7	59.9
HDVRP1	27/04/2019	624.7	59.8
HDVRP1	26/04/2019	624.7	59.8
HDVRP1	25/04/2019	624.6	59.9
HDVRP1	24/04/2019	624.7	59.8
HDVRP1	23/04/2019	624.6	59.9
HDVRP1	22/04/2019	624.7	59.8
HDVRP1	21/04/2019	624.8	59.7
HDVRP1	20/04/2019	624.9	59.6
HDVRP1	19/04/2019	624.8	59.7
HDVRP1	18/04/2019	624.8	59.7
HDVRP1	17/04/2019	624.7	59.9
HDVRP1	16/04/2019	624.9	59.7
HDVRP1	15/04/2019	624.5	60.0
HDVRP1	14/04/2019	624.5	60.0
HDVRP1	13/04/2019	624.8	59.7
HDVRP1	12/04/2019	624.5	60.0
HDVRP1	11/04/2019	624.5	60.0
HDVRP1	10/04/2019	624.5	60.0
HDVRP1	9/04/2019	624.5	60.0
HDVRP1	8/04/2019	624.5	60.0
HDVRP1	7/04/2019	624.6	60.0
HDVRP1	6/04/2019	624.5	60.0
HDVRP1	5/04/2019	624.6	60.0
HDVRP1	4/04/2019	624.6	60.0
HDVRP1	3/04/2019	624.6	60.0
HDVRP1	2/04/2019	624.5	60.0
HDVRP1	1/04/2019	624.5	60.0
HDVRP1	31/03/2019	624.5	60.0
HDVRP1	30/03/2019	624.5	60.0
HDVRP1	29/03/2019	624.5	60.0
HDVRP1	28/03/2019	624.6	59.9

ID	Date	WL mAHD	WL mbgl
MB20WN0131	18/01/2022	618.4	25.6
MB20WN0131	17/01/2022	618.3	25.7
MB20WN0131	16/01/2022	618.3	25.7
MB20WN0131	15/01/2022	618.3	25.7
MB20WN0131	14/01/2022	618.3	25.7
MB20WN0131	13/01/2022	618.4	25.6
MB20WN0131	12/01/2022	618.4	25.6
MB20WN0131	11/01/2022	618.4	25.6
MB20WN0131	10/01/2022	618.4	25.6
MB20WN0131	9/01/2022	618.4	25.6
MB20WN0131	8/01/2022	618.4	25.6
MB20WN0131	7/01/2022	618.4	25.6
MB20WN0131	6/01/2022	618.4	25.6
MB20WN0131	5/01/2022	618.4	25.6
MB20WN0131	4/01/2022	618.4	25.6
MB20WN0131	3/01/2022	618.4	25.6
MB20WN0131	2/01/2022	618.4	25.6
MB20WN0131	1/01/2022	618.4	25.6
MB20WN0131	31/12/2021	618.4	25.6
MB20WN0131	30/12/2021	618.4	25.6
MB20WN0131	29/12/2021	618.4	25.6
MB20WN0131	28/12/2021	618.4	25.6
MB20WN0131	27/12/2021	618.4	25.6
MB20WN0131	26/12/2021	618.5	25.6
MB20WN0131	25/12/2021	618.5	25.6
MB20WN0131	24/12/2021	618.4	25.6
MB20WN0131	23/12/2021	618.4	25.6
MB20WN0131	22/12/2021	618.5	25.6
MB20WN0131	21/12/2021	618.5	25.5
MB20WN0131	20/12/2021	618.5	25.5
MB20WN0131	19/12/2021	618.5	25.5
MB20WN0131	18/12/2021	618.5	25.5
MB20WN0131	17/12/2021	618.5	25.5
MB20WN0131	16/12/2021	618.5	25.5
MB20WN0131	15/12/2021	618.5	25.5
MB20WN0131	14/12/2021	618.5	25.5
MB20WN0131	13/12/2021	618.5	25.5
MB20WN0131	12/12/2021	618.5	25.5
MB20WN0131	11/12/2021	618.5	25.5
MB20WN0131	10/12/2021	618.5	25.5
MB20WN0131	9/12/2021	618.5	25.5
MB20WN0131	8/12/2021	618.5	25.5
MB20WN0131	7/12/2021	618.5	25.5
MB20WN0131	6/12/2021	618.5	25.5
MB20WN0131	5/12/2021	618.5	25.5
MB20WN0131	4/12/2021	618.5	25.5
MB20WN0131	3/12/2021	618.5	25.5
MB20WN0131	2/12/2021	618.5	25.5
MB20WN0131	1/12/2021	618.5	25.5
MB20WN0131	30/11/2021	618.5	25.5
MB20WN0131	29/11/2021	618.6	25.4
MB20WN0131	28/11/2021	618.6	25.4
MB20WN0131	27/11/2021	618.6	25.4
MB20WN0131	26/11/2021	618.6	25.4
MB20WN0131	25/11/2021	618.6	25.4
MB20WN0131	24/11/2021	618.6	25.4
MB20WN0131	23/11/2021	618.6	25.4
MB20WN0131	22/11/2021	618.6	25.4
MB20WN0131	21/11/2021	618.6	25.4
MB20WN0131	20/11/2021	618.6	25.4
MB20WN0131	19/11/2021	618.6	25.4
MB20WN0131	18/11/2021	618.6	25.4
MB20WN0131	17/11/2021	618.6	25.4
MB20WN0131	16/11/2021	618.6	25.4
MB20WN0131	15/11/2021	618.6	25.4
MB20WN0131	14/11/2021	618.7	25.4
MB20WN0131	13/11/2021	618.7	25.4
MB20WN0131	12/11/2021	618.7	25.3
MB20WN0131	11/11/2021	618.7	25.4
MB20WN0131	10/11/2021	618.6	25.4
MB20WN0131	9/11/2021	618.6	25.4
MB20WN0131	8/11/2021	618.6	25.4
MB20WN0131	7/11/2021	618.6	25.4
MB20WN0131	6/11/2021	618.6	25.4
MB20WN0131	5/11/2021	618.7	25.4
MB20WN0131	4/11/2021	618.7	25.3
MB20WN0131	3/11/2021	618.7	25.3
MB20WN0131	2/11/2021	618.7	25.3
MB20WN0131	1/11/2021	618.7	25.3
MB20WN0131	31/10/2021	618.7	25.3
MB20WN0131	30/10/2021	618.7	25.3
MB20WN0131	29/10/2021	618.7	25.3
MB20WN0131	28/10/2021	618.7	25.3
MB20WN0131	27/10/2021	618.7	25.3
MB20WN0131	26/10/2021	618.7	25.3
MB20WN0131	25/10/2021	618.7	25.3
MB20WN0131	24/10/2021	618.7	25.3
MB20WN0131	23/10/2021	618.8	25.3
MB20WN0131	22/10/2021	618.8	25.3
MB20WN0131	21/10/2021	618.8	25.3
MB20WN0131	20/10/2021	618.8	25.3
MB20WN0131	19/10/2021	618.8	25.3
MB20WN0131	18/10/2021	618.8	25.3
MB20WN0131	17/10/2021	618.7	25.3
MB20WN0131	16/10/2021	618.7	25.3
MB20WN0131	15/10/2021	618.7	25.3
MB20WN0131	14/10/2021	618.8	25.3
MB20WN0131	13/10/2021	618.8	25.2
MB20WN0131	12/10/2021	618.8	25.2
MB20WN0131	11/10/2021	618.8	25.2
MB20WN0131	10/10/2021	618.8	25.2
MB20WN0131	9/10/2021	618.8	25.2
MB20WN0131	8/10/2021	618.8	25.3
MB20WN0131	7/10/2021	618.8	25.2
MB20WN0131	6/10/2021	618.8	25.2
MB20WN0131	5/10/2021	618.8	25.3
MB20WN0131	4/10/2021	618.8	25.2
MB20WN0131	3/10/2021	618.8	25.2
MB20WN0131	2/10/2021	618.8	25.2
MB20WN0131	1/10/2021	618.8	25.2
MB20WN0131	30/09/2021	618.8	25.2
MB20WN0131	29/09/2021	618.8	25.2
MB20WN0131	28/09/2021	618.8	25.2
MB20WN0131	27/09/2021	618.8	25.2
MB20WN0131	26/09/2021	618.8	25.2
MB20WN0131	25/09/2021	618.8	25.2
MB20WN0131	24/09/2021	618.8	25.2
MB20WN0131	23/09/2021	618.9	25.1
MB20WN0131	22/09/2021	618.9	25.1
MB20WN0131	21/09/2021	618.9	25.1
MB20WN0131	20/09/2021	618.9	25.1
MB20WN0131	19/09/2021	618.9	25.1
MB20WN0131	18/09/2021	618.9	25.1
MB20WN0131	17/09/2021	618.9	25.1
MB20WN0131	16/09/2021	618.9	25.1
MB20WN0131	15/09/2021	618.9	25.1
MB20WN0131	14/09/2021	618.9	25.1
MB20WN0131	13/09/2021	618.9	25.1
MB20WN0131	12/09/2021	618.9	25.1
MB20WN0131	11/09/2021	618.9	25.1
MB20WN0131	10/09/2021	618.9	25.1
MB20WN0131	9/09/2021	619.0	25.1
MB20WN0131	8/09/2021	619.0	25.0
MB20WN0131	7/09/2021	619.0	25.0
MB20WN0131	6/09/2021	619.0	25.0
MB20WN0131	5/09/2021	619.0	25.0

ID	Date	WL mAHD	WL mbgl
MB18HD20002	1/03/2019	626.9	83.6
MB18HD20002	2/03/2019	626.9	83.6
MB18HD20002	3/03/2019	626.9	83.6
MB18HD20002	4/03/2019	627.0	83.6
MB18HD20002	5/03/2019	627.0	83.6
MB18HD20002	6/03/2019	626.9	83.6
MB18HD20002	7/03/2019	626.9	83.6
MB18HD20002	8/03/2019	626.9	83.6
MB18HD20002	9/03/2019	626.9	83.6
MB18HD20002	10/03/2019	626.9	83.6
MB18HD20002	11/03/2019	627.0	83.6
MB18HD20002	12/03/2019	627.0	83.6
MB18HD20002	13/03/2019	627.0	83.5
MB18HD20002	14/03/2019	627.0	83.5
MB18HD20002	15/03/2019	627.0	83.6
MB18HD20002	16/03/2019	627.0	83.6
MB18HD20002	17/03/2019	626.9	83.6
MB18HD20002	18/03/2019	626.9	83.6
MB18HD20002	19/03/2019	626.9	83.6
MB18HD20002	20/03/2019	626.9	83.6
MB18HD20002	21/03/2019	626.9	83.6
MB18HD20002	22/03/2019	626.9	83.6
MB18HD20002	23/03/2019	626.9	83.6
MB18HD20002	24/03/2019	626.9	83.6
MB18HD20002	25/03/2019	626.9	83.6
MB18HD20002	26/03/2019	626.9	83.6
MB18HD20002	27/03/2019	627.0	83.6
MB18HD20002	28/03/2019	627.0	83.6
MB18HD20002	29/03/2019	627.0	83.6
MB18HD20002	30/03/2019	627.0	83.5
MB18HD20002	31/03/2019	627.0	83.5
MB18HD20002	1/04/2019	627.0	83.5
MB18HD20002	2/04/2019	627.0	83.5
MB18HD20002	3/04/2019	627.0	83.5
MB18HD20002	4/04/2019	627.0	83.5
MB18HD20002	5/04/2019	627.0	83.5
MB18HD20002	6/04/2019	627.0	83.5
MB18HD20002	7/04/2019	627.0	83.5
MB18HD20002	8/04/2019	627.0	83.5
MB18HD20002	9/04/2019	627.0	83.5
MB18HD20002	10/04/2019	627.0	83.5
MB18HD20002	11/04/2019	627.0	83.5
MB18HD20002	12/04/2019	627.0	83.5
MB18HD20002	13/04/2019	627.0	83.5
MB18HD20002	14/04/2019	627.0	83.5
MB18HD20002	15/04/2019	627.0	83.5
MB18HD20002	16/04/2019	627.0	83.5
MB18HD20002	17/04/2019	627.0	83.5
MB18HD20002	18/04/2019	627.1	83.5
MB18HD20002	19/04/2019	627.1	83.4
MB18HD20002	20/04/2019	627.1	83.4
MB18HD20002	21/04/2019	627.1	83.4
MB18HD20002	22/04/2019	627.1	83.4
MB18HD20002	23/04/2019	627.1	83.5
MB18HD20002	24/04/2019	627.0	83.5
MB18HD20002	25/04/2019	627.0	83.5
MB18HD20002	26/04/2019	627.0	83.5
MB18HD20002	27/04/2019	627.0	83.5
MB18HD20002	28/04/2019	627.0	83.5
MB18HD20002	29/04/2019	627.0	83.5
MB18HD20002	30/04/2019	627.0	83.5
MB18HD20002	1/05/2019	627.0	83.5
MB18HD20002	2/05/2019	627.0	83.5
MB18HD20002	3/05/2019	627.0	83.5
MB18HD20002	4/05/2019	627.0	83.5
MB18HD20002	5/05/2019	627.0	83.5
MB18HD20002	6/05/2019	627.0	83.5
MB18HD20002	7/05/2019	627.0	83.5
MB18HD20002	8/05/2019	627.0	83.5
MB18HD20002	9/05/2019	627.0	83.5
MB18HD20002	10/05/2019	627.0	83.5
MB18HD20002	15/05/2019	627.0	83.5
MB18HD20002	16/05/2019	627.0	83.5
MB18HD20002	17/05/2019	627.0	83.5
MB18HD20002	18/05/2019	627.0	83.5
MB18HD20002	19/05/2019	627.0	83.5
MB18HD20002	20/05/2019	627.0	83.5
MB18HD20002	21/05/2019	627.0	83.5
MB18HD20002	22/05/2019	627.0	83.5
MB18HD20002	23/05/2019	627.0	83.5
MB18HD20002	24/05/2019	627.0	83.5
MB18HD20002	25/05/2019	627.0	83.5
MB18HD20002	26/05/2019	627.0	83.5
MB18HD20002	27/05/2019	627.0	83.5
MB18HD20002	28/05/2019	627.0	83.5
MB18HD20002	29/05/2019	627.0	83.5
MB18HD20002	30/05/2019	627.0	83.5
MB18HD20002	12/06/2019	627.0	83.5
MB18HD20002	13/06/2019	627.0	83.5
MB18HD20002	14/06/2019	627.0	83.5
MB18HD20002	15/06/2019	627.0	83.5
MB18HD20002	16/06/2019	627.0	83.5
MB18HD20002	24/06/2019	627.0	83.5
MB18HD20002	25/06/2019	627.0	83.5
MB18HD20002	26/06/2019	627.0	83.5
MB18HD20002	27/06/2019	627.0	83.5
MB18HD20002	28/06/2019	627.0	83.5
MB18HD20002	29/06/2019	627.0	83.5
MB18HD20002	30/06/2019	627.0	83.5
MB18HD20002	16/07/2019	627.1	83.4

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDRE2	28/02/2019	627.6	51.3
HDRE2	27/02/2019	627.6	51.3
HDRE2	26/02/2019	627.6	51.2
HDRE2	25/02/2019	627.6	51.2
HDRE2	24/02/2019	627.6	51.3
HDRE2	23/02/2019	627.6	51.3
HDRE2	22/02/2019	627.6	51.3
HDRE2	21/02/2019	627.6	51.3
HDRE2	20/02/2019	627.6	51.3
HDRE2	19/02/2019	627.6	51.3
HDRE2	18/02/2019	627.6	51.3
HDRE2	17/02/2019	627.6	51.3
HDRE2	16/02/2019	627.6	51.3
HDRE2	15/02/2019	627.6	51.3
HDRE2	14/02/2019	627.6	51.3
HDRE2	13/02/2019	627.6	51.3
HDRE2	12/02/2019	627.6	51.3
HDRE2	21/08/2018	627.3	51.6
HDRE2	31/07/2018	627.1	51.7
HDRE2	23/06/2018	626.7	52.2
HDRE2	25/05/2018	626.3	52.5
HDRE2	28/04/2018	626.0	52.8
HDRE2	28/03/2018	625.7	53.2
HDRE2	28/12/2017	624.8	54.0
HDRE2	14/10/2017	623.8	55.0
HDRE2	29/09/2017	623.7	55.2
HDRE2	30/08/2017	624.0	54.9
HDRE2	5/07/2017	623.6	55.2
HDRE2	28/04/2017	622.9	56.0
HDRE2	30/03/2017	623.0	55.9
HDRE2	30/01/2017	622.6	56.3
HDRE2	28/12/2016	622.5	56.4
HDRE2	30/10/2016	622.1	56.7
HDRE2	26/09/2016	621.9	56.9
HDRE2	30/08/2016	621.8	57.1
HDRE2	23/07/2016	621.6	57.3
HDRE2	27/06/2016	621.6	57.2
HDRE2	29/05/2016	621.6	57.3
HDRE2	30/04/2016	621.3	57.6
HDRE2	30/03/2016	620.7	58.1
HDRE2	28/02/2016	620.3	58.6
HDRE2	20/01/2016	619.7	59.2
HDRE2	26/11/2015	618.7	60.2
HDRE2	28/10/2015	618.4	60.4
HDRE2	1/08/2015	617.8	61.0
HDRE2	22/06/2015	617.4	61.5
HDRE2	2/06/2015	617.2	61.7
HDRE2	6/05/2015	617.0	61.9
HDRE2	27/03/2015	616.3	62.5
HDRE2	23/02/2015	616.2	62.6
HDRE2	24/01/2015	616.1	62.8
HDRE2	29/12/2014	615.9	63.0
HDRE2	30/11/2014	615.7	63.2
HDRE2	27/10/2014	615.5	63.4
HDRE2	28/09/2014	615.2	63.6
HDRE2	30/08/2014	614.9	63.9
HDRE2	26/07/2014	614.6	64.2
HDRE2	24/06/2014	614.3	64.6
HDRE2	21/05/2014	614.1	64.8
HDRE2	27/04/2014	614.0	64.9
HDRE2	22/03/2014	613.8	65.1
HDRE2	25/02/2014	613.6	65.3
HDRE2	25/01/2014	613.4	65.5
HDRE2	28/12/2013	613.3	65.6
HDRE2	30/11/2013	613.2	65.7
HDRE2	23/10/2013	613.2	65.6
HDRE2	28/09/2013	613.1	65.8
HDRE2	29/08/2013	612.8	66.1
HDRE2	27/07/2013	612.5	66.3
HDRE2	30/06/2013	612.3	66.5
HDRE2	28/05/2013	612.3	66.6
HDRE2	27/04/2013	612.2	66.7
HDRE2	31/03/2013	612.2	66.7
HDRE2	23/02/2013	612.1	66.7
HDRE2	24/01/2013	612.1	66.8
HDRE2	26/12/2012	612.1	66.8
HDRE2	20/11/2012	612.1	66.8
HDRE2	31/10/2012	612.1	66.8
HDRE2	26/09/2012	612.1	66.8
HDRE2	22/08/2012	612.0	66.8
HDRE2	29/07/2012	612.0	66.8
HDRE2	26/05/2012	611.9	67.0
HDRE2	29/04/2012	611.9	67.0
HDRE2	31/03/2012	611.9	67.0
HDRE2	27/02/2012	611.8	67.0
HDRE2	2/02/2012	611.8	67.1
HDRE2	27/12/2011	611.7	67.1
HDRE2	2/12/2011	611.6	67.2
HDRE2	29/10/2011	611.7	67.2
HDRE2	30/09/2011	611.6	67.3
HDRE2	28/08/2011	611.5	67.4
HDRE2	24/07/2011	611.4	67.5
HDRE2	28/06/2011	611.3	67.6
HDRE2	19/05/2011	611.2	67.7
HDRE2	24/04/2011	611.1	67.8
HDRE2	20/03/2011	611.0	67.8
HDRE2	26/02/2011	611.0	67.9
HDRE2	28/01/2011	611.0	67.9
HDRE2	6/01/2011	611.0	67.9
HDRE2	28/12/2010	610.9	67.9
HDRE2	28/11/2010	610.9	68.0
HDRE2	29/10/2010	610.9	68.0
HDRE2	27/09/2010	610.8	68.0
HDRE2	22/08/2010	610.4	68.4
HDRE3	14/09/2020	624.6	59.4
HDRE3	29/06/2020	624.5	59.6
HDRE3	16/03/2020	624.5	59.6
HDRE3	28/12/2019	624.3	59.7
HDRE3	14/12/2019	624.6	59.5
HDRE3	5/04/2019	624.4	59.6
HDRE3	4/04/2019	624.4	59.6
HDRE3	3/04/2019	624.4	59.6
HDRE3	2/04/2019	624.4	59.6
HDRE3	1/04/2019	624.4	59.7
HDRE3	31/03/2019	624.4	59.7
HDRE3	30/03/2019	624.4	59.7
HDRE3	29/03/2019	624.4	59.7
HDRE3	28/03/2019	624.5	59.6
HDRE3	27/03/2019	624.5	59.5
HDRE3	26/03/2019	624.5	59.6
HDRE3	25/03/2019	624.6	59.4
HDRE3	24/03/2019	624.4	59.7
HDRE3	23/03/2019	624.4	59.7
HDRE3	22/03/2019	624.5	59.6
HDRE3	21/03/2019	624.4	59.6
HDRE3	20/03/2019	624.4	59.7
HDRE3	19/03/2019	624.4	59.7
HDRE3	18/03/2019	624.4	59.7
HDRE3	17/03/2019	624.4	59.7
HDRE3	16/03/2019	624.4	59.7
HDRE3	15/03/2019	624.4	59.7
HDRE3	14/03/2019	624.4	59.7
HDRE3	13/03/2019	624.4	59.7
HDRE3	12/03/2019	624.4	59.7
HDRE3	11/03/2019	624.4	59.7
HDRE3	10/03/2019	624.4	59.7

ID	Date	WL mAHD	WL mbgl
HDVRP1	27/03/2019	624.7	59.9
HDVRP1	26/03/2019	624.6	59.9
HDVRP1	25/03/2019	624.8	59.8
HDVRP1	24/03/2019	624.5	60.0
HDVRP1	23/03/2019	624.5	60.0
HDVRP1	22/03/2019	624.6	59.9
HDVRP1	21/03/2019	624.5	60.0
HDVRP1	20/03/2019	624.5	60.0
HDVRP1	19/03/2019	624.5	60.0
HDVRP1	18/03/2019	624.5	60.0
HDVRP1	17/03/2019	624.5	60.0
HDVRP1	16/03/2019	624.5	60.0
HDVRP1	15/03/2019	624.5	60.0
HDVRP1	14/03/2019	624.5	60.0
HDVRP1	13/03/2019	624.5	60.0
HDVRP1	12/03/2019	624.5	60.0
HDVRP1	11/03/2019	624.5	60.0
HDVRP1	10/03/2019	624.5	60.0
HDVRP1	9/03/2019	624.5	60.0
HDVRP1	8/03/2019	624.5	60.0
HDVRP1	7/03/2019	624.5	60.0
HDVRP1	6/03/2019	624.8	59.7
HDVRP1	5/03/2019	624.6	60.0
HDVRP1	4/03/2019	624.7	59.8
HDVRP1	3/03/2019	624.6	59.9
HDVRP1	2/03/2019	624.5	60.0
HDVRP1	1/03/2019	624.6	59.9
HDVRP1	28/02/2019	624.5	60.0
HDVRP1	27/02/2019	624.5	60.0
HDVRP1	26/02/2019	624.5	60.0
HDVRP1	25/02/2019	624.5	60.0
HDVRP1	24/02/2019	624.5	60.0
HDVRP1	23/02/2019	624.5	60.0
HDVRP1	22/02/2019	624.5	60.0
HDVRP1	21/02/2019	624.5	60.0
HDVRP1	20/02/2019	624.5	60.0
HDVRP1	19/02/2019	624.5	60.0
HDVRP1	18/02/2019	624.5	60.0
HDVRP1	17/02/2019	624.5	60.0
HDVRP1	16/02/2019	624.5	60.0
HDVRP1	15/02/2019	624.5	60.0
HDVRP1	14/02/2019	624.5	60.0
HDVRP1	13/02/2019	624.5	60.0
HDVRP1	12/02/2019	624.5	60.0
HDVRP1	11/02/2019	624.5	60.0
HDVRP1	10/02/2019	624.5	60.0
HDVRP1	9/02/2019	624.5	60.0
HDVRP1	8/02/2019	624.5	60.0
HDVRP1	7/02/2019	624.5	60.0
HDVRP1	6/02/2019	624.5	60.0
HDVRP1	5/02/2019	624.5	60.0
HDVRP1	4/02/2019	624.5	60.0
HDVRP1	3/02/2019	624.5	60.0
HDVRP1	2/02/2019	624.5	60.0
HDVRP1	1/02/2019	624.5	60.0
HDVRP1	31/01/2019	624.5	60.0
HDVRP1	30/01/2019	624.5	60.0
HDVRP1	29/01/2019	624.5	60.0
HDVRP1	28/01/2019	624.5	60.0
HDVRP1	27/01/2019	624.5	60.1
HDVRP1	26/01/2019	624.4	60.1
HDVRP1	25/01/2019	624.5	60.1
HDVRP1	24/01/2019	624.5	60.0
HDVRP1	23/01/2019	624.9	59.7
HDVRP1	22/01/2019	624.6	59.9
HDVRP1	21/01/2019	624.6	59.9
HDVRP1	20/01/2019	624.6	59.9
HDVRP1	19/01/2019	624.5	60.0
HDVRP1	18/01/2019	624.5	60.0
HDVRP1	17/01/2019	624.5	60.0
HDVRP1	16/01/2019	624.5	60.1
HDVRP1	15/01/2019	624.5	60.1
HDVRP1	28/03/2018	624.7	59.8
HDVRP1	28/12/2017	625.0	59.5
HDVRP1	14/10/2017	624.2	60.3
HDVRP1	29/09/2017	624.6	59.9
HDVRP1	14/07/2017	624.6	59.9
HDVRP1	5/07/2017	625.4	59.2
HDVRP1	28/04/2017	624.5	60.0
HDVRP1	30/03/2017	625.2	59.3
HDVRP1	30/01/2017	625.3	59.2
HDVRP1	28/12/2016	625.0	59.5
HDVRP1	30/11/2016	624.7	59.8
HDVRP1	30/10/2016	625.1	59.4
HDVRP1	26/09/2016	627.7	56.8
HDVRP1	30/08/2016	624.8	59.7
HDVRP1	23/07/2016	625.3	59.2
HDVRP1	27/06/2016	624.7	59.8
HDVRP1	29/05/2016	624.7	59.9
HDVRP1	30/04/2016	625.0	59.5
HDVRP1	30/03/2016	624.7	59.8
HDVRP1	28/02/2016	624.7	59.9
HDVRP1	20/01/2016	624.8	59.8
HDVRP1	26/11/2015	624.7	59.8
HDVRP1	28/10/2015	624.9	59.7
HDVRP1	1/08/2015	625.1	59.4
HDVRP1	22/06/2015	625.4	59.2
HDVRP1	6/05/2015	625.0	59.5
HDVRP1	27/03/2015	625.2	59.3
HDVRP1	23/02/2015	625.5	59.0
HDVRP1	25/01/2015	625.7	58.8
HDVRP1	29/12/2014	625.5	59.0
HDVRP1	30/11/2014	625.2	59.3
HDVRP1	27/10/2014	625.9	58.6
HDVRP1	28/09/2014	625.9	58.6
HDVRP1	30/08/2014	625.7	58.8
HDVRP1	26/07/2014	625.7	58.8
HDVRP1	24/06/2014	625.3	59.2
HDVRP1	21/05/2014	626.1	58.5
HDVRP1	27/04/2014	625.7	58.8
HDVRP1	22/03/2014	625.8	58.7
HDVRP1	25/02/2014	625.8	58.7
HDVRP1	25/01/2014	625.4	59.2
HDVRP1	28/12/2013	625.4	59.1
HDVRP1	30/11/2013	625.8	58.7
HDVRP1	23/10/2013	625.6	58.9
HDVRP1	28/09/2013	625.8	58.8
HDVRP1	28/08/2013	625.8	58.7
HDVRP1	27/07/2013	625.8	58.7
HDVRP1	30/06/2013	625.8	58.7
HDVRP1	28/05/2013	626.0	58.6
HDVRP1	27/04/2013	625.8	58.7
HDVRP1	31/03/2013	626.1	58.5
HDVRP1	3/03/2013	626.0	58.5
HDVRP1	24/01/2013	625.9	58.6
HDVRP1	26/12/2012	625.9	58.6
HDVRP1	20/11/2012	625.8	58.7
HDVRP1	31/10/2012	626.3	58.3
HDVRP1	26/09/2012	626.1	58.5
HDVRP1	22/08/2012	626.0	58.5
HDVRP1	29/07/2012	626.2	58.3
HDVRP1	27/06/2012	625.8	58.7
HDVRP1	26/05/2012	625.9	58.6
HDVRP1	29/04/2012	625.9	58.6
HDVRP1	31/03/2012	626.0	58.5
HDVRP1	27/02/2012	625.7	58.9

ID	Date	WL mAHD	WL mbgl
MB20WN0131	4/09/2021	619.0	25.0
MB20WN0131	3/09/2021	619.0	25.0
MB20WN0131	2/09/2021	619.0	25.1
MB20WN0131	1/09/2021	618.9	25.1
MB20WN0131	31/08/2021	618.9	25.1
MB20WN0131	30/08/2021	618.9	25.1
MB20WN0131	29/08/2021	619.0	25.1
MB20WN0131	28/08/2021	619.0	25.0
MB20WN0131	27/08/2021	619.0	25.0
MB20WN0131	26/08/2021	619.0	25.1
MB20WN0131	25/08/2021	619.0	25.0
MB20WN0131	24/08/2021	619.0	25.0
MB20WN0131	23/08/2021	619.0	25.0
MB20WN0131	22/08/2021	619.0	25.0
MB20WN0131	21/08/2021	619.0	25.0
MB20WN0131	20/08/2021	619.0	25.0
MB20WN0131	19/08/2021	619.0	25.0
MB20WN0131	17/08/2021	619.1	24.9
MB20WN0131	16/08/2021	619.1	24.9
MB20WN0131	15/08/2021	619.1	25.0
MB20WN0131	14/08/2021	619.0	25.0
MB20WN0131	13/08/2021	619.0	25.0
MB20WN0131	12/08/2021	619.1	24.9
MB20WN0131	11/08/2021	619.1	24.9
MB20WN0131	10/08/2021	619.1	25.0
MB20WN0131	9/08/2021	619.0	25.0
MB20WN0131	8/08/2021	619.1	25.0
MB20WN0131	7/08/2021	619.1	24.9
MB20WN0131	6/08/2021	619.1	24.9
MB20WN0131	5/08/2021	619.1	24.9
MB20WN0131	4/08/2021	619.1	24.9
MB20WN0131	3/08/2021	619.1	24.9
MB20WN0131	2/08/2021	619.1	24.9
MB20WN0131	1/08/2021	619.1	24.9
MB20WN0131	31/07/2021	619.1	24.9
MB20WN0131	30/07/2021	619.0	25.0
MB20WN0131	29/07/2021	619.1	25.0
MB20WN0131	28/07/2021	619.1	25.0
MB20WN0131	27/07/2021	619.1	25.0
MB20WN0131	26/07/2021	619.1	25.0
MB20WN0131	25/07/2021	619.1	24.9
MB20WN0131	24/07/2021	619.1	24.9
MB20WN0131	23/07/2021	619.1	24.9
MB20WN0131	22/07/2021	619.1	24.9
MB20WN0131	21/07/2021	619.1	24.9
MB20WN0131	20/07/2021	619.1	24.9
MB20WN0131	19/07/2021	619.1	24.9
MB20WN0131	18/07/2021	619.1	24.9
MB20WN0131	17/07/2021	619.1	24.9
MB20WN0131	16/07/2021	619.2	24.9
MB20WN0131	15/07/2021	619.1	24.9
MB20WN0131	14/07/2021	619.1	24.9
MB20WN0131	13/07/2021	619.1	24.9
MB20WN0131	12/07/2021	619.1	24.9
MB20WN0131	11/07/2021	619.1	24.9
MB20WN0131	10/07/2021	619.1	24.9
MB20WN0131	9/07/2021	619.1	24.9
MB20WN0131	8/07/2021	619.2	24.8
MB20WN0131	7/07/2021	619.2	24.9
MB20WN0131	6/07/2021	619.2	24.9
MB20WN0131	5/07/2021	619.2	24.9
MB20WN0131	4/07/2021	619.2	24.8
MB20WN0131	3/07/2021	619.2	24.8
MB20WN0131	2/07/2021	619.2	24.8
MB20WN0131	1/07/2021	619.2	24.8
MB20WN0131	30/06/2021	619.2	24.8
MB20WN0131	29/06/2021	619.2	24.8
MB20WN0131	28/06/2021	619.2	24.8
MB20WN0131	27/06/2021	619.2	24.8
MB20WN0131	26/06/2021	619.2	24.8
MB20WN0131	25/06/2021	619.3	24.8
MB20WN0131	24/06/2021	619.3	24.8
MB20WN0131	23/06/2021	619.3	24.8
MB20WN0131	22/06/2021	619.2	24.8
MB20WN0131	21/06/2021	619.2	24.8
MB20WN0131	20/06/2021	619.2	24.8
MB20WN0131	19/06/2021	619.3	24.8
MB20WN0131	18/06/2021	619.3	24.7
MB20WN0131	17/06/2021	619.3	24.7
MB20WN0131	16/06/2021	619.3	24.7
MB20WN0131	15/06/2021	619.3	24.7
MB20WN0131	14/06/2021	619.3	24.7
MB20WN0131	13/06/2021	619.3	24.7
MB20WN0131	12/06/2021	619.3	24.7
MB20WN0131	11/06/2021	619.3	24.8
MB20WN0131	10/06/2021	619.3	24.7
MB20WN0131	9/06/2021	619.3	24.7
MB20WN0131	8/06/2021	619.3	24.7
MB20WN0131	7/06/2021	619.3	24.7
MB20WN0131	6/06/2021	619.3	24.7
MB20WN0131	5/06/2021	619.3	24.7
MB20WN0131	4/06/2021	619.4	24.7
MB20WN0131	3/06/2021	619.4	24.6
MB20WN0131	2/06/2021	619.4	24.6
MB20WN0131	1/06/2021	619.4	24.7
MB20WN0131	31/05/2021	619.3	24.7
MB20WN0131	30/05/2021	619.3	24.7
MB20WN0131	29/05/2021	619.4	24.7
MB20WN0131	28/05/2021	619.4	24.6
MB20WN0131	27/05/2021	619.4	24.6
MB20WN0131	26/05/2021	619.4	24.6
MB20WN0131	25/05/2021	619.5	24.6
MB20WN0131	24/05/2021	619.4	24.6
MB20WN0131	23/05/2021	619.4	24.6
MB20WN0131	22/05/2021	619.4	24.6
MB20WN0131	21/05/2021	619.5	24.5
MB20WN0131	20/05/2021	619.5	24.5
MB20WN0131	19/05/2021	619.5	24.5
MB20WN0131	18/05/2021	619.5	24.5
MB20WN0131	17/05/2021	619.5	24.5
MB20WN0131	16/05/2021	619.5	24.5
MB20WN0131	15/05/2021	619.5	24.5
MB20WN0131	14/05/2021	619.5	24.5
MB20WN0131	13/05/2021	619.5	24.5
MB20WN0131	12/05/2021	619.5	24.5
MB20WN0131	11/05/2021	619.6	24.5
MB20WN0131	10/05/2021	619.6	24.4
MB20WN0131	9/05/2021	619.6	24.4
MB20WN0131	8/05/2021	619.6	24.5
MB20WN0131	7/05/2021	619.6	24.4
MB20WN0131	6/05/2021	619.6	24.5
MB20WN0131	5/05/2021	619.6	24.5
MB20WN0131	4/05/2021	619.6	24.5
MB20WN0131	3/05/2021	619.6	24.4
MB20WN0131	2/05/2021	619.6	24.4
MB20WN0131	1/05/2021	619.6	24.4
MB20WN0131	30/04/2021	619.6	24.4
MB20WN0131	29/04/2021	619.6	24.4
MB20WN0131	28/04/2021	619.6	24.4
MB20WN0131	27/04/2021	619.6	24.4
MB20WN0131	26/04/2021	619.6	24.4
MB20WN0131	25/04/2021	619.6	24.4
MB20WN0131	24/04/2021	619.6	24.4
MB20WN0131	23/04/2021	619.6	24.4
MB20WN0131	22/04/2021	619.6	24.4
MB20WN0131	21/04/2021	619.6	24.5

ID	Date	WL mAHD	WL mbgl
MB18HD20002	2/09/2019	627.0	83.5
MB18HD20002	3/09/2019	627.0	83.5
MB18HD20002	4/09/2019	627.0	83.5
MB18HD20002	5/09/2019	627.0	83.5
MB18HD20002	6/09/2019	627.0	83.5
MB18HD20002	7/09/2019	627.0	83.5
MB18HD20002	8/09/2019	627.0	83.5
MB18HD20002	9/09/2019	627.0	83.5
MB18HD20002	10/09/2019	627.0	83.5
MB18HD20002	11/09/2019	627.0	83.5
MB18HD20002	12/09/2019	627.1	83.5
MB18HD20002	13/09/2019	627.1	83.5
MB18HD20002	14/09/2019	627.0	83.5
MB18HD20002	15/09/2019	627.0	83.5
MB18HD20002	16/09/2019	627.0	83.5
MB18HD20002	17/09/2019	627.0	83.5
MB18HD20002	18/09/2019	627.0	83.5
MB18HD20002	19/09/2019	627.0	83.5
MB18HD20002	20/09/2019	627.0	83.5
MB18HD20002	21/09/2019	627.0	83.5
MB18HD20002	22/09/2019	627.0	83.5
MB18HD20002	23/09/2019	627.0	83.5
MB18HD20002	24/09/2019	627.0	83.5
MB18HD20002	25/09/2019	627.0	83.5
MB18HD20002	26/09/2019	627.0	83.5
MB18HD20002	27/09/2019	627.0	83.5
MB18HD20002	28/09/2019	627.0	83.5
MB18HD20002	29/09/2019	627.0	83.5
MB18HD20002	30/09/2019	627.0	83.5
MB18HD20002	1/10/2019	627.0	83.5
MB18HD20002	2/10/2019	627.0	83.5
MB18HD20002	3/10/2019	627.0	83.5
MB18HD20002	4/10/2019	627.0	83.5
MB18HD20002	5/10/2019	627.0	83.5
MB18HD20002	6/10/2019	627.0	83.5
MB18HD20002	7/10/2019	627.0	83.5
MB18HD20002	8/10/2019	627.0	83.5
MB18HD20002	9/10/2019	627.0	83.5
MB18HD20002	10/10/2019	627.0	83.5
MB18HD20002	11/10/2019	627.0	83.5
MB18HD20002	12/10/2019	627.0	83.5
MB18HD20002	13/10/2019	627.0	83.5
MB18HD20002	14/10/2019	627.0	83.5
MB18HD20002	15/10/2019	627.0	83.5
MB18HD20002	3/09/2021	626.7	83.8
MB18HD20002	4/09/2021	626.7	83.8
MB18HD20002	5/09/2021	626.7	83.8
MB18HD20002	6/09/2021	626.8	83.8
MB18HD20002	7/09/2021	626.8	83.8
MB18HD20002	8/09/2021	626.8	83.8
MB18HD20002	9/09/2021	626.7	83.8
MB18HD20002	10/09/2021	626.7	83.8
MB18HD20002	11/09/2021	626.7	83.8
MB18HD20002	12/09/2021	626.7	83.8
MB18HD20002	13/09/2021	626.7	83.8
MB18HD20002	14/09/2021	626.7	83.8
MB18HD20002	15/09/2021	626.7	83.8
MB18HD20002	16/09/2021	626.7	83.8
MB18HD20002	17/09/2021	626.7	83.8
MB18HD20002	18/09/2021	626.7	83.8
MB18HD20002	19/09/2021	626.7	83.8
MB18HD20002	20/09/2021	626.7	83.8
MB18HD20002	21/09/2021	626.7	83.8
MB18HD20002	22/09/2021	626.7	83.8
MB18HD20002	23/09/2021	626.7	83.8
MB18HD20002	24/09/2021	626.7	83.8
MB18HD20002	25/09/2021	626.7	83.8
MB18HD20002	26/09/2021	626.7	83.8
MB18HD20002	27/09/2021	626.7	83.8
MB18HD20002	28/09/2021	626.7	83.8
MB18HD20002	29/09/2021	626.7	83.8
MB18HD20002	30/09/2021	626.7	83.8
MB18HD20002	1/10/2021	626.7	83.9
MB18HD20002	2/10/2021	626.7	83.9
MB18HD20002	3/10/2021	626.7	83.8
MB18HD20002	4/10/2021	626.7	83.9
MB18HD20002	5/10/2021	626.6	83.9
MB18HD20002	6/10/2021	626.6	83.9
MB18HD20002	7/10/2021	626.7	83.9
MB18HD20002	8/10/2021	626.6	83.9
MB18HD20002	9/10/2021	626.7	83.9
MB18HD20002	10/10/2021	626.7	83.8
MB18HD20002	11/10/2021	626.7	83.9
MB18HD20002	12/10/2021	626.7	83.9
MB18HD20002	13/10/2021	626.7	83.9
MB18HD20002	14/10/2021	626.7	83.9
MB18HD20002	15/10/2021	626.7	83.9
MB18HD20002	16/10/2021	626.6	83.9
MB18HD20002	17/10/2021	626.6	83.9
MB18HD20002	18/10/2021	626.6	83.9
MB18HD20002	19/10/2021	626.7	83.9
MB18HD20002	20/10/2021	626.7	83.8
MB18HD20002	21/10/2021	626.7	83.8
MB18HD20002	22/10/2021	626.7	83.8
MB18HD20002	23/10/2021	626.7	83.8
MB18HD20002	24/10/2021	626.7	83.8
MB18HD20002	25/10/2021	626.7	83.9
MB18HD20002	26/10/2021	626.6	83.9
MB18HD20002	27/10/2021	626.6	83.9
MB18HD20002	28/10/2021	626.6	83.9

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDRE3	9/03/2019	624.4	59.7
HDRE3	8/03/2019	624.4	59.7
HDRE3	7/03/2019	624.4	59.6
HDRE3	6/03/2019	624.6	59.4
HDRE3	5/03/2019	624.4	59.6
HDRE3	4/03/2019	624.6	59.5
HDRE3	3/03/2019	624.5	59.6
HDRE3	2/03/2019	624.4	59.7
HDRE3	1/03/2019	624.5	59.6
HDRE3	28/02/2019	624.4	59.6
HDRE3	27/02/2019	624.4	59.7
HDRE3	26/02/2019	624.4	59.7
HDRE3	25/02/2019	624.4	59.7
HDRE3	24/02/2019	624.4	59.7
HDRE3	23/02/2019	624.4	59.7
HDRE3	22/02/2019	624.4	59.7
HDRE3	21/02/2019	624.4	59.7
HDRE3	20/02/2019	624.4	59.7
HDRE3	19/02/2019	624.4	59.7
HDRE3	18/02/2019	624.4	59.7
HDRE3	17/02/2019	624.4	59.7
HDRE3	16/02/2019	624.4	59.7
HDRE3	15/02/2019	624.4	59.7
HDRE3	14/02/2019	624.4	59.7
HDRE3	13/02/2019	624.4	59.7
HDRE3	12/02/2019	624.4	59.7
HDRE3	11/02/2019	624.4	59.7
HDRE3	10/02/2019	624.4	59.7
HDRE3	9/02/2019	624.4	59.7
HDRE3	8/02/2019	624.4	59.7
HDRE3	7/02/2019	624.4	59.7
HDRE3	6/02/2019	624.4	59.7
HDRE3	5/02/2019	624.4	59.7
HDRE3	4/02/2019	624.4	59.7
HDRE3	3/02/2019	624.4	59.7
HDRE3	2/02/2019	624.4	59.7
HDRE3	1/02/2019	624.4	59.7
HDRE3	31/01/2019	624.3	59.7
HDRE3	30/01/2019	624.3	59.7
HDRE3	29/01/2019	624.3	59.7
HDRE3	28/01/2019	624.3	59.7
HDRE3	27/01/2019	624.3	59.7
HDRE3	26/01/2019	624.3	59.7
HDRE3	25/01/2019	624.3	59.7
HDRE3	24/01/2019	624.4	59.6
HDRE3	23/01/2019	624.7	59.3
HDRE3	22/01/2019	624.5	59.5
HDRE3	21/01/2019	624.5	59.6
HDRE3	20/01/2019	624.5	59.6
HDRE3	19/01/2019	624.4	59.7
HDRE3	18/01/2019	624.4	59.7
HDRE3	17/01/2019	624.4	59.7
HDRE3	16/01/2019	624.3	59.7
HDRE3	15/01/2019	624.3	59.7
HDRE3	21/08/2018	624.6	59.5
HDRE3	6/08/2018	623.6	60.5
HDRE3	23/06/2018	624.5	59.6
HDRE3	25/05/2018	624.6	59.4
HDRE3	28/04/2018	626.1	58.0
HDRE3	6/02/2018	624.7	59.3
HDRE3	20/05/2017	625.3	58.8
HDRE3	1/12/2009	626.7	57.4
HDRE3	22/11/2009	626.6	57.5
HDRE3	20/09/2009	626.4	57.7
HDRE3	31/08/2009	626.4	57.6
HDRE3	17/08/2009	625.9	58.2
HDRE3	6/07/2009	626.5	57.6
HDRE3	13/06/2009	626.4	57.7
HDRE3	1/06/2009	626.6	57.5
HDRE3	15/05/2009	626.5	57.5
HDRE3	1/05/2009	626.5	57.6
HDRE3	24/04/2009	626.4	57.6
HDRE3	13/04/2009	626.6	57.5
HDRE3	14/03/2009	626.6	57.4
HDRE3	28/02/2009	626.6	57.5
HDRE3	16/02/2009	626.6	57.5
HDRE3	1/02/2009	626.6	57.5
HDRE3	18/01/2009	626.6	57.4
HDRE3	1/01/2009	626.5	57.6
HDRE3	15/12/2008	626.4	57.6
HDRE3	1/12/2008	626.5	57.6
HDVP1	16/02/2022	673.1	13.1
HDVP1	15/02/2022	673.1	13.1
HDVP1	14/02/2022	673.1	13.1
HDVP1	13/02/2022	673.1	13.1
HDVP1	12/02/2022	673.1	13.1
HDVP1	11/02/2022	673.1	13.1
HDVP1	10/02/2022	673.1	13.1
HDVP1	9/02/2022	673.1	13.1
HDVP1	8/02/2022	673.1	13.1
HDVP1	7/02/2022	673.1	13.1
HDVP1	6/02/2022	673.1	13.1
HDVP1	5/02/2022	673.1	13.1
HDVP1	4/02/2022	673.1	13.1
HDVP1	3/02/2022	673.1	13.1
HDVP1	2/02/2022	673.1	13.1
HDVP1	1/02/2022	673.1	13.1
HDVP1	31/01/2022	673.1	13.1
HDVP1	30/01/2022	673.1	13.1
HDVP1	29/01/2022	673.1	13.1
HDVP1	28/01/2022	673.1	13.1
HDVP1	27/01/2022	673.1	13.1
HDVP1	26/01/2022	673.1	13.1
HDVP1	25/01/2022	673.1	13.1
HDVP1	24/01/2022	673.1	13.1
HDVP1	23/01/2022	673.1	13.1
HDVP1	22/01/2022	673.1	13.1
HDVP1	21/01/2022	673.1	13.1
HDVP1	20/01/2022	558.0	128.2
HDVP1	19/01/2022	558.0	128.2
HDVP1	18/01/2022	558.0	128.2
HDVP1	17/01/2022	558.0	128.2
HDVP1	16/01/2022	558.0	128.2
HDVP1	15/01/2022	558.0	128.2
HDVP1	14/01/2022	558.0	128.2
HDVP1	13/01/2022	558.0	128.2
HDVP1	12/01/2022	558.0	128.2
HDVP1	11/01/2022	558.0	128.2
HDVP1	10/01/2022	558.0	128.2
HDVP1	9/01/2022	558.0	128.2
HDVP1	8/01/2022	558.0	128.2
HDVP1	7/01/2022	558.0	128.2
HDVP1	6/01/2022	558.0	128.2
HDVP1	5/01/2022	558.0	128.2
HDVP1	4/01/2022	558.0	128.2
HDVP1	3/01/2022	558.0	128.2
HDVP1	2/01/2022	558.0	128.2
HDVP1	1/01/2022	558.0	128.2
HDVP1	31/12/2021	558.0	128.2
HDVP1	30/12/2021	558.0	128.2
HDVP1	29/12/2021	558.0	128.2
HDVP1	28/12/2021	558.0	128.2
HDVP1	27/12/2021	558.0	128.2
HDVP1	26/12/2021	558.0	128.2
HDVP1	25/12/2021	558.0	128.2
HDVP1	24/12/2021	558.0	128.2

ID	Date	WL mAHD	WL mbgl
HDVRP1	2/02/2012	626.0	58.5
HDVRP1	27/12/2011	626.1	58.5
HDVRP1	2/12/2011	626.0	58.5
HDVRP1	29/10/2011	626.2	58.4
HDVRP1	30/09/2011	626.2	58.4
HDVRP1	28/08/2011	626.1	58.4
HDVRP1	24/07/2011	626.1	58.4
HDVRP1	28/06/2011	626.0	58.5
HDVRP1	20/05/2011	626.2	58.4
HDVRP1	24/04/2011	625.8	58.7
HDVRP1	20/03/2011	626.1	58.4
HDVRP1	26/02/2011	626.0	58.5
HDVRP1	28/01/2011	626.0	58.5
HDVRP1	6/01/2011	626.1	58.4
HDVRP1	31/12/2010	626.1	58.4
HDVRP1	28/11/2010	625.8	58.7
HDVRP1	29/10/2010	626.2	58.3
HDVRP1	27/09/2010	626.1	58.4
HDVRP1	22/08/2010	626.1	58.4
HDVRP1	26/07/2010	626.2	58.3
HDVRP1	29/06/2010	626.1	58.4
HDVRP1	31/05/2010	626.1	58.4
HDVRP1	29/04/2010	626.2	58.3
HDVRP1	27/03/2010	626.1	58.4
HDVRP1	28/02/2010	626.2	58.3
HDVRP1	7/02/2010	626.2	58.3
HDVRP1	30/12/2009	626.2	58.3
HDVRP1	1/12/2009	626.4	58.2
HDVRP1	22/11/2009	626.3	58.2
HDVRP1	2/10/2009	626.3	58.3
HDVRP1	20/09/2009	626.1	58.4
HDVRP1	31/08/2009	626.2	58.4
HDVRP1	17/08/2009	626.3	58.2
HDVRP1	6/07/2009	626.3	58.3
HDVRP1	13/06/2009	626.1	58.5
HDVRP1	1/06/2009	626.3	58.2
HDVRP1	15/05/2009	626.2	58.4
HDVRP1	1/05/2009	626.0	58.5
HDVRP1	24/04/2009	626.2	58.3
HDVRP1	13/04/2009	626.2	58.3
HDVRP1	1/04/2009	626.3	58.2
HDVRP1	14/03/2009	626.2	58.3
HDVRP1	28/02/2009	626.2	58.3
HDVRP1	16/02/2009	626.4	58.2
HDVRP1	1/02/2009	626.2	58.3
HDVRP1	18/01/2009	626.4	58.1
HDVRP1	1/01/2009	626.2	58.3
HDVRP1	22/12/2008	626.0	58.5
HDVRP1	15/12/2008	626.1	58.4
HDVRP1	1/12/2008	626.1	58.4
MB15H1SW0001	3/03/2022	595.0	50.4
MB15H1SW0001	2/03/2022	595.0	50.4
MB15H1SW0001	1/03/2022	595.0	50.3
MB15H1SW0001	28/02/2022	595.0	50.3
MB15H1SW0001	27/02/2022	595.1	50.3
MB15H1SW0001	26/02/2022	595.1	50.3
MB15H1SW0001	25/02/2022	595.1	50.3
MB15H1SW0001	24/02/2022	595.1	50.3
MB15H1SW0001	23/02/2022	595.1	50.3
MB15H1SW0001	22/02/2022	595.1	50.3
MB15H1SW0001	21/02/2022	595.1	50.3
MB15H1SW0001	20/02/2022	595.1	50.3
MB15H1SW0001	19/02/2022	595.1	50.3
MB15H1SW0001	18/02/2022	595.1	50.3
MB15H1SW0001	17/02/2022	595.1	50.3
MB15H1SW0001	16/02/2022	595.1	50.3
MB15H1SW0001	15/02/2022	595.1	50.3
MB15H1SW0001	14/02/2022	595.1	50.3
MB15H1SW0001	13/02/2022	595.1	50.3
MB15H1SW0001	12/02/2022	595.1	50.3
MB15H1SW0001	11/02/2022	595.1	50.3
MB15H1SW0001	10/02/2022	595.1	50.3
MB15H1SW0001	9/02/2022	595.1	50.3
MB15H1SW0001	8/02/2022	595.1	50.3
MB15H1SW0001	7/02/2022	595.1	50.3
MB15H1SW0001	6/02/2022	595.1	50.3
MB15H1SW0001	5/02/2022	595.1	50.3
MB15H1SW0001	4/02/2022	595.1	50.3
MB15H1SW0001	3/02/2022	595.1	50.3
MB15H1SW0001	2/02/2022	595.0	50.4
MB15H1SW0001	1/02/2022	595.0	50.4
MB15H1SW0001	31/01/2022	595.0	50.4
MB15H1SW0001	30/01/2022	595.0	50.3
MB15H1SW0001	29/01/2022	595.0	50.3
MB15H1SW0001	28/01/2022	595.0	50.4
MB15H1SW0001	27/01/2022	595.0	50.4
MB15H1SW0001	26/01/2022	595.0	50.4
MB15H1SW0001	25/01/2022	595.0	50.4
MB15H1SW0001	24/01/2022	595.1	50.3
MB15H1SW0001	23/01/2022	595.1	50.3
MB15H1SW0001	22/01/2022	595.1	50.3
MB15H1SW0001	21/01/2022	595.1	50.3
MB15H1SW0001	20/01/2022	595.1	50.3
MB15H1SW0001	19/01/2022	595.1	50.3
MB15H1SW0001	18/01/2022	595.1	50.3
MB15H1SW0001	17/01/2022	595.1	50.3
MB15H1SW0001	16/01/2022	595.0	50.3
MB15H1SW0001	15/01/2022	595.1	50.3
MB15H1SW0001	14/01/2022	595.1	50.3
MB15H1SW0001	13/01/2022	595.1	50.3
MB15H1SW0001	12/01/2022	595.1	50.3
MB15H1SW0001	11/01/2022	595.1	50.3
MB15H1SW0001	10/01/2022	595.1	50.3
MB15H1SW0001	9/01/2022	595.1	50.3
MB15H1SW0001	8/01/2022	595.1	50.3
MB15H1SW0001	7/01/2022	595.1	50.3
MB15H1SW0001	6/01/2022	595.1	50.3
MB15H1SW0001	5/01/2022	595.1	50.3
MB15H1SW0001	4/01/2022	595.1	50.3
MB15H1SW0001	3/01/2022	595.1	50.3
MB15H1SW0001	2/01/2022	595.1	50.3
MB15H1SW0001	1/01/2022	595.1	50.3
MB15H1SW0001	31/12/2021	595.1	50.3
MB15H1SW0001	30/12/2021	595.1	50.3
MB15H1SW0001	29/12/2021	595.1	50.3
MB15H1SW0001	28/12/2021	595.1	50.3
MB15H1SW0001	27/12/2021	595.1	50.3
MB15H1SW0001	26/12/2021	595.1	50.3
MB15H1SW0001	25/12/2021	595.1	50.3
MB15H1SW0001	24/12/2021	595.1	50.3
MB15H1SW0001	23/12/2021	595.1	50.3
MB15H1SW0001	22/12/2021	595.1	50.3
MB15H1SW0001	21/12/2021	595.1	50.3
MB15H1SW0001	20/12/2021	595.1	50.3
MB15H1SW0001	19/12/2021	595.1	50.3
MB15H1SW0001	18/12/2021	595.1	50.3
MB15H1SW0001	17/12/2021	595.1	50.3
MB15H1SW0001	16/12/2021	595.1	50.3
MB15H1SW0001	15/12/2021	595.1	50.3
MB15H1SW0001	14/12/2021	595.1	50.3
MB15H1SW0001	13/12/2021	595.1	50.3
MB15H1SW0001	12/12/2021	595.1	50.3
MB15H1SW0001	11/12/2021	595.1	50.3
MB15H1SW0001	10/12/2021	595.1	50.3
MB15H1SW0001	9/12/2021	595.1	50.3
MB15H1SW0001	8/12/2021	595.1	50.3
MB15H1SW0001	7/12/2021	595.1	50.3
MB15H1SW0001	6/12/2021	595.1	50.3
MB15H1SW0001	5/12/2021	595.1	50.3

ID	Date	WL mAHD	WL mbgl
MB20WN0131	20/04/2021	619.5	24.5
MB20WN0131	19/04/2021	619.5	24.5
MB20WN0131	18/04/2021	619.5	24.5
MB20WN0131	17/04/2021	619.5	24.6
MB20WN0131	16/04/2021	619.4	24.6
MB20WN0131	15/04/2021	619.4	24.6
MB20WN0131	14/04/2021	619.4	24.7
MB20WN0131	13/04/2021	619.3	24.7
MB20WN0131	12/04/2021	619.3	24.7
MB20WN0131	11/04/2021	619.3	24.7
MB20WN0131	10/04/2021	619.4	24.7
MB20WN0131	9/04/2021	619.4	24.7
MB20WN0131	8/04/2021	619.4	24.7
MB20WN0131	7/04/2021	619.4	24.6
MB20WN0131	6/04/2021	619.4	24.6
MB20WN0131	5/04/2021	619.4	24.6
MB20WN0131	4/04/2021	619.4	24.6
MB20WN0131	3/04/2021	619.4	24.6
MB20WN0131	2/04/2021	619.5	24.6
MB20WN0131	1/04/2021	619.5	24.6
MB20WN0131	31/03/2021	619.5	24.5
MB20WN0131	30/03/2021	619.5	24.5
MB20WN0131	29/03/2021	619.5	24.5
MB20WN0131	28/03/2021	619.5	24.5
MB20WN0131	27/03/2021	619.5	24.5
MB20WN0131	26/03/2021	619.5	24.5
MB20WN0131	25/03/2021	619.5	24.5
MB20WN0131	24/03/2021	619.5	24.5
MB20WN0131	23/03/2021	619.6	24.5
MB20WN0131	22/03/2021	619.6	24.4
MB20WN0131	21/03/2021	619.6	24.4
MB20WN0131	20/03/2021	619.6	24.4
MB20WN0131	19/03/2021	619.6	24.4
MB20WN0131	18/03/2021	619.7	24.4
MB20WN0131	17/03/2021	619.7	24.4
MB20WN0131	16/03/2021	619.7	24.3
MB20WN0131	15/03/2021	619.7	24.3
MB20WN0131	14/03/2021	619.7	24.3
MB20WN0131	13/03/2021	619.7	24.3
MB20WN0131	12/03/2021	619.7	24.3
MB20WN0131	11/03/2021	619.7	24.3
MB20WN0131	10/03/2021	619.7	24.3
MB20WN0131	9/03/2021	619.7	24.3
MB20WN0131	8/03/2021	619.7	24.3
MB20WN0131	7/03/2021	619.7	24.3
MB20WN0131	6/03/2021	619.8	24.3
MB20WN0131	5/03/2021	619.8	24.3
MB20WN0131	4/03/2021	619.8	24.2
MB20WN0131	3/03/2021	619.8	24.2
MB20WN0131	2/03/2021	619.8	24.2
MB20WN0131	1/03/2021	619.8	24.2
MB20WN0131	28/02/2021	619.8	24.2
MB20WN0131	27/02/2021	619.8	24.3
MB20WN0131	26/02/2021	619.8	24.3
MB20WN0131	25/02/2021	619.8	24.2
MB20WN0131	24/02/2021	619.8	24.2
MB20WN0131	23/02/2021	619.8	24.2
MB20WN0131	22/02/2021	619.7	24.3
MB20WN0131	21/02/2021	619.7	24.3
MB20WN0131	20/02/2021	619.7	24.4
MB20WN0131	19/02/2021	619.6	24.4
MB20WN0131	18/02/2021	619.5	24.5
MB20WN0131	17/02/2021	619.4	24.6
MB20WN0131	16/02/2021	619.3	24.7
MB20WN0131	15/02/2021	619.1	24.9
MB20WN0131	14/02/2021	619.0	25.0
MB20WN0131	13/02/2021	618.9	25.1
MB20WN0131	12/02/2021	618.8	25.2
MB20WN0131	11/02/2021	618.8	25.2
MB20WN0131	10/02/2021	618.8	25.3
MB20WN0131	9/02/2021	618.8	25.2
MB20WN0131	8/02/2021	618.8	25.2
MB20WN0131	7/02/2021	618.8	25.2
MB20WN0131	6/02/2021	618.8	25.3
MB20WN0131	5/02/2021	618.8	25.3
MB20WN0131	4/02/2021	618.7	25.3
MB20WN0131	3/02/2021	618.8	25.3
MB20WN0131	2/02/2021	618.8	25.3
MB20WN0131	1/02/2021	618.8	25.3
MB20WN0131	31/01/2021	618.8	25.2
MB20WN0131	30/01/2021	618.8	25.3
MB20WN0131	29/01/2021	618.8	25.3
MB20WN0131	28/01/2021	618.8	25.3
MB20WN0131	27/01/2021	618.8	25.3
MB20WN0131	26/01/2021	618.8	25.3
MB20WN0131	25/01/2021	618.8	25.3
MB20WN0131	24/01/2021	618.8	25.2
MB20WN0131	23/01/2021	618.8	25.3
MB20WN0131	22/01/2021	618.8	25.3
MB20WN0131	21/01/2021	618.8	25.2
MB20WN0131	20/01/2021	618.8	25.2
MB20WN0131	19/01/2021	618.8	25.2
MB20WN0131	18/01/2021	618.8	25.2
MB20WN0131	17/01/2021	618.8	25.2
MB20WN0131	16/01/2021	618.8	25.3
MB20WN0131	15/01/2021	618.7	25.3
MB20WN0131	14/01/2021	618.7	25.3
MB20WN0131	13/01/2021	618.7	25.3
MB20WN0131	12/01/2021	618.7	25.3
MB20WN0131	11/01/2021	618.7	25.4
MB20WN0131	10/01/2021	618.6	25.4
MB20WN0131	9/01/2021	618.6	25.4
MB20WN0131	8/01/2021	618.6	25.4
MB20WN0131	7/01/2021	618.6	25.5
MB20WN0131	6/01/2021	618.6	25.5
MB20WN0131	5/01/2021	618.6	25.4
MB20WN0131	4/01/2021	618.5	25.5
MB20WN0131	3/01/2021	618.5	25.5
MB20WN0131	2/01/2021	618.5	25.5
MB20WN0131	1/01/2021	618.5	25.5
MB20WN0131	31/12/2020	618.5	25.5
MB20WN0131	30/12/2020	618.5	25.5
MB20WN0131	29/12/2020	618.5	25.5
MB20WN0131	28/12/2020	618.5	25.5
MB20WN0131	27/12/2020	618.5	25.5
MB20WN0131	26/12/2020	618.5	25.5
MB20WN0131	25/12/2020	618.5	25.5
MB20WN0131	24/12/2020	618.6	25.5
MB20WN0131	23/12/2020	618.6	25.5
MB20WN0131	22/12/2020	618.5	25.5
MB20WN0131	21/12/2020	618.5	25.5
MB20WN0131	20/12/2020	618.5	25.6
MB20WN0131	19/12/2020	618.5	25.5
MB20WN0131	18/12/2020	618.5	25.5
MB20WN0131	17/12/2020	618.5	25.6
MB20WN0131	16/12/2020	618.5	25.5
MB20WN0131	15/12/2020	618.5	25.5
MB20WN0131	14/12/2020	618.5	25.6
MB20WN0131	13/12/2020	618.4	25.6
MB20WN0131	12/12/2020	618.4	25.6
MB20WN0131	11/12/2020	618.4	25.6
MB20WN0131	10/12/2020	618.4	25.6
MB20WN0131	9/12/2020	618.4	25.6
MB20WN0131	8/12/2020	618.4	25.6
MB20WN0131	7/12/2020	618.5	25.6
MB20WN0131	6/12/2020	618.4	25.6

ID	Date	WL mAHD	WL mbgl
MB18HD20002	5/12/2021	626.6	83.9
MB18HD20002	6/12/2021	626.6	83.9
MB18HD20002	7/12/2021	626.6	83.9
MB18HD20002	8/12/2021	626.6	83.9
MB18HD20002	9/12/2021	626.6	83.9
MB18HD20002	10/12/2021	626.6	83.9
MB18HD20002	11/12/2021	626.6	83.9
MB18HD20002	12/12/2021	626.6	83.9
MB18HD20002	13/12/2021	626.6	83.9
MB18HD20002	14/12/2021	626.6	83.9
MB18HD20002	15/12/2021	626.6	83.9
MB18HD20002	16/12/2021	626.6	83.9
MB18HD20002	17/12/2021	626.6	83.9
MB18HD20002	18/12/2021	626.6	83.9
MB18HD20002	19/12/2021	626.6	83.9
MB18HD20002	20/12/2021	626.6	83.9
MB18HD20002	21/12/2021	626.6	83.9
MB18HD20002	22/12/2021	626.6	83.9
MB18HD20002	23/12/2021	626.6	83.9
MB18HD20002	24/12/2021	626.6	83.9
MB18HD20002	25/12/2021	626.6	83.9
MB18HD20002	26/12/2021	626.6	83.9
MB18HD20002	30/12/2021	626.6	83.9
MB18HD20002	31/12/2021	626.6	83.9
MB18HD20002	1/01/2022	626.6	83.9
MB18HD20002	2/01/2022	626.6	83.9
MB18HD20002	3/01/2022	626.6	83.9
MB18HD20002	4/01/2022	626.6	83.9
MB18HD20002	5/01/2022	626.6	83.9
MB18HD20002	6/01/2022	626.6	83.9
MB18HD20002	7/01/2022	626.6	83.9
MB18HD20002	8/01/2022	626.6	83.9
MB18HD20002	9/01/2022	626.6	83.9
MB18HD20002	10/01/2022	626.6	83.9
MB18HD20002	11/01/2022	626.6	83.9
MB18HD20002	12/01/2022	626.6	83.9
MB18HD20002	13/01/2022	626.6	83.9
MB18HD20002	14/01/2022	626.6	83.9
MB18HD20002	15/01/2022	626.6	83.9
MB18HD20002	16/01/2022	626.6	83.9
MB18HD20002	17/01/2022	626.6	83.9
MB18HD20002	18/01/2022	626.6	83.9
MB18HD20002	19/01/2022	626.6	83.9
MB18HD20002	20/01/2022	626.6	83.9
MB18HD20002	21/01/2022	626.6	83.9
MB18HD20002	22/01/2022	626.6	83.9
MB18HD20002	23/01/2022	626.6	83.9
MB18HD20002	24/01/2022	626.6	84.0
MB18HD20002	25/01/2022	626.5	84.0
MB18HD20002	26/01/2022	626.5	84.0
MB18HD20002	27/01/2022	626.5	84.0
MB18HD20002	28/01/2022	626.5	84.0
MB18HD20002	29/01/2022	626.6	84.0
MB18HD20002	30/01/2022	626.6	84.0
MB18HD20002	31/01/2022	626.5	84.0
MB18HD20002	1/02/2022	626.5	84.0
MB18HD20002	2/02/2022	626.5	84.0
MB18HD20002	3/02/2022	626.6	84.0
MB18HD20002	4/02/2022	626.6	83.9
MB18HD20002	5/02/2022	626.6	83.9
MB18HD20002	6/02/2022	626.6	84.0
MB18HD20002	7/02/2022	626.6	83.9
MB18HD20002	8/02/2022	626.6	83.9
MB18HD20002	9/02/2022	626.6	83.9
MB18HD20002	10/02/2022	626.6	83.9
MB18HD20002	11/02/2022	626.6	83.9
MB18HD20002	12/02/2022	626.6	83.9
MB18HD20002	13/02/2022	626.6	83.9
MB18HD20002	14/02/2022	626.6	83.9
MB18HD20002	15/02/2022	626.6	83.9
MB18HD20002	16/02/2022	626.6	83.9
MB18HD20002	17/02/2022	626.6	83.9
MB18HD20002	18/02/2022	626.6	83.9
MB18HD20002	19/02/2022	626.6	83.9
MB18HD20002	20/02/2022	626.6	83.9
MB18HD20002	21/02/2022	626.6	83.9
MB18HD20002	22/02/2022	626.6	83.9
MB18HD20002	23/02/2022	626.6	83.9
MB18HD20002	24/02/2022	626.6	83.9
MB18HD20002	25/02/2022	626.6	83.9
MB18HD20002	26/02/2022	626.6	83.9
MB18HD20002	27/02/2022	626.6	84.0
MB18HD20002	28/02/2022	626.5	84.0
MB18HD20002	1/03/2022	626.5	84.0
MB18HD20002	2/03/2022	626.5	84.0
MB18HD20002	3/03/2022	626.5	84.0
MB18HD20002	4/03/2022	626.6	83.9
MB18HD20002	5/03/2022	626.6	83.9
MB18HD20002	6/03/2022	626

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	23/12/2021	558.0	128.2
HDVP1	22/12/2021	558.0	128.2
HDVP1	21/12/2021	558.0	128.2
HDVP1	20/12/2021	558.0	128.2
HDVP1	19/12/2021	558.0	128.2
HDVP1	18/12/2021	558.0	128.2
HDVP1	17/12/2021	558.0	128.2
HDVP1	16/12/2021	558.0	128.2
HDVP1	15/12/2021	558.0	128.2
HDVP1	14/12/2021	558.0	128.2
HDVP1	13/12/2021	558.0	128.2
HDVP1	12/12/2021	558.0	128.2
HDVP1	11/12/2021	558.0	128.2
HDVP1	10/12/2021	558.0	128.2
HDVP1	9/12/2021	558.0	128.2
HDVP1	8/12/2021	558.0	128.2
HDVP1	7/12/2021	558.0	128.2
HDVP1	6/12/2021	558.0	128.2
HDVP1	5/12/2021	558.0	128.2
HDVP1	4/12/2021	558.0	128.2
HDVP1	3/12/2021	558.0	128.2
HDVP1	2/12/2021	558.0	128.2
HDVP1	1/12/2021	558.0	128.2
HDVP1	30/11/2021	558.0	128.2
HDVP1	29/11/2021	558.0	128.2
HDVP1	28/11/2021	558.0	128.2
HDVP1	27/11/2021	558.0	128.2
HDVP1	26/11/2021	558.0	128.2
HDVP1	25/11/2021	558.0	128.2
HDVP1	24/11/2021	558.0	128.2
HDVP1	23/11/2021	558.0	128.2
HDVP1	22/11/2021	558.0	128.2
HDVP1	21/11/2021	558.0	128.2
HDVP1	20/11/2021	558.0	128.2
HDVP1	19/11/2021	558.0	128.2
HDVP1	18/11/2021	558.0	128.2
HDVP1	17/11/2021	558.0	128.2
HDVP1	16/11/2021	558.0	128.2
HDVP1	15/11/2021	558.0	128.2
HDVP1	14/11/2021	558.0	128.2
HDVP1	13/11/2021	558.0	128.2
HDVP1	12/11/2021	558.0	128.2
HDVP1	11/11/2021	558.0	128.2
HDVP1	10/11/2021	679.6	6.5
HDVP1	9/11/2021	679.6	6.5
HDVP1	8/11/2021	679.6	6.5
HDVP1	7/11/2021	679.6	6.5
HDVP1	6/11/2021	679.6	6.5
HDVP1	5/11/2021	679.6	6.5
HDVP1	4/11/2021	679.6	6.5
HDVP1	3/11/2021	679.6	6.5
HDVP1	2/11/2021	679.6	6.5
HDVP1	1/11/2021	679.6	6.5
HDVP1	31/10/2021	679.6	6.5
HDVP1	30/10/2021	679.6	6.5
HDVP1	29/10/2021	679.6	6.5
HDVP1	28/10/2021	679.6	6.5
HDVP1	27/10/2021	679.6	6.5
HDVP1	26/10/2021	679.6	6.5
HDVP1	25/10/2021	679.6	6.5
HDVP1	24/10/2021	679.6	6.5
HDVP1	23/10/2021	679.6	6.5
HDVP1	22/10/2021	679.6	6.5
HDVP1	21/10/2021	679.6	6.5
HDVP1	20/10/2021	679.6	6.5
HDVP1	19/10/2021	679.6	6.5
HDVP1	18/10/2021	679.6	6.5
HDVP1	17/10/2021	679.6	6.5
HDVP1	16/10/2021	679.6	6.5
HDVP1	15/10/2021	641.8	44.4
HDVP1	14/10/2021	641.8	44.4
HDVP1	13/10/2021	641.8	44.4
HDVP1	12/10/2021	641.8	44.4
HDVP1	11/10/2021	641.8	44.4
HDVP1	10/10/2021	641.8	44.4
HDVP1	9/10/2021	641.8	44.4
HDVP1	8/10/2021	641.8	44.4
HDVP1	7/10/2021	641.8	44.4
HDVP1	6/10/2021	641.8	44.4
HDVP1	5/10/2021	641.8	44.4
HDVP1	4/10/2021	641.8	44.4
HDVP1	3/10/2021	641.8	44.4
HDVP1	2/10/2021	641.8	44.4
HDVP1	1/10/2021	641.8	44.4
HDVP1	30/09/2021	641.8	44.4
HDVP1	29/09/2021	641.8	44.4
HDVP1	28/09/2021	641.8	44.4
HDVP1	27/09/2021	641.8	44.4
HDVP1	26/09/2021	641.8	44.4
HDVP1	25/09/2021	641.8	44.4
HDVP1	24/09/2021	641.8	44.4
HDVP1	23/09/2021	641.8	44.4
HDVP1	22/09/2021	641.8	44.4
HDVP1	21/09/2021	641.8	44.4
HDVP1	20/09/2021	641.8	44.4
HDVP1	19/09/2021	641.8	44.4
HDVP1	18/09/2021	641.8	44.4
HDVP1	17/09/2021	641.8	44.4
HDVP1	16/09/2021	641.8	44.4
HDVP1	15/09/2021	534.7	151.5
HDVP1	14/09/2021	534.7	151.5
HDVP1	13/09/2021	534.7	151.5
HDVP1	12/09/2021	534.7	151.5
HDVP1	11/09/2021	534.7	151.5
HDVP1	10/09/2021	534.7	151.5
HDVP1	9/09/2021	534.7	151.5
HDVP1	8/09/2021	534.7	151.5
HDVP1	7/09/2021	534.7	151.5
HDVP1	6/09/2021	534.7	151.5
HDVP1	5/09/2021	635.4	50.8
HDVP1	4/09/2021	635.4	50.8
HDVP1	3/09/2021	635.4	50.8
HDVP1	2/09/2021	635.4	50.8
HDVP1	1/09/2021	635.4	50.8
HDVP1	31/08/2021	635.4	50.8
HDVP1	30/08/2021	635.4	50.8
HDVP1	29/08/2021	635.4	50.8
HDVP1	28/08/2021	635.4	50.8
HDVP1	27/08/2021	635.4	50.8
HDVP1	26/08/2021	635.4	50.8
HDVP1	25/08/2021	635.4	50.8
HDVP1	24/08/2021	635.4	50.8
HDVP1	23/08/2021	635.4	50.8
HDVP1	22/08/2021	635.4	50.8
HDVP1	21/08/2021	635.4	50.8
HDVP1	20/08/2021	635.4	50.8
HDVP1	19/08/2021	635.4	50.8
HDVP1	18/08/2021	635.4	50.8
HDVP1	17/08/2021	635.4	50.8
HDVP1	16/08/2021	635.4	50.8
HDVP1	15/08/2021	635.4	50.8
HDVP1	14/08/2021	635.4	50.8
HDVP1	13/08/2021	635.4	50.8
HDVP1	12/08/2021	635.4	50.8
HDVP1	11/08/2021	635.4	50.8
HDVP1	10/08/2021	635.4	50.8

ID	Date	WL mAHD	WL mbgl
MB15H1SW0001	4/12/2021	595.1	50.3
MB15H1SW0001	3/12/2021	595.1	50.3
MB15H1SW0001	2/12/2021	595.1	50.3
MB15H1SW0001	1/12/2021	595.1	50.3
MB15H1SW0001	30/11/2021	595.1	50.3
MB15H1SW0001	29/11/2021	595.1	50.3
MB15H1SW0001	28/11/2021	595.1	50.3
MB15H1SW0001	27/11/2021	595.1	50.2
MB15H1SW0001	26/11/2021	595.1	50.2
MB15H1SW0001	25/11/2021	595.1	50.3
MB15H1SW0001	24/11/2021	595.1	50.3
MB15H1SW0001	23/11/2021	595.1	50.3
MB15H1SW0001	22/11/2021	595.1	50.3
MB15H1SW0001	21/11/2021	595.1	50.3
MB15H1SW0001	20/11/2021	595.1	50.3
MB15H1SW0001	19/11/2021	595.1	50.3
MB15H1SW0001	18/11/2021	595.1	50.3
MB15H1SW0001	17/11/2021	595.1	50.3
MB15H1SW0001	16/11/2021	595.1	50.2
MB15H1SW0001	15/11/2021	595.2	50.2
MB15H1SW0001	14/11/2021	595.2	50.2
MB15H1SW0001	13/11/2021	595.2	50.2
MB15H1SW0001	12/11/2021	595.1	50.3
MB15H1SW0001	11/11/2021	595.1	50.3
MB15H1SW0001	10/11/2021	595.1	50.3
MB15H1SW0001	9/11/2021	595.1	50.3
MB15H1SW0001	8/11/2021	595.1	50.3
MB15H1SW0001	7/11/2021	595.1	50.3
MB15H1SW0001	6/11/2021	595.1	50.2
MB15H1SW0001	5/11/2021	595.2	50.2
MB15H1SW0001	4/11/2021	595.2	50.2
MB15H1SW0001	3/11/2021	595.2	50.2
MB15H1SW0001	2/11/2021	595.1	50.2
MB15H1SW0001	1/11/2021	595.1	50.2
MB15H1SW0001	31/10/2021	595.2	50.2
MB15H1SW0001	30/10/2021	595.2	50.2
MB15H1SW0001	29/10/2021	595.2	50.2
MB15H1SW0001	28/10/2021	595.2	50.2
MB15H1SW0001	27/10/2021	595.2	50.2
MB15H1SW0001	26/10/2021	595.2	50.2
MB15H1SW0001	25/10/2021	595.2	50.2
MB15H1SW0001	24/10/2021	595.2	50.2
MB15H1SW0001	23/10/2021	595.2	50.2
MB15H1SW0001	22/10/2021	595.2	50.2
MB15H1SW0001	21/10/2021	595.2	50.2
MB15H1SW0001	20/10/2021	595.2	50.2
MB15H1SW0001	19/10/2021	595.2	50.2
MB15H1SW0001	18/10/2021	595.2	50.2
MB15H1SW0001	17/10/2021	595.2	50.2
MB15H1SW0001	16/10/2021	595.2	50.2
MB15H1SW0001	15/10/2021	595.2	50.2
MB15H1SW0001	14/10/2021	595.2	50.2
MB15H1SW0001	13/10/2021	595.2	50.2
MB15H1SW0001	12/10/2021	595.2	50.2
MB15H1SW0001	11/10/2021	595.2	50.2
MB15H1SW0001	10/10/2021	595.2	50.2
MB15H1SW0001	9/10/2021	595.2	50.2
MB15H1SW0001	8/10/2021	595.2	50.2
MB15H1SW0001	7/10/2021	595.2	50.2
MB15H1SW0001	6/10/2021	595.2	50.2
MB15H1SW0001	5/10/2021	595.2	50.2
MB15H1SW0001	4/10/2021	595.2	50.2
MB15H1SW0001	3/10/2021	595.2	50.2
MB15H1SW0001	2/10/2021	595.2	50.2
MB15H1SW0001	1/10/2021	595.2	50.2
MB15H1SW0001	30/09/2021	595.2	50.2
MB15H1SW0001	29/09/2021	595.2	50.2
MB15H1SW0001	28/09/2021	595.2	50.2
MB15H1SW0001	27/09/2021	595.2	50.2
MB15H1SW0001	26/09/2021	595.2	50.2
MB15H1SW0001	25/09/2021	595.2	50.2
MB15H1SW0001	24/09/2021	595.2	50.2
MB15H1SW0001	23/09/2021	595.2	50.1
MB15H1SW0001	22/09/2021	595.3	50.1
MB15H1SW0001	21/09/2021	595.3	50.1
MB15H1SW0001	20/09/2021	595.2	50.2
MB15H1SW0001	19/09/2021	595.2	50.2
MB15H1SW0001	18/09/2021	595.2	50.2
MB15H1SW0001	17/09/2021	595.2	50.2
MB15H1SW0001	16/09/2021	595.2	50.2
MB15H1SW0001	15/09/2021	595.2	50.2
MB15H1SW0001	14/09/2021	595.2	50.2
MB15H1SW0001	13/09/2021	595.2	50.2
MB15H1SW0001	12/09/2021	595.2	50.2
MB15H1SW0001	11/09/2021	595.2	50.2
MB15H1SW0001	10/09/2021	595.3	50.1
MB15H1SW0001	9/09/2021	595.3	50.1
MB15H1SW0001	8/09/2021	595.3	50.1
MB15H1SW0001	7/09/2021	595.3	50.1
MB15H1SW0001	6/09/2021	595.3	50.1
MB15H1SW0001	5/09/2021	595.2	50.1
MB15H1SW0001	4/09/2021	595.2	50.2
MB15H1SW0001	3/09/2021	595.2	50.2
MB15H1SW0001	2/09/2021	595.2	50.2
MB15H1SW0001	1/09/2021	595.2	50.2
MB15H1SW0001	31/08/2021	595.2	50.2
MB15H1SW0001	30/08/2021	595.2	50.2
MB15H1SW0001	29/08/2021	595.2	50.2
MB15H1SW0001	28/08/2021	595.2	50.2
MB15H1SW0001	27/08/2021	595.2	50.2
MB15H1SW0001	26/08/2021	595.2	50.2
MB15H1SW0001	25/08/2021	595.2	50.2
MB15H1SW0001	24/08/2021	595.2	50.1
MB15H1SW0001	23/08/2021	595.2	50.2
MB15H1SW0001	22/08/2021	595.2	50.2
MB15H1SW0001	21/08/2021	595.2	50.2
MB15H1SW0001	20/08/2021	595.2	50.2
MB15H1SW0001	19/08/2021	595.2	50.1
MB15H1SW0001	18/08/2021	595.3	50.1
MB15H1SW0001	17/08/2021	595.3	50.1
MB15H1SW0001	16/08/2021	595.3	50.1
MB15H1SW0001	15/08/2021	595.3	50.1
MB15H1SW0001	14/08/2021	595.3	50.1
MB15H1SW0001	13/08/2021	595.3	50.1
MB15H1SW0001	12/08/2021	595.3	50.1
MB15H1SW0001	11/08/2021	595.3	50.1
MB15H1SW0001	10/08/2021	595.3	50.1
MB15H1SW0001	9/08/2021	595.3	50.1
MB15H1SW0001	8/08/2021	595.3	50.1
MB15H1SW0001	7/08/2021	595.3	50.1
MB15H1SW0001	6/08/2021	595.3	50.1
MB15H1SW0001	5/08/2021	595.3	50.1
MB15H1SW0001	4/08/2021	595.3	50.1
MB15H1SW0001	3/08/2021	595.3	50.1
MB15H1SW0001	2/08/2021	595.2	50.2
MB15H1SW0001	1/08/2021	595.2	50.2
MB15H1SW0001	31/07/2021	595.2	50.2
MB15H1SW0001	30/07/2021	595.2	50.2
MB15H1SW0001	29/07/2021	595.2	50.2
MB15H1SW0001	28/07/2021	595.2	50.2
MB15H1SW0001	27/07/2021	595.2	50.2
MB15H1SW0001	26/07/2021	595.2	50.2
MB15H1SW0001	25/07/2021	595.3	50.1
MB15H1SW0001	24/07/2021	595.2	50.1
MB15H1SW0001	23/07/2021	595.2	50.2
MB15H1SW0001	22/07/2021	595.2	50.2

ID	Date	WL mAHD	WL mbgl
MB20WN0131	5/12/2020	618.4	25.6
MB20WN0131	4/12/2020	618.5	25.6
MB20WN0131	3/12/2020	618.5	25.6
MB20WN0131	2/12/2020	618.5	25.6
MB20WN0131	1/12/2020	618.5	25.5
MB20WN0131	30/11/2020	618.5	25.6
MB20WN0131	29/11/2020	618.4	25.6
MB20WN0131	28/11/2020	618.5	25.6
MB20WN0131	27/11/2020	618.5	25.5
MB20WN0131	26/11/2020	618.5	25.5
MB20WN0131	25/11/2020	618.5	25.5
MB20WN0131	24/11/2020	618.5	25.5
MB20WN0131	23/11/2020	618.5	25.5
MB20WN0131	22/11/2020	618.5	25.5
MB20WN0131	21/11/2020	618.5	25.5
MB20WN0132	2/03/2022	622.4	19.6
MB20WN0132	1/03/2022	622.4	19.6
MB20WN0132	28/02/2022	622.4	19.7
MB20WN0132	27/02/2022	622.3	19.7
MB20WN0132	26/02/2022	622.3	19.7
MB20WN0132	25/02/2022	622.3	19.7
MB20WN0132	24/02/2022	622.3	19.7
MB20WN0132	23/02/2022	622.3	19.7
MB20WN0132	22/02/2022	622.2	19.8
MB20WN0132	21/02/2022	622.2	19.8
MB20WN0132	20/02/2022	622.2	19.8
MB20WN0132	19/02/2022	622.1	19.9
MB20WN0132	18/02/2022	622.1	19.9
MB20WN0132	17/02/2022	622.0	20.0
MB20WN0132	16/02/2022	622.0	20.0
MB20WN0132	15/02/2022	621.9	20.1
MB20WN0132	14/02/2022	621.9	20.1
MB20WN0132	13/02/2022	621.8	20.2
MB20WN0132	12/02/2022	621.7	20.3
MB20WN0132	11/02/2022	621.7	20.3
MB20WN0132	10/02/2022	621.7	20.3
MB20WN0132	9/02/2022	621.7	20.3
MB20WN0132	8/02/2022	621.6	20.4
MB20WN0132	7/02/2022	621.4	20.6
MB20WN0132	6/02/2022	621.4	20.6
MB20WN0132	5/02/2022	621.4	20.6
MB20WN0132	4/02/2022	621.4	20.6
MB20WN0132	3/02/2022	621.4	20.6
MB20WN0132	2/02/2022	621.4	20.6
MB20WN0132	1/02/2022	621.3	20.7
MB20WN0132	31/01/2022	621.3	20.7
MB20WN0132	30/01/2022	621.3	20.7
MB20WN0132	29/01/2022	621.3	20.7
MB20WN0132	28/01/2022	621.3	20.7
MB20WN0132	27/01/2022	621.1	20.9
MB20WN0132	26/01/2022	621.1	21.0
MB20WN0132	25/01/2022	621.0	21.0
MB20WN0132	24/01/2022	621.0	21.0
MB20WN0132	23/01/2022	621.1	20.9
MB20WN0132	22/01/2022	621.1	20.9
MB20WN0132	21/01/2022	621.1	20.9
MB20WN0132	20/01/2022	621.1	21.0
MB20WN0132	19/01/2022	621.0	21.0
MB20WN0132	18/01/2022	621.0	21.0
MB20WN0132	17/01/2022	621.0	21.0
MB20WN0132	16/01/2022	620.9	21.1
MB20WN0132	15/01/2022	620.9	21.1
MB20WN0132	14/01/2022	621.0	21.1
MB20WN0132	13/01/2022	621.0	21.0
MB20WN0132	12/01/2022	621.0	21.0
MB20WN0132	11/01/2022	621.1	20.9
MB20WN0132	10/01/2022	621.0	21.0
MB20WN0132	9/01/2022	621.0	21.0
MB20WN0132	8/01/2022	621.0	21.0
MB20WN0132	7/01/2022	621.1	21.0
MB20WN0132	6/01/2022	621.0	21.0
MB20WN0132	5/01/2022	621.1	21.0
MB20WN0132	4/01/2022	621.0	21.0
MB20WN0132	3/01/2022	621.0	21.0
MB20WN0132	2/01/2022	621.0	21.0
MB20WN0132	1/01/2022	621.1	21.0
MB20WN0132	31/12/2021	621.0	21.0
MB20WN0132	30/12/2021	621.0	21.0
MB20WN0132	29/12/2021	621.0	21.0
MB20WN0132	28/12/2021	621.1	20.9
MB20WN0132	27/12/2021	621.1	20.9
MB20WN0132	26/12/2021	621.1	20.9
MB20WN0132	25/12/2021	621.1	20.9
MB20WN0132	24/12/2021	621.1	20.9
MB20WN0132	23/12/2021	621.1	20.9
MB20WN0132	22/12/2021	621.1	20.9
MB20WN0132	21/12/2021	621.1	20.9
MB20WN0132	20/12/2021	621.1	20.9
MB20WN0132	19/12/2021	621.2	20.9
MB20WN0132	18/12/2021	621.1	20.9
MB20WN0132	17/12/2021	621.1	20.9
MB20WN0132	16/12/2021	621.1	20.9
MB20WN0132	15/12/2021	621.1	20.9
MB20WN0132	14/12/2021	621.1	20.9
MB20WN0132	13/12/2021	621.1	20.9
MB20WN0132	12/12/2021	621.2	20.9
MB20WN0132	11/12/2021	621.2	20.8
MB20WN0132	10/12/2021	621.2	20.9
MB20WN0132	9/12/2021	620.9	21.1
MB20WN0132	8/12/2021	620.9	21.1
MB20WN0132	7/12/2021	620.9	21.1
MB20WN0132	6/12/2021	621.0	21.0
MB20WN0132	5/12/2021	621.0	21.0
MB20WN0132	4/12/2021	621.1	21.0
MB20WN0132	3/12/2021	621.1	20.9
MB20WN0132	2/12/2021	621.1	20.9
MB20WN0132	1/12/2021	621.1	20.9
MB20WN0132	30/11/2021	621.1	20.9
MB20WN0132	29/11/2021	621.1	20.9
MB20WN0132	28/11/2021	621.1	20.9
MB20WN0132	15/11/2021	621.1	20.9
MB20WN0132	14/11/2021	621.1	20.9
MB20WN0132	27/09/2021	621.4	20.6
MB20WN0132	26/09/2021	621.4	20.6
MB20WN0132	25/09/2021	621.4	20.6
MB20WN0132	24/09/2021	621.4	20.6
MB20WN0132	23/09/2021	621.5	20.6
MB20WN0132	22/09/2021	621.5	20.5
MB20WN0132	21/09/2021	621.5	20.5
MB20WN0132	20/09/2021	621.5	20.5
MB20WN0132	19/09/2021	621.5	20.5
MB20WN0132	18/09/2021	621.5	20.5
MB20WN0132	17/09/2021	621.5	20.5
MB20WN0132	16/09/2021	621.5	20.5
MB20WN0132	15/09/2021	621.5	20.5
MB20WN0132	14/09/2021	621.5	20.5
MB20WN0132	13/09/2021	621.5	20.5
MB20WN0132	12/09/2021	621.5	20.5
MB20WN0132	11/09/2021	621.5	20.5
MB20WN0132	10/09/2021	621.6	20.5
MB20WN0132	9/09/2021	621.6	20.4
MB20WN0132	8/09/2021	621.6	20.4
MB20WN0132	7/09/2021	621.6	20.4
MB20WN0132	6/09/2021	621.6	20.4
MB20WN0132	5/09/2021	621.6	20.4
MB20WN0132	4/09/2021	621.6	20.4

ID	Date	WL mAHD	WL mbgl
MB18HD20003	6/11/2018	625.7	82.1
MB18HD20003	7/11/2018	625.7	82.1
MB18HD20003	8/11/2018	625.8	82.1
MB18HD20003	9/11/2018	625.8	82.1
MB18HD20003	10/11/2018	625.8	82.1
MB18HD20003	11/11/2018	625.8	82.1
MB18HD20003	12/11/2018	625.8	82.1
MB18HD20003	13/11/2018	625.8	82.1
MB18HD20003	14/11/2018	625.8	82.1
MB18HD20003	15/11/2018	625.8	82.1
MB18HD20003	16/11/2018	625.8	82.1
MB18HD20003	17/11/2018	625.8	82.1
MB18HD20003	18/11/2018	625.8	82.1
MB18HD20003	19/11/2018	625.8	82.1
MB18HD20003	20/11/2018	625.8	82.1
MB18HD20003	21/11/2018	625.8	82.1
MB18HD20003	22/11/2018	625.8	82.1
MB18HD20003	23/11/2018	625.8	82.1
MB18HD20003	24/11/2018	625.8	82.1
MB18HD20003	25/11/2018	625.8	82.1
MB18HD20003	26/11/2018	625.8	82.1
MB18HD20003	27/11/2018	625.8	82.1
MB18HD20003	28/11/2018	625.8	82.1
MB18HD20003	29/11/2018	625.8	82.1
MB18HD20003	30/11/2018	625.8	82.1
MB18HD20003	1/12/2018	625.8	82.1
MB18HD20003	2/12/2018	625.8	82.1
MB18HD20003	3/12/2018	625.8	82.1
MB18HD20003	4/12/2018	625.8	82.1
MB18HD20003	5/12/2018	625.8	82.1
MB18HD20003	6/12/2018	625.8	82.1
MB18HD20003	7/12/2018	625.8	82.1
MB18HD20003	8/12/2018	625.8	82.1
MB18HD20003	9/12/2018	625.8	82.1
MB18HD20003	10/12/2018	625.8	82.1
MB18HD20003	11/12/2018	625.8	82.1
MB18HD20003	12/12/2018	625.8	82.1
MB18HD20003	13/12/2018	625.8	82.1
MB18HD20003	14/12/2018	625.8	82.1
MB18HD20003	15/12/2018	625.8	82.1
MB18HD20003	16/12/2018	625.8	82.1
MB18HD20003	17/12/2018	625.8	82.1
MB18HD20003	18/12/2018	625.8	82.1
MB18HD20003	19/12/2018	625.8	82.0
MB18HD20003	20/12/2018	625.8	82.0
MB18HD20003	21/12/2018	625.8	82.0
MB18HD20003	22/12/2018	625.9	82.0
MB18HD20003	23/12/2018	625.9	82.0
MB18HD20003	24/12/2018	625.9	82.0
MB18HD20003	25/12/2018	625.9	82.0
MB18HD20003	26/12/2018	625.9	82.0
MB18HD20003	27/12/2018	625.9	82.0
MB18HD20003	28/12/2018	625.8	82.0
MB18HD20003	29/12/2018	625.8	82.0
MB18HD20003	30/12/2018	625.8	82.0
MB18HD20003	31/12/2018	625.8	82.0
MB18HD20003	1/01/2019	625.8	82.0
MB18HD20003	2/01/2019	625.9	82.0
MB18HD20003	3/01/2019	625.9	82.0
MB18HD20003	4/01/2019	625.9	82.0
MB18HD20003	5/01/2019	625.9	82.0
MB18HD20003	6/01/2019	625.9	82.0
MB18HD20003	7/01/2019	625.9	82.0
MB18HD20003	8/01/2019	625.9	82.0
MB18HD20003	9/01/2019	625.9	82.0
MB18HD20003	10/01/2019	625.9	82.0
MB18HD20003	11/01/2019	625.9	82.0
MB18HD20003	12/01/2019	625.9	82.0
MB18HD20003	13/01/2019	625.9	82.0
MB18HD20003	14/01/2019	625.9	82.0
MB18HD20003	15/01/2019	625.9	82.0
MB18HD20003	16/01/2019	625.9	82.0
MB18HD20003	17/01/2019	625.9	82.0
MB18HD20003	18/01/2019	625.9	82.0
MB18HD20003	19/01/2019	625.9	82.0
MB18HD20003	20/01/2019	625.9	82.0
MB18HD20003	21/01/2019	625.9	82.0
MB18HD20003	22/01/2019	625.9	82.0
MB18HD20003	23/01/2019	625.9	82.0
MB18HD20003	24/01/2019	625.9	82.0
MB18HD20003	25/01/2019	625.9	82.0
MB18HD20003	26/01/2019	625.9	82.0
MB18HD20003	27/01/2019	625.9	82.0
MB18HD20003	28/01/2019	625.9	82.0
MB18HD20003	29/01/2019	625.9	82.0
MB18HD20003	30/01/2019	625.9	82.0
MB18HD20003	31/01/2019	625.9	82.0
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	9/08/2021	635.4	50.8
HDVP1	8/08/2021	635.4	50.8
HDVP1	7/08/2021	635.4	50.8
HDVP1	6/08/2021	635.4	50.8
HDVP1	5/08/2021	635.4	50.8
HDVP1	4/08/2021	635.4	50.8
HDVP1	3/08/2021	635.4	50.8
HDVP1	2/08/2021	635.4	50.8
HDVP1	1/08/2021	635.4	50.8
HDVP1	31/07/2021	635.4	50.8
HDVP1	30/07/2021	635.4	50.8
HDVP1	29/07/2021	635.4	50.8
HDVP1	28/07/2021	635.4	50.8
HDVP1	27/07/2021	635.4	50.8
HDVP1	26/07/2021	635.4	50.8
HDVP1	25/07/2021	635.4	50.8
HDVP1	24/07/2021	635.4	50.8
HDVP1	23/07/2021	635.4	50.8
HDVP1	22/07/2021	612.0	74.2
HDVP1	21/07/2021	612.0	74.2
HDVP1	20/07/2021	612.0	74.2
HDVP1	19/07/2021	612.0	74.2
HDVP1	18/07/2021	612.0	74.2
HDVP1	17/07/2021	612.0	74.2
HDVP1	16/07/2021	612.0	74.2
HDVP1	15/07/2021	612.0	74.2
HDVP1	14/07/2021	612.0	74.2
HDVP1	13/07/2021	612.0	74.2
HDVP1	12/07/2021	612.0	74.2
HDVP1	11/07/2021	612.0	74.2
HDVP1	10/07/2021	612.0	74.2
HDVP1	9/07/2021	612.0	74.2
HDVP1	8/07/2021	612.0	74.2
HDVP1	7/07/2021	612.0	74.2
HDVP1	6/07/2021	612.0	74.2
HDVP1	5/07/2021	612.0	74.2
HDVP1	4/07/2021	612.0	74.2
HDVP1	3/07/2021	612.0	74.2
HDVP1	2/07/2021	612.0	74.2
HDVP1	1/07/2021	612.0	74.2
HDVP1	30/06/2021	612.0	74.2
HDVP1	29/06/2021	612.0	74.2
HDVP1	28/06/2021	612.0	74.2
HDVP1	27/06/2021	612.0	74.2
HDVP1	26/06/2021	612.0	74.2
HDVP1	25/06/2021	612.0	74.2
HDVP1	24/06/2021	612.0	74.2
HDVP1	23/06/2021	612.0	74.2
HDVP1	22/06/2021	612.0	74.2
HDVP1	21/06/2021	612.0	74.2
HDVP1	20/06/2021	612.0	74.2
HDVP1	19/06/2021	612.0	74.2
HDVP1	18/06/2021	612.0	74.2
HDVP1	17/06/2021	612.0	74.2
HDVP1	16/06/2021	612.0	74.2
HDVP1	15/06/2021	612.0	74.2
HDVP1	14/06/2021	612.0	74.2
HDVP1	13/06/2021	612.0	74.2
HDVP1	12/06/2021	612.0	74.2
HDVP1	11/06/2021	583.9	102.2
HDVP1	10/06/2021	583.9	102.2
HDVP1	9/06/2021	583.9	102.2
HDVP1	8/06/2021	583.9	102.2
HDVP1	7/06/2021	583.9	102.2
HDVP1	6/06/2021	583.9	102.2
HDVP1	5/06/2021	583.9	102.2
HDVP1	4/06/2021	583.9	102.2
HDVP1	3/06/2021	583.9	102.2
HDVP1	2/06/2021	583.9	102.2
HDVP1	1/06/2021	583.9	102.2
HDVP1	31/05/2021	583.9	102.2
HDVP1	30/05/2021	583.9	102.2
HDVP1	29/05/2021	583.9	102.2
HDVP1	28/05/2021	583.9	102.2
HDVP1	27/05/2021	583.9	102.2
HDVP1	26/05/2021	583.9	102.2
HDVP1	25/05/2021	583.9	102.2
HDVP1	24/05/2021	583.9	102.2
HDVP1	23/05/2021	583.9	102.2
HDVP1	22/05/2021	583.9	102.2
HDVP1	21/05/2021	583.9	102.2
HDVP1	20/05/2021	583.9	102.2
HDVP1	19/05/2021	583.9	102.2
HDVP1	18/05/2021	583.9	102.2
HDVP1	17/05/2021	583.9	102.2
HDVP1	16/05/2021	583.9	102.2
HDVP1	15/05/2021	583.9	102.2
HDVP1	14/05/2021	583.9	102.2
HDVP1	13/05/2021	583.9	102.2
HDVP1	12/05/2021	583.9	102.2
HDVP1	11/05/2021	583.9	102.2
HDVP1	10/05/2021	583.9	102.2
HDVP1	9/05/2021	583.9	102.2
HDVP1	8/05/2021	583.9	102.2
HDVP1	7/05/2021	583.9	102.2
HDVP1	6/05/2021	583.9	102.2
HDVP1	5/05/2021	583.9	102.2
HDVP1	4/05/2021	583.9	102.2
HDVP1	3/05/2021	583.9	102.2
HDVP1	2/05/2021	583.9	102.2
HDVP1	1/05/2021	583.9	102.2
HDVP1	30/04/2021	583.9	102.2
HDVP1	29/04/2021	583.9	102.2
HDVP1	28/04/2021	583.9	102.2
HDVP1	27/04/2021	583.9	102.2
HDVP1	26/04/2021	583.9	102.2
HDVP1	25/04/2021	583.9	102.2
HDVP1	24/04/2021	583.9	102.2
HDVP1	23/04/2021	583.9	102.2
HDVP1	22/04/2021	583.9	102.2
HDVP1	21/04/2021	583.9	102.2
HDVP1	20/04/2021	583.9	102.2
HDVP1	19/04/2021	583.9	102.2
HDVP1	18/04/2021	583.9	102.2
HDVP1	17/04/2021	583.9	102.2
HDVP1	16/04/2021	583.9	102.2
HDVP1	15/04/2021	583.9	102.2
HDVP1	14/04/2021	583.9	102.2
HDVP1	13/04/2021	583.9	102.2
HDVP1	12/04/2021	583.9	102.2
HDVP1	11/04/2021	583.9	102.2
HDVP1	10/04/2021	583.9	102.2
HDVP1	9/04/2021	583.9	102.2
HDVP1	8/04/2021	583.9	102.2
HDVP1	7/04/2021	583.9	102.2
HDVP1	6/04/2021	583.9	102.2
HDVP1	5/04/2021	583.9	102.2
HDVP1	4/04/2021	583.9	102.2
HDVP1	3/04/2021	583.9	102.2
HDVP1	2/04/2021	583.9	102.2
HDVP1	1/04/2021	583.9	102.2
HDVP1	31/03/2021	583.9	102.2
HDVP1	30/03/2021	583.9	102.2
HDVP1	29/03/2021	583.9	102.2
HDVP1	28/03/2021	583.9	102.2
HDVP1	27/03/2021	583.9	102.2

ID	Date	WL mAHD	WL mbgl
MB15H1SW0001	21/07/2021	595.2	50.1
MB15H1SW0001	20/07/2021	595.2	50.1
MB15H1SW0001	19/07/2021	595.2	50.1
MB15H1SW0001	18/07/2021	595.3	50.1
MB15H1SW0001	17/07/2021	595.3	50.1
MB15H1SW0001	16/07/2021	595.2	50.1
MB15H1SW0001	15/07/2021	595.2	50.2
MB15H1SW0001	14/07/2021	595.2	50.2
MB15H1SW0001	13/07/2021	595.2	50.2
MB15H1SW0001	12/07/2021	595.2	50.2
MB15H1SW0001	11/07/2021	595.2	50.2
MB15H1SW0001	10/07/2021	595.2	50.2
MB15H1SW0001	9/07/2021	595.2	50.1
MB15H1SW0001	8/07/2021	595.2	50.1
MB15H1SW0001	7/07/2021	595.2	50.1
MB15H1SW0001	6/07/2021	595.3	50.1
MB15H1SW0001	5/07/2021	595.3	50.1
MB15H1SW0001	4/07/2021	595.3	50.1
MB15H1SW0001	3/07/2021	595.3	50.1
MB15H1SW0001	2/07/2021	595.3	50.1
MB15H1SW0001	1/07/2021	595.3	50.1
MB15H1SW0001	30/06/2021	595.3	50.1
MB15H1SW0001	29/06/2021	595.3	50.1
MB15H1SW0001	28/06/2021	595.3	50.1
MB15H1SW0001	27/06/2021	595.3	50.1
MB15H1SW0001	26/06/2021	595.3	50.1
MB15H1SW0001	25/06/2021	595.3	50.1
MB15H1SW0001	24/06/2021	595.3	50.1
MB15H1SW0001	23/06/2021	595.3	50.1
MB15H1SW0001	22/06/2021	595.2	50.1
MB15H1SW0001	21/06/2021	595.3	50.1
MB15H1SW0001	20/06/2021	595.3	50.1
MB15H1SW0001	19/06/2021	595.3	50.1
MB15H1SW0001	18/06/2021	595.3	50.1
MB15H1SW0001	17/06/2021	595.3	50.1
MB15H1SW0001	16/06/2021	595.3	50.1
MB15H1SW0001	15/06/2021	595.2	50.1
MB15H1SW0001	14/06/2021	595.2	50.1
MB15H1SW0001	13/06/2021	595.2	50.2
MB15H1SW0001	12/06/2021	595.2	50.2
MB15H1SW0001	30/05/2021	595.3	50.1
MB15H1SW0001	6/12/2020	595.3	50.1
MB15H1SW0001	5/12/2020	595.4	50.0
MB15H1SW0001	4/12/2020	595.4	50.0
MB15H1SW0001	3/12/2020	595.3	50.1
MB15H1SW0001	2/12/2020	595.4	50.0
MB15H1SW0001	1/12/2020	595.3	50.1
MB15H1SW0001	30/11/2020	595.3	50.1
MB15H1SW0001	29/11/2020	595.3	50.1
MB15H1SW0001	28/11/2020	595.3	50.1
MB15H1SW0001	27/11/2020	595.3	50.1
MB15H1SW0001	26/11/2020	595.4	50.0
MB15H1SW0001	25/11/2020	595.4	50.0
MB15H1SW0001	24/11/2020	595.4	50.0
MB15H1SW0001	23/11/2020	595.4	50.0
MB15H1SW0001	22/11/2020	595.4	50.0
MB15H1SW0001	21/11/2020	595.4	50.0
MB15H1SW0001	20/11/2020	595.4	50.0
MB15H1SW0001	19/11/2020	595.4	50.0
MB15H1SW0001	18/11/2020	595.4	50.0
MB15H1SW0001	17/11/2020	595.4	50.0
MB15H1SW0001	16/11/2020	595.4	50.0
MB15H1SW0001	15/11/2020	595.4	50.0
MB15H1SW0001	14/11/2020	595.4	50.0
MB15H1SW0001	13/11/2020	595.4	50.0
MB15H1SW0001	12/11/2020	595.4	50.0
MB15H1SW0001	11/11/2020	595.4	50.0
MB15H1SW0001	10/11/2020	595.4	50.0
MB15H1SW0001	9/11/2020	595.4	50.0
MB15H1SW0001	8/11/2020	595.4	50.0
MB15H1SW0001	7/11/2020	595.4	50.0
MB15H1SW0001	6/11/2020	595.4	50.0
MB15H1SW0001	5/11/2020	595.4	50.0
MB15H1SW0001	4/11/2020	595.4	50.0
MB15H1SW0001	3/11/2020	595.4	50.0
MB15H1SW0001	2/11/2020	595.4	50.0
MB15H1SW0001	1/11/2020	595.4	50.0
MB15H1SW0001	31/10/2020	595.4	50.0
MB15H1SW0001	30/10/2020	595.4	50.0
MB15H1SW0001	29/10/2020	595.4	50.0
MB15H1SW0001	28/10/2020	595.4	50.0
MB15H1SW0001	27/10/2020	595.4	50.0
MB15H1SW0001	26/10/2020	595.4	50.0
MB15H1SW0001	25/10/2020	595.4	50.0
MB15H1SW0001	24/10/2020	595.4	50.0
MB15H1SW0001	23/10/2020	595.4	50.0
MB15H1SW0001	22/10/2020	595.4	50.0
MB15H1SW0001	21/10/2020	595.4	50.0
MB15H1SW0001	20/10/2020	595.4	50.0
MB15H1SW0001	19/10/2020	595.4	50.0
MB15H1SW0001	18/10/2020	595.4	50.0
MB15H1SW0001	17/10/2020	595.4	50.0
MB15H1SW0001	16/10/2020	595.4	50.0
MB15H1SW0001	15/10/2020	595.4	50.0
MB15H1SW0001	14/10/2020	595.4	50.0
MB15H1SW0001	13/10/2020	595.4	50.0
MB15H1SW0001	12/10/2020	595.4	50.0
MB15H1SW0001	11/10/2020	595.4	50.0
MB15H1SW0001	10/10/2020	595.4	50.0
MB15H1SW0001	9/10/2020	595.4	50.0
MB15H1SW0001	8/10/2020	595.4	50.0
MB15H1SW0001	7/10/2020	595.5	49.9
MB15H1SW0001	6/10/2020	595.5	49.9
MB15H1SW0001	5/10/2020	595.5	49.9
MB15H1SW0001	4/10/2020	595.4	50.0
MB15H1SW0001	3/10/2020	595.4	50.0
MB15H1SW0001	2/10/2020	595.4	50.0
MB15H1SW0001	1/10/2020	595.4	50.0
MB15H1SW0001	30/09/2020	595.4	50.0
MB15H1SW0001	29/09/2020	595.4	50.0
MB15H1SW0001	28/09/2020	595.4	50.0
MB15H1SW0001	27/09/2020	595.4	50.0
MB15H1SW0001	26/09/2020	595.4	50.0
MB15H1SW0001	25/09/2020	595.4	50.0
MB15H1SW0001	24/09/2020	595.4	50.0
MB15H1SW0001	23/09/2020	595.5	49.9
MB15H1SW0001	22/09/2020	595.4	50.0
MB15H1SW0001	21/09/2020	595.4	50.0
MB15H1SW0001	20/09/2020	595.4	50.0
MB15H1SW0001	19/09/2020	595.4	50.0
MB15H1SW0001	18/09/2020	595.4	50.0
MB15H1SW0001	17/09/2020	595.4	50.0
MB15H1SW0001	16/09/2020	595.5	49.9
MB15H1SW0001	15/09/2020	595.5	49.9
MB15H1SW0001	14/09/2020	595.5	49.9
MB15H1SW0001	13/09/2020	595.4	50.0
MB15H1SW0001	12/09/2020	595.4	50.0
MB15H1SW0001	11/09/2020	595.4	50.0
MB15H1SW0001	10/09/2020	595.4	50.0
MB15H1SW0001	9/09/2020	595.4	50.0
MB15H1SW0001	8/09/2020	595.5	49.9
MB15H1SW0001	7/09/2020	595.4	50.0
MB15H1SW0001	6/09/2020	595.4	50.0
MB15H1SW0001	5/09/2020	595.5	49.9
MB15H1SW0001	4/09/2020	595.5	49.9
MB15H1SW0001	3/09/2020	595.5	49.9

ID	Date	WL mAHD	WL mbgl
MB20WN0132	3/09/2021	621.6	20.4
MB20WN0132	2/09/2021	621.6	20.4
MB20WN0132	1/09/2021	621.6	20.4
MB20WN0132	31/08/2021	621.6	20.4
MB20WN0132	30/08/2021	621.6	20.4
MB20WN0132	29/08/2021	621.6	20.4
MB20WN0132	28/08/2021	621.7	20.4
MB20WN0132	27/08/2021	621.7	20.3
MB20WN0132	26/08/2021	621.7	20.4
MB20WN0132	25/08/2021	621.7	20.3
MB20WN0132	24/08/2021	621.7	20.3
MB20WN0132	23/08/2021	621.7	20.3
MB20WN0132	22/08/2021	621.7	20.3
MB20WN0132	21/08/2021	621.7	20.3
MB20WN0132	20/08/2021	621.7	20.3
MB20WN0132	19/08/2021	621.7	20.3
MB20WN0132	18/08/2021	621.8	20.3
MB20WN0132	17/08/2021	621.8	20.2
MB20WN0132	16/08/2021	621.8	20.2
MB20WN0132	15/08/2021	621.8	20.2
MB20WN0132	14/08/2021	621.8	20.2
MB20WN0132	13/08/2021	621.8	20.2
MB20WN0132	12/08/2021	621.9	20.1
MB20WN0132	11/08/2021	621.9	20.1
MB20WN0132	10/08/2021	621.9	20.1
MB20WN0132	9/08/2021	621.9	20.2
MB20WN0132	8/08/2021	621.9	20.1
MB20WN0132	7/08/2021	621.9	20.1
MB20WN0132	6/08/2021	621.9	20.1
MB20WN0132	5/08/2021	622.0	20.1
MB20WN0132	4/08/2021	622.0	20.0
MB20WN0132	3/08/2021	622.0	20.0
MB20WN0132	2/08/2021	622.0	20.0
MB20WN0132	1/08/2021	622.0	20.0
MB20WN0132	31/07/2021	622.0	20.0
MB20WN0132	30/07/2021	621.9	20.1
MB20WN0132	29/07/2021	622.0	20.1
MB20WN0132	28/07/2021	622.0	20.0
MB20WN0132	27/07/2021	622.0	20.0
MB20WN0132	26/07/2021	622.0	20.0
MB20WN0132	25/07/2021	622.0	20.0
MB20WN0132	24/07/2021	622.1	20.0
MB20WN0132	23/07/2021	622.1	20.0
MB20WN0132	22/07/2021	622.1	20.0
MB20WN0132	21/07/2021	622.1	19.9
MB20WN0132	20/07/2021	622.1	19.9
MB20WN0132	19/07/2021	622.1	19.9
MB20WN0132	18/07/2021	622.1	19.9
MB20WN0132	17/07/2021	622.2	19.8
MB20WN0132	16/07/2021	622.2	19.8
MB20WN0132	15/07/2021	622.2	19.8
MB20WN0132	14/07/2021	622.2	19.8
MB20WN0132	13/07/2021	622.2	19.8
MB20WN0132	12/07/2021	622.2	19.8
MB20WN0132	11/07/2021	622.2	19.8
MB20WN0132	10/07/2021	622.2	19.8
MB20WN0132	9/07/2021	622.3	19.7
MB20WN0132	8/07/2021	622.3	19.7
MB20WN0132	7/07/2021	622.3	19.7
MB20WN0132	6/07/2021	622.3	19.7
MB20WN0132	5/07/2021	622.4	19.7
MB20WN0132	4/07/2021	622.4	19.6
MB20WN0132	3/07/2021	622.4	19.6
MB20WN0132	2/07/2021	622.4	19.6
MB20WN0132	1/07/2021	622.5	19.6
MB20WN0132	30/06/2021	622.5	19.6
MB20WN0132	29/06/2021	622.4	19.6
MB20WN0132	28/06/2021	622.5	19.6
MB20WN0132	27/06/2021	622.5	19.5
MB20WN0132	26/06/2021	622.5	19.5
MB20WN0132	25/06/2021	622.6	19.5
MB20WN0132	24/06/2021	622.6	19.4
MB20WN0132	23/06/2021	622.6	19.4
MB20WN0132	22/06/2021	622.6	19.4
MB20WN0132	21/06/2021	622.6	19.4
MB20WN0132	20/06/2021	622.6	19.4
MB20WN0132	19/06/2021	622.7	19.4
MB20WN0132	18/06/2021	622.7	19.3
MB20WN0132	17/06/2021	622.7	19.3
MB20WN0132	16/06/2021	622.7	19.3
MB20WN0132	15/06/2021	622.7	19.3
MB20WN0132	14/06/2021	622.7	19.3
MB20WN0132	13/06/2021	622.7	19.3
MB20WN0132	12/06/2021	622.7	19.3
MB20WN0132	11/06/2021	622.8	19.3
MB20WN0132	10/06/2021	622.8	19.2
MB20WN0132	9/06/2021	622.8	19.2
MB20WN0132	8/06/2021	622.9	19.1
MB20WN0132	7/06/2021	622.9	19.1
MB20WN0132	6/06/2021	622.9	19.1
MB20WN0132	5/06/2021	622.9	19.1
MB20WN0132	4/06/2021	623.0	19.1
MB20WN0132	3/06/2021	623.0	19.0
MB20WN0132	2/06/2021	623.0	19.0
MB20WN0132	1/06/2021	623.0	19.0
MB20WN0132	31/05/2021	623.0	19.0
MB20WN0132	30/05/2021	623.0	19.0
MB20WN0132	29/05/2021	623.1	19.0
MB20WN0132	28/05/2021	623.1	18.9
MB20WN0132	27/05/2021	623.1	18.9
MB20WN0132	26/05/2021	623.2	18.9
MB20WN0132	25/05/2021	623.2	18.8
MB20WN0132	24/05/2021	623.2	18.9
MB20WN0132	23/05/2021	623.2	18.9
MB20WN0132	21/05/2021	623.3	18.8
MB20WN0132	20/05/2021	623.3	18.7
MB20WN0132	19/05/2021	623.3	18.7
MB20WN0132	18/05/2021	623.3	18.7
MB20WN0132	17/05/2021	623.4	18.6
MB20WN0132	16/05/2021	623.4	18.6
MB20WN0132	15/05/2021	623.4	18.6
MB20WN0132	14/05/2021	623.5	18.6
MB20WN0132	13/05/2021	623.5	18.5
MB20WN0132	12/05/2021	623.5	18.5
MB20WN0132	11/05/2021	623.5	18.5
MB20WN0132	10/05/2021	623.6	18.5
MB20WN0132	9/05/2021	623.6	18.5
MB20WN0132	8/05/2021	623.6	18.5
MB20WN0132	7/05/2021	623.6	18.4
MB20WN0132	6/05/2021	623.5	18.5
MB20WN0132	5/05/2021	623.5	18.5
MB20WN0132	4/05/2021	623.5	18.5
MB20WN0132	3/05/2021	623.6	18.4
MB20WN0132	2/05/2021	623.6	18.4
MB20WN0132	1/05/2021	623.6	18.4
MB20WN0132	30/04/2021	623.7	18.4
MB20WN0132	29/04/2021	623.7	18.3
MB20WN0132	28/04/2021	623.7	18.3
MB20WN0132	27/04/2021	623.7	18.3
MB20WN0132	26/04/2021	623.7	18.3
MB20WN0132	21/11/2020	620.9	21.1
MB21BHT0001	3/03/2022	624.8	62.5
MB21BHT0001	2/03/2022	624.8	62.5
MB21BHT0001	1/03/2022	624.8	62.5
MB21BHT0001	28/02/2022	625.1	62.2
MB21BHT0001	27/02/2022	624.8	62.5

ID	Date	WL mAHD	WL mbgl
MB18HD20003	22/03/2019	626.0	81.9
MB18HD20003	23/03/2019	626.0	81.9
MB18HD20003	24/03/2019	626.0	81.9
MB18HD20003	25/03/2019	626.0	81.9
MB18HD20003	26/03/2019	626.0	81.9
MB18HD20003	27/03/2019	626.0	81.9
MB18HD20003	28/03/2019	626.0	81.9
MB18HD20003	29/03/2019	626.0	81.9
MB18HD20003	30/03/2019	626.0	81.9
MB18HD20003	31/03/2019	626.0	81.8
MB18HD20003	1/04/2019	626.0	81.8
MB18HD20003	2/04/2019	626.0	81.8
MB18HD20003	3/04/2019	626.0	81.8
MB18HD20003	4/04/2019	626.0	81.8
MB18HD20003	5/04/2019	626.0	81.8
MB18HD20003	6/04/2019	626.1	81.8
MB18HD20003	7/04/2019	626.1	81.8
MB18HD20003	8/04/2019	626.0	81.8
MB18HD20003	9/04/2019	626.0	81.8
MB18HD20003	10/04/2019	626.0	81.8
MB18HD20003	11/04/2019	626.1	81.8
MB18HD20003	12/04/2019	626.1	81.8
MB18HD20003	13/04/2019	626.1	81.8
MB18HD20003	14/04/2019	626.1	81.8
MB18HD20003	15/04/2019	626.1	81.8
MB18HD20003	16/04/2019	626.1	81.8
MB18HD20003	17/04/2019	626.1	81.8
MB18HD20003	18/04/2019	626.1	81.8
MB18HD20003	19/04/2019	626.1	81.8
MB18HD20003	20/04/2019	626.1	81.8
MB18HD20003	21/04/2019	626.1	81.8
MB18HD20003	22/04/2019	626.1	81.8
MB18HD20003	23/04/2019	626.1	81.8
MB18HD20003	24/04/2019	626.1	81.8
MB18HD20003	25/04/2019	626.1	81.8
MB18HD20003	26/04/2019	626.1	81.8
MB18HD20003	27/04/2019	626.1	81.8
MB18HD20003	28/04/2019	626.1	81.8
MB18HD20003	29/04/2019	626.1	81.8
MB18HD20003	30/04/2019	626.1	81.8
MB18HD20003	1/05/2019	626.1	81.8
MB18HD20003	2/05/2019	626.1	81.8
MB18HD20003	3/05/2019	626.1	81.8
MB18HD20003	4/05/2019	626.1	81.8
MB18HD20003	5/05/2019	626.1	81.8
MB18HD20003	6/05/2019	626.1	81.8
MB18HD20003	7/05/2019	626.1	81.8
MB18HD20003	8/05/2019	626.1	81.8
MB18HD20003	9/05/2019	626.1	81.8
MB18HD20003	10/05/2019	626.1	81.7
MB18HD20003	11/05/2019	626.1	81.7
MB18HD20003	12/05/2019	626.1	81.7
MB18HD20003	13/05/2019	626.1	81.7
MB18HD20003	14/05/2019	626.1	81.7
MB18HD20003	15/05/2019	626.1	81.7
MB18HD20003	16/05/2019	626.1	81.7
MB18HD20003	17/05/2019	626.1	81.7
MB18HD20003	18/05/2019	626.1	81.8
MB18HD20003	19/05/2019	626.1	81.8
MB18HD20003	20/05/2019	626.1	81.8
MB18HD20003	21/05/2019	626.1	81.7
MB18HD20003	22/05/2019	626.1	81.7
MB18HD20003	23/05/2019	626.1	81.7
MB18HD20003	24/05/2019	626.1	81.7
MB18HD20003	25/05/2019	626.1	81.7
MB18HD20003	26/05/2019	626.1	81.7
MB18HD20003	27/05/2019	626.1	81.7
MB18HD20003	28/05/2019	626.1	81.7
MB18HD20003	29/05/2019	626.1	81.7
MB18HD20003	30/05/2019	626.1	81.7
MB18HD20003	31/05/2019	626.1	81.7
MB18HD20003	2/06/2019	626.2	81.7
MB18HD20003	4/06/2019	626.2	81.7
MB18HD20003	5/06/2019	626.2	81.7
MB18HD20003	6/06/2019	626.2	81.7
MB18HD20003	7/06/2019	626.2	81.7
MB18HD20003	8/06/2019	626.2	81.7
MB18HD20003	9/06/2019	626.1	81.7
MB18HD20003	10/06/2019	626.1	81.7
MB18HD20003	11/06/2019	626.1	81.7
MB18HD20003	12/06/2019	626.1	81.7
MB18HD20003	13/06/2019	626.1	81.7
MB18HD20003	14/06/2019	626.1	81.7
MB18HD20003	16/06/2019	626.2	81.7
MB18HD20003	17/06/2019	626.2	81.7
MB18HD20003	18/06/2019	626.2	81.7
MB18HD20003	19/06/2019	626.2	81.7

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	26/03/2021	583.9	102.2
HDVP1	25/03/2021	583.9	102.2
HDVP1	24/03/2021	583.9	102.2
HDVP1	23/03/2021	583.9	102.2
HDVP1	22/03/2021	583.9	102.2
HDVP1	21/03/2021	583.9	102.2
HDVP1	20/03/2021	583.9	102.2
HDVP1	19/03/2021	583.9	102.2
HDVP1	18/03/2021	583.9	102.2
HDVP1	17/03/2021	583.9	102.2
HDVP1	16/03/2021	583.9	102.2
HDVP1	15/03/2021	583.9	102.2
HDVP1	14/03/2021	583.9	102.2
HDVP1	13/03/2021	583.9	102.2
HDVP1	12/03/2021	583.9	102.2
HDVP1	11/03/2021	583.9	102.2
HDVP1	10/03/2021	583.9	102.2
HDVP1	9/03/2021	583.9	102.2
HDVP1	8/03/2021	583.9	102.2
HDVP1	7/03/2021	583.9	102.2
HDVP1	6/03/2021	583.9	102.2
HDVP1	5/03/2021	583.9	102.2
HDVP1	4/03/2021	583.9	102.2
HDVP1	3/03/2021	583.9	102.2
HDVP1	2/03/2021	583.9	102.2
HDVP1	1/03/2021	583.9	102.2
HDVP1	28/02/2021	583.9	102.2
HDVP1	27/02/2021	583.9	102.2
HDVP1	26/02/2021	583.9	102.2
HDVP1	25/02/2021	583.9	102.2
HDVP1	24/02/2021	583.9	102.2
HDVP1	23/02/2021	583.9	102.2
HDVP1	22/02/2021	583.9	102.2
HDVP1	21/02/2021	583.9	102.2
HDVP1	20/02/2021	583.9	102.2
HDVP1	19/02/2021	583.9	102.2
HDVP1	18/02/2021	583.9	102.2
HDVP1	17/02/2021	583.9	102.2
HDVP1	16/02/2021	583.9	102.2
HDVP1	15/02/2021	583.9	102.2
HDVP1	14/02/2021	583.9	102.2
HDVP1	13/02/2021	583.9	102.2
HDVP1	12/02/2021	583.9	102.2
HDVP1	11/02/2021	583.9	102.2
HDVP1	10/02/2021	583.9	102.2
HDVP1	9/02/2021	583.9	102.2
HDVP1	8/02/2021	583.9	102.2
HDVP1	7/02/2021	583.9	102.2
HDVP1	6/02/2021	583.9	102.2
HDVP1	5/02/2021	583.9	102.2
HDVP1	4/02/2021	583.9	102.2
HDVP1	3/02/2021	583.9	102.2
HDVP1	2/02/2021	583.9	102.2
HDVP1	1/02/2021	578.3	107.8
HDVP1	31/01/2021	578.3	107.8
HDVP1	30/01/2021	578.3	107.8
HDVP1	29/01/2021	578.3	107.8
HDVP1	28/01/2021	578.3	107.8
HDVP1	27/01/2021	578.3	107.8
HDVP1	26/01/2021	578.3	107.8
HDVP1	25/01/2021	578.3	107.8
HDVP1	24/01/2021	578.3	107.8
HDVP1	23/01/2021	578.3	107.8
HDVP1	22/01/2021	578.3	107.8
HDVP1	21/01/2021	578.3	107.8
HDVP1	20/01/2021	578.3	107.8
HDVP1	19/01/2021	578.3	107.8
HDVP1	18/01/2021	578.3	107.8
HDVP1	17/01/2021	578.3	107.8
HDVP1	16/01/2021	578.3	107.8
HDVP1	15/01/2021	578.3	107.8
HDVP1	14/01/2021	578.3	107.8
HDVP1	13/01/2021	578.3	107.8
HDVP1	12/01/2021	578.3	107.8
HDVP1	11/01/2021	578.3	107.8
HDVP1	10/01/2021	578.3	107.8
HDVP1	9/01/2021	578.3	107.8
HDVP1	8/01/2021	578.3	107.8
HDVP1	7/01/2021	578.3	107.8
HDVP1	6/01/2021	578.3	107.8
HDVP1	5/01/2021	578.3	107.8
HDVP1	4/01/2021	578.3	107.8
HDVP1	3/01/2021	578.3	107.8
HDVP1	2/01/2021	578.3	107.8
HDVP1	1/01/2021	556.7	129.5
HDVP1	31/12/2020	556.7	129.5
HDVP1	30/12/2020	556.7	129.5
HDVP1	29/12/2020	556.7	129.5
HDVP1	28/12/2020	556.7	129.5
HDVP1	27/12/2020	556.7	129.5
HDVP1	26/12/2020	556.7	129.5
HDVP1	25/12/2020	556.7	129.5
HDVP1	24/12/2020	556.7	129.5
HDVP1	23/12/2020	556.7	129.5
HDVP1	22/12/2020	556.7	129.5
HDVP1	21/12/2020	556.7	129.5
HDVP1	20/12/2020	556.7	129.5
HDVP1	19/12/2020	556.7	129.5
HDVP1	18/12/2020	556.7	129.5
HDVP1	17/12/2020	556.7	129.5
HDVP1	16/12/2020	556.7	129.5
HDVP1	15/12/2020	556.7	129.5
HDVP1	14/12/2020	556.7	129.5
HDVP1	13/12/2020	556.7	129.5
HDVP1	12/12/2020	556.7	129.5
HDVP1	11/12/2020	556.7	129.5
HDVP1	10/12/2020	556.7	129.5
HDVP1	9/12/2020	556.7	129.5
HDVP1	8/12/2020	556.7	129.5
HDVP1	7/12/2020	556.7	129.5
HDVP1	6/12/2020	556.7	129.5
HDVP1	5/12/2020	556.7	129.5
HDVP1	4/12/2020	556.7	129.5
HDVP1	3/12/2020	556.7	129.5
HDVP1	2/12/2020	556.7	129.5
HDVP1	1/12/2020	662.6	23.5
HDVP1	30/11/2020	662.6	23.5
HDVP1	29/11/2020	662.6	23.5
HDVP1	28/11/2020	662.6	23.5
HDVP1	27/11/2020	662.6	23.5
HDVP1	26/11/2020	662.6	23.5
HDVP1	25/11/2020	662.6	23.5
HDVP1	24/11/2020	662.6	23.5
HDVP1	23/11/2020	662.6	23.5
HDVP1	22/11/2020	662.6	23.5
HDVP1	21/11/2020	662.6	23.5
HDVP1	20/11/2020	662.6	23.5
HDVP1	19/11/2020	662.6	23.5
HDVP1	18/11/2020	662.6	23.5
HDVP1	17/11/2020	662.6	23.5
HDVP1	16/11/2020	662.6	23.5
HDVP1	15/11/2020	662.6	23.5
HDVP1	14/11/2020	662.6	23.5
HDVP1	13/11/2020	662.6	23.5
HDVP1	12/11/2020	662.6	23.5
HDVP1	11/11/2020	662.6	23.5

ID	Date	WL mAHD	WL mbgl
MB15H1SW0001	2/09/2020	595.5	49.9
MB15H1SW0001	1/09/2020	595.5	49.9
MB15H1SW0001	31/08/2020	595.5	49.9
MB15H1SW0001	30/08/2020	595.5	49.9
MB15H1SW0001	29/08/2020	595.5	49.9
MB15H1SW0001	28/08/2020	595.5	49.9
MB15H1SW0001	27/08/2020	595.5	49.9
MB15H1SW0001	26/08/2020	595.5	49.9
MB15H1SW0001	25/08/2020	595.5	49.9
MB15H1SW0001	24/08/2020	595.5	49.9
MB15H1SW0001	23/08/2020	595.5	49.9
MB15H1SW0001	22/08/2020	595.5	49.9
MB15H1SW0001	21/08/2020	595.5	49.9
MB15H1SW0001	20/08/2020	595.5	49.9
MB15H1SW0001	19/08/2020	595.5	49.9
MB15H1SW0001	18/08/2020	595.5	49.9
MB15H1SW0001	17/08/2020	595.5	49.9
MB15H1SW0001	16/08/2020	595.5	49.9
MB15H1SW0001	15/08/2020	595.5	49.9
MB15H1SW0001	14/08/2020	595.5	49.9
MB15H1SW0001	13/08/2020	595.5	49.9
MB15H1SW0001	12/08/2020	595.5	49.9
MB15H1SW0001	11/08/2020	595.5	49.9
MB15H1SW0001	10/08/2020	595.5	49.9
MB15H1SW0001	9/08/2020	595.5	49.9
MB15H1SW0001	8/08/2020	595.5	49.9
MB15H1SW0001	7/08/2020	595.5	49.9
MB15H1SW0001	6/08/2020	595.5	49.9
MB15H1SW0001	5/08/2020	595.5	49.9
MB15H1SW0001	4/08/2020	595.5	49.9
MB15H1SW0001	3/08/2020	595.5	49.9
MB15H1SW0001	2/08/2020	595.5	49.9
MB15H1SW0001	1/08/2020	595.5	49.9
MB15H1SW0001	31/07/2020	595.5	49.9
MB15H1SW0001	30/07/2020	595.5	49.9
MB15H1SW0001	29/07/2020	595.5	49.9
MB15H1SW0001	28/07/2020	595.5	49.9
MB15H1SW0001	27/07/2020	595.5	49.9
MB15H1SW0001	26/07/2020	595.5	49.9
MB15H1SW0001	25/07/2020	595.5	49.9
MB15H1SW0001	24/07/2020	595.5	49.9
MB15H1SW0001	23/07/2020	595.5	49.9
MB15H1SW0001	22/07/2020	595.5	49.9
MB15H1SW0001	21/07/2020	595.5	49.9
MB15H1SW0001	20/07/2020	595.5	49.9
MB15H1SW0001	19/07/2020	595.5	49.9
MB15H1SW0001	18/07/2020	595.5	49.9
MB15H1SW0001	17/07/2020	595.5	49.9
MB15H1SW0001	16/07/2020	595.5	49.9
MB15H1SW0001	15/07/2020	595.5	49.9
MB15H1SW0001	14/07/2020	595.5	49.9
MB15H1SW0001	13/07/2020	595.5	49.9
MB15H1SW0001	12/07/2020	595.5	49.9
MB15H1SW0001	11/07/2020	595.5	49.9
MB15H1SW0001	10/07/2020	595.5	49.9
MB15H1SW0001	9/07/2020	595.5	49.9
MB15H1SW0001	8/07/2020	595.5	49.9
MB15H1SW0001	7/07/2020	595.5	49.9
MB15H1SW0001	6/07/2020	595.5	49.9
MB15H1SW0001	5/07/2020	595.5	49.9
MB15H1SW0001	4/07/2020	595.5	49.9
MB15H1SW0001	3/07/2020	595.5	49.9
MB15H1SW0001	2/07/2020	595.5	49.9
MB15H1SW0001	1/07/2020	595.5	49.9
MB15H1SW0001	30/06/2020	595.5	49.9
MB15H1SW0001	29/06/2020	595.5	49.9
MB15H1SW0001	28/06/2020	595.5	49.9
MB15H1SW0001	27/06/2020	595.5	49.9
MB15H1SW0001	26/06/2020	595.5	49.9
MB15H1SW0001	25/06/2020	595.5	49.9
MB15H1SW0001	24/06/2020	595.5	49.9
MB15H1SW0001	23/06/2020	595.5	49.9
MB15H1SW0001	22/06/2020	595.5	49.9
MB15H1SW0001	21/06/2020	595.5	49.9
MB15H1SW0001	20/06/2020	595.5	49.9
MB15H1SW0001	19/06/2020	595.5	49.9
MB15H1SW0001	18/06/2020	595.5	49.9
MB15H1SW0001	17/06/2020	595.5	49.9
MB15H1SW0001	16/06/2020	595.5	49.9
MB15H1SW0001	15/06/2020	595.5	49.9
MB15H1SW0001	14/06/2020	595.5	49.9
MB15H1SW0001	13/06/2020	595.5	49.9
MB15H1SW0001	12/06/2020	595.5	49.9
MB15H1SW0001	11/06/2020	595.5	49.9
MB15H1SW0001	10/06/2020	595.5	49.9
MB15H1SW0001	9/06/2020	595.5	49.9
MB15H1SW0001	8/06/2020	595.5	49.9
MB15H1SW0001	7/06/2020	595.5	49.9
MB15H1SW0001	6/06/2020	595.5	49.9
MB15H1SW0001	5/06/2020	595.5	49.9
MB15H1SW0001	4/06/2020	595.5	49.9
MB15H1SW0001	3/06/2020	595.5	49.9
MB15H1SW0001	2/06/2020	595.5	49.9
MB15H1SW0001	1/06/2020	595.5	49.9
MB15H1SW0001	31/05/2020	595.5	49.9
MB15H1SW0001	30/05/2020	595.5	49.9
MB15H1SW0001	29/05/2020	595.5	49.9
MB15H1SW0001	28/05/2020	595.5	49.9
MB15H1SW0001	27/05/2020	595.5	49.9
MB15H1SW0001	26/05/2020	595.5	49.9
MB15H1SW0001	25/05/2020	595.5	49.9
MB15H1SW0001	24/05/2020	595.5	49.9
MB15H1SW0001	23/05/2020	595.5	49.9
MB15H1SW0001	22/05/2020	595.5	49.9
MB15H1SW0001	21/05/2020	595.5	49.9
MB15H1SW0001	20/05/2020	595.5	49.9
MB15H1SW0001	19/05/2020	595.5	49.9
MB15H1SW0001	18/05/2020	595.5	49.9
MB15H1SW0001	17/05/2020	595.5	49.9
MB15H1SW0001	16/05/2020	595.5	49.9
MB15H1SW0001	15/05/2020	595.5	49.9
MB15H1SW0001	14/05/2020	595.5	49.9
MB15H1SW0001	13/05/2020	595.5	49.9
MB15H1SW0001	12/05/2020	595.5	49.9
MB15H1SW0001	11/05/2020	595.5	49.9
MB15H1SW0001	10/05/2020	595.5	49.9
MB15H1SW0001	9/05/2020	595.5	49.9
MB15H1SW0001	8/05/2020	595.5	49.9
MB15H1SW0001	7/05/2020	595.5	49.9
MB15H1SW0001	6/05/2020	595.5	49.9
MB15H1SW0001	5/05/2020	595.5	49.9
MB15H1SW0001	4/05/2020	595.5	49.9
MB15H1SW0001	3/05/2020	595.5	49.9
MB15H1SW0001	2/05/2020	595.5	49.9
MB15H1SW0001	1/05/2020	595.5	49.9
MB15H1SW0001	30/04/2020	595.5	49.9
MB15H1SW0001	29/04/2020	595.5	49.9
MB15H1SW0001	28/04/2020	595.5	49.9
MB15H1SW0001	27/04/2020	595.5	49.9
MB15H1SW0001	26/04/2020	595.5	49.9
MB15H1SW0001	25/04/2020	595.5	49.9
MB15H1SW0001	24/04/2020	595.5	49.9
MB15H1SW0001	23/04/2020	595.5	49.9
MB15H1SW0001	22/04/2020	595.5	49.9
MB15H1SW0001	21/04/2020	595.5	49.9
MB15H1SW0001	20/04/2020	595.5	49.9

ID	Date	WL mAHD	WL mbgl
MB21BHT0001	26/02/2022	624.8	62.5
MB21BHT0001	25/02/2022	624.8	62.5
MB21BHT0001	24/02/2022	624.8	62.5
MB21BHT0001	23/02/2022	624.8	62.5
MB21BHT0001	22/02/2022	624.8	62.5
MB21BHT0001	21/02/2022	625.0	62.3
MB21BHT0001	20/02/2022	624.8	62.5
MB21BHT0001	19/02/2022	624.8	62.5
MB21BHT0001	18/02/2022	624.9	62.4
MB21BHT0001	17/02/2022	624.9	62.4
MB21BHT0001	16/02/2022	624.8	62.5
MB21BHT0001	15/02/2022	624.8	62.5
MB21BHT0001	14/02/2022	624.8	62.5
MB21BHT0001	13/02/2022	624.8	62.5
MB21BHT0001	12/02/2022	624.8	62.5
MB21BHT0001	11/02/2022	624.8	62.5
MB21BHT0001	10/02/2022	624.8	62.5
MB21BHT0001	9/02/2022	624.8	62.5
MB21BHT0001	8/02/2022	624.8	62.5
MB21BHT0001	7/02/2022	624.8	62.5
MB21BHT0001	6/02/2022	624.7	62.6
MB21BHT0001	5/02/2022	624.8	62.5
MB21BHT0001	4/02/2022	624.8	62.5
MB21BHT0001	3/02/2022	624.8	62.5
MB21BHT0001	2/02/2022	624.8	62.5
MB21BHT0001	1/02/2022	624.8	62.5
MB21BHT0001	31/01/2022	624.8	62.5
MB21BHT0001	30/01/2022	624.8	62.5
MB21BHT0001	29/01/2022	624.8	62.5
MB21BHT0001	28/01/2022	624.8	62.5
MB21BHT0001	27/01/2022	624.7	62.6
MB21BHT0001	26/01/2022	624.7	62.6
MB21BHT0001	25/01/2022	624.7	62.6
MB21BHT0001	24/01/2022	624.8	62.5
MB21BHT0001	23/01/2022	624.8	62.5
MB21BHT0001	22/01/2022	624.9	62.4
MB21BHT0001	12/06/2021	624.4	62.9
MB21BHT0001	1/03/2021	624.4	62.9
MB21BHT0001	20/01/2021	625.0	62.3
MB21BHT0002	3/03/2022	625.2	62.0
MB21BHT0002	2/03/2022	625.2	62.0
MB21BHT0002	1/03/2022	625.2	62.0
MB21BHT0002	28/02/2022	625.2	62.0
MB21BHT0002	27/02/2022	625.2	62.0
MB21BHT0002	26/02/2022	625.2	62.0
MB21BHT0002	25/02/2022	625.2	62.0
MB21BHT0002	24/02/2022	625.2	62.0
MB21BHT0002	23/02/2022	625.2	62.0
MB21BHT0002	22/02/2022	625.2	62.0
MB21BHT0002	21/02/2022	625.2	62.0
MB21BHT0002	20/02/2022	625.2	62.0
MB21BHT0002	19/02/2022	625.3	62.0
MB21BHT0002	18/02/2022	625.3	62.0
MB21BHT0002	17/02/2022	625.3	62.0
MB21BHT0002	16/02/2022	625.2	62.0
MB21BHT0002	15/02/2022	625.3	62.0
MB21BHT0002	14/02/2022	625.3	62.0
MB21BHT0002	13/02/2022	625.3	62.0
MB21BHT0002	12/02/2022	625.2	62.0
MB21BHT0002	11/02/2022	625.2	62.0
MB21BHT0002	10/02/2022	625.2	62.0
MB21BHT0002	9/02/2022	625.2	62.0
MB21BHT0002	8/02/2022	625.2	62.0
MB21BHT0002	7/02/2022	625.2	62.0
MB21BHT0002	6/02/2022	625.2	62.1
MB21BHT0002	5/02/2022	625.2	62.0
MB21BHT0002	4/02/2022	625.2	62.0
MB21BHT0002	3/02/2022	625.2	62.0
MB21BHT0002	2/02/2022	625.2	62.0
MB21BHT0002	1/02/2022	625.2	62.1
MB21BHT0002	31/01/2022	625.2	62.1
MB21BHT0002	30/01/2022	625.2	62.1
MB21BHT0002	29/01/2022	625.2	62.0
MB21BHT0002	28/01/2022	625.2	62.0
MB21BHT0002	27/01/2022	625.2	62.1
MB21BHT0002	26/01/2022	625.2	62.1
MB21BHT0002	25/01/2022	625.2	62.1
MB21BHT0002	24/01/2022	625.2	62.0
MB21BHT0002	23/01/2022	625.2	62.1
MB21BHT0002	22/01/2022	625.2	62.0
MB21BHT0002	21/01/2022	625.3	62.0
MB21BHT0002	12/06/2021	625.2	62.0
MB21BHT0002	1/03/2021	625.3	61.9
MB21BHT0003	3/03/2022	625.8	49.1
MB21BHT0003	2/03/2022	625.8	49.1
MB21BHT0003	1/03/2022	625.8	49.1
MB21BHT0003	28/02/2022	625.8	49.1
MB21BHT0003	27/02/2022	625.8	49.1
MB21BHT0003	26/02/2022	625.8	49.1
MB21BHT0003	25/02/2022	625.8	49.1
MB21BHT0003	24/02/2022	625.8	49.1
MB21BHT0003	23/02/2022	625.8	49.1
MB21BHT0003	22/02/2022	625.8	49.1
MB21BHT0003	21/02/2022	625.8	49.1
MB21BHT0003	20/02/2022	625.9	49.1
MB21BHT0003	19/02/2022	625.9	49.1
MB21BHT0003	18/02/2022	625.9	49.1
MB21BHT0003	17/02/2022	625.9	49.1
MB21BHT0003	16/02/2022	625.9	49.1
MB21BHT0003	15/02/2022	625.9	49.1
MB21BHT0003	14/02/2022	625.9	49.1
MB21BHT0003	13/02/2022	625.9	49.1
MB21BHT0003	12/02/2022	625.8	49.1
MB21BHT0003	11/02/2022	625.8	49.1
MB21BHT0003	10/02/2022	625.8	49.1
MB21BHT0003	9/02/2022	625.8	49.1
MB21BHT0003	8/02/2022	625.8	49.1
MB21BHT0003	7/02/2022	625.8	49.1
MB21BHT0003	6/02/2022	625.8	49.2
MB21BHT0003	5/02/2022	625.8	49.1
MB21BHT0003	4/02/2022	625.8	49.1
MB21BHT0003	3/02/2022	625.8	49.1
MB21BHT0003	2/02/2022	625.8	49.1
MB21BHT0003	1/02/2022	625.8	49.2
MB21BHT0003	31/01/2022	625.8	49.2
MB21BHT0003	30/01/2022	625.8	49.2
MB21BHT0003	29/01/2022	625.8	49.2
MB21BHT0003	28/01/2022	625.8	49.2
MB21BHT0003	27/01/2022	625.8	49.2
MB21BHT0003	26/01/2022	625.7	49.2
MB21BHT0003	25/01/2022	625.7	49.2
MB21BHT0003	24/01/2022	625.8	49.2
MB21BHT0003	23/01/2022	625.8	49.2
MB21BHT0003	22/01/2022	625.7	49.2
MB21BHT0003	15/10/2021	625.9	49.1
MB21BHT0003	3/10/2021	625.8	49.1
MB21BHT0003	12/06/2021	625.9	49.1
MB21BHT0004	3/03/2022	625.6	49.3
MB21BHT0004	2/03/2022	625.6	49.3
MB21BHT0004	1/03/2022	625.6	49.3
MB21BHT0004	28/02/2022	625.5	49.3
MB21BHT0004	27/02/2022	625.5	49.3
MB21BHT0004	26/02/2022	625.6	49.3
MB21BHT0004	25/02/2022	625.6	49.3
MB21BHT0004	24/02/2022	625.6	49.3
MB21BHT0004	23/02/2022	625.6	49.3

ID	Date	WL mAHD	WL mbgl
MB18HD20003	11/08/2019	626.2	81.7
MB18HD20003	12/08/2019	626.2	81.7
MB18HD20003	13/08/2019	626.2	81.7
MB18HD20003	14/08/2019	626.2	81.7
MB18HD20003	15/08/2019	626.2	81.7
MB18HD20003	16/08/2019	626.2	81.7
MB18HD20003	17/08/2019	626.2	81.7
MB18HD20003	18/08/2019	626.2	81.7
MB18HD20003	19/08/2019	626.2	81.7
MB18HD20003	20/08/2019	626.2	81.7
MB18HD20003	21/08/2019	626.2	81.7
MB18HD20003	22/08/2019	626.2	81.7
MB18HD20003	23/08/2019	626.2	81.7
MB18HD20003	24/08/2019	626.2	81.7
MB18HD20003	25/08/2019	626.2	81.7
MB18HD20003	26/08/2019	626.2	81.7
MB18HD20003	27/08/2019	626.2	81.7
MB18HD20003	28/08/2019	626.2	81.7
MB18HD20003	29/08/2019	626.2	81.7
MB18HD20003	30/08/2019	626.2	81.7
MB18HD20003	31/08/2019	626.2	81.7
MB18HD20003	1/09/2019	626.2	81.7
MB18HD20003	2/09/2019	626.2	81.7
MB18HD20003	3/09/2019	626.2	81.7
MB18HD20003	4/09/2019	626.2	81.7
MB18HD20003	5/09/2019	626.2	81.7
MB18HD20003	6/09/2019	626.2	81.7
MB18HD20003	7/09/2019	626.2	81.7
MB18HD20003	8/09/2019	626.2	81.7
MB18HD20003	9/09/2019	626.2	81.7
MB18HD20003	10/09/2019	626.2	81.7
MB18HD20003	11/09/2019	626.2	81.7
MB18HD20003	12/09/2019	626.2	81.7
MB18HD20003	13/09/2019	626.2	81.7
MB18HD20003	14/09/2019	626.2	81.7
MB18HD20003	15/09/2019	626.2	81.7
MB18HD20003	16/09/2019	626.2	81.7
MB18HD20003	17/09/2019	626.2	81.7
MB18HD20003	18/09/2019	626.2	81.7
MB18HD20003	19/09/2019	626.2	81.7
MB18HD20003	20/09/2019	626.2	81.7
MB18HD20003	21/09/2019	626.2	81.7
MB18HD20003	22/09/2019	626.2	81.7
MB18HD20003	23/09/2019	626.2	81.7
MB18HD20003	24/09/2019	626.2	81.7
MB18HD20003	25/09/2019	626.2	81.7
MB18HD20003	26/09/2019	626.2	81.7
MB18HD20003	27/09/2019	626.2	81.7
MB18HD20003	28/09/2019	626.1	81.8
MB18HD20003	29/09/2019	626.2	81.7
MB18HD20003	30/09/2019	625.8	82.1
MB18HD20003	1/10/2019	626.1	81.7
MB18HD20003	2/10/2019	626.1	81.7
MB18HD20003	3/10/2019	626.0	81.9
MB18HD20003	4/10/2019	626.1	81.8
MB18HD20003	5/10/2019	626.0	81.8
MB18HD20003	6/10/2019	626.1	81.8
MB18HD20003	7/10/2019	626.1	81.8
MB18HD20003	8/10/2019	626.1	81.7
MB18HD20003	9/10/2019	626.1	81.8
MB18HD20003	10/10/2019	626.1	81.8
MB18HD20003	11/10/2019	626.1	81.8
MB18HD20003	12/10/2019	626.1	81.8
MB18HD20003	13/10/2019	626.1	81.8
MB18HD20003	14/10/2019	626.1	81.8
MB18HD20003	15/10/2019	626.0	81.8
MB18HD20003	16/10/2019	626.0	81.9
MB18HD20003	17/10/2019	626.1	81.8
MB18HD20003	18/10/2019	626.1	81.8
MB18HD20003	19/10/2019	626.0	81.9
MB18HD20003	20/10/2019	626.0	81.9
MB18HD20003	21/10/2019	626.0	81.9
MB18HD20003	22/10/2019	626.1	81.8
MB18HD20003	23/10/2019	626.1	81.8
MB18HD20003	24/10/2019	626.1	81.8
MB18HD20003	25/10/2019	626.1	81.8
MB18HD20003	26/10/2019	626.0	81.8
MB18HD20003	27/10/2019	626.1	81.8
MB18HD20003	28/10/2019	626.1	81.8
MB18HD20003	29/10/2019	626.1	81.8
MB18HD20003	30/10/2019	626.1	81.8
MB18HD20003	31/10/2019	626.1	81.8
MB18HD20003	1/11/2019	626.1	81.8

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	10/11/2020	662.6	23.5
HDVP1	9/11/2020	662.6	23.5
HDVP1	8/11/2020	662.6	23.5
HDVP1	7/11/2020	662.6	23.5
HDVP1	6/11/2020	662.6	23.5
HDVP1	5/11/2020	662.6	23.5
HDVP1	4/11/2020	662.6	23.5
HDVP1	3/11/2020	662.6	23.5
HDVP1	2/11/2020	662.6	23.5
HDVP1	1/11/2020	569.5	116.7
HDVP1	31/10/2020	569.5	116.7
HDVP1	30/10/2020	569.5	116.7
HDVP1	29/10/2020	569.5	116.7
HDVP1	28/10/2020	569.5	116.7
HDVP1	27/10/2020	569.5	116.7
HDVP1	26/10/2020	569.5	116.7
HDVP1	25/10/2020	569.5	116.7
HDVP1	24/10/2020	569.5	116.7
HDVP1	23/10/2020	569.5	116.7
HDVP1	22/10/2020	569.5	116.7
HDVP1	21/10/2020	569.5	116.7
HDVP1	20/10/2020	569.5	116.7
HDVP1	19/10/2020	569.5	116.7
HDVP1	18/10/2020	569.5	116.7
HDVP1	17/10/2020	569.5	116.7
HDVP1	16/10/2020	569.5	116.7
HDVP1	15/10/2020	569.5	116.7
HDVP1	14/10/2020	569.5	116.7
HDVP1	13/10/2020	569.5	116.7
HDVP1	12/10/2020	569.5	116.7
HDVP1	11/10/2020	569.5	116.7
HDVP1	10/10/2020	569.5	116.7
HDVP1	9/10/2020	569.5	116.7
HDVP1	8/10/2020	569.5	116.7
HDVP1	7/10/2020	569.5	116.7
HDVP1	6/10/2020	569.5	116.7
HDVP1	5/10/2020	569.5	116.7
HDVP1	4/10/2020	569.5	116.7
HDVP1	3/10/2020	569.5	116.7
HDVP1	2/10/2020	569.5	116.7
HDVP1	1/10/2020	433.5	252.6
HDVP1	30/09/2020	433.5	252.6
HDVP1	29/09/2020	433.5	252.6
HDVP1	28/09/2020	433.5	252.6
HDVP1	27/09/2020	433.5	252.6
HDVP1	26/09/2020	433.5	252.6
HDVP1	25/09/2020	433.5	252.6
HDVP1	24/09/2020	433.5	252.6
HDVP1	23/09/2020	433.5	252.6
HDVP1	22/09/2020	433.5	252.6
HDVP1	21/09/2020	433.5	252.6
HDVP1	20/09/2020	433.5	252.6
HDVP1	19/09/2020	433.5	252.6
HDVP1	18/09/2020	433.5	252.6
HDVP1	17/09/2020	433.5	252.6
HDVP1	16/09/2020	433.5	252.6
HDVP1	15/09/2020	433.5	252.6
HDVP1	14/09/2020	433.5	252.6
HDVP1	13/09/2020	433.5	252.6
HDVP1	12/09/2020	433.5	252.6
HDVP1	11/09/2020	433.5	252.6
HDVP1	10/09/2020	433.5	252.6
HDVP1	9/09/2020	433.5	252.6
HDVP1	8/09/2020	433.5	252.6
HDVP1	7/09/2020	433.5	252.6
HDVP1	6/09/2020	433.5	252.6
HDVP1	5/09/2020	433.5	252.6
HDVP1	4/09/2020	433.5	252.6
HDVP1	3/09/2020	433.5	252.6
HDVP1	2/09/2020	433.5	252.6
HDVP1	1/09/2020	400.9	285.3
HDVP1	31/08/2020	400.9	285.3
HDVP1	30/08/2020	400.9	285.3
HDVP1	29/08/2020	400.9	285.3
HDVP1	28/08/2020	400.9	285.3
HDVP1	27/08/2020	400.9	285.3
HDVP1	26/08/2020	400.9	285.3
HDVP1	25/08/2020	400.9	285.3
HDVP1	24/08/2020	400.9	285.3
HDVP1	23/08/2020	400.9	285.3
HDVP1	22/08/2020	400.9	285.3
HDVP1	21/08/2020	400.9	285.3
HDVP1	20/08/2020	400.9	285.3
HDVP1	19/08/2020	400.9	285.3
HDVP1	18/08/2020	400.9	285.3
HDVP1	17/08/2020	400.9	285.3
HDVP1	16/08/2020	400.9	285.3
HDVP1	15/08/2020	400.9	285.3
HDVP1	14/08/2020	400.9	285.3
HDVP1	13/08/2020	400.9	285.3
HDVP1	12/08/2020	400.9	285.3
HDVP1	11/08/2020	400.9	285.3
HDVP1	10/08/2020	400.9	285.3
HDVP1	9/08/2020	400.9	285.3
HDVP1	8/08/2020	400.9	285.3
HDVP1	7/08/2020	400.9	285.3
HDVP1	6/08/2020	400.9	285.3
HDVP1	5/08/2020	400.9	285.3
HDVP1	4/08/2020	400.9	285.3
HDVP1	3/08/2020	400.9	285.3
HDVP1	2/08/2020	400.9	285.3
HDVP1	1/08/2020	408.0	278.2
HDVP1	31/07/2020	408.0	278.2
HDVP1	30/07/2020	408.0	278.2
HDVP1	29/07/2020	408.0	278.2
HDVP1	28/07/2020	408.0	278.2
HDVP1	27/07/2020	408.0	278.2
HDVP1	26/07/2020	408.0	278.2
HDVP1	25/07/2020	408.0	278.2
HDVP1	24/07/2020	408.0	278.2
HDVP1	23/07/2020	408.0	278.2
HDVP1	22/07/2020	408.0	278.2
HDVP1	21/07/2020	408.0	278.2
HDVP1	20/07/2020	408.0	278.2
HDVP1	19/07/2020	408.0	278.2
HDVP1	18/07/2020	408.0	278.2
HDVP1	17/07/2020	408.0	278.2
HDVP1	16/07/2020	408.0	278.2
HDVP1	15/07/2020	408.0	278.2
HDVP1	14/07/2020	408.0	278.2
HDVP1	13/07/2020	408.0	278.2
HDVP1	12/07/2020	408.0	278.2
HDVP1	11/07/2020	408.0	278.2
HDVP1	10/07/2020	408.0	278.2
HDVP1	9/07/2020	408.0	278.2
HDVP1	8/07/2020	408.0	278.2
HDVP1	7/07/2020	408.0	278.2
HDVP1	6/07/2020	408.0	278.2
HDVP1	5/07/2020	408.0	278.2
HDVP1	4/07/2020	408.0	278.2
HDVP1	3/07/2020	408.0	278.2
HDVP1	2/07/2020	408.0	278.2
HDVP1	1/07/2020	414.1	272.1
HDVP1	30/06/2020	414.1	272.1
HDVP1	29/06/2020	414.1	272.1
HDVP1	28/06/2020	414.1	272.1

ID	Date	WL mAHD	WL mbgl
MB15H1SW0001	19/04/2020	595.5	49.9
MB15H1SW0001	18/04/2020	595.5	49.9
MB15H1SW0001	17/04/2020	595.5	49.9
MB15H1SW0001	16/04/2020	595.5	49.9
MB15H1SW0001	15/04/2020	595.5	49.9
MB15H1SW0001	14/04/2020	595.5	49.9
MB15H1SW0001	13/04/2020	595.5	49.9
MB15H1SW0001	12/04/2020	595.5	49.9
MB15H1SW0001	11/04/2020	595.5	49.9
MB15H1SW0001	10/04/2020	595.5	49.9
MB15H1SW0001	9/04/2020	595.4	50.0
MB15H1SW0001	8/04/2020	595.4	50.0
MB15H1SW0001	7/04/2020	595.4	50.0
MB15H1SW0001	6/04/2020	595.4	50.0
MB15H1SW0001	5/04/2020	595.4	50.0
MB15H1SW0001	4/04/2020	595.4	50.0
MB15H1SW0001	3/04/2020	595.4	50.0
MB15H1SW0001	2/04/2020	595.4	50.0
MB15H1SW0001	1/04/2020	595.4	50.0
MB15H1SW0001	31/03/2020	595.4	50.0
MB15H1SW0001	30/03/2020	595.4	50.0
MB15H1SW0001	29/03/2020	595.4	50.0
MB15H1SW0001	28/03/2020	595.4	50.0
MB15H1SW0001	27/03/2020	595.4	50.0
MB15H1SW0001	26/03/2020	595.4	50.0
MB15H1SW0001	25/03/2020	595.4	50.0
MB15H1SW0001	24/03/2020	595.4	50.0
MB15H1SW0001	23/03/2020	595.4	50.0
MB15H1SW0001	22/03/2020	595.4	50.0
MB15H1SW0001	21/03/2020	595.4	50.0
MB15H1SW0001	20/03/2020	595.4	50.0
MB15H1SW0001	19/03/2020	595.4	50.0
MB15H1SW0001	18/03/2020	595.4	50.0
MB15H1SW0001	17/03/2020	595.4	50.0
MB15H1SW0001	16/03/2020	595.4	50.0
MB15H1SW0001	15/03/2020	595.4	50.0
MB15H1SW0001	14/03/2020	595.4	50.0
MB15H1SW0001	13/03/2020	595.4	50.0
MB15H1SW0001	12/03/2020	595.4	50.0
MB15H1SW0001	11/03/2020	595.4	50.0
MB15H1SW0001	10/03/2020	595.4	50.0
MB15H1SW0001	9/03/2020	595.4	50.0
MB15H1SW0001	8/03/2020	595.4	50.0
MB15H1SW0001	7/03/2020	595.4	50.0
MB15H1SW0001	6/03/2020	595.4	50.0
MB15H1SW0001	5/03/2020	595.4	50.0
MB15H1SW0001	4/03/2020	595.4	50.0
MB15H1SW0001	3/03/2020	595.4	50.0
MB15H1SW0001	2/03/2020	595.4	50.0
MB15H1SW0001	1/03/2020	595.3	50.1
MB15H1SW0001	29/02/2020	595.3	50.1
MB15H1SW0001	28/02/2020	595.4	50.0
MB15H1SW0001	27/02/2020	595.4	50.0
MB15H1SW0001	26/02/2020	595.4	50.0
MB15H1SW0001	25/02/2020	595.4	50.0
MB15H1SW0001	24/02/2020	595.4	50.0
MB15H1SW0001	23/02/2020	595.4	50.0
MB15H1SW0001	22/02/2020	595.3	50.1
MB15H1SW0001	21/02/2020	595.3	50.1
MB15H1SW0001	20/02/2020	595.3	50.1
MB15H1SW0001	19/02/2020	595.3	50.1
MB15H1SW0001	18/02/2020	595.3	50.1
MB15H1SW0001	17/02/2020	595.3	50.1
MB15H1SW0001	16/02/2020	595.3	50.1
MB15H1SW0001	15/02/2020	595.3	50.1
MB15H1SW0001	14/02/2020	595.3	50.1
MB15H1SW0001	13/02/2020	595.3	50.1
MB15H1SW0001	12/02/2020	595.3	50.1
MB15H1SW0001	11/02/2020	595.3	50.1
MB15H1SW0001	10/02/2020	595.3	50.1
MB15H1SW0001	9/02/2020	595.3	50.1
MB15H1SW0001	8/02/2020	595.3	50.1
MB15H1SW0001	7/02/2020	595.3	50.1
MB15H1SW0001	6/02/2020	595.3	50.1
MB15H1SW0001	5/02/2020	595.3	50.1
MB15H1SW0001	4/02/2020	595.3	50.1
MB15H1SW0001	3/02/2020	595.3	50.1
MB15H1SW0001	2/02/2020	595.2	50.2
MB15H1SW0001	1/02/2020	595.2	50.2
MB15H1SW0001	31/01/2020	595.2	50.2
MB15H1SW0001	30/01/2020	595.2	50.2
MB15H1SW0001	29/01/2020	595.2	50.2
MB15H1SW0001	28/01/2020	595.3	50.1
MB15H1SW0001	27/01/2020	595.3	50.1
MB15H1SW0001	26/01/2020	595.3	50.1
MB15H1SW0001	25/01/2020	595.2	50.2
MB15H1SW0001	24/01/2020	595.2	50.2
MB15H1SW0001	23/01/2020	595.2	50.2
MB15H1SW0001	22/01/2020	595.2	50.2
MB15H1SW0001	21/01/2020	595.2	50.2
MB15H1SW0001	20/01/2020	595.2	50.2
MB15H1SW0001	19/01/2020	595.2	50.2
MB15H1SW0001	18/01/2020	595.2	50.2
MB15H1SW0001	17/01/2020	595.2	50.2
MB15H1SW0001	16/01/2020	595.2	50.2
MB15H1SW0001	15/01/2020	595.2	50.2
MB15H1SW0001	14/01/2020	595.2	50.2
MB15H1SW0001	13/01/2020	595.2	50.2
MB15H1SW0001	12/01/2020	595.2	50.2
MB15H1SW0001	11/01/2020	595.2	50.2
MB15H1SW0001	10/01/2020	595.2	50.2
MB15H1SW0001	9/01/2020	595.2	50.2
MB15H1SW0001	8/01/2020	595.2	50.2
MB15H1SW0001	7/01/2020	595.2	50.2
MB15H1SW0001	6/01/2020	595.2	50.2
MB15H1SW0001	5/01/2020	595.2	50.2
MB15H1SW0001	4/01/2020	595.2	50.2
MB15H1SW0001	3/01/2020	595.2	50.2
MB15H1SW0001	2/01/2020	595.2	50.2
MB15H1SW0001	1/01/2020	595.2	50.2
MB15H1SW0001	31/12/2019	595.2	50.2
MB15H1SW0001	30/12/2019	595.2	50.2
MB15H1SW0001	29/12/2019	595.2	50.2
MB15H1SW0001	28/12/2019	595.2	50.2
MB15H1SW0001	27/12/2019	595.2	50.2
MB15H1SW0001	26/12/2019	595.2	50.2
MB15H1SW0001	25/12/2019	595.2	50.2
MB15H1SW0001	24/12/2019	595.2	50.2
MB15H1SW0001	23/12/2019	595.2	50.2
MB15H1SW0001	22/12/2019	595.2	50.2
MB15H1SW0001	21/12/2019	595.2	50.2
MB15H1SW0001	20/12/2019	595.2	50.2
MB15H1SW0001	19/12/2019	595.2	50.2
MB15H1SW0001	18/12/2019	595.2	50.2
MB15H1SW0001	17/12/2019	595.2	50.2
MB15H1SW0001	16/12/2019	595.2	50.2
MB15H1SW0001	15/12/2019	595.2	50.2
MB15H1SW0001	14/12/2019	595.2	50.2
MB15H1SW0001	13/12/2019	595.2	50.2
MB15H1SW0001	12/12/2019	595.2	50.2
MB15H1SW0001	11/12/2019	595.2	50.2
MB15H1SW0001	10/12/2019	595.2	50.2
MB15H1SW0001	9/12/2019	595.2	50.2
MB15H1SW0001	8/12/2019	595.2	50.2
MB15H1SW0001	7/12/2019	595.2	50.2
MB15H1SW0001	6/12/2019	595.2	50.2

ID	Date	WL mAHD	WL mbgl
MB21BHT0004	22/02/2022	625.6	49.3
MB21BHT0004	21/02/2022	625.6	49.3
MB21BHT0004	20/02/2022	625.6	49.3
MB21BHT0004	19/02/2022	625.6	49.2
MB21BHT0004	18/02/2022	625.6	49.2
MB21BHT0004	17/02/2022	625.6	49.2
MB21BHT0004	16/02/2022	625.6	49.3
MB21BHT0004	15/02/2022	625.6	49.2
MB21BHT0004	14/02/2022	625.6	49.2
MB21BHT0004	13/02/2022	625.6	49.2
MB21BHT0004	12/02/2022	625.6	49.3
MB21BHT0004	11/02/2022	625.6	49.3
MB21BHT0004	10/02/2022	625.6	49.3
MB21BHT0004	9/02/2022	625.6	49.3
MB21BHT0004	8/02/2022	625.6	49.3
MB21BHT0004	7/02/2022	625.6	49.3
MB21BHT0004	6/02/2022	625.5	49.3
MB21BHT0004	5/02/2022	625.6	49.3
MB21BHT0004	4/02/2022	625.6	49.3
MB21BHT0004	3/02/2022	625.6	49.3
MB21BHT0004	2/02/2022	625.6	49.3
MB21BHT0004	1/02/2022	625.5	49.3
MB21BHT0004	31/01/2022	625.5	49.3
MB21BHT0004	30/01/2022	625.5	49.3
MB21BHT0004	29/01/2022	625.5	49.3
MB21BHT0004	28/01/2022	625.5	49.3
MB21BHT0004	27/01/2022	625.5	49.3
MB21BHT0004	26/01/2022	625.5	49.4
MB21BHT0004	25/01/2022	625.5	49.4
MB21BHT0004	24/01/2022	625.5	49.3
MB21BHT0004	23/01/2022	625.5	49.3
MB21BHT0004	22/01/2022	625.6	49.3
MB21BHT0004	21/01/2022	625.6	49.3
MB21BHT0004	15/10/2021	625.6	49.2
MB21BHT0004	3/10/2021	625.6	49.2
MB21BHT0004	12/06/2021	625.6	49.2
MB21BHT0006	20/04/2021	627.4	57.7
MB21BHT0007	26/04/2021	623.9	61.3
RC18WON0126	2/03/2022	621.5	77.1
RC18WON0126	1/03/2022	621.5	77.1
RC18WON0126	28/02/2022	621.5	77.1
RC18WON0126	27/02/2022	621.5	77.1
RC18WON0126	26/02/2022	621.5	77.1
RC18WON0126	25/02/2022	621.5	77.1
RC18WON0126	24/02/2022	621.5	77.1
RC18WON0126	23/02/2022	621.5	77.1
RC18WON0126	22/02/2022	621.5	77.1
RC18WON0126	21/02/2022	621.5	77.1
RC18WON0126	20/02/2022	621.5	77.1
RC18WON0126	19/02/2022	621.5	77.1
RC18WON0126	18/02/2022	621.5	77.1
RC18WON0126	17/02/2022	621.5	77.1
RC18WON0126	16/02/2022	621.5	77.1
RC18WON0126	15/02/2022	621.5	77.1
RC18WON0126	14/02/2022	621.5	77.1
RC18WON0126	13/02/2022	621.5	77.1
RC18WON0126	12/02/2022	621.5	77.1
RC18WON0126	11/02/2022	621.5	77.1
RC18WON0126	10/02/2022	621.5	77.2
RC18WON0126	9/02/2022	621.4	77.2
RC18WON0126	8/02/2022	621.4	77.2
RC18WON0126	7/02/2022	621.4	77.2
RC18WON0126	6/02/2022	621.4	77.2
RC18WON0126	5/02/2022	621.4	77.2
RC18WON0126	4/02/2022	621.4	77.2
RC18WON0126	3/02/2022	621.4	77.2
RC18WON0126	2/02/2022	621.4	77.2
RC18WON0126	1/02/2022	621.4	77.2
RC18WON0126	31/01/2022	621.4	77.2
RC18WON0126	30/01/2022	621.4	77.2
RC18WON0126	29/01/2022	621.4	77.2
RC18WON0126	28/01/2022	621.4	77.2
RC18WON0126	27/01/2022	621.4	77.2
RC18WON0126	26/01/2022	621.4	77.2
RC18WON0126	25/01/2022	621.4	77.2
RC18WON0126	24/01/2022	621.4	77.2
RC18WON0126	23/01/2022	621.5	77.2
RC18WON0126	22/01/2022	621.5	77.1
RC18WON0126	21/01/2022	621.5	77.1
RC18WON0126	20/01/2022	621.5	77.1
RC18WON0126	19/01/2022	621.5	77.1
RC18WON0126	18/01/2022	621.5	77.1
RC18WON0126	17/01/2022	621.5	77.2
RC18WON0126	16/01/2022	621.4	77.2
RC18WON0126	15/01/2022	621.5	77.2
RC18WON0126	14/01/2022	621.5	77.1
RC18WON0126	13/01/2022	621.5	77.1
RC18WON0126	12/01/2022	621.5	77.1
RC18WON0126	11/01/2022	621.5	77.1
RC18WON0126	10/01/2022	621.5	77.1
RC18WON0126	9/01/2022	621.5	77.1
RC18WON0126	8/01/2022	621.5	77.1
RC18WON0126	7/01/2022	621.5	77.1
RC18WON0126	6/01/2022	621.5	77.1
RC18WON0126	5/01/2022	621.5	77.1
RC18WON0126	4/01/2022	621.5	77.1
RC18WON0126	3/01/2022	621.5	77.1
RC18WON0126	2/01/2022	621.5	77.1
RC18WON0126	1/01/2022	621.5	77.1
RC18WON0126	31/12/2021	621.5	77.1
RC18WON0126	30/12/2021	621.5	77.1
RC18WON0126	29/12/2021	621.5	77.1
RC18WON0126	28/12/2021	621.5	77.1
RC18WON0126	27/12/2021	621.5	77.1
RC18WON0126	26/12/2021	621.5	77.1
RC18WON0126	25/12/2021	621.5	77.1
RC18WON0126	24/12/2021	621.5	77.1
RC18WON0126	23/12/2021	621.5	77.1
RC18WON0126	22/12/2021	621.5	77.1
RC18WON0126	21/12/2021	621.5	77.1
RC18WON0126	20/12/2021	621.6	77.1
RC18WON0126	19/12/2021	621.6	77.1
RC18WON0126	18/12/2021	621.5	77.1
RC18WON0126	17/12/2021	621.5	77.1
RC18WON0126	16/12/2021	621.5	77.1
RC18WON0126	15/12/2021	621.5	77.1
RC18WON0126	14/12/2021	621.5	77.1
RC18WON0126	13/12/2021	621.5	77.1
RC18WON0126	12/12/2021	621.6	77.0
RC18WON0126	11/12/2021	621.6	77.0
RC18WON0126	10/12/2021	621.6	77.0
RC18WON0126	9/12/2021	621.6	77.0
RC18WON0126	8/12/2021	621.6	77.0
RC18WON0126	7/12/2021	621.6	77.0
RC18WON0126	6/12/2021	621.6	77.0
RC18WON0126	5/12/2021	621.6	77.0
RC18WON0126	4/12/2021	621.6	77.0
RC18WON0126	3/12/2021	621.6	77.0
RC18WON0126	2/12/2021	621.6	77.0
RC18WON0126	1/12/2021	621.6	77.0
RC18WON0126	30/11/2021	621.6	77.0
RC18WON0126	28/11/2021	621.6	77.0
RC18WON0126	27/11/2021	621.6	77.0
RC18WON0126	26/11/2021	621.6	77.0
RC18WON0126	24/11/2021	621.6	77.0
RC18WON0126	21/11/2021	621.6	77.0

ID	Date	WL mAHD	WL mbgl
MB18HD20003	25/12/2019	626.1	81.8
MB18HD20003	26/12/2019	626.1	81.8
MB18HD20003	27/12/2019	626.1	81.8
MB18HD20003	28/12/2019	626.1	81.8
MB18HD20003	29/12/2019	626.1	81.8
MB18HD20003	30/12/2019	626.1	81.8
MB18HD20003	31/12/2019	626.1	81.8
MB18HD20003	1/01/2020	626.1	81.8
MB18HD20003	2/01/2020	626.1	81.8
MB18HD20003	3/01/2020	626.1	81.8
MB18HD20003	4/01/2020	626.1	81.8
MB18HD20003	5/01/2020	626.1	81.8
MB18HD20003	6/01/2020	626.1	81.8
MB18HD20003	7/01/2020	626.1	81.8
MB18HD20003	8/01/2020	626.1	81.8
MB18HD20003	9/01/2020	626.1	81.8
MB18HD20003	10/01/2020	626.1	81.8
MB18HD20003	11/01/2020	626.1	81.8
MB18HD20003	12/01/2020	626.1	81.8
MB18HD20003	13/01/2020	626.1	81.8
MB18HD20003	14/01/2020	626.1	81.8
MB18HD20003	15/01/2020	626.1	81.8
MB18HD20003	16/01/2020	626.1	81.8
MB18HD20003	17/01/2020	626.1	81.8
MB18HD20003	18/01/2020	626.1	81.8
MB18HD20003	19/01/2020	626.1	81.8
MB18HD20003	20/01/2020	626.1	81.8
MB18HD20003	21/01/2020	626.1	81.8
MB18HD20003	22/01/2020	626.1	81.8
MB18HD20003	23/01/2020	626.1	81.8
MB18HD20003	24/01/2020	626.1	81.8
MB18HD20003	25/01/2020	626.1	81.8
MB18HD20003	26/01/2020	626.1	81.8
MB18HD20003	27/01/2020	626.1	81.8
MB18HD20003	28/01/2020	626.1	81.8
MB18HD20003	29/01/2020	626.1	81.8
MB18HD20003	30/01/2020	626.1	81.8
MB18HD20003	31/01/2020	626.1	81.8
MB18HD20003	1/02/2020	626.1	81.8
MB18HD20003	2/02/2020	626.1	81.8
MB18HD20003	3/02/2020	626.1	81.8
MB18HD20003	4/02/2020	626.1	81.8
MB18HD20003	5/02/2020	626.1	81.8
MB18HD20003	6/02/2020	626.1	81.8
MB18HD20003	7/02/2020	626.1	81.8
MB18HD20003	8/02/2020	626.1	81.8
MB18HD20003	9/02/2020	626.1	81.8
MB18HD20003	20/08/2021	625.8	82.1
MB18HD20003	21/08/2021	625.8	82.1
MB18HD20003	22/08/2021	625.8	82.1
MB18HD20003	23/08/2021	625.7	82.1
MB18HD20003	24/08/2021	625.8	82.1
MB18HD20003	25/08/2021	625.8	82.1
MB18HD20003	26/08/2021	625.7	82.1
MB18HD20003	27/08/2021	625.7	82.1
MB18HD20003	28/08/2021	625.7	82.1
MB18HD20003	29/08/2021	625.7	82.1
MB18HD20003	30/08/2021	625.7	82.1
MB18HD20003	31/08/2021	625.7	82.1
MB18HD20003	1/09/2021	625.7	82.1
MB18HD20003	2/09/2021	625.7	82.1
MB18HD20003	3/09/2021	625.7	82.1
MB18HD20003	4/09/2021	625.7	82.1
MB18HD20003	5/09/2021	625.8	82.1
MB18HD20003	6/09/2021	625.8	82.1
MB18HD20003	7/09/2021	625.8	82.1
MB18HD20003	8/09/2021	625.8	82.1
MB18HD20003	9/09/2021	625.8	82.1
MB18HD20003	10/09/2021	625.8	82.1
MB18HD20003	11/09/2021	625.8	82.1
MB18HD20003	12/09/2021	625.8	82.1
MB18HD20003	13/09/2021	625.7	82.1
MB18HD20003	14/09/2021	625.7	82.1
MB18HD20003	15/09/2021	625.7	82.1
MB18HD20003	16/09/2021	625.7	82.1
MB18HD20003	17/09/2021	625.7	82.1
MB18HD20003	18/09/2021	625.7	82.1
MB18HD20003	19/09/2021	625.7	82.1
MB18HD20003	20/09/2021	625.8	82.1
MB18HD20003	21/09/2021	625.8	82.1
MB18HD20003	22/09/2021	625.8	82.1
MB18HD20003	23/09/2021	625.8	82.1
MB18HD20003	24/09/2021	625.8	82.1
MB18HD20003	25/09/2021	625.8	82.1
MB18HD20003	26/09/2021	625.7	82.1
MB18HD20003	27/09/2021	625.7	82.1

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	27/06/2020	414.1	272.1
HDVP1	26/06/2020	414.1	272.1
HDVP1	25/06/2020	414.1	272.1
HDVP1	24/06/2020	414.1	272.1
HDVP1	23/06/2020	414.1	272.1
HDVP1	22/06/2020	414.1	272.1
HDVP1	21/06/2020	414.1	272.1
HDVP1	20/06/2020	414.1	272.1
HDVP1	19/06/2020	414.1	272.1
HDVP1	18/06/2020	414.1	272.1
HDVP1	17/06/2020	414.1	272.1
HDVP1	16/06/2020	414.1	272.1
HDVP1	15/06/2020	414.1	272.1
HDVP1	14/06/2020	414.1	272.1
HDVP1	13/06/2020	414.1	272.1
HDVP1	12/06/2020	414.1	272.1
HDVP1	11/06/2020	414.1	272.1
HDVP1	10/06/2020	414.1	272.1
HDVP1	9/06/2020	414.1	272.1
HDVP1	8/06/2020	414.1	272.1
HDVP1	7/06/2020	414.1	272.1
HDVP1	6/06/2020	414.1	272.1
HDVP1	5/06/2020	414.1	272.1
HDVP1	4/06/2020	414.1	272.1
HDVP1	3/06/2020	414.1	272.1
HDVP1	2/06/2020	414.1	272.1
HDVP1	1/06/2020	423.0	263.2
HDVP1	31/05/2020	423.0	263.2
HDVP1	30/05/2020	423.0	263.2
HDVP1	29/05/2020	423.0	263.2
HDVP1	28/05/2020	423.0	263.2
HDVP1	27/05/2020	423.0	263.2
HDVP1	26/05/2020	423.0	263.2
HDVP1	25/05/2020	423.0	263.2
HDVP1	24/05/2020	423.0	263.2
HDVP1	23/05/2020	423.0	263.2
HDVP1	22/05/2020	423.0	263.2
HDVP1	21/05/2020	423.0	263.2
HDVP1	20/05/2020	423.0	263.2
HDVP1	19/05/2020	423.0	263.2
HDVP1	18/05/2020	423.0	263.2
HDVP1	17/05/2020	423.0	263.2
HDVP1	16/05/2020	423.0	263.2
HDVP1	15/05/2020	423.0	263.2
HDVP1	14/05/2020	423.0	263.2
HDVP1	13/05/2020	423.0	263.2
HDVP1	12/05/2020	423.0	263.2
HDVP1	11/05/2020	423.0	263.2
HDVP1	10/05/2020	423.0	263.2
HDVP1	9/05/2020	423.0	263.2
HDVP1	8/05/2020	423.0	263.2
HDVP1	7/05/2020	423.0	263.2
HDVP1	6/05/2020	423.0	263.2
HDVP1	5/05/2020	423.0	263.2
HDVP1	4/05/2020	423.0	263.2
HDVP1	3/05/2020	423.0	263.2
HDVP1	2/05/2020	423.0	263.2
HDVP1	1/05/2020	429.2	257.0
HDVP1	30/04/2020	429.2	257.0
HDVP1	29/04/2020	429.2	257.0
HDVP1	28/04/2020	429.2	257.0
HDVP1	27/04/2020	429.2	257.0
HDVP1	26/04/2020	429.2	257.0
HDVP1	25/04/2020	429.2	257.0
HDVP1	24/04/2020	429.2	257.0
HDVP1	23/04/2020	429.2	257.0
HDVP1	22/04/2020	429.2	257.0
HDVP1	21/04/2020	429.2	257.0
HDVP1	20/04/2020	429.2	257.0
HDVP1	19/04/2020	429.2	257.0
HDVP1	18/04/2020	429.2	257.0
HDVP1	17/04/2020	429.2	257.0
HDVP1	16/04/2020	429.2	257.0
HDVP1	15/04/2020	429.2	257.0
HDVP1	14/04/2020	429.2	257.0
HDVP1	13/04/2020	429.2	257.0
HDVP1	12/04/2020	429.2	257.0
HDVP1	11/04/2020	429.2	257.0
HDVP1	10/04/2020	429.2	257.0
HDVP1	9/04/2020	429.2	257.0
HDVP1	8/04/2020	429.2	257.0
HDVP1	7/04/2020	429.2	257.0
HDVP1	6/04/2020	429.2	257.0
HDVP1	5/04/2020	429.2	257.0
HDVP1	4/04/2020	429.2	257.0
HDVP1	3/04/2020	429.2	257.0
HDVP1	2/04/2020	429.2	257.0
HDVP1	1/04/2020	429.2	257.0
HDVP1	31/03/2020	429.2	257.0
HDVP1	30/03/2020	429.2	257.0
HDVP1	29/03/2020	429.2	257.0
HDVP1	28/03/2020	429.2	257.0
HDVP1	27/03/2020	429.2	257.0
HDVP1	26/03/2020	429.2	257.0
HDVP1	25/03/2020	429.2	257.0
HDVP1	24/03/2020	429.2	257.0
HDVP1	23/03/2020	429.2	257.0
HDVP1	22/03/2020	429.2	257.0
HDVP1	21/03/2020	429.2	257.0
HDVP1	20/03/2020	429.2	257.0
HDVP1	19/03/2020	429.2	257.0
HDVP1	18/03/2020	429.2	257.0
HDVP1	17/03/2020	429.2	257.0
HDVP1	16/03/2020	429.2	257.0
HDVP1	15/03/2020	429.2	257.0
HDVP1	14/03/2020	429.2	257.0
HDVP1	13/03/2020	429.2	257.0
HDVP1	12/03/2020	429.2	257.0
HDVP1	11/03/2020	429.2	257.0
HDVP1	10/03/2020	429.2	257.0
HDVP1	9/03/2020	429.2	257.0
HDVP1	8/03/2020	429.2	257.0
HDVP1	7/03/2020	429.2	257.0
HDVP1	6/03/2020	429.2	257.0
HDVP1	5/03/2020	429.2	257.0
HDVP1	4/03/2020	429.2	257.0
HDVP1	3/03/2020	429.2	257.0
HDVP1	2/03/2020	429.2	257.0
HDVP1	1/03/2020	422.7	263.5
HDVP1	29/02/2020	422.7	263.5
HDVP1	28/02/2020	422.7	263.5
HDVP1	27/02/2020	422.7	263.5
HDVP1	26/02/2020	422.7	263.5
HDVP1	25/02/2020	422.7	263.5
HDVP1	24/02/2020	422.7	263.5
HDVP1	23/02/2020	422.7	263.5
HDVP1	22/02/2020	422.7	263.5
HDVP1	21/02/2020	422.7	263.5
HDVP1	20/02/2020	422.7	263.5
HDVP1	19/02/2020	422.7	263.5
HDVP1	18/02/2020	422.7	263.5
HDVP1	17/02/2020	422.7	263.5
HDVP1	16/02/2020	422.7	263.5
HDVP1	15/02/2020	422.7	263.5
HDVP1	14/02/2020	422.7	263.5
HDVP1	13/02/2020	422.7	263.5

ID	Date	WL mAHD	WL mbgl
MB15H1SW0001	5/12/2019	595.2	50.2
MB15H1SW0001	4/12/2019	595.2	50.2
MB15H1SW0001	3/12/2019	595.2	50.2
MB15H1SW0001	2/12/2019	595.2	50.2
MB15H1SW0001	1/12/2019	595.2	50.2
MB15H1SW0001	30/11/2019	595.2	50.2
MB15H1SW0001	29/11/2019	595.2	50.2
MB15H1SW0001	28/11/2019	595.2	50.2
MB15H1SW0001	27/11/2019	595.2	50.2
MB15H1SW0001	26/11/2019	595.2	50.2
MB15H1SW0001	25/11/2019	595.2	50.2
MB15H1SW0001	24/11/2019	595.2	50.2
MB15H1SW0001	23/11/2019	595.2	50.2
MB15H1SW0001	22/11/2019	595.2	50.2
MB15H1SW0001	21/11/2019	595.2	50.2
MB15H1SW0001	20/11/2019	595.2	50.2
MB15H1SW0001	19/11/2019	595.2	50.2
MB15H1SW0001	18/11/2019	595.3	50.1
MB15H1SW0001	17/11/2019	595.3	50.1
MB15H1SW0001	16/11/2019	595.3	50.1
MB15H1SW0001	15/11/2019	595.3	50.1
MB15H1SW0001	14/11/2019	595.3	50.1
MB15H1SW0001	13/11/2019	595.3	50.1
MB15H1SW0001	12/11/2019	595.2	50.2
MB15H1SW0001	11/11/2019	595.2	50.2
MB15H1SW0001	10/11/2019	595.3	50.1
MB15H1SW0001	9/11/2019	595.3	50.1
MB15H1SW0001	8/11/2019	595.3	50.1
MB15H1SW0001	7/11/2019	595.3	50.1
MB15H1SW0001	6/11/2019	595.3	50.1
MB15H1SW0001	5/11/2019	595.3	50.1
MB15H1SW0001	4/11/2019	595.3	50.1
MB15H1SW0001	3/11/2019	595.3	50.1
MB15H1SW0001	2/11/2019	595.2	50.2
MB15H1SW0001	1/11/2019	595.2	50.2
MB15H1SW0001	31/10/2019	595.2	50.2
MB15H1SW0001	30/10/2019	595.2	50.2
MB15H1SW0001	29/10/2019	595.3	50.1
MB15H1SW0001	28/10/2019	595.3	50.1
MB15H1SW0001	27/10/2019	595.3	50.1
MB15H1SW0001	26/10/2019	595.3	50.1
MB15H1SW0001	25/10/2019	595.3	50.1
MB15H1SW0001	24/10/2019	595.3	50.1
MB15H1SW0001	23/10/2019	595.3	50.1
MB15H1SW0001	22/10/2019	595.3	50.1
MB15H1SW0001	21/10/2019	595.3	50.1
MB15H1SW0001	20/10/2019	595.3	50.1
MB15H1SW0001	19/10/2019	595.3	50.1
MB15H1SW0001	18/10/2019	595.3	50.1
MB15H1SW0001	17/10/2019	595.3	50.1
MB15H1SW0001	16/10/2019	595.3	50.1
MB15H1SW0001	15/10/2019	595.3	50.1
MB15H1SW0001	14/10/2019	595.3	50.1
MB15H1SW0001	13/10/2019	595.3	50.1
MB15H1SW0001	12/10/2019	595.3	50.1
MB15H1SW0001	11/10/2019	595.3	50.1
MB15H1SW0001	10/10/2019	595.3	50.1
MB15H1SW0001	9/10/2019	595.3	50.1
MB15H1SW0001	8/10/2019	595.3	50.1
MB15H1SW0001	7/10/2019	595.3	50.1
MB15H1SW0001	6/10/2019	595.3	50.1
MB15H1SW0001	5/10/2019	595.3	50.1
MB15H1SW0001	4/10/2019	595.3	50.1
MB15H1SW0001	3/10/2019	595.3	50.1
MB15H1SW0001	2/10/2019	595.3	50.1
MB15H1SW0001	1/10/2019	595.3	50.1
MB15H1SW0001	30/09/2019	595.3	50.1
MB15H1SW0001	29/09/2019	595.3	50.1
MB15H1SW0001	28/09/2019	595.3	50.1
MB15H1SW0001	27/09/2019	595.3	50.1
MB15H1SW0001	26/09/2019	595.3	50.1
MB15H1SW0001	25/09/2019	595.3	50.1
MB15H1SW0001	24/09/2019	595.3	50.1
MB15H1SW0001	23/09/2019	595.3	50.1
MB15H1SW0001	22/09/2019	595.3	50.1
MB15H1SW0001	21/09/2019	595.3	50.1
MB15H1SW0001	20/09/2019	595.3	50.1
MB15H1SW0001	19/09/2019	595.3	50.1
MB15H1SW0001	18/09/2019	595.3	50.1
MB15H1SW0001	17/09/2019	595.3	50.1
MB15H1SW0001	16/09/2019	595.3	50.1
MB15H1SW0001	15/09/2019	595.3	50.1
MB15H1SW0001	14/09/2019	595.3	50.1
MB15H1SW0001	13/09/2019	595.4	50.0
MB15H1SW0001	12/09/2019	595.3	50.1
MB15H1SW0001	11/09/2019	595.3	50.1
MB15H1SW0001	10/09/2019	595.3	50.1
MB15H1SW0001	9/09/2019	595.3	50.1
MB15H1SW0001	8/09/2019	595.3	50.1
MB15H1SW0001	7/09/2019	595.3	50.1
MB15H1SW0001	6/09/2019	595.3	50.1
MB15H1SW0001	5/09/2019	595.3	50.1
MB15H1SW0001	4/09/2019	595.3	50.1
MB15H1SW0001	3/09/2019	595.3	50.1
MB15H1SW0001	2/09/2019	595.3	50.1
MB15H1SW0001	1/09/2019	595.3	50.1
MB15H1SW0001	31/08/2019	595.3	50.1
MB15H1SW0001	30/08/2019	595.3	50.1
MB15H1SW0001	29/08/2019	595.3	50.1
MB15H1SW0001	28/08/2019	595.3	50.1
MB15H1SW0001	27/08/2019	595.3	50.1
MB15H1SW0001	26/08/2019	595.3	50.1
MB15H1SW0001	25/08/2019	595.3	50.1
MB15H1SW0001	24/08/2019	595.4	50.0
MB15H1SW0001	23/08/2019	595.4	50.0
MB15H1SW0001	22/08/2019	595.4	50.0
MB15H1SW0001	21/08/2019	595.4	50.0
MB15H1SW0001	20/08/2019	595.4	50.0
MB15H1SW0001	19/08/2019	595.4	50.0
MB15H1SW0001	18/08/2019	595.4	50.0
MB15H1SW0001	17/08/2019	595.4	50.0
MB15H1SW0001	16/08/2019	595.3	50.1
MB15H1SW0001	15/08/2019	595.3	50.1
MB15H1SW0001	14/08/2019	595.3	50.1
MB15H1SW0001	13/08/2019	595.4	50.0
MB15H1SW0001	12/08/2019	595.4	50.0
MB15H1SW0001	11/08/2019	595.4	50.0
MB15H1SW0001	10/08/2019	595.4	50.0
MB15H1SW0001	9/08/2019	595.4	50.0
MB15H1SW0001	8/08/2019	595.4	50.0
MB15H1SW0001	7/08/2019	595.4	50.0
MB15H1SW0001	6/08/2019	595.4	50.0
MB15H1SW0001	5/08/2019	595.4	50.0
MB15H1SW0001	4/08/2019	595.4	50.0
MB15H1SW0001	3/08/2019	595.4	50.0
MB15H1SW0001	2/08/2019	595.4	50.0
MB15H1SW0001	1/08/2019	595.4	50.0
MB15H1SW0001	31/07/2019	595.4	50.0
MB15H1SW0001	30/07/2019	595.4	50.0
MB15H1SW0001	29/07/2019	595.3	50.1
MB15H1SW0001	28/07/2019	595.4	50.0
MB15H1SW0001	27/07/2019	595.4	50.0
MB15H1SW0001	26/07/2019	595.4	50.0
MB15H1SW0001	25/07/2019	595.4	50.0
MB15H1SW0001	24/07/2019	595.4	50.0
MB15H1SW0001	23/07/2019	595.4	50.0

ID	Date	WL mAHD	WL mbgl
RC18WON0126	19/11/2021	621.6	77.0
RC18WON0126	17/11/2021	621.7	77.0
RC18WON0126	16/11/2021	621.7	77.0
RC18WON0126	15/11/2021	621.7	77.0
RC18WON0126	13/11/2021	621.7	76.9
RC18WON0126	12/11/2021	621.7	76.9
RC18WON0126	11/11/2021	621.7	77.0
RC18WON0126	8/11/2021	621.6	77.0
RC18WON0126	7/11/2021	621.6	77.0
RC18WON0126	6/11/2021	621.7	77.0
RC18WON0126	5/11/2021	621.7	76.9
RC18WON0126	4/11/2021	621.7	76.9
RC18WON0126	3/11/2021	621.7	76.9
RC18WON0126	2/11/2021	621.7	76.9
RC18WON0126	1/11/2021	621.7	76.9
RC18WON0126	31/10/2021	621.7	76.9
RC18WON0126	30/10/2021	621.7	76.9
RC18WON0126	29/10/2021	621.7	76.9
RC18WON0126	28/10/2021	621.7	76.9
RC18WON0126	27/10/2021	621.7	76.9
RC18WON0126	26/10/2021	621.7	76.9
RC18WON0126	25/10/2021	621.7	76.9
RC18WON0126	24/10/2021	621.7	76.9
RC18WON0126	23/10/2021	621.7	76.9
RC18WON0126	22/10/2021	621.7	76.9
RC18WON0126	21/10/2021	621.7	76.9
RC18WON0126	20/10/2021	621.7	76.9
RC18WON0126	19/10/2021	621.7	76.9
RC18WON0126	18/10/2021	621.7	76.9
RC18WON0126	17/10/2021	621.7	76.9
RC18WON0126	16/10/2021	621.7	76.9
RC18WON0126	15/10/2021	621.7	76.9
RC18WON0126	14/10/2021	621.7	76.9
RC18WON0126	13/10/2021	621.7	76.9
RC18WON0126	12/10/2021	621.7	76.9
RC18WON0126	11/10/2021	621.7	76.9
RC18WON0126	10/10/2021	621.7	76.9
RC18WON0126	9/10/2021	621.7	76.9
RC18WON0126	8/10/2021	621.7	76.9
RC18WON0126	7/10/2021	621.7	76.9
RC18WON0126	6/10/2021	621.7	76.9
RC18WON0126	5/10/2021	621.7	76.9
RC18WON0126	4/10/2021	621.7	76.9
RC18WON0126	3/10/2021	621.7	76.9
RC18WON0126	2/10/2021	621.7	76.9
RC18WON0126	1/10/2021	621.7	76.9
RC18WON0126	30/09/2021	621.8	76.9
RC18WON0126	29/09/2021	621.8	76.8
RC18WON0126	28/09/2021	621.8	76.8
RC18WON0126	27/09/2021	621.8	76.8
RC18WON0126	26/09/2021	621.8	76.8
RC18WON0126	25/09/2021	621.8	76.8
RC18WON0126	24/09/2021	621.8	76.8
RC18WON0126	23/09/2021	621.8	76.8
RC18WON0126	22/09/2021	621.8	76.8
RC18WON0126	21/09/2021	621.9	76.8
RC18WON0126	20/09/2021	621.8	76.8
RC18WON0126	19/09/2021	621.8	76.8
RC18WON0126	18/09/2021	621.8	76.8
RC18WON0126	17/09/2021	621.8	76.8
RC18WON0126	16/09/2021	621.8	76.8
RC18WON0126	15/09/2021	621.8	76.8
RC18WON0126	14/09/2021	621.8	76.8
RC18WON0126	13/09/2021	621.8	76.8
RC18WON0126	12/09/2021	621.8	76.8
RC18WON0126	11/09/2021	621.8	76.8
RC18WON0126	10/09/2021	621.8	76.8
RC18WON0126	9/09/2021	621.9	76.7
RC18WON0126	8/09/2021	621.9	76.7
RC18WON0126	7/09/2021	621.9	76.7
RC18WON0126	6/09/2021	621.9	76.7
RC18WON0126	5/09/2021	621.9	76.7
RC18WON0126	4/09/2021	621.9	76.8
RC18WON0126	3/09/2021	621.8	76.8
RC18WON0126	2/09/2021	621.8	76.8
RC18WON0126	1/09/2021	621.8	76.8
RC18WON0126	31/08/2021	621.8	76.8
RC18WON0126	30/08/2021	621.8	76.8
RC18WON0126	29/08/2021	621.8	76.8
RC18WON0126	28/08/2021	621.9	76.8
RC18WON0126	27/08/2021	621.9	76.8
RC18WON0126	26/08/2021	621.9	76.8
RC18WON0126	25/08/2021	621.9	76.8
RC18WON0126	24/08/2021	621.9	76.7
RC18WON0126	23/08/2021	621.9	76.7
RC18WON0126	22/08/2021	621.9	76.8
RC18WON0126	21/08/2021	621.9	76.8
RC18WON0126	20/08/2021	621.9	76.7
RC18WON0126	19/08/2021	621.9	76.7
RC18WON0126	16/08/2021	621.9	76.7
RC18WON0126	15/08/2021	621.9	76.7
RC18WON0126	14/08/2021	621.9	76.7
RC18WON0126	13/08/2021	621.9	76.7
RC18WON0126	12/08/2021	621.9	76.7
RC18WON0126	11/08/2021	621.9	76.7
RC18WON0126	10/08/2021	621.9	76.7
RC18WON0126	9/08/2021	621.9	76.7
RC18WON0126	8/08/2021	621.9	76.7
RC18WON0126	7/08/2021	621.9	76.7
RC18WON0126	6/08/2021	621.9	76.7
RC18WON0126	5/08/2021	621.9	76.7
RC18WON0126	4/08/2021	621.9	76.7
RC18WON0126	3/08/2021	621.9	76.7
RC18WON0126	2/08/2021	621.9	76.7
RC18WON0126	1/08/2021	621.9	76.7
RC18WON0126	31/07/2021	621.9	76.7
RC18WON0126	30/07/2021	621.9	76.7
RC18WON0126	29/07/2021	621.9	76.7
RC18WON0126	28/07/2021	621.9	76.7
RC18WON0126	27/07/2021	621.9	76.7
RC18WON0126	26/07/2021	621.9	76.7
RC18WON0126	25/07/2021	621.9	76.7
RC18WON0126	24/07/2021	621.9	76.7
RC18WON0126	23/07/2021	621.9	76.7
RC18WON0126	22/07/2021	621.9	76.7
RC18WON0126	21/07/2021	621.9	76.7
RC18WON0126	20/07/2021	621.9	76.7
RC18WON0126	19/07/2021	621.9	76.7
RC18WON0126	18/07/2021	621.9	76.7
RC18WON0126	17/07/2021	621.9	76.7
RC18WON0126	16/07/2021	621.9	76.7
RC18WON0126	15/07/2021	621.9	76.7
RC18WON0126	14/07/2021	621.9	76.7
RC18WON0126	13/07/2021	621.9	76.7
RC18WON0126	12/07/2021	621.9	76.7
RC18WON0126	11/07/2021	621.9	76.7
RC18WON0126	10/07/2021	621.9	76.7
RC18WON0126	9/07/2021	621.9	76.7
RC18WON0126	8/07/2021	621.9	76.7
RC18WON0126	7/07/2021	621.9	76.7
RC18WON0126	6/07/2021	621.9	76.7
RC18WON0126	5/07/2021	621.9	76.7
RC18WON0126	4/07/2021	622.0	76.7
RC18WON0126	3/07/2021	622.0	76.7
RC18WON0126	2/07/2021	622.0	76.6
RC18WON0126	1/07/2021	622.0	76.6

ID	Date	WL mAHD	WL mbgl
MB18HD20003	22/11/2021	625.7	82.2
MB18HD20003	23/11/2021	625.7	82.2
MB18HD20003	24/11/2021	625.7	82.2
MB18HD20003	25/11/2021	625.6	82.3
MB18HD20003	26/11/2021	625.7	82.2
MB18HD20003	27/11/2021	625.7	82.2
MB18HD20003	28/11/2021	625.7	82.2
MB18HD20003	29/11/2021	625.7	82.2
MB18HD20003	30/11/2021	625.7	82.2
MB18HD20003	1/12/2021	625.7	82.2
MB18HD20003	2/12/2021	625.7	82.2
MB18HD20003	3/12/2021	625.7	82.2
MB18HD20003	4/12/2021	625.7	82.2
MB18HD20003	5/12/2021	625.7	82.2
MB18HD20003	6/12/2021	625.7	82.2
MB18HD20003	7/12/2021	625.7	82.2
MB18HD20003	8/12/2021	625.6	82.2
MB18HD20003	9/12/2021	625.7	82.2
MB18HD20003	10/12/2021	625.7	82.2
MB18HD20003	11/12/2021	625.7	82.2
MB18HD20003	12/12/2021	625.7	82.2
MB18HD20003	13/12/2021	625.6	82.2
MB18HD20003	14/12/2021	625.7	82.2
MB18HD20003	15/12/2021	625.7	82.2
MB18HD20003	16/12/2021	625.7	82.2
MB18HD20003	17/12/2021	625.7	82.2
MB18HD20003	18/12/2021	625.6	82.2
MB18HD20003	19/12/2021	625.6	82.2
MB18HD20003	20/12/2021	625.7	82.2
MB18HD20003	21/12/2021	625.7	82.2
MB18HD20003	22/12/2021	625.7	82.2
MB18HD20003	23/12/2021	625.7	82.2
MB18HD20003	24/12/2021	625.7	82.2
MB18HD20003	25/12/2021	625.7	82.2
MB18HD20003	26/12/2021	625.7	82.2
MB18HD20003	30/12/2021	625.7	82.2
MB18HD20003	31/12/2021	625.6	82.2
MB18HD20003	1/01/2022	625.6	82.2
MB18HD20003	2/01/2022	625.6	82.2
MB18HD20003	3/01/2022	625.6	82.2
MB18HD20003	4/01/2022	625.7	82.2
MB18HD20003	5/01/2022	625.7	82.2
MB18HD20003	6/01/2022	625.7	82.2
MB18HD20003	7/01/2022	625.7	82.2
MB18HD20003	8/01/2022	625.7	82.2
MB18HD20003	9/01/2022	625.7	82.2
MB18HD20003	10/01/2022	625.7	82.2
MB18HD20003	11/01/2022	625.7	82.2
MB18HD20003	12/01/2022	625.7	82.2
MB18HD20003	13/01/2022	625.7	82.2
MB18HD20003	14/01/2022	625.7	82.2
MB18HD20003	15/01/2022	625.7	82.2
MB18HD20003	16/01/2022	625.7	82.2
MB18HD20003	17/01/2022	625.6	82.2
MB18HD20003	18/01/2022	625.6	82.2
MB18HD20003	19/01/2022	625.7	82.2
MB18HD20003	20/01/2022	625.7	82.2
MB18HD20003	21/01/2022	625.7	82.2
MB18HD20003	22/01/2022	625.7	82.2
MB18HD20003	23/01/2022	625.7	82.2
MB18HD20003	24/01/2022	625.8	82.0
MB18HD20003	25/01/2022	625.8	82.1
MB18HD20003	26/01/2022	625.8	82.1
MB18HD20003	27/01/2022	625.8	82.1
MB18HD20003	28/01/2022	625.8	82.1
MB18HD20003	29/01/2022	625.8	82.1
MB18HD20003	30/01/2022	625.8	82.1
MB18HD20003	31/01/2022	625.4	82.5
MB18HD20003	1/02/2022	625.8	82.1
MB18HD20003	2/02/2022	625.8	82.1
MB18HD20003	3/02/2022	625.8	82.1
MB18HD20003	4/02/2022	625.8	82.1
MB18HD20003	5/02/2022	625.8	82.1
MB18HD20003	6/02/2022	625.8	82.1
MB18HD20003	7/02/2022	625.7	82.2
MB18HD20003	8/02/2022	625.8	82.1
MB18HD20003	9/02/2022	625.8	82.1
MB18HD20003	10/02/2022	625.8	82.1
MB18HD20003	11/02/2022	625.8	82.1
MB18HD20003	12/02/2022	625.8	82.1
MB18HD20003	13/02/2022	625.8	82.1
MB18HD20003	14/02/2022	625.8	82.1
MB18HD20003	15/02/2022	625.8	82.1
MB18HD20003	16/02/2022	625.8	82.1
MB18HD20003	17/02/2022	625.4	82.5
MB18HD20003	18/02/2022	625.8	82.1
MB18HD20003	19/02/2022	625.8	82.1
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	12/02/2020	422.7	263.5
HDVP1	11/02/2020	422.7	263.5
HDVP1	10/02/2020	422.7	263.5
HDVP1	9/02/2020	422.7	263.5
HDVP1	8/02/2020	422.7	263.5
HDVP1	7/02/2020	422.7	263.5
HDVP1	6/02/2020	422.7	263.5
HDVP1	5/02/2020	422.7	263.5
HDVP1	4/02/2020	422.7	263.5
HDVP1	3/02/2020	422.7	263.5
HDVP1	2/02/2020	422.7	263.5
HDVP1	1/02/2020	415.2	271.0
HDVP1	31/01/2020	415.2	271.0
HDVP1	30/01/2020	415.2	271.0
HDVP1	29/01/2020	415.2	271.0
HDVP1	28/01/2020	415.2	271.0
HDVP1	27/01/2020	415.2	271.0
HDVP1	26/01/2020	415.2	271.0
HDVP1	25/01/2020	415.2	271.0
HDVP1	24/01/2020	415.2	271.0
HDVP1	23/01/2020	415.2	271.0
HDVP1	22/01/2020	415.2	271.0
HDVP1	21/01/2020	415.2	271.0
HDVP1	20/01/2020	415.2	271.0
HDVP1	19/01/2020	415.2	271.0
HDVP1	18/01/2020	415.2	271.0
HDVP1	17/01/2020	415.2	271.0
HDVP1	16/01/2020	415.2	271.0
HDVP1	15/01/2020	415.2	271.0
HDVP1	14/01/2020	415.2	271.0
HDVP1	13/01/2020	415.2	271.0
HDVP1	12/01/2020	415.2	271.0
HDVP1	11/01/2020	415.2	271.0
HDVP1	10/01/2020	415.2	271.0
HDVP1	9/01/2020	415.2	271.0
HDVP1	8/01/2020	415.2	271.0
HDVP1	7/01/2020	415.2	271.0
HDVP1	6/01/2020	415.2	271.0
HDVP1	5/01/2020	415.2	271.0
HDVP1	4/01/2020	415.2	271.0
HDVP1	3/01/2020	415.2	271.0
HDVP1	2/01/2020	415.2	271.0
HDVP1	1/01/2020	433.5	252.7
HDVP1	31/12/2019	433.5	252.7
HDVP1	30/12/2019	433.5	252.7
HDVP1	29/12/2019	433.5	252.7
HDVP1	28/12/2019	433.5	252.7
HDVP1	27/12/2019	433.5	252.7
HDVP1	26/12/2019	433.5	252.7
HDVP1	25/12/2019	433.5	252.7
HDVP1	24/12/2019	433.5	252.7
HDVP1	23/12/2019	433.5	252.7
HDVP1	22/12/2019	433.5	252.7
HDVP1	21/12/2019	433.5	252.7
HDVP1	20/12/2019	433.5	252.7
HDVP1	19/12/2019	433.5	252.7
HDVP1	18/12/2019	433.5	252.7
HDVP1	17/12/2019	433.5	252.7
HDVP1	16/12/2019	433.5	252.7
HDVP1	15/12/2019	433.5	252.7
HDVP1	14/12/2019	433.5	252.7
HDVP1	13/12/2019	433.5	252.7
HDVP1	12/12/2019	623.8	62.4
HDVP1	11/12/2019	433.5	252.7
HDVP1	10/12/2019	433.5	252.7
HDVP1	9/12/2019	433.5	252.7
HDVP1	8/12/2019	433.5	252.7
HDVP1	7/12/2019	433.5	252.7
HDVP1	6/12/2019	433.5	252.7
HDVP1	5/12/2019	433.5	252.7
HDVP1	4/12/2019	433.5	252.7
HDVP1	3/12/2019	433.5	252.7
HDVP1	2/12/2019	399.2	287.0
HDVP1	1/12/2019	399.2	287.0
HDVP1	30/11/2019	399.2	287.0
HDVP1	29/11/2019	399.2	287.0
HDVP1	28/11/2019	399.2	287.0
HDVP1	27/11/2019	399.2	287.0
HDVP1	26/11/2019	399.2	287.0
HDVP1	25/11/2019	399.2	287.0
HDVP1	24/11/2019	399.2	287.0
HDVP1	23/11/2019	399.2	287.0
HDVP1	22/11/2019	399.2	287.0
HDVP1	21/11/2019	399.2	287.0
HDVP1	20/11/2019	399.2	287.0
HDVP1	19/11/2019	399.2	287.0
HDVP1	18/11/2019	399.2	287.0
HDVP1	17/11/2019	399.2	287.0
HDVP1	16/11/2019	399.2	287.0
HDVP1	15/11/2019	399.2	287.0
HDVP1	14/11/2019	399.2	287.0
HDVP1	13/11/2019	399.2	287.0
HDVP1	12/11/2019	399.2	287.0
HDVP1	11/11/2019	399.2	287.0
HDVP1	10/11/2019	399.2	287.0
HDVP1	9/11/2019	399.2	287.0
HDVP1	8/11/2019	399.2	287.0
HDVP1	7/11/2019	399.2	287.0
HDVP1	6/11/2019	399.2	287.0
HDVP1	5/11/2019	399.2	287.0
HDVP1	4/11/2019	399.2	287.0
HDVP1	3/11/2019	399.2	287.0
HDVP1	2/11/2019	399.2	287.0
HDVP1	1/11/2019	406.1	280.1
HDVP1	31/10/2019	406.1	280.1
HDVP1	30/10/2019	406.1	280.1
HDVP1	29/10/2019	406.1	280.1
HDVP1	28/10/2019	406.1	280.1
HDVP1	27/10/2019	406.1	280.1
HDVP1	26/10/2019	406.1	280.1
HDVP1	25/10/2019	406.1	280.1
HDVP1	24/10/2019	406.1	280.1
HDVP1	23/10/2019	406.1	280.1
HDVP1	22/10/2019	406.1	280.1
HDVP1	21/10/2019	406.1	280.1
HDVP1	20/10/2019	406.1	280.1
HDVP1	19/10/2019	406.1	280.1
HDVP1	18/10/2019	406.1	280.1
HDVP1	17/10/2019	406.1	280.1
HDVP1	16/10/2019	406.1	280.1
HDVP1	15/10/2019	406.1	280.1
HDVP1	14/10/2019	406.1	280.1
HDVP1	13/10/2019	406.1	280.1
HDVP1	12/10/2019	406.1	280.1
HDVP1	11/10/2019	406.1	280.1
HDVP1	10/10/2019	406.1	280.1
HDVP1	9/10/2019	406.1	280.1
HDVP1	8/10/2019	406.1	280.1
HDVP1	7/10/2019	406.1	280.1
HDVP1	6/10/2019	406.1	280.1
HDVP1	5/10/2019	406.1	280.1
HDVP1	4/10/2019	406.1	280.1
HDVP1	3/10/2019	406.1	280.1
HDVP1	2/10/2019	406.1	280.1
HDVP1	1/10/2019	391.7	294.5
HDVP1	30/09/2019	391.7	294.5

ID	Date	WL mAHD	WL mbgl
MB15H1SW0001	22/07/2019	595.4	50.0
MB15H1SW0001	21/07/2019	595.4	50.0
MB15H1SW0001	20/07/2019	595.4	50.0
MB15H1SW0001	19/07/2019	595.4	50.0
MB15H1SW0001	18/07/2019	595.4	50.0
MB15H1SW0001	17/07/2019	595.4	50.0
MB15H1SW0001	16/07/2019	595.4	50.0
MB15H1SW0001	15/07/2019	595.4	50.0
MB15H1SW0001	14/07/2019	595.4	50.0
MB15H1SW0001	13/07/2019	595.4	50.0
MB15H1SW0001	12/07/2019	595.4	50.0
MB15H1SW0001	11/07/2019	595.4	50.0
MB15H1SW0001	10/07/2019	595.4	50.0
MB15H1SW0001	9/07/2019	595.4	50.0
MB15H1SW0001	8/07/2019	595.4	50.0
MB15H1SW0001	7/07/2019	595.4	50.0
MB15H1SW0001	6/07/2019	595.4	50.0
MB15H1SW0001	5/07/2019	595.4	50.0
MB15H1SW0001	4/07/2019	595.4	50.0
MB15H1SW0001	3/07/2019	595.4	50.0
MB15H1SW0001	2/07/2019	595.4	50.0
MB15H1SW0001	1/07/2019	595.4	50.0
MB15H1SW0001	30/06/2019	595.4	50.0
MB15H1SW0001	29/06/2019	595.4	50.0
MB15H1SW0001	28/06/2019	595.4	50.0
MB15H1SW0001	27/06/2019	595.4	50.0
MB15H1SW0001	26/06/2019	595.4	50.0
MB15H1SW0001	25/06/2019	595.4	50.0
MB15H1SW0001	24/06/2019	595.4	50.0
MB15H1SW0001	23/06/2019	595.4	50.0
MB15H1SW0001	22/06/2019	595.4	50.0
MB15H1SW0001	21/06/2019	595.4	50.0
MB15H1SW0001	20/06/2019	595.4	50.0
MB15H1SW0001	19/06/2019	595.4	50.0
MB15H1SW0001	18/06/2019	595.4	50.0
MB15H1SW0001	17/06/2019	595.4	50.0
MB15H1SW0001	16/06/2019	595.4	50.0
MB15H1SW0001	15/06/2019	595.4	50.0
MB15H1SW0001	14/06/2019	595.4	50.0
MB15H1SW0001	21/03/2019	595.4	50.0
MB15H1SW0001	20/03/2019	595.4	50.0
MB15H1SW0001	19/03/2019	595.4	50.0
MB15H1SW0001	18/03/2019	595.4	50.0
MB15H1SW0001	17/03/2019	595.4	50.0
MB15H1SW0001	16/03/2019	595.4	50.0
MB15H1SW0001	15/03/2019	595.4	50.0
MB15H1SW0001	14/03/2019	595.4	50.0
MB15H1SW0001	13/03/2019	595.4	50.0
MB15H1SW0001	12/03/2019	595.4	50.0
MB15H1SW0001	11/03/2019	595.4	50.0
MB15H1SW0001	10/03/2019	595.4	50.0
MB15H1SW0001	9/03/2019	595.4	50.0
MB15H1SW0001	8/03/2019	595.4	50.0
MB15H1SW0001	7/03/2019	595.4	50.0
MB15H1SW0001	6/03/2019	595.4	50.0
MB15H1SW0001	5/03/2019	595.4	50.0
MB15H1SW0001	4/03/2019	595.4	50.0
MB15H1SW0001	3/03/2019	595.4	50.0
MB15H1SW0001	2/03/2019	595.4	50.0
MB15H1SW0001	1/03/2019	595.4	50.0
MB15H1SW0001	28/02/2019	595.4	50.0
MB15H1SW0001	27/02/2019	595.4	50.0
MB15H1SW0001	26/02/2019	595.4	50.0
MB15H1SW0001	25/02/2019	595.4	50.0
MB15H1SW0001	24/02/2019	595.4	50.0
MB15H1SW0001	23/02/2019	595.4	50.0
MB15H1SW0001	22/02/2019	595.4	50.0
MB15H1SW0001	21/02/2019	595.4	50.0
MB15H1SW0001	20/02/2019	595.4	50.0
MB15H1SW0001	19/02/2019	595.4	50.0
MB15H1SW0001	18/02/2019	595.4	50.0
MB15H1SW0001	17/02/2019	595.4	50.0
MB15H1SW0001	16/02/2019	595.4	50.0
MB15H1SW0001	15/02/2019	595.4	50.0
MB15H1SW0001	14/02/2019	595.4	50.0
MB15H1SW0001	13/02/2019	595.4	50.0
MB15H1SW0001	12/02/2019	595.4	50.0
MB15H1SW0001	11/02/2019	595.4	50.0
MB15H1SW0001	10/02/2019	595.4	50.0
MB15H1SW0001	9/02/2019	595.4	50.0
MB15H1SW0001	8/02/2019	595.4	50.0
MB15H1SW0001	7/02/2019	595.4	50.0
MB15H1SW0001	6/02/2019	595.4	50.0
MB15H1SW0001	5/02/2019	595.4	50.0
MB15H1SW0001	4/02/2019	595.4	50.0
MB15H1SW0001	3/02/2019	595.4	50.0
MB15H1SW0001	2/02/2019	595.4	50.0
MB15H1SW0001	1/02/2019	595.4	50.0
MB15H1SW0001	31/01/2019	595.4	50.0
MB15H1SW0001	30/01/2019	595.4	50.0
MB15H1SW0001	29/01/2019	595.4	50.0
MB15H1SW0001	28/01/2019	595.4	50.0
MB15H1SW0001	27/01/2019	595.4	50.0
MB15H1SW0001	26/01/2019	595.4	50.0
MB15H1SW0001	25/01/2019	595.4	50.0
MB15H1SW0001	24/01/2019	595.4	50.0
MB15H1SW0001	23/01/2019	595.4	50.0
MB15H1SW0001	22/01/2019	595.4	50.0
MB15H1SW0001	21/01/2019	595.4	50.0
MB15H1SW0001	20/01/2019	595.4	50.0
MB15H1SW0001	19/01/2019	595.4	50.0
MB15H1SW0001	18/01/2019	595.4	50.0
MB15H1SW0001	17/01/2019	595.4	50.0
MB15H1SW0001	16/01/2019	595.4	50.0
MB15H1SW0001	15/01/2019	595.4	50.0
MB15H1SW0001	14/01/2019	595.4	50.0
MB15H1SW0001	13/01/2019	595.4	50.0
MB15H1SW0001	12/01/2019	595.4	50.0
MB15H1SW0001	11/01/2019	595.4	50.0
MB15H1SW0001	10/01/2019	595.4	50.0
MB15H1SW0001	9/01/2019	595.4	50.0
MB15H1SW0001	8/01/2019	595.4	50.0
MB15H1SW0001	7/01/2019	595.4	50.0
MB15H1SW0001	6/01/2019	595.4	50.0
MB15H1SW0001	5/01/2019	595.4	50.0
MB15H1SW0001	4/01/2019	595.4	50.0
MB15H1SW0001	3/01/2019	595.4	50.0
MB15H1SW0001	2/01/2019	595.4	50.0
MB15H1SW0001	1/01/2019	595.4	50.0
MB15H1SW0001	31/12/2018	595.4	50.0
MB15H1SW0001	30/12/2018	595.4	50.0
MB15H1SW0001	29/12/2018	595.4	50.0
MB15H1SW0001	28/12/2018	595.4	50.0
MB15H1SW0001	27/12/2018	595.4	50.0
MB15H1SW0001	26/12/2018	595.4	50.0
MB15H1SW0001	25/12/2018	595.4	50.0
MB15H1SW0001	24/12/2018	595.4	50.0
MB15H1SW0001	23/12/2018	595.4	50.0
MB15H1SW0001	22/12/2018	595.4	50.0
MB15H1SW0001	21/12/2018	595.4	50.0
MB15H1SW0001	20/12/2018	595.4	50.0
MB15H1SW0001	19/12/2018	595.4	50.0
MB15H1SW0001	18/12/2018	595.4	50.0
MB15H1SW0001	17/12/2018	595.4	50.0
MB15H1SW0001	16/12/2018	595.4	50.0
MB15H1SW0001	15/12/2018	595.4	50.0

ID	Date	WL mAHD	WL mbgl
RC18WON0126	30/06/2021	622.0	76.7
RC18WON0126	29/06/2021	622.0	76.7
RC18WON0126	28/06/2021	621.9	76.7
RC18WON0126	27/06/2021	622.0	76.7
RC18WON0126	26/06/2021	622.0	76.6
RC18WON0126	25/06/2021	622.0	76.6
RC18WON0126	24/06/2021	622.0	76.6
RC18WON0126	23/06/2021	622.0	76.6
RC18WON0126	22/06/2021	622.0	76.7
RC18WON0126	21/06/2021	622.0	76.7
RC18WON0126	20/06/2021	622.0	76.6
RC18WON0126	19/06/2021	622.0	76.6
RC18WON0126	18/06/2021	622.0	76.6
RC18WON0126	17/06/2021	622.0	76.6
RC18WON0126	16/06/2021	622.0	76.6
RC18WON0126	15/06/2021	622.0	76.7
RC18WON0126	14/06/2021	622.0	76.7
RC18WON0126	13/06/2021	622.0	76.7
RC18WON0126	12/06/2021	621.9	76.7
RC18WON0126	11/06/2021	621.9	76.7
RC18WON0126	10/06/2021	622.0	76.7
RC18WON0126	9/06/2021	622.0	76.6
RC18WON0126	8/06/2021	622.0	76.6
RC18WON0126	7/06/2021	622.0	76.6
RC18WON0126	6/06/2021	622.0	76.6
RC18WON0126	5/06/2021	622.0	76.6
RC18WON0126	4/06/2021	622.0	76.6
RC18WON0126	3/06/2021	622.0	76.6
RC18WON0126	2/06/2021	622.0	76.7
RC18WON0126	1/06/2021	621.9	76.7
RC18WON0126	31/05/2021	621.9	76.7
RC18WON0126	30/05/2021	621.9	76.7
RC18WON0126	29/05/2021	622.0	76.6
RC18WON0126	28/05/2021	622.0	76.6
RC18WON0126	27/05/2021	622.0	76.6
RC18WON0126	26/05/2021	622.0	76.6
RC18WON0126	25/05/2021	622.0	76.7
RC18WON0126	24/05/2021	621.9	76.7
RC18WON0126	23/05/2021	621.9	76.7
RC18WON0126	21/05/2021	621.9	76.7
RC18WON0126	20/05/2021	621.9	76.7
RC18WON0126	19/05/2021	621.9	76.7
RC18WON0126	18/05/2021	621.9	76.7
RC18WON0126	17/05/2021	621.9	76.7
RC18WON0126	16/05/2021	621.9	76.7
RC18WON0126	15/05/2021	621.9	76.7
RC18WON0126	14/05/2021	621.9	76.7
RC18WON0126	13/05/2021	621.9	76.7
RC18WON0126	12/05/2021	621.9	76.7
RC18WON0126	11/05/2021	621.9	76.7
RC18WON0126	10/05/2021	621.9	76.7
RC18WON0126	9/05/2021	621.9	76.7
RC18WON0126	8/05/2021	621.9	76.7
RC18WON0126	7/05/2021	621.9	76.7
RC18WON0126	6/05/2021	621.9	76.7
RC18WON0126	5/05/2021	621.9	76.7
RC18WON0126	4/05/2021	621.9	76.7
RC18WON0126	3/05/2021	621.9	76.7
RC18WON0126	2/05/2021	621.9	76.7
RC18WON0126	1/05/2021	621.9	76.7
RC18WON0126	30/04/2021	621.9	76.7
RC18WON0126	29/04/2021	621.9	76.7
RC18WON0126	28/04/2021	621.9	76.7
RC18WON0126	27/04/2021	621.9	76.7
RC18WON0126	26/04/2021	621.9	76.7
RC18WON0126	25/04/2021	621.9	76.8
RC18WON0126	14/11/2020	622.0	76.6
RC18WON0126	13/12/2018	622.0	76.7
RC18WON0127	2/03/2022	621.8	19.5
RC18WON0127	1/03/2022	621.8	19.5
RC18WON0127	28/02/2022	621.8	19.5
RC18WON0127	27/02/2022	621.8	19.5
RC18WON0127	26/02/2022	621.8	19.5
RC18WON0127	25/02/2022	621.8	19.5
RC18WON0127	24/02/2022	621.8	19.5
RC18WON0127	23/02/2022	621.8	19.5
RC18WON0127	22/02/2022	621.8	19.5
RC18WON0127	21/02/2022	621.8	19.5
RC18WON0127	20/02/2022	621.8	19.5
RC18WON0127	19/02/2022	621.8	19.5
RC18WON0127	18/02/2022	621.8	19.5
RC18WON0127	17/02/2022	621.8	19.5
RC18WON0127	16/02/2022	621.8	19.5
RC18WON0127	15/02/2022	621.8	19.4
RC18WON0127	14/02/2022	621.8	19.4
RC18WON0127	13/02/2022	621.8	19.5
RC18WON0127	12/02/2022	621.8	19.5
RC18WON0127	11/02/2022	621.8	19.5
RC18WON0127	10/02/2022	621.8	19.5
RC18WON0127	9/02/2022	621.8	19.5
RC18WON0127	8/02/2022	621.8	19.5
RC18WON0127	7/02/2022	621.8	19.5
RC18WON0127	6/02/2022	621.8	19.5
RC18WON0127	5/02/2022	621.8	19.5
RC18WON0127	4/02/2022	621.8	19.5
RC18WON0127	3/02/2022	621.8	19.5
RC18WON0127	2/02/2022	621.8	19.5
RC18WON0127	1/02/2022	621.7	19.5
RC18WON0127	31/01/2022	621.7	19.6
RC18WON0127	30/01/2022	621.8	19.5
RC18WON0127	29/01/2022	621.8	19.5
RC18WON0127	28/01/2022	621.7	19.5
RC18WON0127	27/01/2022	621.7	19.5
RC18WON0127	26/01/2022	621.7	19.6
RC18WON0127	25/01/2022	621.7	19.6
RC18WON0127	24/01/2022	621.8	19.5
RC18WON0127	23/01/2022	621.8	19.5
RC18WON0127	22/01/2022	621.8	19.5
RC18WON0127	21/01/2022	621.8	19.5
RC18WON0127	20/01/2022	621.8	19.5
RC18WON0127	19/01/2022	621.8	19.5
RC18WON0127	18/01/2022	621.8	19.5
RC18WON0127	17/01/2022	621.8	19.5
RC18WON0127	16/01/2022	621.7	19.5
RC18WON0127	15/01/2022	621.7	19.5
RC18WON0127	14/01/2022	621.8	19.5
RC18WON0127	13/01/2022	621.8	19.5
RC18WON0127	12/01/2022	621.8	19.5
RC18WON0127	11/01/2022	621.8	19.4
RC18WON0127	10/01/2022	621.8	19.5
RC18WON0127	9/01/2022	621.8	19.5
RC18WON0127	8/01/2022	621.8	19.5
RC18WON0127	7/01/2022	621.8	19.5
RC18WON0127	6/01/2022	621.8	19.5
RC18WON0127	5/01/2022	621.8	19.5
RC18WON0127	4/01/2022	621.8	19.5
RC18WON0127	3/01/2022	621.8	19.5
RC18WON0127	2/01/2022	621.8	19.5
RC18WON0127	1/01/2022	621.8	19.5
RC18WON0127	31/12/2021	621.8	19.5
RC18WON0127	30/12/2021	621.8	19.5
RC18WON0127	29/12/2021	621.8	19.5
RC18WON0127	28/12/2021	621.8	19.5
RC18WON0127	27/12/2021	621.8	19.5
RC18WON0127	26/12/2021	621.8	19.4
RC18WON0127	25/12/2021	621.8	19.5

ID	Date	WL mAHD	WL mbgl
MB18HD20004	18/12/2018	627.0	86.5
MB18HD20004	19/12/2018	627.0	86.5
MB18HD20004	20/12/2018	627.0	86.4
MB18HD20004	21/12/2018	627.0	86.4
MB18HD20004	22/12/2018	627.0	86.4
MB18HD20004	23/12/2018	627.0	86.4
MB18HD20004	24/12/2018	627.0	86.4
MB18HD20004	25/12/2018	627.0	86.5
MB18HD20004	26/12/2018	627.0	86.5
MB18HD20004	27/12/2018	627.0	86.5
MB18HD20004	28/12/2018	626.9	86.5
MB18HD20004	29/12/2018	627.0	86.5
MB18HD20004	30/12/2018	627.0	86.5
MB18HD20004	31/12/2018	627.0	86.5
MB18HD20004	1/01/2019	627.0	86.5
MB18HD20004	2/01/2019	627.0	86.5
MB18HD20004	3/01/2019	627.0	86.5
MB18HD20004	4/01/2019	627.0	86.5
MB18HD20004	5/01/2019	627.0	86.4
MB18HD20004	6/01/2019	627.0	86.4
MB18HD20004	7/01/2019	627.0	86.4
MB18HD20004	8/01/2019	627.0	86.4
MB18HD20004	9/01/2019	627.0	86.4
MB18HD20004	10/01/2019	627.0	86.5
MB18HD20004	11/01/2019	627.0	86.5
MB18HD20004	12/01/2019	627.0	86.5
MB18HD20004	13/01/2019	627.0	86.5
MB18HD20004	14/01/2019	627.0	86.5
MB18HD20004	15/01/2019	627.0	86.5
MB18HD20004	16/01/2019	627.0	86.5
MB18HD20004	17/01/2019	627.0	86.5
MB18HD20004	18/01/2019	627.0	86.5
MB18HD20004	19/01/2019	627.0	86.5
MB18HD20004	20/01/2019	627.0	86.4
MB18HD20004	21/01/2019	627.0	86.5
MB18HD20004	22/01/2019	627.0	86.5
MB18HD20004	23/01/2019	627.0	86.5
MB18HD20004	24/01/2019	627.0	86.5
MB18HD20004	25/01/2019	627.0	86.5
MB18HD20004	26/01/2019	627.0	86.5
MB18HD20004	27/01/2019	627.0	86.5
MB18HD20004	28/01/2019	627.0	86.5
MB18HD20004	29/01/2019	627.0	86.5
MB18HD20004	30/01/2019	627.0	86.5
MB18HD20004	31/01/2019	627.0	86.5
MB18HD20004	1/02/2019	627.0	86.5
MB18HD20004	2/02/2019	627.0	86.5
MB18HD20004	3/02/2019	627.0	86.5
MB18HD20004	4/02/2019	627.0	86.5
MB18HD20004	5/02/2019	627.0	86.5
MB18HD20004	6/02/2019	627.0	86.5
MB18HD20004	7/02/2019	627.0	86.4
MB18HD20004	8/02/2019	627.0	86.4
MB18HD20004	9/02/2019	627.0	86.4
MB18HD20004	10/02/2019	627.0	86.4
MB18HD20004	11/02/2019	627.0	86.4
MB18HD20004	12/02/2019	627.0	86.4
MB18HD20004	13/02/2019	627.0	86.4
MB18HD20004	14/02/2019	627.0	86.4
MB18HD20004	15/02/2019	627.0	86.4
MB18HD20004	16/02/2019	627.0	86.4
MB18HD20004	17/02/2019	627.0	86.4
MB18HD20004	18/02/2019	627.0	86.5
MB18HD20004	19/02/2019	627.0	86.5
MB18HD20004	20/02/2019	627.0	86.4
MB18HD20004	21/02/2019	627.0	86.4
MB18HD20004	22/02/2019	627.0	86.4
MB18HD20004	23/02/2019	627.0	86.4
MB18HD20004	24/02/2019	627.0	86.4
MB18HD20004	25/02/2019	627.0	86.4
MB18HD20004	26/02/2019	627.0	86.4
MB18HD20004	27/02/2019	627.0	86.4
MB18HD20004	28/02/2019	627.0	86.4
MB18HD20004	1/03/2019	627.0	86.4
MB18HD20004	2/03/2019	627.0	86.4
MB18HD20004	3/03/2019	627.0	86.4
MB18HD20004	4/03/2019	627.0	86.4
MB18HD20004	5/03/2019	627.0	86.4
MB18HD20004	6/03/2019	627.0	86.4
MB18HD20004	7/03/2019	627.0	86.4
MB18HD20004	8/03/2019	627.0	86.4
MB18HD20004	9/03/2019	627.0	86.4
MB18HD20004	10/03/2019	627.0	86.4
MB18HD20004	11/03/2019	627.0	86.4
MB18HD20004	12/03/2019	627.0	86.4
MB18HD20004	13/03/2019	627.0	86.4
MB18HD20004	14/03/2019	627.0	86.4
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	29/09/2019	391.7	294.5
HDVP1	28/09/2019	391.7	294.5
HDVP1	27/09/2019	391.7	294.5
HDVP1	26/09/2019	391.7	294.5
HDVP1	25/09/2019	391.7	294.5
HDVP1	24/09/2019	391.7	294.5
HDVP1	23/09/2019	391.7	294.5
HDVP1	22/09/2019	391.7	294.5
HDVP1	21/09/2019	391.7	294.5
HDVP1	20/09/2019	391.7	294.5
HDVP1	19/09/2019	391.7	294.5
HDVP1	18/09/2019	391.7	294.5
HDVP1	17/09/2019	391.7	294.5
HDVP1	16/09/2019	391.7	294.5
HDVP1	15/09/2019	391.7	294.5
HDVP1	14/09/2019	391.7	294.5
HDVP1	13/09/2019	391.7	294.5
HDVP1	12/09/2019	391.7	294.5
HDVP1	11/09/2019	391.7	294.5
HDVP1	10/09/2019	391.7	294.5
HDVP1	9/09/2019	391.7	294.5
HDVP1	8/09/2019	391.7	294.5
HDVP1	7/09/2019	391.7	294.5
HDVP1	6/09/2019	391.7	294.5
HDVP1	5/09/2019	391.7	294.5
HDVP1	4/09/2019	391.7	294.5
HDVP1	3/09/2019	391.7	294.5
HDVP1	2/09/2019	391.7	294.5
HDVP1	1/09/2019	313.7	372.5
HDVP1	31/08/2019	313.7	372.5
HDVP1	30/08/2019	313.7	372.5
HDVP1	29/08/2019	313.7	372.5
HDVP1	28/08/2019	313.7	372.5
HDVP1	27/08/2019	313.7	372.5
HDVP1	26/08/2019	313.7	372.5
HDVP1	25/08/2019	313.7	372.5
HDVP1	24/08/2019	313.7	372.5
HDVP1	23/08/2019	313.7	372.5
HDVP1	22/08/2019	313.7	372.5
HDVP1	21/08/2019	313.7	372.5
HDVP1	20/08/2019	313.7	372.5
HDVP1	19/08/2019	313.7	372.5
HDVP1	18/08/2019	313.7	372.5
HDVP1	17/08/2019	313.7	372.5
HDVP1	16/08/2019	313.7	372.5
HDVP1	15/08/2019	313.7	372.5
HDVP1	14/08/2019	313.7	372.5
HDVP1	13/08/2019	313.7	372.5
HDVP1	12/08/2019	313.7	372.5
HDVP1	11/08/2019	313.7	372.5
HDVP1	10/08/2019	313.7	372.5
HDVP1	9/08/2019	313.7	372.5
HDVP1	8/08/2019	313.7	372.5
HDVP1	7/08/2019	313.7	372.5
HDVP1	6/08/2019	313.7	372.5
HDVP1	5/08/2019	313.7	372.5
HDVP1	4/08/2019	313.7	372.5
HDVP1	3/08/2019	313.7	372.5
HDVP1	2/08/2019	270.7	415.5
HDVP1	1/08/2019	270.7	415.5
HDVP1	31/07/2019	270.7	415.5
HDVP1	30/07/2019	270.7	415.5
HDVP1	29/07/2019	270.7	415.5
HDVP1	28/07/2019	270.7	415.5
HDVP1	27/07/2019	270.7	415.5
HDVP1	26/07/2019	270.7	415.5
HDVP1	25/07/2019	270.7	415.5
HDVP1	24/07/2019	270.7	415.5
HDVP1	23/07/2019	270.7	415.5
HDVP1	22/07/2019	270.7	415.5
HDVP1	21/07/2019	270.7	415.5
HDVP1	20/07/2019	270.7	415.5
HDVP1	19/07/2019	270.7	415.5
HDVP1	18/07/2019	270.7	415.5
HDVP1	17/07/2019	270.7	415.5
HDVP1	16/07/2019	270.7	415.5
HDVP1	15/07/2019	270.7	415.5
HDVP1	14/07/2019	270.7	415.5
HDVP1	13/07/2019	270.7	415.5
HDVP1	12/07/2019	270.7	415.5
HDVP1	11/07/2019	270.7	415.5
HDVP1	10/07/2019	270.7	415.5
HDVP1	9/07/2019	270.7	415.5
HDVP1	8/07/2019	270.7	415.5
HDVP1	7/07/2019	270.7	415.5
HDVP1	6/07/2019	270.7	415.5
HDVP1	5/07/2019	746.6	-60.4
HDVP1	4/07/2019	746.6	-60.4
HDVP1	3/07/2019	746.6	-60.4
HDVP1	2/07/2019	746.6	-60.4
HDVP1	1/07/2019	746.6	-60.4
HDVP1	30/06/2019	746.6	-60.4
HDVP1	29/06/2019	746.6	-60.4
HDVP1	28/06/2019	746.6	-60.4
HDVP1	27/06/2019	746.6	-60.4
HDVP1	26/06/2019	746.6	-60.4
HDVP1	25/06/2019	746.6	-60.4
HDVP1	24/06/2019	746.6	-60.4
HDVP1	23/06/2019	746.6	-60.4
HDVP1	22/06/2019	746.6	-60.4
HDVP1	21/06/2019	746.6	-60.4
HDVP1	20/06/2019	746.6	-60.4
HDVP1	19/06/2019	746.6	-60.4
HDVP1	18/06/2019	746.6	-60.4
HDVP1	17/06/2019	746.6	-60.4
HDVP1	16/06/2019	746.6	-60.4
HDVP1	15/06/2019	746.6	-60.4
HDVP1	14/06/2019	746.6	-60.4
HDVP1	13/06/2019	746.6	-60.4
HDVP1	12/06/2019	746.6	-60.4
HDVP1	11/06/2019	746.6	-60.4
HDVP1	10/06/2019	746.6	-60.4
HDVP1	9/06/2019	746.6	-60.4
HDVP1	8/06/2019	746.6	-60.4
HDVP1	7/06/2019	746.6	-60.4
HDVP1	6/06/2019	746.6	-60.4
HDVP1	5/06/2019	746.6	-60.4
HDVP1	4/06/2019	746.6	-60.4
HDVP1	3/06/2019	746.6	-60.4
HDVP1	2/06/2019	746.6	-60.4
HDVP1	1/06/2019	752.2	-66.1
HDVP1	31/05/2019	752.2	-66.1
HDVP1	30/05/2019	752.2	-66.1
HDVP1	29/05/2019	752.2	-66.1
HDVP1	28/05/2019	752.2	-66.1
HDVP1	27/05/2019	752.2	-66.1
HDVP1	26/05/2019	752.2	-66.1
HDVP1	25/05/2019	752.2	-66.1
HDVP1	24/05/2019	752.2	-66.1
HDVP1	23/05/2019	752.2	-66.1
HDVP1	22/05/2019	752.2	-66.1
HDVP1	21/05/2019	752.2	-66.1
HDVP1	20/05/2019	752.2	-66.1
HDVP1	19/05/2019	752.2	-66.1
HDVP1	18/05/2019	752.2	-66.1
HDVP1	17/05/2019	752.2	-66.1

ID	Date	WL mAHD	WL mbgl
MB15H1SW0001	14/12/2018	595.4	50.0
MB15H1SW0001	13/12/2018	595.4	50.0
MB15H1SW0001	12/12/2018	595.4	50.0
MB15H1SW0001	11/12/2018	595.4	50.0
MB15H1SW0001	10/12/2018	595.4	50.0
MB15H1SW0001	9/12/2018	595.4	50.0
MB15H1SW0001	8/12/2018	595.4	50.0
MB15H1SW0001	7/12/2018	595.4	50.0
MB15H1SW0001	6/12/2018	595.4	50.0
MB15H1SW0001	5/12/2018	595.4	50.0
MB15H1SW0001	4/12/2018	595.4	50.0
MB15H1SW0001	3/12/2018	595.4	50.0
MB15H1SW0001	2/12/2018	595.4	50.0
MB15H1SW0001	1/12/2018	595.4	50.0
MB15H1SW0001	30/11/2018	595.4	50.0
MB15H1SW0001	29/11/2018	595.4	50.0
MB15H1SW0001	28/11/2018	595.4	50.0
MB15H1SW0001	27/11/2018	595.4	50.0
MB15H1SW0001	26/11/2018	595.4	50.0
MB15H1SW0001	25/11/2018	595.4	50.0
MB15H1SW0001	24/11/2018	595.4	50.0
MB15H1SW0001	23/11/2018	595.4	50.0
MB15H1SW0001	22/11/2018	595.4	50.0
MB15H1SW0001	21/11/2018	595.4	50.0
MB15H1SW0001	20/11/2018	595.4	50.0
MB15H1SW0001	19/11/2018	595.4	50.0
MB15H1SW0001	18/11/2018	595.5	49.9
MB15H1SW0001	17/11/2018	595.5	49.9
MB15H1SW0001	16/11/2018	595.5	49.9
MB15H1SW0001	14/11/2018	595.5	49.9
MB15H1SW0001	13/11/2018	595.4	50.0
MB15H1SW0001	12/11/2018	595.4	50.0
MB15H1SW0001	11/11/2018	595.5	49.9
MB15H1SW0001	10/11/2018	595.5	49.9
MB15H1SW0001	9/11/2018	595.5	49.9
MB15H1SW0001	8/11/2018	595.5	49.9
MB15H1SW0001	7/11/2018	595.5	49.9
MB15H1SW0001	6/11/2018	595.4	50.0
MB15H1SW0001	5/11/2018	595.5	49.9
MB15H1SW0001	4/11/2018	595.5	49.9
MB15H1SW0001	3/11/2018	595.5	49.9
MB15H1SW0001	2/11/2018	595.5	49.9
MB15H1SW0001	1/11/2018	595.5	49.9
MB15H1SW0001	31/10/2018	595.5	49.9
MB15H1SW0001	30/10/2018	595.5	49.9
MB15H1SW0001	29/10/2018	595.5	49.9
MB15H1SW0001	28/10/2018	595.5	49.9
MB15H1SW0001	27/10/2018	595.5	49.9
MB15H1SW0001	26/10/2018	595.5	49.9
MB15H1SW0001	25/10/2018	595.5	49.9
MB15H1SW0001	24/10/2018	595.5	49.9
MB15H1SW0001	23/10/2018	595.5	49.9
MB15H1SW0001	22/10/2018	595.5	49.9
MB15H1SW0001	21/10/2018	595.5	49.9
MB15H1SW0001	20/10/2018	595.5	49.9
MB15H1SW0001	19/10/2018	595.5	49.9
MB15H1SW0001	18/10/2018	595.5	49.9
MB15H1SW0001	17/10/2018	595.5	49.9
MB15H1SW0001	16/10/2018	595.5	49.9
MB15H1SW0001	15/10/2018	595.5	49.9
MB15H1SW0001	14/10/2018	595.5	49.9
MB15H1SW0001	13/10/2018	595.5	49.9
MB15H1SW0001	12/10/2018	595.5	49.9
MB15H1SW0001	11/10/2018	595.5	49.9
MB15H1SW0001	10/10/2018	595.5	49.9
MB15H1SW0001	9/10/2018	595.5	49.9
MB15H1SW0001	8/10/2018	595.5	49.9
MB15H1SW0001	7/10/2018	595.5	49.9
MB15H1SW0001	6/10/2018	595.5	49.9
MB15H1SW0001	5/10/2018	595.5	49.9
MB15H1SW0001	4/10/2018	595.5	49.9
MB15H1SW0001	3/10/2018	595.5	49.9
MB15H1SW0001	2/10/2018	595.5	49.9
MB15H1SW0001	1/10/2018	595.5	49.9
MB15H1SW0001	30/09/2018	595.5	49.9
MB15H1SW0001	29/09/2018	595.5	49.9
MB15H1SW0001	28/09/2018	595.5	49.9
MB15H1SW0001	27/09/2018	595.5	49.9
MB15H1SW0001	26/09/2018	595.5	49.9
MB15H1SW0001	25/09/2018	595.5	49.9
MB15H1SW0001	24/09/2018	595.5	49.9
MB15H1SW0001	23/09/2018	595.5	49.9
MB15H1SW0001	22/09/2018	595.5	49.9
MB15H1SW0001	21/09/2018	595.5	49.9
MB15H1SW0001	20/09/2018	595.5	49.9
MB15H1SW0001	19/09/2018	595.5	49.9
MB15H1SW0001	18/09/2018	595.5	49.9
MB15H1SW0001	17/09/2018	595.5	49.9
MB15H1SW0001	16/09/2018	595.5	49.9
MB15H1SW0001	15/09/2018	595.5	49.9
MB15H1SW0001	14/09/2018	595.5	49.9
MB15H1SW0001	13/09/2018	595.5	49.9
MB15H1SW0001	12/09/2018	595.5	49.9
MB15H1SW0001	11/09/2018	595.5	49.9
MB15H1SW0001	10/09/2018	595.5	49.9
MB15H1SW0001	9/09/2018	595.5	49.9
MB15H1SW0001	8/09/2018	595.5	49.9
MB15H1SW0001	7/09/2018	595.5	49.9
MB15H1SW0001	6/09/2018	595.5	49.9
MB15H1SW0001	5/09/2018	595.5	49.9
MB15H1SW0001	4/09/2018	595.5	49.9
MB15H1SW0001	3/09/2018	595.5	49.9
MB15H1SW0001	2/09/2018	595.5	49.9
MB15H1SW0001	1/09/2018	595.5	49.9
MB15H1SW0001	31/08/2018	595.5	49.9
MB15H1SW0001	30/08/2018	595.5	49.9
MB15H1SW0001	29/08/2018	595.5	49.9
MB15H1SW0001	28/08/2018	595.5	49.9
MB15H1SW0001	27/08/2018	595.6	49.8
MB15H1SW0001	26/08/2018	595.6	49.8
MB15H1SW0001	25/08/2018	595.6	49.8
MB15H1SW0001	24/08/2018	595.6	49.8
MB15H1SW0001	23/08/2018	595.6	49.8
MB15H1SW0001	22/08/2018	595.5	49.9
MB15H1SW0001	21/08/2018	595.6	49.8
MB15H1SW0001	20/08/2018	595.6	49.8
MB15H1SW0001	19/08/2018	595.6	49.8
MB15H1SW0001	18/08/2018	595.6	49.8
MB15H1SW0001	17/08/2018	595.6	49.8
MB15H1SW0001	16/08/2018	595.6	49.8
MB15H1SW0001	15/08/2018	595.6	49.8
MB15H1SW0001	14/08/2018	595.6	49.8
MB15H1SW0001	13/08/2018	595.6	49.8
MB15H1SW0001	12/08/2018	595.6	49.8
MB15H1SW0001	11/08/2018	595.6	49.8
MB15H1SW0001	10/08/2018	595.6	49.8
MB15H1SW0001	9/08/2018	595.6	49.8
MB15H1SW0001	8/08/2018	595.6	49.8
MB15H1SW0001	7/08/2018	595.6	49.8
MB15H1SW0001	6/08/2018	595.6	49.8
MB15H1SW0001	5/08/2018	595.6	49.8
MB15H1SW0001	4/08/2018	595.6	49.8
MB15H1SW0001	3/08/2018	595.6	49.8
MB15H1SW0001	2/08/2018	595.6	49.8
MB15H1SW0001	1/08/2018	595.5	49.9
MB15H1SW0001	31/07/2018	595.6	49.8

ID	Date	WL mAHD	WL mbgl
RC18WON0127	24/12/2021	621.8	19.5
RC18WON0127	23/12/2021	621.8	19.5
RC18WON0127	22/12/2021	621.8	19.5
RC18WON0127	21/12/2021	621.8	19.4
RC18WON0127	20/12/2021	621.8	19.4
RC18WON0127	19/12/2021	621.9	19.4
RC18WON0127	18/12/2021	621.8	19.4
RC18WON0127	17/12/2021	621.8	19.5
RC18WON0127	16/12/2021	621.8	19.5
RC18WON0127	15/12/2021	621.8	19.5
RC18WON0127	14/12/2021	621.8	19.5
RC18WON0127	13/12/2021	621.8	19.5
RC18WON0127	12/12/2021	621.8	19.4
RC18WON0127	11/12/2021	621.8	19.4
RC18WON0127	10/12/2021	621.8	19.4
RC18WON0127	9/12/2021	621.8	19.4
RC18WON0127	8/12/2021	621.9	19.4
RC18WON0127	7/12/2021	621.8	19.4
RC18WON0127	6/12/2021	621.8	19.5
RC18WON0127	5/12/2021	621.8	19.4
RC18WON0127	4/12/2021	621.9	19.4
RC18WON0127	3/12/2021	621.8	19.4
RC18WON0127	2/12/2021	621.9	19.4
RC18WON0127	1/12/2021	621.8	19.4
RC18WON0127	30/11/2021	621.9	19.4
RC18WON0127	29/11/2021	621.9	19.4
RC18WON0127	28/11/2021	621.9	19.4
RC18WON0127	27/11/2021	621.9	19.4
RC18WON0127	26/11/2021	621.9	19.4
RC18WON0127	25/11/2021	621.9	19.4
RC18WON0127	24/11/2021	621.9	19.4
RC18WON0127	23/11/2021	621.9	19.4
RC18WON0127	22/11/2021	621.9	19.4
RC18WON0127	21/11/2021	621.9	19.4
RC18WON0127	20/11/2021	621.9	19.4
RC18WON0127	19/11/2021	621.9	19.4
RC18WON0127	18/11/2021	621.9	19.4
RC18WON0127	17/11/2021	621.9	19.4
RC18WON0127	16/11/2021	621.9	19.4
RC18WON0127	15/11/2021	621.9	19.4
RC18WON0127	14/11/2021	621.9	19.4
RC18WON0127	24/10/2021	622.0	19.3
RC18WON0127	23/10/2021	622.0	19.3
RC18WON0127	22/10/2021	622.0	19.3
RC18WON0127	21/10/2021	622.0	19.3
RC18WON0127	20/10/2021	622.0	19.3
RC18WON0127	19/10/2021	621.9	19.3
RC18WON0127	18/10/2021	621.9	19.3
RC18WON0127	17/10/2021	621.9	19.4
RC18WON0127	16/10/2021	621.9	19.4
RC18WON0127	15/10/2021	621.9	19.4
RC18WON0127	14/10/2021	621.9	19.3
RC18WON0127	13/10/2021	622.0	19.3
RC18WON0127	12/10/2021	621.9	19.3
RC18WON0127	11/10/2021	621.9	19.3
RC18WON0127	10/10/2021	621.9	19.3
RC18WON0127	9/10/2021	621.9	19.3
RC18WON0127	8/10/2021	621.9	19.4
RC18WON0127	7/10/2021	621.9	19.3
RC18WON0127	6/10/2021	621.9	19.3
RC18WON0127	5/10/2021	621.9	19.4
RC18WON0127	4/10/2021	621.9	19.4
RC18WON0127	3/10/2021	622.0	19.3
RC18WON0127	2/10/2021	621.9	19.3
RC18WON0127	1/10/2021	621.9	19.4
RC18WON0127	30/09/2021	622.0	19.3
RC18WON0127	29/09/2021	622.0	19.3
RC18WON0127	28/09/2021	622.0	19.3
RC18WON0127	27/09/2021	621.9	19.3
RC18WON0127	26/09/2021	622.0	19.3
RC18WON0127	25/09/2021	621.9	19.3
RC18WON0127	24/09/2021	622.0	19.3
RC18WON0127	23/09/2021	622.0	19.3
RC18WON0127	22/09/2021	622.0	19.3
RC18WON0127	21/09/2021	622.0	19.2
RC18WON0127	20/09/2021	622.0	19.3
RC18WON0127	19/09/2021	622.0	19.3
RC18WON0127	18/09/2021	622.0	19.3
RC18WON0127	17/09/2021	622.0	19.3
RC18WON0127	16/09/2021	622.0	19.3
RC18WON0127	15/09/2021	622.0	19.3
RC18WON0127	14/09/2021	622.0	19.3
RC18WON0127	13/09/2021	622.0	19.3
RC18WON0127	12/09/2021	622.0	19.3
RC18WON0127	11/09/2021	622.0	19.3
RC18WON0127	10/09/2021	622.0	19.3
RC18WON0127	9/09/2021	622.0	19.3
RC18WON0127	8/09/2021	622.0	19.3
RC18WON0127	7/09/2021	622.0	19.2
RC18WON0127	6/09/2021	622.0	19.2
RC18WON0127	5/09/2021	622.0	19.2
RC18WON0127	4/09/2021	622.0	19.3
RC18WON0127	3/09/2021	622.0	19.3
RC18WON0127	2/09/2021	622.0	19.3
RC18WON0127	1/09/2021	621.9	19.3
RC18WON0127	31/08/2021	622.0	19.3
RC18WON0127	30/08/2021	622.0	19.3
RC18WON0127	29/08/2021	622.0	19.3
RC18WON0127	28/08/2021	622.0	19.3
RC18WON0127	27/08/2021	622.0	19.3
RC18WON0127	26/08/2021	622.0	19.3
RC18WON0127	25/08/2021	622.0	19.3
RC18WON0127	24/08/2021	622.0	19.3
RC18WON0127	23/08/2021	622.0	19.3
RC18WON0127	22/08/2021	622.0	19.3
RC18WON0127	21/08/2021	622.0	19.3
RC18WON0127	20/08/2021	622.0	19.3
RC18WON0127	19/08/2021	622.0	19.3
RC18WON0127	18/08/2021	622.0	19.3
RC18WON0127	17/08/2021	622.0	19.2
RC18WON0127	16/08/2021	622.0	19.2
RC18WON0127	15/08/2021	622.0	19.2
RC18WON0127	14/08/2021	622.0	19.3
RC18WON0127	13/08/2021	622.0	19.3
RC18WON0127	12/08/2021	622.1	19.2
RC18WON0127	11/08/2021	622.1	19.2
RC18WON0127	10/08/2021	622.0	19.3
RC18WON0127	9/08/2021	622.0	19.3
RC18WON0127	8/08/2021	622.0	19.3
RC18WON0127	7/08/2021	622.0	19.3
RC18WON0127	6/08/2021	622.0	19.2
RC18WON0127	5/08/2021	622.0	19.2
RC18WON0127	4/08/2021	622.1	19.2
RC18WON0127	3/08/2021	622.0	19.2
RC18WON0127	2/08/2021	622.0	19.3
RC18WON0127	1/08/2021	622.0	19.3
RC18WON0127	31/07/2021	622.0	19.3
RC18WON0127	30/07/2021	622.0	19.3
RC18WON0127	29/07/2021	622.0	19.3
RC18WON0127	28/07/2021	622.0	19.3
RC18WON0127	27/07/2021	622.0	19.3
RC18WON0127	26/07/2021	622.0	19.3
RC18WON0127	25/07/2021	622.0	19.3
RC18WON0127	24/07/2021	622.0	19.3
RC18WON0127	23/07/2021	622.0	19.3
RC18WON0127	22/07/2021	622.0	19.3

ID	Date	WL mAHD	WL mbgl
MB18HD20004	3/05/2019	627.1	86.4
MB18HD20004	4/05/2019	627.1	86.4
MB18HD20004	5/05/2019	627.1	86.4
MB18HD20004	6/05/2019	627.1	86.4
MB18HD20004	7/05/2019	627.1	86.4
MB18HD20004	8/05/2019	627.1	86.4
MB18HD20004	9/05/2019	627.1	86.4
MB18HD20004	10/05/2019	627.1	86.3
MB18HD20004	11/05/2019	627.1	86.3
MB18HD20004	12/05/2019	627.1	86.3
MB18HD20004	13/05/2019	627.1	86.4
MB18HD20004	14/05/2019	627.1	86.4
MB18HD20004	15/05/2019	627.1	86.4
MB18HD20004	16/05/2019	627.1	86.4
MB18HD20004	17/05/2019	627.1	86.4
MB18HD20004	18/05/2019	627.1	86.4
MB18HD20004	19/05/2019	627.1	86.4
MB18HD20004	20/05/2019	627.1	86.4
MB18HD20004	21/05/2019	627.1	86.4
MB18HD20004	22/05/2019	627.1	86.4
MB18HD20004	23/05/2019	627.1	86.4
MB18HD20004	24/05/2019	627.1	86.4
MB18HD20004	25/05/2019	627.1	86.4
MB18HD20004	26/05/2019	627.1	86.4
MB18HD20004	27/05/2019	627.1	86.4
MB18HD20004	28/05/2019	627.1	86.4
MB18HD20004	29/05/2019	627.1	86.4
MB18HD20004	30/05/2019	627.1	86.4
MB18HD20004	31/05/2019	627.1	86.4
MB18HD20004	1/06/2019	627.1	86.3
MB18HD20004	2/06/2019	627.1	86.3
MB18HD20004	3/06/2019	627.1	86.3
MB18HD20004	4/06/2019	627.1	86.3
MB18HD20004	5/06/2019	627.1	86.3
MB18HD20004	6/06/2019	627.1	86.4
MB18HD20004	7/06/2019	627.1	86.4
MB18HD20004	8/06/2019	627.1	86.4
MB18HD20004	9/06/2019	627.0	86.4
MB18HD20004	10/06/2019	627.0	86.4
MB18HD20004	11/06/2019	627.0	86.4
MB18HD20004	12/06/2019	627.1	86.4
MB18HD20004	13/06/2019	627.1	86.4
MB18HD20004	14/06/2019	627.1	86.4
MB18HD20004	15/06/2019	627.1	86.4
MB18HD20004	16/06/2019	627.1	86.4
MB18HD20004	17/06/2019	627.1	86.4
MB18HD20004	18/06/2019	627.1	86.4
MB18HD20004	19/06/2019	627.1	86.3
MB18HD20004	20/06/2019	627.1	86.3
MB18HD20004	21/06/2019	627.1	86.3
MB18HD20004	22/06/2019	627.1	86.4
MB18HD20004	23/06/2019	627.0	86.4
MB18HD20004	24/06/2019	627.1	86.4
MB18HD20004	25/06/2019	627.1	86.4
MB18HD20004	26/06/2019	627.1	86.4
MB18HD20004	27/06/2019	627.0	86.4
MB18HD20004	28/06/2019	627.0	86.4
MB18HD20004	29/06/2019	627.1	86.4
MB18HD20004	30/06/2019	627.1	86.4
MB18HD20004	1/07/2019	627.1	86.4
MB18HD20004	2/07/2019	627.1	86.4
MB18HD20004	3/07/2019	627.1	86.4
MB18HD20004	4/07/2019	627.1	86.4
MB18HD20004	5/07/2019	627.0	86.4
MB18HD20004	6/07/2019	627.0	86.4
MB18HD20004	7/07/2019	627.1	86.4
MB18HD20004	8/07/2019	627.1	86.4
MB18HD20004	9/07/2019	627.1	86.4
MB18HD20004	10/07/2019	627.1	86.4
MB18HD20004	11/07/2019	627.1	86.4
MB18HD20004	12/07/2019	627.1	86.3
MB18HD20004	13/07/2019	627.1	86.3
MB18HD20004	14/07/2019	627.1	86.3
MB18HD20004	15/07/2019	627.1	86.3
MB18HD20004	16/07/2019	627.1	86.3
MB18HD20004	17/07/2019	627.1	86.3
MB18HD20004	18/07/2019	627.1	86.4
MB18HD20004	19/07/2019	627.1	86.4
MB18HD20004	20/07/2019	627.0	86.4
MB18HD20004	21/07/2019	627.1	86.4
MB18HD20004	22/07/2019	627.0	86.4
MB18HD20004	23/07/2019	627.1	86.4
MB18HD20004	24/07/2019	627.1	86.4
MB18HD20004	25/07/2019	627.1	86.4
MB18HD20004	26/07/2019	627.1	86.4
MB18HD20004	27/07/2019	627.0	86.4
MB18HD20004	28/07/2019	627.0	86.4
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	16/05/2019	752.2	-66.1
HDVP1	15/05/2019	752.2	-66.1
HDVP1	14/05/2019	752.2	-66.1
HDVP1	13/05/2019	752.2	-66.1
HDVP1	12/05/2019	752.2	-66.1
HDVP1	11/05/2019	752.2	-66.1
HDVP1	10/05/2019	752.2	-66.1
HDVP1	9/05/2019	752.2	-66.1
HDVP1	8/05/2019	752.2	-66.1
HDVP1	7/05/2019	752.2	-66.1
HDVP1	6/05/2019	752.2	-66.1
HDVP1	5/05/2019	752.2	-66.1
HDVP1	4/05/2019	752.2	-66.1
HDVP1	3/05/2019	752.2	-66.1
HDVP1	2/05/2019	752.2	-66.1
HDVP1	1/05/2019	758.8	-72.6
HDVP1	30/04/2019	758.8	-72.6
HDVP1	29/04/2019	758.8	-72.6
HDVP1	28/04/2019	758.8	-72.6
HDVP1	27/04/2019	758.8	-72.6
HDVP1	26/04/2019	758.8	-72.6
HDVP1	25/04/2019	758.8	-72.6
HDVP1	24/04/2019	758.8	-72.6
HDVP1	23/04/2019	758.8	-72.6
HDVP1	22/04/2019	758.8	-72.6
HDVP1	21/04/2019	758.8	-72.6
HDVP1	20/04/2019	758.8	-72.6
HDVP1	19/04/2019	758.8	-72.6
HDVP1	18/04/2019	758.8	-72.6
HDVP1	17/04/2019	758.8	-72.6
HDVP1	16/04/2019	758.8	-72.6
HDVP1	15/04/2019	758.8	-72.6
HDVP1	14/04/2019	758.8	-72.6
HDVP1	13/04/2019	758.8	-72.6
HDVP1	12/04/2019	758.8	-72.6
HDVP1	11/04/2019	758.8	-72.6
HDVP1	10/04/2019	758.8	-72.6
HDVP1	9/04/2019	758.8	-72.6
HDVP1	8/04/2019	758.8	-72.6
HDVP1	7/04/2019	758.8	-72.6
HDVP1	6/04/2019	758.8	-72.6
HDVP1	5/04/2019	758.8	-72.6
HDVP1	4/04/2019	758.8	-72.6
HDVP1	3/04/2019	758.8	-72.6
HDVP1	2/04/2019	758.8	-72.6
HDVP1	1/04/2019	762.3	-76.1
HDVP1	31/03/2019	762.3	-76.1
HDVP1	30/03/2019	762.3	-76.1
HDVP1	29/03/2019	762.3	-76.1
HDVP1	28/03/2019	762.3	-76.1
HDVP1	27/03/2019	762.3	-76.1
HDVP1	26/03/2019	762.3	-76.1
HDVP1	25/03/2019	762.3	-76.1
HDVP1	24/03/2019	762.3	-76.1
HDVP1	23/03/2019	762.3	-76.1
HDVP1	22/03/2019	762.3	-76.1
HDVP1	21/03/2019	762.3	-76.1
HDVP1	20/03/2019	762.3	-76.1
HDVP1	19/03/2019	762.3	-76.1
HDVP1	18/03/2019	762.3	-76.1
HDVP1	17/03/2019	762.3	-76.1
HDVP1	16/03/2019	762.3	-76.1
HDVP1	15/03/2019	762.3	-76.1
HDVP1	14/03/2019	762.3	-76.1
HDVP1	13/03/2019	762.3	-76.1
HDVP1	12/03/2019	762.3	-76.1
HDVP1	11/03/2019	762.3	-76.1
HDVP1	10/03/2019	762.3	-76.1
HDVP1	9/03/2019	762.3	-76.1
HDVP1	8/03/2019	762.3	-76.1
HDVP1	7/03/2019	762.3	-76.1
HDVP1	6/03/2019	762.3	-76.1
HDVP1	5/03/2019	762.3	-76.1
HDVP1	4/03/2019	762.3	-76.1
HDVP1	3/03/2019	762.3	-76.1
HDVP1	2/03/2019	762.3	-76.1
HDVP1	1/03/2019	768.3	-82.1
HDVP1	28/02/2019	768.3	-82.1
HDVP1	27/02/2019	768.3	-82.1
HDVP1	26/02/2019	768.3	-82.1
HDVP1	25/02/2019	768.3	-82.1
HDVP1	24/02/2019	768.3	-82.1
HDVP1	23/02/2019	768.3	-82.1
HDVP1	22/02/2019	768.3	-82.1
HDVP1	21/02/2019	768.3	-82.1
HDVP1	20/02/2019	768.3	-82.1
HDVP1	19/02/2019	768.3	-82.1
HDVP1	18/02/2019	768.3	-82.1
HDVP1	17/02/2019	768.3	-82.1
HDVP1	16/02/2019	768.3	-82.1
HDVP1	15/02/2019	768.3	-82.1
HDVP1	14/02/2019	768.3	-82.1
HDVP1	13/02/2019	768.3	-82.1
HDVP1	12/02/2019	768.3	-82.1
HDVP1	11/02/2019	768.3	-82.1
HDVP1	10/02/2019	768.3	-82.1
HDVP1	9/02/2019	768.3	-82.1
HDVP1	8/02/2019	768.3	-82.1
HDVP1	7/02/2019	768.3	-82.1
HDVP1	6/02/2019	768.3	-82.1
HDVP1	5/02/2019	768.3	-82.1
HDVP1	4/02/2019	768.3	-82.1
HDVP1	3/02/2019	768.3	-82.1
HDVP1	2/02/2019	768.3	-82.1
HDVP1	1/02/2019	776.1	-89.9
HDVP1	31/01/2019	776.1	-89.9
HDVP1	30/01/2019	776.1	-89.9
HDVP1	29/01/2019	776.1	-89.9
HDVP1	28/01/2019	776.1	-89.9
HDVP1	27/01/2019	776.1	-89.9
HDVP1	26/01/2019	776.1	-89.9
HDVP1	25/01/2019	776.1	-89.9
HDVP1	24/01/2019	776.1	-89.9
HDVP1	23/01/2019	776.1	-89.9
HDVP1	22/01/2019	776.1	-89.9
HDVP1	21/01/2019	776.1	-89.9
HDVP1	20/01/2019	776.1	-89.9
HDVP1	19/01/2019	776.1	-89.9
HDVP1	18/01/2019	776.1	-89.9
HDVP1	17/01/2019	776.1	-89.9
HDVP1	16/01/2019	776.1	-89.9
HDVP1	15/01/2019	776.1	-89.9
HDVP1	14/01/2019	776.1	-89.9
HDVP1	13/01/2019	776.1	-89.9
HDVP1	12/01/2019	776.1	-89.9
HDVP1	11/01/2019	776.1	-89.9
HDVP1	10/01/2019	776.1	-89.9
HDVP1	9/01/2019	776.1	-89.9
HDVP1	8/01/2019	776.1	-89.9
HDVP1	7/01/2019	776.1	-89.9
HDVP1	6/01/2019	776.1	-89.9
HDVP1	5/01/2019	776.1	-89.9
HDVP1	4/01/2019	776.1	-89.9
HDVP1	3/01/2019	776.1	-89.9
HDVP1	2/01/2019	776.1	-89.9
HDVP1	1/01/2019	786.9	-100.7

ID	Date	WL mAHD	WL mbgl
MB15H1SW0001	30/07/2018	595.6	49.8
MB15H1SW0001	29/07/2018	595.6	49.8
MB15H1SW0001	28/07/2018	595.6	49.8
MB15H1SW0001	27/07/2018	595.6	49.8
MB15H1SW0001	26/07/2018	595.5	49.9
MB15H1SW0001	25/07/2018	595.5	49.9
MB15H1SW0001	24/07/2018	595.6	49.8
MB15H1SW0001	23/07/2018	595.6	49.8
MB15H1SW0001	22/07/2018	595.6	49.8
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MB15H1SW0001	20/07/2018	595.6	49.8
MB15H1SW0001	19/07/2018	595.6	49.8
MB15H1SW0001	18/07/2018	595.6	49.8
MB15H1SW0001	17/07/2018	595.6	49.8
MB15H1SW0001	16/07/2018	595.6	49.8
MB15H1SW0001	15/07/2018	595.6	49.8
MB15H1SW0001	14/07/2018	595.6	49.8
MB15H1SW0001	13/07/2018	595.6	49.8
MB15H1SW0001	12/07/2018	595.6	49.8
MB15H1SW0001	11/07/2018	595.6	49.8
MB15H1SW0001	10/07/2018	595.6	49.8
MB15H1SW0001	9/07/2018	595.6	49.8
MB15H1SW0001	8/07/2018	595.6	49.8
MB15H1SW0001	7/07/2018	595.6	49.8
MB15H1SW0001	6/07/2018	595.6	49.8
MB15H1SW0001	5/07/2018	595.6	49.8
MB15H1SW0001	4/07/2018	595.6	49.8
MB15H1SW0001	3/07/2018	595.6	49.8
MB15H1SW0001	2/07/2018	595.6	49.8
MB15H1SW0001	1/07/2018	595.6	49.8
MB15H1SW0001	30/06/2018	595.6	49.8
MB15H1SW0001	29/06/2018	595.6	49.8
MB15H1SW0001	28/06/2018	595.6	49.8
MB15H1SW0001	27/06/2018	595.6	49.8
MB15H1SW0001	26/06/2018	595.6	49.8
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MB15H1SW0001	22/06/2018	595.6	49.8
MB15H1SW0001	21/06/2018	595.6	49.8
MB15H1SW0001	20/06/2018	595.6	49.8
MB15H1SW0001	19/06/2018	595.6	49.8
MB15H1SW0001	18/06/2018	595.6	49.8
MB15H1SW0001	17/06/2018	595.6	49.8
MB15H1SW0001	16/06/2018	595.6	49.8
MB15H1SW0001	15/06/2018	595.6	49.8
MB15H1SW0001	14/06/2018	595.6	49.8
MB15H1SW0001	13/06/2018	595.6	49.8
MB15H1SW0001	12/06/2018	595.6	49.8
MB15H1SW0001	11/06/2018	595.6	49.8
MB15H1SW0001	10/06/2018	595.6	49.8
MB15H1SW0001	9/06/2018	595.6	49.8
MB15H1SW0001	8/06/2018	595.6	49.8
MB15H1SW0001	7/06/2018	595.6	49.8
MB15H1SW0001	6/06/2018	595.6	49.8
MB15H1SW0001	5/06/2018	595.6	49.8
MB15H1SW0001	4/06/2018	595.6	49.8
MB15H1SW0001	3/06/2018	595.6	49.8
MB15H1SW0001	2/06/2018	595.6	49.8
MB15H1SW0001	1/06/2018	595.6	49.8
MB15H1SW0001	31/05/2018	595.6	49.8
MB15H1SW0001	30/05/2018	595.6	49.8
MB15H1SW0001	29/05/2018	595.6	49.8
MB15H1SW0001	28/05/2018	595.6	49.8
MB15H1SW0001	27/05/2018	595.6	49.8
MB15H1SW0001	26/05/2018	595.6	49.8
MB15H1SW0001	25/05/2018	595.6	49.8
MB15H1SW0001	24/05/2018	595.6	49.8
MB15H1SW0001	23/05/2018	595.6	49.8
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MB15H1SW0001	16/05/2018	595.6	49.8
MB15H1SW0001	15/05/2018	595.6	49.8
MB15H1SW0001	14/05/2018	595.6	49.8
MB15H1SW0001	13/05/2018	595.6	49.8
MB15H1SW0001	12/05/2018	595.6	49.8
MB15H1SW0001	11/05/2018	595.6	49.8
MB15H1SW0001	10/05/2018	595.6	49.8
MB15H1SW0001	9/05/2018	595.6	49.8
MB15H1SW0001	8/05/2018	595.6	49.8
MB15H1SW0001	7/05/2018	595.6	49.8
MB15H1SW0001	6/05/2018	595.6	49.8
MB15H1SW0001	5/05/2018	595.6	49.8
MB15H1SW0001	4/05/2018	595.6	49.8
MB15H1SW0001	3/05/2018	595.6	49.8
MB15H1SW0001	2/05/2018	595.6	49.8
MB15H1SW0001	1/05/2018	595.6	49.8
MB15H1SW0001	30/04/2018	595.6	49.8
MB15H1SW0001	9/04/2018	595.6	49.8
MB15H1SW0001	8/04/2018	595.6	49.8
MB15H1SW0001	7/04/2018	595.6	49.8
MB15H1SW0001	6/04/2018	595.6	49.8
MB15H1SW0001	5/04/2018	595.6	49.8
MB15H1SW0001	4/04/2018	595.6	49.8
MB15H1SW0001	3/04/2018	595.6	49.8
MB15H1SW0001	2/04/2018	595.6	49.8
MB15H1SW0001	1/04/2018	595.6	49.8
MB15H1SW0001	31/03/2018	595.6	49.8
MB15H1SW0001	30/03/2018	595.6	49.8
MB15H1SW0001	29/03/2018	595.6	49.8
MB15H1SW0001	28/03/2018	595.6	49.8
MB15H1SW0001	27/03/2018	595.6	49.8
MB15H1SW0001	26/03/2018	595.6	49.8
MB15H1SW0001	25/03/2018	595.6	49.8
MB15H1SW0001	24/03/2018	595.6	49.8
MB15H1SW0001	23/03/2018	595.6	49.8
MB15H1SW0001	22/03/2018	595.6	49.8
MB15H1SW0001	21/03/2018	595.6	49.8
MB15H1SW0001	20/03/2018	595.6	49.8
MB15H1SW0001	19/03/2018	595.6	49.8
MB15H1SW0001	18/03/2018	595.6	49.8
MB15H1SW0001	17/03/2018	595.6	49.8
MB15H1SW0001	16/03/2018	595.6	49.8
MB15H1SW0001	15/03/2018	595.6	49.8
MB15H1SW0001	14/03/2018	595.6	49.8
MB15H1SW0001	13/03/2018	595.6	49.8
MB15H1SW0001	12/03/2018	595.6	49.8
MB15H1SW0001	11/03/2018	595.6	49.8
MB15H1SW0001	10/03/2018	595.6	49.8
MB15H1SW0001	9/03/2018	595.6	49.8
MB15H1SW0001	8/03/2018	595.6	49.8
MB15H1SW0001	7/03/2018	595.6	49.8
MB15H1SW0001	6/03/2018	595.6	49.8
MB15H1SW0001	5/03/2018	595.6	49.8
MB15H1SW0001	4/03/2018	595.6	49.8
MB15H1SW0001	3/03/2018	595.6	49.8
MB15H1SW0001	2/03/2018	595.6	49.8
MB15H1SW0001	1/03/2018	595.6	49.8
MB15H1SW0001	28/02/2018	595.6	49.8
MB15H1SW0001	27/02/2018	595.6	49.8
MB15H1SW0001	26/02/2018	595.6	49.8
MB15H1SW0001	25/02/2018	595.6	49.8

ID	Date	WL mAHD	WL mbgl
RC18WON0127	21/07/2021	622.0	19.3
RC18WON0127	20/07/2021	622.0	19.3
RC18WON0127	19/07/2021	622.0	19.3
RC18WON0127	18/07/2021	622.0	19.3
RC18WON0127	17/07/2021	622.0	19.3
RC18WON0127	16/07/2021	622.0	19.3
RC18WON0127	15/07/2021	622.0	19.3
RC18WON0127	14/07/2021	622.0	19.3
RC18WON0127	13/07/2021	622.0	19.3
RC18WON0127	12/07/2021	622.0	19.3
RC18WON0127	11/07/2021	622.0	19.3
RC18WON0127	10/07/2021	622.0	19.3
RC18WON0127	9/07/2021	622.0	19.3
RC18WON0127	8/07/2021	622.0	19.3
RC18WON0127	7/07/2021	622.0	19.3
RC18WON0127	6/07/2021	622.0	19.3
RC18WON0127	5/07/2021	622.0	19.3
RC18WON0127	4/07/2021	622.0	19.3
RC18WON0127	3/07/2021	622.0	19.3
RC18WON0127	2/07/2021	622.0	19.3
RC18WON0127	1/07/2021	622.0	19.3
RC18WON0127	30/06/2021	622.0	19.3
RC18WON0127	29/06/2021	622.0	19.3
RC18WON0127	28/06/2021	622.0	19.3
RC18WON0127	27/06/2021	622.0	19.3
RC18WON0127	26/06/2021	622.0	19.3
RC18WON0127	25/06/2021	622.0	19.3
RC18WON0127	24/06/2021	622.0	19.3
RC18WON0127	23/06/2021	622.0	19.3
RC18WON0127	22/06/2021	622.0	19.3
RC18WON0127	21/06/2021	622.0	19.3
RC18WON0127	20/06/2021	622.0	19.3
RC18WON0127	19/06/2021	622.0	19.3
RC18WON0127	18/06/2021	622.0	19.3
RC18WON0127	17/06/2021	622.0	19.3
RC18WON0127	16/06/2021	622.0	19.3
RC18WON0127	15/06/2021	622.0	19.3
RC18WON0127	14/06/2021	622.0	19.3
RC18WON0127	13/06/2021	622.0	19.3
RC18WON0127	12/06/2021	622.0	19.3
RC18WON0127	11/06/2021	622.0	19.3
RC18WON0127	10/06/2021	622.0	19.3
RC18WON0127	9/06/2021	622.0	19.3
RC18WON0127	8/06/2021	622.0	19.3
RC18WON0127	7/06/2021	622.0	19.3
RC18WON0127	6/06/2021	622.0	19.3
RC18WON0127	5/06/2021	622.0	19.3
RC18WON0127	4/06/2021	622.0	19.3
RC18WON0127	3/06/2021	622.0	19.3
RC18WON0127	2/06/2021	622.0	19.3
RC18WON0127	1/06/2021	622.0	19.3
RC18WON0127	31/05/2021	621.9	19.3
RC18WON0127	30/05/2021	622.0	19.3
RC18WON0127	29/05/2021	622.0	19.3
RC18WON0127	28/05/2021	622.0	19.3
RC18WON0127	27/05/2021	622.0	19.3
RC18WON0127	26/05/2021	622.0	19.3
RC18WON0127	25/05/2021	622.0	19.3
RC18WON0127	24/05/2021	622.0	19.3
RC18WON0127	23/05/2021	621.9	19.3
RC18WON0127	22/05/2021	621.9	19.3
RC18WON0127	21/05/2021	622.0	19.3
RC18WON0127	20/05/2021	622.0	19.3
RC18WON0127	19/05/2021	622.0	19.3
RC18WON0127	18/05/2021	622.0	19.3
RC18WON0127	17/05/2021	622.0	19.3
RC18WON0127	16/05/2021	622.0	19.3
RC18WON0127	15/05/2021	622.0	19.3
RC18WON0127	14/05/2021	622.0	19.3
RC18WON0127	13/05/2021	622.0	19.3
RC18WON0127	12/05/2021	622.0	19.3
RC18WON0127	11/05/2021	622.0	19.3
RC18WON0127	10/05/2021	622.0	19.3
RC18WON0127	9/05/2021	622.0	19.3
RC18WON0127	8/05/2021	621.9	19.3
RC18WON0127	7/05/2021	622.0	19.3
RC18WON0127	6/05/2021	621.9	19.3
RC18WON0127	5/05/2021	621.9	19.3
RC18WON0127	4/05/2021	621.9	19.3
RC18WON0127	3/05/2021	621.9	19.3
RC18WON0127	2/05/2021	622.0	19.3
RC18WON0127	1/05/2021	622.0	19.3
RC18WON0127	30/04/2021	622.0	19.3
RC18WON0127	29/04/2021	622.0	19.3
RC18WON0127	28/04/2021	622.0	19.3
RC18WON0127	27/04/2021	622.0	19.3
RC18WON0127	26/04/2021	622.0	19.3
RC18WON0127	25/04/2021	622.0	19.3
RC18WON0127	24/04/2021	622.0	19.3
RC18WON0127	23/04/2021	622.0	19.3
RC18WON0127	22/04/2021	622.0	19.3
RC18WON0127	21/04/2021	622.0	19.3
RC18WON0127	20/04/2021	621.9	19.3
RC18WON0127	19/04/2021	621.9	19.4
RC18WON0127	18/04/2021	622.0	19.3
RC18WON0127	17/04/2021	622.0	19.3
RC18WON0127	16/04/2021	622.0	19.3
RC18WON0127	15/04/2021	622.0	19.3
RC18WON0127	14/04/2021	621.9	19.3
RC18WON0127	13/04/2021	621.9	19.4
RC18WON0127	12/04/2021	621.9	19.4
RC18WON0127	11/04/2021	621.9	19.4
RC18WON0127	10/04/2021	621.9	19.4
RC18WON0127	9/04/2021	621.9	19.4
RC18WON0127	8/04/2021	621.9	19.4
RC18WON0127	7/04/2021	621.9	19.4
RC18WON0127	6/04/2021	621.9	19.4
RC18WON0127	5/04/2021	621.9	19.4
RC18WON0127	4/04/2021	621.9	19.4
RC18WON0127	3/04/2021	621.9	19.4
RC18WON0127	2/04/2021	621.9	19.4
RC18WON0127	1/04/2021	621.9	19.4
RC18WON0127	31/03/2021	621.9	19.4
RC18WON0127	30/03/2021	621.9	19.4
RC18WON0127	29/03/2021	621.9	19.4
RC18WON0127	28/03/2021	621.9	19.4
RC18WON0127	27/03/2021	621.9	19.4
RC18WON0127	26/03/2021	621.9	19.4
RC18WON0127	25/03/2021	621.9	19.4
RC18WON0127	24/03/2021	621.9	19.4
RC18WON0127	23/03/2021	621.9	19.4
RC18WON0127	22/03/2021	621.9	19.4
RC18WON0127	21/03/2021	621.9	19.4
RC18WON0127	20/03/2021	621.9	19.4
RC18WON0127	19/03/2021	621.9	19.4
RC18WON0127	18/03/2021	621.9	19.4
RC18WON0127	17/03/2021	621.9	19.4
RC18WON0127	16/03/2021	621.9	19.4
RC18WON0127	15/03/2021	621.9	19.4
RC18WON0127	14/03/2021	621.9	19.4
RC18WON0127	13/03/2021	621.9	19.4
RC18WON0127	12/03/2021	621.9	19.4
RC18WON0127	11/03/2021	621.9	19.4
RC18WON0127	10/03/2021	621.9	19.4
RC18WON0127	9/03/2021	621.9	19.4
RC18WON0127	8/03/2021	621.9	19.4

ID	Date	WL mAHD	WL mbgl
MB18HD20004	16/09/2019	627.0	86.4
MB18HD20004	17/09/2019	627.0	86.4
MB18HD20004	18/09/2019	627.0	86.4
MB18HD20004	19/09/2019	627.0	86.4
MB18HD20004	20/09/2019	627.0	86.4
MB18HD20004	21/09/2019	627.0	86.4
MB18HD20004	22/09/2019	627.1	86.4
MB18HD20004	23/09/2019	627.1	86.4
MB18HD20004	24/09/2019	627.1	86.4
MB18HD20004	25/09/2019	627.1	86.4
MB18HD20004	26/09/2019	627.0	86.4
MB18HD20004	27/09/2019	627.0	86.4
MB18HD20004	28/09/2019	627.0	86.4
MB18HD20004	29/09/2019	627.0	86.4
MB18HD20004	30/09/2019	627.0	86.4
MB18HD20004	1/10/2019	627.0	86.4
MB18HD20004	2/10/2019	627.0	86.4
MB18HD20004	3/10/2019	627.0	86.4
MB18HD20004	4/10/2019	627.0	86.4
MB18HD20004	5/10/2019	627.0	86.4
MB18HD20004	6/10/2019	627.0	86.4
MB18HD20004	7/10/2019	627.0	86.4
MB18HD20004	8/10/2019	627.0	86.4
MB18HD20004	9/10/2019	627.0	86.4
MB18HD20004	10/10/2019	627.1	86.4
MB18HD20004	11/10/2019	627.0	86.4
MB18HD20004	12/10/2019	627.0	86.4
MB18HD20004	13/10/2019	627.0	86.4
MB18HD20004	14/10/2019	627.0	86.4
MB18HD20004	15/10/2019	627.0	86.4
MB18HD20004	16/10/2019	627.0	86.4
MB18HD20004	17/10/2019	627.0	86.4
MB18HD20004	18/10/2019	627.0	86.4
MB18HD20004	19/10/2019	627.0	86.4
MB18HD20004	20/10/2019	627.0	86.4
MB18HD20004	21/10/2019	627.0	86.4
MB18HD20004	22/10/2019	627.0	86.4
MB18HD20004	23/10/2019	627.0	86.4
MB18HD20004	24/10/2019	627.0	86.4
MB18HD20004	25/10/2019	627.0	86.4
MB18HD20004	26/10/2019	627.0	86.4
MB18HD20004	27/10/2019	627.0	86.4
MB18HD20004	28/10/2019	627.0	86.4
MB18HD20004	29/10/2019	627.0	86.4
MB18HD20004	30/10/2019	627.0	86.4
MB18HD20004	31/10/2019	627.0	86.5
MB18HD20004	1/11/2019	627.0	86.5
MB18HD20004	2/11/2019	627.0	86.4
MB18HD20004	3/11/2019	627.0	86.4
MB18HD20004	4/11/2019	627.0	86.4
MB18HD20004	5/11/2019	627.0	86.4
MB18HD20004	6/11/2019	627.0	86.4
MB18HD20004	7/11/2019	627.0	86.4
MB18HD20004	8/11/2019	627.0	86.4
MB18HD20004	9/11/2019	627.0	86.4
MB18HD20004	10/11/2019	627.0	86.4
MB18HD20004	11/11/2019	627.0	86.5
MB18HD20004	12/11/2019	627.0	86.4
MB18HD20004	13/11/2019	627.0	86.4
MB18HD20004	14/11/2019	627.0	86.4
MB18HD20004	15/11/2019	627.0	86.4
MB18HD20004	16/11/2019	627.0	86.4
MB18HD20004	17/11/2019	627.0	86.4
MB18HD20004	18/11/2019	627.0	86.4
MB18HD20004	19/11/2019	627.0	86.5
MB18HD20004	20/11/2019	627.0	86.5
MB18HD20004	21/11/2019	627.0	86.5
MB18HD20004	22/11/2019	627.0	86.4
MB18HD20004	23/11/2019	627.0	86.5
MB18HD20004	24/11/2019	627.0	86.5
MB18HD20004	25/11/2019	627.0	86.5
MB18HD20004	26/11/2019	627.0	86.5
MB18HD20004	27/11/2019	627.0	86.5
MB18HD20004	28/11/2019	627.0	86.5
MB18HD20004	29/11/2019	627.0	86.5
MB18HD20004	30/11/2019	627.0	86.4
MB18HD20004	1/12/2019	627.0	86.4
MB18HD20004	2/12/2019	627.0	86.4
MB18HD20004	3/12/2019	627.0	86.4
MB18HD20004	4/12/2019	627.0	86.5
MB18HD20004	5/12/2019	627.0	86.5
MB18HD20004	6/12/2019	627.0	86.5
MB18HD20004	7/12/2019	627.0	86.5
MB18HD20004	8/12/2019	627.0	86.5
MB18HD20004	9/12/2019	627.0	86.5
MB18HD20004	10/12/2019	627.0	86.5
MB18HD20004	11/12/2019	627.0	86.5
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	31/12/2018	786.9	-100.7
HDVP1	30/12/2018	786.9	-100.7
HDVP1	29/12/2018	786.9	-100.7
HDVP1	28/12/2018	786.9	-100.7
HDVP1	27/12/2018	786.9	-100.7
HDVP1	26/12/2018	786.9	-100.7
HDVP1	25/12/2018	786.9	-100.7
HDVP1	24/12/2018	786.9	-100.7
HDVP1	23/12/2018	786.9	-100.7
HDVP1	22/12/2018	786.9	-100.7
HDVP1	21/12/2018	786.9	-100.7
HDVP1	20/12/2018	786.9	-100.7
HDVP1	19/12/2018	786.9	-100.7
HDVP1	18/12/2018	786.9	-100.7
HDVP1	17/12/2018	786.9	-100.7
HDVP1	16/12/2018	786.9	-100.7
HDVP1	15/12/2018	786.9	-100.7
HDVP1	14/12/2018	786.9	-100.7
HDVP1	13/12/2018	786.9	-100.7
HDVP1	12/12/2018	786.9	-100.7
HDVP1	11/12/2018	786.9	-100.7
HDVP1	10/12/2018	786.9	-100.7
HDVP1	9/12/2018	786.9	-100.7
HDVP1	8/12/2018	786.9	-100.7
HDVP1	7/12/2018	786.9	-100.7
HDVP1	6/12/2018	786.9	-100.7
HDVP1	5/12/2018	786.9	-100.7
HDVP1	4/12/2018	786.9	-100.7
HDVP1	3/12/2018	786.9	-100.7
HDVP1	2/12/2018	786.9	-100.7
HDVP1	1/12/2018	785.4	-99.2
HDVP1	30/11/2018	785.4	-99.2
HDVP1	29/11/2018	785.4	-99.2
HDVP1	28/11/2018	785.4	-99.2
HDVP1	27/11/2018	785.4	-99.2
HDVP1	26/11/2018	785.4	-99.2
HDVP1	25/11/2018	785.4	-99.2
HDVP1	24/11/2018	785.4	-99.2
HDVP1	23/11/2018	785.4	-99.2
HDVP1	22/11/2018	785.4	-99.2
HDVP1	21/11/2018	785.4	-99.2
HDVP1	20/11/2018	785.4	-99.2
HDVP1	19/11/2018	785.4	-99.2
HDVP1	18/11/2018	785.4	-99.2
HDVP1	17/11/2018	785.4	-99.2
HDVP1	16/11/2018	785.4	-99.2
HDVP1	15/11/2018	785.4	-99.2
HDVP1	14/11/2018	785.4	-99.2
HDVP1	13/11/2018	785.4	-99.2
HDVP1	12/11/2018	785.4	-99.2
HDVP1	11/11/2018	785.4	-99.2
HDVP1	10/11/2018	785.4	-99.2
HDVP1	9/11/2018	785.4	-99.2
HDVP1	8/11/2018	785.4	-99.2
HDVP1	7/11/2018	785.4	-99.2
HDVP1	6/11/2018	785.4	-99.2
HDVP1	5/11/2018	785.4	-99.2
HDVP1	4/11/2018	785.4	-99.2
HDVP1	3/11/2018	785.4	-99.2
HDVP1	2/11/2018	785.4	-99.2
HDVP1	1/11/2018	793.8	-107.7
HDVP1	31/10/2018	793.8	-107.7
HDVP1	30/10/2018	793.8	-107.7
HDVP1	29/10/2018	793.8	-107.7
HDVP1	28/10/2018	793.8	-107.7
HDVP1	27/10/2018	793.8	-107.7
HDVP1	26/10/2018	793.8	-107.7
HDVP1	25/10/2018	793.8	-107.7
HDVP1	24/10/2018	793.8	-107.7
HDVP1	23/10/2018	793.8	-107.7
HDVP1	22/10/2018	793.8	-107.7
HDVP1	21/10/2018	793.8	-107.7
HDVP1	20/10/2018	793.8	-107.7
HDVP1	19/10/2018	793.8	-107.7
HDVP1	18/10/2018	793.8	-107.7
HDVP1	17/10/2018	793.8	-107.7
HDVP1	16/10/2018	793.8	-107.7
HDVP1	15/10/2018	793.8	-107.7
HDVP1	14/10/2018	793.8	-107.7
HDVP1	13/10/2018	793.8	-107.7
HDVP1	12/10/2018	793.8	-107.7
HDVP1	11/10/2018	793.8	-107.7
HDVP1	10/10/2018	793.8	-107.7
HDVP1	9/10/2018	793.8	-107.7
HDVP1	8/10/2018	793.8	-107.7
HDVP1	7/10/2018	793.8	-107.7
HDVP1	6/10/2018	793.8	-107.7
HDVP1	5/10/2018	793.8	-107.7
HDVP1	4/10/2018	793.8	-107.7
HDVP1	3/10/2018	793.8	-107.7
HDVP1	2/10/2018	793.8	-107.7
HDVP1	1/10/2018	1480.7	-794.5
HDVP1	30/09/2018	1480.7	-794.5
HDVP1	29/09/2018	1480.7	-794.5
HDVP1	28/09/2018	1480.7	-794.5
HDVP1	27/09/2018	1480.7	-794.5
HDVP1	26/09/2018	1480.7	-794.5
HDVP1	25/09/2018	1480.7	-794.5
HDVP1	24/09/2018	1480.7	-794.5
HDVP1	23/09/2018	1480.7	-794.5
HDVP1	22/09/2018	1480.7	-794.5
HDVP1	21/09/2018	1480.7	-794.5
HDVP1	20/09/2018	1480.7	-794.5
HDVP1	19/09/2018	1480.7	-794.5
HDVP1	18/09/2018	1480.7	-794.5
HDVP1	17/09/2018	1480.7	-794.5
HDVP1	16/09/2018	1480.7	-794.5
HDVP1	15/09/2018	1480.7	-794.5
HDVP1	14/09/2018	1480.7	-794.5
HDVP1	13/09/2018	1480.7	-794.5
HDVP1	12/09/2018	1480.7	-794.5
HDVP1	11/09/2018	1480.7	-794.5
HDVP1	10/09/2018	1480.7	-794.5
HDVP1	9/09/2018	1480.7	-794.5
HDVP1	8/09/2018	1480.7	-794.5
HDVP1	7/09/2018	1480.7	-794.5
HDVP1	6/09/2018	1480.7	-794.5
HDVP1	5/09/2018	1480.7	-794.5
HDVP1	4/09/2018	1480.7	-794.5
HDVP1	3/09/2018	1480.7	-794.5
HDVP1	2/09/2018	1480.7	-794.5
HDVP1	1/09/2018	1480.7	-794.5
HDVP1	31/08/2018	1480.7	-794.5
HDVP1	30/08/2018	1480.7	-794.5
HDVP1	29/08/2018	1480.7	-794.5
HDVP1	28/08/2018	1480.7	-794.5
HDVP1	27/08/2018	1480.7	-794.5
HDVP1	26/08/2018	1480.7	-794.5
HDVP1	25/08/2018	1480.7	-794.5
HDVP1	24/08/2018	1480.7	-794.5
HDVP1	23/08/2018	1480.7	-794.5
HDVP1	22/08/2018	1480.7	-794.5
HDVP1	21/08/2018	1480.7	-794.5
HDVP1	20/08/2018	1480.7	-794.5
HDVP1	19/08/2018	1480.7	-794.5
HDVP1	18/08/2018	1480.7	-794.5

ID	Date	WL mAHD	WL mbgl
MB15H1SW0001	24/02/2018	595.6	49.8
MB15H1SW0001	23/02/2018	595.5	49.9
MB15H1SW0001	22/02/2018	595.5	49.9
MB15H1SW0001	21/02/2018	595.5	49.9
MB15H1SW0001	20/02/2018	595.5	49.9
MB15H1SW0001	19/02/2018	595.5	49.9
MB15H1SW0001	18/02/2018	595.5	49.8
MB15H1SW0001	17/02/2018	595.6	49.8
MB15H1SW0001	16/02/2018	595.6	49.8
MB15H1SW0001	15/02/2018	595.6	49.8
MB15H1SW0001	14/02/2018	595.6	49.8
MB15H1SW0001	13/02/2018	595.6	49.8
MB15H1SW0001	12/02/2018	595.6	49.8
MB15H1SW0001	11/02/2018	595.6	49.8
MB15H1SW0001	10/02/2018	595.6	49.8
MB15H1SW0001	9/02/2018	595.6	49.8
MB15H1SW0001	8/02/2018	595.6	49.8
MB15H1SW0001	7/02/2018	595.6	49.8
MB15H1SW0001	6/02/2018	595.5	49.8
MB15H1SW0001	5/02/2018	595.5	49.9
MB15H1SW0001	4/02/2018	595.5	49.9
MB15H1SW0001	3/02/2018	595.5	49.9
MB15H1SW0001	2/02/2018	595.5	49.9
MB15H1SW0001	1/02/2018	595.5	49.9
MB15H1SW0001	31/01/2018	595.5	49.9
MB15H1SW0001	30/01/2018	595.5	49.9
MB15H1SW0001	29/01/2018	595.5	49.9
MB15H1SW0001	28/01/2018	595.5	49.9
MB15H1SW0001	27/01/2018	595.5	49.9
MB15H1SW0001	26/01/2018	595.5	49.9
MB15H1SW0001	25/01/2018	595.5	49.9
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MB15H1SW0001	20/01/2018	595.6	49.8
MB15H1SW0001	19/01/2018	595.6	49.8
MB15H1SW0001	18/01/2018	595.6	49.8
MB15H1SW0001	17/01/2018	595.6	49.8
MB15H1SW0001	16/01/2018	595.6	49.8
MB15H1SW0001	15/01/2018	595.6	49.8
MB15H1SW0001	14/01/2018	595.5	49.8
MB15H1SW0001	13/01/2018	595.6	49.8
MB15H1SW0001	12/01/2018	595.5	49.8
MB15H1SW0001	11/01/2018	595.5	49.8
MB15H1SW0001	10/01/2018	595.6	49.8
MB15H1SW0001	9/01/2018	595.6	49.8
MB15H1SW0001	8/01/2018	595.6	49.8
MB15H1SW0001	7/01/2018	595.6	49.8
MB15H1SW0001	6/01/2018	595.6	49.8
MB15H1SW0001	5/01/2018	595.6	49.8
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MB15H1SW0001	3/01/2018	595.6	49.8
MB15H1SW0001	2/01/2018	595.6	49.8
MB15H1SW0001	1/01/2018	595.6	49.8
MB15H1SW0001	31/12/2017	595.6	49.8
MB15H1SW0001	30/12/2017	595.6	49.8
MB15H1SW0001	29/12/2017	595.6	49.8
MB15H1SW0001	28/12/2017	595.6	49.8
MB15H1SW0001	27/12/2017	595.6	49.8
MB15H1SW0001	26/12/2017	595.6	49.8
MB15H1SW0001	25/12/2017	595.6	49.8
MB15H1SW0001	24/12/2017	595.6	49.8
MB15H1SW0001	23/12/2017	595.6	49.8
MB15H1SW0001	22/12/2017	595.6	49.8
MB15H1SW0001	21/12/2017	595.6	49.8
MB15H1SW0001	20/12/2017	595.6	49.8
MB15H1SW0001	19/12/2017	595.6	49.8
MB15H1SW0001	18/12/2017	595.6	49.8
MB15H1SW0001	17/12/2017	595.6	49.8
MB15H1SW0001	16/12/2017	595.6	49.8
MB15H1SW0001	15/12/2017	595.6	49.8
MB15H1SW0001	14/12/2017	595.6	49.8
MB15H1SW0001	13/12/2017	595.6	49.8
MB15H1SW0001	12/12/2017	595.6	49.8
MB15H1SW0001	11/12/2017	595.6	49.8
MB15H1SW0001	10/12/2017	595.6	49.8
MB15H1SW0001	9/12/2017	595.6	49.8
MB15H1SW0001	8/12/2017	595.6	49.8
MB15H1SW0001	7/12/2017	595.6	49.8
MB15H1SW0001	6/12/2017	595.6	49.8
MB15H1SW0001	5/12/2017	595.6	49.8
MB15H1SW0001	4/12/2017	595.6	49.8
MB15H1SW0001	3/12/2017	595.6	49.8
MB15H1SW0001	2/12/2017	595.6	49.8
MB15H1SW0001	1/12/2017	595.6	49.8
MB15H1SW0001	30/11/2017	595.6	49.8
MB15H1SW0001	29/11/2017	595.6	49.8
MB15H1SW0001	28/11/2017	595.6	49.8
MB15H1SW0001	27/11/2017	595.6	49.8
MB15H1SW0001	26/11/2017	595.6	49.8
MB15H1SW0001	25/11/2017	595.6	49.8
MB15H1SW0001	24/11/2017	595.6	49.8
MB15H1SW0001	23/11/2017	595.6	49.8
MB15H1SW0001	22/11/2017	595.6	49.8
MB15H1SW0001	21/11/2017	595.6	49.8
MB15H1SW0001	20/11/2017	595.6	49.8
MB15H1SW0001	19/11/2017	595.6	49.8
MB15H1SW0001	18/11/2017	595.6	49.8
MB15H1SW0001	17/11/2017	595.6	49.8
MB15H1SW0001	16/11/2017	595.6	49.8
MB15H1SW0001	15/11/2017	595.6	49.8
MB15H1SW0001	14/11/2017	595.6	49.8
MB15H1SW0001	13/11/2017	595.6	49.8
MB15H1SW0001	12/11/2017	595.6	49.8
MB15H1SW0001	11/11/2017	595.6	49.8
MB15H1SW0001	10/11/2017	595.6	49.8
MB15H1SW0001	9/11/2017	595.6	49.8
MB15H1SW0001	8/11/2017	595.6	49.8
MB15H1SW0001	7/11/2017	595.6	49.8
MB15H1SW0001	6/11/2017	595.6	49.8
MB15H1SW0001	5/11/2017	595.6	49.8
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MB15H1SW0001	3/11/2017	595.6	49.8
MB15H1SW0001	2/11/2017	595.6	49.8
MB15H1SW0001	1/11/2017	595.6	49.8
MB15H1SW0001	31/10/2017	595.6	49.8
MB15H1SW0001	30/10/2017	595.6	49.8
MB15H1SW0001	29/10/2017	595.6	49.8
MB15H1SW0001	28/10/2017	595.6	49.8
MB15H1SW0001	27/10/2017	595.6	49.8
MB15H1SW0001	26/10/2017	595.6	49.8
MB15H1SW0001	25/10/2017	595.6	49.8
MB15H1SW0001	24/10/2017	595.6	49.8
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MB15H1SW0001	22/10/2017	595.6	49.8
MB15H1SW0001	21/10/2017	595.6	49.8
MB15H1SW0001	20/10/2017	595.6	49.8
MB15H1SW0001	19/10/2017	595.6	49.8
MB15H1SW0001	18/10/2017	595.6	49.8
MB15H1SW0001	17/10/2017	595.6	49.8
MB15H1SW0001	16/10/2017	595.6	49.8
MB15H1SW0001	15/10/2017	595.6	49.8
MB15H1SW0001	14/10/2017	595.6	49.8
MB15H1SW0001	13/10/2017	595.6	49.8
MB15H1SW0001	12/10/2017	595.6	49.8

ID	Date	WL mAHD	WL mbgl
RC18WON0127	7/03/2021	621.9	19.4
RC18WON0127	6/03/2021	621.9	19.4
RC18WON0127	5/03/2021	621.9	19.4
RC18WON0127	4/03/2021	621.9	19.4
RC18WON0127	3/03/2021	621.9	19.4
RC18WON0127	2/03/2021	621.9	19.4
RC18WON0127	1/03/2021	621.9	19.4
RC18WON0127	28/02/2021	621.8	19.4
RC18WON0127	27/02/2021	621.8	19.4
RC18WON0127	26/02/2021	621.8	19.4
RC18WON0127	25/02/2021	621.9	19.4
RC18WON0127	24/02/2021	621.9	19.4
RC18WON0127	23/02/2021	621.9	19.4
RC18WON0127	22/02/2021	621.9	19.4
RC18WON0127	21/02/2021	621.9	19.4
RC18WON0127	20/02/2021	621.9	19.4
RC18WON0127	19/02/2021	621.9	19.4
RC18WON0127	18/02/2021	621.8	19.4
RC18WON0127	17/02/2021	621.8	19.4
RC18WON0127	16/02/2021	621.9	19.4
RC18WON0127	15/02/2021	621.8	19.4
RC18WON0127	14/02/2021	621.8	19.4
RC18WON0127	13/02/2021	621.8	19.4
RC18WON0127	12/02/2021	621.8	19.4
RC18WON0127	11/02/2021	621.8	19.5
RC18WON0127	10/02/2021	621.8	19.5
RC18WON0127	9/02/2021	621.8	19.5
RC18WON0127	8/02/2021	621.8	19.5
RC18WON0127	7/02/2021	621.8	19.5
RC18WON0127	6/02/2021	621.8	19.5
RC18WON0127	5/02/2021	621.8	19.5
RC18WON0127	4/02/2021	621.8	19.5
RC18WON0127	3/02/2021	621.8	19.5
RC18WON0127	2/02/2021	621.8	19.5
RC18WON0127	1/02/2021	621.8	19.5
RC18WON0127	31/01/2021	621.8	19.5
RC18WON0127	30/01/2021	621.8	19.5
RC18WON0127	29/01/2021	621.8	19.5
RC18WON0127	28/01/2021	621.8	19.5
RC18WON0127	27/01/2021	621.8	19.5
RC18WON0127	26/01/2021	621.8	19.5
RC18WON0127	25/01/2021	621.8	19.5
RC18WON0127	24/01/2021	621.8	19.5
RC18WON0127	23/01/2021	621.8	19.5
RC18WON0127	22/01/2021	621.8	19.5
RC18WON0127	21/01/2021	621.8	19.5
RC18WON0127	20/01/2021	621.8	19.4
RC18WON0127	19/01/2021	621.8	19.4
RC18WON0127	18/01/2021	621.9	19.4
RC18WON0127	17/01/2021	621.9	19.4
RC18WON0127	16/01/2021	621.8	19.4
RC18WON0127	15/01/2021	621.8	19.5
RC18WON0127	14/01/2021	621.8	19.5
RC18WON0127	13/01/2021	621.8	19.5
RC18WON0127	12/01/2021	621.8	19.5
RC18WON0127	11/01/2021	621.8	19.4
RC18WON0127	10/01/2021	621.8	19.4
RC18WON0127	9/01/2021	621.9	19.4
RC18WON0127	8/01/2021	621.9	19.4
RC18WON0127	7/01/2021	621.8	19.4
RC18WON0127	6/01/2021	621.9	19.4
RC18WON0127	5/01/2021	621.9	19.4
RC18WON0127	4/01/2021	621.8	19.5
RC18WON0127	3/01/2021	621.8	19.5
RC18WON0127	2/01/2021	621.8	19.5
RC18WON0127	1/01/2021	621.8	19.5
RC18WON0127	31/12/2020	621.8	19.5
RC18WON0127	30/12/2020	621.8	19.5
RC18WON0127	29/12/2020	621.8	19.5
RC18WON0127	28/12/2020	621.8	19.5
RC18WON0127	27/12/2020	621.8	19.5
RC18WON0127	26/12/2020	621.8	19.5
RC18WON0127	25/12/2020	621.8	19.4
RC18WON0127	24/12/2020	621.8	19.4
RC18WON0127	23/12/2020	621.8	19.4
RC18WON0127	22/12/2020	621.8	19.4
RC18WON0127	21/12/2020	621.8	19.5
RC18WON0127	20/12/2020	621.8	19.5
RC18WON0127	19/12/2020	621.8	19.5
RC18WON0127	18/12/2020	621.8	19.5
RC18WON0127	17/12/2020	621.8	19.5
RC18WON0127	16/12/2020	621.8	19.5
RC18WON0127	15/12/2020	621.8	19.4
RC18WON0127	14/12/2020	621.8	19.4
RC18WON0127	13/12/2020	621.8	19.5
RC18WON0127	12/12/2020	621.8	19.5
RC18WON0127	11/12/2020	621.8	19.5
RC18WON0127	10/12/2020	621.8	19.5
RC18WON0127	9/12/2020	621.8	19.4
RC18WON0127	8/12/2020	621.8	19.4
RC18WON0127	7/12/2020	621.9	19.4
RC18WON0127	6/12/2020	621.9	19.4
RC18WON0127	5/12/2020	621.9	19.4
RC18WON0127	4/12/2020	621.9	19.4
RC18WON0127	3/12/2020	621.9	19.4
RC18WON0127	2/12/2020	621.9	19.4
RC18WON0127	1/12/2020	621.9	19.4
RC18WON0127	30/11/2020	621.8	19.4
RC18WON0127	29/11/2020	621.8	19.5
RC18WON0127	28/11/2020	621.8	19.4
RC18WON0127	27/11/2020	621.8	19.4
RC18WON0127	26/11/2020	621.8	19.4
RC18WON0127	25/11/2020	621.9	19.4
RC18WON0127	24/11/2020	621.9	19.4
RC18WON0127	23/11/2020	621.9	19.4
RC18WON0127	22/11/2020	621.9	19.4
RC18WON0127	21/11/2020	621.9	19.4
RC18WON0127	20/11/2020	621.9	19.4
RC18WON0127	14/11/2020	621.9	19.4
RC18WON0127	2/09/2020	621.9	19.3
RC18WON0127	29/09/2019	621.9	19.3
RC18WON0127	28/09/2019	621.9	19.3
RC18WON0127	27/09/2019	621.9	19.4
RC18WON0127	26/09/2019	621.9	19.3
RC18WON0127	25/09/2019	621.9	19.3
RC18WON0127	24/09/2019	622.0	19.3
RC18WON0127	23/09/2019	622.0	19.3
RC18WON0127	22/09/2019	622.0	19.3
RC18WON0127	21/09/2019	622.0	19.3
RC18WON0127	20/09/2019	622.0	19.3
RC18WON0127	19/09/2019	621.9	19.4
RC18WON0127	18/09/2019	621.9	19.3
RC18WON0127	17/09/2019	621.9	19.3
RC18WON0127	16/09/2019	621.9	19.3
RC18WON0127	15/09/2019	622.0	19.3
RC18WON0127	14/09/2019	622.0	19.3
RC18WON0127	13/09/2019	622.0	19.3
RC18WON0127	12/09/2019	622.0	19.3
RC18WON0127	11/09/2019	622.0	19.3
RC18WON0127	10/09/2019	622.0	19.3
RC18WON0127	9/09/2019	622.0	19.3
RC18WON0127	8/09/2019	622.0	19.3
RC18WON0127	7/09/2019	621.9	19.3
RC18WON0127	6/09/2019	621.9	19.3
RC18WON0127	5/09/2019	621.9	19.3
RC18WON0127	4/09/2019	621.9	19.3

ID	Date	WL mAHD	WL mbgl
MB18HD20004	30/01/2020	627.0	86.5
MB18HD20004	31/01/2020	627.0	86.5
MB18HD20004	1/02/2020	627.0	86.5
MB18HD20004	2/02/2020	627.0	86.4
MB18HD20004	3/02/2020	627.0	86.4
MB18HD20004	4/02/2020	627.0	86.4
MB18HD20004	5/02/2020	627.0	86.4
MB18HD20004	6/02/2020	627.0	86.4
MB18HD20004	7/02/2020	627.0	86.4
MB18HD20004	8/02/2020	627.0	86.4
MB18HD20004	9/02/2020	627.0	86.5
MB18HD20004	10/02/2020	627.0	86.5
MB18HD20004	11/02/2020	627.0	86.4
MB18HD20004	12/02/2020	627.0	86.4
MB18HD20004	13/02/2020	627.0	86.4
MB18HD20004	14/02/2020	627.0	86.4
MB18HD20004	15/02/2020	627.0	86.4
MB18HD20004	16/02/2020	627.0	86.4
MB18HD20004	17/02/2020	627.0	86.4
MB18HD20004	18/02/2020	627.0	86.4
MB18HD20004	19/02/2020	627.0	86.4
MB18HD20004	20/02/2020	627.0	86.4
MB18HD20004	21/02/2020	627.0	86.4
MB18HD20004	22/02/2020	627.0	86.4
MB18HD20004	23/02/2020	627.0	86.4
MB18HD20004	24/02/2020	627.0	86.4
MB18HD20004	25/02/2020	627.0	86.4
MB18HD20004	26/02/2020	627.0	86.4
MB18HD20004	27/02/2020	627.0	86.4
MB18HD20004	28/02/2020	627.0	86.4
MB18HD20004	29/02/2020	627.0	86.4
MB18HD20004	1/03/2020	627.0	86.4
MB18HD20004	2/03/2020	627.0	86.4
MB18HD20004	3/03/2020	627.0	86.4
MB18HD20004	4/03/2020	627.0	86.4
MB18HD20004	5/03/2020	627.0	86.4
MB18HD20004	6/03/2020	627.0	86.4
MB18HD20004	7/03/2020	627.1	86.4
MB18HD20004	8/03/2020	627.1	86.4
MB18HD20004	9/03/2020	627.0	86.4
MB18HD20004	10/03/2020	627.0	86.4
MB18HD20004	11/03/2020	627.0	86.4
MB18HD20004	12/03/2020	627.1	86.4
MB18HD20004	13/03/2020	627.1	86.4
MB18HD20004	14/03/2020	627.1	86.4
MB18HD20004	15/03/2020	627.1	86.4
MB18HD20004	16/03/2020	627.1	86.4
MB18HD20004	17/03/2020	627.1	86.4
MB18HD20004	18/03/2020	627.1	86.4
MB18HD20004	19/03/2020	627.1	86.3
MB18HD20004	20/03/2020	627.1	86.3
MB18HD20004	21/03/2020	627.1	86.3
MB18HD20004	22/03/2020	627.1	86.3
MB18HD20004	23/03/2020	627.1	86.3
MB18HD20004	24/03/2020	627.1	86.4
MB18HD20004	25/03/2020	627.1	86.4
MB18HD20004	26/03/2020	627.1	86.3
MB18HD20004	27/03/2020	627.1	86.3
MB18HD20004	28/03/2020	627.1	86.4
MB18HD20004	29/03/2020	627.1	86.4
MB18HD20004	30/03/2020	627.1	86.4
MB18HD20004	31/03/2020	627.1	86.4
MB18HD20004	1/04/2020	627.1	86.4
MB18HD20004	2/04/2020	627.1	86.4
MB18HD20004	3/04/2020	627.1	86.4
MB18HD20004	4/04/2020	627.1	86.4
MB18HD20004	5/04/2020	627.1	86.4
MB18HD20004	6/04/2020	627.1	86.4
MB18HD20004	7/04/2020	627.1	86.4
MB18HD20004	8/04/2020	627.1	86.4
MB18HD20004	9/04/2020	627.1	86.4
MB18HD20004	10/04/2020	627.1	86.3
MB18HD20004	11/04/2020	627.1	86.3
MB18HD20004	12/04/2020	627.1	86.3
MB18HD20004	13/04/2020	627.1	86.3
MB18HD20004	14/04/2020	627.1	86.3
MB18HD20004	15/04/2020	627.1	86.3
MB18HD20004	16/04/2020	627.1	86.3
MB18HD20004	17/04/2020	627.1	86.3
MB18HD20004	18/04/2020	627.1	86.3
MB18HD20004	19/04/2020	627.1	86.4
MB18HD20004	20/04/2020	627.1	86.4
MB18HD20004	21/04/2020	627.1	86.3
MB18HD20004	22/04/2020	627.1	86.3
MB18HD20004	23/04/2020	627.1	86.3
MB18HD20004	24/04/2020	627.1

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	17/08/2018	1480.7	-794.5
HDVP1	16/08/2018	1480.7	-794.5
HDVP1	15/08/2018	1480.7	-794.5
HDVP1	14/08/2018	1480.7	-794.5
HDVP1	13/08/2018	1480.7	-794.5
HDVP1	12/08/2018	1480.7	-794.5
HDVP1	11/08/2018	1480.7	-794.5
HDVP1	10/08/2018	1480.7	-794.5
HDVP1	9/08/2018	1480.7	-794.5
HDVP1	8/08/2018	1480.7	-794.5
HDVP1	7/08/2018	1480.7	-794.5
HDVP1	6/08/2018	1480.7	-794.5
HDVP1	5/08/2018	1480.7	-794.5
HDVP1	4/08/2018	1480.7	-794.5
HDVP1	3/08/2018	1480.7	-794.5
HDVP1	2/08/2018	1480.7	-794.5
HDVP1	1/08/2018	514.7	171.4
HDVP1	31/07/2018	514.7	171.4
HDVP1	30/07/2018	514.7	171.4
HDVP1	29/07/2018	514.7	171.4
HDVP1	28/07/2018	514.7	171.4
HDVP1	27/07/2018	514.7	171.4
HDVP1	26/07/2018	514.7	171.4
HDVP1	25/07/2018	514.7	171.4
HDVP1	24/07/2018	514.7	171.4
HDVP1	23/07/2018	514.7	171.4
HDVP1	22/07/2018	514.7	171.4
HDVP1	21/07/2018	514.7	171.4
HDVP1	20/07/2018	514.7	171.4
HDVP1	19/07/2018	514.7	171.4
HDVP1	18/07/2018	514.7	171.4
HDVP1	17/07/2018	514.7	171.4
HDVP1	16/07/2018	514.7	171.4
HDVP1	15/07/2018	514.7	171.4
HDVP1	14/07/2018	514.7	171.4
HDVP1	13/07/2018	514.7	171.4
HDVP1	12/07/2018	514.7	171.4
HDVP1	11/07/2018	514.7	171.4
HDVP1	10/07/2018	514.7	171.4
HDVP1	9/07/2018	514.7	171.4
HDVP1	8/07/2018	514.7	171.4
HDVP1	7/07/2018	514.7	171.4
HDVP1	6/07/2018	514.7	171.4
HDVP1	5/07/2018	514.7	171.4
HDVP1	4/07/2018	514.7	171.4
HDVP1	3/07/2018	514.7	171.4
HDVP1	2/07/2018	514.7	171.4
HDVP1	1/07/2018	485.6	200.6
HDVP1	30/06/2018	485.6	200.6
HDVP1	29/06/2018	485.6	200.6
HDVP1	28/06/2018	485.6	200.6
HDVP1	27/06/2018	485.6	200.6
HDVP1	26/06/2018	485.6	200.6
HDVP1	25/06/2018	485.6	200.6
HDVP1	24/06/2018	485.6	200.6
HDVP1	23/06/2018	485.6	200.6
HDVP1	22/06/2018	485.6	200.6
HDVP1	21/06/2018	485.6	200.6
HDVP1	20/06/2018	485.6	200.6
HDVP1	19/06/2018	485.6	200.6
HDVP1	18/06/2018	485.6	200.6
HDVP1	17/06/2018	485.6	200.6
HDVP1	16/06/2018	485.6	200.6
HDVP1	15/06/2018	485.6	200.6
HDVP1	14/06/2018	485.6	200.6
HDVP1	13/06/2018	485.6	200.6
HDVP1	12/06/2018	485.6	200.6
HDVP1	11/06/2018	485.6	200.6
HDVP1	10/06/2018	485.6	200.6
HDVP1	9/06/2018	485.6	200.6
HDVP1	8/06/2018	485.6	200.6
HDVP1	7/06/2018	485.6	200.6
HDVP1	6/06/2018	485.6	200.6
HDVP1	5/06/2018	485.6	200.6
HDVP1	4/06/2018	485.6	200.6
HDVP1	3/06/2018	485.6	200.6
HDVP1	2/06/2018	485.6	200.6
HDVP1	1/06/2018	653.6	32.6
HDVP1	31/05/2018	653.6	32.6
HDVP1	30/05/2018	653.6	32.6
HDVP1	29/05/2018	653.6	32.6
HDVP1	28/05/2018	653.6	32.6
HDVP1	27/05/2018	653.6	32.6
HDVP1	26/05/2018	653.6	32.6
HDVP1	25/05/2018	653.6	32.6
HDVP1	24/05/2018	653.6	32.6
HDVP1	23/05/2018	653.6	32.6
HDVP1	22/05/2018	653.6	32.6
HDVP1	21/05/2018	653.6	32.6
HDVP1	20/05/2018	653.6	32.6
HDVP1	19/05/2018	653.6	32.6
HDVP1	18/05/2018	653.6	32.6
HDVP1	17/05/2018	653.6	32.6
HDVP1	16/05/2018	653.6	32.6
HDVP1	15/05/2018	653.6	32.6
HDVP1	14/05/2018	653.6	32.6
HDVP1	13/05/2018	653.6	32.6
HDVP1	12/05/2018	653.6	32.6
HDVP1	11/05/2018	653.6	32.6
HDVP1	10/05/2018	653.6	32.6
HDVP1	9/05/2018	653.6	32.6
HDVP1	8/05/2018	653.6	32.6
HDVP1	7/05/2018	653.6	32.6
HDVP1	6/05/2018	653.6	32.6
HDVP1	5/05/2018	653.6	32.6
HDVP1	4/05/2018	653.6	32.6
HDVP1	3/05/2018	653.6	32.6
HDVP1	2/05/2018	653.6	32.6
HDVP1	1/05/2018	704.2	-18.0
HDVP1	30/04/2018	704.2	-18.0
HDVP1	29/04/2018	704.2	-18.0
HDVP1	28/04/2018	704.2	-18.0
HDVP1	27/04/2018	704.2	-18.0
HDVP1	26/04/2018	704.2	-18.0
HDVP1	25/04/2018	704.2	-18.0
HDVP1	24/04/2018	704.2	-18.0
HDVP1	23/04/2018	704.2	-18.0
HDVP1	22/04/2018	704.2	-18.0
HDVP1	21/04/2018	704.2	-18.0
HDVP1	20/04/2018	704.2	-18.0
HDVP1	19/04/2018	704.2	-18.0
HDVP1	18/04/2018	704.2	-18.0
HDVP1	17/04/2018	704.2	-18.0
HDVP1	16/04/2018	704.2	-18.0
HDVP1	15/04/2018	704.2	-18.0
HDVP1	14/04/2018	704.2	-18.0
HDVP1	13/04/2018	704.2	-18.0
HDVP1	12/04/2018	704.2	-18.0
HDVP1	11/04/2018	704.2	-18.0
HDVP1	10/04/2018	704.2	-18.0
HDVP1	9/04/2018	704.2	-18.0
HDVP1	8/04/2018	704.2	-18.0
HDVP1	7/04/2018	704.2	-18.0
HDVP1	6/04/2018	704.2	-18.0
HDVP1	5/04/2018	704.2	-18.0
HDVP1	4/04/2018	704.2	-18.0

ID	Date	WL mAHD	WL mbgl
MB15H1SW0001	11/10/2017	595.6	49.8
MB15H1SW0001	10/10/2017	595.6	49.8
MB15H1SW0001	9/10/2017	595.6	49.8
MB15H1SW0001	8/10/2017	595.6	49.8
MB15H1SW0001	7/10/2017	595.6	49.8
MB15H1SW0001	6/10/2017	595.6	49.8
MB15H1SW0001	5/10/2017	595.6	49.8
MB15H1SW0001	4/10/2017	595.6	49.8
MB15H1SW0001	3/10/2017	595.6	49.8
MB15H1SW0001	2/10/2017	595.6	49.8
MB15H1SW0001	1/10/2017	595.6	49.8
MB15H1SW0001	30/09/2017	595.6	49.8
MB15H1SW0001	29/09/2017	595.6	49.8
MB15H1SW0001	28/09/2017	595.6	49.8
MB15H1SW0001	27/09/2017	595.6	49.8
MB15H1SW0001	26/09/2017	595.6	49.8
MB15H1SW0001	25/09/2017	595.6	49.8
MB15H1SW0001	24/09/2017	595.6	49.8
MB15H1SW0001	23/09/2017	595.6	49.8
MB15H1SW0001	22/09/2017	595.6	49.8
MB15H1SW0001	21/09/2017	595.6	49.8
MB15H1SW0001	20/09/2017	595.6	49.7
MB15H1SW0001	19/09/2017	595.7	49.7
MB15H1SW0001	18/09/2017	595.6	49.7
MB15H1SW0001	17/09/2017	595.6	49.7
MB15H1SW0001	16/09/2017	595.6	49.7
MB15H1SW0001	15/09/2017	595.6	49.7
MB15H1SW0001	14/09/2017	595.6	49.8
MB15H1SW0001	13/09/2017	595.6	49.8
MB15H1SW0001	12/09/2017	595.6	49.8
MB15H1SW0001	11/09/2017	595.6	49.8
MB15H1SW0001	10/09/2017	595.6	49.8
MB15H1SW0001	9/09/2017	595.6	49.8
MB15H1SW0001	8/09/2017	595.6	49.8
MB15H1SW0001	7/09/2017	595.6	49.8
MB15H1SW0001	6/09/2017	595.6	49.7
MB15H1SW0001	5/09/2017	595.6	49.8
MB15H1SW0001	11/08/2017	595.6	49.8
MB15H1SW0001	10/08/2017	595.6	49.8
MB15H1SW0001	9/08/2017	595.6	49.8
MB15H1SW0001	8/08/2017	595.6	49.8
MB15H1SW0001	7/08/2017	595.6	49.8
MB15H1SW0001	6/08/2017	595.6	49.8
MB15H1SW0001	5/08/2017	595.6	49.8
MB15H1SW0001	4/08/2017	595.6	49.8
MB15H1SW0001	3/08/2017	595.6	49.8
MB15H1SW0001	2/08/2017	595.6	49.8
MB15H1SW0001	1/08/2017	595.6	49.8
MB15H1SW0001	31/07/2017	595.6	49.8
MB15H1SW0001	30/07/2017	595.6	49.8
MB15H1SW0001	29/07/2017	595.6	49.8
MB15H1SW0001	28/07/2017	595.6	49.8
MB15H1SW0001	27/07/2017	595.6	49.8
MB15H1SW0001	26/07/2017	595.6	49.8
MB15H1SW0001	25/07/2017	595.6	49.8
MB15H1SW0001	24/07/2017	595.6	49.8
MB15H1SW0001	23/07/2017	595.6	49.8
MB15H1SW0001	22/07/2017	595.6	49.8
MB15H1SW0001	21/07/2017	595.6	49.8
MB15H1SW0001	20/07/2017	595.6	49.8
MB15H1SW0001	19/07/2017	595.6	49.8
MB15H1SW0001	18/07/2017	595.6	49.8
MB15H1SW0001	17/07/2017	595.6	49.8
MB15H1SW0001	13/07/2017	595.6	49.8
MB15H1SW0001	11/07/2017	595.6	49.8
MB15H1SW0001	22/04/2017	595.4	50.0
MB15H1SW0001	22/11/2016	595.6	49.8
MB15H1SW0001	28/06/2016	595.7	49.7
MB16H1SW0001	28/12/2019	620.4	38.3
MB16H1SW0001	2/08/2019	620.5	38.2
MB16H1SW0001	1/08/2019	620.5	38.2
MB16H1SW0001	31/07/2019	620.5	38.2
MB16H1SW0001	30/07/2019	620.5	38.2
MB16H1SW0001	29/07/2019	620.5	38.2
MB16H1SW0001	28/07/2019	620.4	38.2
MB16H1SW0001	27/07/2019	620.4	38.2
MB16H1SW0001	26/07/2019	620.4	38.2
MB16H1SW0001	25/07/2019	620.5	38.2
MB16H1SW0001	24/07/2019	620.5	38.2
MB16H1SW0001	23/07/2019	620.5	38.2
MB16H1SW0001	22/07/2019	620.5	38.2
MB16H1SW0001	21/07/2019	620.4	38.2
MB16H1SW0001	20/07/2019	620.4	38.2
MB16H1SW0001	19/07/2019	620.5	38.2
MB16H1SW0001	18/07/2019	620.5	38.2
MB16H1SW0001	17/07/2019	620.5	38.2
MB16H1SW0001	16/07/2019	620.5	38.2
MB16H1SW0001	15/07/2019	620.5	38.2
MB16H1SW0001	14/07/2019	620.5	38.2
MB16H1SW0001	13/07/2019	620.5	38.2
MB16H1SW0001	12/07/2019	620.5	38.2
MB16H1SW0001	11/07/2019	620.5	38.2
MB16H1SW0001	10/07/2019	620.5	38.2
MB16H1SW0001	9/07/2019	620.5	38.2
MB16H1SW0001	8/07/2019	620.5	38.2
MB16H1SW0001	7/07/2019	620.5	38.2
MB16H1SW0001	6/07/2019	620.5	38.2
MB16H1SW0001	5/07/2019	620.4	38.2
MB16H1SW0001	4/07/2019	620.5	38.2
MB16H1SW0001	3/07/2019	620.5	38.2
MB16H1SW0001	2/07/2019	620.5	38.2
MB16H1SW0001	1/07/2019	620.5	38.2
MB16H1SW0001	30/06/2019	620.5	38.2
MB16H1SW0001	29/06/2019	620.5	38.2
MB16H1SW0001	28/06/2019	620.5	38.2
MB16H1SW0001	27/06/2019	620.4	38.2
MB16H1SW0001	26/06/2019	620.5	38.2
MB16H1SW0001	25/06/2019	620.5	38.2
MB16H1SW0001	24/06/2019	620.5	38.2
MB16H1SW0001	23/06/2019	620.5	38.2
MB16H1SW0001	22/06/2019	620.5	38.2
MB16H1SW0001	21/06/2019	620.4	38.2
MB16H1SW0001	20/06/2019	620.5	38.2
MB16H1SW0001	19/06/2019	620.5	38.2
MB16H1SW0001	18/06/2019	620.5	38.2
MB16H1SW0001	17/06/2019	620.5	38.2
MB16H1SW0001	16/06/2019	620.5	38.2
MB16H1SW0001	15/06/2019	620.5	38.2
MB16H1SW0001	14/06/2019	620.5	38.2
MB16H1SW0001	13/06/2019	620.5	38.2
MB16H1SW0001	12/06/2019	620.5	38.2
MB16H1SW0001	11/06/2019	620.5	38.2
MB16H1SW0001	10/06/2019	620.4	38.2
MB16H1SW0001	9/06/2019	620.4	38.2
MB16H1SW0001	8/06/2019	620.5	38.2
MB16H1SW0001	7/06/2019	620.5	38.2
MB16H1SW0001	6/06/2019	620.5	38.2
MB16H1SW0001	5/06/2019	620.5	38.1
MB16H1SW0001	4/06/2019	620.5	38.1
MB16H1SW0001	3/06/2019	620.5	38.1
MB16H1SW0001	2/06/2019	620.5	38.1
MB16H1SW0001	1/06/2019	620.5	38.1
MB16H1SW0001	31/05/2019	620.5	38.1
MB16H1SW0001	30/05/2019	620.5	38.2
MB16H1SW0001	29/05/2019	620.5	38.1
MB16H1SW0001	28/05/2019	620.5	38.2

ID	Date	WL mAHD	WL mbgl
RC18WON0127	3/09/2019	621.9	19.3
RC18WON0127	2/09/2019	622.0	19.3
RC18WON0127	1/09/2019	622.0	19.3
RC18WON0127	31/08/2019	622.0	19.3
RC18WON0127	30/08/2019	621.9	19.3
RC18WON0127	29/08/2019	622.0	19.3
RC18WON0127	28/08/2019	622.0	19.3
RC18WON0127	27/08/2019	622.0	19.3
RC18WON0127	26/08/2019	622.0	19.3
RC18WON0127	25/08/2019	622.0	19.3
RC18WON0127	24/08/2019	622.0	19.3
RC18WON0127	23/08/2019	622.0	19.3
RC18WON0127	22/08/2019	622.0	19.3
RC18WON0127	21/08/2019	622.0	19.3
RC18WON0127	20/08/2019	622.0	19.2
RC18WON0127	19/08/2019	622.0	19.2
RC18WON0127	18/08/2019	622.0	19.2
RC18WON0127	17/08/2019	622.0	19.3
RC18WON0127	16/08/2019	622.0	19.3
RC18WON0127	15/08/2019	622.0	19.3
RC18WON0127	14/08/2019	622.0	19.3
RC18WON0127	13/08/2019	622.0	19.3
RC18WON0127	12/08/2019	622.0	19.3
RC18WON0127	11/08/2019	622.0	19.3
RC18WON0127	10/08/2019	622.0	19.3
RC18WON0127	9/08/2019	622.0	19.3
RC18WON0127	8/08/2019	622.0	19.3
RC18WON0127	7/08/2019	622.0	19.3
RC18WON0127	6/08/2019	622.0	19.3
RC18WON0127	5/08/2019	622.0	19.3
RC18WON0127	4/08/2019	622.0	19.3
RC18WON0127	3/08/2019	622.0	19.2
RC18WON0127	2/08/2019	622.0	19.2
RC18WON0127	1/08/2019	622.0	19.3
RC18WON0127	31/07/2019	622.0	19.2
RC18WON0127	30/07/2019	622.0	19.3
RC18WON0127	29/07/2019	622.0	19.3
RC18WON0127	28/07/2019	622.0	19.3
RC18WON0127	27/07/2019	622.0	19.3
RC18WON0127	26/07/2019	622.0	19.3
RC18WON0127	25/07/2019	622.0	19.3
RC18WON0127	24/07/2019	622.0	19.3
RC18WON0127	23/07/2019	622.0	19.3
RC18WON0127	22/07/2019	622.0	19.3
RC18WON0127	21/07/2019	622.0	19.3
RC18WON0127	20/07/2019	622.0	19.3
RC18WON0127	19/07/2019	622.0	19.3
RC18WON0127	18/07/2019	622.0	19.3
RC18WON0127	17/07/2019	622.0	19.3
RC18WON0127	16/07/2019	622.0	19.2
RC18WON0127	15/07/2019	622.1	19.2
RC18WON0127	14/07/2019	622.1	19.2
RC18WON0127	13/07/2019	622.1	19.2
RC18WON0127	12/07/2019	622.1	19.2
RC18WON0127	11/07/2019	622.1	19.2
RC18WON0127	10/07/2019	622.0	19.2
RC18WON0127	9/07/2019	622.0	19.2
RC18WON0127	8/07/2019	622.0	19.2
RC18WON0127	7/07/2019	622.0	19.2
RC18WON0127	6/07/2019	622.0	19.3
RC18WON0127	5/07/2019	622.0	19.3
RC18WON0127	4/07/2019	622.0	19.3
RC18WON0127	3/07/2019	622.0	19.2
RC18WON0127	2/07/2019	622.0	19.3
RC18WON0127	1/07/2019	622.0	19.3
RC18WON0127	30/06/2019	622.0	19.3
RC18WON0127	29/06/2019	622.0	19.2
RC18WON0127	28/06/2019	622.0	19.2
RC18WON0127	27/06/2019	622.0	19.3
RC18WON0127	26/06/2019	622.0	19.3
RC18WON0127	25/06/2019	622.0	19.2
RC18WON0127	24/06/2019	622.0	19.3
RC18WON0127	23/06/2019	622.0	19.3
RC18WON0127	22/06/2019	622.0	19.3
RC18WON0127	21/06/2019	622.0	19.2
RC18WON0127	20/06/2019	622.0	19.3
RC18WON0127	19/06/2019	622.0	19.3
RC18WON0127	18/06/2019	622.0	19.3
RC18WON0127	17/06/2019	622.1	19.2
RC18WON0127	16/06/2019	622.1	19.2
RC18WON0127	15/06/2019	622.0	19.2
RC18WON0127	14/06/2019	622.0	19.2
RC18WON0127	13/06/2019	622.0	19.2
RC18WON0127	12/06/2019	622.1	19.2
RC18WON0127	11/06/2019	622.0	19.2
RC18WON0127	10/06/2019	622.0	19.3
RC18WON0127	9/06/2019	622.0	19.3
RC18WON0127	8/06/2019	622.0	19.3
RC18WON0127	7/06/2019	622.0	19.2
RC18WON0127	6/06/2019	622.1	19.2
RC18WON0127	5/06/2019	622.1	19.2
RC18WON0127	4/06/2019	622.1	19.2
RC18WON0127	3/06/2019	622.1	19.2
RC18WON0127	2/06/2019	622.1	19.2
RC18WON0127	1/06/2019	622.1	19.2
RC18WON0127	31/05/2019	622.1	19.2
RC18WON0127	30/05/2019	622.1	19.2
RC18WON0127	29/05/2019	622.1	19.2
RC18WON0127	28/05/2019	622.1	19.2
RC18WON0127	27/05/2019	622.0	19.2
RC18WON0127	26/05/2019	622.0	19.2
RC18WON0127	25/05/2019	622.0	19.2
RC18WON0127	24/05/2019	622.1	19.2
RC18WON0127	23/05/2019	622.1	19.2
RC18WON0127	22/05/2019	622.1	19.2
RC18WON0127	21/05/2019	622.1	19.2
RC18WON0127	20/05/2019	622.1	19.2
RC18WON0127	19/05/2019	622.0	19.2
RC18WON0127	18/05/2019	622.0	19.2
RC18WON0127	17/05/2019	622.0	19.2
RC18WON0127	16/05/2019	622.0	19.2
RC18WON0127	15/05/2019	622.1	19.2
RC18WON0127	14/05/2019	622.1	19.2
RC18WON0127	13/05/2019	622.1	19.2
RC18WON0127	12/05/2019	622.1	19.2
RC18WON0127	11/05/2019	622.1	19.2
RC18WON0127	10/05/2019	622.1	19.2
RC18WON0127	9/05/2019	622.1	19.2
RC18WON0127	8/05/2019	622.1	19.2
RC18WON0127	7/05/2019	622.1	19.2
RC18WON0127	6/05/2019	622.1	19.2
RC18WON0127	5/05/2019	622.1	19.2
RC18WON0127	4/05/2019	622.1	19.2
RC18WON0127	3/05/2019	622.1	19.2
RC18WON0127	2/05/2019	622.0	19.2
RC18WON0127	1/05/2019	622.0	19.3
RC18WON0127	30/04/2019	622.0	19.3
RC18WON0127	29/04/2019	622.0	19.2
RC18WON0127	28/04/2019	622.1	19.2
RC18WON0127	27/04/2019	622.1	19.2
RC18WON0127	26/04/2019	622.1	19.2
RC18WON0127	25/04/2019	622.1	19.2
RC18WON0127	24/04/2019	622.1	19.2
RC18WON0127	23/04/2019	622.1	19.2
RC18WON0127	22/04/2019	622.1	19.2
RC18WON0127	21/04/2019	622.1	19.2

ID	Date	WL mAHD	WL mbgl
MB18HD20004	14/06/2020	627.1	86.3
MB18HD20004	15/06/2020	627.1	86.3
MB18HD20004	16/06/2020	627.1	86.3
MB18HD20004	17/06/2020	627.1	86.3
MB18HD20004	18/06/2020	627.1	86.3
MB18HD20004	19/06/2020	627.1	86.3
MB18HD20004	20/06/2020	627.1	86.3
MB18HD20004	21/06/2020	627.1	86.3
MB18HD20004	22/06/2020	627.1	86.3
MB18HD20004	23/06/2020	627.1	86.3
MB18HD20004	24/06/2020	627.1	86.3
MB18HD20004	25/06/2020	627.1	86.3
MB18HD20004	26/06/2020	627.1	86.3
MB18HD20004	27/06/2020	627.1	86.3
MB18HD20004	28/06/2020	627.1	86.3
MB18HD20004	29/06/2020	627.1	86.3
MB18HD20004	30/06/2020	627.1	86.3
MB18HD20004	1/07/2020	627.1	86.3
MB18HD20004	2/07/2020	627.1	86.3
MB18HD20004	3/07/2020	627.1	86.3
MB18HD20004	4/07/2020	627.1	86.3
MB18HD20004	5/07/2020	627.1	86.3
MB18HD20004	6/07/2020	627.1	86.3
MB18HD20004	7/07/2020	627.1	86.3
MB18HD20004	8/07/2020	627.1	86.3
MB18HD20004	9/07/2020	627.1	86.3
MB18HD20004	10/07/2020	627.1	86.3
MB18HD20004	11/07/2020	627.1	86.3
MB18HD20004	12/07/2020	627.1	86.3
MB18HD20004	13/07/2020	627.1	86.3
MB18HD20004	14/07/2020	627.1	86.3
MB18HD20004	15/07/2020	627.1	86.3
MB18HD20004	16/07/2020	627.1	86.3
MB18HD20004	17/07/2020	627.1	86.4
MB18HD20004	18/07/2020	627.1	86.4
MB18HD20004	19/07/2020	627.1	86.3
MB18HD20004	20/07/2020	627.1	86.3
MB18HD20004	21/07/2020	627.1	86.3
MB18HD20004	22/07/2020	627.1	86.3
MB18HD20004	23/07/2020	627.1	86.3
MB18HD20004	24/07/2020	627.1	86.3
MB18HD20004	25/07/2020	627.1	86.3
MB18HD20004	26/07/2020	627.1	86.3
MB18HD20004	27/07/2020	627.1	86.3
MB18HD20004	28/07/2020	627.1	86.3
MB18HD20004	29/07/2020	627.1	86.3
MB18HD20004	30/07/2020	627.1	86.3
MB18HD20004	31/07/2020	627.1	86.3
MB18HD20004	1/08/2020	627.1	86.3
MB18HD20004	2/08/2020	627.1	86.3
MB18HD20004	3/08/2020	627.1	86.4
MB18HD20004	4/08/2020	627.0	86.4
MB18HD20004	5/08/2020	627.1	86.4
MB18HD20004	6/08/2020	627.1	86.4
MB18HD20004	7/08/2020	627.1	86.3
MB18HD20004	8/08/2020	627.1	86.3
MB18HD20004	9/08/2020	627.1	86.4
MB18HD20004	10/08/2020	627.0	86.4
MB18HD20004	11/08/2020	627.1	86.4
MB18HD20004	12/08/2020	627.1	86.4
MB18HD20004	13/08/2020	627.1	86.4
MB18HD20004	14/08/2020	627.1	86.4
MB18HD20004	15/08/2020	627.1	86.4
MB18HD20004	16/08/2020	627.1	86.4
MB18HD20004	17/08/2020	627.1	86.4
MB18HD20004	18/08/2020	627.1	86.4
MB18HD20004	19/08/2020	627.1	86.4
MB18HD20004	20/08/2020	627.1	86.4
MB18HD20004	21/08/2020	627.1	86.3
MB18HD20004	22/08/2020	627.1	86.3
MB18HD20004	23/08/2020	627.1	86.3
MB18HD20004	24/08/2020	627.1	86.3
MB18HD20004	25/08/2020	627.1	86.3
MB18HD20004	26/08/2020	627.1	86.3
MB18HD20004	27/08/2020	627.1	86.3
MB18HD20004	28/08/2020	627.1	86.3
MB18HD20004	29/08/2020	627.1	86.3
MB18HD20004	30/08/2020	627.1	86.3
MB18HD20004	31/08/2020	627.1	86.3
MB18HD20004	1/09/2020	627.1	86.4
MB18HD20004	2/09/2020	627.1	86.4
MB18HD20004	3/09/2020	627.1	86.4
MB18HD20004	4/09/2020	627.1	86.4
MB18HD20004	5/09/2020	627.1	86.4
MB18HD20004	6/09/2020	627.1	86.4
MB18HD20004	7/09/2020	627.1	86.4
MB18HD20004	8/09/2020	627

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	3/04/2018	704.2	-18.0
HDVP1	2/04/2018	704.2	-18.0
HDVP1	1/04/2018	642.8	43.4
HDVP1	31/03/2018	642.8	43.4
HDVP1	30/03/2018	642.8	43.4
HDVP1	29/03/2018	642.8	43.4
HDVP1	28/03/2018	642.8	43.4
HDVP1	27/03/2018	642.8	43.4
HDVP1	26/03/2018	642.8	43.4
HDVP1	25/03/2018	642.8	43.4
HDVP1	24/03/2018	642.8	43.4
HDVP1	23/03/2018	642.8	43.4
HDVP1	22/03/2018	642.8	43.4
HDVP1	21/03/2018	642.8	43.4
HDVP1	20/03/2018	642.8	43.4
HDVP1	19/03/2018	642.8	43.4
HDVP1	18/03/2018	642.8	43.4
HDVP1	17/03/2018	642.8	43.4
HDVP1	16/03/2018	642.8	43.4
HDVP1	15/03/2018	642.8	43.4
HDVP1	14/03/2018	642.8	43.4
HDVP1	13/03/2018	642.8	43.4
HDVP1	12/03/2018	642.8	43.4
HDVP1	11/03/2018	642.8	43.4
HDVP1	10/03/2018	642.8	43.4
HDVP1	9/03/2018	642.8	43.4
HDVP1	8/03/2018	642.8	43.4
HDVP1	7/03/2018	642.8	43.4
HDVP1	6/03/2018	642.8	43.4
HDVP1	5/03/2018	642.8	43.4
HDVP1	4/03/2018	642.8	43.4
HDVP1	3/03/2018	642.8	43.4
HDVP1	2/03/2018	642.8	43.4
HDVP1	1/03/2018	710.7	-24.5
HDVP1	28/02/2018	710.7	-24.5
HDVP1	27/02/2018	710.7	-24.5
HDVP1	26/02/2018	710.7	-24.5
HDVP1	25/02/2018	710.7	-24.5
HDVP1	24/02/2018	710.7	-24.5
HDVP1	23/02/2018	710.7	-24.5
HDVP1	22/02/2018	710.7	-24.5
HDVP1	21/02/2018	710.7	-24.5
HDVP1	20/02/2018	710.7	-24.5
HDVP1	19/02/2018	710.7	-24.5
HDVP1	18/02/2018	710.7	-24.5
HDVP1	17/02/2018	710.7	-24.5
HDVP1	16/02/2018	710.7	-24.5
HDVP1	15/02/2018	710.7	-24.5
HDVP1	14/02/2018	710.7	-24.5
HDVP1	13/02/2018	710.7	-24.5
HDVP1	12/02/2018	710.7	-24.5
HDVP1	11/02/2018	710.7	-24.5
HDVP1	10/02/2018	710.7	-24.5
HDVP1	9/02/2018	710.7	-24.5
HDVP1	8/02/2018	710.7	-24.5
HDVP1	7/02/2018	710.7	-24.5
HDVP1	6/02/2018	710.7	-24.5
HDVP1	5/02/2018	710.7	-24.5
HDVP1	4/02/2018	710.7	-24.5
HDVP1	3/02/2018	710.7	-24.5
HDVP1	2/02/2018	710.7	-24.5
HDVP1	1/02/2018	710.7	-24.5
HDVP1	31/01/2018	710.7	-24.5
HDVP1	30/01/2018	710.7	-24.5
HDVP1	29/01/2018	710.7	-24.5
HDVP1	28/01/2018	710.7	-24.5
HDVP1	27/01/2018	710.7	-24.5
HDVP1	26/01/2018	710.7	-24.5
HDVP1	25/01/2018	710.7	-24.5
HDVP1	24/01/2018	710.7	-24.5
HDVP1	23/01/2018	710.7	-24.5
HDVP1	22/01/2018	710.7	-24.5
HDVP1	21/01/2018	710.7	-24.5
HDVP1	20/01/2018	710.7	-24.5
HDVP1	19/01/2018	710.7	-24.5
HDVP1	18/01/2018	710.7	-24.5
HDVP1	17/01/2018	710.7	-24.5
HDVP1	16/01/2018	710.7	-24.5
HDVP1	15/01/2018	710.7	-24.5
HDVP1	14/01/2018	710.7	-24.5
HDVP1	13/01/2018	710.7	-24.5
HDVP1	12/01/2018	710.7	-24.5
HDVP1	11/01/2018	710.7	-24.5
HDVP1	10/01/2018	710.7	-24.5
HDVP1	9/01/2018	710.7	-24.5
HDVP1	8/01/2018	710.7	-24.5
HDVP1	7/01/2018	710.7	-24.5
HDVP1	6/01/2018	710.7	-24.5
HDVP1	5/01/2018	710.7	-24.5
HDVP1	4/01/2018	710.7	-24.5
HDVP1	3/01/2018	710.7	-24.5
HDVP1	2/01/2018	658.9	27.3
HDVP1	1/01/2018	658.9	27.3
HDVP1	31/12/2017	658.9	27.3
HDVP1	30/12/2017	658.9	27.3
HDVP1	29/12/2017	658.9	27.3
HDVP1	28/12/2017	658.9	27.3
HDVP1	27/12/2017	658.9	27.3
HDVP1	26/12/2017	658.9	27.3
HDVP1	25/12/2017	658.9	27.3
HDVP1	24/12/2017	658.9	27.3
HDVP1	23/12/2017	658.9	27.3
HDVP1	22/12/2017	658.9	27.3
HDVP1	21/12/2017	658.9	27.3
HDVP1	20/12/2017	658.9	27.3
HDVP1	19/12/2017	658.9	27.3
HDVP1	18/12/2017	658.9	27.3
HDVP1	17/12/2017	658.9	27.3
HDVP1	16/12/2017	658.9	27.3
HDVP1	15/12/2017	658.9	27.3
HDVP1	14/12/2017	658.9	27.3
HDVP1	13/12/2017	658.9	27.3
HDVP1	12/12/2017	658.9	27.3
HDVP1	11/12/2017	658.9	27.3
HDVP1	10/12/2017	658.9	27.3
HDVP1	9/12/2017	658.9	27.3
HDVP1	8/12/2017	658.9	27.3
HDVP1	7/12/2017	658.9	27.3
HDVP1	6/12/2017	658.9	27.3
HDVP1	5/12/2017	658.9	27.3
HDVP1	4/12/2017	658.9	27.3
HDVP1	3/12/2017	658.9	27.3
HDVP1	2/12/2017	658.9	27.3
HDVP1	1/12/2017	658.9	27.3
HDVP1	30/11/2017	658.9	27.3
HDVP1	29/11/2017	658.9	27.3
HDVP1	28/11/2017	658.9	27.3
HDVP1	27/11/2017	658.9	27.3
HDVP1	26/11/2017	658.9	27.3
HDVP1	25/11/2017	658.9	27.3
HDVP1	24/11/2017	658.9	27.3
HDVP1	23/11/2017	658.9	27.3
HDVP1	22/11/2017	658.9	27.3
HDVP1	21/11/2017	658.9	27.3
HDVP1	20/11/2017	658.9	27.3
HDVP1	19/11/2017	658.9	27.3

ID	Date	WL mAHD	WL mbgl
MB16H1SW0001	27/05/2019	620.5	38.2
MB16H1SW0001	26/05/2019	620.5	38.2
MB16H1SW0001	25/05/2019	620.5	38.2
MB16H1SW0001	24/05/2019	620.5	38.2
MB16H1SW0001	23/05/2019	620.5	38.2
MB16H1SW0001	22/05/2019	620.5	38.2
MB16H1SW0001	21/05/2019	620.5	38.2
MB16H1SW0001	20/05/2019	620.5	38.2
MB16H1SW0001	19/05/2019	620.5	38.2
MB16H1SW0001	18/05/2019	620.5	38.2
MB16H1SW0001	17/05/2019	620.5	38.2
MB16H1SW0001	16/05/2019	620.5	38.2
MB16H1SW0001	15/05/2019	620.5	38.2
MB16H1SW0001	14/05/2019	620.5	38.1
MB16H1SW0001	13/05/2019	620.5	38.1
MB16H1SW0001	12/05/2019	620.5	38.1
MB16H1SW0001	11/05/2019	620.5	38.1
MB16H1SW0001	10/05/2019	620.5	38.1
MB16H1SW0001	9/05/2019	620.5	38.1
MB16H1SW0001	8/05/2019	620.5	38.2
MB16H1SW0001	7/05/2019	620.5	38.2
MB16H1SW0001	6/05/2019	620.5	38.2
MB16H1SW0001	5/05/2019	620.5	38.2
MB16H1SW0001	4/05/2019	620.5	38.2
MB16H1SW0001	3/05/2019	620.5	38.2
MB16H1SW0001	2/05/2019	620.5	38.2
MB16H1SW0001	1/05/2019	620.5	38.2
MB16H1SW0001	30/04/2019	620.5	38.2
MB16H1SW0001	29/04/2019	620.5	38.2
MB16H1SW0001	28/04/2019	620.5	38.2
MB16H1SW0001	27/04/2019	620.5	38.2
MB16H1SW0001	26/04/2019	620.5	38.2
MB16H1SW0001	25/04/2019	620.5	38.2
MB16H1SW0001	24/04/2019	620.5	38.2
MB16H1SW0001	23/04/2019	620.5	38.2
MB16H1SW0001	22/04/2019	620.5	38.2
MB16H1SW0001	21/04/2019	620.5	38.1
MB16H1SW0001	20/04/2019	620.5	38.2
MB16H1SW0001	19/04/2019	620.4	38.2
MB16H1SW0001	18/04/2019	620.5	38.2
MB16H1SW0001	17/04/2019	620.5	38.2
MB16H1SW0001	16/04/2019	620.5	38.2
MB16H1SW0001	15/04/2019	620.4	38.2
MB16H1SW0001	14/04/2019	620.5	38.2
MB16H1SW0001	13/04/2019	620.5	38.2
MB16H1SW0001	12/04/2019	620.5	38.2
MB16H1SW0001	11/04/2019	620.5	38.2
MB16H1SW0001	10/04/2019	620.5	38.2
MB16H1SW0001	9/04/2019	620.5	38.2
MB16H1SW0001	8/04/2019	620.5	38.2
MB16H1SW0001	7/04/2019	620.5	38.2
MB16H1SW0001	6/04/2019	620.5	38.2
MB16H1SW0001	5/04/2019	620.5	38.2
MB16H1SW0001	4/04/2019	620.5	38.2
MB16H1SW0001	3/04/2019	620.5	38.2
MB16H1SW0001	1/04/2019	620.5	38.1
MB16H1SW0001	31/03/2019	620.5	38.1
MB16H1SW0001	30/03/2019	620.5	38.1
MB16H1SW0001	29/03/2019	620.5	38.1
MB16H1SW0001	28/03/2019	620.5	38.1
MB16H1SW0001	27/03/2019	620.5	38.1
MB16H1SW0001	26/03/2019	620.5	38.1
MB16H1SW0001	25/03/2019	620.5	38.2
MB16H1SW0001	24/03/2019	620.5	38.2
MB16H1SW0001	23/03/2019	620.5	38.2
MB16H1SW0001	22/03/2019	620.5	38.2
MB16H1SW0001	21/03/2019	620.5	38.2
MB16H1SW0001	20/03/2019	620.5	38.2
MB16H1SW0001	19/03/2019	620.5	38.1
MB16H1SW0001	18/03/2019	620.5	38.1
MB16H1SW0001	17/03/2019	620.5	38.1
MB16H1SW0001	16/03/2019	620.5	38.1
MB16H1SW0001	15/03/2019	620.5	38.1
MB16H1SW0001	14/03/2019	620.5	38.1
MB16H1SW0001	13/03/2019	620.5	38.1
MB16H1SW0001	12/03/2019	620.5	38.1
MB16H1SW0001	11/03/2019	620.5	38.1
MB16H1SW0001	10/03/2019	620.5	38.1
MB16H1SW0001	16/08/2018	620.5	38.2
MB16H1SW0001	5/09/2017	620.6	38.1
MB16H1SW0001	4/09/2017	620.6	38.1
MB16H1SW0001	3/09/2017	620.5	38.1
MB16H1SW0001	2/09/2017	620.5	38.1
MB16H1SW0001	1/09/2017	620.5	38.1
MB16H1SW0001	31/08/2017	620.5	38.1
MB16H1SW0001	30/08/2017	620.5	38.1
MB16H1SW0001	29/08/2017	620.5	38.1
MB16H1SW0001	28/08/2017	620.5	38.1
MB16H1SW0001	27/08/2017	620.5	38.1
MB16H1SW0001	26/08/2017	620.5	38.1
MB16H1SW0001	25/08/2017	620.5	38.1
MB16H1SW0001	24/08/2017	620.5	38.1
MB16H1SW0001	23/08/2017	620.5	38.1
MB16H1SW0001	22/08/2017	620.5	38.1
MB16H1SW0001	21/08/2017	620.5	38.1
MB16H1SW0001	20/08/2017	620.5	38.1
MB16H1SW0001	19/08/2017	620.5	38.1
MB16H1SW0001	18/08/2017	620.5	38.1
MB16H1SW0001	17/08/2017	620.5	38.1
MB16H1SW0001	16/08/2017	620.5	38.1
MB16H1SW0001	15/08/2017	620.5	38.1
MB16H1SW0001	14/08/2017	620.5	38.1
MB16H1SW0001	13/08/2017	620.5	38.1
MB16H1SW0001	12/08/2017	620.5	38.1
MB16H1SW0001	11/08/2017	620.5	38.1
MB16H1SW0001	10/08/2017	620.5	38.1
MB16H1SW0001	9/08/2017	620.5	38.1
MB16H1SW0001	8/08/2017	620.5	38.1
MB16H1SW0001	7/08/2017	620.5	38.1
MB16H1SW0001	6/08/2017	620.6	38.1
MB16H1SW0001	5/08/2017	620.6	38.1
MB16H1SW0001	4/08/2017	620.6	38.1
MB16H1SW0001	3/08/2017	620.6	38.1
MB16H1SW0001	2/08/2017	620.6	38.1
MB16H1SW0001	1/08/2017	620.6	38.1
MB16H1SW0001	31/07/2017	620.6	38.1
MB16H1SW0001	30/07/2017	620.6	38.1
MB16H1SW0001	29/07/2017	620.6	38.1
MB16H1SW0001	28/07/2017	620.5	38.1
MB16H1SW0001	27/07/2017	620.5	38.1
MB16H1SW0001	26/07/2017	620.6	38.1
MB16H1SW0001	25/07/2017	620.6	38.1
MB16H1SW0001	24/07/2017	620.6	38.1
MB16H1SW0001	23/07/2017	620.6	38.1
MB16H1SW0001	22/07/2017	620.6	38.1
MB16H1SW0001	21/07/2017	620.5	38.1
MB16H1SW0001	20/07/2017	620.5	38.1
MB16H1SW0001	19/07/2017	620.6	38.1
MB16H1SW0001	18/07/2017	620.6	38.1
MB16H1SW0001	17/07/2017	620.6	38.1
MB16H1SW0001	13/07/2017	620.6	38.1
MB16H1SW0001	11/07/2017	620.6	38.1
MB16H1SW0001	5/12/2016	620.5	38.2
MB16H1SW0001	23/04/2016	620.9	37.7
MB17H1SW0001	19/08/2019	600.2	58.6
MB17H1SW0001	18/08/2019	600.2	58.6

ID	Date	WL mAHD	WL mbgl
RC18WON0127	20/04/2019	622.0	19.2
RC18WON0127	19/04/2019	622.0	19.2
RC18WON0127	18/04/2019	622.0	19.3
RC18WON0127	17/04/2019	622.0	19.2
RC18WON0127	16/04/2019	622.0	19.3
RC18WON0127	15/04/2019	622.0	19.3
RC18WON0127	14/04/2019	622.0	19.3
RC18WON0127	13/04/2019	622.0	19.3
RC18WON0127	12/04/2019	622.0	19.3
RC18WON0127	11/04/2019	622.0	19.3
RC18WON0127	10/04/2019	622.0	19.3
RC18WON0127	9/04/2019	622.0	19.2
RC18WON0127	8/04/2019	622.0	19.3
RC18WON0127	7/04/2019	622.0	19.3
RC18WON0127	6/04/2019	622.0	19.2
RC18WON0127	5/04/2019	622.0	19.2
RC18WON0127	4/04/2019	622.0	19.2
RC18WON0127	3/04/2019	622.0	19.3
RC18WON0127	2/04/2019	622.0	19.3
RC18WON0127	1/04/2019	622.0	19.3
RC18WON0127	31/03/2019	622.0	19.3
RC18WON0127	30/03/2019	622.0	19.3
RC18WON0127	29/03/2019	622.0	19.3
RC18WON0127	28/03/2019	622.0	19.3
RC18WON0127	27/03/2019	622.0	19.3
RC18WON0127	26/03/2019	622.0	19.3
RC18WON0127	25/03/2019	622.0	19.3
RC18WON0127	24/03/2019	622.0	19.3
RC18WON0127	23/03/2019	622.0	19.3
RC18WON0127	22/03/2019	622.0	19.3
RC18WON0127	21/03/2019	622.0	19.3
RC18WON0127	20/03/2019	622.0	19.3
RC18WON0127	19/03/2019	622.0	19.3
RC18WON0127	18/03/2019	622.0	19.3
RC18WON0127	17/03/2019	622.0	19.3
RC18WON0127	16/03/2019	622.0	19.3
RC18WON0127	15/03/2019	622.0	19.3
RC18WON0127	14/03/2019	622.0	19.2
RC18WON0127	13/03/2019	622.0	19.2
RC18WON0127	12/03/2019	622.0	19.2
RC18WON0127	11/03/2019	622.0	19.3
RC18WON0127	10/03/2019	622.0	19.3
RC18WON0127	9/03/2019	622.0	19.3
RC18WON0127	8/03/2019	622.0	19.3
RC18WON0127	7/03/2019	622.0	19.3
RC18WON0127	6/03/2019	622.0	19.3
RC18WON0127	5/03/2019	622.0	19.3
RC18WON0127	4/03/2019	622.0	19.2
RC18WON0127	3/03/2019	622.0	19.3
RC18WON0127	2/03/2019	622.0	19.3
RC18WON0127	1/03/2019	622.0	19.3
RC18WON0127	28/02/2019	622.0	19.3
RC18WON0127	27/02/2019	622.0	19.3
RC18WON0127	26/02/2019	622.0	19.3
RC18WON0127	25/02/2019	622.0	19.2
RC18WON0127	24/02/2019	622.0	19.3
RC18WON0127	23/02/2019	622.0	19.3
RC18WON0127	22/02/2019	622.0	19.2
RC18WON0127	21/02/2019	622.0	19.3
RC18WON0127	20/02/2019	622.0	19.3
RC18WON0127	19/02/2019	622.0	19.3
RC18WON0127	18/02/2019	622.0	19.3
RC18WON0127	17/02/2019	622.0	19.3
RC18WON0127	16/02/2019	622.0	19.3
RC18WON0127	15/02/2019	622.0	19.2
RC18WON0127	14/02/2019	622.0	19.3
RC18WON0127	13/02/2019	622.0	19.3
RC18WON0127	12/02/2019	622.0	19.3
RC18WON0127	11/02/2019	622.0	19.3
RC18WON0127	10/02/2019	622.0	19.2
RC18WON0127	9/02/2019	622.0	19.2
RC18WON0127	8/02/2019	622.0	19.2
RC18WON0127	7/02/2019	622.0	19.3
RC18WON0127	6/02/2019	622.0	19.3
RC18WON0127	5/02/2019	622.0	19.3
RC18WON0127	4/02/2019	622.0	19.3
RC18WON0127	3/02/2019	622.0	19.3
RC18WON0127	2/02/2019	622.0	19.3
RC18WON0127	1/02/2019	622.0	19.3
RC18WON0127	31/01/2019	622.0	19.3
RC18WON0127	30/01/2019	622.0	19.3
RC18WON0127	29/01/2019	622.0	19.3
RC18WON0127	28/01/2019	622.0	19.3
RC18WON0127	27/01/2019	622.0	19.3
RC18WON0127	26/01/2019	622.0	19.3
RC18WON0127	25/01/2019	622.0	19.3
RC18WON0127	24/01/2019	622.0	19.3
RC18WON0127	23/01/2019	622.0	19.3
RC18WON0127	22/01/2019	622.0	19.3
RC18WON0127	21/01/2019	622.0	19.3
RC18WON0127	20/01/2019	622.0	19.3
RC18WON0127	19/01/2019	622.0	19.3
RC18WON0127	18/01/2019	622.0	19.3
RC18WON0127	17/01/2019	622.0	19.3
RC18WON0127	16/01/2019	622.0	19.3
RC18WON0127	15/01/2019	622.0	19.3
RC18WON0127	14/01/2019	622.0	19.3
RC18WON0127	13/01/2019	622.0	19.3
RC18WON0127	12/01/2019	622.0	19.2
RC18WON0127	11/01/2019	622.0	19.3
RC18WON0127	10/01/2019	622.0	19.3
RC18WON0127	9/01/2019	622.0	19.3
RC18WON0127	8/01/2019	622.1	19.2
RC18WON0127	7/01/2019	622.1	19.2
RC18WON0127	6/01/2019	622.1	19.2
RC18WON0127	5/01/2019	622.1	19.2
RC18WON0127	4/01/2019	622.0	19.2
RC18WON0127	3/01/2019	622.0	19.3
RC18WON0127	2/01/2019	622.0	19.3
RC18WON0127	1/01/2019	622.0	19.3
RC18WON0127	31/12/2018	622.0	19.3
RC18WON0127	30/12/2018	622.0	19.3
RC18WON0127	29/12/2018	622.0	19.3
RC18WON0127	28/12/2018	622.0	19.3
RC18WON0127	27/12/2018	622.0	19.3
RC18WON0127	26/12/2018	622.0	19.2
RC18WON0127	25/12/2018	622.1	19.2
RC18WON0127	24/12/2018	622.1	19.2
RC18WON0127	23/12/2018	622.0	19.2
RC18WON0127	22/12/2018	622.1	19.2
RC18WON0127	21/12/2018	622.1	19.2
RC18WON0127	20/12/2018	622.1	19.2
RC18WON0127	19/12/2018	622.1	19.2
RC18WON0127	18/12/2018	622.1	19.2
RC18WON0127	17/12/2018	622.0	19.2
MB15HD20001	25/02/2016	628.1	86.7
MB15HD20001	2/05/2016	628.1	86.7
MB15HD20001	30/10/2016	628.1	86.7
MB15HD20001	19/02/2017	628.1	86.7
MB15HD20001	13/05/2017	628.1	86.7
MB15HD20001	21/08/2017	628.1	86.7
MB15HD20001	9/11/2017	628.1	86.7
MB15HD20001	12/04/2018	628.1	86.7
MB15HD20001	24/11/2018	628.0	86.8
MB15HD20001	25/11/2018	628.0	86.8
MB15HD20001	26/11/2018	628.0	86.8

ID	Date	WL mAHD	WL mbgl
MB18HD20004	28/10/2020	627.0	86.4
MB18HD20004	29/10/2020	627.0	86.4
MB18HD20004	30/10/2020	627.0	86.4
MB18HD20004	31/10/2020	627.0	86.4
MB18HD20004	1/11/2020	627.0	86.4
MB18HD20004	2/11/2020	627.0	86.4
MB18HD20004	3/11/2020	627.0	86.4
MB18HD20004	4/11/2020	627.1	86.4
MB18HD20004	5/11/2020	627.0	86.4
MB18HD20004	6/11/2020	627.0	86.4
MB18HD20004	7/11/2020	627.0	86.4
MB18HD20004	8/11/2020	627.0	86.4
MB18HD20004	9/11/2020	627.0	86.4
MB18HD20004	10/11/2020	627.0	86.4
MB18HD20004	11/11/2020	627.0	86.4
MB18HD20004	12/11/2020	627.0	86.4
MB18HD20004	13/11/2020	627.0	86.4
MB18HD20004	14/11/2020	627.0	86.4
MB18HD20004	15/11/2020	627.0	86.4
MB18HD20004	16/11/2020	627.0	86.4
MB18HD20004	17/11/2020	627.0	86.4
MB18HD20004	18/11/2020	627.0	86.4
MB18HD20004	19/11/2020	627.0	86.4
MB18HD20004	20/11/2020	627.0	86.4
MB18HD20004	21/11/2020	627.0	86.4
MB18HD20004	22/11/2020	627.0	86.4
MB18HD20004	23/11/2020	627.0	86.4
MB18HD20004	24/11/2020	627.0	86.4
MB18HD20004	25/11/2020	627.0	86.4
MB18HD20004	26/11/2020	627.0	86.4
MB18HD20004	27/11/2020	627.0	86.4
MB18HD20004	28/11/2020	627.0	86.4
MB18HD20004	29/11/2020	627.0	86.4
MB18HD20004	30/11/2020	627.0	86.4
MB18HD20004	1/12/2020	627.0	86.4
MB18HD20004	2/12/2020	627.0	86.4
MB18HD20004	3/12/2020	627.0	86.4
MB18HD20004	4/12/2020	627.0	86.4
MB18HD20004	5/12/2020	627.0	86.4
MB18HD20004	6/12/2020	627.0	86.4
MB18HD20004	7/12/2020	627.0	86.4
MB18HD20004	8/12/2020	627.0	86.4
MB18HD20004	9/12/2020	627.0	86.4
MB18HD20004	10/12/2020	627.0	86.5
MB18HD20004	11/12/2020	627.0	86.5
MB18HD20004	12/12/2020	627.0	86.5
MB18HD20004	13/12/2020	627.0	86.5
MB18HD20004	14/12/2020	627.0	86.5
MB18HD20004	15/12/2020	627.0	86.5
MB18HD20004	16/12/2020	627.0	86.5
MB18HD20004	17/12/2020	627.0	86.5
MB18HD20004	18/12/2020	627.0	86.5
MB18HD20004	19/12/2020	627.0	86.5
MB18HD20004	20/12/2020	627.0	86.5
MB18HD20004	21/12/2020	627.0	86.5
MB18HD20004	22/12/2020	627.0	86.4
MB18HD20004	23/12/2020	627.0	86.4
MB18HD20004	24/12/2020	627.0	86.4
MB18HD20004	25/12/2020	627.0	86.4
MB18HD20004	26/12/2020	627.0	86.4
MB18HD20004	27/12/2020	627.0	86.5
MB18HD20004	28/12/2020	627.0	86.5
MB18HD20004	29/12/2020	627.0	86.5
MB18HD20004	30/12/2020	627.0	86.5
MB18HD20004	31/12/2020	627.0	86.5
MB18HD20004	1/01/2021	627.0	86.5
MB18HD20004	2/01/2021	627.0	86.5
MB18HD20004	3/01/2021	627.0	86.5
MB18HD20004	4/01/2021	627.0	86.5
MB18HD20004	5/01/2021	627.0	86.5
MB18HD20004	6/01/2021	627.0	86.4
MB18HD20004	7/01/2021	627.0	86.4
MB18HD20004	8/01/2021	627.0	86.4
MB18HD20004	9/01/2021	627.0	86.4
MB18HD20004	10/01/2021	627.0	86.4
MB18HD20004	11/01/2021	627.0	86.4
MB18HD20004	12/01/2021	627.0	86.5
MB18HD20004	13/01/2021	627.0	86.5
MB18HD20004	14/01/2021	627.0	86.5
MB18HD20004	15/01/2021	627.0	86.5
MB18HD20004	16/01/2021	627.0	86.5
MB18HD20004	17/01/2021	627.0	86.4
MB18HD20004	18/01/2021	627.0	86.4
MB18HD20004	19/01/2021	627.0	86.4
MB18HD20004	20/01/2021	627.0	86.4
MB18HD20004	21/01/2021	627.0	86.5
MB18HD20004	22/01/2021	627.0	86.5
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	18/11/2017	658.9	27.3
HDVP1	17/11/2017	658.9	27.3
HDVP1	16/11/2017	658.9	27.3
HDVP1	15/11/2017	658.9	27.3
HDVP1	14/11/2017	658.9	27.3
HDVP1	13/11/2017	658.9	27.3
HDVP1	12/11/2017	658.9	27.3
HDVP1	11/11/2017	658.9	27.3
HDVP1	10/11/2017	658.9	27.3
HDVP1	9/11/2017	658.9	27.3
HDVP1	8/11/2017	658.9	27.3
HDVP1	7/11/2017	658.9	27.3
HDVP1	6/11/2017	658.9	27.3
HDVP1	5/11/2017	658.9	27.3
HDVP1	4/11/2017	658.9	27.3
HDVP1	3/11/2017	658.9	27.3
HDVP1	2/11/2017	658.9	27.3
HDVP1	1/11/2017	513.4	172.8
HDVP1	31/10/2017	513.4	172.8
HDVP1	30/10/2017	513.4	172.8
HDVP1	29/10/2017	513.4	172.8
HDVP1	28/10/2017	513.4	172.8
HDVP1	27/10/2017	513.4	172.8
HDVP1	26/10/2017	513.4	172.8
HDVP1	25/10/2017	513.4	172.8
HDVP1	24/10/2017	513.4	172.8
HDVP1	23/10/2017	513.4	172.8
HDVP1	22/10/2017	513.4	172.8
HDVP1	21/10/2017	513.4	172.8
HDVP1	20/10/2017	513.4	172.8
HDVP1	19/10/2017	513.4	172.8
HDVP1	18/10/2017	513.4	172.8
HDVP1	17/10/2017	513.4	172.8
HDVP1	16/10/2017	513.4	172.8
HDVP1	15/10/2017	513.4	172.8
HDVP1	14/10/2017	513.4	172.8
HDVP1	13/10/2017	513.4	172.8
HDVP1	12/10/2017	513.4	172.8
HDVP1	11/10/2017	513.4	172.8
HDVP1	10/10/2017	513.4	172.8
HDVP1	9/10/2017	513.4	172.8
HDVP1	8/10/2017	513.4	172.8
HDVP1	7/10/2017	513.4	172.8
HDVP1	6/10/2017	513.4	172.8
HDVP1	5/10/2017	513.4	172.8
HDVP1	4/10/2017	513.4	172.8
HDVP1	3/10/2017	513.4	172.8
HDVP1	2/10/2017	513.4	172.8
HDVP1	1/10/2017	441.4	244.8
HDVP1	30/09/2017	441.4	244.8
HDVP1	29/09/2017	441.4	244.8
HDVP1	28/09/2017	441.4	244.8
HDVP1	27/09/2017	441.4	244.8
HDVP1	26/09/2017	441.4	244.8
HDVP1	25/09/2017	441.4	244.8
HDVP1	24/09/2017	441.4	244.8
HDVP1	23/09/2017	441.4	244.8
HDVP1	22/09/2017	441.4	244.8
HDVP1	21/09/2017	441.4	244.8
HDVP1	20/09/2017	441.4	244.8
HDVP1	19/09/2017	441.4	244.8
HDVP1	18/09/2017	441.4	244.8
HDVP1	17/09/2017	441.4	244.8
HDVP1	16/09/2017	441.4	244.8
HDVP1	15/09/2017	441.4	244.8
HDVP1	14/09/2017	441.4	244.8
HDVP1	13/09/2017	441.4	244.8
HDVP1	12/09/2017	441.4	244.8
HDVP1	11/09/2017	441.4	244.8
HDVP1	10/09/2017	441.4	244.8
HDVP1	9/09/2017	441.4	244.8
HDVP1	8/09/2017	441.4	244.8
HDVP1	7/09/2017	441.4	244.8
HDVP1	6/09/2017	441.4	244.8
HDVP1	5/09/2017	441.4	244.8
HDVP1	4/09/2017	441.4	244.8
HDVP1	3/09/2017	441.4	244.8
HDVP1	2/09/2017	441.4	244.8
HDVP1	1/09/2017	177.4	508.8
HDVP1	31/08/2017	177.4	508.8
HDVP1	30/08/2017	177.4	508.8
HDVP1	29/08/2017	177.4	508.8
HDVP1	28/08/2017	177.4	508.8
HDVP1	27/08/2017	177.4	508.8
HDVP1	26/08/2017	177.4	508.8
HDVP1	25/08/2017	177.4	508.8
HDVP1	24/08/2017	177.4	508.8
HDVP1	23/08/2017	177.4	508.8
HDVP1	22/08/2017	177.4	508.8
HDVP1	21/08/2017	177.4	508.8
HDVP1	20/08/2017	177.4	508.8
HDVP1	19/08/2017	177.4	508.8
HDVP1	18/08/2017	177.4	508.8
HDVP1	17/08/2017	177.4	508.8
HDVP1	16/08/2017	177.4	508.8
HDVP1	15/08/2017	177.4	508.8
HDVP1	14/08/2017	177.4	508.8
HDVP1	13/08/2017	177.4	508.8
HDVP1	12/08/2017	177.4	508.8
HDVP1	11/08/2017	177.4	508.8
HDVP1	10/08/2017	177.4	508.8
HDVP1	9/08/2017	177.4	508.8
HDVP1	8/08/2017	177.4	508.8
HDVP1	7/08/2017	177.4	508.8
HDVP1	6/08/2017	177.4	508.8
HDVP1	5/08/2017	177.4	508.8
HDVP1	4/08/2017	177.4	508.8
HDVP1	3/08/2017	177.4	508.8
HDVP1	2/08/2017	177.4	508.8
HDVP1	1/08/2017	369.5	316.7
HDVP1	31/07/2017	369.5	316.7
HDVP1	30/07/2017	369.5	316.7
HDVP1	29/07/2017	369.5	316.7
HDVP1	28/07/2017	369.5	316.7
HDVP1	27/07/2017	369.5	316.7
HDVP1	26/07/2017	369.5	316.7
HDVP1	25/07/2017	369.5	316.7
HDVP1	24/07/2017	369.5	316.7
HDVP1	23/07/2017	369.5	316.7
HDVP1	22/07/2017	369.5	316.7
HDVP1	21/07/2017	369.5	316.7
HDVP1	20/07/2017	369.5	316.7
HDVP1	19/07/2017	369.5	316.7
HDVP1	18/07/2017	369.5	316.7
HDVP1	17/07/2017	369.5	316.7
HDVP1	16/07/2017	369.5	316.7
HDVP1	15/07/2017	369.5	316.7
HDVP1	14/07/2017	369.5	316.7
HDVP1	13/07/2017	369.5	316.7
HDVP1	12/07/2017	369.5	316.7
HDVP1	11/07/2017	369.5	316.7
HDVP1	10/07/2017	369.5	316.7
HDVP1	9/07/2017	369.5	316.7
HDVP1	8/07/2017	369.5	316.7
HDVP1	7/07/2017	369.5	316.7
HDVP1	6/07/2017	369.5	316.7

ID	Date	WL mAHD	WL mbgl
MB17H1SW0001	17/08/2019	600.2	58.6
MB17H1SW0001	16/08/2019	600.2	58.6
MB17H1SW0001	15/08/2019	600.2	58.6
MB17H1SW0001	14/08/2019	600.2	58.5
MB17H1SW0001	13/08/2019	600.2	58.5
MB17H1SW0001	12/08/2019	600.2	58.5
MB17H1SW0001	11/08/2019	600.3	58.5
MB17H1SW0001	10/08/2019	600.3	58.4
MB17H1SW0001	9/08/2019	600.3	58.4
MB17H1SW0001	8/08/2019	600.3	58.4
MB17H1SW0001	7/08/2019	600.3	58.4
MB17H1SW0001	6/08/2019	600.3	58.4
MB17H1SW0001	5/08/2019	600.4	58.4
MB17H1SW0001	4/08/2019	600.4	58.3
MB17H1SW0001	3/08/2019	600.4	58.3
MB17H1SW0001	2/08/2019	600.3	58.4
MB17H1SW0001	1/08/2019	600.3	58.4
MB17H1SW0001	31/07/2019	600.3	58.4
MB17H1SW0001	30/07/2019	600.3	58.5
MB17H1SW0001	29/07/2019	600.3	58.5
MB17H1SW0001	28/07/2019	600.3	58.5
MB17H1SW0001	27/07/2019	600.2	58.5
MB17H1SW0001	26/07/2019	600.3	58.5
MB17H1SW0001	25/07/2019	600.3	58.5
MB17H1SW0001	24/07/2019	600.3	58.5
MB17H1SW0001	23/07/2019	600.3	58.5
MB17H1SW0001	22/07/2019	600.2	58.5
MB17H1SW0001	21/07/2019	600.3	58.5
MB17H1SW0001	20/07/2019	600.3	58.5
MB17H1SW0001	19/07/2019	600.3	58.5
MB17H1SW0001	18/07/2019	600.3	58.5
MB17H1SW0001	17/07/2019	600.3	58.5
MB17H1SW0001	16/07/2019	600.3	58.4
MB17H1SW0001	15/07/2019	600.3	58.4
MB17H1SW0001	14/07/2019	600.3	58.4
MB17H1SW0001	13/07/2019	600.3	58.4
MB17H1SW0001	12/07/2019	600.3	58.4
MB17H1SW0001	11/07/2019	600.3	58.4
MB17H1SW0001	10/07/2019	600.3	58.4
MB17H1SW0001	9/07/2019	600.3	58.4
MB17H1SW0001	8/07/2019	600.3	58.4
MB17H1SW0001	7/07/2019	600.3	58.4
MB17H1SW0001	6/07/2019	600.3	58.5
MB17H1SW0001	5/07/2019	600.3	58.5
MB17H1SW0001	4/07/2019	600.3	58.5
MB17H1SW0001	3/07/2019	600.3	58.5
MB17H1SW0001	2/07/2019	600.3	58.5
MB17H1SW0001	1/07/2019	600.3	58.5
MB17H1SW0001	30/06/2019	600.3	58.4
MB17H1SW0001	29/06/2019	600.3	58.4
MB17H1SW0001	28/06/2019	600.3	58.4
MB17H1SW0001	27/06/2019	600.3	58.5
MB17H1SW0001	26/06/2019	600.3	58.5
MB17H1SW0001	25/06/2019	600.3	58.5
MB17H1SW0001	24/06/2019	600.3	58.5
MB17H1SW0001	23/06/2019	600.3	58.5
MB17H1SW0001	22/06/2019	600.3	58.5
MB17H1SW0001	21/06/2019	600.3	58.5
MB17H1SW0001	20/06/2019	600.3	58.5
MB17H1SW0001	19/06/2019	600.3	58.5
MB17H1SW0001	18/06/2019	600.3	58.4
MB17H1SW0001	17/06/2019	600.3	58.4
MB17H1SW0001	16/06/2019	600.3	58.4
MB17H1SW0001	15/06/2019	600.3	58.4
MB17H1SW0001	14/06/2019	600.3	58.4
MB17H1SW0001	13/06/2019	600.3	58.4
MB17H1SW0001	12/06/2019	600.3	58.4
MB17H1SW0001	11/06/2019	600.3	58.5
MB17H1SW0001	10/06/2019	600.3	58.5
MB17H1SW0001	9/06/2019	600.3	58.5
MB17H1SW0001	8/06/2019	600.3	58.5
MB17H1SW0001	7/06/2019	600.3	58.5
MB17H1SW0001	6/06/2019	600.3	58.4
MB17H1SW0001	5/06/2019	600.3	58.4
MB17H1SW0001	4/06/2019	600.3	58.4
MB17H1SW0001	3/06/2019	600.3	58.4
MB17H1SW0001	2/06/2019	600.3	58.4
MB17H1SW0001	1/06/2019	600.3	58.4
MB17H1SW0001	31/05/2019	600.3	58.4
MB17H1SW0001	30/05/2019	600.3	58.4
MB17H1SW0001	29/05/2019	600.3	58.5
MB17H1SW0001	28/05/2019	600.3	58.5
MB17H1SW0001	27/05/2019	600.3	58.5
MB17H1SW0001	26/05/2019	600.3	58.5
MB17H1SW0001	25/05/2019	600.3	58.5
MB17H1SW0001	24/05/2019	600.3	58.5
MB17H1SW0001	23/05/2019	600.3	58.4
MB17H1SW0001	22/05/2019	600.3	58.4
MB17H1SW0001	21/05/2019	600.3	58.5
MB17H1SW0001	20/05/2019	600.3	58.4
MB17H1SW0001	19/05/2019	600.3	58.4
MB17H1SW0001	18/05/2019	600.3	58.5
MB17H1SW0001	17/05/2019	600.3	58.5
MB17H1SW0001	16/05/2019	600.3	58.5
MB17H1SW0001	15/05/2019	600.3	58.4
MB17H1SW0001	14/05/2019	600.3	58.4
MB17H1SW0001	13/05/2019	600.3	58.4
MB17H1SW0001	12/05/2019	600.3	58.4
MB17H1SW0001	11/05/2019	600.3	58.4
MB17H1SW0001	10/05/2019	600.3	58.4
MB17H1SW0001	9/05/2019	600.3	58.4
MB17H1SW0001	8/05/2019	600.3	58.4
MB17H1SW0001	7/05/2019	600.3	58.5
MB17H1SW0001	6/05/2019	600.3	58.5
MB17H1SW0001	5/05/2019	600.3	58.4
MB17H1SW0001	4/05/2019	600.3	58.4
MB17H1SW0001	3/05/2019	600.3	58.5
MB17H1SW0001	2/05/2019	600.3	58.5
MB17H1SW0001	1/05/2019	600.3	58.5
MB17H1SW0001	30/04/2019	600.3	58.5
MB17H1SW0001	29/04/2019	600.3	58.5
MB17H1SW0001	28/04/2019	600.3	58.5
MB17H1SW0001	27/04/2019	600.3	58.5
MB17H1SW0001	26/04/2019	600.3	58.5
MB17H1SW0001	25/04/2019	600.3	58.5
MB17H1SW0001	24/04/2019	600.3	58.5
MB17H1SW0001	23/04/2019	600.3	58.5
MB17H1SW0001	22/04/2019	600.3	58.5
MB17H1SW0001	21/04/2019	600.3	58.5
MB17H1SW0001	20/04/2019	600.3	58.5
MB17H1SW0001	19/04/2019	600.2	58.5
MB17H1SW0001	18/04/2019	600.3	58.5
MB17H1SW0001	17/04/2019	600.3	58.5
MB17H1SW0001	16/04/2019	600.2	58.5
MB17H1SW0001	15/04/2019	600.2	58.5
MB17H1SW0001	14/04/2019	600.3	58.5
MB17H1SW0001	13/04/2019	600.3	58.5
MB17H1SW0001	12/04/2019	600.3	58.5
MB17H1SW0001	11/04/2019	600.2	58.5
MB17H1SW0001	10/04/2019	600.2	58.5
MB17H1SW0001	9/04/2019	600.2	58.5
MB17H1SW0001	8/04/2019	600.2	58.5
MB17H1SW0001	7/04/2019	600.3	58.5
MB17H1SW0001	6/04/2019	600.3	58.5
MB17H1SW0001	5/04/2019	600.3	58.5
MB17H1SW0001	4/04/2019	600.3	58.5

ID	Date	WL mAHD	WL mbgl
MB15HD20001	27/11/2018	628.0	86.8
MB15HD20001	28/11/2018	628.0	86.8
MB15HD20001	29/11/2018	628.0	86.8
MB15HD20001	30/11/2018	628.0	86.8
MB15HD20001	1/12/2018	628.0	86.8
MB15HD20001	2/12/2018	628.0	86.8
MB15HD20001	3/12/2018	628.0	86.8
MB15HD20001	4/12/2018	628.1	86.8
MB15HD20001	5/12/2018	628.1	86.8
MB15HD20001	6/12/2018	628.0	86.8
MB15HD20001	7/12/2018	628.0	86.8
MB15HD20001	8/12/2018	628.0	86.8
MB15HD20001	9/12/2018	628.0	86.8
MB15HD20001	10/12/2018	628.0	86.8
MB15HD20001	11/12/2018	628.0	86.8
MB15HD20001	12/12/2018	628.0	86.8
MB15HD20001	13/12/2018	628.0	86.8
MB15HD20001	14/12/2018	628.0	86.8
MB15HD20001	15/12/2018	628.0	86.8
MB15HD20001	16/12/2018	628.0	86.9
MB15HD20001	17/12/2018	628.0	86.8
MB15HD20001	18/12/2018	628.0	86.8
MB15HD20001	19/12/2018	628.0	86.8
MB15HD20001	20/12/2018	628.0	86.8
MB15HD20001	21/12/2018	628.1	86.8
MB15HD20001	22/12/2018	628.1	86.8
MB15HD20001	23/12/2018	628.0	86.8
MB15HD20001	24/12/2018	628.0	86.8
MB15HD20001	25/12/2018	628.0	86.8
MB15HD20001	26/12/2018	628.0	86.8
MB15HD20001	27/12/2018	628.0	86.8
MB15HD20001	28/12/2018	628.0	86.9
MB15HD20001	29/12/2018	628.0	86.8
MB15HD20001	30/12/2018	628.0	86.8
MB15HD20001	31/12/2018	628.0	86.8
MB15HD20001	1/01/2019	628.0	86.8
MB15HD20001	2/01/2019	628.0	86.8
MB15HD20001	3/01/2019	628.0	86.8
MB15HD20001	4/01/2019	628.0	86.8
MB15HD20001	5/01/2019	628.0	86.8
MB15HD20001	6/01/2019	628.1	86.8
MB15HD20001	7/01/2019	628.1	86.8
MB15HD20001	8/01/2019	628.0	86.8
MB15HD20001	9/01/2019	628.0	86.8
MB15HD20001	10/01/2019	628.0	86.8
MB15HD20001	11/01/2019	628.0	86.8
MB15HD20001	12/01/2019	628.0	86.8
MB15HD20001	13/01/2019	628.0	86.8
MB15HD20001	14/01/2019	628.0	86.8
MB15HD20001	15/01/2019	628.0	86.8
MB15HD20001	16/01/2019	628.0	86.8
MB15HD20001	17/01/2019	628.0	86.8
MB15HD20001	18/01/2019	628.0	86.8
MB15HD20001	19/01/2019	628.0	86.8
MB15HD20001	20/01/2019	628.0	86.8
MB15HD20001	21/01/2019	628.0	86.8
MB15HD20001	22/01/2019	628.0	86.9
MB15HD20001	23/01/2019	628.0	86.9
MB15HD20001	24/01/2019	628.0	86.9
MB15HD20001	25/01/2019	628.0	86.9
MB15HD20001	26/01/2019	628.0	86.9
MB15HD20001	27/01/2019	628.0	86.8
MB15HD20001	28/01/2019	628.0	86.8
MB15HD20001	29/01/2019	628.0	86.8
MB15HD20001	30/01/2019	628.0	86.8
MB15HD20001	31/01/2019	628.0	86.8
MB15HD20001	1/02/2019	628.0	86.8
MB15HD20001	2/02/2019	628.0	86.8
MB15HD20001	3/02/2019	628.0	86.8
MB15HD20001	4/02/2019	628.0	86.8
MB15HD20001	5/02/2019	628.0	86.8
MB15HD20001	6/02/2019	628.0	86.9
MB15HD20001	7/02/2019	628.0	86.8
MB15HD20001	8/02/2019	628.0	86.8
MB15HD20001	9/02/2019	628.0	86.8
MB15HD20001	10/02/2019	628.0	86.8
MB15HD20001	11/02/2019	628.0	86.8
MB15HD20001	12/02/2019	628.0	86.8
MB15HD20001	13/02/2019	628.0	86.8
MB15HD20001	14/02/2019	628.0	86.8
MB15HD20001	15/02/2019	628.1	86.8
MB15HD20001	16/02/2019	628.1	86.8
MB15HD20001	17/02/2019	628.0	86.8
MB15HD20001	18/02/2019	628.0	86.8
MB15HD20001	19/02/2019	628.0	86.8
MB15HD20001	20/02/2019	628.0	86.8
MB15HD20001	21/02/2019	628.0	86.8
MB15HD20001	22/02/2019	628.0	86.8
MB15HD20001	23/02/2019	628.0	86.8
MB15HD20001	24/02/2019	628.0	86.8
MB15HD20001	25/02/2019	628.0	86.8
MB15HD20001	26/02/2019	628.1	86.8
MB15HD20001	27/02/2019	628.0	86.8
MB15HD20001	28/02/2019	628.0	86.8
MB15HD20001	1/03/2019	628.0	86.8
MB15HD20001	2/03/2019	628.0	86.8
MB15HD20001	3/03/2019	628.0	86.8
MB15HD20001	4/03/2019	628.1	86.8
MB15HD20001	5/03/2019	628.0	86.8
MB15HD20001	6/03/2019	628.0	86.8
MB15HD20001	7/03/2019	628.0	86.8
MB15HD20001	8/03/2019	628.0	86.8
MB15HD20001	9/03/2019	628.0	86.8
MB15HD20001	10/03/2019	628.0	86.8
MB15HD20001	11/03/2019	628.0	86.8
MB15HD20001	12/03/2019	628.0	86.8
MB15HD20001	13/03/2019	628.1	86.8
MB15HD20001	14/03/2019	628.1	86.8
MB15HD20001	15/03/2019	628.1	86.8
MB15HD20001	16/03/2019	628.0	86.8
MB15HD20001	17/03/2019	628.0	86.8
MB15HD20001	18/03/2019	628.0	86.8
MB15HD20001	19/03/2019	628.0	86.8
MB15HD20001	20/03/2019	628.0	86.8
MB15HD20001	21/03/2019	628.0	86.8
MB15HD20001	22/03/2019	628.0	86.8
MB15HD20001	23/03/2019	628.0	86.8
MB15HD20001	24/03/2019	628.0	86.9
MB15HD20001	25/03/2019	628.0	86.8
MB15HD20001	26/03/2019	628.0	86.8
MB15HD20001	27/03/2019	628.0	86.8
MB15HD20001	28/03/2019	628.0	86.8
MB15HD20001	29/03/2019	628.0	86.8
MB15HD20001	30/03/2019	628.1	86.8
MB15HD20001	31/03/2019	628.1	86.8
MB15HD20001	1/04/2019	628.1	86.8
MB15HD20001	2/04/2019	628.1	86.8
MB15HD20001	3/04/2019	628.1	86.8
MB15HD20001	4/04/2019	628.1	86.8
MB15HD20001	5/04/2019	628.1	86.8
MB15HD20001	6/04/2019	628.1	86.8
MB15HD20001	7/04/2019	628.1	86.8
MB15HD20001	8/04/2019	628.0	86.8
MB15HD20001	9/04/2019	628.0	86.8
MB15HD20001	10/04/2019	628.1	86.8
MB15HD20001	11/04/2019	628.1	86.8

ID	Date	WL mAHD	WL mbgl
MB18HD20004	13/03/2021	627.0	86.4
MB18HD20004	14/03/2021	627.0	86.4
MB18HD20004	15/03/2021	627.0	86.4
MB18HD20004	16/03/2021	627.0	86.4
MB18HD20004	17/03/2021	627.0	86.4
MB18HD20004	18/03/2021	627.0	86.4
MB18HD20004	19/03/2021	627.0	86.4
MB18HD20004	20/03/2021	627.0	86.4
MB18HD20004	21/03/2021	627.0	86.5
MB18HD20004	22/03/2021	627.0	86.5
MB18HD20004	23/03/2021	627.0	86.5
MB18HD20004	24/03/2021	627.0	86.5
MB18HD20004	25/03/2021	627.0	86.5
MB18HD20004	26/03/2021	627.0	86.5
MB18HD20004	27/03/2021	627.0	86.5
MB18HD20004	28/03/2021	627.0	86.4
MB18HD20004	29/03/2021	627.0	86.4
MB18HD20004	30/03/2021	627.0	86.4
MB18HD20004	31/03/2021	627.0	86.4
MB18HD20004	1/04/2021	627.0	86.4
MB18HD20004	2/04/2021	627.0	86.4
MB18HD20004	3/04/2021	627.0	86.4
MB18HD20004	4/04/2021	627.0	86.4
MB18HD20004	5/04/2021	627.0	86.4
MB18HD20004	6/04/2021	627.0	86.4
MB18HD20004	7/04/2021	627.0	86.4
MB18HD20004	8/04/2021	627.0	86.5
MB18HD20004	9/04/2021	627.0	86.5
MB18HD20004	10/04/2021	627.0	86.4
MB18HD20004	11/04/2021	627.0	86.4
MB18HD20004	12/04/2021	627.0	86.4
MB18HD20004	13/04/2021	627.0	86.4
MB18HD20004	14/04/2021	627.0	86.4
MB18HD20004	15/04/2021	627.0	86.4
MB18HD20004	16/04/2021	627.0	86.4
MB18HD20004	17/04/2021	627.0	86.4
MB18HD20004	18/04/2021	627.0	86.4
MB18HD20004	19/04/2021	627.0	86.4
MB18HD20004	20/04/2021	627.0	86.4
MB18HD20004	21/04/2021	627.0	86.4
MB18HD20004	22/04/2021	627.0	86.4
MB18HD20004	23/04/2021	627.0	86.4
MB18HD20004	24/04/2021	627.0	86.4
MB18HD20004	25/04/2021	627.0	86.4
MB18HD20004	26/04/2021	627.0	86.4
MB18HD20004	27/04/2021	627.1	86.4
MB18HD20004	28/04/2021	627.1	86.4
MB18HD20004	29/04/2021	627.0	86.4
MB18HD20004	30/04/2021	627.0	86.4
MB18HD20004	1/05/2021	627.0	86.4
MB18HD20004	2/05/2021	627.0	86.4
MB18HD20004	3/05/2021	627.0	86.4
MB18HD20004	4/05/2021	627.0	86.4
MB18HD20004	5/05/2021	627.0	86.4
MB18HD20004	6/05/2021	627.0	86.4
MB18HD20004	7/05/2021	627.0	86.4
MB18HD20004	8/05/2021	627.0	86.4
MB18HD20004	9/05/2021	627.0	86.4
MB18HD20004	10/05/2021	627.0	86.4
MB18HD20004	11/05/2021	627.0	86.4
MB18HD20004	12/05/2021	627.0	86.4
MB18HD20004	13/05/2021	627.0	86.4
MB18HD20004	14/05/2021	627.0	86.4
MB18HD20004	15/05/2021	627.1	86.4
MB18HD20004	16/05/2021	627.0	86.4
MB18HD20004	17/05/2021	627.0	86.4
MB18HD20004	18/05/2021	627.0	86.4
MB18HD20004	19/05/2021	627.0	86.4
MB18HD20004	20/05/2021	627.0	86.4
MB18HD20004	21/05/2021	627.0	86.4
MB18HD20004	22/05/2021	627.0	86.4
MB18HD20004	23/05/2021	627.0	86.4
MB18HD20004	24/05/2021	627.0	86.4
MB18HD20004	25/05/2021	627.0	86.4
MB18HD20004	26/05/2021	627.1	86.4
MB18HD20004	27/05/2021	627.1	86.4
MB18HD20004	28/05/2021	627.1	86.4
MB18HD20004	29/05/2021	627.0	86.4
MB18HD20004	30/05/2021	627.0	86.4
MB18HD20004	31/05/2021	627.0	86.4
MB18HD20004	1/06/2021	627.0	86.4
MB18HD20004	2/06/2021	627.0	86.4
MB18HD20004	3/06/2021	627.1	86.4
MB18HD20004	4/06/2021	627.1	86.4
MB18HD20004	5/06/2021	627.1	86.4
MB18HD20004	6/06/2021	627.0	86.4
MB18HD20004	7/06/2021	627.0	86.4
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	5/07/2017	369.5	316.7
HDVP1	4/07/2017	369.5	316.7
HDVP1	3/07/2017	369.5	316.7
HDVP1	2/07/2017	369.5	316.7
HDVP1	1/07/2017	455.6	230.6
HDVP1	30/06/2017	455.6	230.6
HDVP1	29/06/2017	455.6	230.6
HDVP1	28/06/2017	455.6	230.6
HDVP1	27/06/2017	455.6	230.6
HDVP1	26/06/2017	455.6	230.6
HDVP1	25/06/2017	455.6	230.6
HDVP1	24/06/2017	455.6	230.6
HDVP1	23/06/2017	455.6	230.6
HDVP1	22/06/2017	455.6	230.6
HDVP1	21/06/2017	455.6	230.6
HDVP1	20/06/2017	455.6	230.6
HDVP1	19/06/2017	455.6	230.6
HDVP1	18/06/2017	455.6	230.6
HDVP1	17/06/2017	455.6	230.6
HDVP1	16/06/2017	455.6	230.6
HDVP1	15/06/2017	455.6	230.6
HDVP1	14/06/2017	455.6	230.6
HDVP1	13/06/2017	455.6	230.6
HDVP1	12/06/2017	455.6	230.6
HDVP1	11/06/2017	455.6	230.6
HDVP1	10/06/2017	455.6	230.6
HDVP1	9/06/2017	455.6	230.6
HDVP1	8/06/2017	455.6	230.6
HDVP1	7/06/2017	455.6	230.6
HDVP1	6/06/2017	455.6	230.6
HDVP1	5/06/2017	455.6	230.6
HDVP1	4/06/2017	455.6	230.6
HDVP1	3/06/2017	455.6	230.6
HDVP1	2/06/2017	455.6	230.6
HDVP1	1/06/2017	545.3	140.9
HDVP1	31/05/2017	545.3	140.9
HDVP1	30/05/2017	545.3	140.9
HDVP1	29/05/2017	545.3	140.9
HDVP1	28/05/2017	545.3	140.9
HDVP1	27/05/2017	545.3	140.9
HDVP1	26/05/2017	545.3	140.9
HDVP1	25/05/2017	545.3	140.9
HDVP1	24/05/2017	545.3	140.9
HDVP1	23/05/2017	545.3	140.9
HDVP1	22/05/2017	545.3	140.9
HDVP1	21/05/2017	545.3	140.9
HDVP1	20/05/2017	545.3	140.9
HDVP1	19/05/2017	545.3	140.9
HDVP1	18/05/2017	545.3	140.9
HDVP1	17/05/2017	545.3	140.9
HDVP1	16/05/2017	545.3	140.9
HDVP1	15/05/2017	545.3	140.9
HDVP1	14/05/2017	545.3	140.9
HDVP1	13/05/2017	545.3	140.9
HDVP1	12/05/2017	545.3	140.9
HDVP1	11/05/2017	545.3	140.9
HDVP1	10/05/2017	545.3	140.9
HDVP1	9/05/2017	545.3	140.9
HDVP1	8/05/2017	545.3	140.9
HDVP1	7/05/2017	545.3	140.9
HDVP1	6/05/2017	545.3	140.9
HDVP1	5/05/2017	545.3	140.9
HDVP1	4/05/2017	545.3	140.9
HDVP1	3/05/2017	545.3	140.9
HDVP1	2/05/2017	545.3	140.9
HDVP1	1/05/2017	539.3	146.9
HDVP1	30/04/2017	539.3	146.9
HDVP1	29/04/2017	539.3	146.9
HDVP1	28/04/2017	539.3	146.9
HDVP1	27/04/2017	539.3	146.9
HDVP1	26/04/2017	539.3	146.9
HDVP1	25/04/2017	539.3	146.9
HDVP1	24/04/2017	539.3	146.9
HDVP1	23/04/2017	539.3	146.9
HDVP1	22/04/2017	539.3	146.9
HDVP1	21/04/2017	539.3	146.9
HDVP1	20/04/2017	539.3	146.9
HDVP1	19/04/2017	539.3	146.9
HDVP1	18/04/2017	539.3	146.9
HDVP1	17/04/2017	539.3	146.9
HDVP1	16/04/2017	539.3	146.9
HDVP1	15/04/2017	539.3	146.9
HDVP1	14/04/2017	539.3	146.9
HDVP1	13/04/2017	539.3	146.9
HDVP1	12/04/2017	539.3	146.9
HDVP1	11/04/2017	539.3	146.9
HDVP1	10/04/2017	539.3	146.9
HDVP1	9/04/2017	539.3	146.9
HDVP1	8/04/2017	539.3	146.9
HDVP1	7/04/2017	539.3	146.9
HDVP1	6/04/2017	539.3	146.9
HDVP1	5/04/2017	539.3	146.9
HDVP1	4/04/2017	539.3	146.9
HDVP1	3/04/2017	539.3	146.9
HDVP1	2/04/2017	539.3	146.9
HDVP1	1/04/2017	386.8	299.4
HDVP1	31/03/2017	386.8	299.4
HDVP1	30/03/2017	386.8	299.4
HDVP1	29/03/2017	386.8	299.4
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HDVP1	8/03/2017	386.8	299.4
HDVP1	7/03/2017	386.8	299.4
HDVP1	6/03/2017	386.8	299.4
HDVP1	5/03/2017	386.8	299.4
HDVP1	4/03/2017	386.8	299.4
HDVP1	3/03/2017	386.8	299.4
HDVP1	2/03/2017	386.8	299.4
HDVP1	1/03/2017	363.2	323.0
HDVP1	28/02/2017	363.2	323.0
HDVP1	27/02/2017	363.2	323.0
HDVP1	26/02/2017	363.2	323.0
HDVP1	25/02/2017	363.2	323.0
HDVP1	24/02/2017	363.2	323.0
HDVP1	23/02/2017	363.2	323.0
HDVP1	22/02/2017	363.2	323.0
HDVP1	21/02/2017	363.2	323.0
HDVP1	20/02/2017	363.2	323.0

ID	Date	WL mAHD	WL mbgl
MB17H1SW0001	3/04/2019	600.3	58.5
MB17H1SW0001	2/04/2019	600.3	58.5
MB17H1SW0001	1/04/2019	600.3	58.5
MB17H1SW0001	31/03/2019	600.3	58.5
MB17H1SW0001	30/03/2019	600.4	58.3
MB17H1SW0001	29/03/2019	600.4	58.3
MB17H1SW0001	28/03/2019	600.4	58.3
MB17H1SW0001	27/03/2019	600.4	58.3
MB17H1SW0001	26/03/2019	600.4	58.3
MB17H1SW0001	25/03/2019	600.4	58.4
MB17H1SW0001	24/03/2019	600.4	58.4
MB17H1SW0001	23/03/2019	600.4	58.4
MB17H1SW0001	22/03/2019	600.4	58.4
MB17H1SW0001	21/03/2019	600.4	58.4
MB17H1SW0001	20/03/2019	600.4	58.4
MB17H1SW0001	19/03/2019	600.4	58.3
MB17H1SW0001	18/03/2019	600.4	58.3
MB17H1SW0001	17/03/2019	600.4	58.3
MB17H1SW0001	16/03/2019	600.4	58.3
MB17H1SW0001	15/03/2019	600.4	58.3
MB17H1SW0001	14/03/2019	600.4	58.3
MB17H1SW0001	13/03/2019	600.4	58.3
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MB17H1SW0001	9/03/2019	600.4	58.3
MB17H1SW0001	8/03/2019	600.4	58.3
MB17H1SW0001	7/03/2019	600.4	58.4
MB17H1SW0001	6/03/2019	600.4	58.3
MB17H1SW0001	5/03/2019	600.4	58.3
MB17H1SW0001	4/03/2019	600.4	58.3
MB17H1SW0001	3/03/2019	600.4	58.3
MB17H1SW0001	2/03/2019	600.4	58.3
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MB17H1SW0001	27/01/2019	600.4	58.4
MB17H1SW0001	26/01/2019	600.4	58.4
MB17H1SW0001	25/01/2019	600.3	58.4
MB17H1SW0001	24/01/2019	600.3	58.4
MB17H1SW0001	23/01/2019	600.3	58.4
MB17H1SW0001	22/01/2019	600.3	58.4
MB17H1SW0001	21/01/2019	600.4	58.4
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MB17H1SW0001	17/01/2019	600.4	58.4
MB17H1SW0001	16/01/2019	600.4	58.4
MB17H1SW0001	15/01/2019	600.4	58.4
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MB17H1SW0001	2/01/2019	600.4	58.4
MB17H1SW0001	1/01/2019	600.4	58.4
MB17H1SW0001	31/12/2018	600.4	58.4
MB17H1SW0001	30/12/2018	600.3	58.4
MB17H1SW0001	29/12/2018	600.3	58.4
MB17H1SW0001	28/12/2018	600.3	58.4
MB17H1SW0001	27/12/2018	600.3	58.4
MB17H1SW0001	26/12/2018	600.4	58.4
MB17H1SW0001	25/12/2018	600.4	58.4
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MB17H1SW0001	20/12/2018	600.4	58.4
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MB17H1SW0001	18/12/2018	600.4	58.4
MB17H1SW0001	17/12/2018	600.4	58.4
MB17H1SW0001	16/12/2018	600.3	58.4
MB17H1SW0001	15/12/2018	600.3	58.4
MB17H1SW0001	14/12/2018	600.4	58.4
MB17H1SW0001	13/12/2018	600.4	58.4
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MB17H1SW0001	6/12/2018	600.4	58.4
MB17H1SW0001	5/12/2018	600.4	58.3
MB17H1SW0001	4/12/2018	600.4	58.3
MB17H1SW0001	3/12/2018	600.4	58.3
MB17H1SW0001	2/12/2018	600.4	58.4
MB17H1SW0001	1/12/2018	600.4	58.4
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MB17H1SW0001	25/11/2018	600.4	58.4
MB17H1SW0001	24/11/2018	600.4	58.4
MB17H1SW0001	23/11/2018	600.4	58.4
MB17H1SW0001	22/11/2018	600.4	58.4
MB17H1SW0001	21/11/2018	600.4	58.4
MB17H1SW0001	20/11/2018	600.4	58.4
MB17H1SW0001	19/11/2018	600.4	58.4

ID	Date	WL mAHD	WL mbgl
MB15HD20001	12/04/2019	628.1	86.8
MB15HD20001	13/04/2019	628.1	86.8
MB15HD20001	14/04/2019	628.1	86.8
MB15HD20001	15/04/2019	628.0	86.8
MB15HD20001	16/04/2019	628.0	86.8
MB15HD20001	17/04/2019	628.1	86.8
MB15HD20001	18/04/2019	628.1	86.8
MB15HD20001	19/04/2019	628.0	86.8
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MB15HD20001	24/04/2019	628.1	86.8
MB15HD20001	25/04/2019	628.1	86.8
MB15HD20001	26/04/2019	628.1	86.8
MB15HD20001	27/04/2019	628.1	86.8
MB15HD20001	28/04/2019	628.1	86.8
MB15HD20001	29/04/2019	628.1	86.8
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MB15HD20001	30/05/2019	628.1	86.8
MB15HD20001	31/05/2019	628.1	86.7
MB15HD20001	1/06/2019	628.1	86.7
MB15HD20001	2/06/2019	628.1	86.7
MB15HD20001	3/06/2019	628.1	86.7
MB15HD20001	4/06/2019	628.1	86.7
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MB15HD20001	7/06/2019	628.1	86.8
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MB15HD20001	9/06/2019	628.1	86.8
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MB15HD20001	11/06/2019	628.1	86.8
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MB15HD20001	7/07/2019	628.1	86.8
MB15HD20001	8/07/2019	628.1	86.8
MB15HD20001	9/07/2019	628.1	86.8
MB15HD20001	10/07/2019	628.1	86.8
MB15HD20001	11/07/2019	628.1	86.7
MB15HD20001	12/07/2019	628.1	86.7
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MB15HD20001	21/08/2019	628.1	86.7
MB15HD20001	22/08/2019	628.1	86.8
MB15HD20001	23/08/2019	628.1	86.8
MB15HD20001	24/08/2019	628.1	86.8
MB15HD20001	25/08/2019	628.1	86.8

ID	Date	WL mAHD	WL mbgl
MB18HD20004	27/07/2021	627.0	86.5
MB18HD20004	28/07/2021	627.0	86.5
MB18HD20004	29/07/2021	627.0	86.4
MB18HD20004	30/07/2021	627.0	86.5
MB18HD20004	31/07/2021	627.0	86.4
MB18HD20004	1/08/2021	627.0	86.4
MB18HD20004	2/08/2021	627.0	86.4
MB18HD20004	3/08/2021	627.0	86.4
MB18HD20004	4/08/2021	627.1	86.4
MB18HD20004	5/08/2021	627.1	86.4
MB18HD20004	6/08/2021	627.1	86.4
MB18HD20004	7/08/2021	627.1	86.4
MB18HD20004	8/08/2021	627.0	86.4
MB18HD20004	9/08/2021	627.0	86.4
MB18HD20004	10/08/2021	627.0	86.4
MB18HD20004	11/08/2021	627.0	86.4
MB18HD20004	12/08/2021	627.1	86.4
MB18HD20004	13/08/2021	627.0	86.4
MB18HD20004	14/08/2021	627.0	86.4
MB18HD20004	15/08/2021	627.0	86.4
MB18HD20004	16/08/2021	627.0	86.4
MB18HD20004	17/08/2021	627.0	86.4
MB18HD20004	18/08/2021	627.0	86.4
MB18HD20004	19/08/2021	627.0	86.4
MB18HD20004	20/08/2021	627.0	86.4
MB18HD20004	21/08/2021	627.0	86.4
MB18HD20004	22/08/2021	627.0	86.4
MB18HD20004	23/08/2021	627.0	86.4
MB18HD20004	24/08/2021	627.0	86.4
MB18HD20004	25/08/2021	627.0	86.4
MB18HD20004	26/08/2021	627.0	86.4
MB18HD20004	27/08/2021	627.0	86.4
MB18HD20004	28/08/2021	627.0	86.4
MB18HD20004	29/08/2021	627.0	86.4
MB18HD20004	30/08/2021	627.0	86.4
MB18HD20004	31/08/2021	627.0	86.4
MB18HD20004	1/09/2021	627.0	86.5
MB18HD20004	2/09/2021	627.0	86.5
MB18HD20004	3/09/2021	627.0	86.4
MB18HD20004	4/09/2021	627.0	86.4
MB18HD20004	5/09/2021	627.0	86.4
MB18HD20004	6/09/2021	627.0	86.4
MB18HD20004	7/09/2021	627.0	86.4
MB18HD20004	8/09/2021	627.0	86.4
MB18HD20004	9/09/2021	627.0	86.4
MB18HD20004	10/09/2021	627.0	86.4
MB18HD20004	11/09/2021	627.0	86.4
MB18HD20004	12/09/2021	627.0	86.5
MB18HD20004	13/09/2021	627.0	86.5
MB18HD20004	14/09/2021	627.0	86.5
MB18HD20004	15/09/2021	627.0	86.5
MB18HD20004	16/09/2021	627.0	86.5
MB18HD20004	17/09/2021	627.0	86.5
MB18HD20004	18/09/2021	627.0	86.4
MB18HD20004	19/09/2021	627.0	86.4
MB18HD20004	20/09/2021	627.0	86.4
MB18HD20004	21/09/2021	627.0	86.4
MB18HD20004	22/09/2021	627.0	86.4
MB18HD20004	23/09/2021	627.0	86.4
MB18HD20004	24/09/2021	627.0	86.5
MB18HD20004	25/09/2021	627.0	86.5
MB18HD20004	26/09/2021	627.0	86.5
MB18HD20004	27/09/2021	627.0	86.5
MB18HD20004	28/09/2021	627.0	86.5
MB18HD20004	29/09/2021	627.0	86.5
MB18HD20004	30/09/2021	627.0	86.5
MB18HD20004	1/10/2021	626.9	86.5
MB18HD20004	2/10/2021	626.9	86.5
MB18HD20004	3/10/2021	627.0	86.5
MB18HD20004	4/10/2021	626.9	86.5
MB18HD20004	5/10/2021	626.9	86.5
MB18HD20004	6/10/2021	626.9	86.5
MB18HD20004	7/10/2021	627.0	86.5
MB18HD20004	8/10/2021	626.9	86.5
MB18HD20004	9/10/2021	626.9	86.5
MB18HD20004	10/10/2021	627.0	86.5
MB18HD20004	11/10/2021	627.0	86.5
MB18HD20004	12/10/2021	626.9	86.5
MB18HD20004	13/10/2021	627.0	86.5
MB18HD20004	14/10/2021	627.0	86.5
MB18HD20004	15/10/2021	626.9	86.5
MB18HD20004	16/10/2021	626.9	86.5
MB18HD20004	17/10/2021	626.9	86.5
MB18HD20004	18/10/2021	626.9	86.5
MB18HD20004	19/10/2021	626.9	86.5
MB18HD20004	20/10/2021	627.0	86.5
MB18HD20004	21/10/2021	627.0	86.5
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	19/02/2017	363.2	323.0
HDVP1	18/02/2017	363.2	323.0
HDVP1	17/02/2017	363.2	323.0
HDVP1	16/02/2017	363.2	323.0
HDVP1	15/02/2017	363.2	323.0
HDVP1	14/02/2017	363.2	323.0
HDVP1	13/02/2017	363.2	323.0
HDVP1	12/02/2017	363.2	323.0
HDVP1	11/02/2017	363.2	323.0
HDVP1	10/02/2017	363.2	323.0
HDVP1	9/02/2017	363.2	323.0
HDVP1	8/02/2017	363.2	323.0
HDVP1	7/02/2017	363.2	323.0
HDVP1	6/02/2017	363.2	323.0
HDVP1	5/02/2017	363.2	323.0
HDVP1	4/02/2017	363.2	323.0
HDVP1	3/02/2017	363.2	323.0
HDVP1	2/02/2017	363.2	323.0
HDVP1	1/02/2017	411.5	274.7
HDVP1	31/01/2017	411.5	274.7
HDVP1	30/01/2017	411.5	274.7
HDVP1	29/01/2017	411.5	274.7
HDVP1	28/01/2017	411.5	274.7
HDVP1	27/01/2017	411.5	274.7
HDVP1	26/01/2017	411.5	274.7
HDVP1	25/01/2017	411.5	274.7
HDVP1	24/01/2017	411.5	274.7
HDVP1	23/01/2017	411.5	274.7
HDVP1	22/01/2017	411.5	274.7
HDVP1	21/01/2017	411.5	274.7
HDVP1	20/01/2017	411.5	274.7
HDVP1	19/01/2017	411.5	274.7
HDVP1	18/01/2017	411.5	274.7
HDVP1	17/01/2017	411.5	274.7
HDVP1	16/01/2017	411.5	274.7
HDVP1	15/01/2017	411.5	274.7
HDVP1	14/01/2017	411.5	274.7
HDVP1	13/01/2017	411.5	274.7
HDVP1	12/01/2017	411.5	274.7
HDVP1	11/01/2017	411.5	274.7
HDVP1	10/01/2017	411.5	274.7
HDVP1	9/01/2017	411.5	274.7
HDVP1	8/01/2017	411.5	274.7
HDVP1	7/01/2017	411.5	274.7
HDVP1	6/01/2017	411.5	274.7
HDVP1	5/01/2017	411.5	274.7
HDVP1	4/01/2017	411.5	274.7
HDVP1	3/01/2017	411.5	274.7
HDVP1	2/01/2017	411.5	274.7
HDVP1	1/01/2017	542.5	143.7
HDVP1	31/12/2016	542.5	143.7
HDVP1	30/12/2016	542.5	143.7
HDVP1	29/12/2016	542.5	143.7
HDVP1	28/12/2016	542.5	143.7
HDVP1	27/12/2016	542.5	143.7
HDVP1	26/12/2016	542.5	143.7
HDVP1	25/12/2016	542.5	143.7
HDVP1	24/12/2016	542.5	143.7
HDVP1	23/12/2016	542.5	143.7
HDVP1	22/12/2016	542.5	143.7
HDVP1	21/12/2016	542.5	143.7
HDVP1	20/12/2016	542.5	143.7
HDVP1	19/12/2016	542.5	143.7
HDVP1	18/12/2016	542.5	143.7
HDVP1	17/12/2016	542.5	143.7
HDVP1	16/12/2016	542.5	143.7
HDVP1	15/12/2016	542.5	143.7
HDVP1	14/12/2016	542.5	143.7
HDVP1	13/12/2016	542.5	143.7
HDVP1	12/12/2016	542.5	143.7
HDVP1	11/12/2016	542.5	143.7
HDVP1	10/12/2016	542.5	143.7
HDVP1	9/12/2016	542.5	143.7
HDVP1	8/12/2016	542.5	143.7
HDVP1	7/12/2016	542.5	143.7
HDVP1	6/12/2016	542.5	143.7
HDVP1	5/12/2016	542.5	143.7
HDVP1	4/12/2016	542.5	143.7
HDVP1	3/12/2016	542.5	143.7
HDVP1	2/12/2016	542.5	143.7
HDVP1	1/12/2016	432.6	253.6
HDVP1	30/11/2016	432.6	253.6
HDVP1	29/11/2016	432.6	253.6
HDVP1	28/11/2016	432.6	253.6
HDVP1	27/11/2016	432.6	253.6
HDVP1	26/11/2016	432.6	253.6
HDVP1	25/11/2016	432.6	253.6
HDVP1	24/11/2016	432.6	253.6
HDVP1	23/11/2016	432.6	253.6
HDVP1	22/11/2016	432.6	253.6
HDVP1	21/11/2016	432.6	253.6
HDVP1	20/11/2016	432.6	253.6
HDVP1	19/11/2016	432.6	253.6
HDVP1	18/11/2016	432.6	253.6
HDVP1	17/11/2016	432.6	253.6
HDVP1	16/11/2016	432.6	253.6
HDVP1	15/11/2016	432.6	253.6
HDVP1	14/11/2016	432.6	253.6
HDVP1	13/11/2016	432.6	253.6
HDVP1	12/11/2016	432.6	253.6
HDVP1	11/11/2016	432.6	253.6
HDVP1	10/11/2016	432.6	253.6
HDVP1	9/11/2016	432.6	253.6
HDVP1	8/11/2016	432.6	253.6
HDVP1	7/11/2016	432.6	253.6
HDVP1	6/11/2016	432.6	253.6
HDVP1	5/11/2016	432.6	253.6
HDVP1	4/11/2016	432.6	253.6
HDVP1	3/11/2016	432.6	253.6
HDVP1	2/11/2016	432.6	253.6
HDVP1	1/11/2016	517.3	168.9
HDVP1	31/10/2016	517.3	168.9
HDVP1	30/10/2016	517.3	168.9
HDVP1	29/10/2016	517.3	168.9
HDVP1	28/10/2016	517.3	168.9
HDVP1	27/10/2016	517.3	168.9
HDVP1	26/10/2016	517.3	168.9
HDVP1	25/10/2016	517.3	168.9
HDVP1	24/10/2016	517.3	168.9
HDVP1	23/10/2016	517.3	168.9
HDVP1	22/10/2016	517.3	168.9
HDVP1	21/10/2016	517.3	168.9
HDVP1	20/10/2016	517.3	168.9
HDVP1	19/10/2016	517.3	168.9
HDVP1	18/10/2016	517.3	168.9
HDVP1	17/10/2016	517.3	168.9
HDVP1	16/10/2016	517.3	168.9
HDVP1	15/10/2016	517.3	168.9
HDVP1	14/10/2016	517.3	168.9
HDVP1	13/10/2016	517.3	168.9
HDVP1	12/10/2016	517.3	168.9
HDVP1	11/10/2016	517.3	168.9
HDVP1	10/10/2016	517.3	168.9
HDVP1	9/10/2016	517.3	168.9
HDVP1	8/10/2016	517.3	168.9
HDVP1	7/10/2016	517.3	168.9

ID	Date	WL mAHD	WL mbgl
MB17H1SW0001	18/11/2018	600.4	58.3
MB17H1SW0001	17/11/2018	600.4	58.3
MB17H1SW0001	16/11/2018	600.4	58.3
MB17H1SW0001	15/11/2018	600.4	58.3
MB17H1SW0001	14/11/2018	600.4	58.3
MB17H1SW0001	13/11/2018	600.4	58.4
MB17H1SW0001	12/11/2018	600.4	58.4
MB17H1SW0001	11/11/2018	600.4	58.4
MB17H1SW0001	10/11/2018	600.4	58.3
MB17H1SW0001	9/11/2018	600.4	58.3
MB17H1SW0001	8/11/2018	600.4	58.3
MB17H1SW0001	7/11/2018	600.4	58.3
MB17H1SW0001	6/11/2018	600.4	58.3
MB17H1SW0001	5/11/2018	600.4	58.3
MB17H1SW0001	4/11/2018	600.4	58.3
MB17H1SW0001	3/11/2018	600.4	58.3
MB17H1SW0001	2/11/2018	600.4	58.3
MB17H1SW0001	1/11/2018	600.4	58.3
MB17H1SW0001	31/10/2018	600.4	58.4
MB17H1SW0001	30/10/2018	600.4	58.4
MB17H1SW0001	29/10/2018	600.3	58.4
MB17H1SW0001	28/10/2018	600.3	58.4
MB17H1SW0001	27/10/2018	600.3	58.4
MB17H1SW0001	26/10/2018	600.3	58.4
MB17H1SW0001	25/10/2018	600.3	58.4
MB17H1SW0001	24/10/2018	600.3	58.4
MB17H1SW0001	23/10/2018	600.4	58.4
MB17H1SW0001	22/10/2018	600.4	58.4
MB17H1SW0001	21/10/2018	600.4	58.4
MB17H1SW0001	20/10/2018	600.4	58.4
MB17H1SW0001	19/10/2018	600.4	58.4
MB17H1SW0001	18/10/2018	600.3	58.4
MB17H1SW0001	17/10/2018	600.4	58.4
MB17H1SW0001	16/10/2018	600.4	58.4
MB17H1SW0001	15/10/2018	600.4	58.4
MB17H1SW0001	14/10/2018	600.3	58.4
MB17H1SW0001	13/10/2018	600.3	58.4
MB17H1SW0001	12/10/2018	600.4	58.4
MB17H1SW0001	11/10/2018	600.3	58.4
MB17H1SW0001	10/10/2018	600.4	58.4
MB17H1SW0001	9/10/2018	600.4	58.4
MB17H1SW0001	8/10/2018	600.4	58.4
MB17H1SW0001	7/10/2018	600.4	58.4
MB17H1SW0001	6/10/2018	600.4	58.4
MB17H1SW0001	5/10/2018	600.4	58.4
MB17H1SW0001	4/10/2018	600.4	58.4
MB17H1SW0001	3/10/2018	600.4	58.4
MB17H1SW0001	2/10/2018	600.4	58.4
MB17H1SW0001	1/10/2018	600.4	58.4
MB17H1SW0001	30/09/2018	600.4	58.4
MB17H1SW0001	29/09/2018	600.4	58.4
MB17H1SW0001	28/09/2018	600.3	58.4
MB17H1SW0001	27/09/2018	600.4	58.4
MB17H1SW0001	26/09/2018	600.4	58.4
MB17H1SW0001	25/09/2018	600.4	58.3
MB17H1SW0001	24/09/2018	600.4	58.3
MB17H1SW0001	23/09/2018	600.4	58.3
MB17H1SW0001	22/09/2018	600.4	58.3
MB17H1SW0001	21/09/2018	600.4	58.3
MB17H1SW0001	20/09/2018	600.4	58.3
MB17H1SW0001	19/09/2018	600.4	58.3
MB17H1SW0001	18/09/2018	600.4	58.3
MB17H1SW0001	17/09/2018	600.4	58.4
MB17H1SW0001	16/09/2018	600.4	58.4
MB17H1SW0001	15/09/2018	600.4	58.3
MB17H1SW0001	14/09/2018	600.4	58.4
MB17H1SW0001	13/09/2018	600.4	58.4
MB17H1SW0001	12/09/2018	600.4	58.3
MB17H1SW0001	11/09/2018	600.4	58.3
MB17H1SW0001	10/09/2018	600.4	58.3
MB17H1SW0001	9/09/2018	600.4	58.3
MB17H1SW0001	8/09/2018	600.4	58.4
MB17H1SW0001	7/09/2018	600.4	58.4
MB17H1SW0001	6/09/2018	600.4	58.4
MB17H1SW0001	5/09/2018	600.4	58.4
MB17H1SW0001	4/09/2018	600.4	58.4
MB17H1SW0001	3/09/2018	600.4	58.4
MB17H1SW0001	2/09/2018	600.4	58.4
MB17H1SW0001	1/09/2018	600.4	58.4
MB17H1SW0001	31/08/2018	600.4	58.4
MB17H1SW0001	30/08/2018	600.4	58.4
MB17H1SW0001	29/08/2018	600.3	58.4
MB17H1SW0001	28/08/2018	600.4	58.4
MB17H1SW0001	27/08/2018	600.4	58.3
MB17H1SW0001	26/08/2018	600.4	58.3
MB17H1SW0001	25/08/2018	600.4	58.3
MB17H1SW0001	24/08/2018	600.4	58.3
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MB17H1SW0001	18/08/2018	600.4	58.3
MB17H1SW0001	17/08/2018	600.4	58.4
MB17H1SW0001	16/08/2018	600.4	58.4
MB17H1SW0001	15/08/2018	600.4	58.3
MB17H1SW0001	14/08/2018	600.4	58.3
MB17H1SW0001	13/08/2018	600.4	58.3
MB17H1SW0001	12/08/2018	600.4	58.3
MB17H1SW0001	11/08/2018	600.5	58.3
MB17H1SW0001	10/08/2018	600.4	58.3
MB17H1SW0001	9/08/2018	600.4	58.3
MB17H1SW0001	8/08/2018	600.4	58.3
MB17H1SW0001	7/08/2018	600.4	58.3
MB17H1SW0001	6/08/2018	600.4	58.3
MB17H1SW0001	5/08/2018	600.4	58.3
MB17H1SW0001	4/08/2018	600.4	58.3
MB17H1SW0001	3/08/2018	600.4	58.3
MB17H1SW0001	2/08/2018	600.4	58.3
MB17H1SW0001	1/08/2018	600.4	58.4
MB17H1SW0001	31/07/2018	600.4	58.4
MB17H1SW0001	30/07/2018	600.4	58.4
MB17H1SW0001	29/07/2018	600.4	58.3
MB17H1SW0001	28/07/2018	600.4	58.3
MB17H1SW0001	27/07/2018	600.4	58.3
MB17H1SW0001	26/07/2018	600.4	58.3
MB17H1SW0001	25/07/2018	600.4	58.4
MB17H1SW0001	24/07/2018	600.4	58.3
MB17H1SW0001	23/07/2018	600.4	58.3
MB17H1SW0001	22/07/2018	600.4	58.4
MB17H1SW0001	21/07/2018	600.4	58.4
MB17H1SW0001	20/07/2018	600.4	58.3
MB17H1SW0001	19/07/2018	600.4	58.3
MB17H1SW0001	18/07/2018	600.4	58.4
MB17H1SW0001	17/07/2018	600.4	58.3
MB17H1SW0001	16/07/2018	600.4	58.4
MB17H1SW0001	15/07/2018	600.4	58.3
MB17H1SW0001	14/07/2018	600.4	58.3
MB17H1SW0001	13/07/2018	600.4	58.3
MB17H1SW0001	12/07/2018	600.4	58.3
MB17H1SW0001	11/07/2018	600.4	58.3
MB17H1SW0001	10/07/2018	600.4	58.3
MB17H1SW0001	9/07/2018	600.4	58.3
MB17H1SW0001	8/07/2018	600.4	58.3
MB17H1SW0001	7/07/2018	600.4	58.3
MB17H1SW0001	6/07/2018	600.4	58.3

ID	Date	WL mAHD	WL mbgl
MB15HD20001	26/08/2019	628.0	86.8
MB15HD20001	27/08/2019	628.0	86.8
MB15HD20001	28/08/2019	628.1	86.8
MB15HD20001	29/08/2019	628.1	86.8
MB15HD20001	30/08/2019	628.0	86.8
MB15HD20001	31/08/2019	628.0	86.8
MB15HD20001	1/09/2019	628.0	86.8
MB15HD20001	2/09/2019	628.0	86.8
MB15HD20001	3/09/2019	628.0	86.8
MB15HD20001	4/09/2019	628.0	86.8
MB15HD20001	5/09/2019	628.0	86.8
MB15HD20001	6/09/2019	628.0	86.8
MB15HD20001	7/09/2019	628.0	86.8
MB15HD20001	8/09/2019	628.0	86.8
MB15HD20001	9/09/2019	628.1	86.8
MB15HD20001	10/09/2019	628.1	86.8
MB15HD20001	11/09/2019	628.1	86.8
MB15HD20001	12/09/2019	628.1	86.8
MB15HD20001	13/09/2019	628.1	86.8
MB15HD20001	14/09/2019	628.1	86.8
MB15HD20001	15/09/2019	628.1	86.8
MB15HD20001	16/09/2019	628.0	86.8
MB15HD20001	17/09/2019	628.0	86.8
MB15HD20001	18/09/2019	628.0	86.8
MB15HD20001	19/09/2019	628.0	86.8
MB15HD20001	20/09/2019	628.0	86.8
MB15HD20001	21/09/2019	628.1	86.8
MB15HD20001	22/09/2019	628.1	86.8
MB15HD20001	23/09/2019	628.1	86.8
MB15HD20001	24/09/2019	628.1	86.8
MB15HD20001	25/09/2019	628.1	86.8
MB15HD20001	26/09/2019	628.1	86.8
MB15HD20001	27/09/2019	628.0	86.8
MB15HD20001	28/09/2019	628.0	86.8
MB15HD20001	29/09/2019	628.0	86.8
MB15HD20001	30/09/2019	628.0	86.8
MB15HD20001	1/10/2019	628.0	86.8
MB15HD20001	2/10/2019	628.0	86.8
MB15HD20001	3/10/2019	628.0	86.8
MB15HD20001	4/10/2019	628.0	86.8
MB15HD20001	5/10/2019	628.0	86.8
MB15HD20001	6/10/2019	628.0	86.8
MB15HD20001	7/10/2019	628.0	86.8
MB15HD20001	8/10/2019	628.0	86.8
MB15HD20001	9/10/2019	628.0	86.8
MB15HD20001	10/10/2019	628.0	86.8
MB15HD20001	11/10/2019	628.0	86.8
MB15HD20001	12/10/2019	628.0	86.8
MB15HD20001	13/10/2019	628.0	86.9
MB15HD20001	14/10/2019	628.0	86.9
MB15HD20001	15/10/2019	628.0	86.9
MB15HD20001	16/10/2019	628.0	86.9
MB15HD20001	17/10/2019	628.0	86.9
MB15HD20001	18/10/2019	628.0	86.9
MB15HD20001	19/10/2019	628.0	86.8
MB15HD20001	20/10/2019	628.0	86.8
MB15HD20001	21/10/2019	628.0	86.8
MB15HD20001	22/10/2019	628.0	86.8
MB15HD20001	23/10/2019	628.0	86.8
MB15HD20001	24/10/2019	628.0	86.8
MB15HD20001	25/10/2019	628.0	86.8
MB15HD20001	26/10/2019	628.0	86.9
MB15HD20001	27/10/2019	628.0	86.9
MB15HD20001	28/10/2019	628.0	86.9
MB15HD20001	29/10/2019	628.0	86.9
MB15HD20001	30/10/2019	628.0	86.9
MB15HD20001	31/10/2019	628.0	86.9
MB15HD20001	1/11/2019	628.0	86.9
MB15HD20001	2/11/2019	628.0	86.9
MB15HD20001	3/11/2019	628.0	86.8
MB15HD20001	4/11/2019	628.0	86.8
MB15HD20001	5/11/2019	628.0	86.8
MB15HD20001	6/11/2019	628.0	86.8
MB15HD20001	7/11/2019	628.0	86.8
MB15HD20001	8/11/2019	628.0	86.8
MB15HD20001	9/11/2019	628.0	86.8
MB15HD20001	10/11/2019	628.0	86.8
MB15HD20001	11/11/2019	628.0	86.9
MB15HD20001	12/11/2019	628.0	86.9
MB15HD20001	13/11/2019	628.0	86.8
MB15HD20001	14/11/2019	628.0	86.9
MB15HD20001	15/11/2019	628.0	86.9
MB15HD20001	16/11/2019	628.0	86.9
MB15HD20001	17/11/2019	628.0	86.8
MB15HD20001	18/11/2019	628.0	86.8
MB15HD20001	19/11/2019	628.0	86.9
MB15HD20001	20/11/2019	628.0	86.9
MB15HD20001	21/11/2019	628.0	86.9
MB15HD20001	22/11/2019	628.0	86.9
MB15HD20001	23/11/2019	628.0	86.9
MB15HD20001	24/11/2019	628.0	86.9
MB15HD20001	25/11/2019	628.0	86.9
MB15HD20001	26/11/2019	628.0	86.9
MB15HD20001	27/11/2019	628.0	86.9
MB15HD20001	28/11/2019	628.0	86.9
MB15HD20001	29/11/2019	628.0	86.9
MB15HD20001	30/11/2019	628.0	86.9
MB15HD20001	1/12/2019	628.0	86.8
MB15HD20001	2/12/2019	628.0	86.9
MB15HD20001	3/12/2019	628.0	86.9
MB15HD20001	4/12/2019	628.0	86.9
MB15HD20001	5/12/2019	628.0	86.9
MB15HD20001	6/12/2019	628.0	86.9
MB15HD20001	7/12/2019	628.0	86.9
MB15HD20001	8/12/2019	628.0	86.9
MB15HD20001	9/12/2019	628.0	86.9
MB15HD20001	10/12/2019	628.0	86.9
MB15HD20001	11/12/2019	628.0	86.9
MB15HD20001	12/12/2019	628.0	86.9
MB15HD20001	13/12/2019	628.0	86.9
MB15HD20001	14/12/2019	628.0	86.9
MB15HD20001	15/12/2019	628.0	86.9
MB15HD20001	16/12/2019	628.0	86.9
MB15HD20001	17/12/2019	628.0	86.9
MB15HD20001	18/12/2019	628.0	86.9
MB15HD20001	19/12/2019	628.0	86.9
MB15HD20001	20/12/2019	628.0	86.9
MB15HD20001	21/12/2019	628.0	86.9
MB15HD20001	22/12/2019	628.0	86.9
MB15HD20001	23/12/2019	628.0	86.9
MB15HD20001	24/12/2019	628.0	86.9
MB15HD20001	25/12/2019	628.0	86.9
MB15HD20001	26/12/2019	628.0	86.9
MB15HD20001	27/12/2019	628.0	86.9
MB15HD20001	28/12/2019	628.0	86.9
MB15HD20001	29/12/2019	628.0	86.9
MB15HD20001	30/12/2019	628.0	86.9
MB15HD20001	31/12/2019	628.0	86.9
MB15HD20001	1/01/2020	628.0	86.9
MB15HD20001	2/01/2020	628.0	86.9
MB15HD20001	3/01/2020	628.0	86.9
MB15HD20001	4/01/2020	627.9	86.9
MB15HD20001	5/01/2020	628.0	86.9
MB15HD20001	6/01/2020	628.0	86.9
MB15HD20001	7/01/2020	627.9	86.9
MB15HD20001	8/01/2020	627.9	86.9

ID	Date	WL mAHD	WL mbgl
MB18HD20004	5/01/2022	627.2	86.2
MB18HD20004	6/01/2022	627.2	86.2
MB18HD20004	7/01/2022	627.2	86.2
MB18HD20004	8/01/2022	627.2	86.2
MB18HD20004	9/01/2022	627.2	86.2
MB18HD20004	10/01/2022	627.2	86.2
MB18HD20004	11/01/2022	627.2	86.2
MB18HD20004	12/01/2022	627.2	86.2
MB18HD20004	13/01/2022	627.2	86.2
MB18HD20004	14/01/2022	627.2	86.2
MB18HD20004	15/01/2022	627.2	86.3
MB18HD20004	16/01/2022	627.2	86.3
MB18HD20004	17/01/2022	627.2	86.3
MB18HD20004	18/01/2022	627.2	86.2
MB18HD20004	19/01/2022	627.2	86.2
MB18HD20004	20/01/2022	627.2	86.2
MB18HD20004	21/01/2022	627.2	86.2
MB18HD20004	22/01/2022	627.2	86.2
MB18HD20004	23/01/2022	627.2	86.2
MB18HD20004	24/01/2022	627.2	86.3
MB18HD20004	25/01/2022	627.1	86.3
MB18HD20004	26/01/2022	627.1	86.3
MB18HD20004	27/01/2022	627.2	86.3
MB18HD20004	28/01/2022	627.2	86.3
MB18HD20004	29/01/2022	627.2	86.3
MB18HD20004	30/01/2022	627.2	86.3
MB18HD20004	31/01/2022	627.2	86.3
MB18HD20004	1/02/2022	627.1	86.3
MB18HD20004	2/02/2022	627.2	86.3
MB18HD20004	3/02/2022	627.2	86.2
MB18HD20004	4/02/2022	627.2	86.3
MB18HD20004	5/02/2022	627.2	86.3
MB18HD20004	6/02/2022	627.2	86.3
MB18HD20004	7/02/2022	627.2	86.3
MB18HD20004	8/02/2022	627.2	86.3
MB18HD20004	9/02/2022	627.2	86.2
MB18HD20004	10/02/2022	627.2	86.2
MB18HD20004	11/02/2022	627.2	86.2
MB18HD20004	12/02/2022	627.2	86.2
MB18HD20004	13/02/2022	627.2	86.2
MB18HD20004	14/02/2022	627.2	86.2
MB18HD20004	15/02/2022	627.2	86.2
MB18HD20004	16/02/2022	627.2	86.2
MB18HD20004	17/02/2022	627.2	86.2
MB18HD20004	18/02/2022	627.2	86.2
MB18HD20004	19/02/2022	627.2	86.2
MB18HD20004	20/02/2022	627.2	86.2
MB18HD20004	21/02/2022	627.2	86.2
MB18HD20004	22/02/2022	627.2	86.2
MB18HD20004	23/02/2022	627.2	86.2
MB18HD20004	24/02/2022	627.2	86.2
MB18HD20004	25/02/2022	627.2	86.2
MB18HD20004	26/02/2022	627.2	86.2
MB18HD20004	27/02/2022	627.2	86.3
MB18HD20004	28/02/2022	627.2	86.3
MB18HD20004	1/03/2022	627.2	86.3
MB18HD20004	2/03/2022	627.2	86.3
MB18HD20004	3/03/2022	627.2	86.3
MB18HD20004	4/03/2022	627.2	86.2
MB18HD20004	5/03/2022	627.2	86.2
MB18HD20004	6/03/2022	627.2	86.2
MB18HD20004	7/03/2022	627.2	86.2
MB18HD20004	8/03/2022	627.2	86.2
MB18HD20004	9/03/2022	627.2	86.2
MB18HD20004	10/03/2022	627.2	86.2
MB18HD20004	11/03/2022	627.2	86.2
MB18HD20004	12/03/2022	627.2	86.2
MB18HD20004	13/03/2022	627.2	86.2
MB18HD20004	14/03/2022	627.2	86.2
MB18HD20004	15/03/2022	627.2	86.2
MB18HD20004	16/03/2022	627.2	86.2
MB18HD20005	22/11/2018	624.8	68.1
MB18HD20005	23/11/2018	624.8	68.1
MB18HD20005	24/11/2018	624.8	68.1
MB18HD20005	25/11/2018	624.8	68.1
MB18HD20005	26/11/2018	624.8	68.1
MB18HD20005	27/11/2018	624.8	68.1
MB18HD20005	28/11/2018	624.8	68.1
MB18HD20005	29/11/2018	624.8	68.1
MB18HD20005	30/11/2018	624.8	68.1
MB18HD20005	1/12/2018	624.8	68.1
MB18HD20005	2/12/2018	624.8	68.1
MB18HD20005	3/12/2018	624.8	68.1
MB18HD20005	4/12/2018	624.8	68.1
MB18HD20005	5/12/2018	624.8	68.1
MB18HD20005	6/12/2018	624.8	68.1
MB18HD20005	7/12/2018	624.8	68.1
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	6/10/2016	517.3	168.9
HDVP1	5/10/2016	517.3	168.9
HDVP1	4/10/2016	517.3	168.9
HDVP1	3/10/2016	517.3	168.9
HDVP1	2/10/2016	517.3	168.9
HDVP1	1/10/2016	492.2	193.9
HDVP1	30/09/2016	492.2	193.9
HDVP1	29/09/2016	492.2	193.9
HDVP1	28/09/2016	492.2	193.9
HDVP1	27/09/2016	492.2	193.9
HDVP1	26/09/2016	492.2	193.9
HDVP1	25/09/2016	492.2	193.9
HDVP1	24/09/2016	492.2	193.9
HDVP1	23/09/2016	492.2	193.9
HDVP1	22/09/2016	492.2	193.9
HDVP1	21/09/2016	492.2	193.9
HDVP1	20/09/2016	492.2	193.9
HDVP1	19/09/2016	492.2	193.9
HDVP1	18/09/2016	492.2	193.9
HDVP1	17/09/2016	492.2	193.9
HDVP1	16/09/2016	492.2	193.9
HDVP1	15/09/2016	492.2	193.9
HDVP1	14/09/2016	492.2	193.9
HDVP1	13/09/2016	492.2	193.9
HDVP1	12/09/2016	492.2	193.9
HDVP1	11/09/2016	492.2	193.9
HDVP1	10/09/2016	492.2	193.9
HDVP1	9/09/2016	492.2	193.9
HDVP1	8/09/2016	492.2	193.9
HDVP1	7/09/2016	492.2	193.9
HDVP1	6/09/2016	492.2	193.9
HDVP1	5/09/2016	492.2	193.9
HDVP1	4/09/2016	492.2	193.9
HDVP1	3/09/2016	492.2	193.9
HDVP1	2/09/2016	492.2	193.9
HDVP1	1/09/2016	512.0	174.2
HDVP1	31/08/2016	512.0	174.2
HDVP1	30/08/2016	512.0	174.2
HDVP1	29/08/2016	512.0	174.2
HDVP1	28/08/2016	512.0	174.2
HDVP1	27/08/2016	512.0	174.2
HDVP1	26/08/2016	512.0	174.2
HDVP1	25/08/2016	512.0	174.2
HDVP1	24/08/2016	512.0	174.2
HDVP1	23/08/2016	512.0	174.2
HDVP1	22/08/2016	512.0	174.2
HDVP1	21/08/2016	512.0	174.2
HDVP1	20/08/2016	512.0	174.2
HDVP1	19/08/2016	512.0	174.2
HDVP1	18/08/2016	512.0	174.2
HDVP1	17/08/2016	512.0	174.2
HDVP1	16/08/2016	512.0	174.2
HDVP1	15/08/2016	512.0	174.2
HDVP1	14/08/2016	512.0	174.2
HDVP1	13/08/2016	512.0	174.2
HDVP1	12/08/2016	512.0	174.2
HDVP1	11/08/2016	512.0	174.2
HDVP1	10/08/2016	512.0	174.2
HDVP1	9/08/2016	512.0	174.2
HDVP1	8/08/2016	512.0	174.2
HDVP1	7/08/2016	512.0	174.2
HDVP1	6/08/2016	512.0	174.2
HDVP1	5/08/2016	512.0	174.2
HDVP1	4/08/2016	512.0	174.2
HDVP1	3/08/2016	512.0	174.2
HDVP1	2/08/2016	512.0	174.2
HDVP1	1/08/2016	467.6	218.6
HDVP1	31/07/2016	467.6	218.6
HDVP1	30/07/2016	467.6	218.6
HDVP1	29/07/2016	467.6	218.6
HDVP1	28/07/2016	467.6	218.6
HDVP1	27/07/2016	467.6	218.6
HDVP1	26/07/2016	467.6	218.6
HDVP1	25/07/2016	467.6	218.6
HDVP1	24/07/2016	467.6	218.6
HDVP1	23/07/2016	467.6	218.6
HDVP1	22/07/2016	467.6	218.6
HDVP1	21/07/2016	467.6	218.6
HDVP1	20/07/2016	467.6	218.6
HDVP1	19/07/2016	467.6	218.6
HDVP1	18/07/2016	467.6	218.6
HDVP1	17/07/2016	467.6	218.6
HDVP1	16/07/2016	467.6	218.6
HDVP1	15/07/2016	467.6	218.6
HDVP1	14/07/2016	467.6	218.6
HDVP1	13/07/2016	467.6	218.6
HDVP1	12/07/2016	467.6	218.6
HDVP1	11/07/2016	467.6	218.6
HDVP1	10/07/2016	467.6	218.6
HDVP1	9/07/2016	467.6	218.6
HDVP1	8/07/2016	467.6	218.6
HDVP1	7/07/2016	467.6	218.6
HDVP1	6/07/2016	467.6	218.6
HDVP1	5/07/2016	467.6	218.6
HDVP1	4/07/2016	467.6	218.6
HDVP1	3/07/2016	467.6	218.6
HDVP1	2/07/2016	467.6	218.6
HDVP1	1/07/2016	547.0	139.2
HDVP1	30/06/2016	547.0	139.2
HDVP1	29/06/2016	547.0	139.2
HDVP1	28/06/2016	547.0	139.2
HDVP1	27/06/2016	547.0	139.2
HDVP1	26/06/2016	547.0	139.2
HDVP1	25/06/2016	547.0	139.2
HDVP1	24/06/2016	547.0	139.2
HDVP1	23/06/2016	547.0	139.2
HDVP1	22/06/2016	547.0	139.2
HDVP1	21/06/2016	547.0	139.2
HDVP1	20/06/2016	547.0	139.2
HDVP1	19/06/2016	547.0	139.2
HDVP1	18/06/2016	547.0	139.2
HDVP1	17/06/2016	547.0	139.2
HDVP1	16/06/2016	547.0	139.2
HDVP1	15/06/2016	547.0	139.2
HDVP1	14/06/2016	547.0	139.2
HDVP1	13/06/2016	547.0	139.2
HDVP1	12/06/2016	547.0	139.2
HDVP1	11/06/2016	547.0	139.2
HDVP1	10/06/2016	547.0	139.2
HDVP1	9/06/2016	547.0	139.2
HDVP1	8/06/2016	547.0	139.2
HDVP1	7/06/2016	547.0	139.2
HDVP1	6/06/2016	547.0	139.2
HDVP1	5/06/2016	547.0	139.2
HDVP1	4/06/2016	547.0	139.2
HDVP1	3/06/2016	547.0	139.2
HDVP1	2/06/2016	547.0	139.2
HDVP1	1/06/2016	622.7	63.5
HDVP1	31/05/2016	622.7	63.5
HDVP1	30/05/2016	622.7	63.5
HDVP1	29/05/2016	622.7	63.5
HDVP1	28/05/2016	622.7	63.5
HDVP1	27/05/2016	622.7	63.5
HDVP1	26/05/2016	622.7	63.5
HDVP1	25/05/2016	622.7	63.5
HDVP1	24/05/2016	622.7	63.5

ID	Date	WL mAHD	WL mbgl
MB17H1SW0001	5/07/2018	600.4	58.3
MB17H1SW0001	4/07/2018	600.4	58.3
MB17H1SW0001	3/07/2018	600.4	58.3
MB17H1SW0001	2/07/2018	600.4	58.3
MB17H1SW0001	1/07/2018	600.4	58.3
MB17H1SW0001	30/06/2018	600.4	58.3
MB17H1SW0001	29/06/2018	600.4	58.3
MB17H1SW0001	28/06/2018	600.4	58.3
MB17H1SW0001	27/06/2018	600.4	58.3
MB17H1SW0001	26/06/2018	600.4	58.3
MB17H1SW0001	25/06/2018	600.5	58.3
MB17H1SW0001	24/06/2018	600.5	58.3
MB17H1SW0001	23/06/2018	600.5	58.3
MB17H1SW0001	22/06/2018	600.4	58.3
MB17H1SW0001	21/06/2018	600.5	58.3
MB17H1SW0001	20/06/2018	600.4	58.3
MB17H1SW0001	19/06/2018	600.4	58.3
MB17H1SW0001	18/06/2018	600.4	58.3
MB17H1SW0001	17/06/2018	600.4	58.3
MB17H1SW0001	16/06/2018	600.4	58.3
MB17H1SW0001	15/06/2018	600.5	58.3
MB17H1SW0001	14/06/2018	600.4	58.3
MB17H1SW0001	13/06/2018	600.4	58.3
MB17H1SW0001	12/06/2018	600.4	58.3
MB17H1SW0001	11/06/2018	600.4	58.3
MB17H1SW0001	10/06/2018	600.4	58.3
MB17H1SW0001	9/06/2018	600.4	58.3
MB17H1SW0001	8/06/2018	600.4	58.3
MB17H1SW0001	7/06/2018	600.4	58.4
MB17H1SW0001	6/06/2018	600.4	58.4
MB17H1SW0001	5/06/2018	600.4	58.4
MB17H1SW0001	4/06/2018	600.4	58.3
MB17H1SW0001	3/06/2018	600.4	58.3
MB17H1SW0001	2/06/2018	600.4	58.3
MB17H1SW0001	1/06/2018	600.4	58.3
MB17H1SW0001	31/05/2018	600.4	58.3
MB17H1SW0001	30/05/2018	600.4	58.3
MB17H1SW0001	29/05/2018	600.4	58.3
MB17H1SW0001	28/05/2018	600.4	58.3
MB17H1SW0001	27/05/2018	600.4	58.3
MB17H1SW0001	26/05/2018	600.4	58.3
MB17H1SW0001	25/05/2018	600.4	58.3
MB17H1SW0001	24/05/2018	600.4	58.3
MB17H1SW0001	23/05/2018	600.4	58.3
MB17H1SW0001	22/05/2018	600.4	58.3
MB17H1SW0001	21/05/2018	600.4	58.3
MB17H1SW0001	20/05/2018	600.4	58.3
MB17H1SW0001	19/05/2018	600.4	58.3
MB17H1SW0001	18/05/2018	600.4	58.3
MB17H1SW0001	17/05/2018	600.4	58.3
MB17H1SW0001	16/05/2018	600.4	58.3
MB17H1SW0001	15/05/2018	600.5	58.3
MB17H1SW0001	14/05/2018	600.5	58.3
MB17H1SW0001	13/05/2018	600.5	58.3
MB17H1SW0001	12/05/2018	600.5	58.3
MB17H1SW0001	11/05/2018	600.4	58.3
MB17H1SW0001	10/05/2018	600.4	58.3
MB17H1SW0001	9/05/2018	600.4	58.3
MB17H1SW0001	8/05/2018	600.4	58.3
MB17H1SW0001	7/05/2018	600.4	58.3
MB17H1SW0001	6/05/2018	600.4	58.3
MB17H1SW0001	5/05/2018	600.4	58.3
MB17H1SW0001	4/05/2018	600.4	58.3
MB17H1SW0001	3/05/2018	600.4	58.3
MB17H1SW0001	2/05/2018	600.4	58.3
MB17H1SW0001	1/05/2018	600.4	58.3
MB17H1SW0001	30/04/2018	600.4	58.3
MB17H1SW0001	29/04/2018	600.4	58.3
MB17H1SW0001	28/04/2018	600.4	58.3
MB17H1SW0001	27/04/2018	600.4	58.3
MB17H1SW0001	26/04/2018	600.4	58.3
MB17H1SW0001	25/04/2018	600.4	58.4
MB17H1SW0001	24/04/2018	600.4	58.3
MB17H1SW0001	23/04/2018	600.4	58.3
MB17H1SW0001	22/04/2018	600.4	58.3
MB17H1SW0001	21/04/2018	600.4	58.3
MB17H1SW0001	20/04/2018	600.4	58.4
MB17H1SW0001	19/04/2018	600.4	58.4
MB17H1SW0001	18/04/2018	600.4	58.3
MB17H1SW0001	17/04/2018	600.4	58.3
MB17H1SW0001	16/04/2018	600.4	58.3
MB17H1SW0001	15/04/2018	600.4	58.3
MB17H1SW0001	14/04/2018	600.4	58.3
MB17H1SW0001	13/04/2018	600.4	58.3
MB17H1SW0001	12/04/2018	600.4	58.3
MB17H1SW0001	11/04/2018	600.4	58.3
MB17H1SW0001	10/04/2018	600.4	58.3
MB17H1SW0001	9/04/2018	600.4	58.3
MB17H1SW0001	8/04/2018	600.4	58.3
MB17H1SW0001	7/04/2018	600.4	58.3
MB17H1SW0001	6/04/2018	600.4	58.4
MB17H1SW0001	5/04/2018	600.4	58.3
MB17H1SW0001	4/04/2018	600.4	58.3
MB17H1SW0001	3/04/2018	600.4	58.3
MB17H1SW0001	2/04/2018	600.4	58.3
MB17H1SW0001	1/04/2018	600.4	58.3
MB17H1SW0001	31/03/2018	600.4	58.4
MB17H1SW0001	30/03/2018	600.4	58.3
MB17H1SW0001	29/03/2018	600.4	58.3
MB17H1SW0001	28/03/2018	600.4	58.3
MB17H1SW0001	27/03/2018	600.4	58.4
MB17H1SW0001	26/03/2018	600.4	58.3
MB17H1SW0001	25/03/2018	600.4	58.3
MB17H1SW0001	24/03/2018	600.4	58.4
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MB17H1SW0001	22/03/2018	600.4	58.4
MB17H1SW0001	21/03/2018	600.4	58.3
MB17H1SW0001	20/03/2018	600.4	58.3
MB17H1SW0001	19/03/2018	600.4	58.3
MB17H1SW0001	18/03/2018	600.4	58.3
MB17H1SW0001	17/03/2018	600.4	58.4
MB17H1SW0001	16/03/2018	600.4	58.4
MB17H1SW0001	15/03/2018	600.4	58.3
MB17H1SW0001	14/03/2018	600.4	58.3
MB17H1SW0001	13/03/2018	600.4	58.3
MB17H1SW0001	12/03/2018	600.4	58.3
MB17H1SW0001	11/03/2018	600.4	58.3
MB17H1SW0001	10/03/2018	600.4	58.4
MB17H1SW0001	9/03/2018	600.4	58.4
MB17H1SW0001	8/03/2018	600.4	58.4
MB17H1SW0001	7/03/2018	600.4	58.4
MB17H1SW0001	6/03/2018	600.4	58.4
MB17H1SW0001	5/03/2018	600.4	58.4
MB17H1SW0001	4/03/2018	600.4	58.3
MB17H1SW0001	3/03/2018	600.4	58.4
MB17H1SW0001	2/03/2018	600.4	58.4
MB17H1SW0001	1/03/2018	600.4	58.4
MB17H1SW0001	28/02/2018	600.4	58.4
MB17H1SW0001	27/02/2018	600.4	58.4
MB17H1SW0001	26/02/2018	600.4	58.4
MB17H1SW0001	25/02/2018	600.4	58.4
MB17H1SW0001	24/02/2018	600.4	58.4
MB17H1SW0001	23/02/2018	600.4	58.4
MB17H1SW0001	22/02/2018	600.3	58.4
MB17H1SW0001	21/02/2018	600.3	58.4
MB17H1SW0001	20/02/2018	600.3	58.4

ID	Date	WL mAHD	WL mbgl
MB15HD20001	9/01/2020	627.9	87.0
MB15HD20001	10/01/2020	627.9	86.9
MB15HD20001	11/01/2020	627.9	86.9
MB15HD20001	12/01/2020	627.9	86.9
MB15HD20001	13/01/2020	627.9	86.9
MB15HD20001	14/01/2020	627.9	86.9
MB15HD20001	15/01/2020	628.0	86.9
MB15HD20001	16/01/2020	628.0	86.9
MB15HD20001	17/01/2020	628.0	86.9
MB15HD20001	18/01/2020	627.9	86.9
MB15HD20001	19/01/2020	628.0	86.9
MB15HD20001	20/01/2020	628.0	86.9
MB15HD20001	21/01/2020	627.9	86.9
MB15HD20001	22/01/2020	627.9	86.9
MB15HD20001	23/01/2020	627.9	86.9
MB15HD20001	24/01/2020	628.0	86.9
MB15HD20001	25/01/2020	628.0	86.9
MB15HD20001	26/01/2020	628.0	86.9
MB15HD20001	27/01/2020	628.0	86.9
MB15HD20001	28/01/2020	628.0	86.9
MB15HD20001	29/01/2020	627.9	86.9
MB15HD20001	30/01/2020	627.9	86.9
MB15HD20001	31/01/2020	627.9	86.9
MB15HD20001	1/02/2020	627.9	86.9
MB15HD20001	2/02/2020	627.9	86.9
MB15HD20001	3/02/2020	628.0	86.9
MB15HD20001	4/02/2020	628.0	86.9
MB15HD20001	5/02/2020	628.0	86.9
MB15HD20001	6/02/2020	627.9	86.9
MB15HD20001	7/02/2020	627.9	86.9
MB15HD20001	8/02/2020	627.9	86.9
MB15HD20001	9/02/2020	627.9	86.9
MB15HD20001	10/02/2020	627.9	87.0
MB15HD20001	11/02/2020	627.9	86.9
MB15HD20001	12/02/2020	627.9	86.9
MB15HD20001	13/02/2020	628.0	86.9
MB15HD20001	14/02/2020	627.9	86.9
MB15HD20001	15/02/2020	628.0	86.9
MB15HD20001	16/02/2020	628.0	86.9
MB15HD20001	17/02/2020	628.0	86.9
MB15HD20001	18/02/2020	628.0	86.9
MB15HD20001	19/02/2020	628.0	86.9
MB15HD20001	20/02/2020	628.0	86.9
MB15HD20001	21/02/2020	628.0	86.9
MB15HD20001	22/02/2020	628.0	86.9
MB15HD20001	23/02/2020	627.9	86.9
MB15HD20001	24/02/2020	627.9	86.9
MB15HD20001	25/02/2020	627.9	86.9
MB15HD20001	26/02/2020	627.9	86.9
MB15HD20001	27/02/2020	627.9	86.9
MB15HD20001	28/02/2020	627.9	86.9
MB15HD20001	29/02/2020	627.9	86.9
MB15HD20001	1/03/2020	627.9	86.9
MB15HD20001	2/03/2020	627.9	86.9
MB15HD20001	3/03/2020	627.9	86.9
MB15HD20001	4/03/2020	627.9	86.9
MB15HD20001	5/03/2020	627.9	86.9
MB15HD20001	6/03/2020	627.9	86.9
MB15HD20001	7/03/2020	628.0	86.9
MB15HD20001	8/03/2020	628.0	86.9
MB15HD20001	9/03/2020	627.9	86.9
MB15HD20001	10/03/2020	627.9	86.9
MB15HD20001	11/03/2020	627.9	86.9
MB15HD20001	12/03/2020	628.0	86.9
MB15HD20001	13/03/2020	628.0	86.9
MB15HD20001	14/03/2020	628.0	86.9
MB15HD20001	15/03/2020	627.9	86.9
MB15HD20001	16/03/2020	628.0	86.9
MB15HD20001	17/03/2020	628.0	86.9
MB15HD20001	18/03/2020	628.0	86.9
MB15HD20001	19/03/2020	628.0	86.9
MB15HD20001	20/03/2020	628.0	86.9
MB15HD20001	21/03/2020	628.0	86.9
MB15HD20001	22/03/2020	628.0	86.9
MB15HD20001	23/03/2020	628.0	86.9
MB15HD20001	24/03/2020	628.0	86.9
MB15HD20001	25/03/2020	628.0	86.9
MB15HD20001	26/03/2020	628.0	86.9
MB15HD20001	27/03/2020	628.0	86.9
MB15HD20001	28/03/2020	628.0	86.9
MB15HD20001	29/03/2020	628.0	86.9
MB15HD20001	30/03/2020	628.0	86.9
MB15HD20001	31/03/2020	627.9	86.9
MB15HD20001	1/04/2020	627.9	86.9
MB15HD20001	2/04/2020	627.9	86.9
MB15HD20001	3/04/2020	627.9	86.9
MB15HD20001	4/04/2020	628.0	86.9
MB15HD20001	5/04/2020	628.0	86.9
MB15HD20001	6/04/2020	628.0	86.9
MB15HD20001	7/04/2020	627.9	86.9
MB15HD20001	8/04/2020	627.9	86.9
MB15HD20001	9/04/2020	628.0	86.9
MB15HD20001	10/04/2020	628.0	86.9
MB15HD20001	11/04/2020	628.0	86.9
MB15HD20001	12/04/2020	628.0	86.9
MB15HD20001	13/04/2020	628.0	86.9
MB15HD20001	14/04/2020	628.0	86.9
MB15HD20001	15/04/2020	628.0	86.9
MB15HD20001	16/04/2020	628.0	86.9
MB15HD20001	17/04/2020	628.0	86.9
MB15HD20001	18/04/2020	628.0	86.9
MB15HD20001	19/04/2020	628.0	86.9
MB15HD20001	20/04/2020	628.0	86.9
MB15HD20001	21/04/2020	628.0	86.9
MB15HD20001	22/04/2020	628.0	86.9
MB15HD20001	23/04/2020	628.0	86.9
MB15HD20001	24/04/2020	628.0	86.9
MB15HD20001	25/04/2020	628.0	86.9
MB15HD20001	26/04/2020	628.0	86.9
MB15HD20001	27/04/2020	628.0	86.9
MB15HD20001	28/04/2020	628.0	86.9
MB15HD20001	29/04/2020	628.0	86.9
MB15HD20001	30/04/2020	628.0	86.9
MB15HD20001	1/05/2020	628.0	86.8
MB15HD20001	2/05/2020	628.0	86.9
MB15HD20001	3/05/2020	628.0	86.9
MB15HD20001	4/05/2020	628.0	86.9
MB15HD20001	5/05/2020	628.0	86.9
MB15HD20001	6/05/2020	628.0	86.9
MB15HD20001	7/05/2020	628.0	86.9
MB15HD20001	8/05/2020	628.0	86.9
MB15HD20001	9/05/2020	628.0	86.9
MB15HD20001	10/05/2020	628.0	86.9
MB15HD20001	11/05/2020	628.0	86.9
MB15HD20001	12/05/2020	628.0	86.9
MB15HD20001	13/05/2020	628.0	86.8
MB15HD20001	14/05/2020	628.0	86.8
MB15HD20001	15/05/2020	628.0	86.8
MB15HD20001	16/05/2020	628.0	86.9
MB15HD20001	17/05/2020	628.0	86.9
MB15HD20001	18/05/2020	628.0	86.9
MB15HD20001	19/05/2020	628.0	86.9
MB15HD20001	20/05/2020	628.0	86.9
MB15HD20001	21/05/2020	628.0	86.9
MB15HD20001	22/05/2020	628.0	86.9
MB15HD20001	23/05/2020	628.0	86.9

ID	Date	WL mAHD	WL mbgl
MB18HD20005	26/01/2019	624.8	68.1
MB18HD20005	27/01/2019	624.8	68.1
MB18HD20005	28/01/2019	624.8	68.1
MB18HD20005	29/01/2019	624.8	68.1
MB18HD20005	30/01/2019	624.8	68.1
MB18HD20005	31/01/2019	624.8	68.1
MB18HD20005	1/02/2019	624.8	68.1
MB18HD20005	2/02/2019	624.8	68.1
MB18HD20005	3/02/2019	624.8	68.1
MB18HD20005	4/02/2019	624.8	68.1
MB18HD20005	5/02/2019	624.8	68.1
MB18HD20005	6/02/2019	624.8	68.1
MB18HD20005	7/02/2019	624.8	68.1
MB18HD20005	8/02/2019	624.8	68.1
MB18HD20005	9/02/2019	624.8	68.1
MB18HD20005	10/02/2019	624.8	68.1
MB18HD20005	11/02/2019	624.8	68.1
MB18HD20005	12/02/2019	624.8	68.1
MB18HD20005	13/02/2019	624.8	68.1
MB18HD20005	14/02/2019	624.8	68.1
MB18HD20005	15/02/2019	624.8	68.1
MB18HD20005	16/02/2019	624.8	68.1
MB18HD20005	17/02/2019	624.8	68.1
MB18HD20005	18/02/2019	624.8	68.1
MB18HD20005	19/02/2019	624.8	68.1
MB18HD20005	20/02/2019	624.8	68.1
MB18HD20005	21/02/2019	624.8	68.1
MB18HD20005	22/02/2019	624.8	68.1
MB18HD20005	23/02/2019	624.8	68.1
MB18HD20005	24/02/2019	624.8	68.1
MB18HD20005	25/02/2019	624.8	68.1
MB18HD20005	26/02/2019	624.8	68.1
MB18HD20005	27/02/2019	624.8	68.1
MB18HD20005	28/02/2019	624.8	68.1
MB18HD20005	1/03/2019	624.8	68.1
MB18HD20005	2/03/2019	624.8	68.1
MB18HD20005	3/03/2019	624.8	68.1
MB18HD20005	4/03/2019	624.8	68.1
MB18HD20005	5/03/2019	624.8	68.1
MB18HD20005	6/03/2019	624.8	68.1
MB18HD20005	7/03/2019	624.8	68.1
MB18HD20005	8/03/2019	624.8	68.1
MB18HD20005	9/03/2019	624.8	68.1
MB18HD20005	10/03/2019	624.8	68.1
MB18HD20005	11/03/2019	624.8	68.1
MB18HD20005	12/03/2019	624.8	68.1
MB18HD20005	13/03/2019	624.8	68.1
MB18HD20005	14/03/2019	624.8	68.1
MB18HD20005	15/03/2019	624.8	68.1
MB18HD20005	16/03/2019	624.8	68.1
MB18HD20005	17/03/2019	624.8	68.1
MB18HD20005	18/03/2019	624.8	68.1
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MB18HD20005	20/03/2019	624.8	68.1
MB18HD20005	21/03/2019	624.8	68.1
MB18HD20005	22/03/2019	624.8	68.1
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MB18HD20005	29/03/2019	624.8	68.1
MB18HD20005	30/03/2019	624.8	68.1
MB18HD20005	31/03/2019	624.8	68.1
MB18HD20005	1/04/2019	624.8	68.1
MB18HD20005	2/04/2019	624.8	68.1
MB18HD20005	3/04/2019	624.8	68.1
MB18HD20005	4/04/2019	624.8	68.1
MB18HD20005	5/04/2019	624.8	68.1
MB18HD20005	6/04/2019	624.8	68.1
MB18HD20005	7/04/2019	624.8	68.1
MB18HD20005	8/04/2019	624.8	68.1
MB18HD20005	9/04/2019	624.8	68.1
MB18HD20005	10/04/2019	624.8	68.1
MB18HD20005	11/04/2019	624.8	68.1
MB18HD20005	12/04/2019	624.8	68.1
MB18HD20005	13/04/2019	624.8	68.1
MB18HD20005	14/04/2019	624.8	68.1
MB18HD20005	15/04/2019	624.8	68.1
MB18HD20005	16/04/2019	624.8	68.1
MB18HD20005	17/04/2019	624.8	68.1
MB18HD20005	18/04/2019	624.8	68.1
MB18HD20005	19/04/2019	624.8	68.1
MB18HD20005	20/04/2019	624.8	68.1
MB18HD20005	21/04/2019	624.8	68.0
MB18HD20005	22/04/2019	624.8	68.0
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	23/05/2016	622.7	63.5
HDVP1	22/05/2016	622.7	63.5
HDVP1	21/05/2016	622.7	63.5
HDVP1	20/05/2016	622.7	63.5
HDVP1	19/05/2016	622.7	63.5
HDVP1	18/05/2016	622.7	63.5
HDVP1	17/05/2016	622.7	63.5
HDVP1	16/05/2016	622.7	63.5
HDVP1	15/05/2016	622.7	63.5
HDVP1	14/05/2016	622.7	63.5
HDVP1	13/05/2016	622.7	63.5
HDVP1	12/05/2016	622.7	63.5
HDVP1	11/05/2016	622.7	63.5
HDVP1	10/05/2016	622.7	63.5
HDVP1	9/05/2016	622.7	63.5
HDVP1	8/05/2016	622.7	63.5
HDVP1	7/05/2016	622.7	63.5
HDVP1	6/05/2016	622.7	63.5
HDVP1	5/05/2016	622.7	63.5
HDVP1	4/05/2016	622.7	63.5
HDVP1	3/05/2016	622.7	63.5
HDVP1	2/05/2016	622.7	63.5
HDVP1	1/05/2016	643.9	42.3
HDVP1	30/04/2016	643.9	42.3
HDVP1	29/04/2016	643.9	42.3
HDVP1	28/04/2016	643.9	42.3
HDVP1	27/04/2016	643.9	42.3
HDVP1	26/04/2016	643.9	42.3
HDVP1	25/04/2016	643.9	42.3
HDVP1	24/04/2016	643.9	42.3
HDVP1	23/04/2016	643.9	42.3
HDVP1	22/04/2016	643.9	42.3
HDVP1	21/04/2016	643.9	42.3
HDVP1	20/04/2016	643.9	42.3
HDVP1	19/04/2016	643.9	42.3
HDVP1	18/04/2016	643.9	42.3
HDVP1	17/04/2016	643.9	42.3
HDVP1	16/04/2016	643.9	42.3
HDVP1	15/04/2016	643.9	42.3
HDVP1	14/04/2016	643.9	42.3
HDVP1	13/04/2016	643.9	42.3
HDVP1	12/04/2016	643.9	42.3
HDVP1	11/04/2016	643.9	42.3
HDVP1	10/04/2016	643.9	42.3
HDVP1	9/04/2016	643.9	42.3
HDVP1	8/04/2016	643.9	42.3
HDVP1	7/04/2016	643.9	42.3
HDVP1	6/04/2016	643.9	42.3
HDVP1	5/04/2016	643.9	42.3
HDVP1	4/04/2016	643.9	42.3
HDVP1	3/04/2016	643.9	42.3
HDVP1	2/04/2016	643.9	42.3
HDVP1	1/04/2016	625.7	60.5
HDVP1	31/03/2016	625.7	60.5
HDVP1	30/03/2016	625.7	60.5
HDVP1	29/03/2016	625.7	60.5
HDVP1	28/03/2016	625.7	60.5
HDVP1	27/03/2016	625.7	60.5
HDVP1	26/03/2016	625.7	60.5
HDVP1	25/03/2016	625.7	60.5
HDVP1	24/03/2016	625.7	60.5
HDVP1	23/03/2016	625.7	60.5
HDVP1	22/03/2016	625.7	60.5
HDVP1	21/03/2016	625.7	60.5
HDVP1	20/03/2016	625.7	60.5
HDVP1	19/03/2016	625.7	60.5
HDVP1	18/03/2016	625.7	60.5
HDVP1	17/03/2016	625.7	60.5
HDVP1	16/03/2016	625.7	60.5
HDVP1	15/03/2016	625.7	60.5
HDVP1	14/03/2016	625.7	60.5
HDVP1	13/03/2016	625.7	60.5
HDVP1	12/03/2016	625.7	60.5
HDVP1	11/03/2016	625.7	60.5
HDVP1	10/03/2016	625.7	60.5
HDVP1	9/03/2016	625.7	60.5
HDVP1	8/03/2016	625.7	60.5
HDVP1	7/03/2016	625.7	60.5
HDVP1	6/03/2016	625.7	60.5
HDVP1	5/03/2016	625.7	60.5
HDVP1	4/03/2016	625.7	60.5
HDVP1	3/03/2016	625.7	60.5
HDVP1	2/03/2016	625.7	60.5
HDVP1	1/03/2016	619.0	67.1
HDVP1	29/02/2016	619.0	67.1
HDVP1	28/02/2016	619.0	67.1
HDVP1	27/02/2016	619.0	67.1
HDVP1	26/02/2016	619.0	67.1
HDVP1	25/02/2016	619.0	67.1
HDVP1	24/02/2016	619.0	67.1
HDVP1	23/02/2016	619.0	67.1
HDVP1	22/02/2016	619.0	67.1
HDVP1	21/02/2016	619.0	67.1
HDVP1	20/02/2016	619.0	67.1
HDVP1	19/02/2016	619.0	67.1
HDVP1	18/02/2016	619.0	67.1
HDVP1	17/02/2016	619.0	67.1
HDVP1	16/02/2016	619.0	67.1
HDVP1	15/02/2016	619.0	67.1
HDVP1	14/02/2016	619.0	67.1
HDVP1	13/02/2016	619.0	67.1
HDVP1	12/02/2016	619.0	67.1
HDVP1	11/02/2016	619.0	67.1
HDVP1	10/02/2016	619.0	67.1
HDVP1	9/02/2016	619.0	67.1
HDVP1	8/02/2016	619.0	67.1
HDVP1	7/02/2016	619.0	67.1
HDVP1	6/02/2016	619.0	67.1
HDVP1	5/02/2016	619.0	67.1
HDVP1	4/02/2016	619.0	67.1
HDVP1	3/02/2016	619.0	67.1
HDVP1	2/02/2016	619.0	67.1
HDVP1	1/02/2016	612.9	73.3
HDVP1	31/01/2016	612.9	73.3
HDVP1	30/01/2016	612.9	73.3
HDVP1	29/01/2016	612.9	73.3
HDVP1	28/01/2016	612.9	73.3
HDVP1	27/01/2016	612.9	73.3
HDVP1	26/01/2016	612.9	73.3
HDVP1	25/01/2016	612.9	73.3
HDVP1	24/01/2016	612.9	73.3
HDVP1	23/01/2016	612.9	73.3
HDVP1	22/01/2016	612.9	73.3
HDVP1	21/01/2016	612.9	73.3
HDVP1	20/01/2016	612.9	73.3
HDVP1	19/01/2016	612.9	73.3
HDVP1	18/01/2016	612.9	73.3
HDVP1	17/01/2016	612.9	73.3
HDVP1	16/01/2016	612.9	73.3
HDVP1	15/01/2016	612.9	73.3
HDVP1	14/01/2016	612.9	73.3
HDVP1	13/01/2016	612.9	73.3
HDVP1	12/01/2016	612.9	73.3
HDVP1	11/01/2016	612.9	73.3
HDVP1	10/01/2016	612.9	73.3
HDVP1	9/01/2016	612.9	73.3

ID	Date	WL mAHD	WL mbgl
MB17H1SW0001	19/02/2018	600.3	58.4
MB17H1SW0001	18/02/2018	600.3	58.4
MB17H1SW0001	17/02/2018	600.3	58.4
MB17H1SW0001	16/02/2018	600.4	58.4
MB17H1SW0001	15/02/2018	600.4	58.3
MB17H1SW0001	14/02/2018	600.4	58.3
MB17H1SW0001	13/02/2018	600.4	58.4
MB17H1SW0001	12/02/2018	600.4	58.4
MB17H1SW0001	11/02/2018	600.4	58.4
MB17H1SW0001	10/02/2018	600.4	58.4
MB17H1SW0001	9/02/2018	600.4	58.4
MB17H1SW0001	8/02/2018	600.4	58.4
MB17H1SW0001	7/02/2018	600.4	58.4
MB17H1SW0001	6/02/2018	600.3	58.4
MB17H1SW0001	5/02/2018	600.4	58.4
MB17H1SW0001	4/02/2018	600.4	58.4
MB17H1SW0001	3/02/2018	600.3	58.4
MB17H1SW0001	2/02/2018	600.3	58.4
MB17H1SW0001	1/02/2018	600.3	58.4
MB17H1SW0001	31/01/2018	600.3	58.4
MB17H1SW0001	30/01/2018	600.3	58.4
MB17H1SW0001	29/01/2018	600.3	58.4
MB17H1SW0001	28/01/2018	600.3	58.4
MB17H1SW0001	27/01/2018	600.3	58.4
MB17H1SW0001	26/01/2018	600.3	58.4
MB17H1SW0001	25/01/2018	600.3	58.4
MB17H1SW0001	24/01/2018	600.3	58.4
MB17H1SW0001	23/01/2018	600.3	58.4
MB17H1SW0001	22/01/2018	600.3	58.4
MB17H1SW0001	21/01/2018	600.3	58.4
MB17H1SW0001	20/01/2018	600.4	58.4
MB17H1SW0001	19/01/2018	600.4	58.4
MB17H1SW0001	18/01/2018	600.4	58.4
MB17H1SW0001	17/01/2018	600.4	58.4
MB17H1SW0001	16/01/2018	600.4	58.4
MB17H1SW0001	15/01/2018	600.4	58.4
MB17H1SW0001	14/01/2018	600.4	58.4
MB17H1SW0001	13/01/2018	600.3	58.4
MB17H1SW0001	12/01/2018	600.3	58.4
MB17H1SW0001	11/01/2018	600.3	58.4
MB17H1SW0001	10/01/2018	600.3	58.4
MB17H1SW0001	9/01/2018	600.4	58.4
MB17H1SW0001	8/01/2018	600.4	58.4
MB17H1SW0001	7/01/2018	600.4	58.4
MB17H1SW0001	6/01/2018	600.3	58.4
MB17H1SW0001	5/01/2018	600.4	58.4
MB17H1SW0001	4/01/2018	600.4	58.4
MB17H1SW0001	3/01/2018	600.4	58.4
MB17H1SW0001	2/01/2018	600.4	58.4
MB17H1SW0001	1/01/2018	600.4	58.4
MB17H1SW0001	31/12/2017	600.4	58.4
MB17H1SW0001	30/12/2017	600.4	58.4
MB17H1SW0001	29/12/2017	600.4	58.4
MB17H1SW0001	28/12/2017	600.3	58.4
MB17H1SW0001	27/12/2017	600.4	58.4
MB17H1SW0001	26/12/2017	600.4	58.4
MB17H1SW0001	25/12/2017	600.4	58.4
MB17H1SW0001	24/12/2017	600.3	58.4
MB17H1SW0001	23/12/2017	600.3	58.4
MB17H1SW0001	22/12/2017	600.4	58.4
MB17H1SW0001	21/12/2017	600.4	58.4
MB17H1SW0001	20/12/2017	600.4	58.4
MB17H1SW0001	19/12/2017	600.4	58.4
MB17H1SW0001	18/12/2017	600.4	58.4
MB17H1SW0001	17/12/2017	600.4	58.4
MB17H1SW0001	16/12/2017	600.4	58.4
MB17H1SW0001	15/12/2017	600.4	58.4
MB17H1SW0001	14/12/2017	600.4	58.4
MB17H1SW0001	13/12/2017	600.4	58.4
MB17H1SW0001	12/12/2017	600.4	58.4
MB17H1SW0001	11/12/2017	600.4	58.4
MB17H1SW0001	10/12/2017	600.4	58.4
MB17H1SW0001	9/12/2017	600.4	58.4
MB17H1SW0001	8/12/2017	600.4	58.4
MB17H1SW0001	7/12/2017	600.3	58.4
MB17H1SW0001	6/12/2017	600.4	58.4
MB17H1SW0001	5/12/2017	600.4	58.4
MB17H1SW0001	4/12/2017	600.4	58.4
MB17H1SW0001	3/12/2017	600.4	58.4
MB17H1SW0001	2/12/2017	600.4	58.3
MB17H1SW0001	1/12/2017	600.4	58.4
MB17H1SW0001	30/11/2017	600.4	58.4
MB17H1SW0001	29/11/2017	600.3	58.4
MB17H1SW0001	28/11/2017	600.3	58.4
MB17H1SW0001	27/11/2017	600.3	58.4
MB17H1SW0001	26/11/2017	600.4	58.4
MB17H1SW0001	25/11/2017	600.4	58.4
MB17H1SW0001	24/11/2017	600.4	58.3
MB17H1SW0001	23/11/2017	600.4	58.4
MB17H1SW0001	22/11/2017	600.4	58.4
MB17H1SW0001	21/11/2017	600.4	58.3
MB17H1SW0001	20/11/2017	600.4	58.3
MB17H1SW0001	19/11/2017	600.4	58.3
MB17H1SW0001	18/11/2017	600.4	58.3
MB17H1SW0001	17/11/2017	600.4	58.3
MB17H1SW0001	16/11/2017	600.4	58.3
MB17H1SW0001	15/11/2017	600.4	58.3
MB17H1SW0001	14/11/2017	600.4	58.4
MB17H1SW0001	13/11/2017	600.4	58.4
MB17H1SW0001	12/11/2017	600.4	58.4
MB17H1SW0001	11/11/2017	600.4	58.3
MB17H1SW0001	10/11/2017	600.4	58.3
MB17H1SW0001	9/11/2017	600.4	58.4
MB17H1SW0001	8/11/2017	600.4	58.4
MB17H1SW0001	7/11/2017	600.4	58.3
MB17H1SW0001	6/11/2017	600.4	58.3
MB17H1SW0001	5/11/2017	600.4	58.3
MB17H1SW0001	4/11/2017	600.4	58.3
MB17H1SW0001	3/11/2017	600.4	58.3
MB17H1SW0001	2/11/2017	600.4	58.3
MB17H1SW0001	1/11/2017	600.4	58.3
MB17H1SW0001	31/10/2017	600.4	58.3
MB17H1SW0001	30/10/2017	600.4	58.3
MB17H1SW0001	29/10/2017	600.4	58.3
MB17H1SW0001	28/10/2017	600.4	58.3
MB17H1SW0001	27/10/2017	600.4	58.3
MB17H1SW0001	26/10/2017	600.4	58.3
MB17H1SW0001	25/10/2017	600.4	58.3
MB17H1SW0001	24/10/2017	600.4	58.3
MB17H1SW0001	23/10/2017	600.4	58.3
MB17H1SW0001	22/10/2017	600.4	58.3
MB17H1SW0001	21/10/2017	600.4	58.3
MB17H1SW0001	20/10/2017	600.5	58.3
MB17H1SW0001	19/10/2017	600.4	58.3
MB17H1SW0001	18/10/2017	600.4	58.3
MB17H1SW0001	17/10/2017	600.4	58.3
MB17H1SW0001	16/10/2017	600.4	58.3
MB17H1SW0001	15/10/2017	600.4	58.3
MB17H1SW0001	14/10/2017	600.4	58.3
MB17H1SW0001	13/10/2017	600.4	58.3
MB17H1SW0001	12/10/2017	600.4	58.3
MB17H1SW0001	11/10/2017	600.4	58.3
MB17H1SW0001	10/10/2017	600.4	58.4
MB17H1SW0001	9/10/2017	600.4	58.4
MB17H1SW0001	8/10/2017	600.4	58.3
MB17H1SW0001	7/10/2017	600.4	58.3

ID	Date	WL mAHD	WL mbgl
MB15HD20001	24/05/2020	628.0	86.9
MB15HD20001	25/05/2020	627.9	86.9
MB15HD20001	26/05/2020	628.0	86.9
MB15HD20001	27/05/2020	628.0	86.9
MB15HD20001	28/05/2020	628.0	86.9
MB15HD20001	29/05/2020	628.0	86.9
MB15HD20001	30/05/2020	628.0	86.9
MB15HD20001	31/05/2020	628.0	86.9
MB15HD20001	1/06/2020	628.0	86.8
MB15HD20001	2/06/2020	628.0	86.8
MB15HD20001	3/06/2020	628.0	86.8
MB15HD20001	4/06/2020	628.0	86.8
MB15HD20001	5/06/2020	628.0	86.8
MB15HD20001	6/06/2020	628.0	86.9
MB15HD20001	7/06/2020	628.0	86.9
MB15HD20001	8/06/2020	628.0	86.9
MB15HD20001	9/06/2020	628.0	86.9
MB15HD20001	10/06/2020	628.0	86.9
MB15HD20001	11/06/2020	628.0	86.9
MB15HD20001	12/06/2020	628.0	86.9
MB15HD20001	13/06/2020	628.0	86.9
MB15HD20001	14/06/2020	628.0	86.9
MB15HD20001	15/06/2020	628.0	86.9
MB15HD20001	16/06/2020	628.0	86.9
MB15HD20001	17/06/2020	628.0	86.9
MB15HD20001	18/06/2020	628.0	86.9
MB15HD20001	19/06/2020	628.0	86.9
MB15HD20001	20/06/2020	628.0	86.9
MB15HD20001	21/06/2020	628.0	86.9
MB15HD20001	22/06/2020	628.0	86.9
MB15HD20001	23/06/2020	628.0	86.9
MB15HD20001	24/06/2020	628.0	86.9
MB15HD20001	25/06/2020	628.0	86.9
MB15HD20001	26/06/2020	628.0	86.9
MB15HD20001	27/06/2020	628.0	86.9
MB15HD20001	28/06/2020	628.0	86.9
MB15HD20001	29/06/2020	628.0	86.9
MB15HD20001	30/06/2020	628.0	86.9
MB15HD20001	1/07/2020	628.0	86.9
MB15HD20001	2/07/2020	628.0	86.9
MB15HD20001	3/07/2020	628.0	86.9
MB15HD20001	4/07/2020	628.0	86.8
MB15HD20001	5/07/2020	628.0	86.9
MB15HD20001	6/07/2020	628.0	86.9
MB15HD20001	7/07/2020	628.0	86.9
MB15HD20001	8/07/2020	628.0	86.9
MB15HD20001	9/07/2020	628.0	86.9
MB15HD20001	10/07/2020	628.0	86.9
MB15HD20001	11/07/2020	628.0	86.9
MB15HD20001	12/07/2020	628.0	86.9
MB15HD20001	13/07/2020	628.0	86.9
MB15HD20001	14/07/2020	628.0	86.9
MB15HD20001	15/07/2020	628.0	86.9
MB15HD20001	16/07/2020	628.0	86.9
MB15HD20001	17/07/2020	628.0	86.9
MB15HD20001	18/07/2020	627.9	86.9
MB15HD20001	19/07/2020	628.0	86.9
MB15HD20001	20/07/2020	628.0	86.9
MB15HD20001	21/07/2020	628.0	86.9
MB15HD20001	22/07/2020	628.0	86.9
MB15HD20001	23/07/2020	628.0	86.9
MB15HD20001	24/07/2020	628.0	86.9
MB15HD20001	25/07/2020	628.0	86.9
MB15HD20001	26/07/2020	628.0	86.9
MB15HD20001	27/07/2020	628.0	86.9
MB15HD20001	28/07/2020	628.0	86.9
MB15HD20001	29/07/2020	628.0	86.9
MB15HD20001	30/07/2020	628.0	86.9
MB15HD20001	31/07/2020	628.0	86.9
MB15HD20001	1/08/2020	628.0	86.9
MB15HD20001	2/08/2020	627.9	86.9
MB15HD20001	3/08/2020	627.9	86.9
MB15HD20001	4/08/2020	627.9	86.9
MB15HD20001	5/08/2020	627.9	86.9
MB15HD20001	6/08/2020	627.9	86.9
MB15HD20001	7/08/2020	628.0	86.9
MB15HD20001	8/08/2020	627.9	86.9
MB15HD20001	9/08/2020	627.9	86.9
MB15HD20001	10/08/2020	627.9	86.9
MB15HD20001	11/08/2020	627.9	86.9
MB15HD20001	12/08/2020	627.9	86.9
MB15HD20001	13/08/2020	627.9	86.9
MB15HD20001	14/08/2020	627.9	86.9
MB15HD20001	15/08/2020	627.9	86.9
MB15HD20001	16/08/2020	627.9	86.9
MB15HD20001	17/08/2020	627.9	86.9
MB15HD20001	18/08/2020	627.9	86.9
MB15HD20001	19/08/2020	627.9	86.9
MB15HD20001	20/08/2020	627.9	86.9
MB15HD20001	21/08/2020	628.0	86.9
MB15HD20001	22/08/2020	628.0	86.9
MB15HD20001	23/08/2020	628.0	86.9
MB15HD20001	24/08/2020	627.9	86.9
MB15HD20001	25/08/2020	627.9	86.9
MB15HD20001	26/08/2020	628.0	86.9
MB15HD20001	27/08/2020	628.0	86.9
MB15HD20001	28/08/2020	628.0	86.9
MB15HD20001	29/08/2020	628.0	86.9
MB15HD20001	30/08/2020	628.0	86.9
MB15HD20001	31/08/2020	628.0	86.9
MB15HD20001	1/09/2020	627.9	86.9
MB15HD20001	2/09/2020	627.9	86.9
MB15HD20001	3/09/2020	627.9	86.9
MB15HD20001	4/09/2020	627.9	86.9
MB15HD20001	5/09/2020	627.9	86.9
MB15HD20001	6/09/2020	627.9	86.9
MB15HD20001	7/09/2020	627.9	86.9
MB15HD20001	8/09/2020	627.9	86.9
MB15HD20001	9/09/2020	627.9	86.9
MB15HD20001	10/09/2020	627.9	86.9
MB15HD20001	11/09/2020	627.9	86.9
MB15HD20001	12/09/2020	627.9	86.9
MB15HD20001	13/09/2020	627.9	86.9
MB15HD20001	14/09/2020	627.9	86.9
MB15HD20001	15/09/2020	627.9	86.9
MB15HD20001	16/09/2020	627.9	86.9
MB15HD20001	17/09/2020	627.9	86.9
MB15HD20001	18/09/2020	627.9	86.9
MB15HD20001	19/09/2020	627.9	87.0
MB15HD20001	20/09/2020	627.9	86.9
MB15HD20001	21/09/2020	627.9	86.9
MB15HD20001	22/09/2020	627.9	86.9
MB15HD20001	23/09/2020	627.9	86.9
MB15HD20001	24/09/2020	627.9	86.9
MB15HD20001	25/09/2020	627.9	86.9
MB15HD20001	26/09/2020	627.9	86.9
MB15HD20001	27/09/2020	627.9	86.9
MB15HD20001	28/09/2020	627.9	86.9
MB15HD20001	29/09/2020	627.9	86.9
MB15HD20001	30/09/2020	627.9	86.9
MB15HD20001	1/10/2020	627.9	86.9
MB15HD20001	2/10/2020	627.9	87.0
MB15HD20001	3/10/2020	627.9	86.9
MB15HD20001	4/10/2020	627.9	86.9
MB15HD20001	5/10/2020	628.0	86.9
MB15HD20001	6/10/2020	628.0	86.9

ID	Date	WL mAHD	WL mbgl
MB18HD20005	11/06/2019	624.8	68.1
MB18HD20005	12/06/2019	624.8	68.0
MB18HD20005	13/06/2019	624.9	68.0
MB18HD20005	14/06/2019	624.8	68.0
MB18HD20005	15/06/2019	624.8	68.0
MB18HD20005	16/06/2019	624.9	68.0
MB18HD20005	17/06/2019	624.9	68.0
MB18HD20005	18/06/2019	624.8	68.0
MB18HD20005	19/06/2019	624.8	68.1
MB18HD20005	20/06/2019	624.8	68.1
MB18HD20005	21/06/2019	624.8	68.1
MB18HD20005	22/06/2019	624.8	68.1
MB18HD20005	23/06/2019	624.8	68.1
MB18HD20005	24/06/2019	624.8	68.1
MB18HD20005	25/06/2019	624.8	68.0
MB18HD20005	26/06/2019	624.8	68.0
MB18HD20005	27/06/2019	624.8	68.1
MB18HD20005	28/06/2019	624.8	68.1
MB18HD20005	29/06/2019	624.9	68.0
MB18HD20005	30/06/2019	624.9	68.0
MB18HD20005	1/07/2019	624.8	68.0
MB18HD20005	2/07/2019	624.8	68.1
MB18HD20005	3/07/2019	624.8	68.1
MB18HD20005	4/07/2019	624.8	68.1
MB18HD20005	5/07/2019	624.8	68.1
MB18HD20005	6/07/2019	624.8	68.1
MB18HD20005	7/07/2019	624.8	68.0
MB18HD20005	8/07/2019	624.9	68.0
MB18HD20005	9/07/2019	624.9	68.0
MB18HD20005	10/07/2019	624.9	68.0
MB18HD20005	11/07/2019	624.9	68.0
MB18HD20005	12/07/2019	624.9	68.0
MB18HD20005	13/07/2019	624.9	68.0
MB18HD20005	14/07/2019	624.9	68.0
MB18HD20005	15/07/2019	624.9	68.0
MB18HD20005	16/07/2019	624.9	68.0
MB18HD20005	17/07/2019	624.9	68.0
MB18HD20005	18/07/2019	624.8	68.0
MB18HD20005	19/07/2019	624.8	68.1
MB18HD20005	20/07/2019	624.8	68.1
MB18HD20005	21/07/2019	624.8	68.1
MB18HD20005	22/07/2019	624.8	68.1
MB18HD20005	23/07/2019	624.8	68.1
MB18HD20005	24/07/2019	624.8	68.0
MB18HD20005	25/07/2019	624.8	68.0
MB18HD20005	26/07/2019	624.8	68.1
MB18HD20005	27/07/2019	624.8	68.1
MB18HD20005	28/07/2019	624.8	68.1
MB18HD20005	29/07/2019	624.8	68.1
MB18HD20005	30/07/2019	624.8	68.1
MB18HD20005	31/07/2019	624.9	68.0
MB18HD20005	1/08/2019	624.9	68.0
MB18HD20005	2/08/2019	624.9	68.0
MB18HD20005	3/08/2019	624.9	68.0
MB18HD20005	4/08/2019	624.9	68.0
MB18HD20005	5/08/2019	624.8	68.0
MB18HD20005	6/08/2019	624.8	68.1
MB18HD20005	7/08/2019	624.8	68.1
MB18HD20005	8/08/2019	624.8	68.0
MB18HD20005	9/08/2019	624.8	68.0
MB18HD20005	10/08/2019	624.9	68.0
MB18HD20005	11/08/2019	624.8	68.0
MB18HD20005	12/08/2019	624.8	68.0
MB18HD20005	13/08/2019	624.8	68.1
MB18HD20005	14/08/2019	624.8	68.1
MB18HD20005	15/08/2019	624.8	68.1
MB18HD20005	16/08/2019	624.8	68.1
MB18HD20005	17/08/2019	624.8	68.1
MB18HD20005	18/08/2019	624.8	68.0
MB18HD20005	19/08/2019	624.9	68.0
MB18HD20005	20/08/2019	624.9	68.0
MB18HD20005	21/08/2019	624.9	68.0
MB18HD20005	22/08/2019	624.9	68.0
MB18HD20005	23/08/2019	624.8	68.0
MB18HD20005	24/08/2019	624.8	68.1
MB18HD20005	25/08/2019	624.8	68.1
MB18HD20005	26/08/2019	624.8	68.1
MB18HD20005	27/08/2019	624.8	68.1
MB18HD20005	28/08/2019	624.8	68.1
MB18HD20005	29/08/2019	624.8	68.1
MB18HD20005	30/08/2019	624.8	68.1
MB18HD20005	31/08/2019	624.8	68.1
MB18HD20005	1/09/2019	624.8	68.1
MB18HD20005	2/09/2019	624.8	68.1
MB18HD20005	3/09/2019	624.8	68.1
MB18HD20005	4/09/2019	624.8	68.1
MB18HD20005	5/09/2019	624.8	68.1
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	8/01/2016	612.9	73.3
HDVP1	7/01/2016	612.9	73.3
HDVP1	6/01/2016	612.9	73.3
HDVP1	5/01/2016	612.9	73.3
HDVP1	4/01/2016	612.9	73.3
HDVP1	3/01/2016	612.9	73.3
HDVP1	2/01/2016	612.9	73.3
HDVP1	1/01/2016	525.0	161.2
HDVP1	31/12/2015	525.0	161.2
HDVP1	30/12/2015	525.0	161.2
HDVP1	29/12/2015	525.0	161.2
HDVP1	28/12/2015	525.0	161.2
HDVP1	27/12/2015	525.0	161.2
HDVP1	26/12/2015	525.0	161.2
HDVP1	25/12/2015	525.0	161.2
HDVP1	24/12/2015	525.0	161.2
HDVP1	23/12/2015	525.0	161.2
HDVP1	22/12/2015	525.0	161.2
HDVP1	21/12/2015	525.0	161.2
HDVP1	20/12/2015	525.0	161.2
HDVP1	19/12/2015	525.0	161.2
HDVP1	18/12/2015	525.0	161.2
HDVP1	17/12/2015	525.0	161.2
HDVP1	16/12/2015	525.0	161.2
HDVP1	15/12/2015	525.0	161.2
HDVP1	14/12/2015	525.0	161.2
HDVP1	13/12/2015	525.0	161.2
HDVP1	12/12/2015	525.0	161.2
HDVP1	11/12/2015	525.0	161.2
HDVP1	10/12/2015	525.0	161.2
HDVP1	9/12/2015	525.0	161.2
HDVP1	8/12/2015	525.0	161.2
HDVP1	7/12/2015	525.0	161.2
HDVP1	6/12/2015	525.0	161.2
HDVP1	5/12/2015	525.0	161.2
HDVP1	4/12/2015	525.0	161.2
HDVP1	3/12/2015	525.0	161.2
HDVP1	2/12/2015	525.0	161.2
HDVP1	1/12/2015	540.5	145.7
HDVP1	30/11/2015	540.5	145.7
HDVP1	29/11/2015	540.5	145.7
HDVP1	28/11/2015	540.5	145.7
HDVP1	27/11/2015	540.5	145.7
HDVP1	26/11/2015	540.5	145.7
HDVP1	25/11/2015	540.5	145.7
HDVP1	24/11/2015	540.5	145.7
HDVP1	23/11/2015	540.5	145.7
HDVP1	22/11/2015	540.5	145.7
HDVP1	21/11/2015	540.5	145.7
HDVP1	20/11/2015	540.5	145.7
HDVP1	19/11/2015	540.5	145.7
HDVP1	18/11/2015	540.5	145.7
HDVP1	17/11/2015	540.5	145.7
HDVP1	16/11/2015	540.5	145.7
HDVP1	15/11/2015	540.5	145.7
HDVP1	14/11/2015	540.5	145.7
HDVP1	13/11/2015	540.5	145.7
HDVP1	12/11/2015	540.5	145.7
HDVP1	11/11/2015	540.5	145.7
HDVP1	10/11/2015	540.5	145.7
HDVP1	9/11/2015	540.5	145.7
HDVP1	8/11/2015	540.5	145.7
HDVP1	7/11/2015	540.5	145.7
HDVP1	6/11/2015	540.5	145.7
HDVP1	5/11/2015	540.5	145.7
HDVP1	4/11/2015	540.5	145.7
HDVP1	3/11/2015	540.5	145.7
HDVP1	2/11/2015	540.5	145.7
HDVP1	1/11/2015	480.1	206.1
HDVP1	31/10/2015	480.1	206.1
HDVP1	30/10/2015	480.1	206.1
HDVP1	29/10/2015	480.1	206.1
HDVP1	28/10/2015	480.1	206.1
HDVP1	27/10/2015	480.1	206.1
HDVP1	26/10/2015	480.1	206.1
HDVP1	25/10/2015	480.1	206.1
HDVP1	24/10/2015	480.1	206.1
HDVP1	23/10/2015	480.1	206.1
HDVP1	22/10/2015	480.1	206.1
HDVP1	21/10/2015	480.1	206.1
HDVP1	20/10/2015	480.1	206.1
HDVP1	19/10/2015	480.1	206.1
HDVP1	18/10/2015	480.1	206.1
HDVP1	17/10/2015	480.1	206.1
HDVP1	16/10/2015	480.1	206.1
HDVP1	15/10/2015	480.1	206.1
HDVP1	14/10/2015	480.1	206.1
HDVP1	13/10/2015	480.1	206.1
HDVP1	12/10/2015	480.1	206.1
HDVP1	11/10/2015	480.1	206.1
HDVP1	10/10/2015	480.1	206.1
HDVP1	9/10/2015	480.1	206.1
HDVP1	8/10/2015	480.1	206.1
HDVP1	7/10/2015	480.1	206.1
HDVP1	6/10/2015	480.1	206.1
HDVP1	5/10/2015	480.1	206.1
HDVP1	4/10/2015	480.1	206.1
HDVP1	3/10/2015	480.1	206.1
HDVP1	2/10/2015	480.1	206.1
HDVP1	1/10/2015	400.5	285.7
HDVP1	30/09/2015	400.5	285.7
HDVP1	29/09/2015	400.5	285.7
HDVP1	28/09/2015	400.5	285.7
HDVP1	27/09/2015	400.5	285.7
HDVP1	26/09/2015	400.5	285.7
HDVP1	25/09/2015	400.5	285.7
HDVP1	24/09/2015	400.5	285.7
HDVP1	23/09/2015	400.5	285.7
HDVP1	22/09/2015	400.5	285.7
HDVP1	21/09/2015	400.5	285.7
HDVP1	20/09/2015	400.5	285.7
HDVP1	19/09/2015	400.5	285.7
HDVP1	18/09/2015	400.5	285.7
HDVP1	17/09/2015	400.5	285.7
HDVP1	16/09/2015	400.5	285.7
HDVP1	15/09/2015	400.5	285.7
HDVP1	14/09/2015	400.5	285.7
HDVP1	13/09/2015	400.5	285.7
HDVP1	12/09/2015	400.5	285.7
HDVP1	11/09/2015	400.5	285.7
HDVP1	10/09/2015	400.5	285.7
HDVP1	9/09/2015	400.5	285.7
HDVP1	8/09/2015	400.5	285.7
HDVP1	7/09/2015	400.5	285.7
HDVP1	6/09/2015	400.5	285.7
HDVP1	5/09/2015	400.5	285.7
HDVP1	4/09/2015	400.5	285.7
HDVP1	3/09/2015	400.5	285.7
HDVP1	2/09/2015	400.5	285.7
HDVP1	1/09/2015	463.5	222.7
HDVP1	31/08/2015	463.5	222.7
HDVP1	30/08/2015	463.5	222.7
HDVP1	29/08/2015	463.5	222.7
HDVP1	28/08/2015	463.5	222.7
HDVP1	27/08/2015	463.5	222.7
HDVP1	26/08/2015	463.5	222.7

ID	Date	WL mAHD	WL mbgl
MB17H1SW0001	6/10/2017	600.4	58.3
MB17H1SW0001	5/10/2017	600.4	58.3
MB17H1SW0001	4/10/2017	600.4	58.3
MB17H1SW0001	3/10/2017	600.4	58.3
MB17H1SW0001	2/10/2017	600.4	58.3
MB17H1SW0001	1/10/2017	600.4	58.3
MB17H1SW0001	30/09/2017	600.5	58.3
MB17H1SW0001	29/09/2017	600.5	58.3
MB17H1SW0001	28/09/2017	600.4	58.3
MB17H1SW0001	27/09/2017	600.4	58.3
MB17H1SW0001	26/09/2017	600.4	58.3
MB17H1SW0001	25/09/2017	600.4	58.3
MB17H1SW0001	24/09/2017	600.4	58.3
MB17H1SW0001	23/09/2017	600.4	58.3
MB17H1SW0001	22/09/2017	600.4	58.3
MB17H1SW0001	21/09/2017	600.4	58.3
MB17H1SW0001	20/09/2017	600.5	58.3
MB17H1SW0001	19/09/2017	600.5	58.3
MB17H1SW0001	18/09/2017	600.5	58.3
MB17H1SW0001	17/09/2017	600.5	58.3
MB17H1SW0001	16/09/2017	600.5	58.3
MB17H1SW0001	15/09/2017	600.5	58.3
MB17H1SW0001	14/09/2017	600.5	58.3
MB17H1SW0001	13/09/2017	600.5	58.3
MB17H1SW0001	12/09/2017	600.4	58.3
MB17H1SW0001	11/09/2017	600.4	58.3
MB17H1SW0001	10/09/2017	600.4	58.3
MB17H1SW0001	9/09/2017	600.5	58.3
MB17H1SW0001	8/09/2017	600.5	58.3
MB17H1SW0001	7/09/2017	600.5	58.3
MB17H1SW0001	6/09/2017	600.5	58.3
MB17H1SW0001	5/09/2017	600.5	58.3
MB17H1SW0001	4/09/2017	600.4	58.4
MB17H1SW0001	3/09/2017	600.4	58.4
MB17H1SW0001	2/09/2017	600.4	58.4
MB17H1SW0001	1/09/2017	600.4	58.4
MB17H1SW0001	31/08/2017	600.4	58.4
MB17H1SW0001	30/08/2017	600.4	58.4
MB17H1SW0001	29/08/2017	600.4	58.4
MB17H1SW0001	28/08/2017	600.4	58.4
MB17H1SW0001	27/08/2017	600.4	58.3
MB17H1SW0001	26/08/2017	600.4	58.3
MB17H1SW0001	25/08/2017	600.4	58.3
MB17H1SW0001	24/08/2017	600.4	58.3
MB17H1SW0001	23/08/2017	600.4	58.4
MB17H1SW0001	22/08/2017	600.4	58.3
MB17H1SW0001	21/08/2017	600.4	58.3
MB17H1SW0002	26/08/2019	596.8	51.6
MB17H1SW0002	25/08/2019	596.8	51.6
MB17H1SW0002	24/08/2019	596.8	51.6
MB17H1SW0002	23/08/2019	596.8	51.6
MB17H1SW0002	22/08/2019	596.8	51.6
MB17H1SW0002	21/08/2019	596.8	51.6
MB17H1SW0002	20/08/2019	596.8	51.6
MB17H1SW0002	19/08/2019	596.8	51.6
MB17H1SW0002	18/08/2019	596.8	51.6
MB17H1SW0002	17/08/2019	596.8	51.6
MB17H1SW0002	16/08/2019	596.8	51.6
MB17H1SW0002	15/08/2019	596.8	51.6
MB17H1SW0002	14/08/2019	596.8	51.6
MB17H1SW0002	13/08/2019	596.8	51.6
MB17H1SW0002	12/08/2019	596.8	51.6
MB17H1SW0002	11/08/2019	596.8	51.6
MB17H1SW0002	10/08/2019	596.8	51.6
MB17H1SW0002	9/08/2019	596.8	51.6
MB17H1SW0002	8/08/2019	596.8	51.6
MB17H1SW0002	7/08/2019	596.8	51.6
MB17H1SW0002	6/08/2019	596.7	51.7
MB17H1SW0002	5/08/2019	596.8	51.6
MB17H1SW0002	4/08/2019	596.8	51.6
MB17H1SW0002	3/08/2019	596.7	51.7
MB17H1SW0002	2/08/2019	596.6	51.8
MB17H1SW0002	1/08/2019	596.6	51.8
MB17H1SW0002	31/07/2019	596.6	51.8
MB17H1SW0002	30/07/2019	596.6	51.8
MB17H1SW0002	29/07/2019	596.6	51.8
MB17H1SW0002	28/07/2019	596.6	51.8
MB17H1SW0002	27/07/2019	596.6	51.8
MB17H1SW0002	26/07/2019	596.6	51.8
MB17H1SW0002	25/07/2019	596.6	51.8
MB17H1SW0002	24/07/2019	596.6	51.8
MB17H1SW0002	23/07/2019	596.6	51.8
MB17H1SW0002	22/07/2019	596.6	51.8
MB17H1SW0002	21/07/2019	596.6	51.8
MB17H1SW0002	20/07/2019	596.6	51.8
MB17H1SW0002	19/07/2019	596.6	51.8
MB17H1SW0002	18/07/2019	596.6	51.8
MB17H1SW0002	17/07/2019	596.6	51.8
MB17H1SW0002	16/07/2019	596.6	51.8
MB17H1SW0002	15/07/2019	596.6	51.8
MB17H1SW0002	14/07/2019	596.6	51.8
MB17H1SW0002	13/07/2019	596.6	51.8
MB17H1SW0002	12/07/2019	596.6	51.8
MB17H1SW0002	11/07/2019	596.6	51.8
MB17H1SW0002	10/07/2019	596.6	51.8
MB17H1SW0002	9/07/2019	596.6	51.8
MB17H1SW0002	8/07/2019	596.6	51.8
MB17H1SW0002	7/07/2019	596.6	51.8
MB17H1SW0002	6/07/2019	596.6	51.8
MB17H1SW0002	5/07/2019	596.6	51.8
MB17H1SW0002	4/07/2019	596.6	51.8
MB17H1SW0002	3/07/2019	596.6	51.8
MB17H1SW0002	2/07/2019	596.6	51.8
MB17H1SW0002	1/07/2019	596.6	51.8
MB17H1SW0002	30/06/2019	596.6	51.8
MB17H1SW0002	29/06/2019	596.6	51.8
MB17H1SW0002	28/06/2019	596.6	51.8
MB17H1SW0002	27/06/2019	596.6	51.8
MB17H1SW0002	26/06/2019	596.6	51.8
MB17H1SW0002	25/06/2019	596.6	51.8
MB17H1SW0002	24/06/2019	596.6	51.8
MB17H1SW0002	23/06/2019	596.6	51.8
MB17H1SW0002	22/06/2019	596.6	51.8
MB17H1SW0002	21/06/2019	596.6	51.8
MB17H1SW0002	20/06/2019	596.6	51.8
MB17H1SW0002	19/06/2019	596.6	51.8
MB17H1SW0002	18/06/2019	596.6	51.8
MB17H1SW0002	17/06/2019	596.6	51.8
MB17H1SW0002	16/06/2019	596.6	51.8
MB17H1SW0002	15/06/2019	596.6	51.8
MB17H1SW0002	14/06/2019	596.6	51.8
MB17H1SW0002	13/06/2019	596.6	51.8
MB17H1SW0002	12/06/2019	596.6	51.8
MB17H1SW0002	11/06/2019	596.6	51.8
MB17H1SW0002	10/06/2019	596.6	51.8
MB17H1SW0002	9/06/2019	596.6	51.8
MB17H1SW0002	8/06/2019	596.6	51.8
MB17H1SW0002	7/06/2019	596.6	51.8
MB17H1SW0002	6/06/2019	596.6	51.8
MB17H1SW0002	5/06/2019	596.6	51.8
MB17H1SW0002	4/06/2019	596.6	51.8
MB17H1SW0002	3/06/2019	596.6	51.8
MB17H1SW0002	2/06/2019	596.7	51.7
MB17H1SW0002	1/06/2019	596.6	51.8
MB17H1SW0002	31/05/2019	596.6	51.8
MB17H1SW0002	30/05/2019	596.6	51.8

ID	Date	WL mAHD	WL mbgl
MB15HD20001	7/10/2020	627.9	86.9
MB15HD20001	8/10/2020	627.9	86.9
MB15HD20001	9/10/2020	627.9	86.9
MB15HD20001	10/10/2020	627.9	86.9
MB15HD20001	11/10/2020	627.9	86.9
MB15HD20001	12/10/2020	627.9	86.9
MB15HD20001	13/10/2020	627.9	86.9
MB15HD20001	14/10/2020	627.9	86.9
MB15HD20001	15/10/2020	627.9	87.0
MB15HD20001	16/10/2020	627.9	87.0
MB15HD20001	17/10/2020	627.9	87.0
MB15HD20001	18/10/2020	627.9	87.0
MB15HD20001	19/10/2020	627.9	87.0
MB15HD20001	20/10/2020	627.9	87.0
MB15HD20001	21/10/2020	627.9	87.0
MB15HD20001	22/10/2020	627.9	87.0
MB15HD20001	23/10/2020	627.9	87.0
MB15HD20001	24/10/2020	627.9	87.0
MB15HD20001	25/10/2020	627.9	87.0
MB15HD20001	26/10/2020	627.9	87.0
MB15HD20001	27/10/2020	627.9	87.0
MB15HD20001	28/10/2020	627.9	87.0
MB15HD20001	29/10/2020	627.9	87.0
MB15HD20001	30/10/2020	627.9	87.0
MB15HD20001	31/10/2020	627.9	87.0
MB15HD20001	1/11/2020	627.9	87.0
MB15HD20001	2/11/2020	627.9	87.0
MB15HD20001	3/11/2020	627.9	87.0
MB15HD20001	4/11/2020	627.9	86.9
MB15HD20001	5/11/2020	627.9	86.9
MB15HD20001	6/11/2020	627.9	87.0
MB15HD20001	7/11/2020	627.9	87.0
MB15HD20001	8/11/2020	627.9	87.0
MB15HD20001	9/11/2020	627.9	87.0
MB15HD20001	10/11/2020	627.9	87.0
MB15HD20001	11/11/2020	627.9	87.0
MB15HD20001	12/11/2020	627.9	87.0
MB15HD20001	13/11/2020	627.9	87.0
MB15HD20001	14/11/2020	627.9	87.0
MB15HD20001	15/11/2020	627.9	87.0
MB15HD20001	16/11/2020	627.9	87.0
MB15HD20001	17/11/2020	627.9	87.0
MB15HD20001	18/11/2020	627.9	87.0
MB15HD20001	19/11/2020	627.9	87.0
MB15HD20001	20/11/2020	627.9	87.0
MB15HD20001	21/11/2020	627.9	87.0
MB15HD20001	22/11/2020	627.9	87.0
MB15HD20001	23/11/2020	627.9	87.0
MB15HD20001	24/11/2020	627.9	87.0
MB15HD20001	25/11/2020	627.9	87.0
MB15HD20001	26/11/2020	627.9	87.0
MB15HD20001	27/11/2020	627.9	87.0
MB15HD20001	28/11/2020	627.9	87.0
MB15HD20001	29/11/2020	627.9	87.0
MB15HD20001	30/11/2020	627.9	87.0
MB15HD20001	1/12/2020	627.9	87.0
MB15HD20001	2/12/2020	627.9	87.0
MB15HD20001	3/12/2020	627.9	87.0
MB15HD20001	4/12/2020	627.9	87.0
MB15HD20001	5/12/2020	627.9	87.0
MB15HD20001	6/12/2020	627.9	87.0
MB15HD20001	7/12/2020	627.9	87.0
MB15HD20001	8/12/2020	627.9	87.0
MB15HD20001	9/12/2020	627.9	87.0
MB15HD20001	10/12/2020	627.8	87.0
MB15HD20001	11/12/2020	627.8	87.0
MB15HD20001	12/12/2020	627.8	87.0
MB15HD20001	13/12/2020	627.8	87.0
MB15HD20001	14/12/2020	627.8	87.0
MB15HD20001	15/12/2020	627.8	87.0
MB15HD20001	16/12/2020	627.8	87.0
MB15HD20001	17/12/2020	627.8	87.0
MB15HD20001	18/12/2020	627.8	87.0
MB15HD20001	19/12/2020	627.8	87.0
MB15HD20001	20/12/2020	627.8	87.0
MB15HD20001	21/12/2020	627.8	87.0
MB15HD20001	22/12/2020	627.8	87.0
MB15HD20001	23/12/2020	627.9	87.0
MB15HD20001	24/12/2020	627.9	87.0
MB15HD20001	25/12/2020	627.9	87.0
MB15HD20001	26/12/2020	627.9	87.0
MB15HD20001	27/12/2020	627.8	87.0
MB15HD20001	28/12/2020	627.8	87.0
MB15HD20001	29/12/2020	627.8	87.0
MB15HD20001	30/12/2020	627.8	87.0
MB15HD20001	31/12/2020	627.8	87.0
MB15HD20001	1/01/2021	627.8	87.0
MB15HD20001	2/01/2021	627.8	87.0
MB15HD20001	3/01/2021	627.8	87.0
MB15HD20001	4/01/2021	627.8	87.0
MB15HD20001	5/01/2021	627.9	87.0
MB15HD20001	6/01/2021	627.9	87.0
MB15HD20001	7/01/2021	627.9	87.0
MB15HD20001	8/01/2021	627.9	87.0
MB15HD20001	9/01/2021	627.9	87.0
MB15HD20001	10/01/2021	627.9	87.0
MB15HD20001	11/01/2021	627.9	87.0
MB15HD20001	12/01/2021	627.8	87.0
MB15HD20001	13/01/2021	627.8	87.0
MB15HD20001	14/01/2021	627.8	87.0
MB15HD20001	15/01/2021	627.8	87.0
MB15HD20001	16/01/2021	627.8	87.0
MB15HD20001	17/01/2021	627.9	87.0
MB15HD20001	18/01/2021	627.9	87.0
MB15HD20001	19/01/2021	627.9	87.0
MB15HD20001	20/01/2021	627.9	87.0
MB15HD20001	21/01/2021	627.8	87.0
MB15HD20001	22/01/2021	627.8	87.0
MB15HD20001	23/01/2021	627.8	87.0
MB15HD20001	24/01/2021	627.8	87.0
MB15HD20001	25/01/2021	627.8	87.0
MB15HD20001	26/01/2021	627.8	87.0
MB15HD20001	27/01/2021	627.8	87.1
MB15HD20001	28/01/2021	627.8	87.1
MB15HD20001	29/01/2021	627.8	87.1
MB15HD20001	30/01/2021	627.8	87.0
MB15HD20001	31/01/2021	627.8	87.0
MB15HD20001	1/02/2021	627.8	87.1
MB15HD20001	2/02/2021	627.8	87.1
MB15HD20001	3/02/2021	627.8	87.1
MB15HD20001	4/02/2021	627.8	87.1
MB15HD20001	5/02/2021	627.8	87.1
MB15HD20001	6/02/2021	627.8	87.1
MB15HD20001	7/02/2021	627.8	87.1
MB15HD20001	8/02/2021	627.8	87.0
MB15HD20001	9/02/2021	627.8	87.0
MB15HD20001	10/02/2021	627.8	87.1
MB15HD20001	11/02/2021	627.8	87.1
MB15HD20001	12/02/2021	627.8	87.0
MB15HD20001	13/02/2021	627.8	87.0
MB15HD20001	14/02/2021	627.8	87.0
MB15HD20001	15/02/2021	627.8	87.0
MB15HD20001	16/02/2021	627.8	87.0
MB15HD20001	17/02/2021	627.8	87.0
MB15HD20001	18/02/2021	627.8	87.0
MB15HD20001	19/02/2021	627.8	87.0

ID	Date	WL mAHD	WL mbgl
MB18HD20005	25/10/2019	624.8	68.1
MB18HD20005	26/10/2019	624.8	68.1
MB18HD20005	27/10/2019	624.7	68.1
MB18HD20005	28/10/2019	624.7	68.1
MB18HD20005	29/10/2019	624.7	68.1
MB18HD20005	30/10/2019	624.7	68.1
MB18HD20005	31/10/2019	624.7	68.2
MB18HD20005	1/11/2019	624.7	68.2
MB18HD20005	2/11/2019	624.7	68.1
MB18HD20005	3/11/2019	624.8	68.1
MB18HD20005	4/11/2019	624.8	68.1
MB18HD20005	5/11/2019	624.8	68.1
MB18HD20005	6/11/2019	624.8	68.1
MB18HD20005	7/11/2019	624.8	68.1
MB18HD20005	8/11/2019	624.8	68.1
MB18HD20005	9/11/2019	624.8	68.1
MB18HD20005	10/11/2019	624.8	68.1
MB18HD20005	11/11/2019	624.7	68.1
MB18HD20005	12/11/2019	624.7	68.1
MB18HD20005	13/11/2019	624.8	68.1
MB18HD20005	14/11/2019	624.8	68.1
MB18HD20005	15/11/2019	624.8	68.1
MB18HD20005	16/11/2019	624.8	68.1
MB18HD20005	17/11/2019	624.8	68.1
MB18HD20005	18/11/2019	624.8	68.1
MB18HD20005	19/11/2019	624.7	68.2
MB18HD20005	20/11/2019	624.7	68.2
MB18HD20005	21/11/2019	624.7	68.1
MB18HD20005	22/11/2019	624.7	68.1
MB18HD20005	23/11/2019	624.7	68.1
MB18HD20005	24/11/2019	624.7	68.2
MB18HD20005	25/11/2019	624.7	68.2
MB18HD20005	26/11/2019	624.7	68.2
MB18HD20005	27/11/2019	624.7	68.2
MB18HD20005	28/11/2019	624.7	68.2
MB18HD20005	29/11/2019	624.7	68.2
MB18HD20005	30/11/2019	624.7	68.2
MB18HD20005	1/12/2019	624.8	68.1
MB18HD20005	2/12/2019	624.8	68.1
MB18HD20005	3/12/2019	624.7	68.1
MB18HD20005	4/12/2019	624.7	68.1
MB18HD20005	5/12/2019	624.7	68.2
MB18HD20005	6/12/2019	624.7	68.2
MB18HD20005	7/12/2019	624.7	68.2
MB18HD20005	8/12/2019	624.7	68.2
MB18HD20005	9/12/2019	624.7	68.2
MB18HD20005	10/12/2019	624.7	68.2
MB18HD20005	11/12/2019	624.7	68.2
MB18HD20005	12/12/2019	624.7	68.1
MB18HD20005	13/12/2019	624.7	68.1
MB18HD20005	14/12/2019	624.7	68.2
MB18HD20005	15/12/2019	624.7	68.2
MB18HD20005	16/12/2019	624.7	68.2
MB18HD20005	17/12/2019	624.7	68.2
MB18HD20005	18/12/2019	624.7	68.2
MB18HD20005	19/12/2019	624.7	68.2
MB18HD20005	20/12/2019	624.7	68.2
MB18HD20005	21/12/2019	624.7	68.2
MB18HD20005	22/12/2019	624.7	68.2
MB18HD20005	23/12/2019	624.7	68.2
MB18HD20005	24/12/2019	624.7	68.2
MB18HD20005	25/12/2019	624.7	68.2
MB18HD20005	26/12/2019	624.7	68.2
MB18HD20005	27/12/2019	624.7	68.2
MB18HD20005	28/12/2019	624.7	68.2
MB18HD20005	29/12/2019	624.7	68.2
MB18HD20005	30/12/2019	624.7	68.2
MB18HD20005	31/12/2019	624.7	68.2
MB18HD20005	1/01/2020	624.7	68.2
MB18HD20005	2/01/2020	624.7	68.2
MB18HD20005	3/01/2020	624.7	68.2
MB18HD20005	4/01/2020	624.7	68.2
MB18HD20005	5/01/2020	624.7	68.2
MB18HD20005	6/01/2020	624.7	68.2
MB18HD20005	7/01/2020	624.7	68.2
MB18HD20005	8/01/2020	624.7	68.2
MB18HD20005	9/01/2020	624.6	68.3
MB18HD20005	10/01/2020	624.7	68.2
MB18HD20005	11/01/2020	624.7	68.2
MB18HD20005	12/01/2020	624.7	68.2
MB18HD20005	13/01/2020	624.7	68.2
MB18HD20005	14/01/2020	624.7	68.2
MB18HD20005	15/01/2020	624.7	68.2
MB18HD20005	16/01/2020	624.7	68.2
MB18HD20005	17/01/2020	624.7	68.2
MB18HD20005	18/01/2020	624.7	68.2
MB18HD20005	19/01/2020	624.7	68.2
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	25/08/2015	463.5	222.7
HDVP1	24/08/2015	463.5	222.7
HDVP1	23/08/2015	463.5	222.7
HDVP1	22/08/2015	463.5	222.7
HDVP1	21/08/2015	463.5	222.7
HDVP1	20/08/2015	463.5	222.7
HDVP1	19/08/2015	463.5	222.7
HDVP1	18/08/2015	463.5	222.7
HDVP1	17/08/2015	463.5	222.7
HDVP1	16/08/2015	463.5	222.7
HDVP1	15/08/2015	463.5	222.7
HDVP1	14/08/2015	463.5	222.7
HDVP1	13/08/2015	463.5	222.7
HDVP1	12/08/2015	463.5	222.7
HDVP1	11/08/2015	463.5	222.7
HDVP1	10/08/2015	463.5	222.7
HDVP1	9/08/2015	463.5	222.7
HDVP1	8/08/2015	463.5	222.7
HDVP1	7/08/2015	463.5	222.7
HDVP1	6/08/2015	463.5	222.7
HDVP1	5/08/2015	463.5	222.7
HDVP1	4/08/2015	463.5	222.7
HDVP1	3/08/2015	463.5	222.7
HDVP1	2/08/2015	463.5	222.7
HDVP1	1/08/2015	417.1	269.1
HDVP1	31/07/2015	417.1	269.1
HDVP1	30/07/2015	417.1	269.1
HDVP1	29/07/2015	417.1	269.1
HDVP1	28/07/2015	417.1	269.1
HDVP1	27/07/2015	417.1	269.1
HDVP1	26/07/2015	417.1	269.1
HDVP1	25/07/2015	417.1	269.1
HDVP1	24/07/2015	417.1	269.1
HDVP1	23/07/2015	417.1	269.1
HDVP1	22/07/2015	417.1	269.1
HDVP1	21/07/2015	417.1	269.1
HDVP1	20/07/2015	417.1	269.1
HDVP1	19/07/2015	417.1	269.1
HDVP1	18/07/2015	417.1	269.1
HDVP1	17/07/2015	417.1	269.1
HDVP1	16/07/2015	417.1	269.1
HDVP1	15/07/2015	417.1	269.1
HDVP1	14/07/2015	417.1	269.1
HDVP1	13/07/2015	417.1	269.1
HDVP1	12/07/2015	417.1	269.1
HDVP1	11/07/2015	417.1	269.1
HDVP1	10/07/2015	417.1	269.1
HDVP1	9/07/2015	417.1	269.1
HDVP1	8/07/2015	417.1	269.1
HDVP1	7/07/2015	417.1	269.1
HDVP1	6/07/2015	417.1	269.1
HDVP1	5/07/2015	417.1	269.1
HDVP1	4/07/2015	417.1	269.1
HDVP1	3/07/2015	417.1	269.1
HDVP1	2/07/2015	388.5	297.7
HDVP1	1/07/2015	388.5	297.7
HDVP1	30/06/2015	388.5	297.7
HDVP1	29/06/2015	388.5	297.7
HDVP1	28/06/2015	388.5	297.7
HDVP1	27/06/2015	388.5	297.7
HDVP1	26/06/2015	388.5	297.7
HDVP1	25/06/2015	388.5	297.7
HDVP1	24/06/2015	388.5	297.7
HDVP1	23/06/2015	388.5	297.7
HDVP1	22/06/2015	388.5	297.7
HDVP1	21/06/2015	388.5	297.7
HDVP1	20/06/2015	388.5	297.7
HDVP1	19/06/2015	388.5	297.7
HDVP1	18/06/2015	388.5	297.7
HDVP1	17/06/2015	388.5	297.7
HDVP1	16/06/2015	388.5	297.7
HDVP1	15/06/2015	388.5	297.7
HDVP1	14/06/2015	388.5	297.7
HDVP1	13/06/2015	388.5	297.7
HDVP1	12/06/2015	388.5	297.7
HDVP1	11/06/2015	388.5	297.7
HDVP1	10/06/2015	388.5	297.7
HDVP1	9/06/2015	388.5	297.7
HDVP1	8/06/2015	388.5	297.7
HDVP1	7/06/2015	388.5	297.7
HDVP1	6/06/2015	388.5	297.7
HDVP1	5/06/2015	388.5	297.7
HDVP1	4/06/2015	388.5	297.7
HDVP1	3/06/2015	388.5	297.7
HDVP1	2/06/2015	388.5	297.7
HDVP1	1/06/2015	401.7	284.5
HDVP1	31/05/2015	401.7	284.5
HDVP1	30/05/2015	401.7	284.5
HDVP1	29/05/2015	401.7	284.5
HDVP1	28/05/2015	401.7	284.5
HDVP1	27/05/2015	401.7	284.5
HDVP1	26/05/2015	401.7	284.5
HDVP1	25/05/2015	401.7	284.5
HDVP1	24/05/2015	401.7	284.5
HDVP1	23/05/2015	401.7	284.5
HDVP1	22/05/2015	401.7	284.5
HDVP1	21/05/2015	401.7	284.5
HDVP1	20/05/2015	401.7	284.5
HDVP1	19/05/2015	401.7	284.5
HDVP1	18/05/2015	401.7	284.5
HDVP1	17/05/2015	401.7	284.5
HDVP1	16/05/2015	401.7	284.5
HDVP1	15/05/2015	401.7	284.5
HDVP1	14/05/2015	401.7	284.5
HDVP1	13/05/2015	401.7	284.5
HDVP1	12/05/2015	401.7	284.5
HDVP1	11/05/2015	401.7	284.5
HDVP1	10/05/2015	401.7	284.5
HDVP1	9/05/2015	401.7	284.5
HDVP1	8/05/2015	401.7	284.5
HDVP1	7/05/2015	401.7	284.5
HDVP1	6/05/2015	401.7	284.5
HDVP1	5/05/2015	401.7	284.5
HDVP1	4/05/2015	401.7	284.5
HDVP1	3/05/2015	401.7	284.5
HDVP1	2/05/2015	401.7	284.5
HDVP1	1/05/2015	428.5	257.7
HDVP1	30/04/2015	428.5	257.7
HDVP1	29/04/2015	428.5	257.7
HDVP1	28/04/2015	428.5	257.7
HDVP1	27/04/2015	428.5	257.7
HDVP1	26/04/2015	428.5	257.7
HDVP1	25/04/2015	428.5	257.7
HDVP1	24/04/2015	428.5	257.7
HDVP1	23/04/2015	428.5	257.7
HDVP1	22/04/2015	428.5	257.7
HDVP1	21/04/2015	428.5	257.7
HDVP1	20/04/2015	428.5	257.7
HDVP1	19/04/2015	428.5	257.7
HDVP1	18/04/2015	428.5	257.7
HDVP1	17/04/2015	428.5	257.7
HDVP1	16/04/2015	428.5	257.7
HDVP1	15/04/2015	428.5	257.7
HDVP1	14/04/2015	428.5	257.7
HDVP1	13/04/2015	428.5	257.7
HDVP1	12/04/2015	428.5	257.7

ID	Date	WL mAHD	WL mbgl
MB17H1SW0002	29/05/2019	596.6	51.8
MB17H1SW0002	28/05/2019	596.6	51.8
MB17H1SW0002	27/05/2019	596.6	51.8
MB17H1SW0002	26/05/2019	596.6	51.8
MB17H1SW0002	25/05/2019	596.6	51.8
MB17H1SW0002	24/05/2019	596.6	51.8
MB17H1SW0002	23/05/2019	596.6	51.8
MB17H1SW0002	22/05/2019	596.6	51.8
MB17H1SW0002	21/05/2019	596.6	51.8
MB17H1SW0002	20/05/2019	596.6	51.8
MB17H1SW0002	19/05/2019	596.6	51.8
MB17H1SW0002	18/05/2019	596.6	51.8
MB17H1SW0002	17/05/2019	596.6	51.8
MB17H1SW0002	16/05/2019	596.6	51.8
MB17H1SW0002	15/05/2019	596.6	51.8
MB17H1SW0002	14/05/2019	596.7	51.7
MB17H1SW0002	13/05/2019	596.7	51.7
MB17H1SW0002	12/05/2019	596.6	51.8
MB17H1SW0002	11/05/2019	596.7	51.7
MB17H1SW0002	10/05/2019	596.7	51.7
MB17H1SW0002	9/05/2019	596.7	51.7
MB17H1SW0002	8/05/2019	596.6	51.8
MB17H1SW0002	7/05/2019	596.6	51.8
MB17H1SW0002	6/05/2019	596.6	51.8
MB17H1SW0002	5/05/2019	596.6	51.8
MB17H1SW0002	4/05/2019	596.6	51.8
MB17H1SW0002	3/05/2019	596.6	51.8
MB17H1SW0002	2/05/2019	596.6	51.8
MB17H1SW0002	1/05/2019	596.6	51.8
MB17H1SW0002	30/04/2019	596.6	51.8
MB17H1SW0002	29/04/2019	596.6	51.8
MB17H1SW0002	28/04/2019	596.6	51.8
MB17H1SW0002	27/04/2019	596.6	51.8
MB17H1SW0002	26/04/2019	596.6	51.8
MB17H1SW0002	25/04/2019	596.6	51.8
MB17H1SW0002	24/04/2019	596.6	51.8
MB17H1SW0002	23/04/2019	596.6	51.8
MB17H1SW0002	22/04/2019	596.6	51.8
MB17H1SW0002	21/04/2019	596.7	51.8
MB17H1SW0002	20/04/2019	596.6	51.8
MB17H1SW0002	19/04/2019	596.6	51.8
MB17H1SW0002	18/04/2019	596.6	51.8
MB17H1SW0002	17/04/2019	596.6	51.8
MB17H1SW0002	16/04/2019	596.6	51.8
MB17H1SW0002	15/04/2019	596.6	51.8
MB17H1SW0002	14/04/2019	596.6	51.8
MB17H1SW0002	13/04/2019	596.6	51.8
MB17H1SW0002	12/04/2019	596.6	51.8
MB17H1SW0002	11/04/2019	596.6	51.8
MB17H1SW0002	10/04/2019	596.6	51.8
MB17H1SW0002	9/04/2019	596.6	51.8
MB17H1SW0002	8/04/2019	596.6	51.8
MB17H1SW0002	7/04/2019	596.6	51.8
MB17H1SW0002	6/04/2019	596.6	51.8
MB17H1SW0002	5/04/2019	596.6	51.8
MB17H1SW0002	4/04/2019	596.6	51.8
MB17H1SW0002	3/04/2019	596.6	51.8
MB17H1SW0002	2/04/2019	596.6	51.8
MB17H1SW0002	1/04/2019	596.6	51.8
MB17H1SW0002	31/03/2019	596.6	51.8
MB17H1SW0002	30/03/2019	596.6	51.8
MB17H1SW0002	29/03/2019	596.6	51.8
MB17H1SW0002	28/03/2019	596.6	51.8
MB17H1SW0002	27/03/2019	596.6	51.8
MB17H1SW0002	26/03/2019	596.6	51.8
MB17H1SW0002	25/03/2019	596.6	51.8
MB17H1SW0002	24/03/2019	596.6	51.8
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MB17H1SW0002	22/03/2019	596.6	51.8
MB17H1SW0002	21/03/2019	596.6	51.8
MB17H1SW0002	20/03/2019	596.6	51.8
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MB17H1SW0002	18/03/2019	596.6	51.8
MB17H1SW0002	17/03/2019	596.6	51.8
MB17H1SW0002	16/03/2019	596.6	51.8
MB17H1SW0002	15/03/2019	596.6	51.8
MB17H1SW0002	14/03/2019	596.6	51.8
MB17H1SW0002	13/03/2019	596.6	51.8
MB17H1SW0002	12/03/2019	596.6	51.8
MB17H1SW0002	11/03/2019	596.6	51.8
MB17H1SW0002	10/03/2019	596.6	51.8
MB17H1SW0002	9/03/2019	596.6	51.8
MB17H1SW0002	8/03/2019	596.6	51.8
MB17H1SW0002	7/03/2019	596.6	51.8
MB17H1SW0002	6/03/2019	596.6	51.8
MB17H1SW0002	5/03/2019	596.6	51.8
MB17H1SW0002	4/03/2019	596.6	51.8
MB17H1SW0002	3/03/2019	596.6	51.8
MB17H1SW0002	2/03/2019	596.6	51.8
MB17H1SW0002	1/03/2019	596.6	51.8
MB17H1SW0002	28/02/2019	596.6	51.8
MB17H1SW0002	27/02/2019	596.6	51.8
MB17H1SW0002	26/02/2019	596.6	51.8
MB17H1SW0002	25/02/2019	596.6	51.8
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MB17H1SW0002	18/02/2019	596.6	51.8
MB17H1SW0002	17/02/2019	596.6	51.8
MB17H1SW0002	16/02/2019	596.6	51.8
MB17H1SW0002	15/02/2019	596.6	51.8
MB17H1SW0002	14/02/2019	596.6	51.8
MB17H1SW0002	13/02/2019	596.6	51.8
MB17H1SW0002	12/02/2019	596.6	51.8
MB17H1SW0002	11/02/2019	596.6	51.8
MB17H1SW0002	10/02/2019	596.6	51.8
MB17H1SW0002	9/02/2019	596.6	51.8
MB17H1SW0002	8/02/2019	596.6	51.8
MB17H1SW0002	7/02/2019	596.6	51.8
MB17H1SW0002	6/02/2019	596.6	51.8
MB17H1SW0002	5/02/2019	596.6	51.8
MB17H1SW0002	30/01/2019	596.6	51.8
MB17H1SW0002	29/01/2019	596.6	51.8
MB17H1SW0002	28/01/2019	596.6	51.8
MB17H1SW0002	27/01/2019	596.6	51.8
MB17H1SW0002	26/01/2019	596.6	51.8
MB17H1SW0002	25/01/2019	596.6	51.8
MB17H1SW0002	24/01/2019	596.6	51.8
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MB17H1SW0002	17/01/2019	596.6	51.8
MB17H1SW0002	16/01/2019	596.6	51.8
MB17H1SW0002	15/01/2019	596.6	51.8
MB17H1SW0002	14/01/2019	596.6	51.8
MB17H1SW0002	13/01/2019	596.6	51.8
MB17H1SW0002	12/01/2019	596.6	51.8
MB17H1SW0002	11/01/2019	596.6	51.8
MB17H1SW0002	10/01/2019	596.6	51.8
MB17H1SW0002	9/01/2019	596.6	51.8

ID	Date	WL mAHD	WL mbgl
MB15HD20001	20/02/2021	627.8	87.0
MB15HD20001	21/02/2021	627.8	87.0
MB15HD20001	22/02/2021	627.9	87.0
MB15HD20001	23/02/2021	627.9	87.0
MB15HD20001	24/02/2021	627.9	87.0
MB15HD20001	25/02/2021	627.8	87.0
MB15HD20001	26/02/2021	627.8	87.0
MB15HD20001	27/02/2021	627.8	87.0
MB15HD20001	28/02/2021	627.8	87.0
MB15HD20001	1/03/2021	627.8	87.0
MB15HD20001	2/03/2021	627.8	87.0
MB15HD20001	3/03/2021	627.8	87.0
MB15HD20001	4/03/2021	627.8	87.0
MB15HD20001	5/03/2021	627.8	87.0
MB15HD20001	6/03/2021	627.8	87.0
MB15HD20001	7/03/2021	627.8	87.0
MB15HD20001	8/03/2021	627.8	87.0
MB15HD20001	9/03/2021	627.8	87.0
MB15HD20001	10/03/2021	627.8	87.0
MB15HD20001	11/03/2021	627.8	87.0
MB15HD20001	12/03/2021	627.9	87.0
MB15HD20001	13/03/2021	627.9	87.0
MB15HD20001	14/03/2021	627.9	87.0
MB15HD20001	15/03/2021	627.9	87.0
MB15HD20001	16/03/2021	627.9	87.0
MB15HD20001	17/03/2021	627.9	87.0
MB15HD20001	18/03/2021	627.9	87.0
MB15HD20001	19/03/2021	627.8	87.0
MB15HD20001	20/03/2021	627.8	87.0
MB15HD20001	21/03/2021	627.8	87.0
MB15HD20001	22/03/2021	627.8	87.0
MB15HD20001	23/03/2021	627.8	87.0
MB15HD20001	24/03/2021	627.8	87.0
MB15HD20001	25/03/2021	627.8	87.0
MB15HD20001	26/03/2021	627.8	87.0
MB15HD20001	27/03/2021	627.8	87.0
MB15HD20001	28/03/2021	627.8	87.0
MB15HD20001	29/03/2021	627.9	87.0
MB15HD20001	30/03/2021	627.9	87.0
MB15HD20001	31/03/2021	627.9	87.0
MB15HD20001	1/04/2021	627.8	87.0
MB15HD20001	2/04/2021	627.9	87.0
MB15HD20001	3/04/2021	627.8	87.0
MB15HD20001	4/04/2021	627.8	87.0
MB15HD20001	5/04/2021	627.9	87.0
MB15HD20001	6/04/2021	627.9	87.0
MB15HD20001	7/04/2021	627.8	87.0
MB15HD20001	8/04/2021	627.8	87.0
MB15HD20001	9/04/2021	627.8	87.0
MB15HD20001	10/04/2021	627.8	87.0
MB15HD20001	11/04/2021	627.8	87.0
MB15HD20001	12/04/2021	627.8	87.0
MB15HD20001	13/04/2021	627.8	87.0
MB15HD20001	14/04/2021	627.9	87.0
MB15HD20001	15/04/2021	627.9	87.0
MB15HD20001	16/04/2021	627.9	87.0
MB15HD20001	17/04/2021	627.9	87.0
MB15HD20001	18/04/2021	627.9	87.0
MB15HD20001	19/04/2021	627.9	87.0
MB15HD20001	20/04/2021	627.9	87.0
MB15HD20001	21/04/2021	627.9	87.0
MB15HD20001	22/04/2021	627.9	87.0
MB15HD20001	23/04/2021	627.9	87.0
MB15HD20001	24/04/2021	627.9	87.0
MB15HD20001	25/04/2021	627.9	87.0
MB15HD20001	26/04/2021	627.9	87.0
MB15HD20001	27/04/2021	627.9	87.0
MB15HD20001	28/04/2021	627.9	87.0
MB15HD20001	29/04/2021	627.9	87.0
MB15HD20001	30/04/2021	627.9	87.0
MB15HD20001	1/05/2021	627.9	87.0
MB15HD20001	2/05/2021	627.9	87.0
MB15HD20001	3/05/2021	627.9	87.0
MB15HD20001	4/05/2021	627.8	87.0
MB15HD20001	5/05/2021	627.8	87.0
MB15HD20001	6/05/2021	627.8	87.0
MB15HD20001	7/05/2021	627.9	87.0
MB15HD20001	8/05/2021	627.9	87.0
MB15HD20001	9/05/2021	627.9	87.0
MB15HD20001	10/05/2021	627.9	87.0
MB15HD20001	11/05/2021	627.9	87.0
MB15HD20001	12/05/2021	627.9	87.0
MB15HD20001	13/05/2021	627.9	87.0
MB15HD20001	14/05/2021	627.9	87.0
MB15HD20001	15/05/2021	627.9	87.0
MB15HD20001	16/05/2021	627.9	87.0
MB15HD20001	17/05/2021	627.9	87.0
MB15HD20001	18/05/2021	627.9	87.0
MB15HD20001	19/05/2021	627.9	87.0
MB15HD20001	20/05/2021	627.9	87.0
MB15HD20001	21/05/2021	627.9	87.0
MB15HD20001	22/05/2021	627.9	87.0
MB15HD20001	23/05/2021	627.8	87.0
MB15HD20001	24/05/2021	627.8	87.0
MB15HD20001	25/05/2021	627.9	87.0
MB15HD20001	26/05/2021	627.9	87.0
MB15HD20001	27/05/2021	627.9	87.0
MB15HD20001	28/05/2021	627.9	87.0
MB15HD20001	29/05/2021	627.9	87.0
MB15HD20001	30/05/2021	627.8	87.0
MB15HD20001	31/05/2021	627.8	87.0
MB15HD20001	1/06/2021	627.8	87.0
MB15HD20001	2/06/2021	627.9	87.0
MB15HD20001	3/06/2021	627.9	87.0
MB15HD20001	4/06/2021	627.9	87.0
MB15HD20001	5/06/2021	627.9	87.0
MB15HD20001	6/06/2021	627.9	87.0
MB15HD20001	7/06/2021	627.9	87.0
MB15HD20001	8/06/2021	627.9	87.0
MB15HD20001	9/06/2021	627.9	87.0
MB15HD20001	10/06/2021	627.8	87.0
MB15HD20001	11/06/2021	627.8	87.0
MB15HD20001	12/06/2021	627.8	87.0
MB15HD20001	13/06/2021	627.8	87.0
MB15HD20001	14/06/2021	627.8	87.0
MB15HD20001	15/06/2021	627.8	87.0
MB15HD20001	16/06/2021	627.9	87.0
MB15HD20001	17/06/2021	627.9	87.0
MB15HD20001	18/06/2021	627.9	87.0
MB15HD20001	19/06/2021	627.9	87.0
MB15HD20001	20/06/2021	627.9	87.0
MB15HD20001	21/06/2021	627.8	87.0
MB15HD20001	22/06/2021	627.8	87.0
MB15HD20001	23/06/2021	627.9	87.0
MB15HD20001	24/06/2021	627.9	87.0
MB15HD20001	25/06/2021	627.9	87.0
MB15HD20001	26/06/2021	627.9	87.0
MB15HD20001	27/06/2021	627.9	87.0
MB15HD20001	28/06/2021	627.8	87.0
MB15HD20001	29/06/2021	627.8	87.0
MB15HD20001	30/06/2021	627.9	87.0
MB15HD20001	1/07/2021	627.9	87.0
MB15HD20001	2/07/2021	627.9	87.0
MB15HD20001	3/07/2021	627.9	87.0
MB15HD20001	4/07/2021	627.9	87.0
MB15HD20001	5/07/2021	627.8	87.0

ID	Date	WL mAHD	WL mbgl
MB18HD20005	9/03/2020	624.7	68.2
MB18HD20005	10/03/2020	624.7	68.2
MB18HD20005	11/03/2020	624.7	68.2
MB18HD20005	12/03/2020	624.7	68.2
MB18HD20005	13/03/2020	624.7	68.2
MB18HD20005	14/03/2020	624.7	68.2
MB18HD20005	15/03/2020	624.7	68.2
MB18HD20005	16/03/2020	624.7	68.2
MB18HD20005	17/03/2020	624.7	68.2
MB18HD20005	18/03/2020	624.7	68.1
MB18HD20005	19/03/2020	624.7	68.1
MB18HD20005	20/03/2020	624.7	68.1
MB18HD20005	21/03/2020	624.7	68.1
MB18HD20005	22/03/2020	624.7	68.1
MB18HD20005	23/03/2020	624.7	68.1
MB18HD20005	24/03/2020	624.7	68.2
MB18HD20005	25/03/2020	624.7	68.2
MB18HD20005	26/03/2020	624.7	68.1
MB18HD20005	27/03/2020	624.7	68.1
MB18HD20005	28/03/2020	624.7	68.1
MB18HD20005	29/03/2020	624.7	68.2
MB18HD20005	30/03/2020	624.7	68.2
MB18HD20005	31/03/2020	624.7	68.2
MB18HD20005	1/04/2020	624.7	68.2
MB18HD20005	2/04/2020	624.7	68.2
MB18HD20005	3/04/2020	624.7	68.2
MB18HD20005	4/04/2020	624.7	68.2
MB18HD20005	5/04/2020	624.7	68.2
MB18HD20005	6/04/2020	624.7	68.2
MB18HD20005	7/04/2020	624.7	68.2
MB18HD20005	8/04/2020	624.7	68.2
MB18HD20005	9/04/2020	624.7	68.1
MB18HD20005	10/04/2020	624.8	68.1
MB18HD20005	11/04/2020	624.8	68.1
MB18HD20005	12/04/2020	624.8	68.1
MB18HD20005	13/04/2020	624.7	68.1
MB18HD20005	14/04/2020	624.7	68.1
MB18HD20005	15/04/2020	624.7	68.1
MB18HD20005	16/04/2020	624.7	68.1
MB18HD20005	17/04/2020	624.7	68.1
MB18HD20005	18/04/2020	624.7	68.1
MB18HD20005	19/04/2020	624.7	68.2
MB18HD20005	20/04/2020	624.7	68.2
MB18HD20005	21/04/2020	624.7	68.1
MB18HD20005	22/04/2020	624.8	68.1
MB18HD20005	23/04/2020	624.8	68.1
MB18HD20005	24/04/2020	624.7	68.1
MB18HD20005	25/04/2020	624.7	68.1
MB18HD20005	26/04/2020	624.8	68.1
MB18HD20005	27/04/2020	624.8	68.1
MB18HD20005	28/04/2020	624.7	68.1
MB18HD20005	29/04/2020	624.8	68.1
MB18HD20005	30/04/2020	624.8	68.1
MB18HD20005	1/05/2020	624.8	68.1
MB18HD20005	2/05/2020	624.8	68.1
MB18HD20005	3/05/2020	624.8	68.1
MB18HD20005	4/05/2020	624.8	68.1
MB18HD20005	5/05/2020	624.8	68.1
MB18HD20005	6/05/2020	624.8	68.1
MB18HD20005	7/05/2020	624.8	68.1
MB18HD20005	8/05/2020	624.7	68.1
MB18HD20005	9/05/2020	624.8	68.1
MB18HD20005	10/05/2020	624.8	68.1
MB18HD20005	11/05/2020	624.8	68.1
MB18HD20005	12/05/2020	624.8	68.1
MB18HD20005	13/05/2020	624.8	68.1
MB18HD20005	14/05/2020	624.8	68.1
MB18HD20005	15/05/2020	624.8	68.1
MB18HD20005	16/05/2020	624.8	68.1
MB18HD20005	17/05/2020	624.8	68.1
MB18HD20005	18/05/2020	624.8	68.1
MB18HD20005	19/05/2020	624.8	68.1
MB18HD20005	20/05/2020	624.8	68.1
MB18HD20005	21/05/2020	624.8	68.1
MB18HD20005	22/05/2020	624.8	68.1
MB18HD20005	23/05/2020	624.8	68.1
MB18HD20005	24/05/2020	624.8	68.1
MB18HD20005	25/05/2020	624.7	68.2
MB18HD20005	26/05/2020	624.7	68.1
MB18HD20005	27/05/2020	624.8	68.1
MB18HD20005	28/05/2020	624.8	68.1
MB18HD20005	29/05/2020	624.8	68.1
MB18HD20005	30/05/2020	624.8	68.1
MB18HD20005	31/05/2020	624.8	68.1
MB18HD20005	1/06/2020	624.8	68.1
MB18HD20005	2/06/2020	624.8	68.1
MB18HD20005	3/06/2020	624.8	68.1
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	11/04/2015	428.5	257.7
HDVP1	10/04/2015	428.5	257.7
HDVP1	9/04/2015	428.5	257.7
HDVP1	8/04/2015	428.5	257.7
HDVP1	7/04/2015	428.5	257.7
HDVP1	6/04/2015	428.5	257.7
HDVP1	5/04/2015	428.5	257.7
HDVP1	4/04/2015	428.5	257.7
HDVP1	3/04/2015	428.5	257.7
HDVP1	2/04/2015	428.5	257.7
HDVP1	1/04/2015	376.4	309.8
HDVP1	31/03/2015	376.4	309.8
HDVP1	30/03/2015	376.4	309.8
HDVP1	29/03/2015	376.4	309.8
HDVP1	28/03/2015	376.4	309.8
HDVP1	27/03/2015	376.4	309.8
HDVP1	26/03/2015	376.4	309.8
HDVP1	25/03/2015	376.4	309.8
HDVP1	24/03/2015	376.4	309.8
HDVP1	23/03/2015	376.4	309.8
HDVP1	22/03/2015	376.4	309.8
HDVP1	21/03/2015	376.4	309.8
HDVP1	20/03/2015	376.4	309.8
HDVP1	19/03/2015	376.4	309.8
HDVP1	18/03/2015	376.4	309.8
HDVP1	17/03/2015	376.4	309.8
HDVP1	16/03/2015	376.4	309.8
HDVP1	15/03/2015	376.4	309.8
HDVP1	14/03/2015	376.4	309.8
HDVP1	13/03/2015	376.4	309.8
HDVP1	12/03/2015	376.4	309.8
HDVP1	11/03/2015	376.4	309.8
HDVP1	10/03/2015	376.4	309.8
HDVP1	9/03/2015	376.4	309.8
HDVP1	8/03/2015	376.4	309.8
HDVP1	7/03/2015	376.4	309.8
HDVP1	6/03/2015	376.4	309.8
HDVP1	5/03/2015	376.4	309.8
HDVP1	4/03/2015	376.4	309.8
HDVP1	3/03/2015	376.4	309.8
HDVP1	2/03/2015	376.4	309.8
HDVP1	1/03/2015	375.1	311.1
HDVP1	28/02/2015	375.1	311.1
HDVP1	27/02/2015	375.1	311.1
HDVP1	26/02/2015	375.1	311.1
HDVP1	25/02/2015	375.1	311.1
HDVP1	24/02/2015	375.1	311.1
HDVP1	23/02/2015	375.1	311.1
HDVP1	22/02/2015	375.1	311.1
HDVP1	21/02/2015	375.1	311.1
HDVP1	20/02/2015	375.1	311.1
HDVP1	19/02/2015	375.1	311.1
HDVP1	18/02/2015	375.1	311.1
HDVP1	17/02/2015	375.1	311.1
HDVP1	16/02/2015	375.1	311.1
HDVP1	15/02/2015	375.1	311.1
HDVP1	14/02/2015	375.1	311.1
HDVP1	13/02/2015	375.1	311.1
HDVP1	12/02/2015	375.1	311.1
HDVP1	11/02/2015	375.1	311.1
HDVP1	10/02/2015	375.1	311.1
HDVP1	9/02/2015	375.1	311.1
HDVP1	8/02/2015	375.1	311.1
HDVP1	7/02/2015	375.1	311.1
HDVP1	6/02/2015	375.1	311.1
HDVP1	5/02/2015	375.1	311.1
HDVP1	4/02/2015	375.1	311.1
HDVP1	3/02/2015	375.1	311.1
HDVP1	2/02/2015	375.1	311.1
HDVP1	1/02/2015	335.5	350.7
HDVP1	31/01/2015	335.5	350.7
HDVP1	30/01/2015	335.5	350.7
HDVP1	29/01/2015	335.5	350.7
HDVP1	28/01/2015	335.5	350.7
HDVP1	27/01/2015	335.5	350.7
HDVP1	26/01/2015	335.5	350.7
HDVP1	25/01/2015	335.5	350.7
HDVP1	24/01/2015	335.5	350.7
HDVP1	23/01/2015	335.5	350.7
HDVP1	22/01/2015	335.5	350.7
HDVP1	21/01/2015	335.5	350.7
HDVP1	20/01/2015	335.5	350.7
HDVP1	19/01/2015	335.5	350.7
HDVP1	18/01/2015	335.5	350.7
HDVP1	17/01/2015	335.5	350.7
HDVP1	16/01/2015	335.5	350.7
HDVP1	15/01/2015	335.5	350.7
HDVP1	14/01/2015	335.5	350.7
HDVP1	13/01/2015	335.5	350.7
HDVP1	12/01/2015	335.5	350.7
HDVP1	11/01/2015	335.5	350.7
HDVP1	10/01/2015	335.5	350.7
HDVP1	9/01/2015	335.5	350.7
HDVP1	8/01/2015	335.5	350.7
HDVP1	7/01/2015	335.5	350.7
HDVP1	6/01/2015	335.5	350.7
HDVP1	5/01/2015	335.5	350.7
HDVP1	4/01/2015	335.5	350.7
HDVP1	3/01/2015	335.5	350.7
HDVP1	2/01/2015	335.5	350.7
HDVP1	1/01/2015	349.3	336.9
HDVP1	31/12/2014	349.3	336.9
HDVP1	30/12/2014	349.3	336.9
HDVP1	29/12/2014	349.3	336.9
HDVP1	28/12/2014	349.3	336.9
HDVP1	27/12/2014	349.3	336.9
HDVP1	26/12/2014	349.3	336.9
HDVP1	25/12/2014	349.3	336.9
HDVP1	24/12/2014	349.3	336.9
HDVP1	23/12/2014	349.3	336.9
HDVP1	22/12/2014	349.3	336.9
HDVP1	21/12/2014	349.3	336.9
HDVP1	20/12/2014	349.3	336.9
HDVP1	19/12/2014	349.3	336.9
HDVP1	18/12/2014	349.3	336.9
HDVP1	17/12/2014	349.3	336.9
HDVP1	16/12/2014	349.3	336.9
HDVP1	15/12/2014	349.3	336.9
HDVP1	14/12/2014	349.3	336.9
HDVP1	13/12/2014	349.3	336.9
HDVP1	12/12/2014	349.3	336.9
HDVP1	11/12/2014	349.3	336.9
HDVP1	10/12/2014	349.3	336.9
HDVP1	9/12/2014	349.3	336.9
HDVP1	8/12/2014	349.3	336.9
HDVP1	7/12/2014	349.3	336.9
HDVP1	6/12/2014	349.3	336.9
HDVP1	5/12/2014	349.3	336.9
HDVP1	4/12/2014	349.3	336.9
HDVP1	3/12/2014	349.3	336.9
HDVP1	2/12/2014	349.3	336.9
HDVP1	1/12/2014	315.9	370.2
HDVP1	30/11/2014	315.9	370.2
HDVP1	29/11/2014	315.9	370.2
HDVP1	28/11/2014	315.9	370.2
HDVP1	27/11/2014	315.9	370.2

ID	Date	WL mAHD	WL mbgl
MB17H1SW0002	8/01/2019	596.6	51.8
MB17H1SW0002	7/01/2019	596.6	51.8
MB17H1SW0002	6/01/2019	596.6	51.8
MB17H1SW0002	5/01/2019	596.6	51.8
MB17H1SW0002	4/01/2019	596.6	51.8
MB17H1SW0002	3/01/2019	596.6	51.8
MB17H1SW0002	2/01/2019	596.6	51.8
MB17H1SW0002	1/01/2019	596.6	51.8
MB17H1SW0002	31/12/2018	596.6	51.8
MB17H1SW0002	30/12/2018	596.6	51.8
MB17H1SW0002	29/12/2018	596.6	51.8
MB17H1SW0002	28/12/2018	596.6	51.8
MB17H1SW0002	27/12/2018	596.6	51.8
MB17H1SW0002	26/12/2018	596.6	51.8
MB17H1SW0002	25/12/2018	596.6	51.8
MB17H1SW0002	24/12/2018	596.6	51.8
MB17H1SW0002	23/12/2018	596.6	51.8
MB17H1SW0002	22/12/2018	596.6	51.8
MB17H1SW0002	21/12/2018	596.6	51.8
MB17H1SW0002	20/12/2018	596.6	51.8
MB17H1SW0002	19/12/2018	596.6	51.8
MB17H1SW0002	18/12/2018	596.6	51.8
MB17H1SW0002	17/12/2018	596.6	51.8
MB17H1SW0002	16/12/2018	596.6	51.8
MB17H1SW0002	15/12/2018	596.6	51.8
MB17H1SW0002	14/12/2018	596.6	51.8
MB17H1SW0002	13/12/2018	596.6	51.8
MB17H1SW0002	12/12/2018	596.6	51.8
MB17H1SW0002	11/12/2018	596.6	51.8
MB17H1SW0002	10/12/2018	596.6	51.8
MB17H1SW0002	9/12/2018	596.6	51.8
MB17H1SW0002	8/12/2018	596.6	51.8
MB17H1SW0002	7/12/2018	596.6	51.8
MB17H1SW0002	6/12/2018	596.6	51.8
MB17H1SW0002	5/12/2018	596.6	51.8
MB17H1SW0002	4/12/2018	596.6	51.8
MB17H1SW0002	3/12/2018	596.6	51.8
MB17H1SW0002	2/12/2018	596.6	51.8
MB17H1SW0002	1/12/2018	596.6	51.8
MB17H1SW0002	30/11/2018	596.6	51.8
MB17H1SW0002	29/11/2018	596.6	51.8
MB17H1SW0002	28/11/2018	596.6	51.8
MB17H1SW0002	27/11/2018	596.6	51.8
MB17H1SW0002	26/11/2018	596.6	51.8
MB17H1SW0002	25/11/2018	596.6	51.8
MB17H1SW0002	24/11/2018	596.6	51.8
MB17H1SW0002	23/11/2018	596.6	51.8
MB17H1SW0002	22/11/2018	596.6	51.8
MB17H1SW0002	21/11/2018	596.6	51.8
MB17H1SW0002	20/11/2018	596.6	51.8
MB17H1SW0002	19/11/2018	596.6	51.8
MB17H1SW0002	18/11/2018	596.6	51.8
MB17H1SW0002	17/11/2018	596.6	51.8
MB17H1SW0002	16/11/2018	596.7	51.7
MB17H1SW0002	15/11/2018	596.7	51.7
MB17H1SW0002	14/11/2018	596.6	51.8
MB17H1SW0002	13/11/2018	596.6	51.8
MB17H1SW0002	12/11/2018	596.6	51.8
MB17H1SW0002	11/11/2018	596.6	51.8
MB17H1SW0002	10/11/2018	596.6	51.8
MB17H1SW0002	9/11/2018	596.7	51.7
MB17H1SW0002	8/11/2018	596.6	51.8
MB17H1SW0002	7/11/2018	596.6	51.8
MB17H1SW0002	6/11/2018	596.6	51.8
MB17H1SW0002	5/11/2018	596.6	51.8
MB17H1SW0002	4/11/2018	596.6	51.8
MB17H1SW0002	3/11/2018	596.7	51.7
MB17H1SW0002	2/11/2018	596.7	51.7
MB17H1SW0002	1/11/2018	596.7	51.7
MB17H1SW0002	31/10/2018	596.6	51.8
MB17H1SW0002	30/10/2018	596.6	51.8
MB17H1SW0002	29/10/2018	596.7	51.7
MB17H1SW0002	28/10/2018	596.7	51.7
MB17H1SW0002	27/10/2018	596.7	51.7
MB17H1SW0002	26/10/2018	596.7	51.7
MB17H1SW0002	25/10/2018	596.7	51.7
MB17H1SW0002	24/10/2018	596.7	51.7
MB17H1SW0002	23/10/2018	596.7	51.7
MB17H1SW0002	22/10/2018	596.7	51.7
MB17H1SW0002	21/10/2018	596.7	51.7
MB17H1SW0002	20/10/2018	596.7	51.7
MB17H1SW0002	19/10/2018	596.7	51.7
MB17H1SW0002	18/10/2018	596.7	51.7
MB17H1SW0002	17/10/2018	596.7	51.7
MB17H1SW0002	16/10/2018	596.7	51.7
MB17H1SW0002	15/10/2018	596.7	51.7
MB17H1SW0002	14/10/2018	596.7	51.7
MB17H1SW0002	13/10/2018	596.7	51.7
MB17H1SW0002	12/10/2018	596.7	51.7
MB17H1SW0002	11/10/2018	596.7	51.7
MB17H1SW0002	10/10/2018	596.7	51.7
MB17H1SW0002	9/10/2018	596.7	51.7
MB17H1SW0002	8/10/2018	596.7	51.7
MB17H1SW0002	7/10/2018	596.7	51.7
MB17H1SW0002	6/10/2018	596.7	51.7
MB17H1SW0002	5/10/2018	596.7	51.7
MB17H1SW0002	4/10/2018	596.7	51.7
MB17H1SW0002	3/10/2018	596.7	51.7
MB17H1SW0002	2/10/2018	596.7	51.7
MB17H1SW0002	1/10/2018	596.7	51.7
MB17H1SW0002	30/09/2018	596.7	51.7
MB17H1SW0002	29/09/2018	596.7	51.7
MB17H1SW0002	28/09/2018	596.7	51.7
MB17H1SW0002	27/09/2018	596.7	51.7
MB17H1SW0002	26/09/2018	596.7	51.7
MB17H1SW0002	25/09/2018	596.7	51.7
MB17H1SW0002	24/09/2018	596.8	51.6
MB17H1SW0002	23/09/2018	596.8	51.6
MB17H1SW0002	22/09/2018	596.8	51.6
MB17H1SW0002	21/09/2018	596.8	51.6
MB17H1SW0002	20/09/2018	596.8	51.6
MB17H1SW0002	19/09/2018	596.8	51.6
MB17H1SW0002	18/09/2018	596.8	51.6
MB17H1SW0002	17/09/2018	596.7	51.7
MB17H1SW0002	16/09/2018	596.8	51.6
MB17H1SW0002	15/09/2018	596.8	51.6
MB17H1SW0002	14/09/2018	596.8	51.6
MB17H1SW0002	13/09/2018	596.8	51.6
MB17H1SW0002	12/09/2018	596.8	51.6
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MB17H1SW0002	10/09/2018	596.8	51.6
MB17H1SW0002	9/09/2018	596.8	51.6
MB17H1SW0002	8/09/2018	596.8	51.6
MB17H1SW0002	7/09/2018	596.8	51.6
MB17H1SW0002	6/09/2018	596.7	51.7
MB17H1SW0002	5/09/2018	596.8	51.6
MB17H1SW0002	4/09/2018	596.8	51.6
MB17H1SW0002	3/09/2018	596.8	51.6
MB17H1SW0002	2/09/2018	596.8	51.6
MB17H1SW0002	1/09/2018	596.8	51.6
MB17H1SW0002	31/08/2018	596.8	51.6
MB17H1SW0002	30/08/2018	596.8	51.6
MB17H1SW0002	29/08/2018	596.7	51.7
MB17H1SW0002	28/08/2018	596.7	51.7
MB17H1SW0002	27/08/2018	596.8	51.6
MB17H1SW0002	26/08/2018	596.8	51.6

ID	Date	WL mAHD	WL mbgl
MB15HD20001	6/07/2021	627.8	87.0
MB15HD20001	7/07/2021	627.8	87.0
MB15HD20001	8/07/2021	627.8	87.0
MB15HD20001	9/07/2021	627.8	87.0
MB15HD20001	10/07/2021	627.8	87.0
MB15HD20001	11/07/2021	627.8	87.0
MB15HD20001	12/07/2021	627.8	87.0
MB15HD20001	13/07/2021	627.8	87.0
MB15HD20001	14/07/2021	627.8	87.1
MB15HD20001	15/07/2021	627.8	87.0
MB15HD20001	16/07/2021	627.8	87.0
MB15HD20001	17/07/2021	627.9	87.0
MB15HD20001	18/07/2021	627.8	87.0
MB15HD20001	19/07/2021	627.8	87.0
MB15HD20001	20/07/2021	627.8	87.0
MB15HD20001	21/07/2021	627.8	87.0
MB15HD20001	22/07/2021	627.8	87.0
MB15HD20001	23/07/2021	627.8	87.0
MB15HD20001	24/07/2021	627.8	87.0
MB15HD20001	25/07/2021	627.8	87.0
MB15HD20001	26/07/2021	627.8	87.0
MB15HD20001	27/07/2021	627.8	87.1
MB15HD20001	28/07/2021	627.8	87.1
MB15HD20001	29/07/2021	627.8	87.1
MB15HD20001	30/07/2021	627.8	87.1
MB15HD20001	31/07/2021	627.8	87.0
MB15HD20001	1/08/2021	627.8	87.0
MB15HD20001	2/08/2021	627.8	87.0
MB15HD20001	3/08/2021	627.9	87.0
MB15HD20001	4/08/2021	627.9	87.0
MB15HD20001	5/08/2021	627.9	87.0
MB15HD20001	6/08/2021	627.9	87.0
MB15HD20001	7/08/2021	627.9	87.0
MB15HD20001	8/08/2021	627.9	87.0
MB15HD20001	9/08/2021	627.8	87.0
MB15HD20001	10/08/2021	627.8	87.0
MB15HD20001	11/08/2021	627.9	87.0
MB15HD20001	12/08/2021	627.9	87.0
MB15HD20001	13/08/2021	627.9	87.0
MB15HD20001	14/08/2021	627.8	87.0
MB15HD20001	15/08/2021	627.8	87.0
MB15HD20001	16/08/2021	627.9	87.0
MB15HD20001	17/08/2021	627.9	87.0
MB15HD20001	18/08/2021	627.8	87.0
MB15HD20001	19/08/2021	627.8	87.0
MB15HD20001	20/08/2021	627.8	87.0
MB15HD20001	21/08/2021	627.8	87.0
MB15HD20001	22/08/2021	627.8	87.0
MB15HD20001	23/08/2021	627.8	87.0
MB15HD20001	24/08/2021	627.8	87.0
MB15HD20001	25/08/2021	627.8	87.0
MB15HD20001	26/08/2021	627.8	87.1
MB15HD20001	27/08/2021	627.8	87.1
MB15HD20001	28/08/2021	627.8	87.1
MB15HD20001	29/08/2021	627.8	87.0
MB15HD20001	30/08/2021	627.8	87.0
MB15HD20001	31/08/2021	627.8	87.0
MB15HD20001	1/09/2021	627.8	87.1
MB15HD20001	2/09/2021	627.8	87.1
MB15HD20001	3/09/2021	627.8	87.0
MB15HD20001	4/09/2021	627.8	87.0
MB15HD20001	5/09/2021	627.8	87.0
MB15HD20001	6/09/2021	627.9	87.0
MB15HD20001	7/09/2021	627.9	87.0
MB15HD20001	8/09/2021	627.8	87.0
MB15HD20001	9/09/2021	627.8	87.0
MB15HD20001	10/09/2021	627.8	87.0
MB15HD20001	11/09/2021	627.8	87.1
MB15HD20001	12/09/2021	627.8	87.1
MB15HD20001	13/09/2021	627.8	87.1
MB15HD20001	14/09/2021	627.8	87.1
MB15HD20001	15/09/2021	627.8	87.1
MB15HD20001	16/09/2021	627.8	87.1
MB15HD20001	16/10/2021	627.6	87.2
MB15HD20001	17/10/2021	627.6	87.2
MB15HD20001	18/10/2021	627.6	87.2
MB15HD20001	19/10/2021	627.6	87.2
MB15HD20001	20/10/2021	627.7	87.2
MB15HD20001	21/10/2021	627.7	87.2
MB15HD20001	22/10/2021	627.7	87.2
MB15HD20001	23/10/2021	627.7	87.2
MB15HD20001	24/10/2021	627.7	87.2
MB15HD20001	25/10/2021	627.6	87.2
MB15HD20001	26/10/2021	627.6	87.2
MB15HD20001	27/10/2021	627.6	87.2
MB15HD20001	28/10/2021	627.6	87.2
MB15HD20001	30/10/2021	627.6	87.2
MB15HD20001	31/10/2021	627.6	87.2
MB15HD20001	1/11/2021	627.6	87.2
MB15HD20001	2/11/2021	627.6	87.2
MB15HD20001	3/11/2021	627.6	87.2
MB15HD20001	4/11/2021	627.6	87.2
MB15HD20001	5/11/2021	627.6	87.2
MB15HD20001	6/11/2021	627.6	87.2
MB15HD20001	7/11/2021	627.6	87.3
MB15HD20001	9/11/2021	627.6	87.3
MB15HD20001	10/11/2021	627.6	87.3
MB15HD20001	11/11/2021	627.6	87.2
MB15HD20001	12/11/2021	627.6	87.2
MB15HD20001	13/11/2021	627.6	87.2
MB15HD20001	14/11/2021	627.6	87.2
MB15HD20001	15/11/2021	627.6	87.2
MB15HD20001	16/11/2021	627.6	87.2
MB15HD20001	17/11/2021	627.6	87.2
MB15HD20001	18/11/2021	627.6	87.2
MB15HD20001	19/11/2021	627.6	87.3
MB15HD20001	20/11/2021	627.6	87.2
MB15HD20001	21/11/2021	627.6	87.2
MB15HD20001	22/11/2021	627.6	87.2
MB15HD20001	23/11/2021	627.6	87.2
MB15HD20001	24/11/2021	627.6	87.2
MB15HD20001	25/11/2021	627.6	87.2
MB15HD20001	26/11/2021	627.6	87.2
MB15HD20001	27/11/2021	627.6	87.2
MB15HD20001	28/11/2021	627.6	87.2
MB15HD20001	29/11/2021	627.6	87.2
MB15HD20001	30/11/2021	627.6	87.3
MB15HD20001	1/12/2021	627.6	87.3
MB15HD20001	2/12/2021	627.6	87.3
MB15HD20001	3/12/2021	627.6	87.3
MB15HD20001	4/12/2021	627.6	87.3
MB15HD20001	5/12/2021	627.6	87.3
MB15HD20001	6/12/2021	627.6	87.3
MB15HD20001	7/12/2021	627.6	87.3
MB15HD20001	8/12/2021	627.6	87.3
MB15HD20001	9/12/2021	627.6	87.3
MB15HD20001	10/12/2021	627.6	87.3
MB15HD20001	11/12/2021	627.6	87.3
MB15HD20001	12/12/2021	627.6	87.3
MB15HD20001	13/12/2021	627.6	87.3
MB15HD20001	14/12/2021	627.6	87.3
MB15HD20001	15/12/2021	627.6	87.3
MB15HD20001	16/12/2021	627.6	87.3
MB15HD20001	17/12/2021	627.6	87.3
MB15HD20001	18/12/2021	627.6	87.3
MB15HD20001	19/12/2021	627.6	87.2

ID	Date	WL mAHD	WL mbgl
MB18HD20005	23/07/2020	624.8	68.1
MB18HD20005	24/07/2020	624.8	68.1
MB18HD20005	25/07/2020	624.8	68.1
MB18HD20005	26/07/2020	624.8	68.1
MB18HD20005	27/07/2020	624.8	68.1
MB18HD20005	28/07/2020	624.8	68.1
MB18HD20005	29/07/2020	624.8	68.1
MB18HD20005	30/07/2020	624.8	68.1
MB18HD20005	31/07/2020	624.8	68.1
MB18HD20005	1/08/2020	624.8	68.1
MB18HD20005	2/08/2020	624.7	68.1
MB18HD20005	3/08/2020	624.7	68.2
MB18HD20005	4/08/2020	624.7	68.2
MB18HD20005	5/08/2020	624.7	68.2
MB18HD20005	6/08/2020	624.7	68.2
MB18HD20005	7/08/2020	624.7	68.1
MB18HD20005	8/08/2020	624.7	68.1
MB18HD20005	9/08/2020	624.7	68.2
MB18HD20005	10/08/2020	624.7	68.2
MB18HD20005	11/08/2020	624.7	68.2
MB18HD20005	12/08/2020	624.7	68.2
MB18HD20005	13/08/2020	624.7	68.2
MB18HD20005	14/08/2020	624.7	68.1
MB18HD20005	15/08/2020	624.7	68.1
MB18HD20005	16/08/2020	624.7	68.2
MB18HD20005	17/08/2020	624.7	68.2
MB18HD20005	18/08/2020	624.7	68.2
MB18HD20005	19/08/2020	624.7	68.1
MB18HD20005	20/08/2020	624.7	68.1
MB18HD20005	21/08/2020	624.8	68.1
MB18HD20005	22/08/2020	624.8	68.1
MB18HD20005	23/08/2020	624.8	68.1
MB18HD20005	24/08/2020	624.7	68.1
MB18HD20005	25/08/2020	624.7	68.1
MB18HD20005	26/08/2020	624.8	68.1
MB18HD20005	27/08/2020	624.8	68.1
MB18HD20005	28/08/2020	624.8	68.1
MB18HD20005	29/08/2020	624.8	68.1
MB18HD20005	30/08/2020	624.8	68.1
MB18HD20005	31/08/2020	624.8	68.1
MB18HD20005	1/09/2020	624.7	68.1
MB18HD20005	2/09/2020	624.7	68.2
MB18HD20005	3/09/2020	624.7	68.1
MB18HD20005	4/09/2020	624.7	68.1
MB18HD20005	5/09/2020	624.7	68.2
MB18HD20005	6/09/2020	624.7	68.2
MB18HD20005	7/09/2020	624.7	68.2
MB18HD20005	8/09/2020	624.7	68.1
MB18HD20005	9/09/2020	624.7	68.1
MB18HD20005	10/09/2020	624.7	68.2
MB18HD20005	11/09/2020	624.7	68.2
MB18HD20005	12/09/2020	624.7	68.1
MB18HD20005	13/09/2020	624.7	68.1
MB18HD20005	14/09/2020	624.7	68.1
MB18HD20005	15/09/2020	624.7	68.1
MB18HD20005	16/09/2020	624.7	68.2
MB18HD20005	17/09/2020	624.7	68.2
MB18HD20005	18/09/2020	624.7	68.2
MB18HD20005	19/09/2020	624.7	68.2
MB18HD20005	20/09/2020	624.7	68.2
MB18HD20005	21/09/2020	624.7	68.2
MB18HD20005	22/09/2020	624.7	68.1
MB18HD20005	23/09/2020	624.8	68.1
MB18HD20005	24/09/2020	624.7	68.1
MB18HD20005	25/09/2020	624.7	68.2
MB18HD20005	26/09/2020	624.7	68.2
MB18HD20005	27/09/2020	624.7	68.2
MB18HD20005	28/09/2020	624.7	68.2
MB18HD20005	29/09/2020	624.7	68.2
MB18HD20005	30/09/2020	624.7	68.2
MB18HD20005	1/10/2020	624.7	68.2
MB18HD20005	2/10/2020	624.7	68.2
MB18HD20005	3/10/2020	624.7	68.2
MB18HD20005	4/10/2020	624.8	68.1
MB18HD20005	5/10/2020	624.8	68.1
MB18HD20005	6/10/2020	624.8	68.1
MB18HD20005	7/10/2020	624.7	68.1
MB18HD20005	8/10/2020	624.7	68.2
MB18HD20005	9/10/2020	624.7	68.2
MB18HD20005	10/10/2020	624.7	68.2
MB18HD20005	11/10/2020	624.7	68.2
MB18HD20005	12/10/2020	624.7	68.2
MB18HD20005	13/10/2020	624.7	68.2
MB18HD20005	14/10/2020	624.7	68.2
MB18HD20005	15/10/2020	624.7	68.2
MB18HD20005	16/10/2020	624.7	68.2
MB18HD20005	17/10/2020	624.7	68.2
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	26/11/2014	315.9	370.2
HDVP1	25/11/2014	315.9	370.2
HDVP1	24/11/2014	315.9	370.2
HDVP1	23/11/2014	315.9	370.2
HDVP1	22/11/2014	315.9	370.2
HDVP1	21/11/2014	315.9	370.2
HDVP1	20/11/2014	315.9	370.2
HDVP1	19/11/2014	315.9	370.2
HDVP1	18/11/2014	315.9	370.2
HDVP1	17/11/2014	315.9	370.2
HDVP1	16/11/2014	315.9	370.2
HDVP1	15/11/2014	315.9	370.2
HDVP1	14/11/2014	315.9	370.2
HDVP1	13/11/2014	315.9	370.2
HDVP1	12/11/2014	315.9	370.2
HDVP1	11/11/2014	315.9	370.2
HDVP1	10/11/2014	315.9	370.2
HDVP1	9/11/2014	315.9	370.2
HDVP1	8/11/2014	315.9	370.2
HDVP1	7/11/2014	315.9	370.2
HDVP1	6/11/2014	315.9	370.2
HDVP1	5/11/2014	315.9	370.2
HDVP1	4/11/2014	315.9	370.2
HDVP1	3/11/2014	315.9	370.2
HDVP1	2/11/2014	315.9	370.2
HDVP1	1/11/2014	257.0	429.2
HDVP1	31/10/2014	257.0	429.2
HDVP1	30/10/2014	257.0	429.2
HDVP1	29/10/2014	257.0	429.2
HDVP1	28/10/2014	257.0	429.2
HDVP1	27/10/2014	257.0	429.2
HDVP1	26/10/2014	257.0	429.2
HDVP1	25/10/2014	257.0	429.2
HDVP1	24/10/2014	257.0	429.2
HDVP1	23/10/2014	257.0	429.2
HDVP1	22/10/2014	257.0	429.2
HDVP1	21/10/2014	257.0	429.2
HDVP1	20/10/2014	257.0	429.2
HDVP1	19/10/2014	257.0	429.2
HDVP1	18/10/2014	257.0	429.2
HDVP1	17/10/2014	257.0	429.2
HDVP1	16/10/2014	257.0	429.2
HDVP1	15/10/2014	257.0	429.2
HDVP1	14/10/2014	257.0	429.2
HDVP1	13/10/2014	257.0	429.2
HDVP1	12/10/2014	257.0	429.2
HDVP1	11/10/2014	257.0	429.2
HDVP1	10/10/2014	257.0	429.2
HDVP1	9/10/2014	257.0	429.2
HDVP1	8/10/2014	257.0	429.2
HDVP1	7/10/2014	257.0	429.2
HDVP1	6/10/2014	257.0	429.2
HDVP1	5/10/2014	257.0	429.2
HDVP1	4/10/2014	257.0	429.2
HDVP1	3/10/2014	257.0	429.2
HDVP1	2/10/2014	257.0	429.2
HDVP1	1/10/2014	391.1	295.1
HDVP1	30/09/2014	391.1	295.1
HDVP1	29/09/2014	391.1	295.1
HDVP1	28/09/2014	391.1	295.1
HDVP1	27/09/2014	391.1	295.1
HDVP1	26/09/2014	391.1	295.1
HDVP1	25/09/2014	391.1	295.1
HDVP1	24/09/2014	391.1	295.1
HDVP1	23/09/2014	391.1	295.1
HDVP1	22/09/2014	391.1	295.1
HDVP1	21/09/2014	391.1	295.1
HDVP1	20/09/2014	391.1	295.1
HDVP1	19/09/2014	391.1	295.1
HDVP1	18/09/2014	391.1	295.1
HDVP1	17/09/2014	391.1	295.1
HDVP1	16/09/2014	391.1	295.1
HDVP1	15/09/2014	391.1	295.1
HDVP1	14/09/2014	391.1	295.1
HDVP1	13/09/2014	391.1	295.1
HDVP1	12/09/2014	391.1	295.1
HDVP1	11/09/2014	391.1	295.1
HDVP1	10/09/2014	391.1	295.1
HDVP1	9/09/2014	391.1	295.1
HDVP1	8/09/2014	391.1	295.1
HDVP1	7/09/2014	391.1	295.1
HDVP1	6/09/2014	391.1	295.1
HDVP1	5/09/2014	391.1	295.1
HDVP1	4/09/2014	391.1	295.1
HDVP1	3/09/2014	391.1	295.1
HDVP1	2/09/2014	391.1	295.1
HDVP1	1/09/2014	391.1	295.1
HDVP1	31/08/2014	419.6	266.5
HDVP1	30/08/2014	419.6	266.5
HDVP1	29/08/2014	419.6	266.5
HDVP1	28/08/2014	419.6	266.5
HDVP1	27/08/2014	419.6	266.5
HDVP1	26/08/2014	419.6	266.5
HDVP1	25/08/2014	419.6	266.5
HDVP1	24/08/2014	419.6	266.5
HDVP1	23/08/2014	419.6	266.5
HDVP1	22/08/2014	419.6	266.5
HDVP1	21/08/2014	419.6	266.5
HDVP1	20/08/2014	419.6	266.5
HDVP1	19/08/2014	419.6	266.5
HDVP1	18/08/2014	419.6	266.5
HDVP1	17/08/2014	419.6	266.5
HDVP1	16/08/2014	419.6	266.5
HDVP1	15/08/2014	419.6	266.5
HDVP1	14/08/2014	419.6	266.5
HDVP1	13/08/2014	419.6	266.5
HDVP1	12/08/2014	419.6	266.5
HDVP1	11/08/2014	419.6	266.5
HDVP1	10/08/2014	419.6	266.5
HDVP1	9/08/2014	419.6	266.5
HDVP1	8/08/2014	419.6	266.5
HDVP1	7/08/2014	419.6	266.5
HDVP1	6/08/2014	419.6	266.5
HDVP1	5/08/2014	419.6	266.5
HDVP1	4/08/2014	419.6	266.5
HDVP1	3/08/2014	419.6	266.5
HDVP1	2/08/2014	419.6	266.5
HDVP1	1/08/2014	419.6	266.5
HDVP1	31/07/2014	266.3	419.9
HDVP1	30/07/2014	266.3	419.9
HDVP1	29/07/2014	266.3	419.9
HDVP1	28/07/2014	266.3	419.9
HDVP1	27/07/2014	266.3	419.9
HDVP1	26/07/2014	266.3	419.9
HDVP1	25/07/2014	266.3	419.9
HDVP1	24/07/2014	266.3	419.9
HDVP1	23/07/2014	266.3	419.9
HDVP1	22/07/2014	266.3	419.9
HDVP1	21/07/2014	266.3	419.9
HDVP1	20/07/2014	266.3	419.9
HDVP1	19/07/2014	266.3	419.9
HDVP1	18/07/2014	266.3	419.9
HDVP1	17/07/2014	266.3	419.9
HDVP1	16/07/2014	266.3	419.9
HDVP1	15/07/2014	266.3	419.9
HDVP1	14/07/2014	266.3	419.9

ID	Date	WL mAHD	WL mbgl
MB17H1SW0002	25/08/2018	596.8	51.6
MB17H1SW0002	24/08/2018	596.8	51.6
MB17H1SW0002	23/08/2018	596.8	51.6
MB17H1SW0002	22/08/2018	596.8	51.6
MB17H1SW0002	21/08/2018	596.8	51.6
MB17H1SW0002	20/08/2018	596.8	51.6
MB17H1SW0002	19/08/2018	596.8	51.6
MB17H1SW0002	18/08/2018	596.8	51.6
MB17H1SW0002	17/08/2018	596.8	51.6
MB17H1SW0002	16/08/2018	596.8	51.6
MB17H1SW0002	15/08/2018	596.8	51.6
MB17H1SW0002	14/08/2018	596.8	51.6
MB17H1SW0002	13/08/2018	596.8	51.6
MB17H1SW0002	12/08/2018	596.8	51.6
MB17H1SW0002	11/08/2018	596.8	51.6
MB17H1SW0002	10/08/2018	596.8	51.6
MB17H1SW0002	9/08/2018	596.8	51.6
MB17H1SW0002	8/08/2018	596.8	51.6
MB17H1SW0002	7/08/2018	596.8	51.6
MB17H1SW0002	6/08/2018	596.8	51.6
MB17H1SW0002	5/08/2018	596.8	51.6
MB17H1SW0002	4/08/2018	596.8	51.6
MB17H1SW0002	3/08/2018	596.8	51.6
MB17H1SW0002	2/08/2018	596.8	51.6
MB17H1SW0002	1/08/2018	596.7	51.7
MB17H1SW0002	31/07/2018	596.8	51.6
MB17H1SW0002	30/07/2018	596.8	51.6
MB17H1SW0002	29/07/2018	596.8	51.6
MB17H1SW0002	28/07/2018	596.8	51.6
MB17H1SW0002	27/07/2018	596.8	51.6
MB17H1SW0002	26/07/2018	596.8	51.6
MB17H1SW0002	25/07/2018	596.8	51.6
MB17H1SW0002	24/07/2018	596.8	51.6
MB17H1SW0002	23/07/2018	596.8	51.6
MB17H1SW0002	22/07/2018	596.8	51.6
MB17H1SW0002	21/07/2018	596.8	51.6
MB17H1SW0002	20/07/2018	596.8	51.6
MB17H1SW0002	19/07/2018	596.8	51.6
MB17H1SW0002	18/07/2018	596.8	51.6
MB17H1SW0002	17/07/2018	596.8	51.6
MB17H1SW0002	16/07/2018	596.8	51.6
MB17H1SW0002	15/07/2018	596.8	51.6
MB17H1SW0002	14/07/2018	596.8	51.6
MB17H1SW0002	13/07/2018	596.8	51.6
MB17H1SW0002	12/07/2018	596.8	51.6
MB17H1SW0002	11/07/2018	596.8	51.6
MB17H1SW0002	10/07/2018	596.8	51.6
MB17H1SW0002	9/07/2018	596.8	51.6
MB17H1SW0002	8/07/2018	596.8	51.6
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MB17H1SW0002	5/07/2018	596.8	51.6
MB17H1SW0002	4/07/2018	596.8	51.6
MB17H1SW0002	3/07/2018	596.8	51.6
MB17H1SW0002	2/07/2018	596.8	51.6
MB17H1SW0002	1/07/2018	596.8	51.6
MB17H1SW0002	30/06/2018	596.8	51.6
MB17H1SW0002	29/06/2018	596.8	51.6
MB17H1SW0002	28/06/2018	596.8	51.6
MB17H1SW0002	27/06/2018	596.8	51.6
MB17H1SW0002	26/06/2018	596.8	51.6
MB17H1SW0002	25/06/2018	596.8	51.6
MB17H1SW0002	24/06/2018	596.8	51.6
MB17H1SW0002	23/06/2018	596.8	51.6
MB17H1SW0002	22/06/2018	596.8	51.6
MB17H1SW0002	21/06/2018	596.8	51.6
MB17H1SW0002	20/06/2018	596.8	51.6
MB17H1SW0002	19/06/2018	596.8	51.6
MB17H1SW0002	18/06/2018	596.8	51.6
MB17H1SW0002	17/06/2018	596.8	51.6
MB17H1SW0002	16/06/2018	596.8	51.6
MB17H1SW0002	15/06/2018	596.8	51.6
MB17H1SW0002	14/06/2018	596.8	51.6
MB17H1SW0002	13/06/2018	596.8	51.6
MB17H1SW0002	12/06/2018	596.8	51.6
MB17H1SW0002	11/06/2018	596.8	51.6
MB17H1SW0002	10/06/2018	596.8	51.6
MB17H1SW0002	9/06/2018	596.8	51.6
MB17H1SW0002	8/06/2018	596.8	51.6
MB17H1SW0002	7/06/2018	596.8	51.6
MB17H1SW0002	6/06/2018	596.8	51.6
MB17H1SW0002	5/06/2018	596.8	51.6
MB17H1SW0002	4/06/2018	596.8	51.6
MB17H1SW0002	3/06/2018	596.8	51.6
MB17H1SW0002	2/06/2018	596.8	51.6
MB17H1SW0002	1/06/2018	596.8	51.6
MB17H1SW0002	31/05/2018	596.8	51.6
MB17H1SW0002	30/05/2018	596.8	51.6
MB17H1SW0002	29/05/2018	596.8	51.6
MB17H1SW0002	28/05/2018	596.8	51.6
MB17H1SW0002	27/05/2018	596.8	51.6
MB17H1SW0002	26/05/2018	596.8	51.6
MB17H1SW0002	25/05/2018	596.8	51.6
MB17H1SW0002	24/05/2018	596.8	51.6
MB17H1SW0002	23/05/2018	596.8	51.6
MB17H1SW0002	22/05/2018	596.8	51.6
MB17H1SW0002	21/05/2018	596.8	51.6
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MB17H1SW0002	19/05/2018	596.8	51.6
MB17H1SW0002	18/05/2018	596.8	51.6
MB17H1SW0002	17/05/2018	596.8	51.6
MB17H1SW0002	16/05/2018	596.8	51.6
MB17H1SW0002	15/05/2018	596.8	51.6
MB17H1SW0002	14/05/2018	596.8	51.6
MB17H1SW0002	13/05/2018	596.8	51.6
MB17H1SW0002	12/05/2018	596.8	51.6
MB17H1SW0002	11/05/2018	596.8	51.6
MB17H1SW0002	10/05/2018	596.8	51.6
MB17H1SW0002	9/05/2018	596.8	51.6
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MB17H1SW0002	7/05/2018	596.8	51.6
MB17H1SW0002	6/05/2018	596.8	51.6
MB17H1SW0002	5/05/2018	596.8	51.6
MB17H1SW0002	4/05/2018	596.8	51.6
MB17H1SW0002	3/05/2018	596.8	51.6
MB17H1SW0002	2/05/2018	596.8	51.6
MB17H1SW0002	1/05/2018	596.8	51.6
MB17H1SW0002	30/04/2018	596.8	51.6
MB17H1SW0002	29/04/2018	596.8	51.6
MB17H1SW0002	28/04/2018	596.8	51.6
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MB17H1SW0002	26/04/2018	596.8	51.6
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MB17H1SW0002	19/04/2018	596.8	51.6
MB17H1SW0002	18/04/2018	596.8	51.6
MB17H1SW0002	17/04/2018	596.8	51.6
MB17H1SW0002	16/04/2018	596.8	51.6
MB17H1SW0002	15/04/2018	596.8	51.6
MB17H1SW0002	14/04/2018	596.8	51.6
MB17H1SW0002	13/04/2018	596.8	51.6
MB17H1SW0002	12/04/2018	596.8	51.6

ID	Date	WL mAHD	WL mbgl
MB15HD20001	20/12/2021	627.6	87.2
MB15HD20001	21/12/2021	627.6	87.3
MB15HD20001	22/12/2021	627.6	87.3
MB15HD20001	23/12/2021	627.6	87.3
MB15HD20001	24/12/2021	627.6	87.3
MB15HD20001	25/12/2021	627.6	87.3
MB15HD20001	26/12/2021	627.6	87.3
MB15HD20001	30/12/2021	627.6	87.3
MB15HD20001	31/12/2021	627.5	87.3
MB15HD20001	1/01/2022	627.6	87.3
MB15HD20001	2/01/2022	627.6	87.3
MB15HD20001	3/01/2022	627.6	87.3
MB15HD20001	4/01/2022	627.6	87.3
MB15HD20001	5/01/2022	627.6	87.3
MB15HD20001	6/01/2022	627.6	87.3
MB15HD20001	7/01/2022	627.6	87.3
MB15HD20001	8/01/2022	627.6	87.3
MB15HD20001	9/01/2022	627.6	87.3
MB15HD20001	10/01/2022	627.6	87.3
MB15HD20001	11/01/2022	627.6	87.3
MB15HD20001	12/01/2022	627.6	87.3
MB15HD20001	13/01/2022	627.6	87.3
MB15HD20001	14/01/2022	627.6	87.3
MB15HD20001	15/01/2022	627.5	87.3
MB15HD20001	16/01/2022	627.5	87.3
MB15HD20001	17/01/2022	627.5	87.3
MB15HD20001	18/01/2022	627.5	87.3
MB15HD20001	19/01/2022	627.6	87.3
MB15HD20001	20/01/2022	627.6	87.3
MB15HD20001	21/01/2022	627.6	87.3
MB15HD20001	22/01/2022	627.6	87.3
MB15HD20001	23/01/2022	627.6	87.3
MB15HD20001	24/01/2022	627.5	87.3
MB15HD20001	25/01/2022	627.5	87.3
MB15HD20001	26/01/2022	627.5	87.4
MB15HD20001	27/01/2022	627.5	87.3
MB15HD20001	28/01/2022	627.5	87.3
MB15HD20001	29/01/2022	627.5	87.3
MB15HD20001	30/01/2022	627.5	87.3
MB15HD20001	31/01/2022	627.5	87.3
MB15HD20001	1/02/2022	627.5	87.3
MB15HD20001	2/02/2022	627.5	87.3
MB15HD20001	3/02/2022	627.5	87.3
MB15HD20001	4/02/2022	627.5	87.3
MB15HD20001	5/02/2022	627.5	87.3
MB15HD20001	6/02/2022	627.5	87.3
MB15HD20001	7/02/2022	627.5	87.3
MB15HD20001	8/02/2022	627.5	87.3
MB15HD20001	9/02/2022	627.6	87.3
MB15HD20001	10/02/2022	627.6	87.3
MB15HD20001	11/02/2022	627.6	87.3
MB15HD20001	12/02/2022	627.6	87.3
MB15HD20001	13/02/2022	627.6	87.3
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MB15HD20001	15/02/2022	627.6	87.3
MB15HD20001	16/02/2022	627.6	87.3
MB15HD20001	17/02/2022	627.6	87.3
MB15HD20001	18/02/2022	627.6	87.3
MB15HD20001	19/02/2022	627.6	87.3
MB15HD20001	20/02/2022	627.6	87.3
MB15HD20001	21/02/2022	627.6	87.3
MB15HD20001	22/02/2022	627.5	87.3
MB15HD20001	23/02/2022	627.5	87.3
MB15HD20001	24/02/2022	627.5	87.3
MB15HD20001	25/02/2022	627.5	87.3
MB15HD20001	26/02/2022	627.5	87.3
MB15HD20001	27/02/2022	627.5	87.3
MB15HD20001	28/02/2022	627.5	87.3
MB15HD20001	1/03/2022	627.5	87.3
MB15HD20001	2/03/2022	627.5	87.3
MB15HD20001	3/03/2022	627.5	87.3
MB15HD20001	4/03/2022	627.6	87.3
MB15HD20001	5/03/2022	627.6	87.3
MB15HD20001	6/03/2022	627.6	87.3
MB15HD20001	7/03/2022	627.6	87.3
MB15HD20001	8/03/2022	627.6	87.3
MB15HD20001	9/03/2022	627.6	87.3
MB15HD20001	10/03/2022	627.6	87.3
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MB15HD20001	12/03/2022	627.6	87.3
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MB15HD20001	14/03/2022	627.6	87.3
MB15HD20001	15/03/2022	627.6	87.3
MB15HD20001	16/03/2022	627.6	87.3
MB15HD20002	4/02/2016	624.8	59.0
MB15HD20002	2/05/2016	624.8	59.0
MB15HD20002	30/10/2016	624.7	59.1
MB15HD20002	19/02/2017	624.7	59.0
MB15HD20002	14/05/2017	624.8	59.0
MB15HD20002	21/08/2017	624.8	58.9
MB15HD20002	9/11/2017	624.8	59.0
MB15HD20002	12/04/2018	624.8	58.9
MB15HD20002	21/11/2018	624.7	59.0
MB15HD20002	22/11/2018	624.7	59.1
MB15HD20002	23/11/2018	624.7	59.0
MB15HD20002	24/11/2018	624.7	59.0
MB15HD20002	25/11/2018	624.7	59.1
MB15HD20002	26/11/2018	624.7	59.0
MB15HD20002	27/11/2018	624.7	59.0
MB15HD20002	28/11/2018	624.7	59.0
MB15HD20002	29/11/2018	624.7	59.0
MB15HD20002	30/11/2018	624.7	59.1
MB15HD20002	1/12/2018	624.7	59.1
MB15HD20002	2/12/2018	624.7	59.0
MB15HD20002	3/12/2018	624.7	59.0
MB15HD20002	4/12/2018	624.7	59.0
MB15HD20002	5/12/2018	624.7	59.0
MB15HD20002	6/12/2018	624.7	59.0
MB15HD20002	7/12/2018	624.7	59.0
MB15HD20002	8/12/2018	624.7	59.1
MB15HD20002	9/12/2018	624.7	59.0
MB15HD20002	10/12/2018	624.7	59.1
MB15HD20002	11/12/2018	624.7	59.1
MB15HD20002	12/12/2018	624.7	59.0
MB15HD20002	13/12/2018	624.7	59.0
MB15HD20002	14/12/2018	624.7	59.0
MB15HD20002	15/12/2018	624.7	59.1
MB15HD20002	16/12/2018	624.7	59.1
MB15HD20002	17/12/2018	624.7	59.1
MB15HD20002	18/12/2018	624.7	59.0
MB15HD20002	19/12/2018	624.7	59.0
MB15HD20002	20/12/2018	624.7	59.0
MB15HD20002	21/12/2018	624.7	59.0
MB15HD20002	22/12/2018	624.7	59.0
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MB15HD20002	24/12/2018	624.7	59.0
MB15HD20002	25/12/2018	624.7	59.0
MB15HD20002	26/12/2018	624.7	59.0
MB15HD20002	27/12/2018	624.7	59.1
MB15HD20002	28/12/2018	624.7	59.1
MB15HD20002	29/12/2018	624.7	59.1
MB15HD20002	30/12/2018	624.7	59.1
MB15HD20002	31/12/2018	624.7	59.1
MB15HD20002	1/01/2019	624.7	59.1
MB15HD20002	2/01/2019	624.7	59.1
MB15HD20002	3/01/2019	624.7	59.0

ID	Date	WL mAHD	WL mbgl
MB18HD20005	6/12/2020	624.7	68.2
MB18HD20005	7/12/2020	624.7	68.2
MB18HD20005	8/12/2020	624.7	68.2
MB18HD20005	9/12/2020	624.7	68.2
MB18HD20005	10/12/2020	624.6	68.2
MB18HD20005	11/12/2020	624.6	68.2
MB18HD20005	12/12/2020	624.6	68.3
MB18HD20005	13/12/2020	624.6	68.3
MB18HD20005	14/12/2020	624.6	68.2
MB18HD20005	15/12/2020	624.7	68.2
MB18HD20005	16/12/2020	624.7	68.2
MB18HD20005	17/12/2020	624.6	68.2
MB18HD20005	18/12/2020	624.6	68.3
MB18HD20005	19/12/2020	624.6	68.3
MB18HD20005	20/12/2020	624.6	68.3
MB18HD20005	21/12/2020	624.6	68.2
MB18HD20005	22/12/2020	624.7	68.2
MB18HD20005	23/12/2020	624.7	68.2
MB18HD20005	24/12/2020	624.7	68.2
MB18HD20005	25/12/2020	624.7	68.2
MB18HD20005	26/12/2020	624.7	68.2
MB18HD20005	27/12/2020	624.6	68.2
MB18HD20005	28/12/2020	624.6	68.2
MB18HD20005	29/12/2020	624.7	68.2
MB18HD20005	30/12/2020	624.7	68.2
MB18HD20005	31/12/2020	624.6	68.2
MB18HD20005	1/01/2021	624.6	68.2
MB18HD20005	2/01/2021	624.7	68.2
MB18HD20005	3/01/2021	624.6	68.2
MB18HD20005	4/01/2021	624.6	68.2
MB18HD20005	5/01/2021	624.7	68.2
MB18HD20005	6/01/2021	624.7	68.2
MB18HD20005	7/01/2021	624.7	68.2
MB18HD20005	8/01/2021	624.7	68.2
MB18HD20005	9/01/2021	624.7	68.2
MB18HD20005	10/01/2021	624.7	68.2
MB18HD20005	11/01/2021	624.7	68.2
MB18HD20005	12/01/2021	624.7	68.2
MB18HD20005	13/01/2021	624.6	68.2
MB18HD20005	14/01/2021	624.6	68.2
MB18HD20005	15/01/2021	624.6	68.2
MB18HD20005	16/01/2021	624.7	68.2
MB18HD20005	17/01/2021	624.7	68.2
MB18HD20005	18/01/2021	624.7	68.2
MB18HD20005	19/01/2021	624.7	68.2
MB18HD20005	20/01/2021	624.7	68.2
MB18HD20005	21/01/2021	624.7	68.2
MB18HD20005	22/01/2021	624.6	68.2
MB18HD20005	23/01/2021	624.6	68.3
MB18HD20005	24/01/2021	624.6	68.3
MB18HD20005	25/01/2021	624.6	68.3
MB18HD20005	26/01/2021	624.6	68.3
MB18HD20005	27/01/2021	624.6	68.3
MB18HD20005	28/01/2021	624.6	68.3
MB18HD20005	29/01/2021	624.6	68.3
MB18HD20005	30/01/2021	624.6	68.3
MB18HD20005	31/01/2021	624.6	68.3
MB18HD20005	1/02/2021	624.6	68.3
MB18HD20005	2/02/2021	624.6	68.3
MB18HD20005	3/02/2021	624.6	68.3
MB18HD20005	4/02/2021	624.6	68.3
MB18HD20005	5/02/2021	624.6	68.3
MB18HD20005	6/02/2021	624.6	68.3
MB18HD20005	7/02/2021	624.6	68.3
MB18HD20005	8/02/2021	624.6	68.3
MB18HD20005	9/02/2021	624.6	68.3
MB18HD20005	10/02/2021	624.6	68.3
MB18HD20005	11/02/2021	624.6	68.3
MB18HD20005	12/02/2021	624.6	68.3
MB18HD20005	13/02/2021	624.6	68.2
MB18HD20005	14/02/2021	624.7	68.2
MB18HD20005	15/02/2021	624.7	68.2
MB18HD20005	16/02/2021	624.6	68.2
MB18HD20005	17/02/2021	624.6	68.2
MB18HD20005	18/02/2021	624.6	68.2
MB18HD20005	19/02/2021	624.7	68.2
MB18HD20005	20/02/2021	624.7	68.2
MB18HD20005	21/02/2021	624.7	68.2
MB18HD20005	22/02/2021	624.7	68.2
MB18HD20005	23/02/2021	624.7	68.2
MB18HD20005	24/02/2021	624.7	68.2
MB18HD20005	25/02/2021	624.7	68.2
MB18HD20005	26/02/2021	624.7	68.2
MB18HD20005	27/02/2021	624.6	68.3
MB18HD20005	28/02/2021	624.6	68.3
MB18HD20005	1/03/2021	624.6	68.2
MB18HD20005	2/03/2021	624.6	68.2
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	13/07/2014	266.3	419.9
HDVP1	12/07/2014	266.3	419.9
HDVP1	11/07/2014	266.3	419.9
HDVP1	10/07/2014	266.3	419.9
HDVP1	9/07/2014	266.3	419.9
HDVP1	8/07/2014	266.3	419.9
HDVP1	7/07/2014	266.3	419.9
HDVP1	6/07/2014	266.3	419.9
HDVP1	5/07/2014	266.3	419.9
HDVP1	4/07/2014	266.3	419.9
HDVP1	3/07/2014	266.3	419.9
HDVP1	2/07/2014	266.3	419.9
HDVP1	1/07/2014	266.3	419.9
HDVP1	30/06/2014	344.1	342.0
HDVP1	29/06/2014	344.1	342.0
HDVP1	28/06/2014	344.1	342.0
HDVP1	27/06/2014	344.1	342.0
HDVP1	26/06/2014	344.1	342.0
HDVP1	25/06/2014	344.1	342.0
HDVP1	24/06/2014	344.1	342.0
HDVP1	23/06/2014	344.1	342.0
HDVP1	22/06/2014	344.1	342.0
HDVP1	21/06/2014	344.1	342.0
HDVP1	20/06/2014	344.1	342.0
HDVP1	19/06/2014	344.1	342.0
HDVP1	18/06/2014	344.1	342.0
HDVP1	17/06/2014	344.1	342.0
HDVP1	16/06/2014	344.1	342.0
HDVP1	15/06/2014	344.1	342.0
HDVP1	14/06/2014	344.1	342.0
HDVP1	13/06/2014	344.1	342.0
HDVP1	12/06/2014	344.1	342.0
HDVP1	11/06/2014	344.1	342.0
HDVP1	10/06/2014	344.1	342.0
HDVP1	9/06/2014	344.1	342.0
HDVP1	8/06/2014	344.1	342.0
HDVP1	7/06/2014	344.1	342.0
HDVP1	6/06/2014	344.1	342.0
HDVP1	5/06/2014	344.1	342.0
HDVP1	4/06/2014	344.1	342.0
HDVP1	3/06/2014	344.1	342.0
HDVP1	2/06/2014	344.1	342.0
HDVP1	1/06/2014	344.1	342.0
HDVP1	31/05/2014	329.1	357.1
HDVP1	30/05/2014	329.1	357.1
HDVP1	29/05/2014	329.1	357.1
HDVP1	28/05/2014	329.1	357.1
HDVP1	27/05/2014	329.1	357.1
HDVP1	26/05/2014	329.1	357.1
HDVP1	25/05/2014	329.1	357.1
HDVP1	24/05/2014	329.1	357.1
HDVP1	23/05/2014	329.1	357.1
HDVP1	22/05/2014	329.1	357.1
HDVP1	21/05/2014	329.1	357.1
HDVP1	20/05/2014	329.1	357.1
HDVP1	19/05/2014	329.1	357.1
HDVP1	18/05/2014	329.1	357.1
HDVP1	17/05/2014	329.1	357.1
HDVP1	16/05/2014	329.1	357.1
HDVP1	15/05/2014	329.1	357.1
HDVP1	14/05/2014	329.1	357.1
HDVP1	13/05/2014	329.1	357.1
HDVP1	12/05/2014	329.1	357.1
HDVP1	11/05/2014	329.1	357.1
HDVP1	10/05/2014	329.1	357.1
HDVP1	9/05/2014	329.1	357.1
HDVP1	8/05/2014	329.1	357.1
HDVP1	7/05/2014	329.1	357.1
HDVP1	6/05/2014	329.1	357.1
HDVP1	5/05/2014	329.1	357.1
HDVP1	4/05/2014	329.1	357.1
HDVP1	3/05/2014	329.1	357.1
HDVP1	2/05/2014	329.1	357.1
HDVP1	1/05/2014	329.1	357.1
HDVP1	30/04/2014	317.2	369.0
HDVP1	29/04/2014	317.2	369.0
HDVP1	28/04/2014	317.2	369.0
HDVP1	27/04/2014	317.2	369.0
HDVP1	26/04/2014	317.2	369.0
HDVP1	25/04/2014	317.2	369.0
HDVP1	24/04/2014	317.2	369.0
HDVP1	23/04/2014	317.2	369.0
HDVP1	22/04/2014	317.2	369.0
HDVP1	21/04/2014	317.2	369.0
HDVP1	20/04/2014	317.2	369.0
HDVP1	19/04/2014	317.2	369.0
HDVP1	18/04/2014	317.2	369.0
HDVP1	17/04/2014	317.2	369.0
HDVP1	16/04/2014	317.2	369.0
HDVP1	15/04/2014	317.2	369.0
HDVP1	14/04/2014	317.2	369.0
HDVP1	13/04/2014	317.2	369.0
HDVP1	12/04/2014	317.2	369.0
HDVP1	11/04/2014	317.2	369.0
HDVP1	10/04/2014	317.2	369.0
HDVP1	9/04/2014	317.2	369.0
HDVP1	8/04/2014	317.2	369.0
HDVP1	7/04/2014	317.2	369.0
HDVP1	6/04/2014	317.2	369.0
HDVP1	5/04/2014	317.2	369.0
HDVP1	4/04/2014	317.2	369.0
HDVP1	3/04/2014	317.2	369.0
HDVP1	2/04/2014	317.6	368.6
HDVP1	1/04/2014	317.6	368.6
HDVP1	31/03/2014	317.6	368.6
HDVP1	30/03/2014	317.6	368.6
HDVP1	29/03/2014	317.6	368.6
HDVP1	28/03/2014	317.6	368.6
HDVP1	27/03/2014	317.6	368.6
HDVP1	26/03/2014	317.6	368.6
HDVP1	25/03/2014	317.6	368.6
HDVP1	24/03/2014	317.6	368.6
HDVP1	23/03/2014	317.6	368.6
HDVP1	22/03/2014	317.6	368.6
HDVP1	21/03/2014	317.6	368.6
HDVP1	20/03/2014	317.6	368.6
HDVP1	19/03/2014	317.6	368.6
HDVP1	18/03/2014	317.6	368.6
HDVP1	17/03/2014	317.6	368.6
HDVP1	16/03/2014	317.6	368.6
HDVP1	15/03/2014	317.6	368.6
HDVP1	14/03/2014	317.6	368.6
HDVP1	13/03/2014	317.6	368.6
HDVP1	12/03/2014	317.6	368.6
HDVP1	11/03/2014	317.6	368.6
HDVP1	10/03/2014	317.6	368.6
HDVP1	9/03/2014	317.6	368.6
HDVP1	8/03/2014	317.6	368.6
HDVP1	7/03/2014	317.6	368.6
HDVP1	6/03/2014	317.6	368.6
HDVP1	5/03/2014	317.6	368.6
HDVP1	4/03/2014	317.6	368.6
HDVP1	3/03/2014	317.6	368.6
HDVP1	2/03/2014	317.6	368.6
HDVP1	1/03/2014	317.6	368.6
HDVP1	28/02/2014	288.0	398.2

ID	Date	WL mAHD	WL mbgl
MB17H1SW0002	11/04/2018	596.8	51.6
MB17H1SW0002	10/04/2018	596.8	51.6
MB17H1SW0002	9/04/2018	596.8	51.6
MB17H1SW0002	8/04/2018	596.8	51.6
MB17H1SW0002	7/04/2018	596.8	51.6
MB17H1SW0002	6/04/2018	596.8	51.6
MB17H1SW0002	5/04/2018	596.8	51.6
MB17H1SW0002	4/04/2018	596.8	51.6
MB17H1SW0002	3/04/2018	596.8	51.6
MB17H1SW0002	2/04/2018	596.8	51.6
MB17H1SW0002	1/04/2018	596.8	51.6
MB17H1SW0002	31/03/2018	596.7	51.7
MB17H1SW0002	30/03/2018	596.8	51.6
MB17H1SW0002	29/03/2018	596.8	51.6
MB17H1SW0002	28/03/2018	596.8	51.6
MB17H1SW0002	27/03/2018	596.8	51.6
MB17H1SW0002	26/03/2018	596.8	51.6
MB17H1SW0002	25/03/2018	596.8	51.6
MB17H1SW0002	24/03/2018	596.8	51.6
MB17H1SW0002	23/03/2018	596.8	51.6
MB17H1SW0002	22/03/2018	596.8	51.6
MB17H1SW0002	21/03/2018	596.8	51.6
MB17H1SW0002	20/03/2018	596.8	51.6
MB17H1SW0002	19/03/2018	596.8	51.6
MB17H1SW0002	18/03/2018	596.8	51.6
MB17H1SW0002	17/03/2018	596.8	51.6
MB17H1SW0002	16/03/2018	596.8	51.6
MB17H1SW0002	15/03/2018	596.8	51.6
MB17H1SW0002	14/03/2018	596.8	51.6
MB17H1SW0002	13/03/2018	596.8	51.6
MB17H1SW0002	12/03/2018	596.8	51.6
MB17H1SW0002	11/03/2018	596.8	51.6
MB17H1SW0002	10/03/2018	596.8	51.6
MB17H1SW0002	9/03/2018	596.8	51.6
MB17H1SW0002	8/03/2018	596.8	51.6
MB17H1SW0002	7/03/2018	596.8	51.6
MB17H1SW0002	6/03/2018	596.8	51.6
MB17H1SW0002	5/03/2018	596.8	51.6
MB17H1SW0002	4/03/2018	596.8	51.6
MB17H1SW0002	3/03/2018	596.8	51.6
MB17H1SW0002	2/03/2018	596.8	51.6
MB17H1SW0002	1/03/2018	596.8	51.6
MB17H1SW0002	28/02/2018	596.8	51.6
MB17H1SW0002	27/02/2018	596.8	51.6
MB17H1SW0002	26/02/2018	596.8	51.6
MB17H1SW0002	25/02/2018	596.8	51.6
MB17H1SW0002	24/02/2018	596.8	51.6
MB17H1SW0002	23/02/2018	596.8	51.6
MB17H1SW0002	22/02/2018	596.8	51.6
MB17H1SW0002	21/02/2018	596.8	51.6
MB17H1SW0002	20/02/2018	596.8	51.6
MB17H1SW0002	19/02/2018	596.8	51.6
MB17H1SW0002	18/02/2018	596.8	51.6
MB17H1SW0002	17/02/2018	596.8	51.6
MB17H1SW0002	16/02/2018	596.8	51.6
MB17H1SW0002	15/02/2018	596.8	51.6
MB17H1SW0002	14/02/2018	596.8	51.6
MB17H1SW0002	13/02/2018	596.8	51.6
MB17H1SW0002	12/02/2018	596.8	51.6
MB17H1SW0002	11/02/2018	596.8	51.6
MB17H1SW0002	10/02/2018	596.8	51.6
MB17H1SW0002	9/02/2018	596.8	51.6
MB17H1SW0002	8/02/2018	596.8	51.6
MB17H1SW0002	7/02/2018	596.8	51.6
MB17H1SW0002	6/02/2018	596.8	51.6
MB17H1SW0002	5/02/2018	596.8	51.6
MB17H1SW0002	4/02/2018	596.8	51.6
MB17H1SW0002	3/02/2018	596.8	51.6
MB17H1SW0002	2/02/2018	596.7	51.7
MB17H1SW0002	1/02/2018	596.8	51.7
MB17H1SW0002	31/01/2018	596.7	51.7
MB17H1SW0002	30/01/2018	596.7	51.7
MB17H1SW0002	29/01/2018	596.7	51.7
MB17H1SW0002	28/01/2018	596.7	51.7
MB17H1SW0002	27/01/2018	596.7	51.7
MB17H1SW0002	26/01/2018	596.7	51.7
MB17H1SW0002	25/01/2018	596.7	51.7
MB17H1SW0002	24/01/2018	596.8	51.6
MB17H1SW0002	23/01/2018	596.8	51.6
MB17H1SW0002	22/01/2018	596.8	51.6
MB17H1SW0002	21/01/2018	596.8	51.6
MB17H1SW0002	20/01/2018	596.8	51.6
MB17H1SW0002	19/01/2018	596.8	51.6
MB17H1SW0002	18/01/2018	596.8	51.6
MB17H1SW0002	17/01/2018	596.8	51.6
MB17H1SW0002	16/01/2018	596.8	51.6
MB17H1SW0002	15/01/2018	596.8	51.6
MB17H1SW0002	14/01/2018	596.8	51.6
MB17H1SW0002	13/01/2018	596.8	51.6
MB17H1SW0002	12/01/2018	596.8	51.6
MB17H1SW0002	11/01/2018	596.8	51.6
MB17H1SW0002	10/01/2018	596.8	51.6
MB17H1SW0002	9/01/2018	596.8	51.6
MB17H1SW0002	8/01/2018	596.8	51.6
MB17H1SW0002	7/01/2018	596.8	51.6
MB17H1SW0002	6/01/2018	596.8	51.6
MB17H1SW0002	5/01/2018	596.8	51.6
MB17H1SW0002	4/01/2018	596.8	51.6
MB17H1SW0002	3/01/2018	596.8	51.6
MB17H1SW0002	2/01/2018	596.8	51.6
MB17H1SW0002	1/01/2018	596.8	51.6
MB17H1SW0002	31/12/2017	596.8	51.6
MB17H1SW0002	30/12/2017	596.8	51.6
MB17H1SW0002	29/12/2017	596.8	51.6
MB17H1SW0002	28/12/2017	596.8	51.6
MB17H1SW0002	27/12/2017	596.8	51.6
MB17H1SW0002	26/12/2017	596.8	51.6
MB17H1SW0002	25/12/2017	596.8	51.6
MB17H1SW0002	24/12/2017	596.8	51.6
MB17H1SW0002	23/12/2017	596.8	51.6
MB17H1SW0002	22/12/2017	596.8	51.6
MB17H1SW0002	21/12/2017	596.8	51.6
MB17H1SW0002	20/12/2017	596.8	51.6
MB17H1SW0002	19/12/2017	596.8	51.6
MB17H1SW0002	18/12/2017	596.8	51.6
MB17H1SW0002	17/12/2017	596.8	51.6
MB17H1SW0002	16/12/2017	596.8	51.6
MB17H1SW0002	15/12/2017	596.8	51.6
MB17H1SW0002	14/12/2017	596.8	51.6
MB17H1SW0002	13/12/2017	596.8	51.6
MB17H1SW0002	12/12/2017	596.8	51.6
MB17H1SW0002	11/12/2017	596.8	51.6
MB17H1SW0002	10/12/2017	596.8	51.6
MB17H1SW0002	9/12/2017	596.8	51.6
MB17H1SW0002	8/12/2017	596.8	51.6
MB17H1SW0002	7/12/2017	596.8	51.6
MB17H1SW0002	6/12/2017	596.8	51.6
MB17H1SW0002	5/12/2017	596.8	51.6
MB17H1SW0002	4/12/2017	596.8	51.6
MB17H1SW0002	3/12/2017	596.8	51.6
MB17H1SW0002	2/12/2017	596.8	51.6
MB17H1SW0002	1/12/2017	596.8	51.6
MB17H1SW0002	30/11/2017	596.8	51.6
MB17H1SW0002	29/11/2017	596.8	51.6
MB17H1SW0002	28/11/2017	596.8	51.6
MB17H1SW0002	27/11/2017	596.8	51.6

ID	Date	WL mAHD	WL mbgl
MB15HD20002	4/01/2019	624.7	59.0
MB15HD20002	5/01/2019	624.7	59.0
MB15HD20002	6/01/2019	624.7	59.0
MB15HD20002	7/01/2019	624.7	59.0
MB15HD20002	8/01/2019	624.7	59.0
MB15HD20002	9/01/2019	624.7	59.0
MB15HD20002	10/01/2019	624.7	59.1
MB15HD20002	11/01/2019	624.7	59.0
MB15HD20002	12/01/2019	624.7	59.0
MB15HD20002	13/01/2019	624.7	59.0
MB15HD20002	14/01/2019	624.7	59.1
MB15HD20002	15/01/2019	624.7	59.1
MB15HD20002	16/01/2019	624.7	59.1
MB15HD20002	17/01/2019	624.7	59.0
MB15HD20002	18/01/2019	624.7	59.0
MB15HD20002	19/01/2019	624.7	59.0
MB15HD20002	20/01/2019	624.7	59.0
MB15HD20002	21/01/2019	624.7	59.1
MB15HD20002	22/01/2019	624.7	59.1
MB15HD20002	23/01/2019	624.7	59.1
MB15HD20002	24/01/2019	624.7	59.1
MB15HD20002	25/01/2019	624.7	59.1
MB15HD20002	26/01/2019	624.7	59.1
MB15HD20002	27/01/2019	624.7	59.0
MB15HD20002	28/01/2019	624.7	59.0
MB15HD20002	29/01/2019	624.7	59.0
MB15HD20002	30/01/2019	624.7	59.0
MB15HD20002	31/01/2019	624.7	59.0
MB15HD20002	1/02/2019	624.7	59.0
MB15HD20002	2/02/2019	624.7	59.1
MB15HD20002	3/02/2019	624.7	59.1
MB15HD20002	4/02/2019	624.7	59.1
MB15HD20002	5/02/2019	624.7	59.1
MB15HD20002	6/02/2019	624.7	59.1
MB15HD20002	7/02/2019	624.7	59.1
MB15HD20002	8/02/2019	624.7	59.0
MB15HD20002	9/02/2019	624.7	59.0
MB15HD20002	10/02/2019	624.7	59.0
MB15HD20002	11/02/2019	624.7	59.0
MB15HD20002	12/02/2019	624.7	59.0
MB15HD20002	13/02/2019	624.7	59.0
MB15HD20002	14/02/2019	624.7	59.0
MB15HD20002	15/02/2019	624.7	59.0
MB15HD20002	16/02/2019	624.7	59.0
MB15HD20002	17/02/2019	624.7	59.0
MB15HD20002	18/02/2019	624.7	59.0
MB15HD20002	19/02/2019	624.7	59.0
MB15HD20002	20/02/2019	624.7	59.0
MB15HD20002	21/02/2019	624.7	59.0
MB15HD20002	22/02/2019	624.7	59.0
MB15HD20002	23/02/2019	624.7	59.0
MB15HD20002	24/02/2019	624.7	59.0
MB15HD20002	25/02/2019	624.7	59.0
MB15HD20002	26/02/2019	624.7	59.0
MB15HD20002	27/02/2019	624.7	59.0
MB15HD20002	28/02/2019	624.7	59.0
MB15HD20002	1/03/2019	624.7	59.0
MB15HD20002	2/03/2019	624.7	59.0
MB15HD20002	3/03/2019	624.7	59.0
MB15HD20002	4/03/2019	624.7	59.0
MB15HD20002	5/03/2019	624.7	59.0
MB15HD20002	6/03/2019	624.7	59.0
MB15HD20002	7/03/2019	624.7	59.0
MB15HD20002	8/03/2019	624.7	59.0
MB15HD20002	9/03/2019	624.7	59.0
MB15HD20002	10/03/2019	624.7	59.0
MB15HD20002	11/03/2019	624.7	59.0
MB15HD20002	12/03/2019	624.7	59.0
MB15HD20002	13/03/2019	624.8	59.0
MB15HD20002	14/03/2019	624.8	59.0
MB15HD20002	15/03/2019	624.7	59.0
MB15HD20002	16/03/2019	624.7	59.0
MB15HD20002	17/03/2019	624.7	59.0
MB15HD20002	18/03/2019	624.7	59.0
MB15HD20002	19/03/2019	624.7	59.0
MB15HD20002	20/03/2019	624.7	59.0
MB15HD20002	21/03/2019	624.7	59.1
MB15HD20002	22/03/2019	624.7	59.1
MB15HD20002	23/03/2019	624.7	59.1
MB15HD20002	24/03/2019	624.7	59.1
MB15HD20002	25/03/2019	624.7	59.1
MB15HD20002	26/03/2019	624.7	59.0
MB15HD20002	27/03/2019	624.7	59.0
MB15HD20002	28/03/2019	624.7	59.0
MB15HD20002	29/03/2019	624.7	59.0
MB15HD20002	30/03/2019	624.8	59.0
MB15HD20002	31/03/2019	624.8	59.0
MB15HD20002	1/04/2019	624.8	59.0
MB15HD20002	2/04/2019	624.7	59.0
MB15HD20002	3/04/2019	624.8	59.0
MB15HD20002	4/04/2019	624.7	59.0
MB15HD20002	5/04/2019	624.8	59.0
MB15HD20002	6/04/2019	624.8	59.0
MB15HD20002	7/04/2019	624.7	59.0
MB15HD20002	8/04/2019	624.7	59.0
MB15HD20002	9/04/2019	624.7	59.0
MB15HD20002	10/04/2019	624.7	59.0
MB15HD20002	11/04/2019	624.7	59.0
MB15HD20002	12/04/2019	624.7	59.0
MB15HD20002	13/04/2019	624.8	59.0
MB15HD20002	14/04/2019	624.7	59.0
MB15HD20002	15/04/2019	624.7	59.0
MB15HD20002	16/04/2019	624.7	59.0
MB15HD20002	17/04/2019	624.8	59.0
MB15HD20002	18/04/2019	624.8	59.0
MB15HD20002	19/04/2019	624.7	59.0
MB15HD20002	20/04/2019	624.8	59.0
MB15HD20002	21/04/2019	624.8	59.0
MB15HD20002	22/04/2019	624.8	59.0
MB15HD20002	23/04/2019	624.8	59.0
MB15HD20002	24/04/2019	624.8	59.0
MB15HD20002	25/04/2019	624.8	59.0
MB15HD20002	26/04/2019	624.8	59.0
MB15HD20002	27/04/2019	624.8	59.0
MB15HD20002	28/04/2019	624.8	59.0
MB15HD20002	29/04/2019	624.8	59.0
MB15HD20002	30/04/2019	624.8	59.0
MB15HD20002	1/05/2019	624.8	59.0
MB15HD20002	2/05/2019	624.8	59.0
MB15HD20002	3/05/2019	624.8	59.0
MB15HD20002	4/05/2019	624.8	59.0
MB15HD20002	5/05/2019	624.8	59.0
MB15HD20002	6/05/2019	624.8	59.0
MB15HD20002	7/05/2019	624.8	59.0
MB15HD20002	8/05/2019	624.8	59.0
MB15HD20002	9/05/2019	624.8	58.9
MB15HD20002	10/05/2019	624.8	58.9
MB15HD20002	11/05/2019	624.8	58.9
MB15HD20002	12/05/2019	624.8	59.0
MB15HD20002	13/05/2019	624.8	59.0
MB15HD20002	14/05/2019	624.8	59.0
MB15HD20002	15/05/2019	624.8	59.0
MB15HD20002	16/05/2019	624.8	59.0
MB15HD20002	17/05/2019	624.8	59.0
MB15HD20002	18/05/2019	624.8	59.0
MB15HD20002	19/05/2019	624.8	59.0

ID	Date	WL mAHD	WL mbgl
MB18HD20005	21/04/2021	624.7	68.2
MB18HD20005	22/04/2021	624.7	68.2
MB18HD20005	23/04/2021	624.7	68.2
MB18HD20005	24/04/2021	624.7	68.2
MB18HD20005	25/04/2021	624.7	68.2
MB18HD20005	26/04/2021	624.7	68.2
MB18HD20005	27/04/2021	624.7	68.1
MB18HD20005	28/04/2021	624.7	68.1
MB18HD20005	29/04/2021	624.7	68.2
MB18HD20005	30/04/2021	624.7	68.2
MB18HD20005	1/05/2021	624.7	68.2
MB18HD20005	2/05/2021	624.7	68.2
MB18HD20005	3/05/2021	624.7	68.2
MB18HD20005	4/05/2021	624.7	68.2
MB18HD20005	5/05/2021	624.7	68.2
MB18HD20005	6/05/2021	624.7	68.2
MB18HD20005	7/05/2021	624.7	68.2
MB18HD20005	8/05/2021	624.7	68.2
MB18HD20005	9/05/2021	624.7	68.2
MB18HD20005	10/05/2021	624.7	68.2
MB18HD20005	11/05/2021	624.7	68.2
MB18HD20005	12/05/2021	624.7	68.2
MB18HD20005	13/05/2021	624.7	68.2
MB18HD20005	14/05/2021	624.7	68.2
MB18HD20005	15/05/2021	624.7	68.2
MB18HD20005	16/05/2021	624.7	68.2
MB18HD20005	17/05/2021	624.7	68.2
MB18HD20005	18/05/2021	624.7	68.2
MB18HD20005	19/05/2021	624.7	68.2
MB18HD20005	20/05/2021	624.7	68.2
MB18HD20005	21/05/2021	624.7	68.2
MB18HD20005	22/05/2021	624.7	68.2
MB18HD20005	23/05/2021	624.7	68.2
MB18HD20005	24/05/2021	624.7	68.2
MB18HD20005	25/05/2021	624.7	68.2
MB18HD20005	26/05/2021	624.7	68.1
MB18HD20005	27/05/2021	624.7	68.1
MB18HD20005	28/05/2021	624.7	68.1
MB18HD20005	29/05/2021	624.7	68.2
MB18HD20005	30/05/2021	624.7	68.2
MB18HD20005	31/05/2021	624.7	68.2
MB18HD20005	1/06/2021	624.7	68.2
MB18HD20005	2/06/2021	624.7	68.2
MB18HD20005	3/06/2021	624.7	68.1
MB18HD20005	4/06/2021	624.7	68.1
MB18HD20005	5/06/2021	624.7	68.1
MB18HD20005	6/06/2021	624.7	68.2
MB18HD20005	7/06/2021	624.7	68.2
MB18HD20005	8/06/2021	624.7	68.2
MB18HD20005	9/06/2021	624.7	68.2
MB18HD20005	10/06/2021	624.7	68.2
MB18HD20005	11/06/2021	624.7	68.2
MB18HD20005	12/06/2021	624.7	68.2
MB18HD20005	13/06/2021	624.7	68.2
MB18HD20005	14/06/2021	624.7	68.2
MB18HD20005	15/06/2021	624.7	68.2
MB18HD20005	16/06/2021	624.7	68.2
MB18HD20005	17/06/2021	624.7	68.1
MB18HD20005	18/06/2021	624.7	68.1
MB18HD20005	19/06/2021	624.7	68.1
MB18HD20005	20/06/2021	624.7	68.2
MB18HD20005	21/06/2021	624.7	68.2
MB18HD20005	22/06/2021	624.7	68.2
MB18HD20005	23/06/2021	624.7	68.2
MB18HD20005	24/06/2021	624.7	68.1
MB18HD20005	25/06/2021	624.7	68.1
MB18HD20005	26/06/2021	624.7	68.1
MB18HD20005	27/06/2021	624.7	68.2
MB18HD20005	28/06/2021	624.7	68.2
MB18HD20005	29/06/2021	624.7	68.2
MB18HD20005	30/06/2021	624.7	68.2
MB18HD20005	1/07/2021	624.7	68.1
MB18HD20005	2/07/2021	624.7	68.2
MB18HD20005	3/07/2021	624.7	68.1
MB18HD20005	4/07/2021	624.7	68.2
MB18HD20005	5/07/2021	624.7	68.2
MB18HD20005	6/07/2021	624.7	68.2
MB18HD20005	7/07/2021	624.7	68.2
MB18HD20005	8/07/2021	624.7	68.2
MB18HD20005	9/07/2021	624.7	68.2
MB18HD20005	10/07/2021	624.7	68.2
MB18HD20005	11/07/2021	624.7	68.2
MB18HD20005	12/07/2021	624.7	68.2
MB18HD20005	13/07/2021	624.7	68.2
MB18HD20005	14/07/2021	624.7	68.2
MB18HD20005	15/07/2021	624.7	68.2
MB18HD20005	16/07/2021	624.7	68.2
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	27/02/2014	288.0	398.2
HDVP1	26/02/2014	288.0	398.2
HDVP1	25/02/2014	288.0	398.2
HDVP1	24/02/2014	288.0	398.2
HDVP1	23/02/2014	288.0	398.2
HDVP1	22/02/2014	288.0	398.2
HDVP1	21/02/2014	288.0	398.2
HDVP1	20/02/2014	288.0	398.2
HDVP1	19/02/2014	288.0	398.2
HDVP1	18/02/2014	288.0	398.2
HDVP1	17/02/2014	288.0	398.2
HDVP1	16/02/2014	288.0	398.2
HDVP1	15/02/2014	288.0	398.2
HDVP1	14/02/2014	288.0	398.2
HDVP1	13/02/2014	288.0	398.2
HDVP1	12/02/2014	288.0	398.2
HDVP1	11/02/2014	288.0	398.2
HDVP1	10/02/2014	288.0	398.2
HDVP1	9/02/2014	288.0	398.2
HDVP1	8/02/2014	288.0	398.2
HDVP1	7/02/2014	288.0	398.2
HDVP1	6/02/2014	288.0	398.2
HDVP1	5/02/2014	288.0	398.2
HDVP1	4/02/2014	288.0	398.2
HDVP1	3/02/2014	288.0	398.2
HDVP1	2/02/2014	288.0	398.2
HDVP1	1/02/2014	288.0	398.2
HDVP1	31/01/2014	341.7	344.5
HDVP1	30/01/2014	341.7	344.5
HDVP1	29/01/2014	341.7	344.5
HDVP1	28/01/2014	341.7	344.5
HDVP1	27/01/2014	341.7	344.5
HDVP1	26/01/2014	341.7	344.5
HDVP1	25/01/2014	341.7	344.5
HDVP1	24/01/2014	341.7	344.5
HDVP1	23/01/2014	341.7	344.5
HDVP1	22/01/2014	341.7	344.5
HDVP1	21/01/2014	341.7	344.5
HDVP1	20/01/2014	341.7	344.5
HDVP1	19/01/2014	341.7	344.5
HDVP1	18/01/2014	341.7	344.5
HDVP1	17/01/2014	341.7	344.5
HDVP1	16/01/2014	341.7	344.5
HDVP1	15/01/2014	341.7	344.5
HDVP1	14/01/2014	341.7	344.5
HDVP1	13/01/2014	341.7	344.5
HDVP1	12/01/2014	341.7	344.5
HDVP1	11/01/2014	341.7	344.5
HDVP1	10/01/2014	341.7	344.5
HDVP1	9/01/2014	341.7	344.5
HDVP1	8/01/2014	341.7	344.5
HDVP1	7/01/2014	341.7	344.5
HDVP1	6/01/2014	341.7	344.5
HDVP1	5/01/2014	341.7	344.5
HDVP1	4/01/2014	341.7	344.5
HDVP1	3/01/2014	341.7	344.5
HDVP1	2/01/2014	341.7	344.5
HDVP1	1/01/2014	341.7	344.5
HDVP1	31/12/2013	341.7	344.5
HDVP1	30/12/2013	315.1	371.1
HDVP1	29/12/2013	315.1	371.1
HDVP1	28/12/2013	315.1	371.1
HDVP1	27/12/2013	315.1	371.1
HDVP1	26/12/2013	315.1	371.1
HDVP1	25/12/2013	315.1	371.1
HDVP1	24/12/2013	315.1	371.1
HDVP1	23/12/2013	315.1	371.1
HDVP1	22/12/2013	315.1	371.1
HDVP1	21/12/2013	315.1	371.1
HDVP1	20/12/2013	315.1	371.1
HDVP1	19/12/2013	315.1	371.1
HDVP1	18/12/2013	315.1	371.1
HDVP1	17/12/2013	315.1	371.1
HDVP1	16/12/2013	315.1	371.1
HDVP1	15/12/2013	315.1	371.1
HDVP1	14/12/2013	315.1	371.1
HDVP1	13/12/2013	315.1	371.1
HDVP1	12/12/2013	315.1	371.1
HDVP1	11/12/2013	315.1	371.1
HDVP1	10/12/2013	315.1	371.1
HDVP1	9/12/2013	315.1	371.1
HDVP1	8/12/2013	315.1	371.1
HDVP1	7/12/2013	315.1	371.1
HDVP1	6/12/2013	315.1	371.1
HDVP1	5/12/2013	315.1	371.1
HDVP1	4/12/2013	315.1	371.1
HDVP1	3/12/2013	315.1	371.1
HDVP1	2/12/2013	315.1	371.1
HDVP1	1/12/2013	315.1	371.1
HDVP1	30/11/2013	319.1	367.0
HDVP1	29/11/2013	319.1	367.0
HDVP1	28/11/2013	319.1	367.0
HDVP1	27/11/2013	319.1	367.0
HDVP1	26/11/2013	319.1	367.0
HDVP1	25/11/2013	319.1	367.0
HDVP1	24/11/2013	319.1	367.0
HDVP1	23/11/2013	319.1	367.0
HDVP1	22/11/2013	319.1	367.0
HDVP1	21/11/2013	319.1	367.0
HDVP1	20/11/2013	319.1	367.0
HDVP1	19/11/2013	319.1	367.0
HDVP1	18/11/2013	319.1	367.0
HDVP1	17/11/2013	319.1	367.0
HDVP1	16/11/2013	319.1	367.0
HDVP1	15/11/2013	319.1	367.0
HDVP1	14/11/2013	319.1	367.0
HDVP1	13/11/2013	319.1	367.0
HDVP1	12/11/2013	319.1	367.0
HDVP1	11/11/2013	319.1	367.0
HDVP1	10/11/2013	319.1	367.0
HDVP1	9/11/2013	319.1	367.0
HDVP1	8/11/2013	319.1	367.0
HDVP1	7/11/2013	319.1	367.0
HDVP1	6/11/2013	319.1	367.0
HDVP1	5/11/2013	319.1	367.0
HDVP1	4/11/2013	319.1	367.0
HDVP1	3/11/2013	319.1	367.0
HDVP1	2/11/2013	319.1	367.0
HDVP1	1/11/2013	319.1	367.0
HDVP1	31/10/2013	270.3	415.9
HDVP1	30/10/2013	270.3	415.9
HDVP1	29/10/2013	270.3	415.9
HDVP1	28/10/2013	270.3	415.9
HDVP1	27/10/2013	270.3	415.9
HDVP1	26/10/2013	270.3	415.9
HDVP1	25/10/2013	270.3	415.9
HDVP1	24/10/2013	270.3	415.9
HDVP1	23/10/2013	270.3	415.9
HDVP1	22/10/2013	270.3	415.9
HDVP1	21/10/2013	270.3	415.9
HDVP1	20/10/2013	270.3	415.9
HDVP1	19/10/2013	270.3	415.9
HDVP1	18/10/2013	270.3	415.9
HDVP1	17/10/2013	270.3	415.9
HDVP1	16/10/2013	270.3	415.9
HDVP1	15/10/2013	270.3	415.9

ID	Date	WL mAHD	WL mbgl
MB17H1SW0002	26/11/2017	596.8	51.6
MB17H1SW0002	25/11/2017	596.8	51.6
MB17H1SW0002	24/11/2017	596.8	51.6
MB17H1SW0002	23/11/2017	596.8	51.6
MB17H1SW0002	22/11/2017	596.8	51.6
MB17H1SW0002	21/11/2017	596.8	51.6
MB17H1SW0002	20/11/2017	596.8	51.6
MB17H1SW0002	19/11/2017	596.8	51.6
MB17H1SW0002	18/11/2017	596.8	51.6
MB17H1SW0002	17/11/2017	596.8	51.6
MB17H1SW0002	16/11/2017	596.8	51.6
MB17H1SW0002	15/11/2017	596.8	51.6
MB17H1SW0002	14/11/2017	596.8	51.6
MB17H1SW0002	13/11/2017	596.8	51.6
MB17H1SW0002	12/11/2017	596.8	51.6
MB17H1SW0002	11/11/2017	596.8	51.6
MB17H1SW0002	10/11/2017	596.8	51.6
MB17H1SW0002	9/11/2017	596.8	51.6
MB17H1SW0002	8/11/2017	596.8	51.6
MB17H1SW0002	7/11/2017	596.8	51.6
MB17H1SW0002	6/11/2017	596.8	51.6
MB17H1SW0002	5/11/2017	596.8	51.6
MB17H1SW0002	4/11/2017	596.8	51.6
MB17H1SW0002	3/11/2017	596.8	51.6
MB17H1SW0002	2/11/2017	596.8	51.6
MB17H1SW0002	1/11/2017	596.8	51.6
MB17H1SW0002	31/10/2017	596.8	51.6
MB17H1SW0002	30/10/2017	596.8	51.6
MB17H1SW0002	29/10/2017	596.8	51.6
MB17H1SW0002	28/10/2017	596.8	51.6
MB17H1SW0002	27/10/2017	596.8	51.6
MB17H1SW0002	26/10/2017	596.8	51.6
MB17H1SW0002	25/10/2017	596.8	51.6
MB17H1SW0002	24/10/2017	596.8	51.6
MB17H1SW0002	23/10/2017	596.8	51.6
MB17H1SW0002	22/10/2017	596.8	51.6
MB17H1SW0002	21/10/2017	596.8	51.6
MB17H1SW0002	20/10/2017	596.8	51.6
MB17H1SW0002	19/10/2017	596.8	51.6
MB17H1SW0002	18/10/2017	596.8	51.6
MB17H1SW0002	17/10/2017	596.8	51.6
MB17H1SW0002	16/10/2017	596.8	51.6
MB17H1SW0002	15/10/2017	596.8	51.6
MB17H1SW0002	14/10/2017	596.8	51.6
MB17H1SW0002	13/10/2017	596.8	51.6
MB17H1SW0002	12/10/2017	596.8	51.6
MB17H1SW0002	11/10/2017	596.8	51.6
MB17H1SW0002	10/10/2017	596.8	51.6
MB17H1SW0002	9/10/2017	596.8	51.6
MB17H1SW0002	8/10/2017	596.8	51.6
MB17H1SW0002	7/10/2017	596.8	51.6
MB17H1SW0002	6/10/2017	596.8	51.6
MB17H1SW0002	5/10/2017	596.8	51.6
MB17H1SW0002	4/10/2017	596.8	51.6
MB17H1SW0002	3/10/2017	596.8	51.6
MB17H1SW0002	2/10/2017	596.8	51.6
MB17H1SW0002	1/10/2017	596.8	51.6
MB17H1SW0002	30/09/2017	596.9	51.5
MB17H1SW0002	29/09/2017	596.9	51.5
MB17H1SW0002	28/09/2017	596.8	51.6
MB17H1SW0002	27/09/2017	596.8	51.6
MB17H1SW0002	26/09/2017	596.8	51.6
MB17H1SW0002	25/09/2017	596.8	51.6
MB17H1SW0002	24/09/2017	596.8	51.6
MB17H1SW0002	23/09/2017	596.8	51.6
MB17H1SW0002	22/09/2017	596.8	51.6
MB17H1SW0002	21/09/2017	596.9	51.5
MB17H1SW0002	20/09/2017	596.9	51.5
MB17H1SW0002	19/09/2017	596.9	51.5
MB17H1SW0002	18/09/2017	596.9	51.5
MB17H1SW0002	17/09/2017	596.9	51.5
MB17H1SW0002	16/09/2017	596.9	51.5
MB17H1SW0002	15/09/2017	596.9	51.5
MB17H1SW0002	14/09/2017	596.9	51.5
MB17H1SW0002	13/09/2017	596.9	51.5
MB17H1SW0002	12/09/2017	596.9	51.5
MB17H1SW0002	11/09/2017	596.8	51.6
MB17H1SW0002	10/09/2017	596.9	51.5
MB17H1SW0002	9/09/2017	596.9	51.5
MB17H1SW0002	8/09/2017	596.9	51.5
MB17H1SW0002	7/09/2017	596.9	51.5
MB17H1SW0002	6/09/2017	596.9	51.5
MB17H1SW0002	5/09/2017	596.9	51.5
MB17H1SW0025	3/03/2022	621.0	35.2
MB17H1SW0025	2/03/2022	621.0	35.2
MB17H1SW0025	1/03/2022	621.0	35.2
MB17H1SW0025	28/02/2022	621.0	35.2
MB17H1SW0025	27/02/2022	621.0	35.2
MB17H1SW0025	26/02/2022	621.0	35.1
MB17H1SW0025	25/02/2022	621.0	35.1
MB17H1SW0025	24/02/2022	621.0	35.1
MB17H1SW0025	23/02/2022	621.1	35.1
MB17H1SW0025	22/02/2022	621.1	35.1
MB17H1SW0025	21/02/2022	621.1	35.1
MB17H1SW0025	20/02/2022	621.1	35.1
MB17H1SW0025	19/02/2022	621.1	35.1
MB17H1SW0025	18/02/2022	621.1	35.1
MB17H1SW0025	17/02/2022	621.1	35.1
MB17H1SW0025	16/02/2022	621.1	35.1
MB17H1SW0025	15/02/2022	621.1	35.1
MB17H1SW0025	14/02/2022	621.1	35.1
MB17H1SW0025	13/02/2022	621.1	35.1
MB17H1SW0025	12/02/2022	621.1	35.1
MB17H1SW0025	11/02/2022	621.1	35.1
MB17H1SW0025	10/02/2022	621.1	35.1
MB17H1SW0025	9/02/2022	621.1	35.1
MB17H1SW0025	8/02/2022	621.1	35.1
MB17H1SW0025	7/02/2022	621.1	35.1
MB17H1SW0025	6/02/2022	621.1	35.1
MB17H1SW0025	5/02/2022	621.1	35.1
MB17H1SW0025	4/02/2022	621.1	35.1
MB17H1SW0025	3/02/2022	621.3	34.9
MB17H1SW0025	2/02/2022	621.2	35.0
MB17H1SW0025	1/02/2022	621.2	35.0
MB17H1SW0025	31/01/2022	621.2	35.0
MB17H1SW0025	30/01/2022	621.3	34.9
MB17H1SW0025	29/01/2022	621.3	34.9
MB17H1SW0025	28/01/2022	621.3	34.9
MB17H1SW0025	27/01/2022	621.2	35.0
MB17H1SW0025	26/01/2022	621.2	35.0
MB17H1SW0025	25/01/2022	621.3	34.9
MB17H1SW0025	24/01/2022	621.3	34.9
MB17H1SW0025	23/01/2022	621.3	34.9
MB17H1SW0025	22/01/2022	621.3	34.9
MB17H1SW0025	21/01/2022	621.3	34.9
MB17H1SW0025	20/01/2022	621.3	34.9
MB17H1SW0025	19/01/2022	621.3	34.9
MB17H1SW0025	18/01/2022	621.3	34.9
MB17H1SW0025	17/01/2022	621.3	34.9
MB17H1SW0025	16/01/2022	621.3	34.9
MB17H1SW0025	15/01/2022	621.3	34.9
MB17H1SW0025	14/01/2022	621.3	34.9
MB17H1SW0025	13/01/2022	621.3	34.9
MB17H1SW0025	12/01/2022	621.3	34.9
MB17H1SW0025	11/01/2022	621.3	34.9
MB17H1SW0025	10/01/2022	621.3	34.9

ID	Date	WL mAHD	WL mbgl
MB15HD20002	20/05/2019	624.8	59.0
MB15HD20002	21/05/2019	624.8	59.0
MB15HD20002	22/05/2019	624.8	59.0
MB15HD20002	23/05/2019	624.8	59.0
MB15HD20002	24/05/2019	624.8	59.0
MB15HD20002	25/05/2019	624.8	59.0
MB15HD20002	26/05/2019	624.8	59.0
MB15HD20002	27/05/2019	624.8	59.0
MB15HD20002	28/05/2019	624.8	59.0
MB15HD20002	29/05/2019	624.8	59.0
MB15HD20002	30/05/2019	624.8	59.0
MB15HD20002	31/05/2019	624.8	58.9
MB15HD20002	1/06/2019	624.8	58.9
MB15HD20002	2/06/2019	624.8	58.9
MB15HD20002	3/06/2019	624.8	58.9
MB15HD20002	4/06/2019	624.8	59.0
MB15HD20002	5/06/2019	624.8	59.0
MB15HD20002	6/06/2019	624.8	59.0
MB15HD20002	7/06/2019	624.8	59.0
MB15HD20002	8/06/2019	624.8	59.0
MB15HD20002	9/06/2019	624.8	59.0
MB15HD20002	10/06/2019	624.8	59.0
MB15HD20002	11/06/2019	624.7	59.0
MB15HD20002	12/06/2019	624.8	59.0
MB15HD20002	13/06/2019	624.8	59.0
MB15HD20002	14/06/2019	624.8	59.0
MB15HD20002	15/06/2019	624.8	59.0
MB15HD20002	16/06/2019	624.8	59.0
MB15HD20002	17/06/2019	624.8	59.0
MB15HD20002	18/06/2019	624.8	59.0
MB15HD20002	19/06/2019	624.8	59.0
MB15HD20002	20/06/2019	624.8	59.0
MB15HD20002	21/06/2019	624.8	59.0
MB15HD20002	22/06/2019	624.8	59.0
MB15HD20002	23/06/2019	624.8	59.0
MB15HD20002	24/06/2019	624.8	59.0
MB15HD20002	25/06/2019	624.8	59.0
MB15HD20002	26/06/2019	624.8	59.0
MB15HD20002	27/06/2019	624.8	59.0
MB15HD20002	28/06/2019	624.8	59.0
MB15HD20002	29/06/2019	624.8	59.0
MB15HD20002	30/06/2019	624.8	59.0
MB15HD20002	1/07/2019	624.8	59.0
MB15HD20002	2/07/2019	624.8	59.0
MB15HD20002	3/07/2019	624.8	59.0
MB15HD20002	4/07/2019	624.8	59.0
MB15HD20002	5/07/2019	624.8	59.0
MB15HD20002	6/07/2019	624.8	59.0
MB15HD20002	7/07/2019	624.8	59.0
MB15HD20002	8/07/2019	624.8	59.0
MB15HD20002	9/07/2019	624.8	59.0
MB15HD20002	10/07/2019	624.8	59.0
MB15HD20002	11/07/2019	624.8	58.9
MB15HD20002	12/07/2019	624.8	58.9
MB15HD20002	13/07/2019	624.8	58.9
MB15HD20002	14/07/2019	624.8	58.9
MB15HD20002	15/07/2019	624.8	58.9
MB15HD20002	16/07/2019	624.8	59.0
MB15HD20002	17/07/2019	624.8	59.0
MB15HD20002	18/07/2019	624.8	59.0
MB15HD20002	19/07/2019	624.8	59.0
MB15HD20002	20/07/2019	624.8	59.0
MB15HD20002	21/07/2019	624.8	59.0
MB15HD20002	22/07/2019	624.8	59.0
MB15HD20002	23/07/2019	624.8	59.0
MB15HD20002	24/07/2019	624.8	59.0
MB15HD20002	25/07/2019	624.8	59.0
MB15HD20002	26/07/2019	624.8	59.0
MB15HD20002	27/07/2019	624.8	59.0
MB15HD20002	28/07/2019	624.8	59.0
MB15HD20002	29/07/2019	624.8	59.0
MB15HD20002	30/07/2019	624.8	59.0
MB15HD20002	31/07/2019	624.8	59.0
MB15HD20002	1/08/2019	624.8	59.0
MB15HD20002	2/08/2019	624.8	59.0
MB15HD20002	3/08/2019	624.8	59.0
MB15HD20002	4/08/2019	624.8	59.0
MB15HD20002	5/08/2019	624.8	59.0
MB15HD20002	6/08/2019	624.8	59.0
MB15HD20002	7/08/2019	624.8	59.0
MB15HD20002	8/08/2019	624.8	59.0
MB15HD20002	9/08/2019	624.8	59.0
MB15HD20002	10/08/2019	624.8	59.0
MB15HD20002	11/08/2019	624.8	59.0
MB15HD20002	12/08/2019	624.8	59.0
MB15HD20002	13/08/2019	624.8	59.0
MB15HD20002	14/08/2019	624.8	59.0
MB15HD20002	15/08/2019	624.8	59.0
MB15HD20002	16/08/2019	624.8	59.0
MB15HD20002	17/08/2019	624.8	59.0
MB15HD20002	18/08/2019	624.8	59.0
MB15HD20002	19/08/2019	624.8	58.9
MB15HD20002	20/08/2019	624.8	58.9
MB15HD20002	21/08/2019	624.8	59.0
MB15HD20002	22/08/2019	624.8	59.0
MB15HD20002	23/08/2019	624.8	59.0
MB15HD20002	24/08/2019	624.8	59.0
MB15HD20002	25/08/2019	624.8	59.0
MB15HD20002	26/08/2019	624.7	59.0
MB15HD20002	27/08/2019	624.8	59.0
MB15HD20002	28/08/2019	624.8	59.0
MB15HD20002	29/08/2019	624.8	59.0
MB15HD20002	30/08/2019	624.7	59.0
MB15HD20002	31/08/2019	624.7	59.0
MB15HD20002	1/09/2019	624.7	59.0
MB15HD20002	2/09/2019	624.8	59.0
MB15HD20002	3/09/2019	624.7	59.0
MB15HD20002	4/09/2019	624.7	59.0
MB15HD20002	5/09/2019	624.7	59.0
MB15HD20002	6/09/2019	624.7	59.0
MB15HD20002	7/09/2019	624.7	59.0
MB15HD20002	8/09/2019	624.8	59.0
MB15HD20002	9/09/2019	624.8	59.0
MB15HD20002	10/09/2019	624.8	59.0
MB15HD20002	11/09/2019	624.8	59.0
MB15HD20002	12/09/2019	624.8	59.0
MB15HD20002	13/09/2019	624.8	59.0
MB15HD20002	14/09/2019	624.8	59.0
MB15HD20002	15/09/2019	624.8	59.0
MB15HD20002	16/09/2019	624.7	59.0
MB15HD20002	17/09/2019	624.7	59.0
MB15HD20002	18/09/2019	624.7	59.0
MB15HD20002	19/09/2019	624.7	59.0
MB15HD20002	20/09/2019	624.8	59.0
MB15HD20002	21/09/2019	624.8	59.0
MB15HD20002	22/09/2019	624.8	59.0
MB15HD20002	23/09/2019	624.8	59.0
MB15HD20002	24/09/2019	624.8	59.0
MB15HD20002	25/09/2019	624.8	59.0
MB15HD20002	26/09/2019	624.8	59.0
MB15HD20002	27/09/2019	624.7	59.0
MB15HD20002	28/09/2019	624.7	59.0
MB15HD20002	29/09/2019	624.7	59.0
MB15HD20002	30/09/2019	624.7	59.0
MB15HD20002	1/10/2019	624.7	59.0
MB15HD20002	2/10/2019	624.7	59.0

ID	Date	WL mAHD	WL mbgl
MB18HD20005	4/09/2021	624.7	68.2
MB18HD20005	5/09/2021	624.7	68.2
MB18HD20005	6/09/2021	624.7	68.1
MB18HD20005	7/09/2021	624.7	68.1
MB18HD20005	8/09/2021	624.7	68.2
MB18HD20005	9/09/2021	624.7	68.2
MB18HD20005	10/09/2021	624.7	68.2
MB18HD20005	11/09/2021	624.7	68.2
MB18HD20005	12/09/2021	624.7	68.2
MB18HD20005	13/09/2021	624.7	68.2
MB18HD20005	14/09/2021	624.7	68.2
MB18HD20005	15/09/2021	624.7	68.2
MB18HD20005	16/09/2021	624.7	68.2
MB18HD20005	17/09/2021	624.7	68.2
MB18HD20005	18/09/2021	624.7	68.2
MB18HD20005	19/09/2021	624.7	68.2
MB18HD20005	20/09/2021	624.7	68.2
MB18HD20005	21/09/2021	624.7	68.1
MB18HD20005	22/09/2021	624.7	68.1
MB18HD20005	23/09/2021	624.7	68.2
MB18HD20005	24/09/2021	624.7	68.2
MB18HD20005	25/09/2021	624.7	68.2
MB18HD20005	26/09/2021	624.6	68.2
MB18HD20005	27/09/2021	624.7	68.2
MB18HD20005	28/09/2021	624.7	68.2
MB18HD20005	29/09/2021	624.7	68.2
MB18HD20005	30/09/2021	624.7	68.2
MB18HD20005	1/10/2021	624.6	68.2
MB18HD20005	2/10/2021	624.6	68.2
MB18HD20005	3/10/2021	624.7	68.2
MB18HD20005	4/10/2021	624.6	68.2
MB18HD20005	5/10/2021	624.6	68.3
MB18HD20005	6/10/2021	624.6	68.2
MB18HD20005	7/10/2021	624.6	68.2
MB18HD20005	8/10/2021	624.6	68.2
MB18HD20005	9/10/2021	624.6	68.2
MB18HD20005	10/10/2021	624.7	68.2
MB18HD20005	11/10/2021	624.6	68.2
MB18HD20005	12/10/2021	624.6	68.2
MB18HD20005	13/10/2021	624.7	68.2
MB18HD20005	14/10/2021	624.7	68.2
MB18HD20005	15/10/2021	624.6	68.2
MB18HD20005	16/10/2021	624.6	68.3
MB18HD20005	17/10/2021	624.6	68.3
MB18HD20005	18/10/2021	624.6	68.3
MB18HD20005	19/10/2021	624.6	68.2
MB18HD20005	20/10/2021	624.7	68.2
MB18HD20005	21/10/2021	624.7	68.2
MB18HD20005	22/10/2021	624.7	68.2
MB18HD20005	23/10/2021	624.7	68.2
MB18HD20005	24/10/2021	624.7	68.2
MB18HD20005	25/10/2021	624.6	68.2
MB18HD20005	26/10/2021	624.6	68.3
MB18HD20005	27/10/2021	624.6	68.2
MB18HD20005	28/10/2021	624.6	68.2
MB18HD20005	1/11/2021	624.6	68.3
MB18HD20005	2/11/2021	624.6	68.3
MB18HD20005	3/11/2021	624.6	68.2
MB18HD20005	4/11/2021	624.6	68.2
MB18HD20005	5/11/2021	624.6	68.2
MB18HD20005	6/11/2021	624.6	68.3
MB18HD20005	7/11/2021	624.6	68.3
MB18HD20005	9/11/2021	624.6	68.3
MB18HD20005	10/11/2021	624.6	68.3
MB18HD20005	11/11/2021	624.6	68.3
MB18HD20005	12/11/2021	624.7	68.2
MB18HD20005	13/11/2021	624.7	68.2
MB18HD20005	14/11/2021	624.7	68.2
MB18HD20005	15/11/2021	624.6	68.2
MB18HD20005	16/11/2021	624.6	68.3
MB18HD20005	17/11/2021	624.6	68.3
MB18HD20005	18/11/2021	624.6	68.3
MB18HD20005	19/11/2021	624.6	68.3
MB18HD20005	20/11/2021	624.6	68.3
MB18HD20005	21/11/2021	624.6	68.3
MB18HD20005	22/11/2021	624.6	68.2
MB18HD20005	23/11/2021	624.6	68.3
MB18HD20005	24/11/2021	624.6	68.2
MB18HD20005	25/11/2021	624.6	68.2
MB18HD20005	26/11/2021	624.6	68.2
MB18HD20005	27/11/2021	624.7	68.2
MB18HD20005	28/11/2021	624.6	68.2
MB18HD20005	29/11/2021	624.6	68.2
MB18HD20005	30/11/2021	624.6	68.3
MB18HD20005	1/12/2021	624.6	68.3
MB18HD20005	2/12/2021	624.6	68.3
MB18HD20005	3/12/2021	624.6	68.3
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	14/10/2013	270.3	415.9
HDVP1	13/10/2013	270.3	415.9
HDVP1	12/10/2013	270.3	415.9
HDVP1	11/10/2013	270.3	415.9
HDVP1	10/10/2013	270.3	415.9
HDVP1	9/10/2013	270.3	415.9
HDVP1	8/10/2013	270.3	415.9
HDVP1	7/10/2013	270.3	415.9
HDVP1	6/10/2013	270.3	415.9
HDVP1	5/10/2013	270.3	415.9
HDVP1	4/10/2013	270.3	415.9
HDVP1	3/10/2013	270.3	415.9
HDVP1	2/10/2013	270.3	415.9
HDVP1	1/10/2013	270.3	415.9
HDVP1	30/09/2013	229.4	456.8
HDVP1	29/09/2013	229.4	456.8
HDVP1	28/09/2013	229.4	456.8
HDVP1	27/09/2013	229.4	456.8
HDVP1	26/09/2013	229.4	456.8
HDVP1	25/09/2013	229.4	456.8
HDVP1	24/09/2013	229.4	456.8
HDVP1	23/09/2013	229.4	456.8
HDVP1	22/09/2013	229.4	456.8
HDVP1	21/09/2013	229.4	456.8
HDVP1	20/09/2013	229.4	456.8
HDVP1	19/09/2013	229.4	456.8
HDVP1	18/09/2013	229.4	456.8
HDVP1	17/09/2013	229.4	456.8
HDVP1	16/09/2013	229.4	456.8
HDVP1	15/09/2013	229.4	456.8
HDVP1	14/09/2013	229.4	456.8
HDVP1	13/09/2013	229.4	456.8
HDVP1	12/09/2013	229.4	456.8
HDVP1	11/09/2013	229.4	456.8
HDVP1	10/09/2013	229.4	456.8
HDVP1	9/09/2013	229.4	456.8
HDVP1	8/09/2013	229.4	456.8
HDVP1	7/09/2013	229.4	456.8
HDVP1	6/09/2013	229.4	456.8
HDVP1	5/09/2013	229.4	456.8
HDVP1	4/09/2013	229.4	456.8
HDVP1	3/09/2013	229.4	456.8
HDVP1	2/09/2013	229.4	456.8
HDVP1	1/09/2013	229.4	456.8
HDVP1	31/08/2013	241.2	445.0
HDVP1	30/08/2013	241.2	445.0
HDVP1	29/08/2013	241.2	445.0
HDVP1	28/08/2013	241.2	445.0
HDVP1	27/08/2013	241.2	445.0
HDVP1	26/08/2013	241.2	445.0
HDVP1	25/08/2013	241.2	445.0
HDVP1	24/08/2013	241.2	445.0
HDVP1	23/08/2013	241.2	445.0
HDVP1	22/08/2013	241.2	445.0
HDVP1	21/08/2013	241.2	445.0
HDVP1	20/08/2013	241.2	445.0
HDVP1	19/08/2013	241.2	445.0
HDVP1	18/08/2013	241.2	445.0
HDVP1	17/08/2013	241.2	445.0
HDVP1	16/08/2013	241.2	445.0
HDVP1	15/08/2013	241.2	445.0
HDVP1	14/08/2013	241.2	445.0
HDVP1	13/08/2013	241.2	445.0
HDVP1	12/08/2013	241.2	445.0
HDVP1	11/08/2013	241.2	445.0
HDVP1	10/08/2013	241.2	445.0
HDVP1	9/08/2013	241.2	445.0
HDVP1	8/08/2013	241.2	445.0
HDVP1	7/08/2013	241.2	445.0
HDVP1	6/08/2013	241.2	445.0
HDVP1	5/08/2013	241.2	445.0
HDVP1	4/08/2013	241.2	445.0
HDVP1	3/08/2013	241.2	445.0
HDVP1	2/08/2013	241.2	445.0
HDVP1	1/08/2013	241.2	445.0
HDVP1	31/07/2013	285.9	400.2
HDVP1	30/07/2013	285.9	400.2
HDVP1	29/07/2013	285.9	400.2
HDVP1	28/07/2013	285.9	400.2
HDVP1	27/07/2013	285.9	400.2
HDVP1	26/07/2013	285.9	400.2
HDVP1	25/07/2013	285.9	400.2
HDVP1	24/07/2013	285.9	400.2
HDVP1	23/07/2013	285.9	400.2
HDVP1	22/07/2013	285.9	400.2
HDVP1	21/07/2013	285.9	400.2
HDVP1	20/07/2013	285.9	400.2
HDVP1	19/07/2013	285.9	400.2
HDVP1	18/07/2013	285.9	400.2
HDVP1	17/07/2013	285.9	400.2
HDVP1	16/07/2013	285.9	400.2
HDVP1	15/07/2013	285.9	400.2
HDVP1	14/07/2013	285.9	400.2
HDVP1	13/07/2013	285.9	400.2
HDVP1	12/07/2013	285.9	400.2
HDVP1	11/07/2013	285.9	400.2
HDVP1	10/07/2013	285.9	400.2
HDVP1	9/07/2013	285.9	400.2
HDVP1	8/07/2013	285.9	400.2
HDVP1	7/07/2013	285.9	400.2
HDVP1	6/07/2013	285.9	400.2
HDVP1	5/07/2013	285.9	400.2
HDVP1	4/07/2013	285.9	400.2
HDVP1	3/07/2013	285.9	400.2
HDVP1	2/07/2013	285.9	400.2
HDVP1	1/07/2013	285.9	400.2
HDVP1	30/06/2013	290.1	396.0
HDVP1	29/06/2013	290.1	396.0
HDVP1	28/06/2013	290.1	396.0
HDVP1	27/06/2013	290.1	396.0
HDVP1	26/06/2013	290.1	396.0
HDVP1	25/06/2013	290.1	396.0
HDVP1	24/06/2013	290.1	396.0
HDVP1	23/06/2013	290.1	396.0
HDVP1	22/06/2013	290.1	396.0
HDVP1	21/06/2013	290.1	396.0
HDVP1	20/06/2013	290.1	396.0
HDVP1	19/06/2013	290.1	396.0
HDVP1	18/06/2013	290.1	396.0
HDVP1	17/06/2013	290.1	396.0
HDVP1	16/06/2013	290.1	396.0
HDVP1	15/06/2013	290.1	396.0
HDVP1	14/06/2013	290.1	396.0
HDVP1	13/06/2013	290.1	396.0
HDVP1	12/06/2013	290.1	396.0
HDVP1	11/06/2013	290.1	396.0
HDVP1	10/06/2013	290.1	396.0
HDVP1	9/06/2013	290.1	396.0
HDVP1	8/06/2013	290.1	396.0
HDVP1	7/06/2013	290.1	396.0
HDVP1	6/06/2013	290.1	396.0
HDVP1	5/06/2013	290.1	396.0
HDVP1	4/06/2013	290.1	396.0
HDVP1	3/06/2013	290.1	396.0
HDVP1	2/06/2013	290.1	396.0
HDVP1	1/06/2013	290.1	396.0

ID	Date	WL mAHD	WL mbgl
MB17H1SW0025	9/01/2022	621.3	34.9
MB17H1SW0025	8/01/2022	621.3	34.9
MB17H1SW0025	7/01/2022	621.3	34.9
MB17H1SW0025	6/01/2022	621.3	34.9
MB17H1SW0025	5/01/2022	621.3	34.9
MB17H1SW0025	4/01/2022	621.3	34.9
MB17H1SW0025	3/01/2022	621.3	34.9
MB17H1SW0025	2/01/2022	621.3	34.9
MB17H1SW0025	1/01/2022	621.3	34.9
MB17H1SW0025	31/12/2021	621.3	34.9
MB17H1SW0025	30/12/2021	621.3	34.9
MB17H1SW0025	26/12/2021	621.3	34.9
MB17H1SW0025	25/12/2021	621.3	34.9
MB17H1SW0025	24/12/2021	621.3	34.9
MB17H1SW0025	23/12/2021	621.3	34.9
MB17H1SW0025	22/12/2021	621.3	34.9
MB17H1SW0025	21/12/2021	621.3	34.9
MB17H1SW0025	20/12/2021	621.3	34.9
MB17H1SW0025	19/12/2021	621.3	34.9
MB17H1SW0025	18/12/2021	621.3	34.9
MB17H1SW0025	17/12/2021	621.3	34.9
MB17H1SW0025	16/12/2021	621.3	34.9
MB17H1SW0025	15/12/2021	621.3	34.9
MB17H1SW0025	14/12/2021	621.3	34.9
MB17H1SW0025	13/12/2021	621.3	34.9
MB17H1SW0025	12/12/2021	621.3	34.9
MB17H1SW0025	11/12/2021	621.3	34.9
MB17H1SW0025	10/12/2021	621.3	34.9
MB17H1SW0025	9/12/2021	621.3	34.9
MB17H1SW0025	8/12/2021	621.3	34.9
MB17H1SW0025	7/12/2021	621.3	34.9
MB17H1SW0025	6/12/2021	621.4	34.8
MB17H1SW0025	5/12/2021	621.3	34.9
MB17H1SW0025	4/12/2021	621.3	34.9
MB17H1SW0025	3/12/2021	621.3	34.9
MB17H1SW0025	2/12/2021	621.3	34.9
MB17H1SW0025	1/12/2021	621.3	34.9
MB17H1SW0025	30/11/2021	621.4	34.8
MB17H1SW0025	29/11/2021	621.4	34.8
MB17H1SW0025	28/11/2021	621.4	34.8
MB17H1SW0025	27/11/2021	621.4	34.8
MB17H1SW0025	26/11/2021	621.4	34.8
MB17H1SW0025	25/11/2021	621.4	34.8
MB17H1SW0025	24/11/2021	621.4	34.8
MB17H1SW0025	23/11/2021	621.4	34.8
MB17H1SW0025	22/11/2021	621.4	34.8
MB17H1SW0025	21/11/2021	621.4	34.8
MB17H1SW0025	20/11/2021	621.4	34.8
MB17H1SW0025	19/11/2021	621.4	34.8
MB17H1SW0025	18/11/2021	621.4	34.8
MB17H1SW0025	17/11/2021	621.4	34.8
MB17H1SW0025	16/11/2021	621.4	34.8
MB17H1SW0025	15/11/2021	621.4	34.8
MB17H1SW0025	14/11/2021	621.4	34.8
MB17H1SW0025	13/11/2021	621.4	34.8
MB17H1SW0025	12/11/2021	621.4	34.8
MB17H1SW0025	11/11/2021	621.4	34.8
MB17H1SW0025	10/11/2021	621.4	34.8
MB17H1SW0025	9/11/2021	621.4	34.8
MB17H1SW0025	8/11/2021	621.4	34.8
MB17H1SW0025	7/11/2021	621.4	34.8
MB17H1SW0025	6/11/2021	621.4	34.8
MB17H1SW0025	5/11/2021	621.4	34.8
MB17H1SW0025	4/11/2021	621.4	34.8
MB17H1SW0025	3/11/2021	621.4	34.8
MB17H1SW0025	2/11/2021	621.4	34.8
MB17H1SW0025	1/11/2021	621.4	34.8
MB17H1SW0025	31/10/2021	621.4	34.8
MB17H1SW0025	30/10/2021	621.4	34.8
MB17H1SW0025	29/10/2021	621.4	34.8
MB17H1SW0025	28/10/2021	621.4	34.8
MB17H1SW0025	27/10/2021	621.4	34.8
MB17H1SW0025	26/10/2021	621.4	34.8
MB17H1SW0025	25/10/2021	621.4	34.8
MB17H1SW0025	24/10/2021	621.4	34.8
MB17H1SW0025	23/10/2021	621.4	34.8
MB17H1SW0025	22/10/2021	621.4	34.8
MB17H1SW0025	21/10/2021	621.4	34.8
MB17H1SW0025	20/10/2021	621.4	34.8
MB17H1SW0025	19/10/2021	621.4	34.8
MB17H1SW0025	18/10/2021	621.4	34.8
MB17H1SW0025	17/10/2021	621.4	34.8
MB17H1SW0025	16/10/2021	621.4	34.8
MB17H1SW0025	15/10/2021	621.4	34.8
MB17H1SW0025	14/10/2021	621.4	34.8
MB17H1SW0025	13/10/2021	621.4	34.8
MB17H1SW0025	12/10/2021	621.4	34.8
MB17H1SW0025	11/10/2021	621.4	34.8
MB17H1SW0025	10/10/2021	621.4	34.8
MB17H1SW0025	9/10/2021	621.4	34.8
MB17H1SW0025	8/10/2021	621.4	34.8
MB17H1SW0025	7/10/2021	621.4	34.8
MB17H1SW0025	6/10/2021	621.4	34.8
MB17H1SW0025	5/10/2021	621.4	34.8
MB17H1SW0025	4/10/2021	621.4	34.8
MB17H1SW0025	3/10/2021	621.4	34.8
MB17H1SW0025	2/10/2021	621.4	34.8
MB17H1SW0025	1/10/2021	621.4	34.8
MB17H1SW0025	30/09/2021	621.4	34.8
MB17H1SW0025	29/09/2021	621.4	34.8
MB17H1SW0025	28/09/2021	621.4	34.8
MB17H1SW0025	27/09/2021	621.4	34.8
MB17H1SW0025	26/09/2021	621.4	34.8
MB17H1SW0025	25/09/2021	621.4	34.8
MB17H1SW0025	24/09/2021	621.4	34.8
MB17H1SW0025	23/09/2021	621.5	34.7
MB17H1SW0025	22/09/2021	621.5	34.7
MB17H1SW0025	21/09/2021	621.5	34.7
MB17H1SW0025	20/09/2021	621.5	34.7
MB17H1SW0025	19/09/2021	621.4	34.8
MB17H1SW0025	18/09/2021	621.4	34.8
MB17H1SW0025	17/09/2021	621.4	34.8
MB17H1SW0025	16/09/2021	621.4	34.8
MB17H1SW0025	15/09/2021	621.4	34.8
MB17H1SW0025	14/09/2021	621.4	34.8
MB17H1SW0025	13/09/2021	621.4	34.8
MB17H1SW0025	12/09/2021	621.4	34.8
MB17H1SW0025	11/09/2021	621.5	34.7
MB17H1SW0025	10/09/2021	621.5	34.7
MB17H1SW0025	9/09/2021	621.5	34.7
MB17H1SW0025	8/09/2021	621.5	34.7
MB17H1SW0025	7/09/2021	621.5	34.7
MB17H1SW0025	6/09/2021	621.5	34.7
MB17H1SW0025	5/09/2021	621.5	34.7
MB17H1SW0025	4/09/2021	621.5	34.7
MB17H1SW0025	3/09/2021	621.4	34.8
MB17H1SW0025	2/09/2021	621.4	34.8
MB17H1SW0025	1/09/2021	621.4	34.8
MB17H1SW0025	31/08/2021	621.4	34.8
MB17H1SW0025	30/08/2021	621.4	34.8
MB17H1SW0025	29/08/2021	621.5	34.7
MB17H1SW0025	28/08/2021	621.4	34.8
MB17H1SW0025	27/08/2021	621.4	34.8
MB17H1SW0025	26/08/2021	621.5	34.7
MB17H1SW0025	25/08/2021	621.5	34.7
MB17H1SW0025	24/08/2021	621.5	34.7

ID	Date	WL mAHD	WL mbgl
MB15HD20002	3/10/2019	624.7	59.0
MB15HD20002	4/10/2019	624.7	59.0
MB15HD20002	5/10/2019	624.7	59.0
MB15HD20002	6/10/2019	624.7	59.0
MB15HD20002	7/10/2019	624.7	59.0
MB15HD20002	8/10/2019	624.7	59.0
MB15HD20002	9/10/2019	624.7	59.0
MB15HD20002	10/10/2019	624.7	59.0
MB15HD20002	11/10/2019	624.7	59.0
MB15HD20002	12/10/2019	624.7	59.1
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MB15HD20002	14/10/2019	624.7	59.1
MB15HD20002	15/10/2019	624.7	59.1
MB15HD20002	16/10/2019	624.7	59.0
MB15HD20002	17/10/2019	624.7	59.1
MB15HD20002	18/10/2019	624.7	59.1
MB15HD20002	19/10/2019	624.7	59.0
MB15HD20002	20/10/2019	624.7	59.0
MB15HD20002	21/10/2019	624.7	59.0
MB15HD20002	22/10/2019	624.7	59.0
MB15HD20002	23/10/2019	624.7	59.0
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MB15HD20002	25/10/2019	624.7	59.0
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MB15HD20002	2/11/2019	624.7	59.1
MB15HD20002	3/11/2019	624.7	59.0
MB15HD20002	4/11/2019	624.7	59.0
MB15HD20002	5/11/2019	624.7	59.0
MB15HD20002	6/11/2019	624.7	59.0
MB15HD20002	7/11/2019	624.7	59.0
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MB15HD20002	9/11/2019	624.7	59.0
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MB15HD20002	11/11/2019	624.7	59.1
MB15HD20002	12/11/2019	624.7	59.1
MB15HD20002	13/11/2019	624.7	59.0
MB15HD20002	14/11/2019	624.7	59.1
MB15HD20002	15/11/2019	624.7	59.1
MB15HD20002	16/11/2019	624.7	59.0
MB15HD20002	17/11/2019	624.7	59.0
MB15HD20002	18/11/2019	624.7	59.1
MB15HD20002	19/11/2019	624.7	59.1
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MB15HD20002	29/11/2019	624.7	59.1
MB15HD20002	30/11/2019	624.7	59.1
MB15HD20002	1/12/2019	624.7	59.0
MB15HD20002	2/12/2019	624.7	59.1
MB15HD20002	3/12/2019	624.7	59.1
MB15HD20002	4/12/2019	624.7	59.1
MB15HD20002	5/12/2019	624.7	59.1
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MB15HD20002	30/01/2020	624.7	59.1
MB15HD20002	31/01/2020	624.7	59.1
MB15HD20002	1/02/2020	624.7	59.1
MB15HD20002	2/02/2020	624.7	59.1
MB15HD20002	3/02/2020	624.7	59.0
MB15HD20002	4/02/2020	624.7	59.0
MB15HD20002	5/02/2020	624.7	59.1
MB15HD20002	6/02/2020	624.7	59.1
MB15HD20002	7/02/2020	624.7	59.1
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MB15HD20002	9/02/2020	624.6	59.1
MB15HD20002	10/02/2020	624.6	59.1
MB15HD20002	11/02/2020	624.7	59.1
MB15HD20002	12/02/2020	624.7	59.1
MB15HD20002	13/02/2020	624.7	59.1
MB15HD20002	14/02/2020	624.7	59.0
MB15HD20002	15/02/2020	624.7	59.0

ID	Date	WL mAHD	WL mbgl
MB18HD20005	26/01/2022	624.5	68.3
MB18HD20005	27/01/2022	624.6	68.3
MB18HD20005	28/01/2022	624.6	68.3
MB18HD20005	29/01/2022	624.6	68.3
MB18HD20005	30/01/2022	624.6	68.3
MB18HD20005	31/01/2022	624.6	68.3
MB18HD20005	1/02/2022	624.6	68.3
MB18HD20005	2/02/2022	624.6	68.3
MB18HD20005	3/02/2022	624.6	68.3
MB18HD20005	4/02/2022	624.6	68.3
MB18HD20005	5/02/2022	624.6	68.3
MB18HD20005	6/02/2022	624.6	68.3
MB18HD20005	7/02/2022	624.6	68.3
MB18HD20005	8/02/2022	624.6	68.3
MB18HD20005	9/02/2022	624.6	68.3
MB18HD20005	10/02/2022	624.6	68.3
MB18HD20005	11/02/2022	624.6	68.3
MB18HD20005	12/02/2022	624.6	68.3
MB18HD20005	13/02/2022	624.6	68.2
MB18HD20005	14/02/2022	624.6	68.2
MB18HD20005	15/02/2022	624.6	68.2
MB18HD20005	16/02/2022	624.6	68.2
MB18HD20005	17/02/2022	624.6	68.2
MB18HD20005	18/02/2022	624.6	68.2
MB18HD20005	19/02/2022	624.6	68.2
MB18HD20005	20/02/2022	624.6	68.2
MB18HD20005	21/02/2022	624.6	68.3
MB18HD20005	22/02/2022	624.6	68.3
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MB18HD20005	25/02/2022	624.6	68.3
MB18HD20005	26/02/2022	624.6	68.3
MB18HD20005	27/02/2022	624.6	68.3
MB18HD20005	28/02/2022	624.6	68.3
MB18HD20005	1/03/2022	624.6	68.3
MB18HD20005	2/03/2022	624.6	68.3
MB18HD20005	3/03/2022	624.6	68.3
MB18HD20005	4/03/2022	624.6	68.3
MB18HD20005	5/03/2022	624.6	68.3
MB18HD20005	6/03/2022	624.6	68.2
MB18HD20005	7/03/2022	624.6	68.2
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MB18HD20005	9/03/2022	624.6	68.3
MB18HD20005	10/03/2022	624.6	68.2
MB18HD20005	11/03/2022	624.6	68.3
MB18HD20005	12/03/2022	624.6	68.3
MB18HD20005	13/03/2022	624.6	68.3
MB18HD20005	14/03/2022	624.6	68.3
MB18HD20005	15/03/2022	624.6	68.3
MB18HD20005	16/03/2022	624.6	68.3
MB18HD20006	21/11/2018	624.8	71.2
MB18HD20006	22/11/2018	624.8	71.2
MB18HD20006	23/11/2018	624.8	71.1
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MB18HD20006	25/11/2018	624.8	71.1
MB18HD20006	26/11/2018	624.8	71.1
MB18HD20006	27/11/2018	624.8	71.1
MB18HD20006	28/11/2018	624.8	71.1
MB18HD20006	29/11/2018	624.8	71.1
MB18HD20006	30/11/2018	624.8	71.1
MB18HD20006	1/12/2018	624.8	71.1
MB18HD20006	2/12/2018	624.8	71.1
MB18HD20006	3/12/2018	624.8	71.1
MB18HD20006	4/12/2018	624.8	71.1
MB18HD20006	5/12/2018	624.8	71.1
MB18HD20006	6/12/2018	624.8	71.1
MB18HD20006	7/12/2018	624.8	71.1
MB18HD20006	8/12/2018	624.8	71.1
MB18HD20006	9/12/2018	624.8	71.1
MB18HD20006	10/12/2018	624.8	71.1
MB18HD20006	11/12/2018	624.8	71.1
MB18HD20006	12/12/2018	624.8	71.1
MB18HD20006	13/12/2018	624.8	71.1
MB18HD20006	14/12/2018	624.8	71.1
MB18HD20006	15/12/2018	624.8	71.2
MB18HD20006	16/12/2018	624.8	71.2
MB18HD20006	17/12/2018	624.8	71.2
MB18HD20006	18/12/2018	624.8	71.1
MB18HD20006	19/12/2018	624.8	71.1
MB18HD20006	20/12/2018	624.8	71.1
MB18HD20006	21/12/2018	624.8	71.1
MB18HD20006	22/12/2018	624.8	71.1
MB18HD20006	23/12/2018	624.8	71.1
MB18HD20006	24/12/2018	624.8	71.1
MB18HD20006	25/12/2018	624.8	71.1
MB18HD20006	26/12/2018	624.8	71.1
MB18HD20006	27/12/2018	624.8	71.2
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	31/05/2013	284.3	401.9
HDVP1	30/05/2013	284.3	401.9
HDVP1	29/05/2013	284.3	401.9
HDVP1	28/05/2013	284.3	401.9
HDVP1	27/05/2013	284.3	401.9
HDVP1	26/05/2013	284.3	401.9
HDVP1	25/05/2013	284.3	401.9
HDVP1	24/05/2013	284.3	401.9
HDVP1	23/05/2013	284.3	401.9
HDVP1	22/05/2013	284.3	401.9
HDVP1	21/05/2013	284.3	401.9
HDVP1	20/05/2013	284.3	401.9
HDVP1	19/05/2013	284.3	401.9
HDVP1	18/05/2013	284.3	401.9
HDVP1	17/05/2013	284.3	401.9
HDVP1	16/05/2013	284.3	401.9
HDVP1	15/05/2013	284.3	401.9
HDVP1	14/05/2013	284.3	401.9
HDVP1	13/05/2013	284.3	401.9
HDVP1	12/05/2013	284.3	401.9
HDVP1	11/05/2013	284.3	401.9
HDVP1	10/05/2013	284.3	401.9
HDVP1	9/05/2013	284.3	401.9
HDVP1	8/05/2013	284.3	401.9
HDVP1	7/05/2013	284.3	401.9
HDVP1	6/05/2013	284.3	401.9
HDVP1	5/05/2013	284.3	401.9
HDVP1	4/05/2013	284.3	401.9
HDVP1	3/05/2013	284.3	401.9
HDVP1	2/05/2013	284.3	401.9
HDVP1	1/05/2013	284.3	401.9
HDVP1	30/04/2013	300.1	386.0
HDVP1	29/04/2013	300.1	386.0
HDVP1	28/04/2013	300.1	386.0
HDVP1	27/04/2013	300.1	386.0
HDVP1	26/04/2013	300.1	386.0
HDVP1	25/04/2013	300.1	386.0
HDVP1	24/04/2013	300.1	386.0
HDVP1	23/04/2013	300.1	386.0
HDVP1	22/04/2013	300.1	386.0
HDVP1	21/04/2013	300.1	386.0
HDVP1	20/04/2013	300.1	386.0
HDVP1	19/04/2013	300.1	386.0
HDVP1	18/04/2013	300.1	386.0
HDVP1	17/04/2013	300.1	386.0
HDVP1	16/04/2013	300.1	386.0
HDVP1	15/04/2013	300.1	386.0
HDVP1	14/04/2013	300.1	386.0
HDVP1	13/04/2013	300.1	386.0
HDVP1	12/04/2013	300.1	386.0
HDVP1	11/04/2013	300.1	386.0
HDVP1	10/04/2013	300.1	386.0
HDVP1	9/04/2013	300.1	386.0
HDVP1	8/04/2013	300.1	386.0
HDVP1	7/04/2013	300.1	386.0
HDVP1	6/04/2013	300.1	386.0
HDVP1	5/04/2013	300.1	386.0
HDVP1	4/04/2013	300.1	386.0
HDVP1	3/04/2013	300.1	386.0
HDVP1	2/04/2013	300.1	386.0
HDVP1	1/04/2013	300.1	386.0
HDVP1	31/03/2013	262.2	424.0
HDVP1	30/03/2013	262.2	424.0
HDVP1	29/03/2013	262.2	424.0
HDVP1	28/03/2013	262.2	424.0
HDVP1	27/03/2013	262.2	424.0
HDVP1	26/03/2013	262.2	424.0
HDVP1	25/03/2013	262.2	424.0
HDVP1	24/03/2013	262.2	424.0
HDVP1	23/03/2013	262.2	424.0
HDVP1	22/03/2013	262.2	424.0
HDVP1	21/03/2013	262.2	424.0
HDVP1	20/03/2013	262.2	424.0
HDVP1	19/03/2013	262.2	424.0
HDVP1	18/03/2013	262.2	424.0
HDVP1	17/03/2013	262.2	424.0
HDVP1	16/03/2013	262.2	424.0
HDVP1	15/03/2013	262.2	424.0
HDVP1	14/03/2013	262.2	424.0
HDVP1	13/03/2013	262.2	424.0
HDVP1	12/03/2013	262.2	424.0
HDVP1	11/03/2013	262.2	424.0
HDVP1	10/03/2013	262.2	424.0
HDVP1	9/03/2013	262.2	424.0
HDVP1	8/03/2013	262.2	424.0
HDVP1	7/03/2013	262.2	424.0
HDVP1	6/03/2013	262.2	424.0
HDVP1	5/03/2013	262.2	424.0
HDVP1	4/03/2013	262.2	424.0
HDVP1	3/03/2013	262.2	424.0
HDVP1	2/03/2013	262.2	424.0
HDVP1	1/03/2013	236.8	449.4
HDVP1	28/02/2013	236.8	449.4
HDVP1	27/02/2013	236.8	449.4
HDVP1	26/02/2013	236.8	449.4
HDVP1	25/02/2013	236.8	449.4
HDVP1	24/02/2013	236.8	449.4
HDVP1	23/02/2013	236.8	449.4
HDVP1	22/02/2013	236.8	449.4
HDVP1	21/02/2013	236.8	449.4
HDVP1	20/02/2013	236.8	449.4
HDVP1	19/02/2013	236.8	449.4
HDVP1	18/02/2013	236.8	449.4
HDVP1	17/02/2013	236.8	449.4
HDVP1	16/02/2013	236.8	449.4
HDVP1	15/02/2013	236.8	449.4
HDVP1	14/02/2013	236.8	449.4
HDVP1	13/02/2013	236.8	449.4
HDVP1	12/02/2013	236.8	449.4
HDVP1	11/02/2013	236.8	449.4
HDVP1	10/02/2013	236.8	449.4
HDVP1	9/02/2013	236.8	449.4
HDVP1	8/02/2013	236.8	449.4
HDVP1	7/02/2013	236.8	449.4
HDVP1	6/02/2013	236.8	449.4
HDVP1	5/02/2013	236.8	449.4
HDVP1	4/02/2013	236.8	449.4
HDVP1	3/02/2013	236.8	449.4
HDVP1	2/02/2013	236.8	449.4
HDVP1	1/02/2013	236.8	449.4
HDVP1	31/01/2013	195.6	490.6
HDVP1	30/01/2013	195.6	490.6
HDVP1	29/01/2013	195.6	490.6
HDVP1	28/01/2013	195.6	490.6
HDVP1	27/01/2013	195.6	490.6
HDVP1	26/01/2013	195.6	490.6
HDVP1	25/01/2013	195.6	490.6
HDVP1	24/01/2013	195.6	490.6
HDVP1	23/01/2013	195.6	490.6
HDVP1	22/01/2013	195.6	490.6
HDVP1	21/01/2013	195.6	490.6
HDVP1	20/01/2013	195.6	490.6
HDVP1	19/01/2013	195.6	490.6
HDVP1	18/01/2013	195.6	490.6
HDVP1	17/01/2013	195.6	490.6
HDVP1	16/01/2013	195.6	490.6

ID	Date	WL mAHD	WL mbgl
MB17H1SW0025	23/08/2021	621.5	34.7
MB17H1SW0025	22/08/2021	621.5	34.7
MB17H1SW0025	21/08/2021	621.4	34.8
MB17H1SW0025	20/08/2021	621.5	34.7
MB17H1SW0025	19/08/2021	621.5	34.7
MB17H1SW0025	18/08/2021	621.5	34.7
MB17H1SW0025	17/08/2021	621.5	34.7
MB17H1SW0025	16/08/2021	621.5	34.7
MB17H1SW0025	15/08/2021	621.5	34.7
MB17H1SW0025	14/08/2021	621.5	34.7
MB17H1SW0025	13/08/2021	621.5	34.7
MB17H1SW0025	12/08/2021	621.5	34.7
MB17H1SW0025	11/08/2021	621.5	34.7
MB17H1SW0025	10/08/2021	621.5	34.7
MB17H1SW0025	9/08/2021	621.5	34.7
MB17H1SW0025	8/08/2021	621.5	34.7
MB17H1SW0025	7/08/2021	621.5	34.7
MB17H1SW0025	6/08/2021	621.5	34.7
MB17H1SW0025	5/08/2021	621.5	34.7
MB17H1SW0025	4/08/2021	621.5	34.7
MB17H1SW0025	3/08/2021	621.5	34.7
MB17H1SW0025	2/08/2021	621.5	34.7
MB17H1SW0025	1/08/2021	621.5	34.7
MB17H1SW0025	31/07/2021	621.5	34.7
MB17H1SW0025	30/07/2021	621.4	34.8
MB17H1SW0025	29/07/2021	621.4	34.8
MB17H1SW0025	28/07/2021	621.4	34.8
MB17H1SW0025	27/07/2021	621.4	34.8
MB17H1SW0025	26/07/2021	621.5	34.7
MB17H1SW0025	25/07/2021	621.5	34.7
MB17H1SW0025	24/07/2021	621.5	34.7
MB17H1SW0025	23/07/2021	621.5	34.7
MB17H1SW0025	22/07/2021	621.5	34.7
MB17H1SW0025	21/07/2021	621.5	34.7
MB17H1SW0025	20/07/2021	621.5	34.7
MB17H1SW0025	19/07/2021	621.5	34.7
MB17H1SW0025	18/07/2021	621.5	34.7
MB17H1SW0025	17/07/2021	621.5	34.7
MB17H1SW0025	16/07/2021	621.5	34.7
MB17H1SW0025	15/07/2021	621.5	34.7
MB17H1SW0025	14/07/2021	621.4	34.8
MB17H1SW0025	13/07/2021	621.4	34.8
MB17H1SW0025	12/07/2021	621.5	34.7
MB17H1SW0025	11/07/2021	621.5	34.7
MB17H1SW0025	10/07/2021	621.5	34.7
MB17H1SW0025	9/07/2021	621.5	34.7
MB17H1SW0025	8/07/2021	621.5	34.7
MB17H1SW0025	7/07/2021	621.5	34.7
MB17H1SW0025	6/07/2021	621.5	34.7
MB17H1SW0025	5/07/2021	621.5	34.7
MB17H1SW0025	4/07/2021	621.5	34.7
MB17H1SW0025	3/07/2021	621.5	34.7
MB17H1SW0025	2/07/2021	621.5	34.7
MB17H1SW0025	1/07/2021	621.5	34.7
MB17H1SW0025	30/06/2021	621.5	34.7
MB17H1SW0025	29/06/2021	621.5	34.7
MB17H1SW0025	28/06/2021	621.5	34.7
MB17H1SW0025	27/06/2021	621.5	34.7
MB17H1SW0025	26/06/2021	621.5	34.7
MB17H1SW0025	25/06/2021	621.5	34.7
MB17H1SW0025	24/06/2021	621.5	34.7
MB17H1SW0025	23/06/2021	621.5	34.7
MB17H1SW0025	22/06/2021	621.5	34.7
MB17H1SW0025	21/06/2021	621.5	34.7
MB17H1SW0025	20/06/2021	621.5	34.7
MB17H1SW0025	19/06/2021	621.5	34.7
MB17H1SW0025	18/06/2021	621.5	34.7
MB17H1SW0025	17/06/2021	621.5	34.7
MB17H1SW0025	16/06/2021	621.5	34.7
MB17H1SW0025	15/06/2021	621.5	34.7
MB17H1SW0025	14/06/2021	621.5	34.7
MB17H1SW0025	13/06/2021	621.4	34.8
MB17H1SW0025	12/06/2021	621.4	34.8
MB17H1SW0025	11/06/2021	621.4	34.8
MB17H1SW0025	10/06/2021	621.5	34.7
MB17H1SW0025	9/06/2021	621.5	34.7
MB17H1SW0025	8/06/2021	621.5	34.7
MB17H1SW0025	7/06/2021	621.5	34.7
MB17H1SW0025	6/06/2021	621.5	34.7
MB17H1SW0025	5/06/2021	621.5	34.7
MB17H1SW0025	4/06/2021	621.5	34.7
MB17H1SW0025	3/06/2021	621.5	34.7
MB17H1SW0025	2/06/2021	621.5	34.7
MB17H1SW0025	1/06/2021	621.4	34.8
MB17H1SW0025	31/05/2021	621.4	34.8
MB17H1SW0025	30/05/2021	621.4	34.8
MB17H1SW0025	29/05/2021	621.5	34.7
MB17H1SW0025	28/05/2021	621.5	34.7
MB17H1SW0025	17/09/2020	621.5	34.7
MB17H1SW0025	16/09/2020	621.5	34.7
MB17H1SW0025	15/09/2020	621.5	34.7
MB17H1SW0025	14/09/2020	621.5	34.7
MB17H1SW0025	13/09/2020	621.5	34.7
MB17H1SW0025	8/09/2020	621.5	34.7
MB17H1SW0025	7/09/2020	621.5	34.7
MB17H1SW0025	6/09/2020	621.5	34.7
MB17H1SW0025	5/09/2020	621.5	34.7
MB17H1SW0025	4/09/2020	621.5	34.7
MB17H1SW0025	3/09/2020	621.5	34.7
MB17H1SW0025	2/09/2020	621.5	34.7
MB17H1SW0025	1/09/2020	621.5	34.7
MB17H1SW0025	31/08/2020	621.5	34.7
MB17H1SW0025	30/08/2020	621.5	34.7
MB17H1SW0025	29/08/2020	621.5	34.7
MB17H1SW0025	28/08/2020	621.5	34.7
MB17H1SW0025	27/08/2020	621.5	34.7
MB17H1SW0025	26/08/2020	621.5	34.7
MB17H1SW0025	25/08/2020	621.5	34.7
MB17H1SW0025	24/08/2020	621.5	34.7
MB17H1SW0025	23/08/2020	621.5	34.7
MB17H1SW0025	22/08/2020	621.5	34.7
MB17H1SW0025	18/08/2020	621.5	34.7
MB17H1SW0025	17/08/2020	621.5	34.7
MB17H1SW0025	16/08/2020	621.5	34.7
MB17H1SW0025	15/08/2020	621.5	34.7
MB17H1SW0025	14/08/2020	621.5	34.7
MB17H1SW0025	13/08/2020	621.5	34.7
MB17H1SW0025	12/08/2020	621.5	34.7
MB17H1SW0025	11/08/2020	621.5	34.7
MB17H1SW0025	10/08/2020	621.5	34.7
MB17H1SW0025	9/08/2020	621.5	34.7
MB17H1SW0025	8/08/2020	621.5	34.7
MB17H1SW0025	7/08/2020	621.5	34.7
MB17H1SW0025	6/08/2020	621.5	34.7
MB17H1SW0025	5/08/2020	621.4	34.8
MB17H1SW0025	4/08/2020	621.4	34.8
MB17H1SW0025	3/08/2020	621.4	34.8
MB17H1SW0025	2/08/2020	621.4	34.8
MB17H1SW0025	1/08/2020	621.5	34.7
MB17H1SW0025	31/07/2020	621.5	34.7
MB17H1SW0025	30/07/2020	621.5	34.7
MB17H1SW0025	26/07/2020	621.5	34.7
MB17H1SW0025	25/07/2020	621.5	34.7
MB17H1SW0025	24/07/2020	621.5	34.7
MB17H1SW0025	23/07/2020	621.4	34.8
MB17H1SW0025	22/07/2020	621.4	34.8

ID	Date	WL mAHD	WL mbgl
MB15HD20002	16/02/2020	624.7	59.0
MB15HD20002	17/02/2020	624.7	59.0
MB15HD20002	18/02/2020	624.7	59.0
MB15HD20002	19/02/2020	624.7	59.0
MB15HD20002	20/02/2020	624.7	59.0
MB15HD20002	21/02/2020	624.7	59.0
MB15HD20002	22/02/2020	624.7	59.0
MB15HD20002	23/02/2020	624.7	59.0
MB15HD20002	24/02/2020	624.7	59.0
MB15HD20002	25/02/2020	624.7	59.0
MB15HD20002	26/02/2020	624.7	59.1
MB15HD20002	27/02/2020	624.7	59.1
MB15HD20002	28/02/2020	624.7	59.1
MB15HD20002	29/02/2020	624.7	59.1
MB15HD20002	1/03/2020	624.7	59.1
MB15HD20002	2/03/2020	624.7	59.1
MB15HD20002	3/03/2020	624.7	59.0
MB15HD20002	4/03/2020	624.7	59.0
MB15HD20002	5/03/2020	624.7	59.0
MB15HD20002	6/03/2020	624.7	59.0
MB15HD20002	7/03/2020	624.8	59.0
MB15HD20002	8/03/2020	624.7	59.0
MB15HD20002	9/03/2020	624.7	59.0
MB15HD20002	10/03/2020	624.7	59.0
MB15HD20002	11/03/2020	624.7	59.0
MB15HD20002	12/03/2020	624.7	59.0
MB15HD20002	13/03/2020	624.8	59.0
MB15HD20002	14/03/2020	624.7	59.0
MB15HD20002	15/03/2020	624.7	59.0
MB15HD20002	16/03/2020	624.8	59.0
MB15HD20002	17/03/2020	624.8	59.0
MB15HD20002	18/03/2020	624.8	59.0
MB15HD20002	19/03/2020	624.8	59.0
MB15HD20002	20/03/2020	624.8	59.0
MB15HD20002	21/03/2020	624.8	59.0
MB15HD20002	22/03/2020	624.8	59.0
MB15HD20002	23/03/2020	624.8	59.0
MB15HD20002	24/03/2020	624.8	59.0
MB15HD20002	25/03/2020	624.8	59.0
MB15HD20002	26/03/2020	624.8	59.0
MB15HD20002	27/03/2020	624.8	59.0
MB15HD20002	28/03/2020	624.8	59.0
MB15HD20002	29/03/2020	624.8	59.0
MB15HD20002	30/03/2020	624.8	59.0
MB15HD20002	31/03/2020	624.7	59.0
MB15HD20002	1/04/2020	624.7	59.0
MB15HD20002	2/04/2020	624.7	59.0
MB15HD20002	3/04/2020	624.7	59.0
MB15HD20002	4/04/2020	624.8	59.0
MB15HD20002	5/04/2020	624.8	59.0
MB15HD20002	6/04/2020	624.8	59.0
MB15HD20002	7/04/2020	624.7	59.0
MB15HD20002	8/04/2020	624.8	59.0
MB15HD20002	9/04/2020	624.8	59.0
MB15HD20002	10/04/2020	624.8	59.0
MB15HD20002	11/04/2020	624.8	59.0
MB15HD20002	12/04/2020	624.8	59.0
MB15HD20002	13/04/2020	624.8	59.0
MB15HD20002	14/04/2020	624.8	59.0
MB15HD20002	15/04/2020	624.8	59.0
MB15HD20002	16/04/2020	624.8	59.0
MB15HD20002	17/04/2020	624.8	59.0
MB15HD20002	18/04/2020	624.8	59.0
MB15HD20002	19/04/2020	624.8	59.0
MB15HD20002	20/04/2020	624.8	59.0
MB15HD20002	21/04/2020	624.8	59.0
MB15HD20002	22/04/2020	624.8	59.0
MB15HD20002	23/04/2020	624.8	59.0
MB15HD20002	24/04/2020	624.8	59.0
MB15HD20002	25/04/2020	624.8	59.0
MB15HD20002	26/04/2020	624.8	59.0
MB15HD20002	27/04/2020	624.8	59.0
MB15HD20002	28/04/2020	624.8	59.0
MB15HD20002	29/04/2020	624.8	59.0
MB15HD20002	30/04/2020	624.8	58.9
MB15HD20002	1/05/2020	624.8	59.0
MB15HD20002	2/05/2020	624.8	59.0
MB15HD20002	3/05/2020	624.8	59.0
MB15HD20002	4/05/2020	624.8	59.0
MB15HD20002	5/05/2020	624.8	59.0
MB15HD20002	6/05/2020	624.8	59.0
MB15HD20002	7/05/2020	624.8	59.0
MB15HD20002	8/05/2020	624.8	59.0
MB15HD20002	9/05/2020	624.8	59.0
MB15HD20002	10/05/2020	624.8	59.0
MB15HD20002	11/05/2020	624.8	59.0
MB15HD20002	12/05/2020	624.8	59.0
MB15HD20002	13/05/2020	624.8	59.0
MB15HD20002	14/05/2020	624.8	58.9
MB15HD20002	15/05/2020	624.8	59.0
MB15HD20002	16/05/2020	624.8	59.0
MB15HD20002	17/05/2020	624.8	59.0
MB15HD20002	18/05/2020	624.8	59.0
MB15HD20002	19/05/2020	624.8	59.0
MB15HD20002	20/05/2020	624.8	59.0
MB15HD20002	21/05/2020	624.8	59.0
MB15HD20002	22/05/2020	624.8	59.0
MB15HD20002	23/05/2020	624.8	59.0
MB15HD20002	24/05/2020	624.8	59.0
MB15HD20002	25/05/2020	624.7	59.0
MB15HD20002	26/05/2020	624.8	59.0
MB15HD20002	27/05/2020	624.8	59.0
MB15HD20002	28/05/2020	624.8	59.0
MB15HD20002	29/05/2020	624.8	59.0
MB15HD20002	30/05/2020	624.8	59.0
MB15HD20002	31/05/2020	624.8	58.9
MB15HD20002	1/06/2020	624.8	58.9
MB15HD20002	2/06/2020	624.8	58.9
MB15HD20002	3/06/2020	624.8	58.9
MB15HD20002	4/06/2020	624.8	58.9
MB15HD20002	5/06/2020	624.8	58.9
MB15HD20002	6/06/2020	624.8	59.0
MB15HD20002	7/06/2020	624.8	59.0
MB15HD20002	8/06/2020	624.8	59.0
MB15HD20002	9/06/2020	624.8	59.0
MB15HD20002	10/06/2020	624.8	59.0
MB15HD20002	11/06/2020	624.8	59.0
MB15HD20002	12/06/2020	624.8	59.0
MB15HD20002	13/06/2020	624.8	59.0
MB15HD20002	14/06/2020	624.8	59.0
MB15HD20002	15/06/2020	624.8	59.0
MB15HD20002	16/06/2020	624.8	59.0
MB15HD20002	17/06/2020	624.8	59.0
MB15HD20002	18/06/2020	624.8	59.0
MB15HD20002	19/06/2020	624.8	59.0
MB15HD20002	20/06/2020	624.8	58.9
MB15HD20002	21/06/2020	624.8	59.0
MB15HD20002	22/06/2020	624.8	59.0
MB15HD20002	23/06/2020	624.8	59.0
MB15HD20002	24/06/2020	624.8	59.0
MB15HD20002	25/06/2020	624.8	59.0
MB15HD20002	26/06/2020	624.8	59.0
MB15HD20002	27/06/2020	624.8	59.0
MB15HD20002	28/06/2020	624.8	59.0
MB15HD20002	29/06/2020	624.8	59.0
MB15HD20002	30/06/2020	624.8	59.0

ID	Date	WL mAHD	WL mbgl
MB18HD20006	15/02/2019	624.8	71.1
MB18HD20006	16/02/2019	624.8	71.1
MB18HD20006	17/02/2019	624.8	71.1
MB18HD20006	18/02/2019	624.8	71.2
MB18HD20006	19/02/2019	624.8	71.2
MB18HD20006	20/02/2019	624.8	71.1
MB18HD20006	21/02/2019	624.8	71.1
MB18HD20006	22/02/2019	624.8	71.1
MB18HD20006	23/02/2019	624.8	71.1
MB18HD20006	24/02/2019	624.8	71.1
MB18HD20006	25/02/2019	624.8	71.1
MB18HD20006	26/02/2019	624.8	71.1
MB18HD20006	27/02/2019	624.8	71.1
MB18HD20006	28/02/2019	624.8	71.1
MB18HD20006	1/03/2019	624.8	71.1
MB18HD20006	2/03/2019	624.8	71.1
MB18HD20006	3/03/2019	624.8	71.1
MB18HD20006	4/03/2019	624.8	71.1
MB18HD20006	5/03/2019	624.8	71.1
MB18HD20006	6/03/2019	624.8	71.1
MB18HD20006	7/03/2019	624.8	71.1
MB18HD20006	8/03/2019	624.8	71.1
MB18HD20006	9/03/2019	624.8	71.1
MB18HD20006	10/03/2019	624.8	71.1
MB18HD20006	11/03/2019	624.8	71.1
MB18HD20006	12/03/2019	624.8	71.1
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MB18HD20006	14/03/2019	624.8	71.1
MB18HD20006	15/03/2019	624.8	71.1
MB18HD20006	16/03/2019	624.8	71.1
MB18HD20006	17/03/2019	624.8	71.1
MB18HD20006	18/03/2019	624.8	71.1
MB18HD20006	19/03/2019	624.8	71.1
MB18HD20006	20/03/2019	624.8	71.2
MB18HD20006	21/03/2019	624.8	71.2
MB18HD20006	22/03/2019	624.8	71.2
MB18HD20006	23/03/2019	624.8	71.2
MB18HD20006	24/03/2019	624.8	71.2
MB18HD20006	25/03/2019	624.8	71.2
MB18HD20006	26/03/2019	624.8	71.1
MB18HD20006	27/03/2019	624.8	71.1
MB18HD20006	28/03/2019	624.8	71.1
MB18HD20006	29/03/2019	624.8	71.1
MB18HD20006	30/03/2019	624.8	71.1
MB18HD20006	31/03/2019	624.8	71.1
MB18HD20006	1/04/2019	624.9	71.1
MB18HD20006	2/04/2019	624.8	71.1
MB18HD20006	3/04/2019	624.8	71.1
MB18HD20006	4/04/2019	624.8	71.1
MB18HD20006	5/04/2019	624.8	71.1
MB18HD20006	6/04/2019	624.9	71.1
MB18HD20006	7/04/2019	624.8	71.1
MB18HD20006	8/04/2019	624.8	71.1
MB18HD20006	9/04/2019	624.8	71.1
MB18HD20006	10/04/2019	624.8	71.1
MB18HD20006	11/04/2019	624.8	71.1
MB18HD20006	12/04/2019	624.8	71.1
MB18HD20006	13/04/2019	624.9	71.1
MB18HD20006	14/04/2019	624.8	71.1
MB18HD20006	15/04/2019	624.8	71.1
MB18HD20006	16/04/2019	624.8	71.1
MB18HD20006	17/04/2019	624.8	71.1
MB18HD20006	18/04/2019	624.8	71.1
MB18HD20006	19/04/2019	624.8	71.1
MB18HD20006	20/04/2019	624.8	71.1
MB18HD20006	21/04/2019	624.9	71.1
MB18HD20006	22/04/2019	624.9	71.1
MB18HD20006	23/04/2019	624.9	71.1
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MB18HD20006	25/04/2019	624.9	71.1
MB18HD20006	26/04/2019	624.9	71.1
MB18HD20006	27/04/2019	624.9	71.1
MB18HD20006	28/04/2019	624.9	71.1
MB18HD20006	29/04/2019	624.9	71.1
MB18HD20006	30/04/2019	624.8	71.1
MB18HD20006	1/05/2019	624.8	71.1
MB18HD20006	2/05/2019	624.8	71.1
MB18HD20006	3/05/2019	624.9	71.1
MB18HD20006	4/05/2019	624.9	71.1
MB18HD20006	5/05/2019	624.9	71.1
MB18HD20006	6/05/2019	624.9	71.1
MB18HD20006	7/05/2019	624.9	71.1
MB18HD20006	8/05/2019	624.9	71.1
MB18HD20006	9/05/2019	624.9	71.1
MB18HD20006	10/05/2019	624.9	71.0
MB18HD20006	11/05/2019	624.9	71.0
MB18HD20006	12/05/2019	624.9	71.1
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	15/01/2013	195.6	490.6
HDVP1	14/01/2013	195.6	490.6
HDVP1	13/01/2013	195.6	490.6
HDVP1	12/01/2013	195.6	490.6
HDVP1	11/01/2013	195.6	490.6
HDVP1	10/01/2013	195.6	490.6
HDVP1	9/01/2013	195.6	490.6
HDVP1	8/01/2013	195.6	490.6
HDVP1	7/01/2013	195.6	490.6
HDVP1	6/01/2013	195.6	490.6
HDVP1	5/01/2013	195.6	490.6
HDVP1	4/01/2013	195.6	490.6
HDVP1	3/01/2013	195.6	490.6
HDVP1	2/01/2013	195.6	490.6
HDVP1	1/01/2013	195.6	490.6
HDVP1	31/12/2012	187.9	498.3
HDVP1	30/12/2012	187.9	498.3
HDVP1	29/12/2012	187.9	498.3
HDVP1	28/12/2012	187.9	498.3
HDVP1	27/12/2012	187.9	498.3
HDVP1	26/12/2012	187.9	498.3
HDVP1	25/12/2012	187.9	498.3
HDVP1	24/12/2012	187.9	498.3
HDVP1	23/12/2012	187.9	498.3
HDVP1	22/12/2012	187.9	498.3
HDVP1	21/12/2012	187.9	498.3
HDVP1	20/12/2012	187.9	498.3
HDVP1	19/12/2012	187.9	498.3
HDVP1	18/12/2012	187.9	498.3
HDVP1	17/12/2012	187.9	498.3
HDVP1	16/12/2012	187.9	498.3
HDVP1	15/12/2012	187.9	498.3
HDVP1	14/12/2012	187.9	498.3
HDVP1	13/12/2012	187.9	498.3
HDVP1	12/12/2012	187.9	498.3
HDVP1	11/12/2012	187.9	498.3
HDVP1	10/12/2012	187.9	498.3
HDVP1	9/12/2012	187.9	498.3
HDVP1	8/12/2012	187.9	498.3
HDVP1	7/12/2012	187.9	498.3
HDVP1	6/12/2012	187.9	498.3
HDVP1	5/12/2012	187.9	498.3
HDVP1	4/12/2012	187.9	498.3
HDVP1	3/12/2012	187.9	498.3
HDVP1	2/12/2012	187.9	498.3
HDVP1	1/12/2012	187.9	498.3
HDVP1	30/11/2012	213.2	473.0
HDVP1	29/11/2012	213.2	473.0
HDVP1	28/11/2012	213.2	473.0
HDVP1	27/11/2012	213.2	473.0
HDVP1	26/11/2012	213.2	473.0
HDVP1	25/11/2012	213.2	473.0
HDVP1	24/11/2012	213.2	473.0
HDVP1	23/11/2012	213.2	473.0
HDVP1	22/11/2012	213.2	473.0
HDVP1	21/11/2012	213.2	473.0
HDVP1	20/11/2012	213.2	473.0
HDVP1	19/11/2012	213.2	473.0
HDVP1	18/11/2012	213.2	473.0
HDVP1	17/11/2012	213.2	473.0
HDVP1	16/11/2012	213.2	473.0
HDVP1	15/11/2012	213.2	473.0
HDVP1	14/11/2012	213.2	473.0
HDVP1	13/11/2012	213.2	473.0
HDVP1	12/11/2012	213.2	473.0
HDVP1	11/11/2012	213.2	473.0
HDVP1	10/11/2012	213.2	473.0
HDVP1	9/11/2012	213.2	473.0
HDVP1	8/11/2012	213.2	473.0
HDVP1	7/11/2012	213.2	473.0
HDVP1	6/11/2012	213.2	473.0
HDVP1	5/11/2012	213.2	473.0
HDVP1	4/11/2012	213.2	473.0
HDVP1	3/11/2012	213.2	473.0
HDVP1	2/11/2012	213.2	473.0
HDVP1	1/11/2012	213.2	473.0
HDVP1	31/10/2012	199.4	486.8
HDVP1	30/10/2012	199.4	486.8
HDVP1	29/10/2012	199.4	486.8
HDVP1	28/10/2012	199.4	486.8
HDVP1	27/10/2012	199.4	486.8
HDVP1	26/10/2012	199.4	486.8
HDVP1	25/10/2012	199.4	486.8
HDVP1	24/10/2012	199.4	486.8
HDVP1	23/10/2012	199.4	486.8
HDVP1	22/10/2012	199.4	486.8
HDVP1	21/10/2012	199.4	486.8
HDVP1	20/10/2012	199.4	486.8
HDVP1	19/10/2012	199.4	486.8
HDVP1	18/10/2012	199.4	486.8
HDVP1	17/10/2012	199.4	486.8
HDVP1	16/10/2012	199.4	486.8
HDVP1	15/10/2012	199.4	486.8
HDVP1	14/10/2012	199.4	486.8
HDVP1	13/10/2012	199.4	486.8
HDVP1	12/10/2012	199.4	486.8
HDVP1	11/10/2012	199.4	486.8
HDVP1	10/10/2012	199.4	486.8
HDVP1	9/10/2012	199.4	486.8
HDVP1	8/10/2012	199.4	486.8
HDVP1	7/10/2012	199.4	486.8
HDVP1	6/10/2012	199.4	486.8
HDVP1	5/10/2012	199.4	486.8
HDVP1	4/10/2012	199.4	486.8
HDVP1	3/10/2012	199.4	486.8
HDVP1	2/10/2012	199.4	486.8
HDVP1	1/10/2012	199.4	486.8
HDVP1	30/09/2012	184.1	502.1
HDVP1	29/09/2012	184.1	502.1
HDVP1	28/09/2012	184.1	502.1
HDVP1	27/09/2012	184.1	502.1
HDVP1	26/09/2012	184.1	502.1
HDVP1	25/09/2012	184.1	502.1
HDVP1	24/09/2012	184.1	502.1
HDVP1	23/09/2012	184.1	502.1
HDVP1	22/09/2012	184.1	502.1
HDVP1	21/09/2012	184.1	502.1
HDVP1	20/09/2012	184.1	502.1
HDVP1	19/09/2012	184.1	502.1
HDVP1	18/09/2012	184.1	502.1
HDVP1	17/09/2012	184.1	502.1
HDVP1	16/09/2012	184.1	502.1
HDVP1	15/09/2012	184.1	502.1
HDVP1	14/09/2012	184.1	502.1
HDVP1	13/09/2012	184.1	502.1
HDVP1	12/09/2012	184.1	502.1
HDVP1	11/09/2012	184.1	502.1
HDVP1	10/09/2012	184.1	502.1
HDVP1	9/09/2012	184.1	502.1
HDVP1	8/09/2012	184.1	502.1
HDVP1	7/09/2012	184.1	502.1
HDVP1	6/09/2012	184.1	502.1
HDVP1	5/09/2012	184.1	502.1
HDVP1	4/09/2012	184.1	502.1
HDVP1	3/09/2012	184.1	502.1
HDVP1	2/09/2012	184.1	502.1

ID	Date	WL mAHD	WL mbgl
MB17H1SW0025	21/07/2020	621.4	34.8
MB17H1SW0025	20/07/2020	621.4	34.8
MB17H1SW0025	19/07/2020	621.4	34.8
MB17H1SW0025	18/07/2020	621.4	34.8
MB17H1SW0025	17/07/2020	621.4	34.8
MB17H1SW0025	16/07/2020	621.4	34.8
MB17H1SW0025	15/07/2020	621.4	34.8
MB17H1SW0025	14/07/2020	621.4	34.8
MB17H1SW0025	13/07/2020	621.4	34.8
MB17H1SW0025	12/07/2020	621.4	34.8
MB17H1SW0025	11/07/2020	621.4	34.8
MB17H1SW0025	10/07/2020	621.4	34.8
MB17H1SW0025	9/07/2020	621.4	34.8
MB17H1SW0025	8/07/2020	621.4	34.8
MB17H1SW0025	6/07/2020	621.4	34.8
MB17H1SW0025	5/07/2020	621.4	34.8
MB17H1SW0025	4/07/2020	621.4	34.8
MB17H1SW0025	3/07/2020	621.4	34.8
MB17H1SW0025	2/07/2020	621.4	34.8
MB17H1SW0025	1/07/2020	621.4	34.8
MB17H1SW0025	30/06/2020	621.4	34.8
MB17H1SW0025	29/06/2020	621.4	34.8
MB17H1SW0025	28/06/2020	621.4	34.8
MB17H1SW0025	27/06/2020	621.4	34.8
MB17H1SW0025	26/06/2020	621.4	34.8
MB17H1SW0025	25/06/2020	621.4	34.8
MB17H1SW0025	24/06/2020	621.4	34.8
MB17H1SW0025	23/06/2020	621.4	34.8
MB17H1SW0025	22/06/2020	621.4	34.8
MB17H1SW0025	21/06/2020	621.4	34.8
MB17H1SW0025	20/06/2020	621.4	34.8
MB17H1SW0025	19/06/2020	621.4	34.8
MB17H1SW0025	16/06/2020	621.4	34.8
MB17H1SW0025	15/06/2020	621.3	34.9
MB17H1SW0025	14/06/2020	621.3	34.9
MB17H1SW0025	13/06/2020	621.3	34.9
MB17H1SW0025	12/06/2020	621.3	34.9
MB17H1SW0025	11/06/2020	621.3	34.9
MB17H1SW0025	10/06/2020	621.3	34.9
MB17H1SW0025	9/06/2020	621.3	34.9
MB17H1SW0025	8/06/2020	621.3	34.9
MB17H1SW0025	7/06/2020	621.3	34.9
MB17H1SW0025	6/06/2020	621.3	34.9
MB17H1SW0025	5/06/2020	621.3	34.9
MB17H1SW0025	4/06/2020	621.3	34.9
MB17H1SW0025	3/06/2020	621.3	34.9
MB17H1SW0025	2/06/2020	621.3	34.9
MB17H1SW0025	1/06/2020	621.3	34.9
MB17H1SW0025	31/05/2020	621.3	34.9
MB17H1SW0025	30/05/2020	621.3	34.9
MB17H1SW0025	29/05/2020	621.3	34.9
MB17H1SW0025	28/05/2020	621.3	34.9
MB17H1SW0025	26/05/2020	621.3	34.9
MB17H1SW0025	25/05/2020	621.3	34.9
MB17H1SW0025	24/05/2020	621.3	34.9
MB17H1SW0025	23/05/2020	621.3	34.9
MB17H1SW0025	22/05/2020	621.3	34.9
MB17H1SW0025	21/05/2020	621.3	34.9
MB17H1SW0025	20/05/2020	621.3	34.9
MB17H1SW0025	19/05/2020	621.3	34.9
MB17H1SW0025	18/05/2020	621.3	34.9
MB17H1SW0025	17/05/2020	621.3	34.9
MB17H1SW0025	16/05/2020	621.3	34.9
MB17H1SW0025	15/05/2020	621.3	34.9
MB17H1SW0025	14/05/2020	621.3	34.9
MB17H1SW0025	13/05/2020	621.3	34.9
MB17H1SW0025	12/05/2020	621.3	34.9
MB17H1SW0025	11/05/2020	621.3	34.9
MB17H1SW0025	10/05/2020	621.3	34.9
MB17H1SW0025	9/05/2020	621.2	35.0
MB17H1SW0025	8/05/2020	621.2	35.0
MB17H1SW0025	7/05/2020	621.2	35.0
MB17H1SW0025	6/05/2020	621.2	35.0
MB17H1SW0025	5/05/2020	621.2	35.0
MB17H1SW0025	3/05/2020	621.2	35.0
MB17H1SW0025	2/05/2020	621.2	35.0
MB17H1SW0025	1/05/2020	621.2	35.0
MB17H1SW0025	30/04/2020	621.2	35.0
MB17H1SW0025	29/04/2020	621.2	35.0
MB17H1SW0025	28/04/2020	621.2	35.0
MB17H1SW0025	27/04/2020	621.2	35.0
MB17H1SW0025	26/04/2020	621.2	35.0
MB17H1SW0025	25/04/2020	621.2	35.0
MB17H1SW0025	24/04/2020	621.2	35.0
MB17H1SW0025	23/04/2020	621.2	35.0
MB17H1SW0025	22/04/2020	621.2	35.0
MB17H1SW0025	21/04/2020	621.2	35.0
MB17H1SW0025	20/04/2020	621.2	35.0
MB17H1SW0025	19/04/2020	621.2	35.0
MB17H1SW0025	18/04/2020	621.2	35.0
MB17H1SW0025	17/04/2020	621.2	35.0
MB17H1SW0025	16/04/2020	621.2	35.0
MB17H1SW0025	15/04/2020	621.2	35.0
MB17H1SW0025	13/04/2020	621.2	35.0
MB17H1SW0025	12/04/2020	621.2	35.0
MB17H1SW0025	11/04/2020	621.2	35.0
MB17H1SW0025	10/04/2020	621.2	35.0
MB17H1SW0025	9/04/2020	621.1	35.1
MB17H1SW0025	8/04/2020	621.1	35.1
MB17H1SW0025	7/04/2020	621.1	35.1
MB17H1SW0025	6/04/2020	621.1	35.1
MB17H1SW0025	5/04/2020	621.1	35.1
MB17H1SW0025	4/04/2020	621.1	35.1
MB17H1SW0025	3/04/2020	621.1	35.1
MB17H1SW0025	2/04/2020	621.1	35.1
MB17H1SW0025	1/04/2020	621.1	35.1
MB17H1SW0025	31/03/2020	621.1	35.1
MB17H1SW0025	30/03/2020	621.1	35.1
MB17H1SW0025	29/03/2020	621.1	35.1
MB17H1SW0025	28/03/2020	621.1	35.1
MB17H1SW0025	27/03/2020	621.1	35.1
MB17H1SW0025	26/03/2020	621.1	35.1
MB17H1SW0025	25/03/2020	621.1	35.1
MB17H1SW0025	22/03/2020	621.1	35.1
MB17H1SW0025	21/03/2020	621.1	35.1
MB17H1SW0025	20/03/2020	621.1	35.1
MB17H1SW0025	19/03/2020	621.1	35.1
MB17H1SW0025	18/03/2020	621.1	35.1
MB17H1SW0025	17/03/2020	621.1	35.1
MB17H1SW0025	16/03/2020	621.1	35.1
MB17H1SW0025	15/03/2020	621.1	35.1
MB17H1SW0025	14/03/2020	621.1	35.1
MB17H1SW0025	13/03/2020	621.1	35.1
MB17H1SW0025	12/03/2020	621.1	35.1
MB17H1SW0025	11/03/2020	621.1	35.1
MB17H1SW0025	10/03/2020	621.1	35.1
MB17H1SW0025	9/03/2020	621.1	35.1
MB17H1SW0025	8/03/2020	621.1	35.1
MB17H1SW0025	7/03/2020	621.1	35.1
MB17H1SW0025	6/03/2020	621.1	35.1
MB17H1SW0025	5/03/2020	621.1	35.1
MB17H1SW0025	4/03/2020	621.1	35.1
MB17H1SW0025	3/03/2020	621.1	35.1
MB17H1SW0025	2/03/2020	621.1	35.1
MB17H1SW0025	1/03/2020	621.1	35.1
MB17H1SW0025	29/02/2020	621.1	35.1

ID	Date	WL mAHD	WL mbgl
MB15HD20002	1/07/2020	624.8	59.0
MB15HD20002	2/07/2020	624.8	59.0
MB15HD20002	3/07/2020	624.8	58.9
MB15HD20002	4/07/2020	624.8	58.9
MB15HD20002	5/07/2020	624.8	59.0
MB15HD20002	6/07/2020	624.8	59.0
MB15HD20002	7/07/2020	624.8	59.0
MB15HD20002	8/07/2020	624.8	59.0
MB15HD20002	9/07/2020	624.8	59.0
MB15HD20002	10/07/2020	624.8	59.0
MB15HD20002	11/07/2020	624.8	58.9
MB15HD20002	12/07/2020	624.8	59.0
MB15HD20002	13/07/2020	624.8	59.0
MB15HD20002	14/07/2020	624.8	59.0
MB15HD20002	15/07/2020	624.8	59.0
MB15HD20002	16/07/2020	624.8	59.0
MB15HD20002	17/07/2020	624.7	59.0
MB15HD20002	18/07/2020	624.8	59.0
MB15HD20002	19/07/2020	624.8	59.0
MB15HD20002	20/07/2020	624.8	59.0
MB15HD20002	21/07/2020	624.8	59.0
MB15HD20002	22/07/2020	624.8	59.0
MB15HD20002	23/07/2020	624.8	59.0
MB15HD20002	24/07/2020	624.8	59.0
MB15HD20002	25/07/2020	624.8	59.0
MB15HD20002	26/07/2020	624.8	59.0
MB15HD20002	27/07/2020	624.8	59.0
MB15HD20002	28/07/2020	624.8	59.0
MB15HD20002	29/07/2020	624.8	59.0
MB15HD20002	30/07/2020	624.8	59.0
MB15HD20002	31/07/2020	624.8	59.0
MB15HD20002	1/08/2020	624.8	59.0
MB15HD20002	2/08/2020	624.7	59.0
MB15HD20002	3/08/2020	624.7	59.0
MB15HD20002	4/08/2020	624.7	59.0
MB15HD20002	5/08/2020	624.7	59.0
MB15HD20002	6/08/2020	624.8	59.0
MB15HD20002	7/08/2020	624.8	59.0
MB15HD20002	8/08/2020	624.8	59.0
MB15HD20002	9/08/2020	624.7	59.0
MB15HD20002	10/08/2020	624.7	59.0
MB15HD20002	11/08/2020	624.7	59.0
MB15HD20002	12/08/2020	624.7	59.0
MB15HD20002	13/08/2020	624.7	59.0
MB15HD20002	14/08/2020	624.8	59.0
MB15HD20002	15/08/2020	624.7	59.0
MB15HD20002	16/08/2020	624.7	59.0
MB15HD20002	17/08/2020	624.7	59.0
MB15HD20002	18/08/2020	624.7	59.0
MB15HD20002	19/08/2020	624.8	59.0
MB15HD20002	20/08/2020	624.8	59.0
MB15HD20002	21/08/2020	624.8	59.0
MB15HD20002	22/08/2020	624.8	59.0
MB15HD20002	23/08/2020	624.8	59.0
MB15HD20002	24/08/2020	624.8	59.0
MB15HD20002	25/08/2020	624.8	59.0
MB15HD20002	26/08/2020	624.8	59.0
MB15HD20002	27/08/2020	624.8	59.0
MB15HD20002	28/08/2020	624.8	59.0
MB15HD20002	29/08/2020	624.8	59.0
MB15HD20002	30/08/2020	624.8	59.0
MB15HD20002	31/08/2020	624.8	59.0
MB15HD20002	1/09/2020	624.7	59.0
MB15HD20002	2/09/2020	624.7	59.0
MB15HD20002	3/09/2020	624.8	59.0
MB15HD20002	4/09/2020	624.7	59.0
MB15HD20002	5/09/2020	624.7	59.0
MB15HD20002	6/09/2020	624.7	59.0
MB15HD20002	7/09/2020	624.7	59.0
MB15HD20002	8/09/2020	624.7	59.0
MB15HD20002	9/09/2020	624.7	59.0
MB15HD20002	10/09/2020	624.7	59.0
MB15HD20002	11/09/2020	624.7	59.0
MB15HD20002	12/09/2020	624.8	59.0
MB15HD20002	13/09/2020	624.8	59.0
MB15HD20002	14/09/2020	624.8	59.0
MB15HD20002	15/09/2020	624.7	59.0
MB15HD20002	16/09/2020	624.7	59.0
MB15HD20002	17/09/2020	624.7	59.0
MB15HD20002	18/09/2020	624.7	59.0
MB15HD20002	19/09/2020	624.7	59.1
MB15HD20002	20/09/2020	624.7	59.0
MB15HD20002	21/09/2020	624.7	59.0
MB15HD20002	22/09/2020	624.7	59.0
MB15HD20002	23/09/2020	624.8	59.0
MB15HD20002	24/09/2020	624.7	59.0
MB15HD20002	25/09/2020	624.7	59.0
MB15HD20002	26/09/2020	624.7	59.1
MB15HD20002	27/09/2020	624.7	59.0
MB15HD20002	28/09/2020	624.7	59.0
MB15HD20002	29/09/2020	624.7	59.0
MB15HD20002	30/09/2020	624.7	59.0
MB15HD20002	1/10/2020	624.7	59.0
MB15HD20002	2/10/2020	624.7	59.1
MB15HD20002	3/10/2020	624.7	59.0
MB15HD20002	4/10/2020	624.8	59.0
MB15HD20002	5/10/2020	624.8	59.0
MB15HD20002	6/10/2020	624.8	59.0
MB15HD20002	7/10/2020	624.7	59.0
MB15HD20002	8/10/2020	624.7	59.0
MB15HD20002	9/10/2020	624.7	59.0
MB15HD20002	10/10/2020	624.7	59.0
MB15HD20002	11/10/2020	624.7	59.0
MB15HD20002	12/10/2020	624.7	59.0
MB15HD20002	13/10/2020	624.7	59.0
MB15HD20002	14/10/2020	624.7	59.0
MB15HD20002	15/10/2020	624.7	59.1
MB15HD20002	16/10/2020	624.7	59.1
MB15HD20002	17/10/2020	624.7	59.1
MB15HD20002	18/10/2020	624.7	59.1
MB15HD20002	19/10/2020	624.7	59.1
MB15HD20002	20/10/2020	624.7	59.1
MB15HD20002	21/10/2020	624.7	59.1
MB15HD20002	22/10/2020	624.7	59.1
MB15HD20002	23/10/2020	624.7	59.1
MB15HD20002	24/10/2020	624.7	59.1
MB15HD20002	25/10/2020	624.7	59.1
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MB15HD20002	28/10/2020	624.7	59.1
MB15HD20002	29/10/2020	624.7	59.1
MB15HD20002	30/10/2020	624.7	59.1
MB15HD20002	31/10/2020	624.7	59.1
MB15HD20002	1/11/2020	624.7	59.1
MB15HD20002	2/11/2020	624.7	59.1
MB15HD20002	3/11/2020	624.7	59.0
MB15HD20002	4/11/2020	624.7	59.0
MB15HD20002	5/11/2020	624.7	59.1
MB15HD20002	6/11/2020	624.7	59.1
MB15HD20002	7/11/2020	624.7	59.1
MB15HD20002	8/11/2020	624.7	59.1
MB15HD20002	9/11/2020	624.7	59.1
MB15HD20002	10/11/2020	624.7	59.1
MB15HD20002	11/11/2020	624.7	59.1
MB15HD20002	12/11/2020	624.7	59.1
MB15HD20002	13/11/2020	624.7	59.1

ID	Date	WL mAHD	WL mbgl
MB18HD20006	1/07/2019	624.9	71.1
MB18HD20006	2/07/2019	624.9	71.1
MB18HD20006	3/07/2019	624.9	71.1
MB18HD20006	4/07/2019	624.9	71.1
MB18HD20006	5/07/2019	624.8	71.1
MB18HD20006	6/07/2019	624.9	71.1
MB18HD20006	7/07/2019	624.9	71.1
MB18HD20006	8/07/2019	624.9	71.1
MB18HD20006	9/07/2019	624.9	71.1
MB18HD20006	10/07/2019	624.9	71.1
MB18HD20006	11/07/2019	624.9	71.1
MB18HD20006	12/07/2019	624.9	71.0
MB18HD20006	13/07/2019	624.9	71.0
MB18HD20006	14/07/2019	624.9	71.0
MB18HD20006	15/07/2019	624.9	71.0
MB18HD20006	16/07/2019	624.9	71.1
MB18HD20006	17/07/2019	624.9	71.1
MB18HD20006	18/07/2019	624.9	71.1
MB18HD20006	19/07/2019	624.9	71.1
MB18HD20006	20/07/2019	624.8	71.1
MB18HD20006	21/07/2019	624.9	71.1
MB18HD20006	22/07/2019	624.9	71.1
MB18HD20006	23/07/2019	624.9	71.1
MB18HD20006	24/07/2019	624.9	71.1
MB18HD20006	25/07/2019	624.9	71.1
MB18HD20006	26/07/2019	624.9	71.1
MB18HD20006	27/07/2019	624.8	71.1
MB18HD20006	28/07/2019	624.8	71.1
MB18HD20006	29/07/2019	624.9	71.1
MB18HD20006	30/07/2019	624.9	71.1
MB18HD20006	31/07/2019	624.9	71.1
MB18HD20006	1/08/2019	624.9	71.1
MB18HD20006	2/08/2019	624.9	71.1
MB18HD20006	3/08/2019	624.9	71.1
MB18HD20006	4/08/2019	624.9	71.1
MB18HD20006	5/08/2019	624.9	71.1
MB18HD20006	6/08/2019	624.8	71.1
MB18HD20006	7/08/2019	624.8	71.1
MB18HD20006	8/08/2019	624.9	71.1
MB18HD20006	9/08/2019	624.9	71.1
MB18HD20006	10/08/2019	624.9	71.1
MB18HD20006	11/08/2019	624.9	71.1
MB18HD20006	12/08/2019	624.9	71.1
MB18HD20006	13/08/2019	624.9	71.1
MB18HD20006	14/08/2019	624.9	71.1
MB18HD20006	15/08/2019	624.8	71.1
MB18HD20006	16/08/2019	624.9	71.1
MB18HD20006	17/08/2019	624.9	71.1
MB18HD20006	18/08/2019	624.9	71.1
MB18HD20006	19/08/2019	624.9	71.1
MB18HD20006	20/08/2019	624.9	71.0
MB18HD20006	21/08/2019	624.9	71.1
MB18HD20006	22/08/2019	624.9	71.1
MB18HD20006	23/08/2019	624.9	71.1
MB18HD20006	24/08/2019	624.9	71.1
MB18HD20006	25/08/2019	624.8	71.1
MB18HD20006	26/08/2019	624.8	71.1
MB18HD20006	27/08/2019	624.8	71.1
MB18HD20006	28/08/2019	624.8	71.1
MB18HD20006	29/08/2019	624.8	71.1
MB18HD20006	30/08/2019	624.8	71.1
MB18HD20006	31/08/2019	624.8	71.1
MB18HD20006	1/09/2019	624.8	71.1
MB18HD20006	2/09/2019	624.8	71.1
MB18HD20006	3/09/2019	624.8	71.1
MB18HD20006	4/09/2019	624.8	71.1
MB18HD20006	5/09/2019	624.8	71.2
MB18HD20006	6/09/2019	624.8	71.2
MB18HD20006	7/09/2019	624.8	71.1
MB18HD20006	8/09/2019	624.8	71.1
MB18HD20006	9/09/2019	624.8	71.1
MB18HD20006	10/09/2019	624.9	71.1
MB18HD20006	11/09/2019	624.9	71.1
MB18HD20006	12/09/2019	624.9	71.1
MB18HD20006	13/09/2019	624.9	71.1
MB18HD20006	14/09/2019	624.9	71.1
MB18HD20006	15/09/2019	624.9	71.1
MB18HD20006	16/09/2019	624.8	71.1
MB18HD20006	17/09/2019	624.8	71.1
MB18HD20006	18/09/2019	624.8	71.1
MB18HD20006	19/09/2019	624.8	71.1
MB18HD20006	20/09/2019	624.8	71.1
MB18HD20006	21/09/2019	624.8	71.1
MB18HD20006	22/09/2019	624.9	71.1
MB18HD20006	23/09/2019	624.9	71.1
MB18HD20006	24/09/2019	624.9	71.1
MB18HD20006	25/09/2019	624.9	71.1
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	1/09/2012	150.6	535.6
HDVP1	31/08/2012	150.6	535.6
HDVP1	30/08/2012	150.6	535.6
HDVP1	29/08/2012	150.6	535.6
HDVP1	28/08/2012	150.6	535.6
HDVP1	27/08/2012	150.6	535.6
HDVP1	26/08/2012	150.6	535.6
HDVP1	25/08/2012	150.6	535.6
HDVP1	24/08/2012	150.6	535.6
HDVP1	23/08/2012	150.6	535.6
HDVP1	22/08/2012	150.6	535.6
HDVP1	21/08/2012	150.6	535.6
HDVP1	20/08/2012	150.6	535.6
HDVP1	19/08/2012	150.6	535.6
HDVP1	18/08/2012	150.6	535.6
HDVP1	17/08/2012	150.6	535.6
HDVP1	16/08/2012	150.6	535.6
HDVP1	15/08/2012	150.6	535.6
HDVP1	14/08/2012	150.6	535.6
HDVP1	13/08/2012	150.6	535.6
HDVP1	12/08/2012	150.6	535.6
HDVP1	11/08/2012	150.6	535.6
HDVP1	10/08/2012	150.6	535.6
HDVP1	9/08/2012	150.6	535.6
HDVP1	8/08/2012	150.6	535.6
HDVP1	7/08/2012	150.6	535.6
HDVP1	6/08/2012	150.6	535.6
HDVP1	5/08/2012	150.6	535.6
HDVP1	4/08/2012	150.6	535.6
HDVP1	3/08/2012	150.6	535.6
HDVP1	2/08/2012	150.6	535.6
HDVP1	1/08/2012	150.6	535.6
HDVP1	31/07/2012	153.9	532.3
HDVP1	30/07/2012	153.9	532.3
HDVP1	29/07/2012	153.9	532.3
HDVP1	28/07/2012	153.9	532.3
HDVP1	27/07/2012	153.9	532.3
HDVP1	26/07/2012	153.9	532.3
HDVP1	25/07/2012	153.9	532.3
HDVP1	24/07/2012	153.9	532.3
HDVP1	23/07/2012	153.9	532.3
HDVP1	22/07/2012	153.9	532.3
HDVP1	21/07/2012	153.9	532.3
HDVP1	20/07/2012	153.9	532.3
HDVP1	19/07/2012	153.9	532.3
HDVP1	18/07/2012	153.9	532.3
HDVP1	17/07/2012	153.9	532.3
HDVP1	16/07/2012	153.9	532.3
HDVP1	15/07/2012	153.9	532.3
HDVP1	14/07/2012	153.9	532.3
HDVP1	13/07/2012	153.9	532.3
HDVP1	12/07/2012	153.9	532.3
HDVP1	11/07/2012	153.9	532.3
HDVP1	10/07/2012	153.9	532.3
HDVP1	9/07/2012	153.9	532.3
HDVP1	8/07/2012	153.9	532.3
HDVP1	7/07/2012	153.9	532.3
HDVP1	6/07/2012	153.9	532.3
HDVP1	5/07/2012	153.9	532.3
HDVP1	4/07/2012	153.9	532.3
HDVP1	3/07/2012	153.9	532.3
HDVP1	2/07/2012	153.9	532.3
HDVP1	1/07/2012	175.2	511.0
HDVP1	30/06/2012	175.2	511.0
HDVP1	29/06/2012	175.2	511.0
HDVP1	28/06/2012	175.2	511.0
HDVP1	27/06/2012	175.2	511.0
HDVP1	26/06/2012	175.2	511.0
HDVP1	25/06/2012	175.2	511.0
HDVP1	24/06/2012	175.2	511.0
HDVP1	23/06/2012	175.2	511.0
HDVP1	22/06/2012	175.2	511.0
HDVP1	21/06/2012	175.2	511.0
HDVP1	20/06/2012	175.2	511.0
HDVP1	19/06/2012	175.2	511.0
HDVP1	18/06/2012	175.2	511.0
HDVP1	17/06/2012	175.2	511.0
HDVP1	16/06/2012	175.2	511.0
HDVP1	15/06/2012	175.2	511.0
HDVP1	14/06/2012	175.2	511.0
HDVP1	13/06/2012	175.2	511.0
HDVP1	12/06/2012	175.2	511.0
HDVP1	11/06/2012	175.2	511.0
HDVP1	10/06/2012	175.2	511.0
HDVP1	9/06/2012	175.2	511.0
HDVP1	8/06/2012	175.2	511.0
HDVP1	7/06/2012	175.2	511.0
HDVP1	6/06/2012	175.2	511.0
HDVP1	5/06/2012	175.2	511.0
HDVP1	4/06/2012	175.2	511.0
HDVP1	3/06/2012	175.2	511.0
HDVP1	2/06/2012	175.2	511.0
HDVP1	1/06/2012	175.2	511.0
HDVP1	31/05/2012	186.5	499.7
HDVP1	30/05/2012	186.5	499.7
HDVP1	29/05/2012	186.5	499.7
HDVP1	28/05/2012	186.5	499.7
HDVP1	27/05/2012	186.5	499.7
HDVP1	26/05/2012	186.5	499.7
HDVP1	25/05/2012	186.5	499.7
HDVP1	24/05/2012	186.5	499.7
HDVP1	23/05/2012	186.5	499.7
HDVP1	22/05/2012	186.5	499.7
HDVP1	21/05/2012	186.5	499.7
HDVP1	20/05/2012	186.5	499.7
HDVP1	19/05/2012	186.5	499.7
HDVP1	18/05/2012	186.5	499.7
HDVP1	17/05/2012	186.5	499.7
HDVP1	16/05/2012	186.5	499.7
HDVP1	15/05/2012	186.5	499.7
HDVP1	14/05/2012	186.5	499.7
HDVP1	13/05/2012	186.5	499.7
HDVP1	12/05/2012	186.5	499.7
HDVP1	11/05/2012	186.5	499.7
HDVP1	10/05/2012	186.5	499.7
HDVP1	9/05/2012	186.5	499.7
HDVP1	8/05/2012	186.5	499.7
HDVP1	7/05/2012	186.5	499.7
HDVP1	6/05/2012	186.5	499.7
HDVP1	5/05/2012	186.5	499.7
HDVP1	4/05/2012	186.5	499.7
HDVP1	3/05/2012	186.5	499.7
HDVP1	2/05/2012	186.5	499.7
HDVP1	1/05/2012	186.5	499.7
HDVP1	30/04/2012	207.6	478.6
HDVP1	29/04/2012	207.6	478.6
HDVP1	28/04/2012	207.6	478.6
HDVP1	27/04/2012	207.6	478.6
HDVP1	26/04/2012	207.6	478.6
HDVP1	25/04/2012	207.6	478.6
HDVP1	24/04/2012	207.6	478.6
HDVP1	23/04/2012	207.6	478.6
HDVP1	22/04/2012	207.6	478.6
HDVP1	21/04/2012	207.6	478.6
HDVP1	20/04/2012	207.6	478.6
HDVP1	19/04/2012	207.6	478.6

ID	Date	WL mAHD	WL mbgl
MB17H1SW0025	28/02/2020	621.1	35.1
MB17H1SW0025	27/02/2020	621.1	35.1
MB17H1SW0025	26/02/2020	621.1	35.1
MB17H1SW0025	25/02/2020	621.1	35.1
MB17H1SW0025	24/02/2020	621.1	35.1
MB17H1SW0025	23/02/2020	621.1	35.1
MB17H1SW0025	22/02/2020	621.1	35.1
MB17H1SW0025	21/02/2020	621.1	35.1
MB17H1SW0025	20/02/2020	621.1	35.1
MB17H1SW0025	19/02/2020	621.1	35.1
MB17H1SW0025	18/02/2020	621.1	35.1
MB17H1SW0025	17/02/2020	621.1	35.1
MB17H1SW0025	16/02/2020	621.1	35.1
MB17H1SW0025	15/02/2020	621.1	35.1
MB17H1SW0025	14/02/2020	621.1	35.1
MB17H1SW0025	12/02/2020	621.1	35.1
MB17H1SW0025	9/02/2020	621.1	35.1
MB17H1SW0025	8/02/2020	621.1	35.1
MB17H1SW0025	7/02/2020	621.1	35.1
MB17H1SW0025	6/02/2020	621.1	35.1
MB17H1SW0025	5/02/2020	621.1	35.1
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MB17H1SW0025	3/02/2020	621.1	35.1
MB17H1SW0025	2/02/2020	621.1	35.1
MB17H1SW0025	1/02/2020	621.1	35.1
MB17H1SW0025	31/01/2020	621.1	35.1
MB17H1SW0025	30/01/2020	621.1	35.1
MB17H1SW0025	29/01/2020	621.1	35.1
MB17H1SW0025	28/01/2020	621.1	35.1
MB17H1SW0025	27/01/2020	621.1	35.1
MB17H1SW0025	26/01/2020	621.1	35.1
MB17H1SW0025	25/01/2020	621.1	35.1
MB17H1SW0025	24/01/2020	621.1	35.1
MB17H1SW0025	23/01/2020	621.1	35.1
MB17H1SW0025	22/01/2020	621.1	35.1
MB17H1SW0025	21/01/2020	621.1	35.1
MB17H1SW0025	20/01/2020	621.1	35.1
MB17H1SW0025	19/01/2020	621.1	35.1
MB17H1SW0025	18/01/2020	621.1	35.1
MB17H1SW0025	17/01/2020	621.1	35.1
MB17H1SW0025	16/01/2020	621.1	35.1
MB17H1SW0025	15/01/2020	621.1	35.1
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MB17H1SW0025	13/01/2020	621.1	35.1
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MB17H1SW0025	11/01/2020	621.1	35.1
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MB17H1SW0025	23/12/2019	621.1	35.1
MB17H1SW0025	22/12/2019	621.1	35.1
MB17H1SW0025	21/12/2019	621.1	35.1
MB17H1SW0025	20/12/2019	621.1	35.1
MB17H1SW0025	19/12/2019	621.1	35.1
MB17H1SW0025	18/12/2019	621.1	35.1
MB17H1SW0025	17/12/2019	621.1	35.1
MB17H1SW0025	16/12/2019	621.1	35.1
MB17H1SW0025	15/12/2019	621.1	35.1
MB17H1SW0025	14/12/2019	621.2	35.0
MB17H1SW0025	13/12/2019	621.1	35.1
MB17H1SW0025	12/12/2019	621.1	35.1
MB17H1SW0025	11/12/2019	621.1	35.1
MB17H1SW0025	8/12/2019	621.1	35.1
MB17H1SW0025	7/12/2019	621.2	35.0
MB17H1SW0025	6/12/2019	621.2	35.0
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MB17H1SW0025	4/12/2019	621.2	35.0
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MB17H1SW0025	29/11/2019	621.1	35.1
MB17H1SW0025	28/11/2019	621.1	35.1
MB17H1SW0025	27/11/2019	621.1	35.1
MB17H1SW0025	26/11/2019	621.1	35.1
MB17H1SW0025	25/11/2019	621.1	35.1
MB17H1SW0025	24/11/2019	621.2	35.0
MB17H1SW0025	23/11/2019	621.2	35.0
MB17H1SW0025	22/11/2019	621.2	35.0
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MB17H1SW0025	20/11/2019	621.2	35.0
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MB17H1SW0025	18/11/2019	621.2	35.0
MB17H1SW0025	17/11/2019	621.2	35.0
MB17H1SW0025	15/11/2019	621.2	35.0
MB17H1SW0025	14/11/2019	621.2	35.0
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MB17H1SW0025	11/11/2019	621.2	35.0
MB17H1SW0025	10/11/2019	621.2	35.0
MB17H1SW0025	9/11/2019	621.2	35.0
MB17H1SW0025	8/11/2019	621.2	35.0
MB17H1SW0025	7/11/2019	621.2	35.0
MB17H1SW0025	6/11/2019	621.2	35.0
MB17H1SW0025	5/11/2019	621.2	35.0
MB17H1SW0025	4/11/2019	621.2	35.0
MB17H1SW0025	3/11/2019	621.2	35.0
MB17H1SW0025	2/11/2019	621.2	35.0
MB17H1SW0025	1/11/2019	621.2	35.0
MB17H1SW0025	31/10/2019	621.2	35.0
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MB17H1SW0025	19/10/2019	621.2	35.0
MB17H1SW0025	18/10/2019	621.2	35.0
MB17H1SW0025	17/10/2019	621.2	35.0
MB17H1SW0025	16/10/2019	621.2	35.0
MB17H1SW0025	15/10/2019	621.2	35.0
MB17H1SW0025	14/10/2019	621.2	35.0
MB17H1SW0025	13/10/2019	621.2	35.0
MB17H1SW0025	12/10/2019	621.2	35.0
MB17H1SW0025	11/10/2019	621.2	35.0
MB17H1SW0025	10/10/2019	621.2	35.0
MB17H1SW0025	9/10/2019	621.2	35.0

ID	Date	WL mAHD	WL mbgl
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MB15HD20002	15/11/2020	624.7	59.1
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MB15HD20002	17/11/2020	624.7	59.1
MB15HD20002	18/11/2020	624.7	59.1
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MB15HD20002	4/12/2020	624.7	59.1
MB15HD20002	5/12/2020	624.7	59.1
MB15HD20002	6/12/2020	624.7	59.1
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MB15HD20002	3/01/2021	624.6	59.1
MB15HD20002	4/01/2021	624.6	59.1
MB15HD20002	5/01/2021	624.7	59.1
MB15HD20002	6/01/2021	624.7	59.1
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MB15HD20002	16/01/2021	624.6	59.1
MB15HD20002	17/01/2021	624.7	59.1
MB15HD20002	18/01/2021	624.7	59.1
MB15HD20002	19/01/2021	624.7	59.1
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MB15HD20002	23/01/2021	624.6	59.2
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MB15HD20002	25/01/2021	624.6	59.1
MB15HD20002	26/01/2021	624.6	59.2
MB15HD20002	27/01/2021	624.6	59.2
MB15HD20002	28/01/2021	624.6	59.2
MB15HD20002	29/01/2021	624.6	59.2
MB15HD20002	30/01/2021	624.6	59.2
MB15HD20002	31/01/2021	624.6	59.2
MB15HD20002	1/02/2021	624.6	59.2
MB15HD20002	2/02/2021	624.6	59.2
MB15HD20002	3/02/2021	624.6	59.2
MB15HD20002	4/02/2021	624.6	59.2
MB15HD20002	5/02/2021	624.6	59.2
MB15HD20002	6/02/2021	624.6	59.2
MB15HD20002	7/02/2021	624.6	59.2
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MB15HD20002	16/02/2021	624.6	59.1
MB15HD20002	17/02/2021	624.6	59.1
MB15HD20002	18/02/2021	624.6	59.1
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MB15HD20002	25/02/2021	624.7	59.1
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MB15HD20002	1/03/2021	624.6	59.1
MB15HD20002	2/03/2021	624.6	59.1
MB15HD20002	3/03/2021	624.6	59.1
MB15HD20002	4/03/2021	624.7	59.1
MB15HD20002	5/03/2021	624.7	59.1
MB15HD20002	6/03/2021	624.7	59.1
MB15HD20002	7/03/2021	624.7	59.1
MB15HD20002	8/03/2021	624.7	59.1
MB15HD20002	9/03/2021	624.7	59.1
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MB15HD20002	18/03/2021	624.7	59.1
MB15HD20002	19/03/2021	624.7	59.1
MB15HD20002	20/03/2021	624.7	59.1
MB15HD20002	21/03/2021	624.7	59.1
MB15HD20002	22/03/2021	624.7	59.1
MB15HD20002	23/03/2021	624.7	59.1
MB15HD20002	24/03/2021	624.7	59.1
MB15HD20002	25/03/2021	624.7	59.1
MB15HD20002	26/03/2021	624.7	59.1
MB15HD20002	27/03/2021	624.7	59.1
MB15HD20002	28/03/2021	624.7	59.1
MB15HD20002	29/03/2021	624.7	59.1

ID	Date	WL mAHD	WL mbgl
MB18HD20006	14/11/2019	624.8	71.2
MB18HD20006	15/11/2019	624.8	71.2
MB18HD20006	16/11/2019	624.8	71.2
MB18HD20006	17/11/2019	624.8	71.2
MB18HD20006	18/11/2019	624.8	71.2
MB18HD20006	19/11/2019	624.8	71.2
MB18HD20006	20/11/2019	624.7	71.2
MB18HD20006	21/11/2019	624.8	71.2
MB18HD20006	22/11/2019	624.8	71.2
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MB18HD20006	24/11/2019	624.8	71.2
MB18HD20006	25/11/2019	624.8	71.2
MB18HD20006	26/11/2019	624.7	71.2
MB18HD20006	27/11/2019	624.8	71.2
MB18HD20006	28/11/2019	624.8	71.2
MB18HD20006	29/11/2019	624.7	71.2
MB18HD20006	30/11/2019	624.8	71.2
MB18HD20006	1/12/2019	624.8	71.2
MB18HD20006	2/12/2019	624.8	71.2
MB18HD20006	3/12/2019	624.8	71.2
MB18HD20006	4/12/2019	624.8	71.2
MB18HD20006	5/12/2019	624.8	71.2
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MB18HD20006	7/12/2019	624.8	71.2
MB18HD20006	8/12/2019	624.8	71.2
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MB18HD20006	18/12/2019	624.8	71.2
MB18HD20006	19/12/2019	624.7	71.2
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MB18HD20006	21/12/2019	624.8	71.2
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MB18HD20006	29/12/2019	624.7	71.2
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MB18HD20006	31/12/2019	624.7	71.2
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MB18HD20006	3/01/2020	624.7	71.2
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MB18HD20006	5/01/2020	624.7	71.2
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MB18HD20006	27/01/2020	624.7	71.2
MB18HD20006	28/01/2020	624.7	71.2
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MB18HD20006	30/01/2020	624.7	71.3
MB18HD20006	31/01/2020	624.7	71.3
MB18HD20006	1/02/2020	624.7	71.3
MB18HD20006	2/02/2020	624.7	71.2
MB18HD20006	3/02/2020	624.7	71.2
MB18HD20006	4/02/2020	624.7	71.2
MB18HD20006	5/02/2020	624.7	71.2
MB18HD20006	6/02/2020	624.7	71.2
MB18HD20006	7/02/2020	624.7	71.2
MB18HD20006	8/02/2020	624.7	71.2
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	18/04/2012	207.6	478.6
HDVP1	17/04/2012	207.6	478.6
HDVP1	16/04/2012	207.6	478.6
HDVP1	15/04/2012	207.6	478.6
HDVP1	14/04/2012	207.6	478.6
HDVP1	13/04/2012	207.6	478.6
HDVP1	12/04/2012	207.6	478.6
HDVP1	11/04/2012	207.6	478.6
HDVP1	10/04/2012	207.6	478.6
HDVP1	9/04/2012	207.6	478.6
HDVP1	8/04/2012	207.6	478.6
HDVP1	7/04/2012	207.6	478.6
HDVP1	6/04/2012	207.6	478.6
HDVP1	5/04/2012	207.6	478.6
HDVP1	4/04/2012	207.6	478.6
HDVP1	3/04/2012	207.6	478.6
HDVP1	2/04/2012	207.6	478.6
HDVP1	1/04/2012	207.6	478.6
HDVP1	31/03/2012	245.7	440.5
HDVP1	30/03/2012	245.7	440.5
HDVP1	29/03/2012	245.7	440.5
HDVP1	28/03/2012	245.7	440.5
HDVP1	27/03/2012	245.7	440.5
HDVP1	26/03/2012	245.7	440.5
HDVP1	25/03/2012	245.7	440.5
HDVP1	24/03/2012	245.7	440.5
HDVP1	23/03/2012	245.7	440.5
HDVP1	22/03/2012	245.7	440.5
HDVP1	21/03/2012	245.7	440.5
HDVP1	20/03/2012	245.7	440.5
HDVP1	19/03/2012	245.7	440.5
HDVP1	18/03/2012	245.7	440.5
HDVP1	17/03/2012	245.7	440.5
HDVP1	16/03/2012	245.7	440.5
HDVP1	15/03/2012	245.7	440.5
HDVP1	14/03/2012	245.7	440.5
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HDVP1	5/03/2012	245.7	440.5
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HDVP1	2/03/2012	321.6	364.6
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HDVP1	25/02/2012	321.6	364.6
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HDVP1	20/02/2012	321.6	364.6
HDVP1	19/02/2012	321.6	364.6
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HDVP1	17/02/2012	321.6	364.6
HDVP1	16/02/2012	321.6	364.6
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HDVP1	13/02/2012	321.6	364.6
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HDVP1	7/02/2012	321.6	364.6
HDVP1	6/02/2012	321.6	364.6
HDVP1	5/02/2012	321.6	364.6
HDVP1	4/02/2012	321.6	364.6
HDVP1	3/02/2012	321.6	364.6
HDVP1	2/02/2012	321.6	364.6
HDVP1	1/02/2012	321.6	364.6
HDVP1	31/01/2012	184.7	501.5
HDVP1	30/01/2012	184.7	501.5
HDVP1	29/01/2012	184.7	501.5
HDVP1	28/01/2012	184.7	501.5
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HDVP1	3/01/2012	184.7	501.5
HDVP1	2/01/2012	184.7	501.5
HDVP1	1/01/2012	184.7	501.5
HDVP1	31/12/2011	237.9	448.3
HDVP1	30/12/2011	237.9	448.3
HDVP1	29/12/2011	237.9	448.3
HDVP1	28/12/2011	237.9	448.3
HDVP1	27/12/2011	237.9	448.3
HDVP1	26/12/2011	237.9	448.3
HDVP1	25/12/2011	237.9	448.3
HDVP1	24/12/2011	237.9	448.3
HDVP1	23/12/2011	237.9	448.3
HDVP1	22/12/2011	237.9	448.3
HDVP1	21/12/2011	237.9	448.3
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HDVP1	19/12/2011	237.9	448.3
HDVP1	18/12/2011	237.9	448.3
HDVP1	17/12/2011	237.9	448.3
HDVP1	16/12/2011	237.9	448.3
HDVP1	15/12/2011	237.9	448.3
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HDVP1	13/12/2011	237.9	448.3
HDVP1	12/12/2011	237.9	448.3
HDVP1	11/12/2011	237.9	448.3
HDVP1	10/12/2011	237.9	448.3
HDVP1	9/12/2011	237.9	448.3
HDVP1	8/12/2011	237.9	448.3
HDVP1	7/12/2011	237.9	448.3
HDVP1	6/12/2011	237.9	448.3
HDVP1	5/12/2011	237.9	448.3

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MB17H1SW0025	7/10/2019	621.2	35.0
MB17H1SW0025	6/10/2019	621.2	35.0
MB17H1SW0025	4/10/2019	621.2	35.0
MB17H1SW0025	3/10/2019	621.2	35.0
MB17H1SW0025	2/10/2019	621.2	35.0
MB17H1SW0025	1/10/2019	621.2	35.0
MB17H1SW0025	30/09/2019	621.2	35.0
MB17H1SW0025	29/09/2019	621.2	35.0
MB17H1SW0025	28/09/2019	621.2	35.0
MB17H1SW0025	27/09/2019	621.2	35.0
MB17H1SW0025	26/09/2019	621.2	35.0
MB17H1SW0025	25/09/2019	621.3	34.9
MB17H1SW0025	24/09/2019	621.3	34.9
MB17H1SW0025	23/09/2019	621.3	34.9
MB17H1SW0025	22/09/2019	621.3	34.9
MB17H1SW0025	21/09/2019	621.3	34.9
MB17H1SW0025	20/09/2019	621.2	35.0
MB17H1SW0025	19/09/2019	621.2	35.0
MB17H1SW0025	18/09/2019	621.2	35.0
MB17H1SW0025	17/09/2019	621.2	35.0
MB17H1SW0025	16/09/2019	621.2	35.0
MB17H1SW0025	15/09/2019	621.3	34.9
MB17H1SW0025	14/09/2019	621.3	34.9
MB17H1SW0025	13/09/2019	621.3	34.9
MB17H1SW0025	12/09/2019	621.3	34.9
MB17H1SW0025	11/09/2019	621.3	34.9
MB17H1SW0025	10/09/2019	621.3	34.9
MB17H1SW0025	9/09/2019	621.3	34.9
MB17H1SW0025	8/09/2019	621.2	35.0
MB17H1SW0025	7/09/2019	621.2	35.0
MB17H1SW0025	6/09/2019	621.2	35.0
MB17H1SW0025	5/09/2019	621.2	35.0
MB17H1SW0025	4/09/2019	621.2	35.0
MB17H1SW0025	3/09/2019	621.3	34.9
MB17H1SW0025	2/09/2019	621.3	34.9
MB17H1SW0025	1/09/2019	621.3	34.9
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MB17H1SW0025	27/08/2019	621.3	34.9
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MB17H1SW0025	17/08/2019	621.3	34.9
MB17H1SW0025	16/08/2019	621.3	34.9
MB17H1SW0025	15/08/2019	621.3	34.9
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MB17H1SW0025	13/08/2019	621.3	34.9
MB17H1SW0025	12/08/2019	621.3	34.9
MB17H1SW0025	11/08/2019	621.3	34.9
MB17H1SW0025	10/08/2019	621.3	34.9
MB17H1SW0025	9/08/2019	621.3	34.9
MB17H1SW0025	8/08/2019	621.3	34.9
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MB17H1SW0025	6/08/2019	621.3	34.9
MB17H1SW0025	5/08/2019	621.3	34.9
MB17H1SW0025	4/08/2019	621.3	34.9
MB17H1SW0025	3/08/2019	621.3	34.9
MB17H1SW0025	2/08/2019	621.3	34.9
MB17H1SW0025	1/08/2019	621.3	34.9
MB17H1SW0025	31/07/2019	621.3	34.9
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MB17H1SW0025	27/07/2019	621.3	34.9
MB17H1SW0025	26/07/2019	621.3	34.9
MB17H1SW0025	25/07/2019	621.3	34.9
MB17H1SW0025	24/07/2019	621.3	34.9
MB17H1SW0025	23/07/2019	621.3	34.9
MB17H1SW0025	22/07/2019	621.3	34.9
MB17H1SW0025	21/07/2019	621.3	34.9
MB17H1SW0025	20/07/2019	621.3	34.9
MB17H1SW0025	19/07/2019	621.3	34.9
MB17H1SW0025	18/07/2019	621.3	34.9
MB17H1SW0025	17/07/2019	621.3	34.9
MB17H1SW0025	16/07/2019	621.3	34.9
MB17H1SW0025	15/07/2019	621.3	34.9
MB17H1SW0025	14/07/2019	621.3	34.9
MB17H1SW0025	13/07/2019	621.3	34.9
MB17H1SW0025	12/07/2019	621.3	34.9
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MB17H1SW0025	10/07/2019	621.3	34.9
MB17H1SW0025	9/07/2019	621.3	34.9
MB17H1SW0025	8/07/2019	621.3	34.9
MB17H1SW0025	6/07/2019	621.3	34.9
MB17H1SW0025	5/07/2019	621.3	34.9
MB17H1SW0025	4/07/2019	621.3	34.9
MB17H1SW0025	3/07/2019	621.3	34.9
MB17H1SW0025	2/07/2019	621.3	34.9
MB17H1SW0025	1/07/2019	621.3	34.9
MB17H1SW0025	30/06/2019	621.3	34.9
MB17H1SW0025	29/06/2019	621.3	34.9
MB17H1SW0025	28/06/2019	621.3	34.9
MB17H1SW0025	27/06/2019	621.3	34.9
MB17H1SW0025	26/06/2019	621.3	34.9
MB17H1SW0025	25/06/2019	621.3	34.9
MB17H1SW0025	24/06/2019	621.3	34.9
MB17H1SW0025	23/06/2019	621.3	34.9
MB17H1SW0025	22/06/2019	621.3	34.9
MB17H1SW0025	21/06/2019	621.3	34.9
MB17H1SW0025	20/06/2019	621.3	34.9
MB17H1SW0025	19/06/2019	621.3	34.9
MB17H1SW0025	18/06/2019	621.3	34.9
MB17H1SW0025	10/01/2019	621.3	34.9
MB17H1SW0025	9/01/2019	621.3	34.9
MB17H1SW0025	8/01/2019	621.4	34.8
MB17H1SW0025	7/01/2019	621.4	34.8
MB17H1SW0025	6/01/2019	621.4	34.8
MB17H1SW0025	5/01/2019	621.3	34.9
MB17H1SW0025	4/01/2019	621.3	34.9
MB17H1SW0025	3/01/2019	621.3	34.9
MB17H1SW0025	2/01/2019	621.3	34.9
MB17H1SW0025	30/12/2018	621.3	34.9
MB17H1SW0025	29/12/2018	621.3	34.9
MB17H1SW0025	28/12/2018	621.3	34.9
MB17H1SW0025	27/12/2018	621.3	34.9
MB17H1SW0025	26/12/2018	621.3	34.9
MB17H1SW0025	25/12/2018	621.4	34.8
MB17H1SW0025	24/12/2018	621.4	34.8
MB17H1SW0025	23/12/2018	621.4	34.8
MB17H1SW0025	22/12/2018	621.4	34.8
MB17H1SW0025	21/12/2018	621.4	34.8
MB17H1SW0025	20/12/2018	621.4	34.8
MB17H1SW0025	19/12/2018	621.3	34.9
MB17H1SW0025	18/12/2018	621.3	34.9
MB17H1SW0025	17/12/2018	621.3	34.9
MB17H1SW0025	16/12/2018	621.3	34.9
MB17H1SW0025	15/12/2018	621.3	34.9
MB17H1SW0025	14/12/2018	621.3	34.9

ID	Date	WL mAHD	WL mbgl
MB15HD20002	30/03/2021	624.7	59.1
MB15HD20002	31/03/2021	624.7	59.1
MB15HD20002	1/04/2021	624.7	59.1
MB15HD20002	2/04/2021	624.7	59.1
MB15HD20002	3/04/2021	624.7	59.1
MB15HD20002	4/04/2021	624.7	59.1
MB15HD20002	5/04/2021	624.7	59.1
MB15HD20002	6/04/2021	624.7	59.1
MB15HD20002	7/04/2021	624.7	59.1
MB15HD20002	8/04/2021	624.7	59.1
MB15HD20002	9/04/2021	624.7	59.1
MB15HD20002	10/04/2021	624.7	59.1
MB15HD20002	11/04/2021	624.7	59.1
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MB15HD20002	13/04/2021	624.7	59.1
MB15HD20002	14/04/2021	624.7	59.1
MB15HD20002	15/04/2021	624.7	59.0
MB15HD20002	16/04/2021	624.7	59.0
MB15HD20002	17/04/2021	624.7	59.0
MB15HD20002	18/04/2021	624.7	59.0
MB15HD20002	19/04/2021	624.7	59.1
MB15HD20002	20/04/2021	624.7	59.1
MB15HD20002	21/04/2021	624.7	59.0
MB15HD20002	22/04/2021	624.7	59.0
MB15HD20002	23/04/2021	624.7	59.0
MB15HD20002	24/04/2021	624.7	59.0
MB15HD20002	25/04/2021	624.7	59.0
MB15HD20002	26/04/2021	624.7	59.0
MB15HD20002	27/04/2021	624.7	59.0
MB15HD20002	28/04/2021	624.7	59.0
MB15HD20002	29/04/2021	624.7	59.0
MB15HD20002	30/04/2021	624.7	59.1
MB15HD20002	1/05/2021	624.7	59.0
MB15HD20002	2/05/2021	624.7	59.1
MB15HD20002	3/05/2021	624.7	59.1
MB15HD20002	4/05/2021	624.7	59.1
MB15HD20002	5/05/2021	624.7	59.1
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MB15HD20002	7/05/2021	624.7	59.1
MB15HD20002	8/05/2021	624.7	59.1
MB15HD20002	9/05/2021	624.7	59.0
MB15HD20002	10/05/2021	624.7	59.0
MB15HD20002	11/05/2021	624.7	59.0
MB15HD20002	12/05/2021	624.7	59.0
MB15HD20002	13/05/2021	624.7	59.0
MB15HD20002	14/05/2021	624.7	59.0
MB15HD20002	15/05/2021	624.7	59.0
MB15HD20002	16/05/2021	624.7	59.0
MB15HD20002	17/05/2021	624.7	59.0
MB15HD20002	18/05/2021	624.7	59.0
MB15HD20002	19/05/2021	624.7	59.0
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MB15HD20002	22/05/2021	624.7	59.1
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MB15HD20002	24/05/2021	624.7	59.1
MB15HD20002	25/05/2021	624.7	59.0
MB15HD20002	26/05/2021	624.7	59.0
MB15HD20002	27/05/2021	624.7	59.0
MB15HD20002	28/05/2021	624.7	59.0
MB15HD20002	29/05/2021	624.7	59.0
MB15HD20002	30/05/2021	624.7	59.1
MB15HD20002	31/05/2021	624.7	59.1
MB15HD20002	1/06/2021	624.7	59.1
MB15HD20002	2/06/2021	624.7	59.0
MB15HD20002	3/06/2021	624.8	59.0
MB15HD20002	4/06/2021	624.8	59.0
MB15HD20002	5/06/2021	624.7	59.0
MB15HD20002	6/06/2021	624.7	59.0
MB15HD20002	7/06/2021	624.7	59.0
MB15HD20002	8/06/2021	624.7	59.0
MB15HD20002	9/06/2021	624.7	59.0
MB15HD20002	10/06/2021	624.7	59.1
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MB15HD20002	20/06/2021	624.7	59.0
MB15HD20002	21/06/2021	624.7	59.1
MB15HD20002	22/06/2021	624.7	59.0
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MB15HD20002	29/06/2021	624.7	59.0
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MB15HD20002	2/07/2021	624.7	59.0
MB15HD20002	3/07/2021	624.7	59.0
MB15HD20002	4/07/2021	624.7	59.0
MB15HD20002	5/07/2021	624.7	59.0
MB15HD20002	6/07/2021	624.7	59.1
MB15HD20002	7/07/2021	624.7	59.1
MB15HD20002	8/07/2021	624.7	59.0
MB15HD20002	9/07/2021	624.7	59.1
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MB15HD20002	29/07/2021	624.7	59.1
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MB15HD20002	31/07/2021	624.7	59.1
MB15HD20002	1/08/2021	624.7	59.1
MB15HD20002	2/08/2021	624.7	59.0
MB15HD20002	3/08/2021	624.8	59.0
MB15HD20002	4/08/2021	624.8	59.0
MB15HD20002	5/08/2021	624.8	59.0
MB15HD20002	6/08/2021	624.8	59.0
MB15HD20002	7/08/2021	624.7	59.0
MB15HD20002	8/08/2021	624.7	59.0
MB15HD20002	9/08/2021	624.7	59.0
MB15HD20002	10/08/2021	624.7	59.1
MB15HD20002	11/08/2021	624.8	59.0
MB15HD20002	12/08/2021	624.8	59.0

ID	Date	WL mAHD	WL mbgl
MB18HD20006	29/03/2020	624.8	71.2
MB18HD20006	30/03/2020	624.8	71.2
MB18HD20006	31/03/2020	624.7	71.2
MB18HD20006	1/04/2020	624.7	71.2
MB18HD20006	2/04/2020	624.7	71.2
MB18HD20006	3/04/2020	624.7	71.2
MB18HD20006	4/04/2020	624.8	71.2
MB18HD20006	5/04/2020	624.8	71.2
MB18HD20006	6/04/2020	624.8	71.2
MB18HD20006	7/04/2020	624.8	71.2
MB18HD20006	8/04/2020	624.8	71.2
MB18HD20006	9/04/2020	624.8	71.2
MB18HD20006	10/04/2020	624.8	71.2
MB18HD20006	11/04/2020	624.8	71.2
MB18HD20006	12/04/2020	624.8	71.2
MB18HD20006	13/04/2020	624.8	71.2
MB18HD20006	14/04/2020	624.8	71.2
MB18HD20006	15/04/2020	624.8	71.2
MB18HD20006	16/04/2020	624.8	71.2
MB18HD20006	17/04/2020	624.8	71.2
MB18HD20006	18/04/2020	624.8	71.2
MB18HD20006	19/04/2020	624.8	71.2
MB18HD20006	20/04/2020	624.8	71.2
MB18HD20006	21/04/2020	624.8	71.2
MB18HD20006	22/04/2020	624.8	71.2
MB18HD20006	23/04/2020	624.8	71.2
MB18HD20006	24/04/2020	624.8	71.2
MB18HD20006	25/04/2020	624.8	71.2
MB18HD20006	26/04/2020	624.8	71.2
MB18HD20006	27/04/2020	624.8	71.2
MB18HD20006	28/04/2020	624.8	71.2
MB18HD20006	29/04/2020	624.8	71.2
MB18HD20006	30/04/2020	624.8	71.1
MB18HD20006	1/05/2020	624.8	71.1
MB18HD20006	2/05/2020	624.8	71.2
MB18HD20006	3/05/2020	624.8	71.2
MB18HD20006	4/05/2020	624.8	71.2
MB18HD20006	5/05/2020	624.8	71.2
MB18HD20006	6/05/2020	624.8	71.2
MB18HD20006	7/05/2020	624.8	71.2
MB18HD20006	8/05/2020	624.8	71.2
MB18HD20006	9/05/2020	624.8	71.2
MB18HD20006	10/05/2020	624.8	71.2
MB18HD20006	11/05/2020	624.8	71.2
MB18HD20006	12/05/2020	624.8	71.2
MB18HD20006	13/05/2020	624.8	71.1
MB18HD20006	14/05/2020	624.8	71.1
MB18HD20006	15/05/2020	624.8	71.1
MB18HD20006	16/05/2020	624.8	71.2
MB18HD20006	17/05/2020	624.8	71.2
MB18HD20006	18/05/2020	624.8	71.2
MB18HD20006	19/05/2020	624.8	71.2
MB18HD20006	20/05/2020	624.8	71.2
MB18HD20006	21/05/2020	624.8	71.1
MB18HD20006	22/05/2020	624.8	71.2
MB18HD20006	23/05/2020	624.8	71.2
MB18HD20006	24/05/2020	624.8	71.2
MB18HD20006	25/05/2020	624.8	71.2
MB18HD20006	26/05/2020	624.8	71.2
MB18HD20006	27/05/2020	624.8	71.2
MB18HD20006	28/05/2020	624.8	71.2
MB18HD20006	29/05/2020	624.8	71.2
MB18HD20006	30/05/2020	624.8	71.2
MB18HD20006	31/05/2020	624.8	71.1
MB18HD20006	1/06/2020	624.8	71.1
MB18HD20006	2/06/2020	624.8	71.1
MB18HD20006	3/06/2020	624.8	71.1
MB18HD20006	4/06/2020	624.8	71.1
MB18HD20006	5/06/2020	624.8	71.1
MB18HD20006	6/06/2020	624.8	71.1
MB18HD20006	7/06/2020	624.8	71.2
MB18HD20006	8/06/2020	624.8	71.2
MB18HD20006	9/06/2020	624.8	71.2
MB18HD20006	10/06/2020	624.8	71.2
MB18HD20006	11/06/2020	624.8	71.2
MB18HD20006	12/06/2020	624.8	71.2
MB18HD20006	13/06/2020	624.8	71.2
MB18HD20006	14/06/2020	624.8	71.2
MB18HD20006	15/06/2020	624.8	71.1
MB18HD20006	16/06/2020	624.8	71.1
MB18HD20006	17/06/2020	624.8	71.2
MB18HD20006	18/06/2020	624.8	71.2
MB18HD20006	19/06/2020	624.8	71.1
MB18HD20006	20/06/2020	624.8	71.1
MB18HD20006	21/06/2020	624.8	71.1
MB18HD20006	22/06/2020	624.8	71.2
MB18HD20006	23/06/2020	624.8	71.2
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	4/12/2011	237.9	448.3
HDVP1	3/12/2011	237.9	448.3
HDVP1	2/12/2011	237.9	448.3
HDVP1	1/12/2011	237.9	448.3
HDVP1	30/11/2011	366.7	319.5
HDVP1	29/11/2011	366.7	319.5
HDVP1	28/11/2011	366.7	319.5
HDVP1	27/11/2011	366.7	319.5
HDVP1	26/11/2011	366.7	319.5
HDVP1	25/11/2011	366.7	319.5
HDVP1	24/11/2011	366.7	319.5
HDVP1	23/11/2011	366.7	319.5
HDVP1	22/11/2011	366.7	319.5
HDVP1	21/11/2011	366.7	319.5
HDVP1	20/11/2011	366.7	319.5
HDVP1	19/11/2011	366.7	319.5
HDVP1	18/11/2011	366.7	319.5
HDVP1	17/11/2011	366.7	319.5
HDVP1	16/11/2011	366.7	319.5
HDVP1	15/11/2011	366.7	319.5
HDVP1	14/11/2011	366.7	319.5
HDVP1	13/11/2011	366.7	319.5
HDVP1	12/11/2011	366.7	319.5
HDVP1	11/11/2011	366.7	319.5
HDVP1	10/11/2011	366.7	319.5
HDVP1	9/11/2011	366.7	319.5
HDVP1	8/11/2011	366.7	319.5
HDVP1	7/11/2011	366.7	319.5
HDVP1	6/11/2011	366.7	319.5
HDVP1	5/11/2011	366.7	319.5
HDVP1	4/11/2011	366.7	319.5
HDVP1	3/11/2011	366.7	319.5
HDVP1	2/11/2011	366.7	319.5
HDVP1	1/11/2011	366.7	319.5
HDVP1	31/10/2011	53.3	632.9
HDVP1	30/10/2011	53.3	632.9
HDVP1	29/10/2011	53.3	632.9
HDVP1	28/10/2011	53.3	632.9
HDVP1	27/10/2011	53.3	632.9
HDVP1	26/10/2011	53.3	632.9
HDVP1	25/10/2011	53.3	632.9
HDVP1	24/10/2011	53.3	632.9
HDVP1	23/10/2011	53.3	632.9
HDVP1	22/10/2011	53.3	632.9
HDVP1	21/10/2011	53.3	632.9
HDVP1	20/10/2011	53.3	632.9
HDVP1	19/10/2011	53.3	632.9
HDVP1	18/10/2011	53.3	632.9
HDVP1	17/10/2011	53.3	632.9
HDVP1	16/10/2011	53.3	632.9
HDVP1	15/10/2011	53.3	632.9
HDVP1	14/10/2011	53.3	632.9
HDVP1	13/10/2011	53.3	632.9
HDVP1	12/10/2011	53.3	632.9
HDVP1	11/10/2011	53.3	632.9
HDVP1	10/10/2011	53.3	632.9
HDVP1	9/10/2011	53.3	632.9
HDVP1	8/10/2011	53.3	632.9
HDVP1	7/10/2011	53.3	632.9
HDVP1	6/10/2011	53.3	632.9
HDVP1	5/10/2011	53.3	632.9
HDVP1	4/10/2011	53.3	632.9
HDVP1	3/10/2011	53.3	632.9
HDVP1	2/10/2011	53.3	632.9
HDVP1	1/10/2011	53.3	632.9
HDVP1	30/09/2011	170.5	515.7
HDVP1	29/09/2011	170.5	515.7
HDVP1	28/09/2011	170.5	515.7
HDVP1	27/09/2011	170.5	515.7
HDVP1	26/09/2011	170.5	515.7
HDVP1	25/09/2011	170.5	515.7
HDVP1	24/09/2011	170.5	515.7
HDVP1	23/09/2011	170.5	515.7
HDVP1	22/09/2011	170.5	515.7
HDVP1	21/09/2011	170.5	515.7
HDVP1	20/09/2011	170.5	515.7
HDVP1	19/09/2011	170.5	515.7
HDVP1	18/09/2011	170.5	515.7
HDVP1	17/09/2011	170.5	515.7
HDVP1	16/09/2011	170.5	515.7
HDVP1	15/09/2011	170.5	515.7
HDVP1	14/09/2011	170.5	515.7
HDVP1	13/09/2011	170.5	515.7
HDVP1	12/09/2011	170.5	515.7
HDVP1	11/09/2011	170.5	515.7
HDVP1	10/09/2011	170.5	515.7
HDVP1	9/09/2011	170.5	515.7
HDVP1	8/09/2011	170.5	515.7
HDVP1	7/09/2011	170.5	515.7
HDVP1	6/09/2011	170.5	515.7
HDVP1	5/09/2011	170.5	515.7
HDVP1	4/09/2011	170.5	515.7
HDVP1	3/09/2011	170.5	515.7
HDVP1	2/09/2011	170.5	515.7
HDVP1	1/09/2011	170.5	515.7
HDVP1	31/08/2011	167.1	519.0
HDVP1	30/08/2011	167.1	519.0
HDVP1	29/08/2011	167.1	519.0
HDVP1	28/08/2011	167.1	519.0
HDVP1	27/08/2011	167.1	519.0
HDVP1	26/08/2011	167.1	519.0
HDVP1	25/08/2011	167.1	519.0
HDVP1	24/08/2011	167.1	519.0
HDVP1	23/08/2011	167.1	519.0
HDVP1	22/08/2011	167.1	519.0
HDVP1	21/08/2011	167.1	519.0
HDVP1	20/08/2011	167.1	519.0
HDVP1	19/08/2011	167.1	519.0
HDVP1	18/08/2011	167.1	519.0
HDVP1	17/08/2011	167.1	519.0
HDVP1	16/08/2011	167.1	519.0
HDVP1	15/08/2011	167.1	519.0
HDVP1	14/08/2011	167.1	519.0
HDVP1	13/08/2011	167.1	519.0
HDVP1	12/08/2011	167.1	519.0
HDVP1	11/08/2011	167.1	519.0
HDVP1	10/08/2011	167.1	519.0
HDVP1	9/08/2011	167.1	519.0
HDVP1	8/08/2011	167.1	519.0
HDVP1	7/08/2011	167.1	519.0
HDVP1	6/08/2011	167.1	519.0
HDVP1	5/08/2011	167.1	519.0
HDVP1	4/08/2011	167.1	519.0
HDVP1	3/08/2011	167.1	519.0
HDVP1	2/08/2011	167.1	519.0
HDVP1	1/08/2011	167.1	519.0
HDVP1	31/07/2011	158.1	528.1
HDVP1	30/07/2011	158.1	528.1
HDVP1	29/07/2011	158.1	528.1
HDVP1	28/07/2011	158.1	528.1
HDVP1	27/07/2011	158.1	528.1
HDVP1	26/07/2011	158.1	528.1
HDVP1	25/07/2011	158.1	528.1
HDVP1	24/07/2011	158.1	528.1
HDVP1	23/07/2011	158.1	528.1
HDVP1	22/07/2011	158.1	528.1

ID	Date	WL mAHD	WL mbgl
MB17H1SW0025	13/12/2018	621.3	34.9
MB17H1SW0025	12/12/2018	621.4	34.8
MB17H1SW0025	11/12/2018	621.4	34.8
MB17H1SW0025	10/12/2018	621.4	34.8
MB17H1SW0025	9/12/2018	621.4	34.8
MB17H1SW0025	8/12/2018	621.4	34.8
MB17H1SW0025	7/12/2018	621.4	34.8
MB17H1SW0025	6/12/2018	621.4	34.8
MB17H1SW0025	5/12/2018	621.4	34.8
MB17H1SW0025	4/12/2018	621.4	34.8
MB17H1SW0025	3/12/2018	621.4	34.8
MB17H1SW0025	2/12/2018	621.4	34.8
MB17H1SW0025	1/12/2018	621.4	34.8
MB17H1SW0025	30/11/2018	621.4	34.8
MB17H1SW0025	29/11/2018	621.4	34.8
MB17H1SW0025	28/11/2018	621.4	34.8
MB17H1SW0025	27/11/2018	621.4	34.8
MB17H1SW0025	26/11/2018	621.4	34.8
MB17H1SW0025	25/11/2018	621.4	34.8
MB17H1SW0025	24/11/2018	621.4	34.8
MB17H1SW0025	23/11/2018	621.4	34.8
MB17H1SW0025	22/11/2018	621.4	34.8
MB17H1SW0025	21/11/2018	621.4	34.8
MB17H1SW0025	20/11/2018	621.4	34.8
MB17H1SW0025	19/11/2018	621.4	34.8
MB17H1SW0025	18/11/2018	621.4	34.8
MB17H1SW0025	17/11/2018	621.4	34.8
MB17H1SW0025	16/11/2018	621.4	34.8
MB17H1SW0025	15/11/2018	621.4	34.8
MB17H1SW0025	14/11/2018	621.4	34.8
MB17H1SW0025	13/11/2018	621.4	34.8
MB17H1SW0025	12/11/2018	621.4	34.8
MB17H1SW0025	11/11/2018	621.4	34.8
MB17H1SW0025	10/11/2018	621.4	34.8
MB17H1SW0025	9/11/2018	621.4	34.8
MB17H1SW0025	8/11/2018	621.4	34.8
MB17H1SW0025	7/11/2018	621.4	34.8
MB17H1SW0025	6/11/2018	621.4	34.8
MB17H1SW0025	5/11/2018	621.4	34.8
MB17H1SW0025	4/11/2018	621.4	34.8
MB17H1SW0025	3/11/2018	621.4	34.8
MB17H1SW0025	2/11/2018	621.4	34.8
MB17H1SW0025	1/11/2018	621.4	34.8
MB17H1SW0025	31/10/2018	621.4	34.8
MB17H1SW0025	30/10/2018	621.4	34.8
MB17H1SW0025	29/10/2018	621.4	34.8
MB17H1SW0025	28/10/2018	621.4	34.8
MB17H1SW0025	27/10/2018	621.4	34.8
MB17H1SW0025	26/10/2018	621.4	34.8
MB17H1SW0025	25/10/2018	621.4	34.8
MB17H1SW0025	24/10/2018	621.4	34.8
MB17H1SW0025	23/10/2018	621.4	34.8
MB17H1SW0025	22/10/2018	621.4	34.8
MB17H1SW0025	21/10/2018	621.4	34.8
MB17H1SW0025	20/10/2018	621.4	34.8
MB17H1SW0025	19/10/2018	621.4	34.8
MB17H1SW0025	18/10/2018	621.4	34.8
MB17H1SW0025	17/10/2018	621.4	34.8
MB17H1SW0025	16/10/2018	621.4	34.8
MB17H1SW0025	15/10/2018	621.4	34.8
MB17H1SW0025	14/10/2018	621.4	34.8
MB17H1SW0025	13/10/2018	621.4	34.8
MB17H1SW0025	12/10/2018	621.4	34.8
MB17H1SW0025	11/10/2018	621.4	34.8
MB17H1SW0025	10/10/2018	621.4	34.8
MB17H1SW0025	9/10/2018	621.4	34.8
MB17H1SW0025	8/10/2018	621.4	34.8
MB17H1SW0025	7/10/2018	621.4	34.8
MB17H1SW0025	6/10/2018	621.4	34.8
MB17H1SW0025	5/10/2018	621.4	34.8
MB17H1SW0025	4/10/2018	621.4	34.8
MB17H1SW0025	3/10/2018	621.4	34.8
MB17H1SW0025	2/10/2018	621.4	34.8
MB17H1SW0025	1/10/2018	621.4	34.8
MB17H1SW0025	30/09/2018	621.4	34.8
MB17H1SW0025	29/09/2018	621.4	34.8
MB17H1SW0025	28/09/2018	621.4	34.8
MB17H1SW0025	27/09/2018	621.4	34.8
MB17H1SW0025	26/09/2018	621.4	34.8
MB17H1SW0025	25/09/2018	621.5	34.7
MB17H1SW0025	24/09/2018	621.5	34.7
MB17H1SW0025	23/09/2018	621.5	34.7
MB17H1SW0025	22/09/2018	621.5	34.7
MB17H1SW0025	21/09/2018	621.5	34.7
MB17H1SW0025	20/09/2018	621.5	34.7
MB17H1SW0025	19/09/2018	621.5	34.7
MB17H1SW0025	18/09/2018	621.5	34.7
MB17H1SW0025	17/09/2018	621.5	34.7
MB17H1SW0025	16/09/2018	621.5	34.7
MB17H1SW0025	15/09/2018	621.5	34.7
MB17H1SW0025	14/09/2018	621.5	34.7
MB17H1SW0025	13/09/2018	621.5	34.7
MB17H1SW0025	12/09/2018	621.5	34.7
MB17H1SW0025	11/09/2018	621.5	34.7
MB17H1SW0025	10/09/2018	621.5	34.7
MB17H1SW0025	9/09/2018	621.5	34.7
MB17H1SW0025	8/09/2018	621.5	34.7
MB17H1SW0025	7/09/2018	621.5	34.7
MB17H1SW0025	6/09/2018	621.5	34.7
MB17H1SW0025	5/09/2018	621.5	34.7
MB17H1SW0025	4/09/2018	621.5	34.7
MB17H1SW0025	3/09/2018	621.5	34.7
MB17H1SW0025	2/09/2018	621.5	34.7
MB17H1SW0025	1/09/2018	621.5	34.7
MB17H1SW0025	31/08/2018	621.5	34.7
MB17H1SW0025	30/08/2018	621.5	34.7
MB17H1SW0025	29/08/2018	621.4	34.8
MB17H1SW0025	28/08/2018	621.5	34.7
MB17H1SW0025	27/08/2018	621.5	34.7
MB17H1SW0025	26/08/2018	621.5	34.7
MB17H1SW0025	25/08/2018	621.5	34.7
MB17H1SW0025	24/08/2018	621.5	34.7
MB17H1SW0025	23/08/2018	621.5	34.7
MB17H1SW0025	22/08/2018	621.5	34.7
MB17H1SW0025	21/08/2018	621.5	34.7
MB17H1SW0025	20/08/2018	621.5	34.7
MB17H1SW0025	19/08/2018	621.5	34.7
MB17H1SW0025	18/08/2018	621.5	34.7
MB17H1SW0025	17/08/2018	621.5	34.7
MB17H1SW0025	16/08/2018	621.5	34.7
MB17H1SW0025	15/08/2018	621.5	34.7
MB17H1SW0025	14/08/2018	621.5	34.7
MB17H1SW0025	13/08/2018	621.5	34.7
MB17H1SW0025	12/08/2018	621.5	34.7
MB17H1SW0025	11/08/2018	621.5	34.7
MB17H1SW0025	10/08/2018	621.5	34.7
MB17H1SW0025	9/08/2018	621.5	34.7
MB17H1SW0025	8/08/2018	621.5	34.7
MB17H1SW0025	7/08/2018	621.5	34.7
MB17H1SW0025	6/08/2018	621.5	34.7
MB17H1SW0025	5/08/2018	621.5	34.7
MB17H1SW0025	4/08/2018	621.5	34.7
MB17H1SW0025	3/08/2018	621.5	34.7
MB17H1SW0025	2/08/2018	621.5	34.7
MB17H1SW0025	1/08/2018	621.5	34.7
MB17H1SW0025	31/07/2018	621.5	34.7
MB17H1SW0025	30/07/2018	621.5	34.7

ID	Date	WL mAHD	WL mbgl
MB15HD20002	13/08/2021	624.7	59.0
MB15HD20002	14/08/2021	624.7	59.1
MB15HD20002	15/08/2021	624.7	59.0
MB15HD20002	16/08/2021	624.8	59.0
MB15HD20002	17/08/2021	624.7	59.0
MB15HD20002	18/08/2021	624.7	59.0
MB15HD20002	19/08/2021	624.7	59.1
MB15HD20002	20/08/2021	624.7	59.1
MB15HD20002	21/08/2021	624.7	59.1
MB15HD20002	22/08/2021	624.7	59.1
MB15HD20002	23/08/2021	624.7	59.0
MB15HD20002	24/08/2021	624.7	59.1
MB15HD20002	25/08/2021	624.7	59.1
MB15HD20002	26/08/2021	624.7	59.1
MB15HD20002	27/08/2021	624.7	59.1
MB15HD20002	28/08/2021	624.7	59.1
MB15HD20002	29/08/2021	624.7	59.1
MB15HD20002	30/08/2021	624.7	59.1
MB15HD20002	31/08/2021	624.7	59.1
MB15HD20002	1/09/2021	624.7	59.1
MB15HD20002	2/09/2021	624.7	59.1
MB15HD20002	3/09/2021	624.7	59.1
MB15HD20002	4/09/2021	624.7	59.0
MB15HD20002	5/09/2021	624.7	59.0
MB15HD20002	6/09/2021	624.7	59.0
MB15HD20002	7/09/2021	624.7	59.0
MB15HD20002	8/09/2021	624.7	59.0
MB15HD20002	9/09/2021	624.7	59.0
MB15HD20002	10/09/2021	624.7	59.0
MB15HD20002	11/09/2021	624.7	59.1
MB15HD20002	12/09/2021	624.7	59.1
MB15HD20002	13/09/2021	624.7	59.1
MB15HD20002	14/09/2021	624.7	59.1
MB15HD20002	15/09/2021	624.7	59.1
MB15HD20002	16/09/2021	624.7	59.1
MB15HD20002	17/09/2021	624.7	59.1
MB15HD20002	18/09/2021	624.7	59.1
MB15HD20002	19/09/2021	624.7	59.1
MB15HD20002	20/09/2021	624.7	59.0
MB15HD20002	21/09/2021	624.7	59.0
MB15HD20002	22/09/2021	624.7	59.0
MB15HD20002	23/09/2021	624.7	59.1
MB15HD20002	24/09/2021	624.7	59.1
MB15HD20002	25/09/2021	624.6	59.1
MB15HD20002	26/09/2021	624.7	59.1
MB15HD20002	27/09/2021	624.7	59.1
MB15HD20002	28/09/2021	624.7	59.1
MB15HD20002	29/09/2021	624.7	59.1
MB15HD20002	30/09/2021	624.6	59.1
MB15HD20002	1/10/2021	624.6	59.1
MB15HD20002	2/10/2021	624.6	59.1
MB15HD20002	3/10/2021	624.6	59.1
MB15HD20002	4/10/2021	624.6	59.1
MB15HD20002	5/10/2021	624.6	59.1
MB15HD20002	6/10/2021	624.6	59.1
MB15HD20002	7/10/2021	624.7	59.1
MB15HD20002	8/10/2021	624.6	59.1
MB15HD20002	9/10/2021	624.7	59.1
MB15HD20002	10/10/2021	624.7	59.1
MB15HD20002	11/10/2021	624.6	59.1
MB15HD20002	12/10/2021	624.6	59.1
MB15HD20002	13/10/2021	624.7	59.1
MB15HD20002	14/10/2021	624.6	59.1
MB15HD20002	15/10/2021	624.6	59.1
MB15HD20002	16/10/2021	624.6	59.1
MB15HD20002	17/10/2021	624.6	59.1
MB15HD20002	18/10/2021	624.6	59.1
MB15HD20002	19/10/2021	624.6	59.1
MB15HD20002	20/10/2021	624.7	59.1
MB15HD20002	21/10/2021	624.7	59.1
MB15HD20002	22/10/2021	624.7	59.1
MB15HD20002	23/10/2021	624.7	59.1
MB15HD20002	24/10/2021	624.7	59.1
MB15HD20002	25/10/2021	624.6	59.1
MB15HD20002	26/10/2021	624.6	59.1
MB15HD20002	27/10/2021	624.6	59.1
MB15HD20002	28/10/2021	624.6	59.1
MB15HD20002	1/11/2021	624.6	59.1
MB15HD20002	2/11/2021	624.6	59.1
MB15HD20002	3/11/2021	624.6	59.1
MB15HD20002	4/11/2021	624.6	59.1
MB15HD20002	5/11/2021	624.6	59.1
MB15HD20002	6/11/2021	624.6	59.1
MB15HD20002	7/11/2021	624.6	59.2
MB15HD20002	9/11/2021	624.6	59.2
MB15HD20002	10/11/2021	624.6	59.2
MB15HD20002	11/11/2021	624.6	59.1
MB15HD20002	12/11/2021	624.6	59.1
MB15HD20002	13/11/2021	624.7	59.1
MB15HD20002	15/11/2021	624.6	59.1
MB15HD20002	16/11/2021	624.6	59.1
MB15HD20002	17/11/2021	624.6	59.1
MB15HD20002	18/11/2021	624.6	59.2
MB15HD20002	19/11/2021	624.6	59.2
MB15HD20002	20/11/2021	624.6	59.1
MB15HD20002	21/11/2021	624.6	59.1
MB15HD20002	22/11/2021	624.6	59.1
MB15HD20002	23/11/2021	624.6	59.1
MB15HD20002	24/11/2021	624.6	59.1
MB15HD20002	25/11/2021	624.6	59.1
MB15HD20002	26/11/2021	624.6	59.1
MB15HD20002	27/11/2021	624.6	59.1
MB15HD20002	28/11/2021	624.6	59.1
MB15HD20002	29/11/2021	624.6	59.1
MB15HD20002	30/11/2021	624.6	59.2
MB15HD20002	1/12/2021	624.6	59.2
MB15HD20002	2/12/2021	624.6	59.2
MB15HD20002	3/12/2021	624.6	59.2
MB15HD20002	4/12/2021	624.6	59.2
MB15HD20002	5/12/2021	624.6	59.2
MB15HD20002	6/12/2021	624.6	59.2
MB15HD20002	7/12/2021	624.6	59.2
MB15HD20002	8/12/2021	624.6	59.1
MB15HD20002	9/12/2021	624.6	59.2
MB15HD20002	10/12/2021	624.6	59.2
MB15HD20002	11/12/2021	624.6	59.2
MB15HD20002	12/12/2021	624.6	59.2
MB15HD20002	13/12/2021	624.6	59.2
MB15HD20002	14/12/2021	624.6	59.2
MB15HD20002	15/12/2021	624.6	59.2
MB15HD20002	16/12/2021	624.6	59.2
MB15HD20002	17/12/2021	624.6	59.2
MB15HD20002	18/12/2021	624.6	59.2
MB15HD20002	19/12/2021	624.6	59.1
MB15HD20002	20/12/2021	624.6	59.1
MB15HD20002	21/12/2021	624.6	59.2
MB15HD20002	22/12/2021	624.6	59.2
MB15HD20002	23/12/2021	624.6	59.2
MB15HD20002	24/12/2021	624.6	59.2
MB15HD20002	25/12/2021	624.6	59.2
MB15HD20002	26/12/2021	624.6	59.2
MB15HD20002	30/12/2021	624.6	59.2
MB15HD20002	31/12/2021	624.6	59.2
MB15HD20002	1/01/2022	624.6	59.2
MB15HD20002	2/01/2022	624.6	59.2
MB15HD20002	3/01/2022	624.6	59.2

ID	Date	WL mAHD	WL mbgl
MB18HD20006	12/08/2020	624.7	71.2
MB18HD20006	13/08/2020	624.8	71.2
MB18HD20006	14/08/2020	624.8	71.2
MB18HD20006	15/08/2020	624.8	71.2
MB18HD20006	16/08/2020	624.7	71.2
MB18HD20006	17/08/2020	624.8	71.2
MB18HD20006	18/08/2020	624.8	71.2
MB18HD20006	19/08/2020	624.8	71.2
MB18HD20006	20/08/2020	624.8	71.2
MB18HD20006	21/08/2020	624.8	71.2
MB18HD20006	22/08/2020	624.8	71.2
MB18HD20006	23/08/2020	624.8	71.2
MB18HD20006	24/08/2020	624.8	71.2
MB18HD20006	25/08/2020	624.8	71.2
MB18HD20006	26/08/2020	624.8	71.2
MB18HD20006	27/08/2020	624.8	71.2
MB18HD20006	28/08/2020	624.8	71.2
MB18HD20006	29/08/2020	624.8	71.2
MB18HD20006	30/08/2020	624.8	71.2
MB18HD20006	31/08/2020	624.8	71.2
MB18HD20006	1/09/2020	624.8	71.2
MB18HD20006	2/09/2020	624.8	71.2
MB18HD20006	3/09/2020	624.8	71.2
MB18HD20006	4/09/2020	624.8	71.2
MB18HD20006	5/09/2020	624.8	71.2
MB18HD20006	6/09/2020	624.7	71.2
MB18HD20006	7/09/2020	624.7	71.2
MB18HD20006	8/09/2020	624.8	71.2
MB18HD20006	9/09/2020	624.8	71.2
MB18HD20006	10/09/2020	624.8	71.2
MB18HD20006	11/09/2020	624.8	71.2
MB18HD20006	12/09/2020	624.8	71.2
MB18HD20006	13/09/2020	624.8	71.2
MB18HD20006	14/09/2020	624.8	71.2
MB18HD20006	15/09/2020	624.8	71.2
MB18HD20006	16/09/2020	624.8	71.2
MB18HD20006	17/09/2020	624.8	71.2
MB18HD20006	18/09/2020	624.7	71.2
MB18HD20006	19/09/2020	624.7	71.2
MB18HD20006	20/09/2020	624.7	71.2
MB18HD20006	21/09/2020	624.8	71.2
MB18HD20006	22/09/2020	624.8	71.2
MB18HD20006	23/09/2020	624.8	71.2
MB18HD20006	24/09/2020	624.8	71.2
MB18HD20006	25/09/2020	624.8	71.2
MB18HD20006	26/09/2020	624.7	71.2
MB18HD20006	27/09/2020	624.7	71.2
MB18HD20006	28/09/2020	624.7	71.2
MB18HD20006	29/09/2020	624.8	71.2
MB18HD20006	30/09/2020	624.8	71.2
MB18HD20006	1/10/2020	624.7	71.2
MB18HD20006	2/10/2020	624.7	71.2
MB18HD20006	3/10/2020	624.7	71.2
MB18HD20006	4/10/2020	624.8	71.2
MB18HD20006	5/10/2020	624.8	71.2
MB18HD20006	6/10/2020	624.8	71.2
MB18HD20006	7/10/2020	624.8	71.2
MB18HD20006	8/10/2020	624.8	71.2
MB18HD20006	9/10/2020	624.7	71.2
MB18HD20006	10/10/2020	624.7	71.2
MB18HD20006	11/10/2020	624.7	71.2
MB18HD20006	12/10/2020	624.7	71.2
MB18HD20006	13/10/2020	624.7	71.2
MB18HD20006	14/10/2020	624.7	71.2
MB18HD20006	15/10/2020	624.7	71.2
MB18HD20006	16/10/2020	624.7	71.2
MB18HD20006	17/10/2020	624.7	71.3
MB18HD20006	18/10/2020	624.7	71.3
MB18HD20006	19/10/2020	624.7	71.3
MB18HD20006	20/10/2020	624.7	71.3
MB18HD20006	21/10/2020	624.7	71.3
MB18HD20006	22/10/2020	624.7	71.3
MB18HD20006	23/10/2020	624.7	71.3
MB18HD20006	24/10/2020	624.7	71.3
MB18HD20006	25/10/2020	624.7	71.3
MB18HD20006	26/10/2020	624.7	71.3
MB18HD20006	27/10/2020	624.7	71.3
MB18HD20006	28/10/2020	624.7	71.2
MB18HD20006	29/10/2020	624.7	71.2
MB18HD20006	30/10/2020	624.7	71.2
MB18HD20006	31/10/2020	624.7	71.2
MB18HD20006	1/11/2020	624.7	71.3
MB18HD20006	2/11/2020	624.7	71.3
MB18HD20006	3/11/2020	624.7	71.2
MB18HD20006	4/11/2020	624.8	71.2
MB18HD20006	5/11/2020	624.7	71.2
MB

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	21/07/2011	158.1	528.1
HDVP1	20/07/2011	158.1	528.1
HDVP1	19/07/2011	158.1	528.1
HDVP1	18/07/2011	158.1	528.1
HDVP1	17/07/2011	158.1	528.1
HDVP1	16/07/2011	158.1	528.1
HDVP1	15/07/2011	158.1	528.1
HDVP1	14/07/2011	158.1	528.1
HDVP1	13/07/2011	158.1	528.1
HDVP1	12/07/2011	158.1	528.1
HDVP1	11/07/2011	158.1	528.1
HDVP1	10/07/2011	158.1	528.1
HDVP1	9/07/2011	158.1	528.1
HDVP1	8/07/2011	158.1	528.1
HDVP1	7/07/2011	158.1	528.1
HDVP1	6/07/2011	158.1	528.1
HDVP1	5/07/2011	158.1	528.1
HDVP1	4/07/2011	158.1	528.1
HDVP1	3/07/2011	158.1	528.1
HDVP1	2/07/2011	158.1	528.1
HDVP1	1/07/2011	158.1	528.1
HDVP1	30/06/2011	184.1	502.1
HDVP1	29/06/2011	184.1	502.1
HDVP1	28/06/2011	184.1	502.1
HDVP1	27/06/2011	184.1	502.1
HDVP1	26/06/2011	184.1	502.1
HDVP1	25/06/2011	184.1	502.1
HDVP1	24/06/2011	184.1	502.1
HDVP1	23/06/2011	184.1	502.1
HDVP1	22/06/2011	184.1	502.1
HDVP1	21/06/2011	184.1	502.1
HDVP1	20/06/2011	184.1	502.1
HDVP1	19/06/2011	184.1	502.1
HDVP1	18/06/2011	184.1	502.1
HDVP1	17/06/2011	184.1	502.1
HDVP1	16/06/2011	184.1	502.1
HDVP1	15/06/2011	184.1	502.1
HDVP1	14/06/2011	184.1	502.1
HDVP1	13/06/2011	184.1	502.1
HDVP1	12/06/2011	184.1	502.1
HDVP1	11/06/2011	184.1	502.1
HDVP1	10/06/2011	184.1	502.1
HDVP1	9/06/2011	184.1	502.1
HDVP1	8/06/2011	184.1	502.1
HDVP1	7/06/2011	184.1	502.1
HDVP1	6/06/2011	184.1	502.1
HDVP1	5/06/2011	184.1	502.1
HDVP1	4/06/2011	184.1	502.1
HDVP1	3/06/2011	184.1	502.1
HDVP1	2/06/2011	184.1	502.1
HDVP1	1/06/2011	184.1	502.1
HDVP1	31/05/2011	174.5	511.7
HDVP1	30/05/2011	174.5	511.7
HDVP1	29/05/2011	174.5	511.7
HDVP1	28/05/2011	174.5	511.7
HDVP1	27/05/2011	174.5	511.7
HDVP1	26/05/2011	174.5	511.7
HDVP1	25/05/2011	174.5	511.7
HDVP1	24/05/2011	174.5	511.7
HDVP1	23/05/2011	174.5	511.7
HDVP1	22/05/2011	174.5	511.7
HDVP1	21/05/2011	174.5	511.7
HDVP1	20/05/2011	174.5	511.7
HDVP1	19/05/2011	174.5	511.7
HDVP1	18/05/2011	174.5	511.7
HDVP1	17/05/2011	174.5	511.7
HDVP1	16/05/2011	174.5	511.7
HDVP1	15/05/2011	174.5	511.7
HDVP1	14/05/2011	174.5	511.7
HDVP1	13/05/2011	174.5	511.7
HDVP1	12/05/2011	174.5	511.7
HDVP1	11/05/2011	174.5	511.7
HDVP1	10/05/2011	174.5	511.7
HDVP1	9/05/2011	174.5	511.7
HDVP1	8/05/2011	174.5	511.7
HDVP1	7/05/2011	174.5	511.7
HDVP1	6/05/2011	174.5	511.7
HDVP1	5/05/2011	174.5	511.7
HDVP1	4/05/2011	174.5	511.7
HDVP1	3/05/2011	174.5	511.7
HDVP1	2/05/2011	174.5	511.7
HDVP1	1/05/2011	174.5	511.7
HDVP1	30/04/2011	198.7	487.4
HDVP1	29/04/2011	198.7	487.4
HDVP1	28/04/2011	198.7	487.4
HDVP1	27/04/2011	198.7	487.4
HDVP1	26/04/2011	198.7	487.4
HDVP1	25/04/2011	198.7	487.4
HDVP1	24/04/2011	198.7	487.4
HDVP1	23/04/2011	198.7	487.4
HDVP1	22/04/2011	198.7	487.4
HDVP1	21/04/2011	198.7	487.4
HDVP1	20/04/2011	198.7	487.4
HDVP1	19/04/2011	198.7	487.4
HDVP1	18/04/2011	198.7	487.4
HDVP1	17/04/2011	198.7	487.4
HDVP1	16/04/2011	198.7	487.4
HDVP1	15/04/2011	198.7	487.4
HDVP1	14/04/2011	198.7	487.4
HDVP1	13/04/2011	198.7	487.4
HDVP1	12/04/2011	198.7	487.4
HDVP1	11/04/2011	198.7	487.4
HDVP1	10/04/2011	198.7	487.4
HDVP1	9/04/2011	198.7	487.4
HDVP1	8/04/2011	198.7	487.4
HDVP1	7/04/2011	198.7	487.4
HDVP1	6/04/2011	198.7	487.4
HDVP1	5/04/2011	198.7	487.4
HDVP1	4/04/2011	198.7	487.4
HDVP1	3/04/2011	198.7	487.4
HDVP1	2/04/2011	198.7	487.4
HDVP1	1/04/2011	198.7	487.4
HDVP1	31/03/2011	191.3	494.9
HDVP1	30/03/2011	191.3	494.9
HDVP1	29/03/2011	191.3	494.9
HDVP1	28/03/2011	191.3	494.9
HDVP1	27/03/2011	191.3	494.9
HDVP1	26/03/2011	191.3	494.9
HDVP1	25/03/2011	191.3	494.9
HDVP1	24/03/2011	191.3	494.9
HDVP1	23/03/2011	191.3	494.9
HDVP1	22/03/2011	191.3	494.9
HDVP1	21/03/2011	191.3	494.9
HDVP1	20/03/2011	191.3	494.9
HDVP1	19/03/2011	191.3	494.9
HDVP1	18/03/2011	191.3	494.9
HDVP1	17/03/2011	191.3	494.9
HDVP1	16/03/2011	191.3	494.9
HDVP1	15/03/2011	191.3	494.9
HDVP1	14/03/2011	191.3	494.9
HDVP1	13/03/2011	191.3	494.9
HDVP1	12/03/2011	191.3	494.9
HDVP1	11/03/2011	191.3	494.9
HDVP1	10/03/2011	191.3	494.9
HDVP1	9/03/2011	191.3	494.9
HDVP1	8/03/2011	191.3	494.9

ID	Date	WL mAHD	WL mbgl
MB17H1SW0025	29/07/2018	621.5	34.7
MB17H1SW0025	28/07/2018	621.5	34.7
MB17H1SW0025	27/07/2018	621.5	34.7
MB17H1SW0025	26/07/2018	621.5	34.7
MB17H1SW0025	25/07/2018	621.5	34.7
MB17H1SW0025	24/07/2018	621.5	34.7
MB17H1SW0025	23/07/2018	621.5	34.7
MB17H1SW0025	22/07/2018	621.5	34.7
MB17H1SW0025	21/07/2018	621.5	34.7
MB17H1SW0025	20/07/2018	621.5	34.7
MB17H1SW0025	19/07/2018	621.5	34.7
MB17H1SW0025	18/07/2018	621.5	34.7
MB17H1SW0025	17/07/2018	621.5	34.7
MB17H1SW0025	16/07/2018	621.5	34.7
MB17H1SW0025	14/07/2018	621.5	34.7
MB17H1SW0025	13/07/2018	621.5	34.7
MB17H1SW0025	12/07/2018	621.5	34.7
MB17H1SW0025	11/07/2018	621.5	34.7
MB17H1SW0025	10/07/2018	621.5	34.7
MB17H1SW0025	9/07/2018	621.5	34.7
MB17H1SW0025	8/07/2018	621.5	34.7
MB17H1SW0025	7/07/2018	621.5	34.7
MB17H1SW0025	6/07/2018	621.5	34.7
MB17H1SW0025	5/07/2018	621.5	34.7
MB17H1SW0025	4/07/2018	621.5	34.7
MB17H1SW0025	3/07/2018	621.5	34.7
MB17H1SW0025	2/07/2018	621.5	34.7
MB17H1SW0025	1/07/2018	621.5	34.7
MB17H1SW0025	30/06/2018	621.5	34.7
MB17H1SW0025	29/06/2018	621.5	34.7
MB17H1SW0025	28/06/2018	621.5	34.7
MB17H1SW0025	27/06/2018	621.5	34.7
MB17H1SW0025	26/06/2018	621.6	34.6
MB17H1SW0025	25/06/2018	621.6	34.6
MB17H1SW0025	24/06/2018	621.6	34.6
MB17H1SW0025	23/06/2018	621.5	34.7
MB17H1SW0025	22/06/2018	621.5	34.7
MB17H1SW0025	21/06/2018	621.5	34.7
MB17H1SW0025	20/06/2018	621.5	34.7
MB17H1SW0025	19/06/2018	621.5	34.7
MB17H1SW0025	18/06/2018	621.5	34.7
MB17H1SW0025	17/06/2018	621.5	34.7
MB17H1SW0025	16/06/2018	621.5	34.7
MB17H1SW0025	15/06/2018	621.5	34.7
MB17H1SW0025	14/06/2018	621.5	34.7
MB17H1SW0025	13/06/2018	621.5	34.7
MB17H1SW0025	12/06/2018	621.5	34.7
MB17H1SW0025	11/06/2018	621.5	34.7
MB17H1SW0025	10/06/2018	621.5	34.7
MB17H1SW0025	9/06/2018	621.5	34.7
MB17H1SW0025	8/06/2018	621.5	34.7
MB17H1SW0025	7/06/2018	621.5	34.7
MB17H1SW0025	6/06/2018	621.5	34.7
MB17H1SW0025	5/06/2018	621.5	34.7
MB17H1SW0025	4/06/2018	621.5	34.7
MB17H1SW0025	3/06/2018	621.5	34.7
MB17H1SW0025	2/06/2018	621.5	34.7
MB17H1SW0025	1/06/2018	621.5	34.7
MB17H1SW0025	31/05/2018	621.5	34.7
MB17H1SW0025	30/05/2018	621.5	34.7
MB17H1SW0025	29/05/2018	621.5	34.7
MB17H1SW0025	28/05/2018	621.5	34.7
MB17H1SW0025	27/05/2018	621.5	34.7
MB17H1SW0025	26/05/2018	621.5	34.7
MB17H1SW0025	25/05/2018	621.5	34.7
MB17H1SW0025	24/05/2018	621.5	34.7
MB17H1SW0025	23/05/2018	621.5	34.7
MB17H1SW0025	22/05/2018	621.6	34.6
MB17H1SW0025	21/05/2018	621.6	34.6
MB17H1SW0025	20/05/2018	621.6	34.6
MB17H1SW0025	19/05/2018	621.6	34.6
MB17H1SW0025	18/05/2018	621.6	34.6
MB17H1SW0025	17/05/2018	621.6	34.6
MB17H1SW0025	16/05/2018	621.6	34.6
MB17H1SW0025	15/05/2018	621.6	34.6
MB17H1SW0025	14/05/2018	621.6	34.6
MB17H1SW0025	13/05/2018	621.6	34.6
MB17H1SW0025	12/05/2018	621.6	34.6
MB17H1SW0025	10/05/2018	621.6	34.6
MB17H1SW0025	9/05/2018	621.5	34.7
MB17H1SW0025	8/05/2018	621.5	34.7
MB17H1SW0025	7/05/2018	621.6	34.6
MB17H1SW0025	6/05/2018	621.6	34.6
MB17H1SW0025	5/05/2018	621.6	34.6
MB17H1SW0025	4/05/2018	621.6	34.6
MB17H1SW0025	3/05/2018	621.5	34.7
MB17H1SW0025	2/05/2018	621.5	34.7
MB17H1SW0025	1/05/2018	621.5	34.7
MB17H1SW0025	30/04/2018	621.5	34.7
MB17H1SW0025	29/04/2018	621.5	34.7
MB17H1SW0025	28/04/2018	621.5	34.7
MB17H1SW0025	27/04/2018	621.5	34.7
MB17H1SW0025	26/04/2018	621.5	34.7
MB17H1SW0025	25/04/2018	621.5	34.7
MB17H1SW0025	24/04/2018	621.5	34.7
MB17H1SW0025	23/04/2018	621.5	34.7
MB17H1SW0025	22/04/2018	621.5	34.7
MB17H1SW0025	21/04/2018	621.5	34.7
MB17H1SW0025	20/04/2018	621.5	34.7
MB17H1SW0025	19/04/2018	621.5	34.7
MB17H1SW0025	18/04/2018	621.5	34.7
MB17H1SW0025	17/04/2018	621.5	34.7
MB17H1SW0025	16/04/2018	621.5	34.7
MB17H1SW0025	15/04/2018	621.5	34.7
MB17H1SW0025	14/04/2018	621.5	34.7
MB17H1SW0025	13/04/2018	621.5	34.7
MB17H1SW0025	12/04/2018	621.5	34.7
MB17H1SW0025	11/04/2018	621.5	34.7
MB17H1SW0025	10/04/2018	621.5	34.7
MB17H1SW0025	9/04/2018	621.5	34.7
MB17H1SW0025	8/04/2018	621.5	34.7
MB17H1SW0025	7/04/2018	621.5	34.7
MB17H1SW0025	6/04/2018	621.5	34.7
MB17H1SW0025	5/04/2018	621.5	34.7
MB17H1SW0025	4/04/2018	621.5	34.7
MB17H1SW0025	3/04/2018	621.5	34.7
MB17H1SW0025	2/04/2018	621.5	34.7
MB17H1SW0025	1/04/2018	621.5	34.7
MB17H1SW0025	31/03/2018	621.5	34.7
MB17H1SW0025	30/03/2018	621.5	34.7
MB17H1SW0025	28/03/2018	621.5	34.7
MB17H1SW0025	27/03/2018	621.5	34.7
MB17H1SW0025	5/09/2017	621.5	34.7
MB17H1SW0025	4/09/2017	621.5	34.7
MB17H1SW0025	3/09/2017	621.5	34.7
MB17H1SW0025	2/09/2017	621.5	34.7
MB17H1SW0025	1/09/2017	621.5	34.7
MB17H1SW0025	31/08/2017	621.5	34.7
MB17H1SW0025	30/08/2017	621.5	34.7
MB17H1SW0025	29/08/2017	621.5	34.7
MB17H1SW0025	28/08/2017	621.5	34.7
MB17H1SW0025	27/08/2017	621.5	34.7
MB17H1SW0025	26/08/2017	621.5	34.7
MB17H1SW0025	25/08/2017	621.5	34.7
MB17H1SW0025	24/08/2017	621.5	34.7
MB17H1SW0025	23/08/2017	621.5	34.7

ID	Date	WL mAHD	WL mbgl
MB15HD20002	4/01/2022	624.6	59.2
MB15HD20002	5/01/2022	624.6	59.2
MB15HD20002	6/01/2022	624.6	59.2
MB15HD20002	7/01/2022	624.6	59.2
MB15HD20002	8/01/2022	624.6	59.2
MB15HD20002	9/01/2022	624.6	59.2
MB15HD20002	10/01/2022	624.6	59.2
MB15HD20002	11/01/2022	624.6	59.1
MB15HD20002	12/01/2022	624.6	59.1
MB15HD20002	13/01/2022	624.6	59.2
MB15HD20002	14/01/2022	624.6	59.2
MB15HD20002	15/01/2022	624.5	59.2
MB15HD20002	16/01/2022	624.5	59.2
MB15HD20002	17/01/2022	624.6	59.2
MB15HD20002	18/01/2022	624.6	59.2
MB15HD20002	19/01/2022	624.6	59.2
MB15HD20002	20/01/2022	624.6	59.2
MB15HD20002	21/01/2022	624.6	59.2
MB15HD20002	22/01/2022	624.6	59.2
MB15HD20002	23/01/2022	624.5	59.3
MB15HD20002	24/01/2022	624.5	59.3
MB15HD20002	25/01/2022	624.5	59.3
MB15HD20002	26/01/2022	624.5	59.3
MB15HD20002	27/01/2022	624.5	59.3
MB15HD20002	28/01/2022	624.5	59.3
MB15HD20002	29/01/2022	624.5	59.2
MB15HD20002	30/01/2022	624.5	59.3
MB15HD20002	31/01/2022	624.5	59.3
MB15HD20002	1/02/2022	624.5	59.3
MB15HD20002	2/02/2022	624.5	59.2
MB15HD20002	3/02/2022	624.5	59.2
MB15HD20002	4/02/2022	624.5	59.2
MB15HD20002	5/02/2022	624.5	59.2
MB15HD20002	6/02/2022	624.5	59.3
MB15HD20002	7/02/2022	624.5	59.2
MB15HD20002	8/02/2022	624.5	59.2
MB15HD20002	9/02/2022	624.5	59.2
MB15HD20002	10/02/2022	624.5	59.2
MB15HD20002	11/02/2022	624.6	59.2
MB15HD20002	12/02/2022	624.5	59.2
MB15HD20002	13/02/2022	624.6	59.2
MB15HD20002	14/02/2022	624.6	59.2
MB15HD20002	15/02/2022	624.6	59.2
MB15HD20002	16/02/2022	624.6	59.2
MB15HD20002	17/02/2022	624.6	59.2
MB15HD20002	18/02/2022	624.6	59.2
MB15HD20002	19/02/2022	624.6	59.2
MB15HD20002	20/02/2022	624.6	59.2
MB15HD20002	21/02/2022	624.5	59.2
MB15HD20002	22/02/2022	624.5	59.2
MB15HD20002	23/02/2022	624.5	59.2
MB15HD20002	24/02/2022	624.5	59.2
MB15HD20002	25/02/2022	624.5	59.2
MB15HD20002	26/02/2022	624.5	59.2
MB15HD20002	27/02/2022	624.5	59.2
MB15HD20002	28/02/2022	624.5	59.2
MB15HD20002	1/03/2022	624.5	59.2
MB15HD20002	2/03/2022	624.5	59.2
MB15HD20002	3/03/2022	624.5	59.2
MB15HD20002	4/03/2022	624.6	59.2
MB15HD20002	5/03/2022	624.6	59.2
MB15HD20002	6/03/2022	624.6	59.2
MB15HD20002	7/03/2022	624.6	59.2
MB15HD20002	8/03/2022	624.6	59.2
MB15HD20002	9/03/2022	624.6	59.2
MB15HD20002	10/03/2022	624.6	59.2
MB15HD20002	11/03/2022	624.6	59.2
MB15HD20002	12/03/2022	624.6	59.2
MB15HD20002	13/03/2022	624.6	59.2
MB15HD20002	14/03/2022	624.6	59.2
MB15HD20003	4/02/2016	625.3	63.1
MB15HD20003	2/05/2016	625.3	63.1
MB15HD20003	30/10/2016	625.3	63.1
MB15HD20003	19/02/2017	625.3	63.1
MB15HD20003	14/05/2017	625.3	63.1
MB15HD20003	21/08/2017	625.3	63.1
MB15HD20003	9/11/2017	625.3	63.1
MB15HD20003	12/04/2018	625.3	63.1
MB15HD20003	21/11/2018	625.1	63.3
MB15HD20003	22/11/2018	625.1	63.3
MB15HD20003	23/11/2018	625.1	63.3
MB15HD20003	24/11/2018	625.1	63.3
MB15HD20003	25/11/2018	625.1	63.3
MB15HD20003	26/11/2018	625.1	63.3
MB15HD20003	27/11/2018	625.1	63.3
MB15HD20003	28/11/2018	625.1	63.3
MB15HD20003	29/11/2018	625.1	63.3
MB15HD20003	30/11/2018	625.1	63.3
MB15HD20003	1/12/2018	625.1	63.3
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MB15HD20003	3/12/2018	625.1	63.3
MB15HD20003	4/12/2018	625.2	63.3
MB15HD20003	5/12/2018	625.1	63.3
MB15HD20003	6/12/2018	625.1	63.3
MB15HD20003	7/12/2018	625.1	63.3
MB15HD20003	8/12/2018	625.1	63.3
MB15HD20003	9/12/2018	625.1	63.3
MB15HD20003	10/12/2018	625.1	63.3
MB15HD20003	11/12/2018	625.1	63.3
MB15HD20003	12/12/2018	625.1	63.3
MB15HD20003	13/12/2018	625.1	63.3
MB15HD20003	14/12/2018	625.1	63.3
MB15HD20003	15/12/2018	625.1	63.3
MB15HD20003	16/12/2018	625.1	63.3
MB15HD20003	17/12/2018	625.1	63.3
MB15HD20003	18/12/2018	625.1	63.3
MB15HD20003	19/12/2018	625.1	63.3
MB15HD20003	20/12/2018	625.2	63.3
MB15HD20003	21/12/2018	625.2	63.3
MB15HD20003	22/12/2018	625.2	63.3
MB15HD20003	23/12/2018	625.1	63.3
MB15HD20003	24/12/2018	625.1	63.3
MB15HD20003	25/12/2018	625.1	63.3
MB15HD20003	26/12/2018	625.1	63.3
MB15HD20003	27/12/2018	625.1	63.3
MB15HD20003	28/12/2018	625.1	63.3
MB15HD20003	29/12/2018	625.1	63.3
MB15HD20003	30/12/2018	625.1	63.3
MB15HD20003	31/12/2018	625.1	63.3
MB15HD20003	1/01/2019	625.1	63.3
MB15HD20003	2/01/2019	625.1	63.3
MB15HD20003	3/01/2019	625.1	63.3
MB15HD20003	4/01/2019	625.1	63.3
MB15HD20003	5/01/2019	625.2	63.3
MB15HD20003	6/01/2019	625.2	63.3
MB15HD20003	7/01/2019	625.2	63.3
MB15HD20003	8/01/2019	625.2	63.3
MB15HD20003	9/01/2019	625.1	63.3
MB15HD20003	10/01/2019	625.1	63.3
MB15HD20003	11/01/2019	625.1	63.3
MB15HD20003	12/01/2019	625.1	63.3
MB15HD20003	13/01/2019	625.1	63.3
MB15HD20003	14/01/2019	625.1	63.3
MB15HD20003	15/01/2019	625.1	63.3
MB15HD20003	16/01/2019	625.1	63.3
MB15HD20003	17/01/2019	625.1	63.3

ID	Date	WL mAHD	WL mbgl
MB18HD20006	26/12/2020	624.7	71.3
MB18HD20006	27/12/2020	624.7	71.3
MB18HD20006	28/12/2020	624.7	71.3
MB18HD20006	29/12/2020	624.7	71.3
MB18HD20006	30/12/2020	624.7	71.3
MB18HD20006	31/12/2020	624.7	71.3
MB18HD20006	1/01/2021	624.7	71.3
MB18HD20006	2/01/2021	624.7	71.3
MB18HD20006	3/01/2021	624.7	71.3
MB18HD20006	4/01/2021	624.7	71.3
MB18HD20006	5/01/2021	624.7	71.3
MB18HD20006	6/01/2021	624.7	71.2
MB18HD20006	7/01/2021	624.7	71.3
MB18HD20006	8/01/2021	624.7	71.3
MB18HD20006	9/01/2021	624.7	71.3
MB18HD20006	10/01/2021	624.7	71.3
MB18HD20006	11/01/2021	624.7	71.3
MB18HD20006	12/01/2021	624.7	71.3
MB18HD20006	13/01/2021	624.7	71.3
MB18HD20006	14/01/2021	624.7	71.3
MB18HD20006	15/01/2021	624.7	71.3
MB18HD20006	16/01/2021	624.7	71.3
MB18HD20006	17/01/2021	624.7	71.3
MB18HD20006	18/01/2021	624.7	71.3
MB18HD20006	19/01/2021	624.7	71.3
MB18HD20006	20/01/2021	624.7	71.3
MB18HD20006	21/01/2021	624.7	71.3
MB18HD20006	22/01/2021	624.7	71.3
MB18HD20006	23/01/2021	624.7	71.3
MB18HD20006	24/01/2021	624.7	71.3
MB18HD20006	25/01/2021	624.7	71.3
MB18HD20006	26/01/2021	624.6	71.3
MB18HD20006	27/01/2021	624.6	71.3
MB18HD20006	28/01/2021	624.6	71.3
MB18HD20006	29/01/2021	624.6	71.3
MB18HD20006	30/01/2021	624.7	71.3
MB18HD20006	31/01/2021	624.6	71.3
MB18HD20006	1/02/2021	624.6	71.3
MB18HD20006	2/02/2021	624.6	71.3
MB18HD20006	3/02/2021	624.6	71.3
MB18HD20006	4/02/2021	624.6	71.3
MB18HD20006	5/02/2021	624.6	71.3
MB18HD20006	6/02/2021	624.6	71.3
MB18HD20006	7/02/2021	624.6	71.3
MB18HD20006	8/02/2021	624.7	71.3
MB18HD20006	9/02/2021	624.6	71.3
MB18HD20006	10/02/2021	624.6	71.3
MB18HD20006	11/02/2021	624.6	71.3
MB18HD20006	12/02/2021	624.6	71.3
MB18HD20006	13/02/2021	624.7	71.3
MB18HD20006	14/02/2021	624.7	71.3
MB18HD20006	15/02/2021	624.7	71.3
MB18HD20006	16/02/2021	624.7	71.3
MB18HD20006	17/02/2021	624.7	71.3
MB18HD20006	18/02/2021	624.7	71.3
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MB18HD20006	20/02/2021	624.7	71.3
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MB18HD20006	24/02/2021	624.7	71.3
MB18HD20006	25/02/2021	624.7	71.3
MB18HD20006	26/02/2021	624.7	71.3
MB18HD20006	27/02/2021	624.7	71.3
MB18HD20006	28/02/2021	624.7	71.3
MB18HD20006	1/03/2021	624.7	71.3
MB18HD20006	2/03/2021	624.7	71.3
MB18HD20006	3/03/2021	624.7	71.3
MB18HD20006	4/03/2021	624.7	71.3
MB18HD20006	5/03/2021	624.7	71.3
MB18HD20006	6/03/2021	624.7	71.3
MB18HD20006	7/03/2021	624.7	71.3
MB18HD20006	8/03/2021	624.7	71.3
MB18HD20006	9/03/2021	624.7	71.3
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MB18HD20006	11/03/2021	624.7	71.3
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MB18HD20006	13/03/2021	624.7	71.2
MB18HD20006	14/03/2021	624.7	71.2
MB18HD20006	15/03/2021	624.7	71.2
MB18HD20006	16/03/2021	624.7	71.2
MB18HD20006	17/03/2021	624.7	71.2
MB18HD20006	18/03/2021	624.7	71.3
MB18HD20006	19/03/2021	624.7	71.3
MB18HD20006	20/03/2021	624.7	71.3
MB18HD20006	21/03/2021	624.7	71.3
MB18HD20006	22/03/2021	624.7	71.3
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	7/03/2011	191.3	494.9
HDVP1	6/03/2011	191.3	494.9
HDVP1	5/03/2011	191.3	494.9
HDVP1	4/03/2011	191.3	494.9
HDVP1	3/03/2011	191.3	494.9
HDVP1	2/03/2011	191.3	494.9
HDVP1	1/03/2011	191.3	494.9
HDVP1	28/02/2011	200.2	486.0
HDVP1	27/02/2011	200.2	486.0
HDVP1	26/02/2011	200.2	486.0
HDVP1	25/02/2011	200.2	486.0
HDVP1	24/02/2011	200.2	486.0
HDVP1	23/02/2011	200.2	486.0
HDVP1	22/02/2011	200.2	486.0
HDVP1	21/02/2011	200.2	486.0
HDVP1	20/02/2011	200.2	486.0
HDVP1	19/02/2011	200.2	486.0
HDVP1	18/02/2011	200.2	486.0
HDVP1	17/02/2011	200.2	486.0
HDVP1	16/02/2011	200.2	486.0
HDVP1	15/02/2011	200.2	486.0
HDVP1	14/02/2011	200.2	486.0
HDVP1	13/02/2011	200.2	486.0
HDVP1	12/02/2011	200.2	486.0
HDVP1	11/02/2011	200.2	486.0
HDVP1	10/02/2011	200.2	486.0
HDVP1	9/02/2011	200.2	486.0
HDVP1	8/02/2011	200.2	486.0
HDVP1	7/02/2011	200.2	486.0
HDVP1	6/02/2011	200.2	486.0
HDVP1	5/02/2011	200.2	486.0
HDVP1	4/02/2011	200.2	486.0
HDVP1	3/02/2011	200.2	486.0
HDVP1	2/02/2011	200.2	486.0
HDVP1	1/02/2011	200.2	486.0
HDVP1	31/01/2011	200.2	486.0
HDVP1	30/01/2011	200.2	486.0
HDVP1	29/01/2011	200.2	486.0
HDVP1	28/01/2011	200.2	486.0
HDVP1	27/01/2011	200.2	486.0
HDVP1	26/01/2011	200.2	486.0
HDVP1	25/01/2011	200.2	486.0
HDVP1	24/01/2011	200.2	486.0
HDVP1	23/01/2011	200.2	486.0
HDVP1	22/01/2011	200.2	486.0
HDVP1	21/01/2011	200.2	486.0
HDVP1	20/01/2011	200.2	486.0
HDVP1	19/01/2011	200.2	486.0
HDVP1	18/01/2011	200.2	486.0
HDVP1	17/01/2011	200.2	486.0
HDVP1	16/01/2011	200.2	486.0
HDVP1	15/01/2011	200.2	486.0
HDVP1	14/01/2011	200.2	486.0
HDVP1	13/01/2011	200.2	486.0
HDVP1	12/01/2011	200.2	486.0
HDVP1	11/01/2011	200.2	486.0
HDVP1	10/01/2011	200.2	486.0
HDVP1	9/01/2011	200.2	486.0
HDVP1	8/01/2011	200.2	486.0
HDVP1	7/01/2011	200.2	486.0
HDVP1	6/01/2011	200.2	486.0
HDVP1	5/01/2011	200.2	486.0
HDVP1	4/01/2011	200.2	486.0
HDVP1	3/01/2011	200.2	486.0
HDVP1	2/01/2011	200.2	486.0
HDVP1	1/01/2011	200.2	486.0
HDVP1	31/12/2010	236.6	449.5
HDVP1	30/12/2010	236.6	449.5
HDVP1	29/12/2010	236.6	449.5
HDVP1	28/12/2010	236.6	449.5
HDVP1	27/12/2010	236.6	449.5
HDVP1	26/12/2010	236.6	449.5
HDVP1	25/12/2010	236.6	449.5
HDVP1	24/12/2010	236.6	449.5
HDVP1	23/12/2010	236.6	449.5
HDVP1	22/12/2010	236.6	449.5
HDVP1	21/12/2010	236.6	449.5
HDVP1	20/12/2010	236.6	449.5
HDVP1	19/12/2010	236.6	449.5
HDVP1	18/12/2010	236.6	449.5
HDVP1	17/12/2010	236.6	449.5
HDVP1	16/12/2010	236.6	449.5
HDVP1	15/12/2010	236.6	449.5
HDVP1	14/12/2010	236.6	449.5
HDVP1	13/12/2010	236.6	449.5
HDVP1	12/12/2010	236.6	449.5
HDVP1	11/12/2010	236.6	449.5
HDVP1	10/12/2010	236.6	449.5
HDVP1	9/12/2010	236.6	449.5
HDVP1	8/12/2010	236.6	449.5
HDVP1	7/12/2010	236.6	449.5
HDVP1	6/12/2010	236.6	449.5
HDVP1	5/12/2010	236.6	449.5
HDVP1	4/12/2010	236.6	449.5
HDVP1	3/12/2010	236.6	449.5
HDVP1	2/12/2010	236.6	449.5
HDVP1	1/12/2010	236.6	449.5
HDVP1	30/11/2010	281.0	405.2
HDVP1	29/11/2010	281.0	405.2
HDVP1	28/11/2010	281.0	405.2
HDVP1	27/11/2010	281.0	405.2
HDVP1	26/11/2010	281.0	405.2
HDVP1	25/11/2010	281.0	405.2
HDVP1	24/11/2010	281.0	405.2
HDVP1	23/11/2010	281.0	405.2
HDVP1	22/11/2010	281.0	405.2
HDVP1	21/11/2010	281.0	405.2
HDVP1	20/11/2010	281.0	405.2
HDVP1	19/11/2010	281.0	405.2
HDVP1	18/11/2010	281.0	405.2
HDVP1	17/11/2010	281.0	405.2
HDVP1	16/11/2010	281.0	405.2
HDVP1	15/11/2010	281.0	405.2
HDVP1	14/11/2010	281.0	405.2
HDVP1	13/11/2010	281.0	405.2
HDVP1	12/11/2010	281.0	405.2
HDVP1	11/11/2010	281.0	405.2
HDVP1	10/11/2010	281.0	405.2
HDVP1	9/11/2010	281.0	405.2
HDVP1	8/11/2010	281.0	405.2
HDVP1	7/11/2010	281.0	405.2
HDVP1	6/11/2010	281.0	405.2
HDVP1	5/11/2010	281.0	405.2
HDVP1	4/11/2010	281.0	405.2
HDVP1	3/11/2010	281.0	405.2
HDVP1	2/11/2010	281.0	405.2
HDVP1	1/11/2010	281.0	405.2
HDVP1	31/10/2010	155.9	530.2
HDVP1	30/10/2010	155.9	530.2
HDVP1	29/10/2010	155.9	530.2
HDVP1	28/10/2010	155.9	530.2
HDVP1	27/10/2010	155.9	530.2
HDVP1	26/10/2010	155.9	530.2
HDVP1	25/10/2010	155.9	530.2
HDVP1	24/10/2010	155.9	530.2
HDVP1	23/10/2010	155.9	530.2

ID	Date	WL mAHD	WL mbgl
MB17H1SW0025	22/08/2017	621.5	34.7
MB17H1SW0025	21/08/2017	621.5	34.7
MB17H1SW0025	20/08/2017	621.5	34.7
MB17H1SW0025	19/08/2017	621.5	34.7
MB17H1SW0025	18/08/2017	621.5	34.7
MB17H1SW0025	17/08/2017	621.5	34.7
MB17H1SW0025	16/08/2017	621.5	34.7
MB17H1SW0025	15/08/2017	621.5	34.7
MB17H1SW0025	14/08/2017	621.5	34.7
MB17H1SW0025	13/08/2017	621.5	34.7
MB17H1SW0025	12/08/2017	621.5	34.7
MB17H1SW0025	11/08/2017	621.5	34.7
MB17H1SW0025	10/08/2017	621.5	34.7
MB17H1SW0025	9/08/2017	621.5	34.7
MB17H1SW0025	8/08/2017	621.5	34.7
MB17H1SW0025	7/08/2017	621.5	34.7
MB17H1SW0025	6/08/2017	621.5	34.7
MB17H1SW0025	5/08/2017	621.5	34.7
MB17H1SW0025	4/08/2017	621.5	34.7
MB17H1SW0025	3/08/2017	621.5	34.7
MB17H1SW0025	2/08/2017	621.5	34.7
MB17H1SW0025	1/08/2017	621.5	34.7
MB17H1SW0025	31/07/2017	621.5	34.7
MB17H1SW0025	30/07/2017	621.5	34.7
MB17H1SW0025	29/07/2017	621.5	34.7
MB17H1SW0025	28/07/2017	621.5	34.7
MB17H1SW0025	27/07/2017	621.5	34.7
MB17H1SW0025	26/07/2017	621.5	34.7
MB17H1SW0025	25/07/2017	621.5	34.7
MB17H1SW0025	24/07/2017	621.5	34.7
MB17H1SW0025	23/07/2017	621.5	34.7
MB17H1SW0025	22/07/2017	621.5	34.7
MB17H1SW0025	21/07/2017	621.5	34.7
MB17H1SW0025	20/07/2017	621.5	34.7
MB17H1SW0025	19/07/2017	621.5	34.7
MB17H1SW0025	18/07/2017	621.5	34.7
MB17H1SW0025	17/07/2017	621.5	34.7
MB17H1SW0025	11/07/2017	621.5	34.7
MB17H1SW0026	3/03/2022	620.7	35.7
MB17H1SW0026	2/03/2022	620.7	35.7
MB17H1SW0026	1/03/2022	620.7	35.7
MB17H1SW0026	28/02/2022	620.7	35.7
MB17H1SW0026	27/02/2022	620.7	35.7
MB17H1SW0026	26/02/2022	620.7	35.6
MB17H1SW0026	25/02/2022	620.7	35.6
MB17H1SW0026	24/02/2022	620.7	35.6
MB17H1SW0026	23/02/2022	620.7	35.6
MB17H1SW0026	22/02/2022	620.7	35.6
MB17H1SW0026	21/02/2022	620.7	35.6
MB17H1SW0026	20/02/2022	620.8	35.6
MB17H1SW0026	19/02/2022	620.8	35.6
MB17H1SW0026	18/02/2022	620.8	35.6
MB17H1SW0026	17/02/2022	620.8	35.6
MB17H1SW0026	16/02/2022	620.8	35.6
MB17H1SW0026	15/02/2022	620.8	35.6
MB17H1SW0026	14/02/2022	620.8	35.6
MB17H1SW0026	13/02/2022	620.8	35.6
MB17H1SW0026	12/02/2022	620.8	35.6
MB17H1SW0026	11/02/2022	620.8	35.6
MB17H1SW0026	10/02/2022	620.8	35.6
MB17H1SW0026	9/02/2022	620.8	35.6
MB17H1SW0026	8/02/2022	620.7	35.6
MB17H1SW0026	7/02/2022	620.7	35.6
MB17H1SW0026	6/02/2022	620.7	35.7
MB17H1SW0026	5/02/2022	620.7	35.7
MB17H1SW0026	4/02/2022	620.7	35.6
MB17H1SW0026	3/02/2022	620.6	35.8
MB17H1SW0026	2/02/2022	620.6	35.8
MB17H1SW0026	1/02/2022	620.5	35.9
MB17H1SW0026	31/01/2022	620.5	35.9
MB17H1SW0026	30/01/2022	620.6	35.8
MB17H1SW0026	29/01/2022	620.6	35.8
MB17H1SW0026	28/01/2022	620.6	35.8
MB17H1SW0026	27/01/2022	620.5	35.9
MB17H1SW0026	26/01/2022	620.5	35.9
MB17H1SW0026	25/01/2022	620.5	35.9
MB17H1SW0026	24/01/2022	620.5	35.9
MB17H1SW0026	23/01/2022	620.6	35.8
MB17H1SW0026	22/01/2022	620.6	35.8
MB17H1SW0026	21/01/2022	620.6	35.8
MB17H1SW0026	20/01/2022	620.6	35.8
MB17H1SW0026	19/01/2022	620.6	35.8
MB17H1SW0026	18/01/2022	620.6	35.8
MB17H1SW0026	17/01/2022	620.5	35.9
MB17H1SW0026	16/01/2022	620.5	35.9
MB17H1SW0026	15/01/2022	620.5	35.9
MB17H1SW0026	14/01/2022	620.5	35.9
MB17H1SW0026	13/01/2022	620.6	35.8
MB17H1SW0026	12/01/2022	620.6	35.8
MB17H1SW0026	11/01/2022	620.6	35.8
MB17H1SW0026	10/01/2022	620.6	35.8
MB17H1SW0026	9/01/2022	620.6	35.8
MB17H1SW0026	8/01/2022	620.6	35.8
MB17H1SW0026	7/01/2022	620.6	35.8
MB17H1SW0026	6/01/2022	620.6	35.8
MB17H1SW0026	5/01/2022	620.6	35.8
MB17H1SW0026	4/01/2022	620.5	35.8
MB17H1SW0026	3/01/2022	620.5	35.8
MB17H1SW0026	2/01/2022	620.5	35.8
MB17H1SW0026	1/01/2022	620.6	35.8
MB17H1SW0026	31/12/2021	620.5	35.9
MB17H1SW0026	30/12/2021	620.5	35.9
MB17H1SW0026	26/12/2021	620.6	35.8
MB17H1SW0026	25/12/2021	620.5	35.8
MB17H1SW0026	24/12/2021	620.5	35.9
MB17H1SW0026	23/12/2021	620.5	35.9
MB17H1SW0026	22/12/2021	620.5	35.9
MB17H1SW0026	21/12/2021	620.6	35.8
MB17H1SW0026	20/12/2021	620.6	35.8
MB17H1SW0026	19/12/2021	620.6	35.8
MB17H1SW0026	18/12/2021	620.6	35.8
MB17H1SW0026	17/12/2021	620.5	35.8
MB17H1SW0026	16/12/2021	620.5	35.8
MB17H1SW0026	15/12/2021	620.5	35.9
MB17H1SW0026	14/12/2021	620.5	35.9
MB17H1SW0026	13/12/2021	620.5	35.9
MB17H1SW0026	12/12/2021	620.5	35.8
MB17H1SW0026	11/12/2021	620.5	35.8
MB17H1SW0026	10/12/2021	620.5	35.9
MB17H1SW0026	9/12/2021	620.6	35.8
MB17H1SW0026	8/12/2021	620.6	35.8
MB17H1SW0026	7/12/2021	620.5	35.8
MB17H1SW0026	6/12/2021	620.5	35.8
MB17H1SW0026	5/12/2021	620.5	35.9
MB17H1SW0026	4/12/2021	620.5	35.9
MB17H1SW0026	3/12/2021	620.5	35.8
MB17H1SW0026	2/12/2021	620.5	35.8
MB17H1SW0026	1/12/2021	620.5	35.9
MB17H1SW0026	30/11/2021	620.5	35.9
MB17H1SW0026	29/11/2021	620.6	35.8
MB17H1SW0026	28/11/2021	620.6	35.8
MB17H1SW0026	27/11/2021	620.6	35.8
MB17H1SW0026	26/11/2021	620.6	35.8
MB17H1SW0026	25/11/2021	620.6	35.8
MB17H1SW0026	24/11/2021	620.6	35.8
MB17H1SW0026	23/11/2021	620.6	35.8

ID	Date	WL mAHD	WL mbgl
MB15HD20003	18/01/2019	625.1	63.3
MB15HD20003	19/01/2019	625.1	63.3
MB15HD20003	20/01/2019	625.1	63.3
MB15HD20003	21/01/2019	625.1	63.3
MB15HD20003	22/01/2019	625.1	63.3
MB15HD20003	23/01/2019	625.1	63.3
MB15HD20003	24/01/2019	625.1	63.3
MB15HD20003	25/01/2019	625.1	63.3
MB15HD20003	26/01/2019	625.1	63.3
MB15HD20003	27/01/2019	625.1	63.3
MB15HD20003	28/01/2019	625.1	63.3
MB15HD20003	29/01/2019	625.1	63.3
MB15HD20003	30/01/2019	625.1	63.3
MB15HD20003	31/01/2019	625.1	63.3
MB15HD20003	1/02/2019	625.1	63.3
MB15HD20003	2/02/2019	625.1	63.3
MB15HD20003	3/02/2019	625.1	63.3
MB15HD20003	4/02/2019	625.1	63.3
MB15HD20003	5/02/2019	625.1	63.3
MB15HD20003	6/02/2019	625.1	63.3
MB15HD20003	7/02/2019	625.1	63.3
MB15HD20003	8/02/2019	625.1	63.3
MB15HD20003	9/02/2019	625.1	63.3
MB15HD20003	10/02/2019	625.2	63.3
MB15HD20003	11/02/2019	625.1	63.3
MB15HD20003	12/02/2019	625.1	63.3
MB15HD20003	13/02/2019	625.2	63.3
MB15HD20003	14/02/2019	625.2	63.3
MB15HD20003	15/02/2019	625.2	63.3
MB15HD20003	16/02/2019	625.2	63.3
MB15HD20003	17/02/2019	625.1	63.3
MB15HD20003	18/02/2019	625.1	63.3
MB15HD20003	19/02/2019	625.1	63.3
MB15HD20003	20/02/2019	625.1	63.3
MB15HD20003	21/02/2019	625.2	63.3
MB15HD20003	22/02/2019	625.2	63.3
MB15HD20003	23/02/2019	625.2	63.3
MB15HD20003	24/02/2019	625.2	63.3
MB15HD20003	25/02/2019	625.2	63.3
MB15HD20003	26/02/2019	625.2	63.3
MB15HD20003	27/02/2019	625.2	63.3
MB15HD20003	28/02/2019	625.1	63.3
MB15HD20003	1/03/2019	625.1	63.3
MB15HD20003	2/03/2019	625.1	63.3
MB15HD20003	3/03/2019	625.2	63.3
MB15HD20003	4/03/2019	625.2	63.3
MB15HD20003	5/03/2019	625.2	63.3
MB15HD20003	6/03/2019	625.2	63.3
MB15HD20003	7/03/2019	625.1	63.3
MB15HD20003	8/03/2019	625.1	63.3
MB15HD20003	9/03/2019	625.2	63.3
MB15HD20003	10/03/2019	625.2	63.3
MB15HD20003	11/03/2019	625.2	63.3
MB15HD20003	12/03/2019	625.2	63.3
MB15HD20003	13/03/2019	625.2	63.3
MB15HD20003	14/03/2019	625.2	63.2
MB15HD20003	15/03/2019	625.2	63.3
MB15HD20003	16/03/2019	625.2	63.3
MB15HD20003	17/03/2019	625.1	63.3
MB15HD20003	18/03/2019	625.1	63.3
MB15HD20003	19/03/2019	625.1	63.3
MB15HD20003	20/03/2019	625.1	63.3
MB15HD20003	21/03/2019	625.1	63.3
MB15HD20003	22/03/2019	625.1	63.3
MB15HD20003	23/03/2019	625.1	63.3
MB15HD20003	24/03/2019	625.1	63.3
MB15HD20003	25/03/2019	625.1	63.3
MB15HD20003	26/03/2019	625.1	63.3
MB15HD20003	27/03/2019	625.2	63.3
MB15HD20003	28/03/2019	625.2	63.3
MB15HD20003	29/03/2019	625.1	63.3
MB15HD20003	30/03/2019	625.2	63.2
MB15HD20003	31/03/2019	625.2	63.2
MB15HD20003	1/04/2019	625.2	63.2
MB15HD20003	2/04/2019	625.2	63.2
MB15HD20003	3/04/2019	625.2	63.2
MB15HD20003	4/04/2019	625.2	63.2
MB15HD20003	5/04/2019	625.2	63.2
MB15HD20003	6/04/2019	625.2	63.2
MB15HD20003	7/04/2019	625.2	63.2
MB15HD20003	8/04/2019	625.2	63.3
MB15HD20003	9/04/2019	625.2	63.3
MB15HD20003	10/04/2019	625.2	63.3
MB15HD20003	11/04/2019	625.2	63.3
MB15HD20003	12/04/2019	625.2	63.3
MB15HD20003	13/04/2019	625.2	63.2
MB15HD20003	14/04/2019	625.2	63.3
MB15HD20003	15/04/2019	625.2	63.3
MB15HD20003	16/04/2019	625.2	63.3
MB15HD20003	17/04/2019	625.2	63.2
MB15HD20003	18/04/2019	625.2	63.2
MB15HD20003	19/04/2019	625.2	63.3
MB15HD20003	20/04/2019	625.2	63.2
MB15HD20003	21/04/2019	625.2	63.2
MB15HD20003	22/04/2019	625.2	63.2
MB15HD20003	23/04/2019	625.2	63.2
MB15HD20003	24/04/2019	625.2	63.2
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MB15HD20003	26/04/2019	625.2	63.2
MB15HD20003	27/04/2019	625.2	63.2
MB15HD20003	28/04/2019	625.2	63.2
MB15HD20003	29/04/2019	625.2	63.2
MB15HD20003	30/04/2019	625.2	63.2
MB15HD20003	1/05/2019	625.2	63.3
MB15HD20003	2/05/2019	625.2	63.2
MB15HD20003	3/05/2019	625.2	63.2
MB15HD20003	4/05/2019	625.2	63.2
MB15HD20003	5/05/2019	625.2	63.2
MB15HD20003	6/05/2019	625.2	63.2
MB15HD20003	7/05/2019	625.2	63.2
MB15HD20003	8/05/2019	625.2	63.2
MB15HD20003	9/05/2019	625.2	63.2
MB15HD20003	10/05/2019	625.2	63.2
MB15HD20003	11/05/2019	625.2	63.2
MB15HD20003	12/05/2019	625.2	63.2
MB15HD20003	13/05/2019	625.2	63.2
MB15HD20003	14/05/2019	625.2	63.2
MB15HD20003	15/05/2019	625.2	63.2
MB15HD20003	16/05/2019	625.2	63.2
MB15HD20003	17/05/2019	625.2	63.2
MB15HD20003	18/05/2019	625.2	63.2
MB15HD20003	19/05/2019	625.2	63.2
MB15HD20003	20/05/2019	625.2	63.2
MB15HD20003	21/05/2019	625.2	63.2
MB15HD20003	22/05/2019	625.2	63.2
MB15HD20003	23/05/2019	625.2	63.2
MB15HD20003	24/05/2019	625.2	63.2
MB15HD20003	25/05/2019	625.2	63.2
MB15HD20003	26/05/2019	625.2	63.2
MB15HD20003	27/05/2019	625.2	63.2
MB15HD20003	28/05/2019	625.2	63.2
MB15HD20003	29/05/2019	625.2	63.2
MB15HD20003	30/05/2019	625.2	63.2
MB15HD20003	31/05/2019	625.2	63.2
MB15HD20003	1/06/2019	625.2	63.2
MB15HD20003	2/06/2019	625.2	63.2

ID	Date	WL mAHD	WL mbgl
MB18HD20006	11/05/2021	624.7	71.2
MB18HD20006	12/05/2021	624.7	71.2
MB18HD20006	13/05/2021	624.7	71.2
MB18HD20006	14/05/2021	624.7	71.2
MB18HD20006	15/05/2021	624.8	71.2
MB18HD20006	16/05/2021	624.8	71.2
MB18HD20006	17/05/2021	624.8	71.2
MB18HD20006	18/05/2021	624.7	71.2
MB18HD20006	19/05/2021	624.7	71.2
MB18HD20006	20/05/2021	624.7	71.2
MB18HD20006	21/05/2021	624.8	71.2
MB18HD20006	22/05/2021	624.7	71.2
MB18HD20006	23/05/2021	624.7	71.3
MB18HD20006	24/05/2021	624.7	71.3
MB18HD20006	25/05/2021	624.7	71.2
MB18HD20006	26/05/2021	624.8	71.2
MB18HD20006	27/05/2021	624.8	71.2
MB18HD20006	28/05/2021	624.8	71.2
MB18HD20006	29/05/2021	624.7	71.2
MB18HD20006	30/05/2021	624.7	71.2
MB18HD20006	31/05/2021	624.7	71.3
MB18HD20006	1/06/2021	624.7	71.2
MB18HD20006	2/06/2021	624.7	71.2
MB18HD20006	3/06/2021	624.8	71.2
MB18HD20006	4/06/2021	624.8	71.2
MB18HD20006	5/06/2021	624.8	71.2
MB18HD20006	6/06/2021	624.7	71.2
MB18HD20006	7/06/2021	624.7	71.2
MB18HD20006	8/06/2021	624.8	71.2
MB18HD20006	9/06/2021	624.7	71.2
MB18HD20006	10/06/2021	624.7	71.2
MB18HD20006	11/06/2021	624.7	71.2
MB18HD20006	12/06/2021	624.7	71.2
MB18HD20006	13/06/2021	624.7	71.2
MB18HD20006	14/06/2021	624.7	71.2
MB18HD20006	15/06/2021	624.7	71.2
MB18HD20006	16/06/2021	624.7	71.2
MB18HD20006	17/06/2021	624.8	71.2
MB18HD20006	18/06/2021	624.8	71.2
MB18HD20006	19/06/2021	624.8	71.2
MB18HD20006	20/06/2021	624.8	71.2
MB18HD20006	21/06/2021	624.7	71.2
MB18HD20006	22/06/2021	624.7	71.2
MB18HD20006	23/06/2021	624.7	71.2
MB18HD20006	24/06/2021	624.8	71.2
MB18HD20006	25/06/2021	624.8	71.2
MB18HD20006	26/06/2021	624.8	71.2
MB18HD20006	27/06/2021	624.8	71.2
MB18HD20006	28/06/2021	624.7	71.2
MB18HD20006	29/06/2021	624.7	71.2
MB18HD20006	30/06/2021	624.7	71.2
MB18HD20006	1/07/2021	624.8	71.2
MB18HD20006	2/07/2021	624.8	71.2
MB18HD20006	3/07/2021	624.8	71.2
MB18HD20006	4/07/2021	624.8	71.2
MB18HD20006	5/07/2021	624.7	71.2
MB18HD20006	6/07/2021	624.7	71.2
MB18HD20006	7/07/2021	624.7	71.2
MB18HD20006	8/07/2021	624.7	71.2
MB18HD20006	9/07/2021	624.7	71.2
MB18HD20006	10/07/2021	624.7	71.2
MB18HD20006	11/07/2021	624.7	71.2
MB18HD20006	12/07/2021	624.7	71.2
MB18HD20006	13/07/2021	624.7	71.3
MB18HD20006	14/07/2021	624.7	71.3
MB18HD20006	15/07/2021	624.7	71.2
MB18HD20006	16/07/2021	624.7	71.2
MB18HD20006	17/07/2021	624.8	71.2
MB18HD20006	18/07/2021	624.7	71.2
MB18HD20006	19/07/2021	624.7	71.2
MB18HD20006	20/07/2021	624.7	71.2
MB18HD20006	21/07/2021	624.7	71.2
MB18HD20006	22/07/2021	624.7	71.2
MB18HD20006	23/07/2021	624.7	71.2
MB18HD20006	24/07/2021	624.7	71.2
MB18HD20006	25/07/2021	624.7	71.2
MB18HD20006	26/07/2021	624.7	71.2
MB18HD20006	27/07/2021	624.7	71.3
MB18HD20006	28/07/2021	624.7	71.3
MB18HD20006	29/07/2021	624.7	71.3
MB18HD20006	30/07/2021	624.7	71.3
MB18HD20006	31/07/2021	624.7	71.3
MB18HD20006	1/08/2021	624.7	71.2
MB18HD20006	2/08/2021	624.7	71.2
MB18HD20006	3/08/2021	624.8	71.2
MB18HD20006	4/08/2021	624.8	71.2
MB18HD20006	5/08/2021	624.8	71.2
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	22/10/2010	155.9	530.2
HDVP1	21/10/2010	155.9	530.2
HDVP1	20/10/2010	155.9	530.2
HDVP1	19/10/2010	155.9	530.2
HDVP1	18/10/2010	155.9	530.2
HDVP1	17/10/2010	155.9	530.2
HDVP1	16/10/2010	155.9	530.2
HDVP1	15/10/2010	155.9	530.2
HDVP1	14/10/2010	155.9	530.2
HDVP1	13/10/2010	155.9	530.2
HDVP1	12/10/2010	155.9	530.2
HDVP1	11/10/2010	155.9	530.2
HDVP1	10/10/2010	155.9	530.2
HDVP1	9/10/2010	155.9	530.2
HDVP1	8/10/2010	155.9	530.2
HDVP1	7/10/2010	155.9	530.2
HDVP1	6/10/2010	155.9	530.2
HDVP1	5/10/2010	155.9	530.2
HDVP1	4/10/2010	155.9	530.2
HDVP1	3/10/2010	155.9	530.2
HDVP1	2/10/2010	155.9	530.2
HDVP1	1/10/2010	155.9	530.2
HDVP1	30/09/2010	155.9	530.2
HDVP1	29/09/2010	137.8	548.4
HDVP1	28/09/2010	137.8	548.4
HDVP1	27/09/2010	137.8	548.4
HDVP1	26/09/2010	137.8	548.4
HDVP1	25/09/2010	137.8	548.4
HDVP1	24/09/2010	137.8	548.4
HDVP1	23/09/2010	137.8	548.4
HDVP1	22/09/2010	137.8	548.4
HDVP1	21/09/2010	137.8	548.4
HDVP1	20/09/2010	137.8	548.4
HDVP1	19/09/2010	137.8	548.4
HDVP1	18/09/2010	137.8	548.4
HDVP1	17/09/2010	137.8	548.4
HDVP1	16/09/2010	137.8	548.4
HDVP1	15/09/2010	137.8	548.4
HDVP1	14/09/2010	137.8	548.4
HDVP1	13/09/2010	137.8	548.4
HDVP1	12/09/2010	137.8	548.4
HDVP1	11/09/2010	137.8	548.4
HDVP1	10/09/2010	137.8	548.4
HDVP1	9/09/2010	137.8	548.4
HDVP1	8/09/2010	137.8	548.4
HDVP1	7/09/2010	137.8	548.4
HDVP1	6/09/2010	137.8	548.4
HDVP1	5/09/2010	137.8	548.4
HDVP1	4/09/2010	137.8	548.4
HDVP1	3/09/2010	137.8	548.4
HDVP1	2/09/2010	137.8	548.4
HDVP1	1/09/2010	137.8	548.4
HDVP1	31/08/2010	170.3	515.9
HDVP1	30/08/2010	170.3	515.9
HDVP1	29/08/2010	170.3	515.9
HDVP1	28/08/2010	170.3	515.9
HDVP1	27/08/2010	170.3	515.9
HDVP1	26/08/2010	170.3	515.9
HDVP1	25/08/2010	170.3	515.9
HDVP1	24/08/2010	170.3	515.9
HDVP1	23/08/2010	170.3	515.9
HDVP1	22/08/2010	170.3	515.9
HDVP1	21/08/2010	170.3	515.9
HDVP1	20/08/2010	170.3	515.9
HDVP1	19/08/2010	170.3	515.9
HDVP1	18/08/2010	170.3	515.9
HDVP1	17/08/2010	170.3	515.9
HDVP1	16/08/2010	170.3	515.9
HDVP1	15/08/2010	170.3	515.9
HDVP1	14/08/2010	170.3	515.9
HDVP1	13/08/2010	170.3	515.9
HDVP1	12/08/2010	170.3	515.9
HDVP1	11/08/2010	170.3	515.9
HDVP1	10/08/2010	170.3	515.9
HDVP1	9/08/2010	170.3	515.9
HDVP1	8/08/2010	170.3	515.9
HDVP1	7/08/2010	170.3	515.9
HDVP1	6/08/2010	170.3	515.9
HDVP1	5/08/2010	170.3	515.9
HDVP1	4/08/2010	170.3	515.9
HDVP1	3/08/2010	170.3	515.9
HDVP1	2/08/2010	170.3	515.9
HDVP1	1/08/2010	170.3	515.9
HDVP1	31/07/2010	155.5	530.7
HDVP1	30/07/2010	155.5	530.7
HDVP1	29/07/2010	155.5	530.7
HDVP1	28/07/2010	155.5	530.7
HDVP1	27/07/2010	155.5	530.7
HDVP1	26/07/2010	155.5	530.7
HDVP1	25/07/2010	155.5	530.7
HDVP1	24/07/2010	155.5	530.7
HDVP1	23/07/2010	155.5	530.7
HDVP1	22/07/2010	155.5	530.7
HDVP1	21/07/2010	155.5	530.7
HDVP1	20/07/2010	155.5	530.7
HDVP1	19/07/2010	155.5	530.7
HDVP1	18/07/2010	155.5	530.7
HDVP1	17/07/2010	155.5	530.7
HDVP1	16/07/2010	155.5	530.7
HDVP1	15/07/2010	155.5	530.7
HDVP1	14/07/2010	155.5	530.7
HDVP1	13/07/2010	155.5	530.7
HDVP1	12/07/2010	155.5	530.7
HDVP1	11/07/2010	155.5	530.7
HDVP1	10/07/2010	155.5	530.7
HDVP1	9/07/2010	155.5	530.7
HDVP1	8/07/2010	155.5	530.7
HDVP1	7/07/2010	155.5	530.7
HDVP1	6/07/2010	155.5	530.7
HDVP1	5/07/2010	155.5	530.7
HDVP1	4/07/2010	155.5	530.7
HDVP1	3/07/2010	155.5	530.7
HDVP1	2/07/2010	155.5	530.7
HDVP1	1/07/2010	155.5	530.7
HDVP1	30/06/2010	154.0	532.1
HDVP1	29/06/2010	154.0	532.1
HDVP1	28/06/2010	154.0	532.1
HDVP1	27/06/2010	154.0	532.1
HDVP1	26/06/2010	154.0	532.1
HDVP1	25/06/2010	154.0	532.1
HDVP1	24/06/2010	154.0	532.1
HDVP1	23/06/2010	154.0	532.1
HDVP1	22/06/2010	154.0	532.1
HDVP1	21/06/2010	154.0	532.1
HDVP1	20/06/2010	154.0	532.1
HDVP1	19/06/2010	154.0	532.1
HDVP1	18/06/2010	154.0	532.1
HDVP1	17/06/2010	154.0	532.1
HDVP1	16/06/2010	154.0	532.1
HDVP1	15/06/2010	154.0	532.1
HDVP1	14/06/2010	154.0	532.1
HDVP1	13/06/2010	154.0	532.1
HDVP1	12/06/2010	154.0	532.1
HDVP1	11/06/2010	154.0	532.1
HDVP1	10/06/2010	154.0	532.1
HDVP1	9/06/2010	154.0	532.1

ID	Date	WL mAHD	WL mbgl
MB17H1SW0026	22/11/2021	620.6	35.8
MB17H1SW0026	21/11/2021	620.6	35.8
MB17H1SW0026	20/11/2021	620.6	35.8
MB17H1SW0026	19/11/2021	620.5	35.9
MB17H1SW0026	18/11/2021	620.5	35.9
MB17H1SW0026	17/11/2021	620.6	35.8
MB17H1SW0026	16/11/2021	620.6	35.8
MB17H1SW0026	15/11/2021	620.5	35.8
MB17H1SW0026	14/11/2021	620.6	35.8
MB17H1SW0026	13/11/2021	620.6	35.8
MB17H1SW0026	12/11/2021	620.6	35.8
MB17H1SW0026	11/11/2021	620.6	35.8
MB17H1SW0026	10/11/2021	620.5	35.8
MB17H1SW0026	9/11/2021	620.5	35.9
MB17H1SW0026	8/11/2021	620.5	35.9
MB17H1SW0026	7/11/2021	620.5	35.9
MB17H1SW0026	6/11/2021	620.5	35.9
MB17H1SW0026	5/11/2021	620.5	35.8
MB17H1SW0026	4/11/2021	620.6	35.8
MB17H1SW0026	3/11/2021	620.6	35.8
MB17H1SW0026	2/11/2021	620.5	35.8
MB17H1SW0026	1/11/2021	620.5	35.9
MB17H1SW0026	31/10/2021	620.5	35.8
MB17H1SW0026	30/10/2021	620.5	35.8
MB17H1SW0026	29/10/2021	620.5	35.9
MB17H1SW0026	28/10/2021	620.5	35.8
MB17H1SW0026	27/10/2021	620.6	35.8
MB17H1SW0026	26/10/2021	620.5	35.9
MB17H1SW0026	25/10/2021	620.5	35.9
MB17H1SW0026	24/10/2021	620.6	35.8
MB17H1SW0026	23/10/2021	620.6	35.8
MB17H1SW0026	22/10/2021	620.6	35.8
MB17H1SW0026	21/10/2021	620.6	35.8
MB17H1SW0026	20/10/2021	620.6	35.8
MB17H1SW0026	19/10/2021	620.6	35.8
MB17H1SW0026	18/10/2021	620.5	35.8
MB17H1SW0026	17/10/2021	620.5	35.9
MB17H1SW0026	16/10/2021	620.5	35.9
MB17H1SW0026	15/10/2021	620.5	35.9
MB17H1SW0026	14/10/2021	620.5	35.9
MB17H1SW0026	13/10/2021	620.6	35.8
MB17H1SW0026	12/10/2021	620.5	35.8
MB17H1SW0026	11/10/2021	620.5	35.9
MB17H1SW0026	10/10/2021	620.5	35.8
MB17H1SW0026	9/10/2021	620.5	35.9
MB17H1SW0026	8/10/2021	620.5	35.9
MB17H1SW0026	7/10/2021	620.5	35.9
MB17H1SW0026	6/10/2021	620.5	35.9
MB17H1SW0026	5/10/2021	620.5	35.9
MB17H1SW0026	4/10/2021	620.5	35.9
MB17H1SW0026	3/10/2021	620.5	35.9
MB17H1SW0026	2/10/2021	620.5	35.9
MB17H1SW0026	1/10/2021	620.5	35.9
MB17H1SW0026	30/09/2021	620.5	35.9
MB17H1SW0026	29/09/2021	620.5	35.9
MB17H1SW0026	28/09/2021	620.5	35.9
MB17H1SW0026	27/09/2021	620.5	35.9
MB17H1SW0026	26/09/2021	620.5	35.9
MB17H1SW0026	25/09/2021	620.5	35.9
MB17H1SW0026	24/09/2021	620.5	35.9
MB17H1SW0026	23/09/2021	620.6	35.8
MB17H1SW0026	22/09/2021	620.6	35.8
MB17H1SW0026	21/09/2021	620.6	35.8
MB17H1SW0026	20/09/2021	620.6	35.8
MB17H1SW0026	19/09/2021	620.6	35.8
MB17H1SW0026	18/09/2021	620.6	35.8
MB17H1SW0026	17/09/2021	620.6	35.8
MB17H1SW0026	16/09/2021	620.5	35.9
MB17H1SW0026	15/09/2021	620.5	35.9
MB17H1SW0026	14/09/2021	620.5	35.9
MB17H1SW0026	13/09/2021	620.5	35.9
MB17H1SW0026	12/09/2021	620.5	35.9
MB17H1SW0026	11/09/2021	620.5	35.9
MB17H1SW0026	10/09/2021	620.5	35.9
MB17H1SW0026	9/09/2021	620.6	35.8
MB17H1SW0026	8/09/2021	620.6	35.8
MB17H1SW0026	7/09/2021	620.6	35.8
MB17H1SW0026	6/09/2021	620.6	35.8
MB17H1SW0026	5/09/2021	620.6	35.8
MB17H1SW0026	4/09/2021	620.6	35.8
MB17H1SW0026	3/09/2021	620.5	35.8
MB17H1SW0026	2/09/2021	620.5	35.9
MB17H1SW0026	1/09/2021	620.5	35.9
MB17H1SW0026	31/08/2021	620.5	35.9
MB17H1SW0026	30/08/2021	620.5	35.9
MB17H1SW0026	29/08/2021	620.5	35.9
MB17H1SW0026	28/08/2021	620.5	35.9
MB17H1SW0026	27/08/2021	620.5	35.9
MB17H1SW0026	26/08/2021	620.5	35.9
MB17H1SW0026	25/08/2021	620.5	35.9
MB17H1SW0026	24/08/2021	620.5	35.9
MB17H1SW0026	23/08/2021	620.5	35.9
MB17H1SW0026	22/08/2021	620.5	35.9
MB17H1SW0026	21/08/2021	620.5	35.9
MB17H1SW0026	20/08/2021	620.5	35.9
MB17H1SW0026	19/08/2021	620.5	35.9
MB17H1SW0026	18/08/2021	620.5	35.9
MB17H1SW0026	17/08/2021	620.5	35.9
MB17H1SW0026	16/08/2021	620.6	35.8
MB17H1SW0026	15/08/2021	620.5	35.9
MB17H1SW0026	14/08/2021	620.5	35.9
MB17H1SW0026	13/08/2021	620.5	35.9
MB17H1SW0026	12/08/2021	620.5	35.8
MB17H1SW0026	11/08/2021	620.6	35.8
MB17H1SW0026	10/08/2021	620.5	35.9
MB17H1SW0026	9/08/2021	620.5	35.9
MB17H1SW0026	8/08/2021	620.5	35.9
MB17H1SW0026	7/08/2021	620.5	35.9
MB17H1SW0026	6/08/2021	620.5	35.9
MB17H1SW0026	5/08/2021	620.5	35.8
MB17H1SW0026	4/08/2021	620.5	35.8
MB17H1SW0026	3/08/2021	620.5	35.9
MB17H1SW0026	2/08/2021	620.5	35.9
MB17H1SW0026	1/08/2021	620.5	35.9
MB17H1SW0026	31/07/2021	620.5	35.9
MB17H1SW0026	30/07/2021	620.4	36.0
MB17H1SW0026	29/07/2021	620.4	36.0
MB17H1SW0026	28/07/2021	620.4	36.0
MB17H1SW0026	27/07/2021	620.4	36.0
MB17H1SW0026	26/07/2021	620.4	36.0
MB17H1SW0026	25/07/2021	620.5	35.9
MB17H1SW0026	24/07/2021	620.5	35.9
MB17H1SW0026	23/07/2021	620.4	35.9
MB17H1SW0026	22/07/2021	620.4	36.0
MB17H1SW0026	21/07/2021	620.4	35.9
MB17H1SW0026	20/07/2021	620.4	35.9
MB17H1SW0026	19/07/2021	620.4	35.9
MB17H1SW0026	18/07/2021	620.4	36.0
MB17H1SW0026	17/07/2021	620.5	35.9
MB17H1SW0026	16/07/2021	620.5	35.9
MB17H1SW0026	15/07/2021	620.5	35.9
MB17H1SW0026	14/07/2021	620.4	36.0
MB17H1SW0026	13/07/2021	620.4	36.0
MB17H1SW0026	12/07/2021	620.4	36.0
MB17H1SW0026	11/07/2021	620.4	36.0
MB17H1SW0026	10/07/2021	620.4	36.0

ID	Date	WL mAHD	WL mbgl
MB15HD20003	3/06/2019	625.2	63.2
MB15HD20003	4/06/2019	625.2	63.2
MB15HD20003	5/06/2019	625.2	63.2
MB15HD20003	6/06/2019	625.2	63.2
MB15HD20003	7/06/2019	625.2	63.2
MB15HD20003	8/06/2019	625.2	63.2
MB15HD20003	9/06/2019	625.2	63.2
MB15HD20003	10/06/2019	625.2	63.2
MB15HD20003	11/06/2019	625.2	63.3
MB15HD20003	12/06/2019	625.2	63.2
MB15HD20003	13/06/2019	625.2	63.2
MB15HD20003	14/06/2019	625.2	63.2
MB15HD20003	15/06/2019	625.2	63.2
MB15HD20003	16/06/2019	625.2	63.2
MB15HD20003	17/06/2019	625.2	63.2
MB15HD20003	18/06/2019	625.2	63.2
MB15HD20003	19/06/2019	625.2	63.2
MB15HD20003	20/06/2019	625.2	63.2
MB15HD20003	21/06/2019	625.2	63.2
MB15HD20003	22/06/2019	625.2	63.2
MB15HD20003	23/06/2019	625.2	63.2
MB15HD20003	24/06/2019	625.2	63.2
MB15HD20003	25/06/2019	625.2	63.2
MB15HD20003	26/06/2019	625.2	63.2
MB15HD20003	27/06/2019	625.2	63.2
MB15HD20003	28/06/2019	625.2	63.2
MB15HD20003	29/06/2019	625.2	63.2
MB15HD20003	30/06/2019	625.2	63.2
MB15HD20003	1/07/2019	625.2	63.2
MB15HD20003	2/07/2019	625.2	63.2
MB15HD20003	3/07/2019	625.2	63.2
MB15HD20003	4/07/2019	625.2	63.2
MB15HD20003	5/07/2019	625.2	63.2
MB15HD20003	6/07/2019	625.2	63.2
MB15HD20003	7/07/2019	625.2	63.2
MB15HD20003	8/07/2019	625.2	63.2
MB15HD20003	9/07/2019	625.2	63.2
MB15HD20003	10/07/2019	625.2	63.2
MB15HD20003	11/07/2019	625.2	63.2
MB15HD20003	12/07/2019	625.2	63.2
MB15HD20003	13/07/2019	625.2	63.2
MB15HD20003	14/07/2019	625.2	63.2
MB15HD20003	15/07/2019	625.2	63.2
MB15HD20003	16/07/2019	625.2	63.2
MB15HD20003	17/07/2019	625.2	63.2
MB15HD20003	18/07/2019	625.2	63.2
MB15HD20003	19/07/2019	625.2	63.2
MB15HD20003	20/07/2019	625.2	63.2
MB15HD20003	21/07/2019	625.2	63.2
MB15HD20003	22/07/2019	625.2	63.2
MB15HD20003	23/07/2019	625.2	63.2
MB15HD20003	24/07/2019	625.2	63.2
MB15HD20003	25/07/2019	625.2	63.2
MB15HD20003	26/07/2019	625.2	63.2
MB15HD20003	27/07/2019	625.2	63.2
MB15HD20003	28/07/2019	625.2	63.2
MB15HD20003	29/07/2019	625.2	63.2
MB15HD20003	30/07/2019	625.2	63.2
MB15HD20003	31/07/2019	625.2	63.2
MB15HD20003	1/08/2019	625.2	63.2
MB15HD20003	2/08/2019	625.2	63.2
MB15HD20003	3/08/2019	625.2	63.2
MB15HD20003	4/08/2019	625.2	63.2
MB15HD20003	5/08/2019	625.2	63.2
MB15HD20003	6/08/2019	625.2	63.2
MB15HD20003	7/08/2019	625.2	63.2
MB15HD20003	8/08/2019	625.2	63.2
MB15HD20003	9/08/2019	625.2	63.2
MB15HD20003	10/08/2019	625.2	63.2
MB15HD20003	11/08/2019	625.2	63.2
MB15HD20003	12/08/2019	625.2	63.2
MB15HD20003	13/08/2019	625.2	63.2
MB15HD20003	14/08/2019	625.2	63.2
MB15HD20003	15/08/2019	625.2	63.2
MB15HD20003	16/08/2019	625.2	63.2
MB15HD20003	17/08/2019	625.2	63.2
MB15HD20003	18/08/2019	625.2	63.2
MB15HD20003	19/08/2019	625.2	63.2
MB15HD20003	20/08/2019	625.2	63.2
MB15HD20003	21/08/2019	625.2	63.2
MB15HD20003	22/08/2019	625.2	63.2
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MB15HD20003	24/08/2019	625.2	63.2
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MB15HD20003	26/08/2019	625.2	63.3
MB15HD20003	27/08/2019	625.2	63.3
MB15HD20003	28/08/2019	625.2	63.2
MB15HD20003	29/08/2019	625.2	63.2
MB15HD20003	30/08/2019	625.2	63.3
MB15HD20003	31/08/2019	625.2	63.3
MB15HD20003	1/09/2019	625.2	63.3
MB15HD20003	2/09/2019	625.2	63.3
MB15HD20003	3/09/2019	625.2	63.3
MB15HD20003	4/09/2019	625.2	63.3
MB15HD20003	5/09/2019	625.1	63.3
MB15HD20003	6/09/2019	625.1	63.3
MB15HD20003	7/09/2019	625.2	63.3
MB15HD20003	8/09/2019	625.2	63.3
MB15HD20003	9/09/2019	625.2	63.3
MB15HD20003	10/09/2019	625.2	63.2
MB15HD20003	11/09/2019	625.2	63.2
MB15HD20003	12/09/2019	625.2	63.2
MB15HD20003	13/09/2019	625.2	63.2
MB15HD20003	14/09/2019	625.2	63.2
MB15HD20003	15/09/2019	625.2	63.2
MB15HD20003	16/09/2019	625.2	63.3
MB15HD20003	17/09/2019	625.2	63.3
MB15HD20003	18/09/2019	625.2	63.3
MB15HD20003	19/09/2019	625.1	63.3
MB15HD20003	20/09/2019	625.2	63.3
MB15HD20003	21/09/2019	625.2	63.2
MB15HD20003	22/09/2019	625.2	63.2
MB15HD20003	23/09/2019	625.2	63.2
MB15HD20003	24/09/2019	625.2	63.2
MB15HD20003	25/09/2019	625.2	63.2
MB15HD20003	26/09/2019	625.2	63.3
MB15HD20003	27/09/2019	625.2	63.3
MB15HD20003	28/09/2019	625.2	63.3
MB15HD20003	29/09/2019	625.2	63.3
MB15HD20003	30/09/2019	625.1	63.3
MB15HD20003	1/10/2019	625.2	63.3
MB15HD20003	2/10/2019	625.2	63.3
MB15HD20003	3/10/2019	625.1	63.3
MB15HD20003	4/10/2019	625.1	63.3
MB15HD20003	5/10/2019	625.1	63.3
MB15HD20003	6/10/2019	625.1	63.3
MB15HD20003	7/10/2019	625.1	63.3
MB15HD20003	8/10/2019	625.1	63.3
MB15HD20003	9/10/2019	625.1	63.3
MB15HD20003	10/10/2019	625.1	63.3
MB15HD20003	11/10/2019	625.1	63.3
MB15HD20003	12/10/2019	625.1	63.3
MB15HD20003	13/10/2019	625.1	63.3
MB15HD20003	14/10/2019	625.1	63.3
MB15HD20003	15/10/2019	625.1	63.3
MB15HD20003	16/10/2019	625.1	63.3

ID	Date	WL mAHD	WL mbgl
MB18HD20006	24/09/2021	624.7	71.2
MB18HD20006	25/09/2021	624.7	71.3
MB18HD20006	26/09/2021	624.7	71.3
MB18HD20006	27/09/2021	624.7	71.3
MB18HD20006	28/09/2021	624.7	71.3
MB18HD20006	29/09/2021	624.7	71.3
MB18HD20006	30/09/2021	624.7	71.3
MB18HD20006	1/10/2021	624.7	71.3
MB18HD20006	2/10/2021	624.7	71.3
MB18HD20006	3/10/2021	624.7	71.3
MB18HD20006	4/10/2021	624.7	71.3
MB18HD20006	5/10/2021	624.7	71.3
MB18HD20006	6/10/2021	624.7	71.3
MB18HD20006	7/10/2021	624.7	71.3
MB18HD20006	8/10/2021	624.7	71.3
MB18HD20006	9/10/2021	624.7	71.3
MB18HD20006	10/10/2021	624.7	71.3
MB18HD20006	11/10/2021	624.7	71.3
MB18HD20006	12/10/2021	624.7	71.3
MB18HD20006	13/10/2021	624.7	71.3
MB18HD20006	14/10/2021	624.7	71.3
MB18HD20006	15/10/2021	624.7	71.3
MB18HD20006	16/10/2021	624.7	71.3
MB18HD20006	17/10/2021	624.7	71.3
MB18HD20006	18/10/2021	624.7	71.3
MB18HD20006	19/10/2021	624.7	71.3
MB18HD20006	20/10/2021	624.7	71.3
MB18HD20006	21/10/2021	624.7	71.3
MB18HD20006	22/10/2021	624.7	71.3
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MB18HD20006	24/10/2021	624.7	71.3
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MB18HD20006	28/10/2021	624.7	71.3
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MB18HD20006	2/11/2021	624.7	71.3
MB18HD20006	3/11/2021	624.7	71.3
MB18HD20006	4/11/2021	624.7	71.3
MB18HD20006	5/11/2021	624.7	71.3
MB18HD20006	6/11/2021	624.7	71.3
MB18HD20006	7/11/2021	624.6	71.3
MB18HD20006	9/11/2021	624.6	71.3
MB18HD20006	10/11/2021	624.6	71.3
MB18HD20006	11/11/2021	624.7	71.3
MB18HD20006	12/11/2021	624.7	71.3
MB18HD20006	13/11/2021	624.7	71.3
MB18HD20006	14/11/2021	624.7	71.3
MB18HD20006	15/11/2021	624.7	71.3
MB18HD20006	16/11/2021	624.7	71.3
MB18HD20006	17/11/2021	624.7	71.3
MB18HD20006	18/11/2021	624.7	71.3
MB18HD20006	19/11/2021	624.6	71.3
MB18HD20006	20/11/2021	624.6	71.3
MB18HD20006	21/11/2021	624.7	71.3
MB18HD20006	22/11/2021	624.7	71.3
MB18HD20006	23/11/2021	624.7	71.3
MB18HD20006	24/11/2021	624.7	71.3
MB18HD20006	25/11/2021	624.7	71.3
MB18HD20006	26/11/2021	624.7	71.3
MB18HD20006	27/11/2021	624.7	71.3
MB18HD20006	28/11/2021	624.7	71.3
MB18HD20006	29/11/2021	624.7	71.3
MB18HD20006	30/11/2021	624.6	71.3
MB18HD20006	1/12/2021	624.6	71.3
MB18HD20006	2/12/2021	624.6	71.3
MB18HD20006	3/12/2021	624.6	71.3
MB18HD20006	4/12/2021	624.6	71.3
MB18HD20006	5/12/2021	624.6	71.3
MB18HD20006	6/12/2021	624.6	71.3
MB18HD20006	7/12/2021	624.6	71.3
MB18HD20006	8/12/2021	624.7	71.3
MB18HD20006	9/12/2021	624.6	71.3
MB18HD20006	10/12/2021	624.6	71.3
MB18HD20006	11/12/2021	624.6	71.3
MB18HD20006	12/12/2021	624.6	71.3
MB18HD20006	13/12/2021	624.6	71.3
MB18HD20006	14/12/2021	624.6	71.3
MB18HD20006	15/12/2021	624.6	71.3
MB18HD20006	16/12/2021	624.6	71.3
MB18HD20006	17/12/2021	624.6	71.3
MB18HD20006	18/12/2021	624.6	71.3
MB18HD20006	19/12/2021	624.7	71.3
MB18HD20006	20/12/2021	624.7	71.3
MB18HD20006	23/01/2022	624.7	71.3
MB18HD20006	25/01/2022	624.6	71.3
MB18HD20006	26/01/2022	624.6	71.3
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	8/06/2010	154.0	532.1
HDVP1	7/06/2010	154.0	532.1
HDVP1	6/06/2010	154.0	532.1
HDVP1	5/06/2010	154.0	532.1
HDVP1	4/06/2010	154.0	532.1
HDVP1	3/06/2010	154.0	532.1
HDVP1	2/06/2010	154.0	532.1
HDVP1	1/06/2010	154.0	532.1
HDVP1	31/05/2010	319.6	366.6
HDVP1	30/05/2010	319.6	366.6
HDVP1	29/05/2010	319.6	366.6
HDVP1	28/05/2010	319.6	366.6
HDVP1	27/05/2010	319.6	366.6
HDVP1	26/05/2010	319.6	366.6
HDVP1	25/05/2010	319.6	366.6
HDVP1	24/05/2010	319.6	366.6
HDVP1	23/05/2010	319.6	366.6
HDVP1	22/05/2010	319.6	366.6
HDVP1	21/05/2010	319.6	366.6
HDVP1	20/05/2010	319.6	366.6
HDVP1	19/05/2010	319.6	366.6
HDVP1	18/05/2010	319.6	366.6
HDVP1	17/05/2010	319.6	366.6
HDVP1	16/05/2010	319.6	366.6
HDVP1	15/05/2010	319.6	366.6
HDVP1	14/05/2010	319.6	366.6
HDVP1	13/05/2010	319.6	366.6
HDVP1	12/05/2010	319.6	366.6
HDVP1	11/05/2010	319.6	366.6
HDVP1	10/05/2010	319.6	366.6
HDVP1	9/05/2010	319.6	366.6
HDVP1	8/05/2010	319.6	366.6
HDVP1	7/05/2010	319.6	366.6
HDVP1	6/05/2010	319.6	366.6
HDVP1	5/05/2010	319.6	366.6
HDVP1	4/05/2010	319.6	366.6
HDVP1	3/05/2010	319.6	366.6
HDVP1	2/05/2010	319.6	366.6
HDVP1	1/05/2010	319.6	366.6
HDVP1	30/04/2010	257.2	429.0
HDVP1	29/04/2010	257.2	429.0
HDVP1	28/04/2010	257.2	429.0
HDVP1	27/04/2010	257.2	429.0
HDVP1	26/04/2010	257.2	429.0
HDVP1	25/04/2010	257.2	429.0
HDVP1	24/04/2010	257.2	429.0
HDVP1	23/04/2010	257.2	429.0
HDVP1	22/04/2010	257.2	429.0
HDVP1	21/04/2010	257.2	429.0
HDVP1	20/04/2010	257.2	429.0
HDVP1	19/04/2010	257.2	429.0
HDVP1	18/04/2010	257.2	429.0
HDVP1	17/04/2010	257.2	429.0
HDVP1	16/04/2010	257.2	429.0
HDVP1	15/04/2010	257.2	429.0
HDVP1	14/04/2010	257.2	429.0
HDVP1	13/04/2010	257.2	429.0
HDVP1	12/04/2010	257.2	429.0
HDVP1	11/04/2010	257.2	429.0
HDVP1	10/04/2010	257.2	429.0
HDVP1	9/04/2010	257.2	429.0
HDVP1	8/04/2010	257.2	429.0
HDVP1	7/04/2010	257.2	429.0
HDVP1	6/04/2010	257.2	429.0
HDVP1	5/04/2010	257.2	429.0
HDVP1	4/04/2010	257.2	429.0
HDVP1	3/04/2010	257.2	429.0
HDVP1	2/04/2010	257.2	429.0
HDVP1	1/04/2010	257.2	429.0
HDVP1	31/03/2010	257.2	429.0
HDVP1	30/03/2010	257.2	429.0
HDVP1	29/03/2010	137.7	548.4
HDVP1	28/03/2010	137.7	548.4
HDVP1	27/03/2010	137.7	548.4
HDVP1	26/03/2010	137.7	548.4
HDVP1	25/03/2010	137.7	548.4
HDVP1	24/03/2010	137.7	548.4
HDVP1	23/03/2010	137.7	548.4
HDVP1	22/03/2010	137.7	548.4
HDVP1	21/03/2010	137.7	548.4
HDVP1	20/03/2010	137.7	548.4
HDVP1	19/03/2010	137.7	548.4
HDVP1	18/03/2010	137.7	548.4
HDVP1	17/03/2010	137.7	548.4
HDVP1	16/03/2010	137.7	548.4
HDVP1	15/03/2010	137.7	548.4
HDVP1	14/03/2010	137.7	548.4
HDVP1	13/03/2010	137.7	548.4
HDVP1	12/03/2010	137.7	548.4
HDVP1	11/03/2010	137.7	548.4
HDVP1	10/03/2010	137.7	548.4
HDVP1	9/03/2010	137.7	548.4
HDVP1	8/03/2010	137.7	548.4
HDVP1	7/03/2010	137.7	548.4
HDVP1	6/03/2010	137.7	548.4
HDVP1	5/03/2010	137.7	548.4
HDVP1	4/03/2010	137.7	548.4
HDVP1	3/03/2010	137.7	548.4
HDVP1	2/03/2010	137.7	548.4
HDVP1	1/03/2010	137.7	548.4
HDVP1	28/02/2010	139.6	546.5
HDVP1	27/02/2010	139.6	546.5
HDVP1	26/02/2010	139.6	546.5
HDVP1	25/02/2010	139.6	546.5
HDVP1	24/02/2010	139.6	546.5
HDVP1	23/02/2010	139.6	546.5
HDVP1	22/02/2010	139.6	546.5
HDVP1	21/02/2010	139.6	546.5
HDVP1	20/02/2010	139.6	546.5
HDVP1	19/02/2010	139.6	546.5
HDVP1	18/02/2010	139.6	546.5
HDVP1	17/02/2010	139.6	546.5
HDVP1	16/02/2010	139.6	546.5
HDVP1	15/02/2010	139.6	546.5
HDVP1	14/02/2010	139.6	546.5
HDVP1	13/02/2010	139.6	546.5
HDVP1	12/02/2010	139.6	546.5
HDVP1	11/02/2010	139.6	546.5
HDVP1	10/02/2010	139.6	546.5
HDVP1	9/02/2010	139.6	546.5
HDVP1	8/02/2010	139.6	546.5
HDVP1	7/02/2010	3.3	682.8
HDVP1	6/02/2010	3.3	682.8
HDVP1	5/02/2010	3.3	682.8
HDVP1	4/02/2010	3.3	682.8
HDVP1	3/02/2010	3.3	682.8
HDVP1	2/02/2010	3.3	682.8
HDVP1	1/02/2010	3.3	682.8
HDVP1	31/01/2010	3.3	682.8
HDVP1	30/01/2010	3.3	682.8
HDVP1	29/01/2010	3.3	682.8
HDVP1	28/01/2010	3.3	682.8
HDVP1	27/01/2010	3.3	682.8
HDVP1	26/01/2010	3.3	682.8
HDVP1	25/01/2010	3.3	682.8
HDVP1	24/01/2010	3.3	682.8

ID	Date	WL mAHD	WL mbgl
MB17H1SW0026	9/07/2021	620.4	36.0
MB17H1SW0026	8/07/2021	620.4	36.0
MB17H1SW0026	7/07/2021	620.4	36.0
MB17H1SW0026	6/07/2021	620.4	36.0
MB17H1SW0026	5/07/2021	620.4	36.0
MB17H1SW0026	4/07/2021	620.4	36.0
MB17H1SW0026	3/07/2021	620.4	36.0
MB17H1SW0026	2/07/2021	620.4	36.0
MB17H1SW0026	1/07/2021	620.4	36.0
MB17H1SW0026	30/06/2021	620.4	36.0
MB17H1SW0026	29/06/2021	620.4	36.0
MB17H1SW0026	28/06/2021	620.4	36.0
MB17H1SW0026	27/06/2021	620.4	36.0
MB17H1SW0026	26/06/2021	620.4	36.0
MB17H1SW0026	25/06/2021	620.4	36.0
MB17H1SW0026	24/06/2021	620.4	36.0
MB17H1SW0026	23/06/2021	620.4	36.0
MB17H1SW0026	22/06/2021	620.4	36.0
MB17H1SW0026	21/06/2021	620.3	36.0
MB17H1SW0026	20/06/2021	620.3	36.0
MB17H1SW0026	19/06/2021	620.4	36.0
MB17H1SW0026	18/06/2021	620.4	36.0
MB17H1SW0026	17/06/2021	620.4	36.0
MB17H1SW0026	16/06/2021	620.4	36.0
MB17H1SW0026	15/06/2021	620.4	36.0
MB17H1SW0026	14/06/2021	620.3	36.0
MB17H1SW0026	13/06/2021	620.3	36.0
MB17H1SW0026	12/06/2021	620.3	36.1
MB17H1SW0026	11/06/2021	620.3	36.1
MB17H1SW0026	10/06/2021	620.3	36.1
MB17H1SW0026	9/06/2021	620.3	36.1
MB17H1SW0026	8/06/2021	620.3	36.0
MB17H1SW0026	7/06/2021	620.3	36.0
MB17H1SW0026	6/06/2021	620.3	36.1
MB17H1SW0026	5/06/2021	620.3	36.1
MB17H1SW0026	4/06/2021	620.3	36.0
MB17H1SW0026	3/06/2021	620.3	36.0
MB17H1SW0026	2/06/2021	620.3	36.1
MB17H1SW0026	1/06/2021	620.3	36.1
MB17H1SW0026	31/05/2021	620.3	36.1
MB17H1SW0026	30/05/2021	620.3	36.1
MB17H1SW0026	29/05/2021	620.5	35.8
MB17H1SW0026	28/05/2021	620.6	35.8
MB17H1SW0026	28/11/2020	620.6	35.8
MB17H1SW0026	24/07/2020	620.6	35.8
MB17H1SW0026	23/07/2020	620.5	35.9
MB17H1SW0026	22/07/2020	620.5	35.9
MB17H1SW0026	21/07/2020	620.5	35.9
MB17H1SW0026	20/07/2020	620.5	35.9
MB17H1SW0026	18/07/2020	620.5	35.9
MB17H1SW0026	17/07/2020	620.5	35.9
MB17H1SW0026	16/07/2020	620.5	35.9
MB17H1SW0026	15/07/2020	620.5	35.9
MB17H1SW0026	14/07/2020	620.5	35.9
MB17H1SW0026	13/07/2020	620.5	35.9
MB17H1SW0026	12/07/2020	620.5	35.9
MB17H1SW0026	11/07/2020	620.5	35.9
MB17H1SW0026	10/07/2020	620.5	35.9
MB17H1SW0026	9/07/2020	620.5	35.9
MB17H1SW0026	8/07/2020	620.5	35.9
MB17H1SW0026	7/07/2020	620.5	35.9
MB17H1SW0026	6/07/2020	620.5	35.9
MB17H1SW0026	5/07/2020	620.5	35.9
MB17H1SW0026	4/07/2020	620.5	35.9
MB17H1SW0026	3/07/2020	620.5	35.9
MB17H1SW0026	2/07/2020	620.4	35.9
MB17H1SW0026	1/07/2020	620.4	36.0
MB17H1SW0026	30/06/2020	620.4	36.0
MB17H1SW0026	29/06/2020	620.4	36.0
MB17H1SW0026	28/06/2020	620.4	36.0
MB17H1SW0026	27/06/2020	620.4	36.0
MB17H1SW0026	26/06/2020	620.4	36.0
MB17H1SW0026	25/06/2020	620.4	36.0
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MB17H1SW0026	22/06/2020	620.4	36.0
MB17H1SW0026	21/06/2020	620.4	36.0
MB17H1SW0026	20/06/2020	620.4	36.0
MB17H1SW0026	19/06/2020	620.4	36.0
MB17H1SW0026	18/06/2020	620.4	36.0
MB17H1SW0026	17/06/2020	620.4	36.0
MB17H1SW0026	16/06/2020	620.4	36.0
MB17H1SW0026	15/06/2020	620.4	36.0
MB17H1SW0026	14/06/2020	620.4	36.0
MB17H1SW0026	13/06/2020	620.3	36.0
MB17H1SW0026	12/06/2020	620.3	36.1
MB17H1SW0026	11/06/2020	620.3	36.1
MB17H1SW0026	10/06/2020	620.3	36.1
MB17H1SW0026	9/06/2020	620.3	36.1
MB17H1SW0026	8/06/2020	620.3	36.1
MB17H1SW0026	7/06/2020	620.3	36.1
MB17H1SW0026	6/06/2020	620.3	36.1
MB17H1SW0026	5/06/2020	620.3	36.1
MB17H1SW0026	4/06/2020	620.3	36.1
MB17H1SW0026	3/06/2020	620.3	36.1
MB17H1SW0026	2/06/2020	620.3	36.1
MB17H1SW0026	1/06/2020	620.3	36.1
MB17H1SW0026	31/05/2020	620.3	36.1
MB17H1SW0026	30/05/2020	620.3	36.1
MB17H1SW0026	29/05/2020	620.3	36.1
MB17H1SW0026	28/05/2020	620.3	36.1
MB17H1SW0026	27/05/2020	620.3	36.1
MB17H1SW0026	26/05/2020	620.2	36.1
MB17H1SW0026	25/05/2020	620.2	36.2
MB17H1SW0026	24/05/2020	620.2	36.2
MB17H1SW0026	23/05/2020	620.2	36.2
MB17H1SW0026	22/05/2020	620.2	36.2
MB17H1SW0026	21/05/2020	620.2	36.2
MB17H1SW0026	20/05/2020	620.2	36.2
MB17H1SW0026	19/05/2020	620.2	36.2
MB17H1SW0026	18/05/2020	620.2	36.2
MB17H1SW0026	17/05/2020	620.2	36.2
MB17H1SW0026	16/05/2020	620.2	36.2
MB17H1SW0026	15/05/2020	620.2	36.2
MB17H1SW0026	14/05/2020	620.2	36.2
MB17H1SW0026	13/05/2020	620.2	36.2
MB17H1SW0026	12/05/2020	620.2	36.2
MB17H1SW0026	11/05/2020	620.2	36.2
MB17H1SW0026	10/05/2020	620.2	36.2
MB17H1SW0026	9/05/2020	620.2	36.2
MB17H1SW0026	8/05/2020	620.1	36.3
MB17H1SW0026	7/05/2020	620.1	36.3
MB17H1SW0026	6/05/2020	620.1	36.3
MB17H1SW0026	5/05/2020	620.1	36.3
MB17H1SW0026	4/05/2020	620.1	36.3
MB17H1SW0026	3/05/2020	620.1	36.3
MB17H1SW0026	2/05/2020	620.1	36.3
MB17H1SW0026	1/05/2020	620.1	36.3
MB17H1SW0026	30/04/2020	620.1	36.3
MB17H1SW0026	29/04/2020	620.1	36.3
MB17H1SW0026	28/04/2020	620.0	36.3
MB17H1SW0026	27/04/2020	620.1	36.3
MB17H1SW0026	26/04/2020	620.0	36.3
MB17H1SW0026	25/04/2020	620.0	36.3
MB17H1SW0026	24/04/2020	620.0	36.4
MB17H1SW0026	23/04/2020	620.0	36.4

ID	Date	WL mAHD	WL mbgl
MB15HD20003	17/10/2019	625.1	63.3
MB15HD20003	18/10/2019	625.1	63.3
MB15HD20003	19/10/2019	625.1	63.3
MB15HD20003	20/10/2019	625.1	63.3
MB15HD20003	21/10/2019	625.1	63.3
MB15HD20003	22/10/2019	625.1	63.3
MB15HD20003	23/10/2019	625.1	63.3
MB15HD20003	24/10/2019	625.1	63.3
MB15HD20003	25/10/2019	625.1	63.3
MB15HD20003	26/10/2019	625.1	63.3
MB15HD20003	27/10/2019	625.1	63.3
MB15HD20003	28/10/2019	625.1	63.3
MB15HD20003	29/10/2019	625.1	63.3
MB15HD20003	30/10/2019	625.1	63.3
MB15HD20003	31/10/2019	625.1	63.3
MB15HD20003	1/11/2019	625.1	63.3
MB15HD20003	2/11/2019	625.1	63.3
MB15HD20003	3/11/2019	625.1	63.3
MB15HD20003	4/11/2019	625.2	63.3
MB15HD20003	5/11/2019	625.2	63.3
MB15HD20003	6/11/2019	625.1	63.3
MB15HD20003	7/11/2019	625.1	63.3
MB15HD20003	8/11/2019	625.1	63.3
MB15HD20003	9/11/2019	625.1	63.3
MB15HD20003	10/11/2019	625.1	63.3
MB15HD20003	11/11/2019	625.1	63.3
MB15HD20003	12/11/2019	625.1	63.3
MB15HD20003	13/11/2019	625.1	63.3
MB15HD20003	14/11/2019	625.1	63.3
MB15HD20003	15/11/2019	625.1	63.3
MB15HD20003	16/11/2019	625.1	63.3
MB15HD20003	17/11/2019	625.1	63.3
MB15HD20003	18/11/2019	625.1	63.3
MB15HD20003	19/11/2019	625.1	63.3
MB15HD20003	20/11/2019	625.1	63.3
MB15HD20003	21/11/2019	625.1	63.3
MB15HD20003	22/11/2019	625.1	63.3
MB15HD20003	23/11/2019	625.1	63.3
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MB15HD20003	25/11/2019	625.1	63.3
MB15HD20003	26/11/2019	625.1	63.3
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MB15HD20003	28/11/2019	625.1	63.3
MB15HD20003	29/11/2019	625.1	63.4
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MB15HD20003	1/12/2019	625.1	63.3
MB15HD20003	2/12/2019	625.1	63.3
MB15HD20003	3/12/2019	625.1	63.3
MB15HD20003	4/12/2019	625.1	63.3
MB15HD20003	5/12/2019	625.1	63.3
MB15HD20003	6/12/2019	625.1	63.3
MB15HD20003	7/12/2019	625.1	63.3
MB15HD20003	8/12/2019	625.1	63.3
MB15HD20003	9/12/2019	625.1	63.3
MB15HD20003	10/12/2019	625.1	63.3
MB15HD20003	11/12/2019	625.1	63.3
MB15HD20003	12/12/2019	625.1	63.3
MB15HD20003	13/12/2019	625.1	63.3
MB15HD20003	14/12/2019	625.1	63.3
MB15HD20003	15/12/2019	625.1	63.3
MB15HD20003	16/12/2019	625.1	63.3
MB15HD20003	17/12/2019	625.1	63.3
MB15HD20003	18/12/2019	625.1	63.3
MB15HD20003	19/12/2019	625.1	63.3
MB15HD20003	20/12/2019	625.1	63.3
MB15HD20003	21/12/2019	625.1	63.3
MB15HD20003	22/12/2019	625.1	63.3
MB15HD20003	23/12/2019	625.1	63.3
MB15HD20003	24/12/2019	625.1	63.3
MB15HD20003	25/12/2019	625.1	63.3
MB15HD20003	26/12/2019	625.1	63.3
MB15HD20003	27/12/2019	625.1	63.3
MB15HD20003	28/12/2019	625.1	63.3
MB15HD20003	29/12/2019	625.1	63.3
MB15HD20003	30/12/2019	625.1	63.3
MB15HD20003	31/12/2019	625.1	63.3
MB15HD20003	1/01/2020	625.1	63.3
MB15HD20003	2/01/2020	625.1	63.3
MB15HD20003	3/01/2020	625.1	63.3
MB15HD20003	4/01/2020	625.1	63.4
MB15HD20003	5/01/2020	625.1	63.3
MB15HD20003	6/01/2020	625.1	63.4
MB15HD20003	7/01/2020	625.0	63.4
MB15HD20003	8/01/2020	625.0	63.4
MB15HD20003	9/01/2020	625.0	63.4
MB15HD20003	10/01/2020	625.0	63.4
MB15HD20003	11/01/2020	625.1	63.4
MB15HD20003	12/01/2020	625.1	63.4
MB15HD20003	13/01/2020	625.0	63.4
MB15HD20003	14/01/2020	625.1	63.4
MB15HD20003	15/01/2020	625.1	63.3
MB15HD20003	16/01/2020	625.1	63.3
MB15HD20003	17/01/2020	625.1	63.4
MB15HD20003	18/01/2020	625.1	63.4
MB15HD20003	19/01/2020	625.1	63.4
MB15HD20003	20/01/2020	625.1	63.4
MB15HD20003	21/01/2020	625.1	63.4
MB15HD20003	22/01/2020	625.1	63.4
MB15HD20003	23/01/2020	625.1	63.4
MB15HD20003	24/01/2020	625.1	63.3
MB15HD20003	25/01/2020	625.1	63.3
MB15HD20003	26/01/2020	625.1	63.3
MB15HD20003	27/01/2020	625.1	63.3
MB15HD20003	28/01/2020	625.1	63.3
MB15HD20003	29/01/2020	625.1	63.4
MB15HD20003	30/01/2020	625.0	63.4
MB15HD20003	31/01/2020	625.0	63.4
MB15HD20003	1/02/2020	625.0	63.4
MB15HD20003	2/02/2020	625.1	63.4
MB15HD20003	3/02/2020	625.1	63.3
MB15HD20003	4/02/2020	625.1	63.3
MB15HD20003	5/02/2020	625.1	63.3
MB15HD20003	6/02/2020	625.1	63.4
MB15HD20003	7/02/2020	625.1	63.4
MB15HD20003	8/02/2020	625.1	63.4
MB15HD20003	9/02/2020	625.0	63.4
MB15HD20003	10/02/2020	625.0	63.4
MB15HD20003	11/02/2020	625.1	63.4
MB15HD20003	12/02/2020	625.1	63.3
MB15HD20003	13/02/2020	625.1	63.3
MB15HD20003	14/02/2020	625.1	63.4
MB15HD20003	15/02/2020	625.1	63.3
MB15HD20003	16/02/2020	625.1	63.3
MB15HD20003	17/02/2020	625.1	63.3
MB15HD20003	18/02/2020	625.1	63.3
MB15HD20003	19/02/2020	625.1	63.3
MB15HD20003	20/02/2020	625.1	63.3
MB15HD20003	21/02/2020	625.1	63.3
MB15HD20003	22/02/2020	625.1	63.3
MB15HD20003	23/02/2020	625.1	63.3
MB15HD20003	24/02/2020	625.1	63.3
MB15HD20003	25/02/2020	625.1	63.4
MB15HD20003	26/02/2020	625.1	63.4
MB15HD20003	27/02/2020	625.1	63.4
MB15HD20003	28/02/2020	625.1	63.4
MB15HD20003	29/02/2020	625.0	63.4

ID	Date	WL mAHD	WL mbgl
MB18HD20007	28/09/2018	628.5	97.3
MB18HD20007	29/09/2018	628.5	97.3
MB18HD20007	30/09/2018	628.5	97.3
MB18HD20007	1/10/2018	628.5	97.3
MB18HD20007	2/10/2018	628.5	97.3
MB18HD20007	3/10/2018	628.5	97.3
MB18HD20007	4/10/2018	628.5	97.3
MB18HD20007	5/10/2018	628.5	97.3
MB18HD20007	6/10/2018	628.5	97.3
MB18HD20007	7/10/2018	628.5	97.3
MB18HD20007	8/10/2018	628.5	97.3
MB18HD20007	9/10/2018	628.5	97.3
MB18HD20007	10/10/2018	628.5	97.3
MB18HD20007	11/10/2018	628.5	97.3
MB18HD20007	12/10/2018	628.5	97.3
MB18HD20007	13/10/2018	628.5	97.3
MB18HD20007	14/10/2018	628.5	97.3
MB18HD20007	15/10/2018	628.5	97.3
MB18HD20007	16/10/2018	628.5	97.3
MB18HD20007	17/10/2018	628.5	97.3
MB18HD20007	18/10/2018	628.5	97.3
MB18HD20007	19/10/2018	628.5	97.3
MB18HD20007	20/10/2018	628.5	97.3
MB18HD20007	21/10/2018	628.5	97.3
MB18HD20007	22/10/2018	628.5	97.3
MB18HD20007	23/10/2018	628.5	97.3
MB18HD20007	24/10/2018	628.5	97.3
MB18HD20007	25/10/2018	628.5	97.3
MB18HD20007	26/10/2018	628.5	97.3
MB18HD20007	27/10/2018	628.5	97.3
MB18HD20007	28/10/2018	628.5	97.3
MB18HD20007	29/10/2018	628.5	97.3
MB18HD20007	30/10/2018	628.5	97.3
MB18HD20007	31/10/2018	628.5	97.3
MB18HD20007	1/11/2018	628.5	97.3
MB18HD20007	2/11/2018	628.5	97.3
MB18HD20007	3/11/2018	628.5	97.3
MB18HD20007	4/11/2018	628.5	97.3
MB18HD20007	5/11/2018	628.5	97.3
MB18HD20007	6/11/2018	628.5	97.3
MB18HD20007	7/11/2018	628.5	97.3
MB18HD20007	8/11/2018	628.5	97.3
MB18HD20007	9/11/2018	628.5	97.3
MB18HD20007	10/11/2018	628.5	97.3
MB18HD20007	11/11/2018	628.5	97.3
MB18HD20007	12/11/2018	628.5	97.3
MB18HD20007	13/11/2018	628.5	97.3
MB18HD20007	14/11/2018	628.5	97.3
MB18HD20007	15/11/2018	628.5	97.3
MB18HD20007	16/11/2018	628.5	97.3
MB18HD20007	17/11/2018	628.5	97.3
MB18HD20007	18/11/2018	628.5	97.3
MB18HD20007	19/11/2018	628.5	97.3
MB18HD20007	20/11/2018	628.5	97.3
MB18HD20007	21/11/2018	628.4	97.3
MB18HD20007	22/11/2018	628.4	97.3
MB18HD20007	23/11/2018	628.4	97.3
MB18HD20007	24/11/2018	628.4	97.3
MB18HD20007	25/11/2018	628.4	97.3
MB18HD20007	26/11/2018	628.4	97.3
MB18HD20007	27/11/2018	628.4	97.3
MB18HD20007	28/11/2018	628.4	97.3
MB18HD20007	29/11/2018	628.4	97.3
MB18HD20007	30/11/2018	628.4	97.3
MB18HD20007	1/12/2018	628.4	97.3
MB18HD20007	2/12/2018	628.4	97.4
MB18HD20007	3/12/2018	628.4	97.3
MB18HD20007	4/12/2018	628.4	97.3
MB18HD20007	5/12/2018	628.4	97.3
MB18HD20007	6/12/2018	628.4	97.3
MB18HD20007	7/12/2018	628.4	97.3
MB18HD20007	8/12/2018	628.4	97.3
MB18HD20007	9/12/2018	628.4	97.3
MB18HD20007	10/12/2018	628.4	97.4
MB18HD20007	11/12/2018	628.4	97.4
MB18HD20007	12/12/2018	628.4	97.4
MB18HD20007	13/12/2018	628.4	97.4
MB18HD20007	14/12/2018	628.4	97.4
MB18HD20007	15/12/2018	628.4	97.4
MB18HD20007	16/12/2018	628.4	97.4
MB18HD20007	17/12/2018	628.4	97.4
MB18HD20007	18/12/2018	628.4	97.4
MB18HD20007	19/12/2018	628.4	97.4
MB18HD20007	20/12/2018	628.4	97.3
MB18HD20007	21/12/2018	628.4	97.3
MB18HD20007	22/12/2018	628.4	97.3
MB18HD20007	23/12/2018	628.4	97.3
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	23/01/2010	3.3	682.8
HDVP1	22/01/2010	3.3	682.8
HDVP1	21/01/2010	3.3	682.8
HDVP1	20/01/2010	3.3	682.8
HDVP1	19/01/2010	3.3	682.8
HDVP1	18/01/2010	3.3	682.8
HDVP1	17/01/2010	3.3	682.8
HDVP1	16/01/2010	3.3	682.8
HDVP1	15/01/2010	3.3	682.8
HDVP1	14/01/2010	3.3	682.8
HDVP1	13/01/2010	3.3	682.8
HDVP1	12/01/2010	3.3	682.8
HDVP1	11/01/2010	3.3	682.8
HDVP1	10/01/2010	3.3	682.8
HDVP1	9/01/2010	3.3	682.8
HDVP1	8/01/2010	3.3	682.8
HDVP1	7/01/2010	3.3	682.8
HDVP1	6/01/2010	3.3	682.8
HDVP1	5/01/2010	3.3	682.8
HDVP1	4/01/2010	3.3	682.8
HDVP1	3/01/2010	3.3	682.8
HDVP1	2/01/2010	3.3	682.8
HDVP1	1/01/2010	3.3	682.8
HDVP1	31/12/2009	3.3	682.8
HDVP1	30/12/2009	0.0	686.2
HDVP1	29/12/2009	0.0	686.2
HDVP1	28/12/2009	0.0	686.2
HDVP1	27/12/2009	0.0	686.2
HDVP1	26/12/2009	0.0	686.2
HDVP1	25/12/2009	0.0	686.2
HDVP1	24/12/2009	0.0	686.2
HDVP1	23/12/2009	0.0	686.2
HDVP1	22/12/2009	0.0	686.2
HDVP1	21/12/2009	0.0	686.2
HDVP1	20/12/2009	0.0	686.2
HDVP1	19/12/2009	0.0	686.2
HDVP1	18/12/2009	0.0	686.2
HDVP1	17/12/2009	0.0	686.2
HDVP1	16/12/2009	0.0	686.2
HDVP1	15/12/2009	0.0	686.2
HDVP1	14/12/2009	0.0	686.2
HDVP1	13/12/2009	0.0	686.2
HDVP1	12/12/2009	0.0	686.2
HDVP1	11/12/2009	0.0	686.2
HDVP1	10/12/2009	0.0	686.2
HDVP1	9/12/2009	0.0	686.2
HDVP1	8/12/2009	0.0	686.2
HDVP1	7/12/2009	0.0	686.2
HDVP1	6/12/2009	0.0	686.2
HDVP1	5/12/2009	0.0	686.2
HDVP1	4/12/2009	0.0	686.2
HDVP1	3/12/2009	0.0	686.2
HDVP1	2/12/2009	0.0	686.2
HDVP1	1/12/2009	0.0	686.2
HDVP1	30/11/2009	0.0	686.2
HDVP1	29/11/2009	0.0	686.2
HDVP1	28/11/2009	0.0	686.2
HDVP1	27/11/2009	0.0	686.2
HDVP1	26/11/2009	0.0	686.2
HDVP1	25/11/2009	0.0	686.2
HDVP1	24/11/2009	0.0	686.2
HDVP1	23/11/2009	0.0	686.2
HDVP1	22/11/2009	0.0	686.2
HDVP1	21/11/2009	0.0	686.2
HDVP1	20/11/2009	0.0	686.2
HDVP1	19/11/2009	0.0	686.2
HDVP1	18/11/2009	0.0	686.2
HDVP1	17/11/2009	0.0	686.2
HDVP1	16/11/2009	0.0	686.2
HDVP1	15/11/2009	0.0	686.2
HDVP1	14/11/2009	0.0	686.2
HDVP1	13/11/2009	0.0	686.2
HDVP1	12/11/2009	0.0	686.2
HDVP1	11/11/2009	0.0	686.2
HDVP1	10/11/2009	0.0	686.2
HDVP1	9/11/2009	0.0	686.2
HDVP1	8/11/2009	0.0	686.2
HDVP1	7/11/2009	0.0	686.2
HDVP1	6/11/2009	0.0	686.2
HDVP1	5/11/2009	0.0	686.2
HDVP1	4/11/2009	0.0	686.2
HDVP1	3/11/2009	0.0	686.2
HDVP1	2/11/2009	0.2	686.0
HDVP1	1/11/2009	0.2	686.0
HDVP1	31/10/2009	0.2	686.0
HDVP1	30/10/2009	0.2	686.0
HDVP1	29/10/2009	0.2	686.0
HDVP1	28/10/2009	0.2	686.0
HDVP1	27/10/2009	0.2	686.0
HDVP1	26/10/2009	0.2	686.0
HDVP1	25/10/2009	0.2	686.0
HDVP1	24/10/2009	0.2	686.0
HDVP1	23/10/2009	0.2	686.0
HDVP1	22/10/2009	0.2	686.0
HDVP1	21/10/2009	0.2	686.0
HDVP1	20/10/2009	0.2	686.0
HDVP1	19/10/2009	0.2	686.0
HDVP1	18/10/2009	0.2	686.0
HDVP1	17/10/2009	0.2	686.0
HDVP1	16/10/2009	0.2	686.0
HDVP1	15/10/2009	0.2	686.0
HDVP1	14/10/2009	0.2	686.0
HDVP1	13/10/2009	0.2	686.0
HDVP1	12/10/2009	0.2	686.0
HDVP1	11/10/2009	0.2	686.0
HDVP1	10/10/2009	0.2	686.0
HDVP1	9/10/2009	0.2	686.0
HDVP1	8/10/2009	0.2	686.0
HDVP1	7/10/2009	0.2	686.0
HDVP1	6/10/2009	0.2	686.0
HDVP1	5/10/2009	0.2	686.0
HDVP1	4/10/2009	0.2	686.0
HDVP1	3/10/2009	0.2	686.0
HDVP1	2/10/2009	0.2	686.0
HDVP1	1/10/2009	0.2	686.0
HDVP1	30/09/2009	0.0	686.2
HDVP1	29/09/2009	0.0	686.2
HDVP1	28/09/2009	0.0	686.2
HDVP1	27/09/2009	0.0	686.2
HDVP1	26/09/2009	0.0	686.2
HDVP1	25/09/2009	0.0	686.2
HDVP1	24/09/2009	0.0	686.2
HDVP1	23/09/2009	0.0	686.2
HDVP1	22/09/2009	0.0	686.2
HDVP1	21/09/2009	0.0	686.2
HDVP1	20/09/2009	0.0	686.2
HDVP1	19/09/2009	0.0	686.2
HDVP1	18/09/2009	0.0	686.2
HDVP1	17/09/2009	0.0	686.2
HDVP1	16/09/2009	0.0	686.2
HDVP1	15/09/2009	0.0	686.2
HDVP1	14/09/2009	0.0	686.2
HDVP1	13/09/2009	0.0	686.2
HDVP1	12/09/2009	0.0	686.2
HDVP1	11/09/2009	0.0	686.2
HDVP1	10/09/2009	0.0	686.2

ID	Date	WL mAHD	WL mbgl
MB17H1SW0026	22/04/2020	620.0	36.4
MB17H1SW0026	21/04/2020	620.0	36.4
MB17H1SW0026	20/04/2020	620.0	36.4
MB17H1SW0026	19/04/2020	620.0	36.4
MB17H1SW0026	18/04/2020	620.0	36.4
MB17H1SW0026	17/04/2020	620.0	36.4
MB17H1SW0026	16/04/2020	620.0	36.4
MB17H1SW0026	15/04/2020	620.0	36.4
MB17H1SW0026	14/04/2020	620.0	36.4
MB17H1SW0026	13/04/2020	619.9	36.5
MB17H1SW0026	12/04/2020	619.9	36.5
MB17H1SW0026	11/04/2020	619.9	36.5
MB17H1SW0026	10/04/2020	619.9	36.5
MB17H1SW0026	9/04/2020	619.9	36.5
MB17H1SW0026	8/04/2020	619.9	36.5
MB17H1SW0026	7/04/2020	619.9	36.5
MB17H1SW0026	6/04/2020	619.9	36.5
MB17H1SW0026	5/04/2020	619.9	36.5
MB17H1SW0026	4/04/2020	619.9	36.5
MB17H1SW0026	3/04/2020	619.8	36.6
MB17H1SW0026	2/04/2020	619.8	36.6
MB17H1SW0026	1/04/2020	619.8	36.6
MB17H1SW0026	31/03/2020	619.8	36.6
MB17H1SW0026	30/03/2020	619.8	36.6
MB17H1SW0026	29/03/2020	619.8	36.6
MB17H1SW0026	28/03/2020	619.8	36.6
MB17H1SW0026	27/03/2020	619.8	36.6
MB17H1SW0026	26/03/2020	619.8	36.6
MB17H1SW0026	25/03/2020	619.8	36.6
MB17H1SW0026	24/03/2020	619.8	36.6
MB17H1SW0026	23/03/2020	619.8	36.6
MB17H1SW0026	22/03/2020	619.8	36.6
MB17H1SW0026	21/03/2020	619.8	36.6
MB17H1SW0026	20/03/2020	619.8	36.6
MB17H1SW0026	19/03/2020	619.8	36.6
MB17H1SW0026	18/03/2020	619.7	36.7
MB17H1SW0026	17/03/2020	619.7	36.7
MB17H1SW0026	16/03/2020	619.7	36.7
MB17H1SW0026	15/03/2020	619.7	36.7
MB17H1SW0026	14/03/2020	619.7	36.7
MB17H1SW0026	13/03/2020	619.7	36.7
MB17H1SW0026	12/03/2020	619.7	36.7
MB17H1SW0026	11/03/2020	619.7	36.7
MB17H1SW0026	10/03/2020	619.6	36.8
MB17H1SW0026	9/03/2020	619.6	36.8
MB17H1SW0026	8/03/2020	619.6	36.8
MB17H1SW0026	7/03/2020	619.6	36.8
MB17H1SW0026	6/03/2020	619.6	36.8
MB17H1SW0026	5/03/2020	619.6	36.8
MB17H1SW0026	4/03/2020	619.6	36.8
MB17H1SW0026	3/03/2020	619.6	36.8
MB17H1SW0026	2/03/2020	619.6	36.8
MB17H1SW0026	1/03/2020	619.5	36.9
MB17H1SW0026	29/02/2020	619.5	36.9
MB17H1SW0026	28/02/2020	619.5	36.9
MB17H1SW0026	27/02/2020	619.5	36.9
MB17H1SW0026	26/02/2020	619.5	36.9
MB17H1SW0026	25/02/2020	619.5	36.9
MB17H1SW0026	24/02/2020	619.5	36.9
MB17H1SW0026	23/02/2020	619.5	36.9
MB17H1SW0026	22/02/2020	619.5	36.9
MB17H1SW0026	21/02/2020	619.5	36.9
MB17H1SW0026	20/02/2020	619.5	36.9
MB17H1SW0026	19/02/2020	619.4	37.0
MB17H1SW0026	18/02/2020	619.4	36.9
MB17H1SW0026	17/02/2020	619.5	36.9
MB17H1SW0026	16/02/2020	619.4	37.0
MB17H1SW0026	15/02/2020	619.4	37.0
MB17H1SW0026	14/02/2020	619.4	37.0
MB17H1SW0026	13/02/2020	619.4	37.0
MB17H1SW0026	12/02/2020	619.4	37.0
MB17H1SW0026	11/02/2020	619.4	37.0
MB17H1SW0026	10/02/2020	619.3	37.1
MB17H1SW0026	9/02/2020	619.3	37.1
MB17H1SW0026	8/02/2020	619.4	37.0
MB17H1SW0026	7/02/2020	619.4	37.0
MB17H1SW0026	6/02/2020	619.3	37.0
MB17H1SW0026	5/02/2020	619.3	37.1
MB17H1SW0026	4/02/2020	619.3	37.0
MB17H1SW0026	3/02/2020	619.4	37.0
MB17H1SW0026	2/02/2020	619.4	37.0
MB17H1SW0026	1/02/2020	619.4	37.0
MB17H1SW0026	31/01/2020	619.3	37.1
MB17H1SW0026	30/01/2020	619.3	37.1
MB17H1SW0026	29/01/2020	619.3	37.1
MB17H1SW0026	28/01/2020	619.3	37.1
MB17H1SW0026	27/01/2020	619.3	37.1
MB17H1SW0026	26/01/2020	619.3	37.1
MB17H1SW0026	25/01/2020	619.2	37.2
MB17H1SW0026	24/01/2020	619.2	37.2
MB17H1SW0026	23/01/2020	619.2	37.2
MB17H1SW0026	22/01/2020	619.1	37.2
MB17H1SW0026	21/01/2020	619.1	37.3
MB17H1SW0026	20/01/2020	619.1	37.3
MB17H1SW0026	19/01/2020	619.1	37.3
MB17H1SW0026	18/01/2020	619.0	37.4
MB17H1SW0026	17/01/2020	619.0	37.4
MB17H1SW0026	16/01/2020	619.0	37.4
MB17H1SW0026	15/01/2020	619.0	37.4
MB17H1SW0026	14/01/2020	619.0	37.4
MB17H1SW0026	13/01/2020	618.9	37.5
MB17H1SW0026	12/01/2020	618.9	37.5
MB17H1SW0026	11/01/2020	618.9	37.5
MB17H1SW0026	10/01/2020	618.8	37.5
MB17H1SW0026	9/01/2020	618.7	37.7
MB17H1SW0026	8/01/2020	618.7	37.7
MB17H1SW0026	7/01/2020	618.6	37.8
MB17H1SW0026	6/01/2020	618.6	37.8
MB17H1SW0026	5/01/2020	618.5	37.8
MB17H1SW0026	4/01/2020	618.5	37.9
MB17H1SW0026	3/01/2020	618.4	38.0
MB17H1SW0026	2/01/2020	618.3	38.0
MB17H1SW0026	1/01/2020	618.3	38.1
MB17H1SW0026	31/12/2019	618.2	38.2
MB17H1SW0026	30/12/2019	618.1	38.3
MB17H1SW0026	29/12/2019	618.0	38.4
MB17H1SW0026	28/12/2019	618.0	38.4
MB17H1SW0026	27/12/2019	617.9	38.5
MB17H1SW0026	26/12/2019	617.8	38.5
MB17H1SW0026	25/12/2019	617.8	38.5
MB17H1SW0026	24/12/2019	617.9	38.5
MB17H1SW0026	23/12/2019	617.9	38.5
MB17H1SW0026	22/12/2019	618.0	38.4
MB17H1SW0026	21/12/2019	618.0	38.4
MB17H1SW0026	20/12/2019	618.1	38.3
MB17H1SW0026	19/12/2019	618.1	38.3
MB17H1SW0026	18/12/2019	618.1	38.3
MB17H1SW0026	17/12/2019	618.1	38.3
MB17H1SW0026	16/12/2019	617.5	38.9
MB17H1SW0026	15/12/2019	615.3	41.1
MB17H1SW0026	14/12/2019	607.5	48.9
MB17H1SW0026	13/12/2019	619.2	37.2
MB17H1SW0026	12/12/2019	619.2	37.2
MB17H1SW0026	11/12/2019	619.2	37.2
MB17H1SW0026	10/12/2019	619.1	37.3
MB17H1SW0026	9/12/2019	619.1	37.3

ID	Date	WL mAHD	WL mbgl
MB15HD20003	1/03/2020	625.0	63.4
MB15HD20003	2/03/2020	625.1	63.4
MB15HD20003	3/03/2020	625.1	63.3
MB15HD20003	4/03/2020	625.1	63.3
MB15HD20003	5/03/2020	625.1	63.4
MB15HD20003	6/03/2020	625.1	63.3
MB15HD20003	7/03/2020	625.1	63.3
MB15HD20003	8/03/2020	625.1	63.3
MB15HD20003	9/03/2020	625.1	63.3
MB15HD20003	10/03/2020	625.1	63.4
MB15HD20003	11/03/2020	625.1	63.3
MB15HD20003	12/03/2020	625.1	63.3
MB15HD20003	13/03/2020	625.1	63.3
MB15HD20003	14/03/2020	625.1	63.3
MB15HD20003	15/03/2020	625.1	63.3
MB15HD20003	16/03/2020	625.1	63.3
MB15HD20003	17/03/2020	625.1	63.3
MB15HD20003	18/03/2020	625.1	63.3
MB15HD20003	19/03/2020	625.1	63.3
MB15HD20003	20/03/2020	625.1	63.3
MB15HD20003	21/03/2020	625.1	63.3
MB15HD20003	22/03/2020	625.1	63.3
MB15HD20003	23/03/2020	625.1	63.3
MB15HD20003	24/03/2020	625.1	63.3
MB15HD20003	25/03/2020	625.1	63.3
MB15HD20003	26/03/2020	625.1	63.3
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MB15HD20003	30/03/2020	625.1	63.3
MB15HD20003	31/03/2020	625.1	63.3
MB15HD20003	1/04/2020	625.1	63.3
MB15HD20003	2/04/2020	625.1	63.3
MB15HD20003	3/04/2020	625.1	63.3
MB15HD20003	4/04/2020	625.1	63.3
MB15HD20003	5/04/2020	625.1	63.3
MB15HD20003	6/04/2020	625.1	63.3
MB15HD20003	7/04/2020	625.1	63.3
MB15HD20003	8/04/2020	625.1	63.3
MB15HD20003	9/04/2020	625.1	63.3
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MB15HD20003	11/04/2020	625.1	63.3
MB15HD20003	12/04/2020	625.1	63.3
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MB15HD20003	14/04/2020	625.1	63.3
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MB15HD20003	16/04/2020	625.1	63.3
MB15HD20003	17/04/2020	625.1	63.3
MB15HD20003	18/04/2020	625.1	63.3
MB15HD20003	19/04/2020	625.1	63.3
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MB15HD20003	21/04/2020	625.1	63.3
MB15HD20003	22/04/2020	625.1	63.3
MB15HD20003	23/04/2020	625.1	63.3
MB15HD20003	24/04/2020	625.1	63.3
MB15HD20003	25/04/2020	625.1	63.3
MB15HD20003	26/04/2020	625.1	63.3
MB15HD20003	27/04/2020	625.1	63.3
MB15HD20003	28/04/2020	625.1	63.3
MB15HD20003	29/04/2020	625.1	63.3
MB15HD20003	30/04/2020	625.2	63.3
MB15HD20003	1/05/2020	625.2	63.3
MB15HD20003	2/05/2020	625.1	63.3
MB15HD20003	3/05/2020	625.1	63.3
MB15HD20003	4/05/2020	625.1	63.3
MB15HD20003	5/05/2020	625.1	63.3
MB15HD20003	6/05/2020	625.1	63.3
MB15HD20003	7/05/2020	625.1	63.3
MB15HD20003	8/05/2020	625.1	63.3
MB15HD20003	9/05/2020	625.1	63.3
MB15HD20003	10/05/2020	625.1	63.3
MB15HD20003	11/05/2020	625.1	63.3
MB15HD20003	12/05/2020	625.1	63.3
MB15HD20003	13/05/2020	625.2	63.3
MB15HD20003	14/05/2020	625.2	63.3
MB15HD20003	15/05/2020	625.2	63.3
MB15HD20003	16/05/2020	625.2	63.3
MB15HD20003	17/05/2020	625.1	63.3
MB15HD20003	18/05/2020	625.1	63.3
MB15HD20003	19/05/2020	625.1	63.3
MB15HD20003	20/05/2020	625.2	63.3
MB15HD20003	21/05/2020	625.2	63.3
MB15HD20003	22/05/2020	625.1	63.3
MB15HD20003	23/05/2020	625.1	63.3
MB15HD20003	24/05/2020	625.1	63.3
MB15HD20003	25/05/2020	625.1	63.3
MB15HD20003	26/05/2020	625.1	63.3
MB15HD20003	27/05/2020	625.1	63.3
MB15HD20003	28/05/2020	625.1	63.3
MB15HD20003	29/05/2020	625.1	63.3
MB15HD20003	30/05/2020	625.1	63.3
MB15HD20003	31/05/2020	625.2	63.3
MB15HD20003	1/06/2020	625.2	63.2
MB15HD20003	2/06/2020	625.2	63.3
MB15HD20003	3/06/2020	625.2	63.3
MB15HD20003	4/06/2020	625.2	63.2
MB15HD20003	5/06/2020	625.2	63.3
MB15HD20003	6/06/2020	625.2	63.3
MB15HD20003	7/06/2020	625.1	63.3
MB15HD20003	8/06/2020	625.1	63.3
MB15HD20003	9/06/2020	625.1	63.3
MB15HD20003	10/06/2020	625.1	63.3
MB15HD20003	11/06/2020	625.1	63.3
MB15HD20003	12/06/2020	625.1	63.3
MB15HD20003	13/06/2020	625.1	63.3
MB15HD20003	14/06/2020	625.1	63.3
MB15HD20003	15/06/2020	625.2	63.3
MB15HD20003	16/06/2020	625.2	63.3
MB15HD20003	17/06/2020	625.1	63.3
MB15HD20003	18/06/2020	625.1	63.3
MB15HD20003	19/06/2020	625.2	63.3
MB15HD20003	20/06/2020	625.2	63.3
MB15HD20003	21/06/2020	625.2	63.3
MB15HD20003	22/06/2020	625.1	63.3
MB15HD20003	23/06/2020	625.1	63.3
MB15HD20003	24/06/2020	625.1	63.3
MB15HD20003	25/06/2020	625.1	63.3
MB15HD20003	26/06/2020	625.1	63.3
MB15HD20003	27/06/2020	625.1	63.3
MB15HD20003	28/06/2020	625.1	63.3
MB15HD20003	29/06/2020	625.1	63.3
MB15HD20003	30/06/2020	625.1	63.3
MB15HD20003	1/07/2020	625.1	63.3
MB15HD20003	2/07/2020	625.1	63.3
MB15HD20003	3/07/2020	625.2	63.3
MB15HD20003	4/07/2020	625.2	63.3
MB15HD20003	5/07/2020	625.2	63.3
MB15HD20003	6/07/2020	625.2	63.3
MB15HD20003	7/07/2020	625.2	63.3
MB15HD20003	8/07/2020	625.1	63.3
MB15HD20003	9/07/2020	625.1	63.3
MB15HD20003	10/07/2020	625.2	63.3
MB15HD20003	11/07/2020	625.2	63.3
MB15HD20003	12/07/2020	625.2	63.3
MB15HD20003	13/07/2020	625.1	63.3
MB15HD20003	14/07/2020	625.1	63.3

ID	Date	WL mAHD	WL mbgl
MB18HD20007	11/02/2019	628.4	97.4
MB18HD20007	12/02/2019	628.4	97.4
MB18HD20007	13/02/2019	628.4	97.4
MB18HD20007	14/02/2019	628.4	97.4
MB18HD20007	15/02/2019	628.4	97.3
MB18HD20007	16/02/2019	628.4	97.3
MB18HD20007	17/02/2019	628.4	97.4
MB18HD20007	18/02/2019	628.4	97.4
MB18HD20007	19/02/2019	628.4	97.4
MB18HD20007	20/02/2019	628.4	97.4
MB18HD20007	21/02/2019	628.4	97.4
MB18HD20007	22/02/2019	628.4	97.4
MB18HD20007	23/02/2019	628.4	97.4
MB18HD20007	24/02/2019	628.4	97.4
MB18HD20007	25/02/2019	628.4	97.4
MB18HD20007	26/02/2019	628.4	97.4
MB18HD20007	27/02/2019	628.4	97.4
MB18HD20007	28/02/2019	628.4	97.4
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MB18HD20007	2/03/2019	628.4	97.4
MB18HD20007	3/03/2019	628.4	97.4
MB18HD20007	4/03/2019	628.4	97.4
MB18HD20007	5/03/2019	628.4	97.4
MB18HD20007	6/03/2019	628.4	97.4
MB18HD20007	7/03/2019	628.4	97.4
MB18HD20007	8/03/2019	628.4	97.4
MB18HD20007	9/03/2019	628.4	97.4
MB18HD20007	10/03/2019	628.4	97.4
MB18HD20007	11/03/2019	628.4	97.4
MB18HD20007	12/03/2019	628.4	97.4
MB18HD20007	13/03/2019	628.4	97.3
MB18HD20007	14/03/2019	628.4	97.3
MB18HD20007	15/03/2019	628.4	97.3
MB18HD20007	16/03/2019	628.4	97.4
MB18HD20007	17/03/2019	628.4	97.4
MB18HD20007	18/03/2019	628.4	97.4
MB18HD20007	19/03/2019	628.4	97.4
MB18HD20007	20/03/2019	628.4	97.4
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MB18HD20007	24/03/2019	628.4	97.4
MB18HD20007	25/03/2019	628.4	97.4
MB18HD20007	26/03/2019	628.4	97.4
MB18HD20007	27/03/2019	628.4	97.4
MB18HD20007	28/03/2019	628.4	97.4
MB18HD20007	29/03/2019	628.4	97.4
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MB18HD20007	31/03/2019	628.4	97.3
MB18HD20007	1/04/2019	628.4	97.3
MB18HD20007	2/04/2019	628.4	97.3
MB18HD20007	3/04/2019	628.4	97.3
MB18HD20007	4/04/2019	628.4	97.3
MB18HD20007	5/04/2019	628.4	97.4
MB18HD20007	6/04/2019	628.4	97.3
MB18HD20007	7/04/2019	628.4	97.3
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MB18HD20007	9/04/2019	628.4	97.4
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MB18HD20007	12/04/2019	628.4	97.4
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MB18HD20007	16/04/2019	628.4	97.4
MB18HD20007	17/04/2019	628.4	97.4
MB18HD20007	18/04/2019	628.4	97.4
MB18HD20007	19/04/2019	628.4	97.4
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MB18HD20007	22/04/2019	628.4	97.3
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MB18HD20007	26/04/2019	628.5	97.3
MB18HD20007	27/04/2019	628.5	97.3
MB18HD20007	28/04/2019	628.5	97.3
MB18HD20007	29/04/2019	628.4	97.3
MB18HD20007	30/04/2019	628.4	97.3
MB18HD20007	1/05/2019	628.4	97.4
MB18HD20007	2/05/2019	628.4	97.4
MB18HD20007	3/05/2019	628.4	97.3
MB18HD20007	4/05/2019	628.4	97.3
MB18HD20007	5/05/2019	628.5	97.3
MB18HD20007	6/05/2019	628.4	97.3
MB18HD20007	7/05/2019	628.4	97.3
MB18HD20007	8/05/2019	628.5	97.3
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	9/09/2009	0.0	686.2
HDVP1	8/09/2009	0.0	686.2
HDVP1	7/09/2009	0.0	686.2
HDVP1	6/09/2009	0.0	686.2
HDVP1	5/09/2009	0.0	686.2
HDVP1	4/09/2009	0.0	686.2
HDVP1	3/09/2009	0.0	686.2
HDVP1	2/09/2009	0.0	686.2
HDVP1	1/09/2009	0.0	686.2
HDVP1	31/08/2009	0.0	686.2
HDVP1	30/08/2009	0.0	686.2
HDVP1	29/08/2009	0.0	686.2
HDVP1	28/08/2009	0.0	686.2
HDVP1	27/08/2009	0.0	686.2
HDVP1	26/08/2009	0.0	686.2
HDVP1	25/08/2009	0.0	686.2
HDVP1	24/08/2009	0.0	686.2
HDVP1	23/08/2009	0.0	686.2
HDVP1	22/08/2009	0.0	686.2
HDVP1	21/08/2009	0.0	686.2
HDVP1	20/08/2009	0.0	686.2
HDVP1	19/08/2009	0.0	686.2
HDVP1	18/08/2009	0.0	686.2
HDVP1	17/08/2009	0.0	686.2
HDVP1	16/08/2009	0.0	686.2
HDVP1	15/08/2009	0.0	686.2
HDVP1	14/08/2009	0.0	686.2
HDVP1	13/08/2009	0.0	686.2
HDVP1	12/08/2009	0.0	686.2
HDVP1	11/08/2009	0.0	686.2
HDVP1	10/08/2009	0.0	686.2
HDVP1	9/08/2009	0.0	686.2
HDVP1	8/08/2009	0.0	686.2
HDVP1	7/08/2009	0.0	686.2
HDVP1	6/08/2009	0.0	686.2
HDVP1	5/08/2009	0.0	686.2
HDVP1	4/08/2009	0.0	686.2
HDVP1	3/08/2009	0.0	686.2
HDVP1	2/08/2009	0.0	686.2
HDVP1	1/08/2009	0.0	686.2
HDVP1	31/07/2009	0.0	686.2
HDVP1	30/07/2009	0.0	686.2
HDVP1	29/07/2009	0.0	686.2
HDVP1	28/07/2009	0.0	686.2
HDVP1	27/07/2009	0.0	686.2
HDVP1	26/07/2009	0.0	686.2
HDVP1	25/07/2009	0.0	686.2
HDVP1	24/07/2009	0.0	686.2
HDVP1	23/07/2009	0.0	686.2
HDVP1	22/07/2009	0.0	686.2
HDVP1	21/07/2009	0.0	686.2
HDVP1	20/07/2009	0.0	686.2
HDVP1	19/07/2009	0.0	686.2
HDVP1	18/07/2009	0.0	686.2
HDVP1	17/07/2009	0.0	686.2
HDVP1	16/07/2009	0.0	686.2
HDVP1	15/07/2009	0.0	686.2
HDVP1	14/07/2009	0.0	686.2
HDVP1	13/07/2009	0.0	686.2
HDVP1	12/07/2009	0.0	686.2
HDVP1	11/07/2009	0.0	686.2
HDVP1	10/07/2009	0.0	686.2
HDVP1	9/07/2009	0.0	686.2
HDVP1	8/07/2009	0.0	686.2
HDVP1	7/07/2009	0.0	686.2
HDVP1	6/07/2009	0.0	686.2
HDVP1	5/07/2009	0.0	686.2
HDVP1	4/07/2009	0.0	686.2
HDVP1	3/07/2009	0.0	686.2
HDVP1	2/07/2009	0.0	686.2
HDVP1	1/07/2009	0.0	686.2
HDVP1	30/06/2009	0.0	686.2
HDVP1	29/06/2009	0.0	686.2
HDVP1	28/06/2009	0.0	686.2
HDVP1	27/06/2009	0.0	686.2
HDVP1	26/06/2009	0.0	686.2
HDVP1	25/06/2009	0.0	686.2
HDVP1	24/06/2009	0.0	686.2
HDVP1	23/06/2009	0.0	686.2
HDVP1	22/06/2009	0.0	686.2
HDVP1	21/06/2009	0.0	686.2
HDVP1	20/06/2009	0.0	686.2
HDVP1	19/06/2009	0.0	686.2
HDVP1	18/06/2009	0.0	686.2
HDVP1	17/06/2009	0.0	686.2
HDVP1	16/06/2009	0.0	686.2
HDVP1	15/06/2009	0.0	686.2
HDVP1	14/06/2009	0.0	686.2
HDVP1	13/06/2009	0.0	686.2
HDVP1	12/06/2009	0.0	686.2
HDVP1	11/06/2009	0.0	686.2
HDVP1	10/06/2009	0.0	686.2
HDVP1	9/06/2009	0.0	686.2
HDVP1	8/06/2009	0.0	686.2
HDVP1	7/06/2009	0.0	686.2
HDVP1	6/06/2009	0.0	686.2
HDVP1	5/06/2009	0.0	686.2
HDVP1	4/06/2009	0.0	686.2
HDVP1	3/06/2009	0.0	686.2
HDVP1	2/06/2009	0.0	686.2
HDVP1	1/06/2009	0.0	686.2
HDVP1	31/05/2009	0.0	686.2
HDVP1	30/05/2009	0.0	686.2
HDVP1	29/05/2009	0.0	686.2
HDVP1	28/05/2009	0.0	686.2
HDVP1	27/05/2009	0.0	686.2
HDVP1	26/05/2009	0.0	686.2
HDVP1	25/05/2009	0.0	686.2
HDVP1	24/05/2009	0.0	686.2
HDVP1	23/05/2009	0.0	686.2
HDVP1	22/05/2009	0.0	686.2
HDVP1	21/05/2009	0.0	686.2
HDVP1	20/05/2009	0.0	686.2
HDVP1	19/05/2009	0.0	686.2
HDVP1	18/05/2009	0.0	686.2
HDVP1	17/05/2009	0.0	686.2
HDVP1	16/05/2009	0.0	686.2
HDVP1	15/05/2009	0.0	686.2
HDVP1	14/05/2009	0.0	686.2
HDVP1	13/05/2009	0.0	686.2
HDVP1	12/05/2009	0.0	686.2
HDVP1	11/05/2009	0.0	686.2
HDVP1	10/05/2009	0.0	686.2
HDVP1	9/05/2009	0.0	686.2
HDVP1	8/05/2009	0.0	686.2
HDVP1	7/05/2009	0.0	686.2
HDVP1	6/05/2009	0.0	686.2
HDVP1	5/05/2009	0.0	686.2
HDVP1	4/05/2009	0.0	686.2
HDVP1	3/05/2009	0.0	686.2
HDVP1	2/05/2009	0.0	686.2
HDVP1	1/05/2009	0.0	686.2
HDVP1	30/04/2009	0.0	686.2
HDVP1	29/04/2009	0.0	686.2
HDVP1	28/04/2009	0.0	686.2
HDVP1	27/04/2009	0.0	686.2

ID	Date	WL mAHD	WL mbgl
MB17H1SW0026	8/12/2019	619.1	37.3
MB17H1SW0026	7/12/2019	619.1	37.3
MB17H1SW0026	6/12/2019	619.1	37.3
MB17H1SW0026	5/12/2019	619.1	37.3
MB17H1SW0026	4/12/2019	619.1	37.3
MB17H1SW0026	3/12/2019	619.1	37.3
MB17H1SW0026	2/12/2019	619.1	37.3
MB17H1SW0026	1/12/2019	619.1	37.3
MB17H1SW0026	30/11/2019	619.1	37.3
MB17H1SW0026	29/11/2019	619.1	37.3
MB17H1SW0026	28/11/2019	619.0	37.3
MB17H1SW0026	27/11/2019	619.0	37.3
MB17H1SW0026	26/11/2019	619.0	37.4
MB17H1SW0026	25/11/2019	619.0	37.4
MB17H1SW0026	24/11/2019	619.0	37.4
MB17H1SW0026	23/11/2019	619.0	37.4
MB17H1SW0026	22/11/2019	619.0	37.4
MB17H1SW0026	21/11/2019	619.0	37.4
MB17H1SW0026	20/11/2019	619.0	37.4
MB17H1SW0026	19/11/2019	619.0	37.4
MB17H1SW0026	18/11/2019	619.0	37.4
MB17H1SW0026	17/11/2019	619.0	37.4
MB17H1SW0026	16/11/2019	619.0	37.4
MB17H1SW0026	15/11/2019	619.0	37.4
MB17H1SW0026	14/11/2019	619.0	37.4
MB17H1SW0026	13/11/2019	619.0	37.4
MB17H1SW0026	12/11/2019	619.0	37.4
MB17H1SW0026	11/11/2019	618.9	37.5
MB17H1SW0026	10/11/2019	618.9	37.5
MB17H1SW0026	9/11/2019	619.0	37.4
MB17H1SW0026	8/11/2019	619.0	37.4
MB17H1SW0026	7/11/2019	618.9	37.4
MB17H1SW0026	6/11/2019	618.9	37.5
MB17H1SW0026	5/11/2019	618.9	37.4
MB17H1SW0026	4/11/2019	619.0	37.4
MB17H1SW0026	3/11/2019	619.0	37.4
MB17H1SW0026	2/11/2019	618.9	37.5
MB17H1SW0026	1/11/2019	618.9	37.5
MB17H1SW0026	31/10/2019	618.9	37.5
MB17H1SW0026	30/10/2019	618.9	37.5
MB17H1SW0026	29/10/2019	618.9	37.5
MB17H1SW0026	28/10/2019	618.9	37.5
MB17H1SW0026	27/10/2019	618.9	37.5
MB17H1SW0026	26/10/2019	618.9	37.5
MB17H1SW0026	25/10/2019	618.9	37.5
MB17H1SW0026	24/10/2019	618.9	37.5
MB17H1SW0026	23/10/2019	618.9	37.5
MB17H1SW0026	22/10/2019	618.9	37.5
MB17H1SW0026	21/10/2019	618.9	37.5
MB17H1SW0026	20/10/2019	618.9	37.5
MB17H1SW0026	19/10/2019	618.9	37.5
MB17H1SW0026	18/10/2019	618.9	37.5
MB17H1SW0026	17/10/2019	618.9	37.5
MB17H1SW0026	16/10/2019	618.9	37.5
MB17H1SW0026	15/10/2019	618.9	37.5
MB17H1SW0026	14/10/2019	618.8	37.5
MB17H1SW0026	13/10/2019	618.8	37.6
MB17H1SW0026	12/10/2019	618.8	37.6
MB17H1SW0026	11/10/2019	618.8	37.6
MB17H1SW0026	10/10/2019	618.8	37.6
MB17H1SW0026	9/10/2019	618.8	37.6
MB17H1SW0026	8/10/2019	618.8	37.6
MB17H1SW0026	7/10/2019	618.8	37.6
MB17H1SW0026	6/10/2019	618.8	37.6
MB17H1SW0026	5/10/2019	618.8	37.6
MB17H1SW0026	4/10/2019	618.8	37.6
MB17H1SW0026	3/10/2019	618.8	37.6
MB17H1SW0026	2/10/2019	618.8	37.6
MB17H1SW0026	1/10/2019	618.8	37.6
MB17H1SW0026	30/09/2019	618.7	37.6
MB17H1SW0026	29/09/2019	618.7	37.7
MB17H1SW0026	28/09/2019	618.7	37.7
MB17H1SW0026	27/09/2019	618.7	37.7
MB17H1SW0026	26/09/2019	618.7	37.7
MB17H1SW0026	25/09/2019	618.7	37.7
MB17H1SW0026	24/09/2019	618.7	37.7
MB17H1SW0026	23/09/2019	618.7	37.7
MB17H1SW0026	22/09/2019	618.7	37.7
MB17H1SW0026	21/09/2019	618.7	37.7
MB17H1SW0026	20/09/2019	618.7	37.7
MB17H1SW0026	19/09/2019	618.6	37.8
MB17H1SW0026	18/09/2019	618.6	37.8
MB17H1SW0026	17/09/2019	618.6	37.8
MB17H1SW0026	16/09/2019	618.6	37.8
MB17H1SW0026	15/09/2019	618.6	37.8
MB17H1SW0026	14/09/2019	618.6	37.8
MB17H1SW0026	13/09/2019	618.6	37.8
MB17H1SW0026	12/09/2019	618.6	37.8
MB17H1SW0026	11/09/2019	618.5	37.8
MB17H1SW0026	10/09/2019	618.5	37.9
MB17H1SW0026	9/09/2019	618.5	37.9
MB17H1SW0026	8/09/2019	618.5	37.9
MB17H1SW0026	7/09/2019	618.4	38.0
MB17H1SW0026	6/09/2019	618.4	38.0
MB17H1SW0026	5/09/2019	618.4	38.0
MB17H1SW0026	4/09/2019	618.4	38.0
MB17H1SW0026	3/09/2019	618.3	38.0
MB17H1SW0026	2/09/2019	618.4	38.0
MB17H1SW0026	1/09/2019	618.3	38.0
MB17H1SW0026	31/08/2019	618.3	38.1
MB17H1SW0026	30/08/2019	618.3	38.1
MB17H1SW0026	29/08/2019	618.3	38.1
MB17H1SW0026	28/08/2019	618.3	38.1
MB17H1SW0026	27/08/2019	618.3	38.1
MB17H1SW0026	26/08/2019	618.3	38.1
MB17H1SW0026	25/08/2019	618.2	38.2
MB17H1SW0026	24/08/2019	618.2	38.2
MB17H1SW0026	23/08/2019	618.1	38.2
MB17H1SW0026	22/08/2019	618.1	38.3
MB17H1SW0026	21/08/2019	618.1	38.3
MB17H1SW0026	20/08/2019	618.0	38.4
MB17H1SW0026	19/08/2019	618.0	38.4
MB17H1SW0026	18/08/2019	617.9	38.5
MB17H1SW0026	17/08/2019	617.8	38.6
MB17H1SW0026	16/08/2019	617.7	38.7
MB17H1SW0026	15/08/2019	617.6	38.8
MB17H1SW0026	14/08/2019	617.6	38.8
MB17H1SW0026	13/08/2019	617.5	38.9
MB17H1SW0026	12/08/2019	617.5	38.9
MB17H1SW0026	11/08/2019	617.4	39.0
MB17H1SW0026	10/08/2019	617.4	39.0
MB17H1SW0026	9/08/2019	617.3	39.1
MB17H1SW0026	8/08/2019	617.2	39.2
MB17H1SW0026	7/08/2019	617.2	39.2
MB17H1SW0026	6/08/2019	617.1	39.3
MB17H1SW0026	5/08/2019	617.0	39.4
MB17H1SW0026	4/08/2019	617.0	39.4
MB17H1SW0026	3/08/2019	617.0	39.4
MB17H1SW0026	2/08/2019	617.0	39.4
MB17H1SW0026	1/08/2019	617.0	39.4
MB17H1SW0026	31/07/2019	617.1	39.3
MB17H1SW0026	30/07/2019	617.1	39.3
MB17H1SW0026	29/07/2019	617.1	39.3
MB17H1SW0026	28/07/2019	617.1	39.3
MB17H1SW0026	27/07/2019	617.1	39.3
MB17H1SW0026	26/07/2019	616.9	39.5

ID	Date	WL mAHD	WL mbgl
MB15HD20003	15/07/2020	625.1	63.3
MB15HD20003	16/07/2020	625.1	63.3
MB15HD20003	17/07/2020	625.1	63.3
MB15HD20003	18/07/2020	625.1	63.3
MB15HD20003	19/07/2020	625.1	63.3
MB15HD20003	20/07/2020	625.1	63.3
MB15HD20003	21/07/2020	625.1	63.3
MB15HD20003	22/07/2020	625.1	63.3
MB15HD20003	23/07/2020	625.1	63.3
MB15HD20003	24/07/2020	625.1	63.3
MB15HD20003	25/07/2020	625.2	63.3
MB15HD20003	26/07/2020	625.2	63.3
MB15HD20003	27/07/2020	625.2	63.3
MB15HD20003	28/07/2020	625.1	63.3
MB15HD20003	29/07/2020	625.1	63.3
MB15HD20003	30/07/2020	625.1	63.3
MB15HD20003	31/07/2020	625.1	63.3
MB15HD20003	1/08/2020	625.1	63.3
MB15HD20003	2/08/2020	625.1	63.3
MB15HD20003	3/08/2020	625.1	63.3
MB15HD20003	4/08/2020	625.1	63.3
MB15HD20003	5/08/2020	625.1	63.3
MB15HD20003	6/08/2020	625.1	63.3
MB15HD20003	7/08/2020	625.1	63.3
MB15HD20003	8/08/2020	625.1	63.3
MB15HD20003	9/08/2020	625.1	63.3
MB15HD20003	10/08/2020	625.1	63.3
MB15HD20003	11/08/2020	625.1	63.3
MB15HD20003	12/08/2020	625.1	63.3
MB15HD20003	13/08/2020	625.1	63.3
MB15HD20003	14/08/2020	625.1	63.3
MB15HD20003	15/08/2020	625.1	63.3
MB15HD20003	16/08/2020	625.1	63.3
MB15HD20003	17/08/2020	625.1	63.3
MB15HD20003	18/08/2020	625.1	63.3
MB15HD20003	19/08/2020	625.1	63.3
MB15HD20003	20/08/2020	625.1	63.3
MB15HD20003	21/08/2020	625.1	63.3
MB15HD20003	22/08/2020	625.1	63.3
MB15HD20003	23/08/2020	625.1	63.3
MB15HD20003	24/08/2020	625.1	63.3
MB15HD20003	25/08/2020	625.1	63.3
MB15HD20003	26/08/2020	625.1	63.3
MB15HD20003	27/08/2020	625.1	63.3
MB15HD20003	28/08/2020	625.1	63.3
MB15HD20003	29/08/2020	625.1	63.3
MB15HD20003	30/08/2020	625.1	63.3
MB15HD20003	31/08/2020	625.1	63.3
MB15HD20003	1/09/2020	625.1	63.3
MB15HD20003	2/09/2020	625.1	63.3
MB15HD20003	3/09/2020	625.1	63.3
MB15HD20003	4/09/2020	625.1	63.3
MB15HD20003	5/09/2020	625.1	63.3
MB15HD20003	6/09/2020	625.1	63.3
MB15HD20003	7/09/2020	625.1	63.3
MB15HD20003	8/09/2020	625.1	63.3
MB15HD20003	9/09/2020	625.1	63.3
MB15HD20003	10/09/2020	625.1	63.3
MB15HD20003	11/09/2020	625.1	63.3
MB15HD20003	12/09/2020	625.1	63.3
MB15HD20003	13/09/2020	625.1	63.3
MB15HD20003	14/09/2020	625.1	63.3
MB15HD20003	15/09/2020	625.1	63.3
MB15HD20003	16/09/2020	625.1	63.3
MB15HD20003	17/09/2020	625.1	63.3
MB15HD20003	18/09/2020	625.1	63.3
MB15HD20003	19/09/2020	625.1	63.3
MB15HD20003	20/09/2020	625.1	63.3
MB15HD20003	21/09/2020	625.1	63.3
MB15HD20003	22/09/2020	625.1	63.3
MB15HD20003	23/09/2020	625.1	63.3
MB15HD20003	24/09/2020	625.1	63.3
MB15HD20003	25/09/2020	625.1	63.3
MB15HD20003	26/09/2020	625.1	63.3
MB15HD20003	27/09/2020	625.1	63.3
MB15HD20003	28/09/2020	625.1	63.3
MB15HD20003	29/09/2020	625.1	63.3
MB15HD20003	30/09/2020	625.1	63.3
MB15HD20003	1/10/2020	625.1	63.3
MB15HD20003	2/10/2020	625.1	63.3
MB15HD20003	3/10/2020	625.1	63.3
MB15HD20003	4/10/2020	625.1	63.3
MB15HD20003	5/10/2020	625.1	63.3
MB15HD20003	6/10/2020	625.1	63.3
MB15HD20003	7/10/2020	625.1	63.3
MB15HD20003	8/10/2020	625.1	63.3
MB15HD20003	9/10/2020	625.1	63.3
MB15HD20003	10/10/2020	625.1	63.3
MB15HD20003	11/10/2020	625.1	63.3
MB15HD20003	12/10/2020	625.1	63.3
MB15HD20003	13/10/2020	625.1	63.3
MB15HD20003	14/10/2020	625.1	63.3
MB15HD20003	15/10/2020	625.1	63.3
MB15HD20003	16/10/2020	625.1	63.4
MB15HD20003	17/10/2020	625.0	63.4
MB15HD20003	18/10/2020	625.0	63.4
MB15HD20003	19/10/2020	625.1	63.4
MB15HD20003	20/10/2020	625.1	63.4
MB15HD20003	21/10/2020	625.0	63.4
MB15HD20003	22/10/2020	625.0	63.4
MB15HD20003	23/10/2020	625.0	63.4
MB15HD20003	24/10/2020	625.0	63.4
MB15HD20003	25/10/2020	625.1	63.4
MB15HD20003	26/10/2020	625.0	63.4
MB15HD20003	27/10/2020	625.1	63.4
MB15HD20003	28/10/2020	625.1	63.4
MB15HD20003	29/10/2020	625.1	63.3
MB15HD20003	30/10/2020	625.1	63.3
MB15HD20003	31/10/2020	625.1	63.4
MB15HD20003	1/11/2020	625.0	63.4
MB15HD20003	2/11/2020	625.1	63.4
MB15HD20003	3/11/2020	625.1	63.3
MB15HD20003	4/11/2020	625.1	63.3
MB15HD20003	5/11/2020	625.1	63.3
MB15HD20003	6/11/2020	625.1	63.4
MB15HD20003	7/11/2020	625.1	63.4
MB15HD20003	8/11/2020	625.1	63.4
MB15HD20003	9/11/2020	625.1	63.4
MB15HD20003	10/11/2020	625.1	63.4
MB15HD20003	11/11/2020	625.1	63.3
MB15HD20003	12/11/2020	625.1	63.3
MB15HD20003	13/11/2020	625.1	63.4
MB15HD20003	14/11/2020	625.0	63.4
MB15HD20003	15/11/2020	625.1	63.4
MB15HD20003	16/11/2020	625.1	63.3
MB15HD20003	17/11/2020	625.1	63.4
MB15HD20003	18/11/2020	625.1	63.4
MB15HD20003	19/11/2020	625.1	63.4
MB15HD20003	20/11/2020	625.0	63.4
MB15HD20003	21/11/2020	625.1	63.4
MB15HD20003	22/11/2020	625.1	63.4
MB15HD20003	23/11/2020	625.1	63.4
MB15HD20003	24/11/2020	625.1	63.4
MB15HD20003	25/11/2020	625.0	63.4
MB15HD20003	26/11/2020	625.0	63.4
MB15HD20003	27/11/2020	625.0	63.4

ID	Date	WL mAHD	WL mbgl
MB18HD20007	27/06/2019	628.4	97.4
MB18HD20007	30/06/2019	628.4	97.3
MB18HD20007	1/07/2019	628.4	97.3
MB18HD20007	2/07/2019	628.4	97.3
MB18HD20007	3/07/2019	628.4	97.4
MB18HD20007	4/07/2019	628.4	97.4
MB18HD20007	5/07/2019	628.4	97.4
MB18HD20007	6/07/2019	628.4	97.4
MB18HD20007	7/07/2019	628.4	97.3
MB18HD20007	8/07/2019	628.4	97.3
MB18HD20007	9/07/2019	628.4	97.3
MB18HD20007	10/07/2019	628.5	97.3
MB18HD20007	11/07/2019	628.5	97.3
MB18HD20007	12/07/2019	628.5	97.3
MB18HD20007	13/07/2019	628.5	97.3
MB18HD20007	14/07/2019	628.5	97.3
MB18HD20007	15/07/2019	628.5	97.3
MB18HD20007	16/07/2019	628.5	97.3
MB18HD20007	17/07/2019	628.5	97.3
MB18HD20007	18/07/2019	628.4	97.3
MB18HD20007	19/07/2019	628.4	97.4
MB18HD20007	20/07/2019	628.4	97.4
MB18HD20007	21/07/2019	628.4	97.4
MB18HD20007	22/07/2019	628.4	97.4
MB18HD20007	23/07/2019	628.4	97.4
MB18HD20007	24/07/2019	628.4	97.3
MB18HD20007	25/07/2019	628.4	97.3
MB18HD20007	26/07/2019	628.4	97.4
MB18HD20007	27/07/2019	628.4	97.4
MB18HD20007	28/07/2019	628.4	97.4
MB18HD20007	29/07/2019	628.4	97.4
MB18HD20007	30/07/2019	628.4	97.4
MB18HD20007	31/07/2019	628.4	97.3
MB18HD20007	1/08/2019	628.4	97.3
MB18HD20007	2/08/2019	628.5	97.3
MB18HD20007	3/08/2019	628.5	97.3
MB18HD20007	4/08/2019	628.5	97.3
MB18HD20007	5/08/2019	628.4	97.3
MB18HD20007	6/08/2019	628.4	97.4
MB18HD20007	7/08/2019	628.4	97.4
MB18HD20007	8/08/2019	628.4	97.4
MB18HD20007	9/08/2019	628.4	97.3
MB18HD20007	10/08/2019	628.4	97.3
MB18HD20007	11/08/2019	628.4	97.3
MB18HD20007	12/08/2019	628.4	97.3
MB18HD20007	13/08/2019	628.4	97.3
MB18HD20007	14/08/2019	628.4	97.4
MB18HD20007	15/08/2019	628.4	97.4
MB18HD20007	16/08/2019	628.4	97.4
MB18HD20007	17/08/2019	628.4	97.4
MB18HD20007	18/08/2019	628.4	97.3
MB18HD20007	19/08/2019	628.5	97.3
MB18HD20007	20/08/2019	628.5	97.3
MB18HD20007	21/08/2019	628.5	97.3
MB18HD20007	22/08/2019	628.5	97.3
MB18HD20007	23/08/2019	628.4	97.3
MB18HD20007	24/08/2019	628.4	97.4
MB18HD20007	25/08/2019	628.4	97.4
MB18HD20007	26/08/2019	628.4	97.4
MB18HD20007	27/08/2019	628.4	97.4
MB18HD20007	28/08/2019	628.4	97.4
MB18HD20007	29/08/2019	628.4	97.4
MB18HD20007	30/08/2019	628.4	97.4
MB18HD20007	31/08/2019	628.4	97.4
MB18HD20007	1/09/2019	628.4	97.4
MB18HD20007	2/09/2019	628.4	97.4
MB18HD20007	3/09/2019	628.4	97.4
MB18HD20007	4/09/2019	628.4	97.4
MB18HD20007	5/09/2019	628.4	97.4
MB18HD20007	6/09/2019	628.4	97.4
MB18HD20007	7/09/2019	628.4	97.4
MB18HD20007	8/09/2019	628.4	97.4
MB18HD20007	9/09/2019	628.4	97.4
MB18HD20007	10/09/2019	628.4	97.4
MB18HD20007	11/09/2019	628.4	97.4
MB18HD20007	12/09/2019	628.4	97.3
MB18HD20007	13/09/2019	628.4	97.3
MB18HD20007	14/09/2019	628.4	97.4
MB18HD20007	15/09/2019	628.4	97.4
MB18HD20007	16/09/2019	628.4	97.4
MB18HD20007	17/09/2019	628.4	97.4
MB18HD20007	18/09/2019	628.4	97.4
MB18HD20007	19/09/2019	628.4	97.4
MB18HD20007	20/09/2019	628.4	97.4
MB18HD20007	21/09/2019	628.4	97.4
MB18HD20007	22/09/2019	628.4	97.4
MB18HD20007	23/09/2019	628.4	97.4
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	26/04/2009	0.0	686.2
HDVP1	25/04/2009	0.0	686.2
HDVP1	24/04/2009	0.0	686.2
HDVP1	23/04/2009	0.0	686.2
HDVP1	22/04/2009	0.0	686.2
HDVP1	21/04/2009	0.0	686.2
HDVP1	20/04/2009	0.0	686.2
HDVP1	19/04/2009	0.0	686.2
HDVP1	18/04/2009	0.0	686.2
HDVP1	17/04/2009	0.0	686.2
HDVP1	16/04/2009	0.0	686.2
HDVP1	15/04/2009	0.0	686.2
HDVP1	14/04/2009	0.0	686.2
HDVP1	13/04/2009	4.6	681.6
HDVP1	12/04/2009	4.6	681.6
HDVP1	11/04/2009	4.6	681.6
HDVP1	10/04/2009	4.6	681.6
HDVP1	9/04/2009	4.6	681.6
HDVP1	8/04/2009	4.6	681.6
HDVP1	7/04/2009	4.6	681.6
HDVP1	6/04/2009	4.6	681.6
HDVP1	5/04/2009	4.6	681.6
HDVP1	4/04/2009	4.6	681.6
HDVP1	3/04/2009	4.6	681.6
HDVP1	2/04/2009	4.6	681.6
HDVP1	1/04/2009	23.4	662.8
HDVP1	31/03/2009	23.4	662.8
HDVP1	30/03/2009	23.4	662.8
HDVP1	29/03/2009	23.4	662.8
HDVP1	28/03/2009	23.4	662.8
HDVP1	27/03/2009	23.4	662.8
HDVP1	26/03/2009	23.4	662.8
HDVP1	25/03/2009	23.4	662.8
HDVP1	24/03/2009	23.4	662.8
HDVP1	23/03/2009	23.4	662.8
HDVP1	22/03/2009	23.4	662.8
HDVP1	21/03/2009	23.4	662.8
HDVP1	20/03/2009	23.4	662.8
HDVP1	19/03/2009	23.4	662.8
HDVP1	18/03/2009	23.4	662.8
HDVP1	17/03/2009	23.4	662.8
HDVP1	16/03/2009	23.4	662.8
HDVP1	15/03/2009	23.4	662.8
HDVP1	14/03/2009	11.0	675.2
HDVP1	13/03/2009	11.0	675.2
HDVP1	12/03/2009	11.0	675.2
HDVP1	11/03/2009	11.0	675.2
HDVP1	10/03/2009	11.0	675.2
HDVP1	9/03/2009	11.0	675.2
HDVP1	8/03/2009	11.0	675.2
HDVP1	7/03/2009	11.0	675.2
HDVP1	6/03/2009	11.0	675.2
HDVP1	5/03/2009	11.0	675.2
HDVP1	4/03/2009	11.0	675.2
HDVP1	3/03/2009	11.0	675.2
HDVP1	2/03/2009	11.0	675.2
HDVP1	1/03/2009	11.0	675.2
HDVP1	28/02/2009	0.0	686.2
HDVP1	27/02/2009	0.0	686.2
HDVP1	26/02/2009	0.0	686.2
HDVP1	25/02/2009	0.0	686.2
HDVP1	24/02/2009	0.0	686.2
HDVP1	23/02/2009	0.0	686.2
HDVP1	22/02/2009	0.0	686.2
HDVP1	21/02/2009	0.0	686.2
HDVP1	20/02/2009	0.0	686.2
HDVP1	19/02/2009	0.0	686.2
HDVP1	18/02/2009	0.0	686.2
HDVP1	17/02/2009	0.0	686.2
HDVP1	16/02/2009	9.5	676.7
HDVP1	15/02/2009	9.5	676.7
HDVP1	14/02/2009	9.5	676.7
HDVP1	13/02/2009	9.5	676.7
HDVP1	12/02/2009	9.5	676.7
HDVP1	11/02/2009	9.5	676.7
HDVP1	10/02/2009	9.5	676.7
HDVP1	9/02/2009	9.5	676.7
HDVP1	8/02/2009	9.5	676.7
HDVP1	7/02/2009	9.5	676.7
HDVP1	6/02/2009	9.5	676.7
HDVP1	5/02/2009	9.5	676.7
HDVP1	4/02/2009	9.5	676.7
HDVP1	3/02/2009	9.5	676.7
HDVP1	2/02/2009	9.5	676.7
HDVP1	1/02/2009	76.8	609.3
HDVP1	31/01/2009	76.8	609.3
HDVP1	30/01/2009	76.8	609.3
HDVP1	29/01/2009	76.8	609.3
HDVP1	28/01/2009	76.8	609.3
HDVP1	27/01/2009	76.8	609.3
HDVP1	26/01/2009	76.8	609.3
HDVP1	25/01/2009	76.8	609.3
HDVP1	24/01/2009	76.8	609.3
HDVP1	23/01/2009	76.8	609.3
HDVP1	22/01/2009	76.8	609.3
HDVP1	21/01/2009	76.8	609.3
HDVP1	20/01/2009	76.8	609.3
HDVP1	19/01/2009	76.8	609.3
HDVP1	18/01/2009	84.3	601.8
HDVP1	17/01/2009	84.3	601.8
HDVP1	16/01/2009	84.3	601.8
HDVP1	15/01/2009	84.3	601.8
HDVP1	14/01/2009	84.3	601.8
HDVP1	13/01/2009	84.3	601.8
HDVP1	12/01/2009	84.3	601.8
HDVP1	11/01/2009	84.3	601.8
HDVP1	10/01/2009	84.3	601.8
HDVP1	9/01/2009	84.3	601.8
HDVP1	8/01/2009	84.3	601.8
HDVP1	7/01/2009	84.3	601.8
HDVP1	6/01/2009	84.3	601.8
HDVP1	5/01/2009	84.3	601.8
HDVP1	4/01/2009	84.3	601.8
HDVP1	3/01/2009	84.3	601.8
HDVP1	2/01/2009	84.3	601.8
HDVP1	1/01/2009	77.3	608.9
HDVP1	31/12/2008	77.3	608.9
HDVP1	30/12/2008	77.3	608.9
HDVP1	29/12/2008	77.3	608.9
HDVP1	28/12/2008	77.3	608.9
HDVP1	27/12/2008	77.3	608.9
HDVP1	26/12/2008	77.3	608.9
HDVP1	25/12/2008	77.3	608.9
HDVP1	24/12/2008	77.3	608.9
HDVP1	23/12/2008	77.3	608.9
HDVP1	22/12/2008	77.3	608.9
HDVP1	21/12/2008	102.1	584.0
HDVP1	20/12/2008	102.1	584.0
HDVP1	19/12/2008	102.1	584.0
HDVP1	18/12/2008	102.1	584.0
HDVP1	17/12/2008	102.1	584.0
HDVP1	16/12/2008	102.1	584.0
HDVP1	15/12/2008	102.1	584.0
HDVP1	14/12/2008	131.1	555.1
HDVP1	13/12/2008	131.1	555.1
HDVP1	12/12/2008	131.1	555.1

ID	Date	WL mAHD	WL mbgl
MB17H1SW0026	25/07/2019	616.7	39.7
MB17H1SW0026	24/07/2019	615.7	40.7
MB17H1SW0026	23/07/2019	612.1	44.3
MB17H1SW0026	22/07/2019	607.6	48.8
MB17H1SW0026	21/07/2019	620.2	36.2
MB17H1SW0026	20/07/2019	620.2	36.2
MB17H1SW0026	19/07/2019	620.2	36.2
MB17H1SW0026	18/07/2019	620.2	36.2
MB17H1SW0026	17/07/2019	620.2	36.2
MB17H1SW0026	16/07/2019	620.2	36.2
MB17H1SW0026	15/07/2019	620.2	36.2
MB17H1SW0026	14/07/2019	620.2	36.1
MB17H1SW0026	13/07/2019	620.3	36.1
MB17H1SW0026	12/07/2019	620.2	36.2
MB17H1SW0026	11/07/2019	620.3	36.1
MB17H1SW0026	10/07/2019	620.2	36.2
MB17H1SW0026	9/07/2019	620.2	36.2
MB17H1SW0026	8/07/2019	620.2	36.2
MB17H1SW0026	7/07/2019	620.2	36.2
MB17H1SW0026	6/07/2019	620.2	36.2
MB17H1SW0026	5/07/2019	620.2	36.2
MB17H1SW0026	4/07/2019	620.2	36.2
MB17H1SW0026	3/07/2019	620.2	36.2
MB17H1SW0026	2/07/2019	620.2	36.2
MB17H1SW0026	1/07/2019	620.2	36.2
MB17H1SW0026	30/06/2019	620.2	36.2
MB17H1SW0026	29/06/2019	620.2	36.2
MB17H1SW0026	28/06/2019	620.2	36.2
MB17H1SW0026	27/06/2019	620.1	36.2
MB17H1SW0026	26/06/2019	620.2	36.2
MB17H1SW0026	25/06/2019	620.2	36.2
MB17H1SW0026	24/06/2019	620.2	36.2
MB17H1SW0026	23/06/2019	620.2	36.2
MB17H1SW0026	22/06/2019	620.1	36.2
MB17H1SW0026	21/06/2019	620.2	36.2
MB17H1SW0026	20/06/2019	620.1	36.2
MB17H1SW0026	19/06/2019	620.1	36.3
MB17H1SW0026	18/06/2019	620.2	36.2
MB17H1SW0026	17/06/2019	620.2	36.2
MB17H1SW0026	11/03/2019	620.0	36.4
MB17H1SW0026	10/03/2019	619.9	36.5
MB17H1SW0026	9/03/2019	619.9	36.4
MB17H1SW0026	8/03/2019	619.9	36.5
MB17H1SW0026	7/03/2019	619.9	36.5
MB17H1SW0026	5/03/2019	619.9	36.5
MB17H1SW0026	27/02/2019	619.9	36.5
MB17H1SW0026	26/02/2019	619.9	36.5
MB17H1SW0026	25/02/2019	619.9	36.5
MB17H1SW0026	24/02/2019	619.9	36.5
MB17H1SW0026	23/02/2019	619.9	36.5
MB17H1SW0026	22/02/2019	619.9	36.5
MB17H1SW0026	21/02/2019	619.9	36.5
MB17H1SW0026	20/02/2019	619.9	36.5
MB17H1SW0026	19/02/2019	619.9	36.5
MB17H1SW0026	18/02/2019	619.9	36.5
MB17H1SW0026	17/02/2019	619.9	36.5
MB17H1SW0026	16/02/2019	619.9	36.5
MB17H1SW0026	15/02/2019	619.9	36.5
MB17H1SW0026	14/02/2019	619.9	36.5
MB17H1SW0026	13/02/2019	619.9	36.5
MB17H1SW0026	12/02/2019	619.9	36.5
MB17H1SW0026	11/02/2019	619.9	36.5
MB17H1SW0026	10/02/2019	619.9	36.5
MB17H1SW0026	9/02/2019	619.9	36.5
MB17H1SW0026	8/02/2019	619.9	36.5
MB17H1SW0026	7/02/2019	619.9	36.5
MB17H1SW0026	6/02/2019	619.8	36.6
MB17H1SW0026	5/02/2019	619.8	36.6
MB17H1SW0026	4/02/2019	619.8	36.6
MB17H1SW0026	3/02/2019	619.8	36.6
MB17H1SW0026	2/02/2019	619.8	36.6
MB17H1SW0026	1/02/2019	619.8	36.6
MB17H1SW0026	31/01/2019	619.8	36.6
MB17H1SW0026	30/01/2019	619.8	36.6
MB17H1SW0026	29/01/2019	619.8	36.6
MB17H1SW0026	28/01/2019	619.8	36.6
MB17H1SW0026	27/01/2019	619.8	36.6
MB17H1SW0026	26/01/2019	619.8	36.6
MB17H1SW0026	25/01/2019	619.8	36.6
MB17H1SW0026	24/01/2019	619.8	36.6
MB17H1SW0026	23/01/2019	619.8	36.6
MB17H1SW0026	22/01/2019	619.8	36.6
MB17H1SW0026	21/01/2019	619.8	36.6
MB17H1SW0026	20/01/2019	619.8	36.6
MB17H1SW0026	19/01/2019	619.8	36.6
MB17H1SW0026	18/01/2019	619.8	36.6
MB17H1SW0026	17/01/2019	619.8	36.6
MB17H1SW0026	16/01/2019	619.8	36.6
MB17H1SW0026	15/01/2019	619.8	36.6
MB17H1SW0026	14/01/2019	619.8	36.6
MB17H1SW0026	13/01/2019	619.8	36.6
MB17H1SW0026	12/01/2019	619.8	36.6
MB17H1SW0026	11/01/2019	619.8	36.6
MB17H1SW0026	10/01/2019	619.8	36.6
MB17H1SW0026	9/01/2019	619.8	36.6
MB17H1SW0026	8/01/2019	619.8	36.6
MB17H1SW0026	7/01/2019	619.8	36.6
MB17H1SW0026	6/01/2019	619.8	36.6
MB17H1SW0026	5/01/2019	619.8	36.6
MB17H1SW0026	4/01/2019	619.8	36.6
MB17H1SW0026	3/01/2019	619.8	36.6
MB17H1SW0026	2/01/2019	619.7	36.7
MB17H1SW0026	1/01/2019	619.7	36.6
MB17H1SW0026	31/12/2018	619.7	36.7
MB17H1SW0026	30/12/2018	619.7	36.7
MB17H1SW0026	29/12/2018	619.7	36.7
MB17H1SW0026	28/12/2018	619.7	36.7
MB17H1SW0026	27/12/2018	619.7	36.7
MB17H1SW0026	26/12/2018	619.7	36.6
MB17H1SW0026	25/12/2018	619.8	36.6
MB17H1SW0026	24/12/2018	619.8	36.6
MB17H1SW0026	23/12/2018	619.7	36.7
MB17H1SW0026	22/12/2018	619.7	36.6
MB17H1SW0026	21/12/2018	619.8	36.6
MB17H1SW0026	20/12/2018	619.7	36.7
MB17H1SW0026	19/12/2018	619.7	36.7
MB17H1SW0026	18/12/2018	619.7	36.7
MB17H1SW0026	17/12/2018	619.7	36.7
MB17H1SW0026	16/12/2018	619.7	36.7
MB17H1SW0026	15/12/2018	619.7	36.7
MB17H1SW0026	14/12/2018	619.7	36.7
MB17H1SW0026	13/12/2018	619.7	36.7
MB17H1SW0026	12/12/2018	619.7	36.7
MB17H1SW0026	11/12/2018	619.7	36.7
MB17H1SW0026	10/12/2018	619.7	36.7
MB17H1SW0026	9/12/2018	619.7	36.7
MB17H1SW0026	8/12/2018	619.7	36.7
MB17H1SW0026	7/12/2018	619.7	36.7
MB17H1SW0026	6/12/2018	619.7	36.7
MB17H1SW0026	5/12/2018	619.7	36.7
MB17H1SW0026	4/12/2018	619.7	36.7
MB17H1SW0026	3/12/2018	619.7	36.7
MB17H1SW0026	2/12/2018	619.7	36.7
MB17H1SW0026	30/11/2018	619.7	36.7
MB17H1SW0026	29/11/2018	619.7	36.7
MB17H1SW0026	28/11/2018	619.7	36.7

ID	Date	WL mAHD	WL mbgl
MB15HD20003	28/11/2020	625.0	63.4
MB15HD20003	29/11/2020	625.0	63.4
MB15HD20003	30/11/2020	625.0	63.4
MB15HD20003	1/12/2020	625.1	63.4
MB15HD20003	2/12/2020	625.1	63.4
MB15HD20003	3/12/2020	625.1	63.4
MB15HD20003	4/12/2020	625.1	63.4
MB15HD20003	5/12/2020	625.0	63.4
MB15HD20003	6/12/2020	625.0	63.4
MB15HD20003	7/12/2020	625.0	63.4
MB15HD20003	8/12/2020	625.1	63.4
MB15HD20003	9/12/2020	625.0	63.4
MB15HD20003	10/12/2020	625.0	63.4
MB15HD20003	11/12/2020	625.0	63.4
MB15HD20003	12/12/2020	625.0	63.4
MB15HD20003	13/12/2020	625.0	63.4
MB15HD20003	14/12/2020	625.0	63.4
MB15HD20003	15/12/2020	625.0	63.4
MB15HD20003	16/12/2020	625.0	63.4
MB15HD20003	17/12/2020	625.0	63.4
MB15HD20003	18/12/2020	625.0	63.4
MB15HD20003	19/12/2020	625.0	63.4
MB15HD20003	20/12/2020	625.0	63.4
MB15HD20003	21/12/2020	625.0	63.4
MB15HD20003	22/12/2020	625.0	63.4
MB15HD20003	23/12/2020	625.0	63.4
MB15HD20003	24/12/2020	625.0	63.4
MB15HD20003	25/12/2020	625.0	63.4
MB15HD20003	26/12/2020	625.0	63.4
MB15HD20003	27/12/2020	625.0	63.4
MB15HD20003	28/12/2020	625.0	63.4
MB15HD20003	29/12/2020	625.0	63.4
MB15HD20003	30/12/2020	625.0	63.4
MB15HD20003	31/12/2020	625.0	63.4
MB15HD20003	1/01/2021	625.0	63.4
MB15HD20003	2/01/2021	625.0	63.4
MB15HD20003	3/01/2021	625.0	63.4
MB15HD20003	4/01/2021	625.0	63.4
MB15HD20003	5/01/2021	625.0	63.4
MB15HD20003	6/01/2021	625.1	63.4
MB15HD20003	7/01/2021	625.1	63.4
MB15HD20003	8/01/2021	625.1	63.4
MB15HD20003	9/01/2021	625.1	63.4
MB15HD20003	10/01/2021	625.0	63.4
MB15HD20003	11/01/2021	625.0	63.4
MB15HD20003	12/01/2021	625.0	63.4
MB15HD20003	13/01/2021	625.0	63.4
MB15HD20003	14/01/2021	625.0	63.4
MB15HD20003	15/01/2021	625.0	63.4
MB15HD20003	16/01/2021	625.0	63.4
MB15HD20003	17/01/2021	625.0	63.4
MB15HD20003	18/01/2021	625.1	63.4
MB15HD20003	19/01/2021	625.0	63.4
MB15HD20003	20/01/2021	625.0	63.4
MB15HD20003	21/01/2021	625.0	63.4
MB15HD20003	22/01/2021	625.0	63.4
MB15HD20003	23/01/2021	625.0	63.4
MB15HD20003	24/01/2021	625.0	63.4
MB15HD20003	25/01/2021	625.0	63.4
MB15HD20003	26/01/2021	625.0	63.4
MB15HD20003	27/01/2021	625.0	63.4
MB15HD20003	28/01/2021	625.0	63.4
MB15HD20003	29/01/2021	625.0	63.4
MB15HD20003	30/01/2021	625.0	63.4
MB15HD20003	31/01/2021	625.0	63.4
MB15HD20003	1/02/2021	625.0	63.4
MB15HD20003	2/02/2021	625.0	63.4
MB15HD20003	3/02/2021	625.0	63.4
MB15HD20003	4/02/2021	625.0	63.4
MB15HD20003	5/02/2021	625.0	63.4
MB15HD20003	6/02/2021	625.0	63.4
MB15HD20003	7/02/2021	625.0	63.4
MB15HD20003	8/02/2021	625.0	63.4
MB15HD20003	9/02/2021	625.0	63.4
MB15HD20003	10/02/2021	625.0	63.4
MB15HD20003	11/02/2021	625.0	63.4
MB15HD20003	12/02/2021	625.0	63.4
MB15HD20003	13/02/2021	625.0	63.4
MB15HD20003	14/02/2021	625.0	63.4
MB15HD20003	15/02/2021	625.0	63.4
MB15HD20003	16/02/2021	625.0	63.4
MB15HD20003	17/02/2021	625.0	63.4
MB15HD20003	18/02/2021	625.0	63.4
MB15HD20003	19/02/2021	625.0	63.4
MB15HD20003	20/02/2021	625.0	63.4
MB15HD20003	21/02/2021	625.0	63.4
MB15HD20003	22/02/2021	625.0	63.4
MB15HD20003	23/02/2021	625.0	63.4
MB15HD20003	24/02/2021	625.0	63.4
MB15HD20003	25/02/2021	625.0	63.4
MB15HD20003	26/02/2021	625.0	63.4
MB15HD20003	27/02/2021	625.0	63.4
MB15HD20003	28/02/2021	625.0	63.4
MB15HD20003	1/03/2021	625.0	63.4
MB15HD20003	2/03/2021	625.0	63.4
MB15HD20003	3/03/2021	625.0	63.4
MB15HD20003	4/03/2021	625.0	63.4
MB15HD20003	5/03/2021	625.0	63.4
MB15HD20003	6/03/2021	625.0	63.4
MB15HD20003	7/03/2021	625.0	63.4
MB15HD20003	8/03/2021	625.0	63.4
MB15HD20003	9/03/2021	625.0	63.4
MB15HD20003	10/03/2021	625.0	63.4
MB15HD20003	11/03/2021	625.0	63.4
MB15HD20003	12/03/2021	625.0	63.4
MB15HD20003	13/03/2021	625.1	63.4
MB15HD20003	14/03/2021	625.1	63.4
MB15HD20003	15/03/2021	625.1	63.4
MB15HD20003	16/03/2021	625.1	63.4
MB15HD20003	17/03/2021	625.1	63.4
MB15HD20003	18/03/2021	625.0	63.4
MB15HD20003	19/03/2021	625.1	63.4
MB15HD20003	20/03/2021	625.0	63.4
MB15HD20003	21/03/2021	625.0	63.4
MB15HD20003	22/03/2021	625.0	63.4
MB15HD20003	23/03/2021	625.0	63.4
MB15HD20003	24/03/2021	625.0	63.4
MB15HD20003	25/03/2021	625.0	63.4
MB15HD20003	26/03/2021	625.0	63.4
MB15HD20003	27/03/2021	625.0	63.4
MB15HD20003	28/03/2021	625.0	63.4
MB15HD20003	29/03/2021	625.1	63.4
MB15HD20003	30/03/2021	625.1	63.4
MB15HD20003	31/03/2021	625.1	63.4
MB15HD20003	1/04/2021	625.0	63.4
MB15HD20003	2/04/2021	625.1	63.4
MB15HD20003	3/04/2021	625.1	63.4
MB15HD20003	4/04/2021	625.0	63.4
MB15HD20003	5/04/2021	625.0	63.4
MB15HD20003	6/04/2021	625.1	63.4
MB15HD20003	7/04/2021	625.1	63.4
MB15HD20003	8/04/2021	625.0	63.4
MB15HD20003	9/04/2021	625.0	63.4
MB15HD20003	10/04/2021	625.0	63.4
MB15HD20003	11/04/2021	625.1	63.4
MB15HD20003	12/04/2021	625.0	63.4

ID	Date	WL mAHD	WL mbgl
MB18HD20007	12/11/2019	628.3	97.5
MB18HD20007	13/11/2019	628.3	97.4
MB18HD20007	14/11/2019	628.3	97.4
MB18HD20007	15/11/2019	628.3	97.4
MB18HD20007	16/11/2019	628.3	97.4
MB18HD20007	17/11/2019	628.3	97.4
MB18HD20007	18/11/2019	628.3	97.4
MB18HD20007	19/11/2019	628.3	97.5
MB18HD20007	20/11/2019	628.3	97.5
MB18HD20007	21/11/2019	628.3	97.5
MB18HD20007	22/11/2019	628.3	97.5
MB18HD20007	23/11/2019	628.3	97.5
MB18HD20007	24/11/2019	628.3	97.5
MB18HD20007	25/11/2019	628.3	97.5
MB18HD20007	26/11/2019	628.3	97.5
MB18HD20007	27/11/2019	628.3	97.5
MB18HD20007	28/11/2019	628.3	97.5
MB18HD20007	29/11/2019	628.3	97.5
MB18HD20007	30/11/2019	628.3	97.5
MB18HD20007	1/12/2019	628.3	97.4
MB18HD20007	2/12/2019	628.3	97.4
MB18HD20007	3/12/2019	628.3	97.4
MB18HD20007	4/12/2019	628.3	97.5
MB18HD20007	5/12/2019	628.3	97.5
MB18HD20007	6/12/2019	628.3	97.5
MB18HD20007	7/12/2019	628.3	97.5
MB18HD20007	8/12/2019	628.3	97.5
MB18HD20007	9/12/2019	628.3	97.5
MB18HD20007	10/12/2019	628.3	97.5
MB18HD20007	11/12/2019	628.3	97.5
MB18HD20007	12/12/2019	628.3	97.5
MB18HD20007	13/12/2019	628.3	97.5
MB18HD20007	14/12/2019	628.3	97.5
MB18HD20007	15/12/2019	628.3	97.5
MB18HD20007	16/12/2019	628.3	97.5
MB18HD20007	17/12/2019	628.3	97.5
MB18HD20007	18/12/2019	628.3	97.5
MB18HD20007	19/12/2019	628.3	97.5
MB18HD20007	20/12/2019	628.3	97.5
MB18HD20007	21/12/2019	628.3	97.5
MB18HD20007	22/12/2019	628.3	97.5
MB18HD20007	23/12/2019	628.3	97.5
MB18HD20007	24/12/2019	628.3	97.5
MB18HD20007	25/12/2019	628.3	97.5
MB18HD20007	26/12/2019	628.3	97.5
MB18HD20007	27/12/2019	628.3	97.5
MB18HD20007	28/12/2019	628.3	97.5
MB18HD20007	29/12/2019	628.3	97.5
MB18HD20007	30/12/2019	628.3	97.5
MB18HD20007	31/12/2019	628.3	97.5
MB18HD20007	1/01/2020	628.3	97.5
MB18HD20007	2/01/2020	628.3	97.5
MB18HD20007	3/01/2020	628.3	97.5
MB18HD20007	4/01/2020	628.3	97.5
MB18HD20007	5/01/2020	628.3	97.5
MB18HD20007	6/01/2020	628.3	97.5
MB18HD20007	7/01/2020	628.3	97.5
MB18HD20007	8/01/2020	628.3	97.5
MB18HD20007	9/01/2020	628.2	97.5
MB18HD20007	10/01/2020	628.2	97.5
MB18HD20007	11/01/2020	628.3	97.5
MB18HD20007	12/01/2020	628.3	97.5
MB18HD20007	13/01/2020	628.3	97.5
MB18HD20007	14/01/2020	628.3	97.5
MB18HD20007	15/01/2020	628.3	97.5
MB18HD20007	16/01/2020	628.3	97.5
MB18HD20007	17/01/2020	628.3	97.5
MB18HD20007	18/01/2020	628.3	97.5
MB18HD20007	19/01/2020	628.3	97.5
MB18HD20007	20/01/2020	628.3	97.5
MB18HD20007	21/01/2020	628.3	97.5
MB18HD20007	22/01/2020	628.3	97.5
MB18HD20007	23/01/2020	628.3	97.5
MB18HD20007	24/01/2020	628.3	97.5
MB18HD20007	25/01/2020	628.3	97.5
MB18HD20007	26/01/2020	628.3	97.5
MB18HD20007	27/01/2020	628.3	97.5
MB18HD20007	28/01/2020	628.3	97.5
MB18HD20007	29/01/2020	628.3	97.5
MB18HD20007	30/01/2020	628.3	97.5
MB18HD20007	31/01/2020	628.2	97.5
MB18HD20007	1/02/2020	628.3	97.5
MB18HD20007	2/02/2020	628.3	97.5
MB18HD20007	3/02/2020	628.3	97.5
MB18HD20007	4/02/2020	628.3	97.5
MB18HD20007	5/02/2020	628.3	97.5
MB18HD20007	6/02/2020	628.3	97.5
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	11/12/2008	131.1	555.1
HDVP1	10/12/2008	131.1	555.1
HDVP1	9/12/2008	131.1	555.1
HDVP1	8/12/2008	131.1	555.1
HDVP1	7/12/2008	131.1	555.1
HDVP1	6/12/2008	131.1	555.1
HDVP1	5/12/2008	131.1	555.1
HDVP1	4/12/2008	131.1	555.1
HDVP1	3/12/2008	131.1	555.1
HDVP1	2/12/2008	131.1	555.1
HDVP1	1/12/2008	151.4	534.8
HDVP1	30/11/2008	151.4	534.8
HDVP1	29/11/2008	151.4	534.8
HDVP1	28/11/2008	151.4	534.8
HDVP1	27/11/2008	178.7	507.4
HDVP1	26/11/2008	178.7	507.4
HDVP1	25/11/2008	178.7	507.4
HDVP1	24/11/2008	178.7	507.4
HDVP1	23/11/2008	178.7	507.4
HDVP1	22/11/2008	178.7	507.4
HDVP1	21/11/2008	178.7	507.4
HDVP1	20/11/2008	178.7	507.4
HDVP1	19/11/2008	178.7	507.4
HDVP1	18/11/2008	178.7	507.4
HDVP1	17/11/2008	178.7	507.4
HDVP1	16/11/2008	178.7	507.4
HDVP1	15/11/2008	178.7	507.4
HDVP1	14/11/2008	178.7	507.4
HDVP1	13/11/2008	178.7	507.4
HDVP1	12/11/2008	178.7	507.4
HDVP1	11/11/2008	178.7	507.4
HDVP1	10/11/2008	178.7	507.4
HDVP1	9/11/2008	133.2	553.0
HDVP1	8/11/2008	133.2	553.0
HDVP1	7/11/2008	133.2	553.0
HDVP1	6/11/2008	133.2	553.0
HDVP1	5/11/2008	133.2	553.0
HDVP1	4/11/2008	133.2	553.0
HDVP1	3/11/2008	133.2	553.0
HDVP1	2/11/2008	133.2	553.0
HDVP1	1/11/2008	90.6	595.5
HDVP1	31/10/2008	90.6	595.5
HDVP1	30/10/2008	90.6	595.5
HDVP1	29/10/2008	90.6	595.5
HDVP1	28/10/2008	90.6	595.5
HDVP1	27/10/2008	90.6	595.5
HDVP1	26/10/2008	90.6	595.5
HDVP1	25/10/2008	90.6	595.5
HDVP1	24/10/2008	90.6	595.5
HDVP1	23/10/2008	90.6	595.5
HDVP1	22/10/2008	90.6	595.5
HDVP1	21/10/2008	125.6	560.6
HDVP1	20/10/2008	125.6	560.6
HDVP1	19/10/2008	125.6	560.6
HDVP1	18/10/2008	125.6	560.6
HDVP1	17/10/2008	125.6	560.6
HDVP1	16/10/2008	125.6	560.6
HDVP1	15/10/2008	125.6	560.6
HDVP1	14/10/2008	125.6	560.6
HDVP1	13/10/2008	125.6	560.6
HDVP1	12/10/2008	79.9	606.2
HDVP1	11/10/2008	79.9	606.2
HDVP1	10/10/2008	79.9	606.2
HDVP1	9/10/2008	79.9	606.2
HDVP1	8/10/2008	79.9	606.2
HDVP1	7/10/2008	79.9	606.2
HDVP1	6/10/2008	79.9	606.2
HDVP1	5/10/2008	79.9	606.2
HDVP1	4/10/2008	79.9	606.2
HDVP1	3/10/2008	79.9	606.2
HDVP1	2/10/2008	79.9	606.2
HDVP1	1/10/2008	83.2	603.0
HDVP1	30/09/2008	83.2	603.0
HDVP1	29/09/2008	83.2	603.0
HDVP1	28/09/2008	83.2	603.0
HDVP1	27/09/2008	83.2	603.0
HDVP1	26/09/2008	83.2	603.0
HDVP1	25/09/2008	83.2	603.0
HDVP1	24/09/2008	83.2	603.0
HDVP1	23/09/2008	83.2	603.0
HDVP1	22/09/2008	87.1	599.0
HDVP1	21/09/2008	87.1	599.0
HDVP1	20/09/2008	87.1	599.0
HDVP1	19/09/2008	87.1	599.0
HDVP1	18/09/2008	87.1	599.0
HDVP1	17/09/2008	87.1	599.0
HDVP1	16/09/2008	87.1	599.0
HDVP1	15/09/2008	87.1	599.0
HDVP1	14/09/2008	87.1	599.0
HDVP1	13/09/2008	65.8	620.4
HDVP1	12/09/2008	65.8	620.4
HDVP1	11/09/2008	65.8	620.4
HDVP1	10/09/2008	65.8	620.4
HDVP1	9/09/2008	65.8	620.4
HDVP1	8/09/2008	65.8	620.4
HDVP1	7/09/2008	65.8	620.4
HDVP1	6/09/2008	65.8	620.4
HDVP1	5/09/2008	65.8	620.4
HDVP1	4/09/2008	65.8	620.4
HDVP1	3/09/2008	65.8	620.4
HDVP1	2/09/2008	65.8	620.4
HDVP1	1/09/2008	65.8	620.4
HDVP1	31/08/2008	66.6	619.6
HDVP1	30/08/2008	66.6	619.6
HDVP1	29/08/2008	66.6	619.6
HDVP1	28/08/2008	66.6	619.6
HDVP1	27/08/2008	66.6	619.6
HDVP1	26/08/2008	66.6	619.6
HDVP1	25/08/2008	66.6	619.6
HDVP1	24/08/2008	86.7	599.4
HDVP1	23/08/2008	86.7	599.4
HDVP1	22/08/2008	86.7	599.4
HDVP1	21/08/2008	86.7	599.4
HDVP1	20/08/2008	86.7	599.4
HDVP1	19/08/2008	93.0	593.2
HDVP1	18/08/2008	93.0	593.2
HDVP1	17/08/2008	93.0	593.2
HDVP1	16/08/2008	93.0	593.2
HDVP1	15/08/2008	93.0	593.2
HDVP1	14/08/2008	93.0	593.2
HDVP1	13/08/2008	93.0	593.2
HDVP1	12/08/2008	93.0	593.2
HDVP1	11/08/2008	93.0	593.2
HDVP1	10/08/2008	93.0	593.2
HDVP1	9/08/2008	93.0	593.2
HDVP1	8/08/2008	93.0	593.2
HDVP1	7/08/2008	93.0	593.2
HDVP1	6/08/2008	93.0	593.2
HDVP1	5/08/2008	93.0	593.2
HDVP1	4/08/2008	93.0	593.2
HDVP1	3/08/2008	104.8	581.3
HDVP1	2/08/2008	104.8	581.3
HDVP1	1/08/2008	104.8	581.3
HDVP1	31/07/2008	104.8	581.3
HDVP1	30/07/2008	104.8	581.3
HDVP1	29/07/2008	104.8	581.3

ID	Date	WL mAHD	WL mbgl
MB17H1SW0026	27/11/2018	619.7	36.7
MB17H1SW0026	26/11/2018	619.7	36.7
MB17H1SW0026	25/11/2018	619.7	36.7
MB17H1SW0026	24/11/2018	619.7	36.7
MB17H1SW0026	23/11/2018	619.7	36.7
MB17H1SW0026	22/11/2018	619.6	36.8
MB17H1SW0026	21/11/2018	619.6	36.7
MB17H1SW0026	20/11/2018	619.7	36.7
MB17H1SW0026	19/11/2018	619.7	36.7
MB17H1SW0026	18/11/2018	619.7	36.7
MB17H1SW0026	17/11/2018	619.7	36.7
MB17H1SW0026	16/11/2018	619.7	36.7
MB17H1SW0026	14/11/2018	619.7	36.7
MB17H1SW0026	13/11/2018	619.6	36.7
MB17H1SW0026	12/11/2018	619.6	36.7
MB17H1SW0026	11/11/2018	619.6	36.8
MB17H1SW0026	10/11/2018	619.6	36.7
MB17H1SW0026	9/11/2018	619.7	36.7
MB17H1SW0026	8/11/2018	619.6	36.8
MB17H1SW0026	7/11/2018	619.6	36.7
MB17H1SW0026	6/11/2018	619.6	36.8
MB17H1SW0026	5/11/2018	619.6	36.8
MB17H1SW0026	4/11/2018	619.6	36.8
MB17H1SW0026	3/11/2018	619.6	36.7
MB17H1SW0026	2/11/2018	619.6	36.7
MB17H1SW0026	1/11/2018	619.6	36.8
MB17H1SW0026	31/10/2018	619.6	36.8
MB17H1SW0026	30/10/2018	619.6	36.8
MB17H1SW0026	29/10/2018	619.6	36.8
MB17H1SW0026	28/10/2018	619.6	36.8
MB17H1SW0026	27/10/2018	619.6	36.8
MB17H1SW0026	26/10/2018	619.6	36.8
MB17H1SW0026	25/10/2018	619.6	36.8
MB17H1SW0026	24/10/2018	619.6	36.8
MB17H1SW0026	23/10/2018	619.6	36.8
MB17H1SW0026	22/10/2018	619.6	36.8
MB17H1SW0026	21/10/2018	619.6	36.8
MB17H1SW0026	20/10/2018	619.6	36.8
MB17H1SW0026	18/10/2018	619.6	36.8
MB17H1SW0026	17/10/2018	619.6	36.8
MB17H1SW0026	16/10/2018	619.6	36.8
MB17H1SW0026	15/10/2018	619.6	36.8
MB17H1SW0026	14/10/2018	619.6	36.8
MB17H1SW0026	13/10/2018	619.6	36.8
MB17H1SW0026	12/10/2018	619.6	36.8
MB17H1SW0026	11/10/2018	619.6	36.8
MB17H1SW0026	10/10/2018	619.6	36.8
MB17H1SW0026	9/10/2018	619.6	36.8
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MB17H1SW0026	7/10/2018	619.6	36.8
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MB17H1SW0026	5/10/2018	619.6	36.8
MB17H1SW0026	4/10/2018	619.6	36.8
MB17H1SW0026	3/10/2018	619.6	36.8
MB17H1SW0026	2/10/2018	619.6	36.8
MB17H1SW0026	1/10/2018	619.6	36.8
MB17H1SW0026	30/09/2018	619.6	36.8
MB17H1SW0026	29/09/2018	619.5	36.8
MB17H1SW0026	28/09/2018	619.5	36.8
MB17H1SW0026	27/09/2018	619.5	36.9
MB17H1SW0026	26/09/2018	619.5	36.9
MB17H1SW0026	25/09/2018	619.5	36.9
MB17H1SW0026	24/09/2018	619.6	36.8
MB17H1SW0026	23/09/2018	619.6	36.8
MB17H1SW0026	22/09/2018	619.6	36.8
MB17H1SW0026	21/09/2018	619.6	36.8
MB17H1SW0026	20/09/2018	619.6	36.8
MB17H1SW0026	19/09/2018	619.6	36.8
MB17H1SW0026	18/09/2018	619.6	36.8
MB17H1SW0026	17/09/2018	619.5	36.9
MB17H1SW0026	16/09/2018	619.5	36.9
MB17H1SW0026	15/09/2018	619.6	36.8
MB17H1SW0026	14/09/2018	619.5	36.9
MB17H1SW0026	13/09/2018	619.5	36.9
MB17H1SW0026	12/09/2018	619.5	36.9
MB17H1SW0026	11/09/2018	619.5	36.9
MB17H1SW0026	10/09/2018	619.5	36.9
MB17H1SW0026	9/09/2018	619.5	36.9
MB17H1SW0026	8/09/2018	619.5	36.9
MB17H1SW0026	7/09/2018	619.5	36.9
MB17H1SW0026	6/09/2018	619.5	36.9
MB17H1SW0026	5/09/2018	619.5	36.9
MB17H1SW0026	4/09/2018	619.5	36.9
MB17H1SW0026	3/09/2018	619.5	36.9
MB17H1SW0026	2/09/2018	619.5	36.9
MB17H1SW0026	1/09/2018	619.5	36.9
MB17H1SW0026	31/08/2018	619.5	36.9
MB17H1SW0026	30/08/2018	619.5	36.9
MB17H1SW0026	29/08/2018	619.4	37.0
MB17H1SW0026	28/08/2018	619.4	37.0
MB17H1SW0026	27/08/2018	619.5	36.9
MB17H1SW0026	26/08/2018	619.5	36.9
MB17H1SW0026	25/08/2018	619.5	36.9
MB17H1SW0026	24/08/2018	619.5	36.9
MB17H1SW0026	23/08/2018	619.5	36.9
MB17H1SW0026	22/08/2018	619.5	36.9
MB17H1SW0026	21/08/2018	619.5	36.9
MB17H1SW0026	20/08/2018	619.5	36.9
MB17H1SW0026	19/08/2018	619.5	36.9
MB17H1SW0026	18/08/2018	619.5	36.9
MB17H1SW0026	17/08/2018	619.4	37.0
MB17H1SW0026	16/08/2018	619.4	37.0
MB17H1SW0026	15/08/2018	619.4	37.0
MB17H1SW0026	14/08/2018	619.5	36.9
MB17H1SW0026	13/08/2018	619.5	36.9
MB17H1SW0026	12/08/2018	619.5	36.9
MB17H1SW0026	11/08/2018	619.5	36.9
MB17H1SW0026	10/08/2018	619.5	36.9
MB17H1SW0026	9/08/2018	619.4	37.0
MB17H1SW0026	8/08/2018	619.4	37.0
MB17H1SW0026	7/08/2018	619.4	37.0
MB17H1SW0026	6/08/2018	619.4	36.9
MB17H1SW0026	5/08/2018	619.4	36.9
MB17H1SW0026	4/08/2018	619.4	37.0
MB17H1SW0026	3/08/2018	619.4	37.0
MB17H1SW0026	2/08/2018	619.4	37.0
MB17H1SW0026	1/08/2018	619.3	37.0
MB17H1SW0026	31/07/2018	619.4	37.0
MB17H1SW0026	30/07/2018	619.4	37.0
MB17H1SW0026	29/07/2018	619.4	37.0
MB17H1SW0026	28/07/2018	619.4	37.0
MB17H1SW0026	27/07/2018	619.4	37.0
MB17H1SW0026	26/07/2018	619.4	37.0
MB17H1SW0026	25/07/2018	619.3	37.1
MB17H1SW0026	24/07/2018	619.4	37.0
MB17H1SW0026	23/07/2018	619.4	37.0
MB17H1SW0026	22/07/2018	619.3	37.1
MB17H1SW0026	21/07/2018	619.3	37.1
MB17H1SW0026	20/07/2018	619.4	37.0
MB17H1SW0026	19/07/2018	619.4	37.0
MB17H1SW0026	18/07/2018	619.3	37.0
MB17H1SW0026	17/07/2018	619.3	37.1
MB17H1SW0026	16/07/2018	619.3	37.1
MB17H1SW0026	15/07/2018	619.3	37.1
MB17H1SW0026	14/07/2018	619.3	37.1
MB17H1SW0026	13/07/2018	619.3	37.1

ID	Date	WL mAHD	WL mbgl
MB15HD20003	13/04/2021	625.0	63.4
MB15HD20003	14/04/2021	625.1	63.3
MB15HD20003	15/04/2021	625.1	63.3
MB15HD20003	16/04/2021	625.1	63.3
MB15HD20003	17/04/2021	625.1	63.3
MB15HD20003	18/04/2021	625.1	63.3
MB15HD20003	19/04/2021	625.1	63.3
MB15HD20003	20/04/2021	625.1	63.4
MB15HD20003	21/04/2021	625.1	63.3
MB15HD20003	22/04/2021	625.1	63.3
MB15HD20003	23/04/2021	625.1	63.3
MB15HD20003	24/04/2021	625.1	63.3
MB15HD20003	25/04/2021	625.1	63.3
MB15HD20003	26/04/2021	625.1	63.3
MB15HD20003	27/04/2021	625.1	63.3
MB15HD20003	28/04/2021	625.1	63.3
MB15HD20003	29/04/2021	625.1	63.3
MB15HD20003	30/04/2021	625.1	63.3
MB15HD20003	1/05/2021	625.1	63.3
MB15HD20003	2/05/2021	625.1	63.3
MB15HD20003	3/05/2021	625.1	63.3
MB15HD20003	4/05/2021	625.1	63.4
MB15HD20003	5/05/2021	625.1	63.4
MB15HD20003	6/05/2021	625.1	63.4
MB15HD20003	7/05/2021	625.1	63.4
MB15HD20003	8/05/2021	625.1	63.3
MB15HD20003	9/05/2021	625.1	63.3
MB15HD20003	10/05/2021	625.1	63.3
MB15HD20003	11/05/2021	625.1	63.3
MB15HD20003	12/05/2021	625.1	63.3
MB15HD20003	13/05/2021	625.1	63.3
MB15HD20003	14/05/2021	625.1	63.3
MB15HD20003	15/05/2021	625.1	63.3
MB15HD20003	16/05/2021	625.1	63.3
MB15HD20003	17/05/2021	625.1	63.3
MB15HD20003	18/05/2021	625.1	63.3
MB15HD20003	19/05/2021	625.1	63.3
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MB15HD20003	21/05/2021	625.1	63.3
MB15HD20003	22/05/2021	625.1	63.3
MB15HD20003	23/05/2021	625.1	63.4
MB15HD20003	24/05/2021	625.1	63.4
MB15HD20003	25/05/2021	625.1	63.3
MB15HD20003	26/05/2021	625.1	63.3
MB15HD20003	27/05/2021	625.1	63.3
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MB15HD20003	31/05/2021	625.1	63.4
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MB15HD20003	2/06/2021	625.1	63.3
MB15HD20003	3/06/2021	625.1	63.3
MB15HD20003	4/06/2021	625.1	63.3
MB15HD20003	5/06/2021	625.1	63.3
MB15HD20003	6/06/2021	625.1	63.3
MB15HD20003	7/06/2021	625.1	63.3
MB15HD20003	8/06/2021	625.1	63.3
MB15HD20003	9/06/2021	625.1	63.3
MB15HD20003	10/06/2021	625.1	63.3
MB15HD20003	11/06/2021	625.1	63.4
MB15HD20003	12/06/2021	625.1	63.4
MB15HD20003	13/06/2021	625.1	63.3
MB15HD20003	14/06/2021	625.1	63.3
MB15HD20003	15/06/2021	625.1	63.3
MB15HD20003	16/06/2021	625.1	63.3
MB15HD20003	17/06/2021	625.1	63.3
MB15HD20003	18/06/2021	625.1	63.3
MB15HD20003	19/06/2021	625.1	63.3
MB15HD20003	20/06/2021	625.1	63.3
MB15HD20003	21/06/2021	625.1	63.4
MB15HD20003	22/06/2021	625.1	63.3
MB15HD20003	23/06/2021	625.1	63.3
MB15HD20003	24/06/2021	625.1	63.3
MB15HD20003	25/06/2021	625.1	63.3
MB15HD20003	26/06/2021	625.1	63.3
MB15HD20003	27/06/2021	625.1	63.3
MB15HD20003	28/06/2021	625.1	63.3
MB15HD20003	29/06/2021	625.1	63.3
MB15HD20003	30/06/2021	625.1	63.3
MB15HD20003	1/07/2021	625.1	63.3
MB15HD20003	2/07/2021	625.1	63.3
MB15HD20003	3/07/2021	625.1	63.3
MB15HD20003	4/07/2021	625.1	63.3
MB15HD20003	5/07/2021	625.1	63.3
MB15HD20003	6/07/2021	625.1	63.3
MB15HD20003	7/07/2021	625.1	63.4
MB15HD20003	8/07/2021	625.1	63.3
MB15HD20003	9/07/2021	625.1	63.3
MB15HD20003	10/07/2021	625.1	63.4
MB15HD20003	11/07/2021	625.1	63.4
MB15HD20003	12/07/2021	625.1	63.4
MB15HD20003	13/07/2021	625.0	63.4
MB15HD20003	14/07/2021	625.0	63.4
MB15HD20003	15/07/2021	625.1	63.4
MB15HD20003	16/07/2021	625.1	63.3
MB15HD20003	17/07/2021	625.1	63.3
MB15HD20003	18/07/2021	625.1	63.3
MB15HD20003	19/07/2021	625.1	63.3
MB15HD20003	20/07/2021	625.1	63.3
MB15HD20003	21/07/2021	625.1	63.3
MB15HD20003	22/07/2021	625.1	63.4
MB15HD20003	23/07/2021	625.1	63.4
MB15HD20003	24/07/2021	625.1	63.3
MB15HD20003	25/07/2021	625.1	63.3
MB15HD20003	26/07/2021	625.1	63.4
MB15HD20003	27/07/2021	625.0	63.4
MB15HD20003	28/07/2021	625.0	63.4
MB15HD20003	29/07/2021	625.0	63.4
MB15HD20003	30/07/2021	625.0	63.4
MB15HD20003	31/07/2021	625.1	63.4
MB15HD20003	1/08/2021	625.1	63.4
MB15HD20003	2/08/2021	625.1	63.3
MB15HD20003	3/08/2021	625.1	63.3
MB15HD20003	4/08/2021	625.1	63.3
MB15HD20003	5/08/2021	625.1	63.3
MB15HD20003	6/08/2021	625.1	63.3
MB15HD20003	7/08/2021	625.1	63.3
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MB15HD20003	15/08/2021	625.1	63.3
MB15HD20003	16/08/2021	625.1	63.3
MB15HD20003	17/08/2021	625.1	63.3
MB15HD20003	18/08/2021	625.1	63.3
MB15HD20003	19/08/2021	625.1	63.4
MB15HD20003	20/08/2021	625.1	63.3
MB15HD20003	21/08/2021	625.1	63.4
MB15HD20003	22/08/2021	625.1	63.4
MB15HD20003	23/08/2021	625.1	63.3
MB15HD20003	24/08/2021	625.1	63.3
MB15HD20003	25/08/2021	625.1	63.3
MB15HD20003	26/08/2021	625.1	63.4

ID	Date	WL mAHD	WL mbgl
MB18HD20007	27/03/2020	628.3	97.5
MB18HD20007	28/03/2020	628.3	97.5
MB18HD20007	29/03/2020	628.3	97.5
MB18HD20007	30/03/2020	628.3	97.5
MB18HD20007	31/03/2020	628.3	97.5
MB18HD20007	1/04/2020	628.3	97.5
MB18HD20007	2/04/2020	628.3	97.5
MB18HD20007	3/04/2020	628.3	97.5
MB18HD20007	4/04/2020	628.3	97.5
MB18HD20007	5/04/2020	628.3	97.5
MB18HD20007	6/04/2020	628.3	97.5
MB18HD20007	7/04/2020	628.3	97.5
MB18HD20007	8/04/2020	628.3	97.5
MB18HD20007	9/04/2020	628.3	97.5
MB18HD20007	10/04/2020	628.3	97.5
MB18HD20007	11/04/2020	628.3	97.5
MB18HD20007	12/04/2020	628.3	97.5
MB18HD20007	13/04/2020	628.3	97.5
MB18HD20007	14/04/2020	628.3	97.5
MB18HD20007	15/04/2020	628.3	97.5
MB18HD20007	16/04/2020	628.3	97.5
MB18HD20007	17/04/2020	628.3	97.5
MB18HD20007	18/04/2020	628.3	97.5
MB18HD20007	19/04/2020	628.3	97.5
MB18HD20007	20/04/2020	628.3	97.5
MB18HD20007	21/04/2020	628.3	97.5
MB18HD20007	22/04/2020	628.3	97.5
MB18HD20007	23/04/2020	628.3	97.5
MB18HD20007	24/04/2020	628.3	97.5
MB18HD20007	25/04/2020	628.3	97.5
MB18HD20007	26/04/2020	628.3	97.5
MB18HD20007	27/04/2020	628.3	97.5
MB18HD20007	28/04/2020	628.3	97.5
MB18HD20007	29/04/2020	628.3	97.5
MB18HD20007	30/04/2020	628.3	97.5
MB18HD20007	1/05/2020	628.3	97.4
MB18HD20007	2/05/2020	628.3	97.5
MB18HD20007	3/05/2020	628.3	97.5
MB18HD20007	4/05/2020	628.3	97.5
MB18HD20007	5/05/2020	628.3	97.5
MB18HD20007	6/05/2020	628.3	97.5
MB18HD20007	7/05/2020	628.3	97.5
MB18HD20007	8/05/2020	628.3	97.5
MB18HD20007	9/05/2020	628.3	97.5
MB18HD20007	10/05/2020	628.3	97.5
MB18HD20007	11/05/2020	628.3	97.5
MB18HD20007	12/05/2020	628.3	97.5
MB18HD20007	13/05/2020	628.3	97.4
MB18HD20007	14/05/2020	628.3	97.4
MB18HD20007	15/05/2020	628.3	97.4
MB18HD20007	16/05/2020	628.3	97.5
MB18HD20007	17/05/2020	628.3	97.5
MB18HD20007	18/05/2020	628.3	97.5
MB18HD20007	19/05/2020	628.3	97.5
MB18HD20007	20/05/2020	628.3	97.5
MB18HD20007	21/05/2020	628.3	97.5
MB18HD20007	22/05/2020	628.3	97.5
MB18HD20007	23/05/2020	628.3	97.5
MB18HD20007	24/05/2020	628.3	97.5
MB18HD20007	25/05/2020	628.3	97.5
MB18HD20007	26/05/2020	628.3	97.5
MB18HD20007	27/05/2020	628.3	97.5
MB18HD20007	28/05/2020	628.3	97.5
MB18HD20007	29/05/2020	628.3	97.5
MB18HD20007	30/05/2020	628.3	97.5
MB18HD20007	31/05/2020	628.3	97.5
MB18HD20007	1/06/2020	628.3	97.4
MB18HD20007	2/06/2020	628.3	97.4
MB18HD20007	3/06/2020	628.3	97.4
MB18HD20007	4/06/2020	628.3	97.4
MB18HD20007	5/06/2020	628.3	97.4
MB18HD20007	6/06/2020	628.3	97.4
MB18HD20007	7/06/2020	628.3	97.5
MB18HD20007	8/06/2020	628.3	97.5
MB18HD20007	9/06/2020	628.3	97.5
MB18HD20007	10/06/2020	628.3	97.5
MB18HD20007	11/06/2020	628.3	97.5
MB18HD20007	12/06/2020	628.3	97.5
MB18HD20007	13/06/2020	628.3	97.5
MB18HD20007	14/06/2020	628.3	97.5
MB18HD20007	15/06/2020	628.3	97.5
MB18HD20007	16/06/2020	628.3	97.5
MB18HD20007	17/06/2020	628.3	97.5
MB18HD20007	18/06/2020	628.3	97.5
MB18HD20007	19/06/2020	628.3	97.5
MB18HD20007	20/06/2020	628.3	97.5
MB18HD20007	21/06/2020	628.3	97.5
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	28/07/2008	104.8	581.3
HDVP1	27/07/2008	104.8	581.3
HDVP1	26/07/2008	104.8	581.3
HDVP1	25/07/2008	104.8	581.3
HDVP1	24/07/2008	104.8	581.3
HDVP1	23/07/2008	104.8	581.3
HDVP1	22/07/2008	104.8	581.3
HDVP1	21/07/2008	104.8	581.3
HDVP1	20/07/2008	104.8	581.3
HDVP1	19/07/2008	104.8	581.3
HDVP1	18/07/2008	104.8	581.3
HDVP1	17/07/2008	104.8	581.3
HDVP1	16/07/2008	104.8	581.3
HDVP1	15/07/2008	104.8	581.3
HDVP1	14/07/2008	104.8	581.3
HDVP1	13/07/2008	104.8	581.3
HDVP1	12/07/2008	104.8	581.3
HDVP1	11/07/2008	104.8	581.3
HDVP1	10/07/2008	104.8	581.3
HDVP1	9/07/2008	104.8	581.3
HDVP1	8/07/2008	104.8	581.3
HDVP1	7/07/2008	104.8	581.3
HDVP1	6/07/2008	104.8	581.3
HDVP1	5/07/2008	104.8	581.3
HDVP1	4/07/2008	104.8	581.3
HDVP1	3/07/2008	104.8	581.3
HDVP1	2/07/2008	104.8	581.3
HDVP1	1/07/2008	101.8	584.4
HDVP1	30/06/2008	101.8	584.4
HDVP1	29/06/2008	101.8	584.4
HDVP1	28/06/2008	101.8	584.4
HDVP1	27/06/2008	101.8	584.4
HDVP1	26/06/2008	101.8	584.4
HDVP1	25/06/2008	101.8	584.4
HDVP1	24/06/2008	101.8	584.4
HDVP1	23/06/2008	101.8	584.4
HDVP1	22/06/2008	101.8	584.4
HDVP1	21/06/2008	101.8	584.4
HDVP1	20/06/2008	101.8	584.4
HDVP1	19/06/2008	101.8	584.4
HDVP1	18/06/2008	101.8	584.4
HDVP1	17/06/2008	101.8	584.4
HDVP1	16/06/2008	101.8	584.4
HDVP1	15/06/2008	101.8	584.4
HDVP1	14/06/2008	101.8	584.4
HDVP1	13/06/2008	101.8	584.4
HDVP1	12/06/2008	101.8	584.4
HDVP1	11/06/2008	101.8	584.4
HDVP1	10/06/2008	101.8	584.4
HDVP1	8/06/2008	138.1	548.0
HDVP1	7/06/2008	138.1	548.0
HDVP1	6/06/2008	138.1	548.0
HDVP1	5/06/2008	138.1	548.0
HDVP1	4/06/2008	138.1	548.0
HDVP1	3/06/2008	138.1	548.0
HDVP1	2/06/2008	138.1	548.0
HDVP1	1/06/2008	138.1	548.0
HDVP1	31/05/2008	138.1	548.0
HDVP1	30/05/2008	138.1	548.0
HDVP1	29/05/2008	138.1	548.0
HDVP1	28/05/2008	138.1	548.0
HDVP1	27/05/2008	138.1	548.0
HDVP1	26/05/2008	138.1	548.0
HDVP1	25/05/2008	138.1	548.0
HDVP1	24/05/2008	138.1	548.0
HDVP1	23/05/2008	138.1	548.0
HDVP1	22/05/2008	138.1	548.0
HDVP1	21/05/2008	138.1	548.0
HDVP1	20/05/2008	138.1	548.0
HDVP1	19/05/2008	138.1	548.0
HDVP1	18/05/2008	138.1	548.0
HDVP1	17/05/2008	138.1	548.0
HDVP1	16/05/2008	138.1	548.0
HDVP1	15/05/2008	138.1	548.0
HDVP1	14/05/2008	138.1	548.0
HDVP1	13/05/2008	138.1	548.0
HDVP1	12/05/2008	138.1	548.0
HDVP1	11/05/2008	138.1	548.0
HDVP1	10/05/2008	138.1	548.0
HDVP1	9/05/2008	138.1	548.0
HDVP1	8/05/2008	138.1	548.0
HDVP1	7/05/2008	138.1	548.0
HDVP1	6/05/2008	138.1	548.0
HDVP1	5/05/2008	138.1	548.0
HDVP1	4/05/2008	138.1	548.0
HDVP1	3/05/2008	138.1	548.0
HDVP1	2/05/2008	138.1	548.0
HDVP1	1/05/2008	138.1	548.0
HDVP1	30/04/2008	138.1	548.0
HDVP1	29/04/2008	138.1	548.0
HDVP1	28/04/2008	138.1	548.0
HDVP1	27/04/2008	138.1	548.0
HDVP1	26/04/2008	138.1	548.0
HDVP1	25/04/2008	138.1	548.0
HDVP1	24/04/2008	138.1	548.0
HDVP1	23/04/2008	138.1	548.0
HDVP1	22/04/2008	138.1	548.0
HDVP1	21/04/2008	138.1	548.0
HDVP1	20/04/2008	138.1	548.0
HDVP1	19/04/2008	138.1	548.0
HDVP1	18/04/2008	138.1	548.0
HDVP1	17/04/2008	138.1	548.0
HDVP1	16/04/2008	138.1	548.0
HDVP1	15/04/2008	138.1	548.0
HDVP1	14/04/2008	138.1	548.0
HDVP1	13/04/2008	138.1	548.0
HDVP1	12/04/2008	138.1	548.0
HDVP1	11/04/2008	138.1	548.0
HDVP1	10/04/2008	138.1	548.0
HDVP1	9/04/2008	138.1	548.0
HDVP1	8/04/2008	138.1	548.0
HDVP1	7/04/2008	138.1	548.0
HDVP1	6/04/2008	138.1	548.0
HDVP1	5/04/2008	138.1	548.0
HDVP1	4/04/2008	138.1	548.0
HDVP1	3/04/2008	138.1	548.0
HDVP1	2/04/2008	138.1	548.0
HDVP1	1/04/2008	138.1	548.0
HDVP1	31/03/2008	135.0	551.2
HDVP1	30/03/2008	135.0	551.2
HDVP1	29/03/2008	135.0	551.2
HDVP1	28/03/2008	135.0	551.2
HDVP1	27/03/2008	135.0	551.2
HDVP1	26/03/2008	135.0	551.2
HDVP1	25/03/2008	135.0	551.2
HDVP1	24/03/2008	135.0	551.2
HDVP1	23/03/2008	135.0	551.2
HDVP1	22/03/2008	135.0	551.2
HDVP1	21/03/2008	135.0	551.2
HDVP1	20/03/2008	135.0	551.2
HDVP1	19/03/2008	135.0	551.2
HDVP1	18/03/2008	135.0	551.2
HDVP1	17/03/2008	135.0	551.2
HDVP1	16/03/2008	135.0	551.2
HDVP1	15/03/2008	135.0	551.2
HDVP1	14/03/2008	135.0	551.2

ID	Date	WL mAHD	WL mbgl
MB17H1SW0026	12/07/2018	619.3	37.0
MB17H1SW0026	11/07/2018	619.4	37.0
MB17H1SW0026	10/07/2018	619.3	37.0
MB17H1SW0026	9/07/2018	619.3	37.0
MB17H1SW0026	8/07/2018	619.3	37.1
MB17H1SW0026	7/07/2018	619.3	37.1
MB17H1SW0026	6/07/2018	619.3	37.0
MB17H1SW0026	5/07/2018	619.3	37.0
MB17H1SW0026	4/07/2018	619.3	37.1
MB17H1SW0026	3/07/2018	619.3	37.1
MB17H1SW0026	2/07/2018	619.3	37.1
MB17H1SW0026	1/07/2018	619.3	37.1
MB17H1SW0026	30/06/2018	619.3	37.1
MB17H1SW0026	29/06/2018	619.3	37.1
MB17H1SW0026	28/06/2018	619.3	37.1
MB17H1SW0026	27/06/2018	619.3	37.1
MB17H1SW0026	26/06/2018	619.3	37.1
MB17H1SW0026	25/06/2018	619.3	37.1
MB17H1SW0026	24/06/2018	619.3	37.1
MB17H1SW0026	23/06/2018	619.3	37.1
MB17H1SW0026	22/06/2018	619.3	37.1
MB17H1SW0026	21/06/2018	619.3	37.1
MB17H1SW0026	18/06/2018	619.3	37.1
MB17H1SW0026	17/06/2018	619.3	37.1
MB17H1SW0026	16/06/2018	619.3	37.1
MB17H1SW0026	15/06/2018	619.3	37.1
MB17H1SW0026	14/06/2018	619.3	37.1
MB17H1SW0026	13/06/2018	619.2	37.1
MB17H1SW0026	12/06/2018	619.2	37.2
MB17H1SW0026	11/06/2018	619.2	37.2
MB17H1SW0026	10/06/2018	619.2	37.2
MB17H1SW0026	9/06/2018	619.2	37.2
MB17H1SW0026	8/06/2018	619.2	37.2
MB17H1SW0026	7/06/2018	619.2	37.2
MB17H1SW0026	6/06/2018	619.2	37.2
MB17H1SW0026	5/06/2018	619.2	37.2
MB17H1SW0026	4/06/2018	619.2	37.2
MB17H1SW0026	3/06/2018	619.2	37.2
MB17H1SW0026	2/06/2018	619.2	37.2
MB17H1SW0026	1/06/2018	619.2	37.2
MB17H1SW0026	31/05/2018	619.2	37.2
MB17H1SW0026	30/05/2018	619.2	37.2
MB17H1SW0026	29/05/2018	619.2	37.2
MB17H1SW0026	28/05/2018	619.2	37.2
MB17H1SW0026	27/05/2018	619.2	37.2
MB17H1SW0026	26/05/2018	619.2	37.2
MB17H1SW0026	25/05/2018	619.1	37.3
MB17H1SW0026	24/05/2018	619.2	37.2
MB17H1SW0026	23/05/2018	619.2	37.2
MB17H1SW0026	22/05/2018	619.2	37.2
MB17H1SW0026	21/05/2018	619.2	37.2
MB17H1SW0026	20/05/2018	619.2	37.2
MB17H1SW0026	19/05/2018	619.2	37.2
MB17H1SW0026	18/05/2018	619.2	37.2
MB17H1SW0026	17/05/2018	619.2	37.1
MB17H1SW0026	16/05/2018	619.3	37.1
MB17H1SW0026	15/05/2018	619.3	37.1
MB17H1SW0026	14/05/2018	619.3	37.1
MB17H1SW0026	13/05/2018	619.3	37.1
MB17H1SW0026	12/05/2018	619.4	37.0
MB17H1SW0026	11/05/2018	619.4	37.0
MB17H1SW0026	10/05/2018	619.4	37.0
MB17H1SW0026	9/05/2018	619.4	37.0
MB17H1SW0026	8/05/2018	619.4	37.0
MB17H1SW0026	7/05/2018	619.4	37.0
MB17H1SW0026	6/05/2018	619.4	37.0
MB17H1SW0026	5/05/2018	619.4	37.0
MB17H1SW0026	4/05/2018	619.4	37.0
MB17H1SW0026	3/05/2018	619.3	37.0
MB17H1SW0026	2/05/2018	619.3	37.1
MB17H1SW0026	1/05/2018	619.3	37.1
MB17H1SW0026	30/04/2018	619.3	37.1
MB17H1SW0026	29/04/2018	619.3	37.1
MB17H1SW0026	28/04/2018	619.3	37.1
MB17H1SW0026	27/04/2018	619.3	37.1
MB17H1SW0026	26/04/2018	619.3	37.1
MB17H1SW0026	25/04/2018	619.3	37.1
MB17H1SW0026	24/04/2018	619.3	37.1
MB17H1SW0026	23/04/2018	619.3	37.1
MB17H1SW0026	22/04/2018	619.3	37.1
MB17H1SW0026	21/04/2018	619.3	37.1
MB17H1SW0026	20/04/2018	619.3	37.1
MB17H1SW0026	19/04/2018	619.2	37.1
MB17H1SW0026	18/04/2018	619.3	37.1
MB17H1SW0026	17/04/2018	619.3	37.1
MB17H1SW0026	16/04/2018	619.3	37.1
MB17H1SW0026	15/04/2018	619.2	37.1
MB17H1SW0026	14/04/2018	619.2	37.1
MB17H1SW0026	13/04/2018	619.2	37.1
MB17H1SW0026	12/04/2018	619.2	37.1
MB17H1SW0026	11/04/2018	619.2	37.2
MB17H1SW0026	10/04/2018	619.2	37.2
MB17H1SW0026	9/04/2018	619.2	37.2
MB17H1SW0026	8/04/2018	619.2	37.2
MB17H1SW0026	7/04/2018	619.2	37.2
MB17H1SW0026	6/04/2018	619.2	37.2
MB17H1SW0026	5/04/2018	619.2	37.2
MB17H1SW0026	4/04/2018	619.2	37.2
MB17H1SW0026	3/04/2018	619.2	37.2
MB17H1SW0026	2/04/2018	619.2	37.2
MB17H1SW0026	1/04/2018	619.2	37.2
MB17H1SW0026	31/03/2018	619.1	37.3
MB17H1SW0026	30/03/2018	619.1	37.2
MB17H1SW0026	29/03/2018	619.2	37.2
MB17H1SW0026	28/03/2018	619.1	37.3
MB17H1SW0026	27/03/2018	619.1	37.3
MB17H1SW0026	5/09/2017	616.8	39.6
MB17H1SW0026	4/09/2017	616.9	39.5
MB17H1SW0026	3/09/2017	616.9	39.5
MB17H1SW0026	2/09/2017	616.8	39.6
MB17H1SW0026	1/09/2017	616.8	39.6
MB17H1SW0026	31/08/2017	616.8	39.6
MB17H1SW0026	30/08/2017	616.8	39.5
MB17H1SW0026	29/08/2017	616.9	39.5
MB17H1SW0026	28/08/2017	616.9	39.5
MB17H1SW0026	27/08/2017	616.9	39.5
MB17H1SW0026	26/08/2017	616.9	39.5
MB17H1SW0026	25/08/2017	616.9	39.5
MB17H1SW0026	24/08/2017	616.8	39.6
MB17H1SW0026	23/08/2017	616.8	39.5
MB17H1SW0026	22/08/2017	616.8	39.6
MB17H1SW0026	21/08/2017	616.8	39.6
MB17H1SW0026	20/08/2017	616.8	39.6
MB17H1SW0026	19/08/2017	616.8	39.6
MB17H1SW0026	18/08/2017	616.7	39.7
MB17H1SW0026	17/08/2017	616.7	39.7
MB17H1SW0026	16/08/2017	616.7	39.7
MB17H1SW0026	15/08/2017	616.6	39.7
MB17H1SW0026	14/08/2017	616.6	39.8
MB17H1SW0026	13/08/2017	616.6	39.8
MB17H1SW0026	12/08/2017	616.6	39.8
MB17H1SW0026	11/08/2017	616.6	39.8
MB17H1SW0026	10/08/2017	616.6	39.8
MB17H1SW0026	9/08/2017	616.5	39.8
MB17H1SW0026	8/08/2017	616.5	39.9
MB17H1SW0026	7/08/2017	616.5	39.9

ID	Date	WL mAHD	WL mbgl
MB15HD20003	27/08/2021	625.1	63.4
MB15HD20003	28/08/2021	625.1	63.4
MB15HD20003	29/08/2021	625.1	63.4
MB15HD20003	30/08/2021	625.1	63.4
MB15HD20003	31/08/2021	625.1	63.4
MB15HD20003	1/09/2021	625.0	63.4
MB15HD20003	2/09/2021	625.0	63.4
MB15HD20003	3/09/2021	625.1	63.4
MB15HD20003	4/09/2021	625.1	63.3
MB15HD20003	5/09/2021	625.1	63.3
MB15HD20003	6/09/2021	625.1	63.3
MB15HD20003	7/09/2021	625.1	63.3
MB15HD20003	8/09/2021	625.1	63.3
MB15HD20003	9/09/2021	625.1	63.3
MB15HD20003	10/09/2021	625.1	63.3
MB15HD20003	11/09/2021	625.1	63.4
MB15HD20003	12/09/2021	625.0	63.4
MB15HD20003	13/09/2021	625.0	63.4
MB15HD20003	14/09/2021	625.0	63.4
MB15HD20003	15/09/2021	625.0	63.4
MB15HD20003	16/09/2021	625.0	63.4
MB15HD20003	17/09/2021	625.1	63.4
MB15HD20003	18/09/2021	625.1	63.4
MB15HD20003	19/09/2021	625.1	63.3
MB15HD20003	20/09/2021	625.1	63.3
MB15HD20003	21/09/2021	625.1	63.3
MB15HD20003	22/09/2021	625.1	63.3
MB15HD20003	23/09/2021	625.1	63.3
MB15HD20003	24/09/2021	625.0	63.4
MB15HD20003	25/09/2021	625.0	63.4
MB15HD20003	26/09/2021	625.0	63.4
MB15HD20003	27/09/2021	625.0	63.4
MB15HD20003	28/09/2021	625.0	63.4
MB15HD20003	29/09/2021	625.0	63.4
MB15HD20003	30/09/2021	625.0	63.4
MB15HD20003	1/10/2021	625.0	63.4
MB15HD20003	2/10/2021	625.0	63.4
MB15HD20003	3/10/2021	625.0	63.4
MB15HD20003	4/10/2021	625.0	63.4
MB15HD20003	5/10/2021	625.0	63.4
MB15HD20003	6/10/2021	625.0	63.4
MB15HD20003	7/10/2021	625.0	63.4
MB15HD20003	8/10/2021	625.0	63.4
MB15HD20003	9/10/2021	625.0	63.4
MB15HD20003	10/10/2021	625.0	63.4
MB15HD20003	11/10/2021	625.0	63.4
MB15HD20003	12/10/2021	625.0	63.4
MB15HD20003	13/10/2021	625.0	63.4
MB15HD20003	14/10/2021	625.0	63.4
MB15HD20003	15/10/2021	625.0	63.4
MB15HD20003	16/10/2021	625.0	63.4
MB15HD20003	17/10/2021	625.0	63.4
MB15HD20003	18/10/2021	625.0	63.4
MB15HD20003	19/10/2021	625.0	63.4
MB15HD20003	20/10/2021	625.0	63.4
MB15HD20003	21/10/2021	625.0	63.4
MB15HD20003	22/10/2021	625.0	63.4
MB15HD20003	23/10/2021	625.0	63.4
MB15HD20003	24/10/2021	625.0	63.4
MB15HD20003	25/10/2021	625.0	63.4
MB15HD20003	26/10/2021	625.0	63.4
MB15HD20003	27/10/2021	625.0	63.4
MB15HD20003	28/10/2021	625.0	63.4
MB15HD20003	1/11/2021	625.0	63.4
MB15HD20003	2/11/2021	625.0	63.4
MB15HD20003	3/11/2021	625.0	63.4
MB15HD20003	4/11/2021	625.0	63.4
MB15HD20003	5/11/2021	625.0	63.4
MB15HD20003	6/11/2021	625.0	63.4
MB15HD20003	7/11/2021	625.0	63.4
MB15HD20003	9/11/2021	625.0	63.5
MB15HD20003	10/11/2021	625.0	63.4
MB15HD20003	11/11/2021	625.0	63.4
MB15HD20003	12/11/2021	625.0	63.4
MB15HD20003	13/11/2021	625.0	63.4
MB15HD20003	14/11/2021	625.0	63.4
MB15HD20003	15/11/2021	625.0	63.4
MB15HD20003	16/11/2021	625.0	63.4
MB15HD20003	17/11/2021	625.0	63.4
MB15HD20003	18/11/2021	625.0	63.4
MB15HD20003	19/11/2021	625.0	63.4
MB15HD20003	20/11/2021	625.0	63.4
MB15HD20003	22/01/2022	624.9	63.5
MB15HD20003	23/01/2022	624.9	63.5
MB15HD20003	24/01/2022	624.9	63.5
MB15HD20003	25/01/2022	624.9	63.5
MB15HD20003	26/01/2022	624.9	63.5
MB15HD20003	27/01/2022	624.9	63.5
MB15HD20003	28/01/2022	624.9	63.5
MB15HD20003	29/01/2022	624.9	63.5
MB15HD20003	30/01/2022	624.9	63.5
MB15HD20003	31/01/2022	624.9	63.5
MB15HD20003	1/02/2022	624.9	63.5
MB15HD20003	2/02/2022	624.9	63.5
MB15HD20003	3/02/2022	624.9	63.5
MB15HD20003	4/02/2022	624.9	63.5
MB15HD20003	5/02/2022	624.9	63.5
MB15HD20003	6/02/2022	624.9	63.5
MB15HD20003	7/02/2022	624.9	63.5
MB15HD20003	8/02/2022	624.9	63.5
MB15HD20003	9/02/2022	624.9	63.5
MB15HD20003	10/02/2022	624.9	63.5
MB15HD20003	11/02/2022	625.0	63.5
MB15HD20003	12/02/2022	624.9	63.5
MB15HD20003	13/02/2022	625.0	63.5
MB15HD20003	14/02/2022	625.0	63.4
MB15HD20003	15/02/2022	625.0	63.5
MB15HD20003	16/02/2022	625.0	63.5
MB15HD20003	17/02/2022	625.0	63.5
MB15HD20003	18/02/2022	625.0	63.5
MB15HD20003	19/02/2022	625.0	63.5
MB15HD20003	20/02/2022	625.0	63.5
MB15HD20003	21/02/2022	624.9	63.5
MB15HD20003	22/02/2022	624.9	63.5
MB15HD20003	23/02/2022	624.9	63.5
MB15HD20003	24/02/2022	624.9	63.5
MB15HD20003	25/02/2022	624.9	63.5
MB15HD20003	26/02/2022	624.9	63.5
MB15HD20003	27/02/2022	624.9	63.5
MB15HD20003	28/02/2022	624.9	63.5
MB15HD20003	1/03/2022	624.9	63.5
MB15HD20003	2/03/2022	624.9	63.5
MB15HD20003	3/03/2022	624.9	63.5
MB15HD20003	4/03/2022	624.9	63.5
MB15HD20003	5/03/2022	625.0	63.5
MB15HD20003	6/03/2022	625.0	63.5
MB15HD20003	7/03/2022	625.0	63.5
MB15HD20003	8/03/2022	625.0	63.5
MB15HD20003	9/03/2022	625.0	63.5
MB15HD20003	10/03/2022	625.0	63.5
MB15HD20003	11/03/2022	625.0	63.5
MB15HD20003	12/03/2022	624.9	63.5
MB15HD20003	13/03/2022	624.9	63.5
MB15HD20003	14/03/2022	624.9	63.5
MB15HD20003	15/03/2022	624.9	63.5
MB15HD20003	16/03/2022	624.9	63.5

ID	Date	WL mAHD	WL mbgl
MB18HD20007	10/08/2020	628.2	97.5
MB18HD20007	11/08/2020	628.2	97.5
MB18HD20007	12/08/2020	628.2	97.5
MB18HD20007	13/08/2020	628.2	97.5
MB18HD20007	14/08/2020	628.3	97.5
MB18HD20007	15/08/2020	628.3	97.5
MB18HD20007	16/08/2020	628.2	97.5
MB18HD20007	17/08/2020	628.2	97.5
MB18HD20007	18/08/2020	628.3	97.5
MB18HD20007	19/08/2020	628.2	97.5
MB18HD20007	20/08/2020	628.3	97.5
MB18HD20007	21/08/2020	628.3	97.5
MB18HD20007	22/08/2020	628.3	97.5
MB18HD20007	23/08/2020	628.3	97.5
MB18HD20007	24/08/2020	628.3	97.5
MB18HD20007	25/08/2020	628.3	97.5
MB18HD20007	26/08/2020	628.3	97.5
MB18HD20007	27/08/2020	628.3	97.5
MB18HD20007	28/08/2020	628.3	97.5
MB18HD20007	29/08/2020	628.3	97.5
MB18HD20007	30/08/2020	628.3	97.5
MB18HD20007	31/08/2020	628.3	97.5
MB18HD20007	1/09/2020	628.3	97.5
MB18HD20007	2/09/2020	628.2	97.5
MB18HD20007	3/09/2020	628.3	97.5
MB18HD20007	4/09/2020	628.3	97.5
MB18HD20007	5/09/2020	628.2	97.5
MB18HD20007	6/09/2020	628.2	97.5
MB18HD20007	7/09/2020	628.2	97.6
MB18HD20007	8/09/2020	628.2	97.5
MB18HD20007	9/09/2020	628.3	97.5
MB18HD20007	10/09/2020	628.2	97.5
MB18HD20007	11/09/2020	628.2	97.5
MB18HD20007	12/09/2020	628.2	97.5
MB18HD20007	13/09/2020	628.3	97.5
MB18HD20007	14/09/2020	628.3	97.5
MB18HD20007	15/09/2020	628.3	97.5
MB18HD20007	16/09/2020	628.2	97.5
MB18HD20007	17/09/2020	628.2	97.5
MB18HD20007	18/09/2020	628.2	97.5
MB18HD20007	19/09/2020	628.2	97.6
MB18HD20007	20/09/2020	628.2	97.6
MB18HD20007	21/09/2020	628.2	97.5
MB18HD20007	22/09/2020	628.2	97.5
MB18HD20007	23/09/2020	628.2	97.5
MB18HD20007	24/09/2020	628.3	97.5
MB18HD20007	25/09/2020	628.2	97.5
MB18HD20007	26/09/2020	628.2	97.6
MB18HD20007	27/09/2020	628.2	97.6
MB18HD20007	28/09/2020	628.2	97.6
MB18HD20007	29/09/2020	628.2	97.6
MB18HD20007	30/09/2020	628.2	97.6
MB18HD20007	1/10/2020	628.2	97.6
MB18HD20007	2/10/2020	628.2	97.6
MB18HD20007	3/10/2020	628.2	97.6
MB18HD20007	4/10/2020	628.2	97.5
MB18HD20007	5/10/2020	628.3	97.5
MB18HD20007	6/10/2020	628.3	97.5
MB18HD20007	7/10/2020	628.3	97.5
MB18HD20007	8/10/2020	628.2	97.5
MB18HD20007	9/10/2020	628.2	97.6
MB18HD20007	10/10/2020	628.2	97.6
MB18HD20007	11/10/2020	628.2	97.6
MB18HD20007	12/10/2020	628.2	97.6
MB18HD20007	13/10/2020	628.2	97.6
MB18HD20007	14/10/2020	628.2	97.6
MB18HD20007	15/10/2020	628.2	97.6
MB18HD20007	16/10/2020	628.2	97.6
MB18HD20007	17/10/2020	628.2	97.6
MB18HD20007	18/10/2020	628.2	97.6
MB18HD20007	19/10/2020	628.2	97.6
MB18HD20007	20/10/2020	628.2	97.6
MB18HD20007	21/10/2020	628.2	97.6
MB18HD20007	22/10/2020	628.2	97.6
MB18HD20007	23/10/2020	628.2	97.6
MB18HD20007	24/10/2020	628.2	97.6
MB18HD20007	25/10/2020	628.2	97.6
MB18HD20007	26/10/2020	628.2	97.6
MB18HD20007	27/10/2020	628.2	97.6
MB18HD20007	28/10/2020	628.2	97.6
MB18HD20007	29/10/2020	628.2	97.6
MB18HD20007	30/10/2020	628.2	97.6
MB18HD20007	31/10/2020	628.2	97.6
MB18HD20007	1/11/2020	628.2	97.6
MB18HD20007	2/11/2020	628.2	97.6
MB18HD20007	3/11/2020	628.2	97.6
MB18HD20007	4/11/2020	628.2	97.6
MB18H

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	13/03/2008	135.0	551.2
HDVP1	12/03/2008	135.0	551.2
HDVP1	11/03/2008	135.0	551.2
HDVP1	10/03/2008	135.0	551.2
HDVP1	9/03/2008	135.0	551.2
HDVP1	8/03/2008	135.0	551.2
HDVP1	7/03/2008	135.0	551.2
HDVP1	6/03/2008	135.0	551.2
HDVP1	5/03/2008	135.0	551.2
HDVP1	4/03/2008	135.0	551.2
HDVP1	3/03/2008	135.0	551.2
HDVP1	2/03/2008	135.0	551.2
HDVP1	1/03/2008	135.0	551.2
HDVP1	29/02/2008	135.0	551.2
HDVP1	28/02/2008	169.6	516.5
HDVP1	27/02/2008	169.6	516.5
HDVP1	26/02/2008	169.6	516.5
HDVP1	25/02/2008	169.6	516.5
HDVP1	24/02/2008	169.6	516.5
HDVP1	23/02/2008	169.6	516.5
HDVP1	22/02/2008	169.6	516.5
HDVP1	21/02/2008	169.6	516.5
HDVP1	20/02/2008	169.6	516.5
HDVP1	19/02/2008	169.6	516.5
HDVP1	18/02/2008	169.6	516.5
HDVP1	17/02/2008	169.6	516.5
HDVP1	16/02/2008	169.6	516.5
HDVP1	15/02/2008	169.6	516.5
HDVP1	14/02/2008	169.6	516.5
HDVP1	13/02/2008	169.6	516.5
HDVP1	12/02/2008	169.6	516.5
HDVP1	11/02/2008	169.6	516.5
HDVP1	10/02/2008	169.6	516.5
HDVP1	9/02/2008	169.6	516.5
HDVP1	8/02/2008	169.6	516.5
HDVP1	7/02/2008	169.6	516.5
HDVP1	6/02/2008	169.6	516.5
HDVP1	5/02/2008	169.6	516.5
HDVP1	4/02/2008	169.6	516.5
HDVP1	3/02/2008	169.6	516.5
HDVP1	2/02/2008	169.6	516.5
HDVP1	1/02/2008	169.6	516.5
HDVP1	31/01/2008	107.5	578.7
HDVP1	30/01/2008	107.5	578.7
HDVP1	29/01/2008	107.5	578.7
HDVP1	28/01/2008	107.5	578.7
HDVP1	27/01/2008	107.5	578.7
HDVP1	26/01/2008	107.5	578.7
HDVP1	25/01/2008	107.5	578.7
HDVP1	24/01/2008	107.5	578.7
HDVP1	23/01/2008	107.5	578.7
HDVP1	22/01/2008	107.5	578.7
HDVP1	21/01/2008	107.5	578.7
HDVP1	20/01/2008	107.5	578.7
HDVP1	19/01/2008	107.5	578.7
HDVP1	18/01/2008	107.5	578.7
HDVP1	17/01/2008	107.5	578.7
HDVP1	16/01/2008	107.5	578.7
HDVP1	15/01/2008	107.5	578.7
HDVP1	14/01/2008	107.5	578.7
HDVP1	13/01/2008	107.5	578.7
HDVP1	12/01/2008	107.5	578.7
HDVP1	11/01/2008	107.5	578.7
HDVP1	10/01/2008	107.5	578.7
HDVP1	9/01/2008	107.5	578.7
HDVP1	8/01/2008	107.5	578.7
HDVP1	7/01/2008	107.5	578.7
HDVP1	6/01/2008	107.5	578.7
HDVP1	5/01/2008	107.5	578.7
HDVP1	4/01/2008	107.5	578.7
HDVP1	3/01/2008	107.5	578.7
HDVP1	2/01/2008	107.5	578.7
HDVP1	1/01/2008	107.5	578.7
HDVP1	31/12/2007	109.7	576.5
HDVP1	30/12/2007	109.7	576.5
HDVP1	29/12/2007	109.7	576.5
HDVP1	28/12/2007	109.7	576.5
HDVP1	27/12/2007	109.7	576.5
HDVP1	26/12/2007	109.7	576.5
HDVP1	25/12/2007	109.7	576.5
HDVP1	24/12/2007	109.7	576.5
HDVP1	23/12/2007	109.7	576.5
HDVP1	22/12/2007	109.7	576.5
HDVP1	21/12/2007	109.7	576.5
HDVP1	20/12/2007	109.7	576.5
HDVP1	19/12/2007	109.7	576.5
HDVP1	18/12/2007	109.7	576.5
HDVP1	17/12/2007	109.7	576.5
HDVP1	16/12/2007	109.7	576.5
HDVP1	15/12/2007	109.7	576.5
HDVP1	14/12/2007	109.7	576.5
HDVP1	13/12/2007	109.7	576.5
HDVP1	12/12/2007	109.7	576.5
HDVP1	11/12/2007	109.7	576.5
HDVP1	10/12/2007	109.7	576.5
HDVP1	9/12/2007	109.7	576.5
HDVP1	8/12/2007	109.7	576.5
HDVP1	7/12/2007	109.7	576.5
HDVP1	6/12/2007	109.7	576.5
HDVP1	5/12/2007	109.7	576.5
HDVP1	4/12/2007	109.7	576.5
HDVP1	3/12/2007	109.7	576.5
HDVP1	2/12/2007	109.7	576.5
HDVP1	1/12/2007	109.7	576.5
HDVP1	30/11/2007	47.2	638.9
HDVP1	29/11/2007	47.2	638.9
HDVP1	28/11/2007	47.2	638.9
HDVP1	27/11/2007	47.2	638.9
HDVP1	26/11/2007	47.2	638.9
HDVP1	25/11/2007	47.2	638.9
HDVP1	24/11/2007	47.2	638.9
HDVP1	23/11/2007	47.2	638.9
HDVP1	22/11/2007	47.2	638.9
HDVP1	21/11/2007	47.2	638.9
HDVP1	20/11/2007	47.2	638.9
HDVP1	19/11/2007	47.2	638.9
HDVP1	18/11/2007	47.2	638.9
HDVP1	17/11/2007	47.2	638.9
HDVP1	16/11/2007	47.2	638.9
HDVP1	15/11/2007	47.2	638.9
HDVP1	14/11/2007	47.2	638.9
HDVP1	13/11/2007	47.2	638.9
HDVP1	12/11/2007	47.2	638.9
HDVP1	11/11/2007	47.2	638.9
HDVP1	10/11/2007	47.2	638.9
HDVP1	9/11/2007	47.2	638.9
HDVP1	8/11/2007	47.2	638.9
HDVP1	7/11/2007	47.2	638.9
HDVP1	6/11/2007	47.2	638.9
HDVP1	5/11/2007	47.2	638.9
HDVP1	4/11/2007	47.2	638.9
HDVP1	3/11/2007	47.2	638.9
HDVP1	2/11/2007	47.2	638.9
HDVP1	1/11/2007	47.2	638.9
HDVP1	31/10/2007	138.7	547.5
HDVP1	30/10/2007	138.7	547.5

ID	Date	WL mAHD	WL mbgl
MB17H1SW0026	6/08/2017	616.6	39.8
MB17H1SW0026	5/08/2017	616.5	39.9
MB17H1SW0026	4/08/2017	616.5	39.9
MB17H1SW0026	3/08/2017	616.4	40.0
MB17H1SW0026	2/08/2017	616.4	40.0
MB17H1SW0026	1/08/2017	616.4	40.0
MB17H1SW0026	31/07/2017	616.3	40.1
MB17H1SW0026	30/07/2017	616.2	40.2
MB17H1SW0026	29/07/2017	616.1	40.2
MB17H1SW0026	28/07/2017	616.1	40.3
MB17H1SW0026	27/07/2017	616.0	40.4
MB17H1SW0026	26/07/2017	616.0	40.4
MB17H1SW0026	25/07/2017	615.9	40.5
MB17H1SW0026	24/07/2017	615.9	40.5
MB17H1SW0026	23/07/2017	615.8	40.6
MB17H1SW0026	22/07/2017	615.7	40.6
MB17H1SW0026	21/07/2017	615.8	40.6
MB17H1SW0026	20/07/2017	615.8	40.6
MB17H1SW0026	19/07/2017	615.8	40.6
MB17H1SW0026	18/07/2017	615.9	40.5
MB17H1SW0026	17/07/2017	616.0	40.4
MB17H1SW0026	11/07/2017	616.0	40.4
MB18BHT0003	3/03/2022	613.5	67.3
MB18BHT0003	2/03/2022	613.5	67.3
MB18BHT0003	1/03/2022	613.5	67.3
MB18BHT0003	28/02/2022	613.5	67.3
MB18BHT0003	27/02/2022	613.5	67.3
MB18BHT0003	26/02/2022	613.5	67.3
MB18BHT0003	25/02/2022	613.5	67.3
MB18BHT0003	24/02/2022	613.5	67.3
MB18BHT0003	23/02/2022	613.5	67.3
MB18BHT0003	22/02/2022	613.5	67.3
MB18BHT0003	21/02/2022	613.5	67.3
MB18BHT0003	20/02/2022	613.6	67.3
MB18BHT0003	19/02/2022	613.6	67.2
MB18BHT0003	18/02/2022	613.6	67.2
MB18BHT0003	17/02/2022	613.6	67.3
MB18BHT0003	16/02/2022	613.6	67.3
MB18BHT0003	15/02/2022	613.6	67.3
MB18BHT0003	14/02/2022	613.6	67.2
MB18BHT0003	13/02/2022	613.6	67.2
MB18BHT0003	12/02/2022	613.5	67.3
MB18BHT0003	11/02/2022	613.6	67.3
MB18BHT0003	10/02/2022	613.6	67.3
MB18BHT0003	9/02/2022	613.5	67.3
MB18BHT0003	8/02/2022	613.5	67.3
MB18BHT0003	7/02/2022	613.5	67.3
MB18BHT0003	6/02/2022	613.5	67.3
MB18BHT0003	5/02/2022	613.5	67.3
MB18BHT0003	4/02/2022	613.5	67.3
MB18BHT0003	3/02/2022	613.5	67.3
MB18BHT0003	2/02/2022	613.5	67.3
MB18BHT0003	1/02/2022	613.5	67.3
MB18BHT0003	31/01/2022	613.5	67.3
MB18BHT0003	30/01/2022	613.5	67.3
MB18BHT0003	29/01/2022	613.5	67.3
MB18BHT0003	28/01/2022	613.5	67.3
MB18BHT0003	27/01/2022	613.5	67.3
MB18BHT0003	26/01/2022	613.5	67.4
MB18BHT0003	25/01/2022	613.5	67.4
MB18BHT0003	24/01/2022	613.5	67.3
MB18BHT0003	23/01/2022	613.5	67.3
MB18BHT0003	22/01/2022	613.5	67.3
MB18BHT0003	21/01/2022	613.5	67.3
MB18BHT0003	20/01/2022	613.5	67.3
MB18BHT0003	19/01/2022	613.5	67.3
MB18BHT0003	18/01/2022	613.5	67.4
MB18BHT0003	17/01/2022	613.4	67.4
MB18BHT0003	16/01/2022	613.4	67.4
MB18BHT0003	15/01/2022	613.4	67.4
MB18BHT0003	14/01/2022	613.4	67.4
MB18BHT0003	13/01/2022	613.5	67.4
MB18BHT0003	12/01/2022	613.5	67.3
MB18BHT0003	11/01/2022	613.5	67.3
MB18BHT0003	10/01/2022	613.5	67.3
MB18BHT0003	9/01/2022	613.5	67.4
MB18BHT0003	8/01/2022	613.5	67.4
MB18BHT0003	7/01/2022	613.5	67.3
MB18BHT0003	6/01/2022	613.5	67.4
MB18BHT0003	5/01/2022	613.5	67.4
MB18BHT0003	4/01/2022	613.5	67.4
MB18BHT0003	3/01/2022	613.5	67.4
MB18BHT0003	2/01/2022	613.5	67.4
MB18BHT0003	1/01/2022	613.5	67.4
MB18BHT0003	31/12/2021	613.4	67.4
MB18BHT0003	30/12/2021	613.4	67.4
MB18BHT0003	26/12/2021	613.5	67.3
MB18BHT0003	25/12/2021	613.5	67.4
MB18BHT0003	24/12/2021	613.4	67.4
MB18BHT0003	23/12/2021	613.4	67.4
MB18BHT0003	22/12/2021	613.4	67.4
MB18BHT0003	21/12/2021	613.5	67.4
MB18BHT0003	12/12/2021	613.5	67.3
MB18BHT0003	11/12/2021	613.5	67.4
MB18BHT0003	10/12/2021	613.5	67.4
MB18BHT0003	9/12/2021	613.5	67.4
MB18BHT0003	8/12/2021	613.5	67.4
MB18BHT0003	7/12/2021	613.5	67.4
MB18BHT0003	6/12/2021	613.5	67.4
MB18BHT0003	5/12/2021	613.4	67.4
MB18BHT0003	4/12/2021	613.5	67.3
MB18BHT0003	3/12/2021	613.5	67.4
MB18BHT0003	2/12/2021	613.5	67.4
MB18BHT0003	1/12/2021	613.5	67.4
MB18BHT0003	30/11/2021	613.5	67.4
MB18BHT0003	29/11/2021	613.5	67.3
MB18BHT0003	28/11/2021	613.5	67.3
MB18BHT0003	27/11/2021	613.5	67.3
MB18BHT0003	26/11/2021	613.5	67.3
MB18BHT0003	25/11/2021	613.5	67.3
MB18BHT0003	24/11/2021	613.5	67.3
MB18BHT0003	23/11/2021	613.5	67.3
MB18BHT0003	22/11/2021	613.5	67.3
MB18BHT0003	21/11/2021	613.5	67.3
MB18BHT0003	20/11/2021	613.5	67.4
MB18BHT0003	19/11/2021	613.4	67.4
MB18BHT0003	18/11/2021	613.5	67.4
MB18BHT0003	17/11/2021	613.5	67.3
MB18BHT0003	16/11/2021	613.5	67.4
MB18BHT0003	15/11/2021	613.5	67.4
MB18BHT0003	14/11/2021	613.5	67.3
MB18BHT0003	13/11/2021	613.5	67.3
MB18BHT0003	12/11/2021	613.5	67.3
MB18BHT0003	11/11/2021	613.5	67.3
MB18BHT0003	10/11/2021	613.5	67.4
MB18BHT0003	9/11/2021	613.4	67.4
MB18BHT0003	7/11/2021	613.4	67.4
MB18BHT0003	6/11/2021	613.4	67.4
MB18BHT0003	5/11/2021	613.5	67.4
MB18BHT0003	4/11/2021	613.5	67.3
MB18BHT0003	3/11/2021	613.5	67.3
MB18BHT0003	2/11/2021	613.5	67.4
MB18BHT0003	1/11/2021	613.5	67.4
MB18BHT0003	31/10/2021	613.5	67.4
MB18BHT0003	30/10/2021	613.5	67.4
MB18BHT0003	29/10/2021	613.4	67.4

ID	Date	WL mAHD	WL mbgl
MB15HD20004	4/02/2016	625.4	68.8
MB15HD20004	2/05/2016	625.3	68.9
MB15HD20004	30/10/2016	625.3	68.9
MB15HD20004	19/02/2017	625.3	68.9
MB15HD20004	14/05/2017	625.3	68.9
MB15HD20004	21/08/2017	625.4	68.9
MB15HD20004	9/11/2017	625.4	68.8
MB15HD20004	12/04/2018	625.3	68.9
MB15HD20004	21/11/2018	625.3	68.9
MB15HD20004	22/11/2018	625.3	68.9
MB15HD20004	23/11/2018	625.3	68.9
MB15HD20004	24/11/2018	625.3	68.9
MB15HD20004	25/11/2018	625.3	68.9
MB15HD20004	26/11/2018	625.3	68.9
MB15HD20004	27/11/2018	625.3	68.9
MB15HD20004	28/11/2018	625.3	68.9
MB15HD20004	29/11/2018	625.3	68.9
MB15HD20004	30/11/2018	625.3	68.9
MB15HD20004	1/12/2018	625.3	68.9
MB15HD20004	2/12/2018	625.3	68.9
MB15HD20004	3/12/2018	625.3	68.9
MB15HD20004	4/12/2018	625.3	68.9
MB15HD20004	5/12/2018	625.3	68.9
MB15HD20004	6/12/2018	625.3	68.9
MB15HD20004	7/12/2018	625.3	68.9
MB15HD20004	8/12/2018	625.3	68.9
MB15HD20004	9/12/2018	625.3	68.9
MB15HD20004	10/12/2018	625.3	68.9
MB15HD20004	11/12/2018	625.3	68.9
MB15HD20004	12/12/2018	625.3	68.9
MB15HD20004	13/12/2018	625.3	68.9
MB15HD20004	14/12/2018	625.3	68.9
MB15HD20004	15/12/2018	625.3	68.9
MB15HD20004	16/12/2018	625.3	68.9
MB15HD20004	17/12/2018	625.3	68.9
MB15HD20004	18/12/2018	625.3	68.9
MB15HD20004	19/12/2018	625.3	68.9
MB15HD20004	20/12/2018	625.3	68.9
MB15HD20004	21/12/2018	625.3	68.9
MB15HD20004	22/12/2018	625.3	68.9
MB15HD20004	23/12/2018	625.3	68.9
MB15HD20004	24/12/2018	625.3	68.9
MB15HD20004	25/12/2018	625.3	68.9
MB15HD20004	26/12/2018	625.3	68.9
MB15HD20004	27/12/2018	625.3	68.9
MB15HD20004	28/12/2018	625.3	68.9
MB15HD20004	29/12/2018	625.3	68.9
MB15HD20004	30/12/2018	625.3	68.9
MB15HD20004	31/12/2018	625.3	68.9
MB15HD20004	1/01/2019	625.3	68.9
MB15HD20004	2/01/2019	625.3	68.9
MB15HD20004	3/01/2019	625.3	68.9
MB15HD20004	4/01/2019	625.3	68.9
MB15HD20004	5/01/2019	625.3	68.9
MB15HD20004	6/01/2019	625.3	68.9
MB15HD20004	7/01/2019	625.3	68.9
MB15HD20004	8/01/2019	625.3	68.9
MB15HD20004	9/01/2019	625.3	68.9
MB15HD20004	10/01/2019	625.3	68.9
MB15HD20004	11/01/2019	625.3	68.9
MB15HD20004	12/01/2019	625.3	68.9
MB15HD20004	13/01/2019	625.3	68.9
MB15HD20004	14/01/2019	625.3	68.9
MB15HD20004	15/01/2019	625.3	68.9
MB15HD20004	16/01/2019	625.3	68.9
MB15HD20004	17/01/2019	625.3	68.9
MB15HD20004	18/01/2019	625.3	68.9
MB15HD20004	19/01/2019	625.3	68.9
MB15HD20004	20/01/2019	625.3	68.9
MB15HD20004	21/01/2019	625.3	68.9
MB15HD20004	22/01/2019	625.3	68.9
MB15HD20004	23/01/2019	625.3	68.9
MB15HD20004	24/01/2019	625.3	68.9
MB15HD20004	25/01/2019	625.3	68.9
MB15HD20004	26/01/2019	625.3	68.9
MB15HD20004	27/01/2019	625.3	68.9
MB15HD20004	28/01/2019	625.3	68.9
MB15HD20004	29/01/2019	625.3	68.9
MB15HD20004	30/01/2019	625.3	68.9
MB15HD20004	31/01/2019	625.3	68.9
MB15HD20004	1/02/2019	625.3	68.9
MB15HD20004	2/02/2019	625.3	68.9
MB15HD20004	3/02/2019	625.3	68.9
MB15HD20004	4/02/2019	625.3	68.9
MB15HD20004	5/02/2019	625.3	68.9
MB15HD20004	6/02/2019	625.3	68.9
MB15HD20004	7/02/2019	625.3	68.9
MB15HD20004	8/02/2019	625.3	68.9
MB15HD20004	9/02/2019	625.3	68.9
MB15HD20004	10/02/2019	625.3	68.9
MB15HD20004	11/02/2019	625.3	68.9
MB15HD20004	12/02/2019	625.3	68.9
MB15HD20004	13/02/2019	625.3	68.9
MB15HD20004	14/02/2019	625.3	68.9
MB15HD20004	15/02/2019	625.3	68.9
MB15HD20004	16/02/2019	625.3	68.9
MB15HD20004	17/02/2019	625.3	68.9
MB15HD20004	18/02/2019	625.3	68.9
MB15HD20004	19/02/2019	625.3	68.9
MB15HD20004	20/02/2019	625.3	68.9
MB15HD20004	21/02/2019	625.3	68.9
MB15HD20004	22/02/2019	625.3	68.9
MB15HD20004	23/02/2019	625.3	68.9
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MB15HD20004	25/02/2019	625.3	68.9
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MB15HD20004	5/03/2019	625.3	68.9
MB15HD20004	6/03/2019	625.3	68.9
MB15HD20004	7/03/2019	625.3	68.9
MB15HD20004	8/03/2019	625.3	68.9
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MB15HD20004	18/03/2019	625.3	68.9
MB15HD20004	19/03/2019	625.3	68.9
MB15HD20004	20/03/2019	625.3	68.9
MB15HD20004	21/03/2019	625.3	68.9
MB15HD20004	22/03/2019	625.3	68.9
MB15HD20004	23/03/2019	625.3	68.9
MB15HD20004	24/03/2019	625.3	68.9
MB15HD20004	25/03/2019	625.3	68.9
MB15HD20004	26/03/2019	625.3	68.9
MB15HD20004	27/03/2019	625.3	68.9
MB15HD20004	28/03/2019	625.3	68.9

ID	Date	WL mAHD	WL mbgl
MB18HD20007	24/12/2020	628.1	97.6
MB18HD20007	25/12/2020	628.1	97.6
MB18HD20007	26/12/2020	628.1	97.6
MB18HD20007	27/12/2020	628.1	97.6
MB18HD20007	28/12/2020	628.1	97.7
MB18HD20007	29/12/2020	628.1	97.6
MB18HD20007	30/12/2020	628.1	97.6
MB18HD20007	31/12/2020	628.1	97.7
MB18HD20007	1/01/2021	628.1	97.7
MB18HD20007	2/01/2021	628.1	97.7
MB18HD20007	3/01/2021	628.1	97.7
MB18HD20007	4/01/2021	628.1	97.7
MB18HD20007	5/01/2021	628.1	97.7
MB18HD20007	6/01/2021	628.2	97.6
MB18HD20007	7/01/2021	628.2	97.6
MB18HD20007	8/01/2021	628.2	97.6
MB18HD20007	9/01/2021	628.2	97.6
MB18HD20007	10/01/2021	628.2	97.6
MB18HD20007	11/01/2021	628.1	97.6
MB18HD20007	12/01/2021	628.1	97.6
MB18HD20007	13/01/2021	628.1	97.7
MB18HD20007	14/01/2021	628.1	97.7
MB18HD20007	15/01/2021	628.1	97.7
MB18HD20007	16/01/2021	628.1	97.6
MB18HD20007	17/01/2021	628.1	97.6
MB18HD20007	18/01/2021	628.1	97.6
MB18HD20007	19/01/2021	628.1	97.6
MB18HD20007	20/01/2021	628.1	97.6
MB18HD20007	21/01/2021	628.1	97.7
MB18HD20007	22/01/2021	628.1	97.7
MB18HD20007	23/01/2021	628.1	97.7
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MB18HD20007	25/01/2021	628.1	97.7
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MB18HD20007	27/01/2021	628.1	97.7
MB18HD20007	28/01/2021	628.1	97.7
MB18HD20007	29/01/2021	628.1	97.7
MB18HD20007	30/01/2021	628.1	97.7
MB18HD20007	31/01/2021	628.1	97.7
MB18HD20007	1/02/2021	628.1	97.7
MB18HD20007	2/02/2021	628.1	97.7
MB18HD20007	3/02/2021	628.1	97.7
MB18HD20007	4/02/2021	628.1	97.7
MB18HD20007	5/02/2021	628.1	97.7
MB18HD20007	6/02/2021	628.1	97.7
MB18HD20007	7/02/2021	628.1	97.7
MB18HD20007	8/02/2021	628.1	97.7
MB18HD20007	9/02/2021	628.1	97.7
MB18HD20007	10/02/2021	628.1	97.7
MB18HD20007	11/02/2021	628.1	97.7
MB18HD20007	12/02/2021	628.1	97.7
MB18HD20007	13/02/2021	628.1	97.7
MB18HD20007	14/02/2021	628.1	97.7
MB18HD20007	15/02/2021	628.1	97.7
MB18HD20007	16/02/2021	628.1	97.7
MB18HD20007	17/02/2021	628.1	97.7
MB18HD20007	18/02/2021	628.1	97.7
MB18HD20007	19/02/2021	628.1	97.7
MB18HD20007	20/02/2021	628.1	97.7
MB18HD20007	21/02/2021	628.1	97.7
MB18HD20007	22/02/2021	628.1	97.7
MB18HD20007	23/02/2021	628.1	97.7
MB18HD20007	24/02/2021	628.1	97.7
MB18HD20007	25/02/2021	628.1	97.7
MB18HD20007	26/02/2021	628.1	97.7
MB18HD20007	27/02/2021	628.1	97.7
MB18HD20007	28/02/2021	628.1	97.7
MB18HD20007	1/03/2021	628.1	97.7
MB18HD20007	2/03/2021	628.1	97.7
MB18HD20007	3/03/2021	628.1	97.7
MB18HD20007	4/03/2021	628.1	97.7
MB18HD20007	5/03/2021	628.1	97.7
MB18HD20007	6/03/2021	628.1	97.7
MB18HD20007	7/03/2021	628.1	97.7
MB18HD20007	8/03/2021	628.1	97.7
MB18HD20007	9/03/2021	628.1	97.7
MB18HD20007	10/03/2021	628.1	97.7
MB18HD20007	11/03/2021	628.1	97.7
MB18HD20007	12/03/2021	628.1	97.7
MB18HD20007	13/03/2021	628.1	97.7
MB18HD20007	14/03/2021	628.1	97.7
MB18HD20007	15/03/2021	628.1	97.6
MB18HD20007	16/03/2021	628.1	97.6
MB18HD20007	17/03/2021	628.1	97.7
MB18HD20007	18/03/2021	628.1	97.7
MB18HD20007	19/03/2021	628.1	97.7
MB18HD20007	20/03/2021	628.1	97.7
MB18HD20007	21/03/2021	628.1	97.7
MB18HD20007	22/03/2021	628.1	97.7
MB18HD20007	23/03/2021	628.1	97.7
MB18HD20007	24/03/2021	628.1

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	29/10/2007	138.7	547.5
HDVP1	28/10/2007	138.7	547.5
HDVP1	27/10/2007	138.7	547.5
HDVP1	26/10/2007	138.7	547.5
HDVP1	25/10/2007	138.7	547.5
HDVP1	24/10/2007	138.7	547.5
HDVP1	23/10/2007	138.7	547.5
HDVP1	22/10/2007	138.7	547.5
HDVP1	21/10/2007	138.7	547.5
HDVP1	20/10/2007	138.7	547.5
HDVP1	19/10/2007	138.7	547.5
HDVP1	18/10/2007	138.7	547.5
HDVP1	17/10/2007	138.7	547.5
HDVP1	16/10/2007	138.7	547.5
HDVP1	15/10/2007	138.7	547.5
HDVP1	14/10/2007	138.7	547.5
HDVP1	13/10/2007	138.7	547.5
HDVP1	12/10/2007	138.7	547.5
HDVP1	11/10/2007	138.7	547.5
HDVP1	10/10/2007	138.7	547.5
HDVP1	9/10/2007	138.7	547.5
HDVP1	8/10/2007	138.7	547.5
HDVP1	7/10/2007	138.7	547.5
HDVP1	6/10/2007	138.7	547.5
HDVP1	5/10/2007	138.7	547.5
HDVP1	4/10/2007	138.7	547.5
HDVP1	3/10/2007	138.7	547.5
HDVP1	2/10/2007	138.7	547.5
HDVP1	1/10/2007	138.7	547.5
HDVP1	30/09/2007	263.3	422.8
HDVP1	29/09/2007	263.3	422.8
HDVP1	28/09/2007	263.3	422.8
HDVP1	27/09/2007	263.3	422.8
HDVP1	26/09/2007	263.3	422.8
HDVP1	25/09/2007	263.3	422.8
HDVP1	24/09/2007	263.3	422.8
HDVP1	23/09/2007	263.3	422.8
HDVP1	22/09/2007	263.3	422.8
HDVP1	21/09/2007	263.3	422.8
HDVP1	20/09/2007	263.3	422.8
HDVP1	19/09/2007	263.3	422.8
HDVP1	18/09/2007	263.3	422.8
HDVP1	17/09/2007	263.3	422.8
HDVP1	16/09/2007	263.3	422.8
HDVP1	15/09/2007	263.3	422.8
HDVP1	14/09/2007	263.3	422.8
HDVP1	13/09/2007	263.3	422.8
HDVP1	12/09/2007	263.3	422.8
HDVP1	11/09/2007	263.3	422.8
HDVP1	10/09/2007	263.3	422.8
HDVP1	9/09/2007	263.3	422.8
HDVP1	8/09/2007	263.3	422.8
HDVP1	7/09/2007	263.3	422.8
HDVP1	6/09/2007	263.3	422.8
HDVP1	5/09/2007	263.3	422.8
HDVP1	4/09/2007	263.3	422.8
HDVP1	3/09/2007	263.3	422.8
HDVP1	2/09/2007	263.3	422.8
HDVP1	1/09/2007	263.3	422.8
HDVP1	31/08/2007	48.8	637.4
HDVP1	30/08/2007	48.8	637.4
HDVP1	29/08/2007	48.8	637.4
HDVP1	28/08/2007	48.8	637.4
HDVP1	27/08/2007	48.8	637.4
HDVP1	26/08/2007	48.8	637.4
HDVP1	25/08/2007	48.8	637.4
HDVP1	24/08/2007	48.8	637.4
HDVP1	23/08/2007	48.8	637.4
HDVP1	22/08/2007	48.8	637.4
HDVP1	21/08/2007	48.8	637.4
HDVP1	20/08/2007	48.8	637.4
HDVP1	19/08/2007	48.8	637.4
HDVP1	18/08/2007	48.8	637.4
HDVP1	17/08/2007	48.8	637.4
HDVP1	16/08/2007	48.8	637.4
HDVP1	15/08/2007	48.8	637.4
HDVP1	14/08/2007	48.8	637.4
HDVP1	13/08/2007	48.8	637.4
HDVP1	12/08/2007	48.8	637.4
HDVP1	11/08/2007	48.8	637.4
HDVP1	10/08/2007	48.8	637.4
HDVP1	9/08/2007	48.8	637.4
HDVP1	8/08/2007	48.8	637.4
HDVP1	7/08/2007	48.8	637.4
HDVP1	6/08/2007	48.8	637.4
HDVP1	5/08/2007	48.8	637.4
HDVP1	4/08/2007	48.8	637.4
HDVP1	3/08/2007	48.8	637.4
HDVP1	2/08/2007	48.8	637.4
HDVP1	1/08/2007	48.8	637.4
HDVP1	31/07/2007	47.8	638.4
HDVP1	30/07/2007	47.8	638.4
HDVP1	29/07/2007	47.8	638.4
HDVP1	28/07/2007	47.8	638.4
HDVP1	27/07/2007	47.8	638.4
HDVP1	26/07/2007	47.8	638.4
HDVP1	25/07/2007	47.8	638.4
HDVP1	24/07/2007	47.8	638.4
HDVP1	23/07/2007	47.8	638.4
HDVP1	22/07/2007	47.8	638.4
HDVP1	21/07/2007	47.8	638.4
HDVP1	20/07/2007	47.8	638.4
HDVP1	19/07/2007	47.8	638.4
HDVP1	18/07/2007	47.8	638.4
HDVP1	17/07/2007	47.8	638.4
HDVP1	16/07/2007	47.8	638.4
HDVP1	15/07/2007	47.8	638.4
HDVP1	14/07/2007	47.8	638.4
HDVP1	13/07/2007	47.8	638.4
HDVP1	12/07/2007	47.8	638.4
HDVP1	11/07/2007	47.8	638.4
HDVP1	10/07/2007	47.8	638.4
HDVP1	9/07/2007	47.8	638.4
HDVP1	8/07/2007	47.8	638.4
HDVP1	7/07/2007	47.8	638.4
HDVP1	6/07/2007	47.8	638.4
HDVP1	5/07/2007	47.8	638.4
HDVP1	4/07/2007	47.8	638.4
HDVP1	3/07/2007	47.8	638.4
HDVP1	2/07/2007	47.8	638.4
HDVP1	1/07/2007	47.8	638.4
HDVP1	30/06/2007	0.1	686.0
HDVP1	29/06/2007	0.1	686.0
HDVP1	28/06/2007	0.1	686.0
HDVP1	27/06/2007	0.1	686.0
HDVP1	26/06/2007	0.1	686.0
HDVP1	25/06/2007	0.1	686.0
HDVP1	24/06/2007	0.1	686.0
HDVP1	23/06/2007	0.1	686.0
HDVP1	22/06/2007	0.1	686.0
HDVP1	21/06/2007	0.1	686.0
HDVP1	20/06/2007	0.1	686.0
HDVP1	19/06/2007	0.1	686.0
HDVP1	18/06/2007	0.1	686.0
HDVP1	17/06/2007	0.1	686.0
HDVP1	16/06/2007	0.1	686.0

ID	Date	WL mAHD	WL mbgl
MB18BHT0003	28/10/2021	613.5	67.4
MB18BHT0003	27/10/2021	613.5	67.3
MB18BHT0003	26/10/2021	613.5	67.4
MB18BHT0003	25/10/2021	613.4	67.4
MB18BHT0003	24/10/2021	613.5	67.3
MB18BHT0003	23/10/2021	613.5	67.3
MB18BHT0003	22/10/2021	613.5	67.3
MB18BHT0003	21/10/2021	613.5	67.3
MB18BHT0003	20/10/2021	613.5	67.3
MB18BHT0003	19/10/2021	613.5	67.3
MB18BHT0003	18/10/2021	613.5	67.4
MB18BHT0003	17/10/2021	613.4	67.4
MB18BHT0003	16/10/2021	613.4	67.4
MB18BHT0003	15/10/2021	613.5	67.4
MB18BHT0003	14/10/2021	613.5	67.4
MB18BHT0003	13/10/2021	613.5	67.3
MB18BHT0003	12/10/2021	613.5	67.4
MB18BHT0003	11/10/2021	613.5	67.4
MB18BHT0003	10/10/2021	613.5	67.4
MB18BHT0003	9/10/2021	613.5	67.4
MB18BHT0003	8/10/2021	613.4	67.4
MB18BHT0003	7/10/2021	613.5	67.4
MB18BHT0003	6/10/2021	613.5	67.4
MB18BHT0003	5/10/2021	613.4	67.4
MB18BHT0003	4/10/2021	613.4	67.4
MB18BHT0003	3/10/2021	613.5	67.4
MB18BHT0003	2/10/2021	613.5	67.4
MB18BHT0003	1/10/2021	613.4	67.4
MB18BHT0003	30/09/2021	613.5	67.4
MB18BHT0003	29/09/2021	613.5	67.4
MB18BHT0003	28/09/2021	613.5	67.4
MB18BHT0003	27/09/2021	613.5	67.4
MB18BHT0003	26/09/2021	613.5	67.4
MB18BHT0003	25/09/2021	613.4	67.4
MB18BHT0003	24/09/2021	613.5	67.4
MB18BHT0003	23/09/2021	613.5	67.3
MB18BHT0003	22/09/2021	613.5	67.3
MB18BHT0003	21/09/2021	613.5	67.3
MB18BHT0003	20/09/2021	613.5	67.3
MB18BHT0003	19/09/2021	613.5	67.3
MB18BHT0003	18/09/2021	613.5	67.3
MB18BHT0003	17/09/2021	613.5	67.3
MB18BHT0003	16/09/2021	613.5	67.3
MB18BHT0003	15/09/2021	613.5	67.4
MB18BHT0003	14/09/2021	613.5	67.4
MB18BHT0003	13/09/2021	613.5	67.4
MB18BHT0003	12/09/2021	613.4	67.4
MB18BHT0003	11/09/2021	613.5	67.4
MB18BHT0003	10/09/2021	613.5	67.3
MB18BHT0003	9/09/2021	613.5	67.3
MB18BHT0003	8/09/2021	613.5	67.3
MB18BHT0003	7/09/2021	613.5	67.3
MB18BHT0003	6/09/2021	613.5	67.3
MB18BHT0003	5/09/2021	613.5	67.3
MB18BHT0003	4/09/2021	613.5	67.3
MB18BHT0003	3/09/2021	613.5	67.3
MB18BHT0003	2/09/2021	613.5	67.3
MB18BHT0003	1/09/2021	613.5	67.4
MB18BHT0003	31/08/2021	613.5	67.3
MB18BHT0003	30/08/2021	613.5	67.3
MB18BHT0003	29/08/2021	613.5	67.3
MB18BHT0003	28/08/2021	613.5	67.3
MB18BHT0003	27/08/2021	613.5	67.3
MB18BHT0003	26/08/2021	613.5	67.4
MB18BHT0003	25/08/2021	613.5	67.3
MB18BHT0003	24/08/2021	613.5	67.3
MB18BHT0003	23/08/2021	613.5	67.3
MB18BHT0003	22/08/2021	613.5	67.3
MB18BHT0003	21/08/2021	613.5	67.4
MB18BHT0003	20/08/2021	613.5	67.4
MB18BHT0003	19/08/2021	613.5	67.4
MB18BHT0003	18/08/2021	613.5	67.4
MB18BHT0003	17/08/2021	613.5	67.3
MB18BHT0003	16/08/2021	613.5	67.3
MB18BHT0003	15/08/2021	613.5	67.3
MB18BHT0003	14/08/2021	613.5	67.3
MB18BHT0003	13/08/2021	613.5	67.3
MB18BHT0003	12/08/2021	613.5	67.3
MB18BHT0003	11/08/2021	613.5	67.3
MB18BHT0003	10/08/2021	613.5	67.3
MB18BHT0003	9/08/2021	613.5	67.3
MB18BHT0003	8/08/2021	613.5	67.3
MB18BHT0003	7/08/2021	613.5	67.3
MB18BHT0003	6/08/2021	613.5	67.3
MB18BHT0003	5/08/2021	613.5	67.3
MB18BHT0003	4/08/2021	613.5	67.3
MB18BHT0003	3/08/2021	613.5	67.3
MB18BHT0003	2/08/2021	613.5	67.3
MB18BHT0003	1/08/2021	613.5	67.3
MB18BHT0003	31/07/2021	613.5	67.4
MB18BHT0003	30/07/2021	613.4	67.4
MB18BHT0003	29/07/2021	613.4	67.4
MB18BHT0003	28/07/2021	613.4	67.4
MB18BHT0003	27/07/2021	613.4	67.4
MB18BHT0003	26/07/2021	613.4	67.4
MB18BHT0003	25/07/2021	613.5	67.3
MB18BHT0003	24/07/2021	613.5	67.3
MB18BHT0003	23/07/2021	613.5	67.4
MB18BHT0003	22/07/2021	613.4	67.4
MB18BHT0003	21/07/2021	613.5	67.4
MB18BHT0003	20/07/2021	613.5	67.4
MB18BHT0003	19/07/2021	613.5	67.4
MB18BHT0003	18/07/2021	613.5	67.4
MB18BHT0003	17/07/2021	613.5	67.4
MB18BHT0003	16/07/2021	613.5	67.3
MB18BHT0003	15/07/2021	613.5	67.3
MB18BHT0003	14/07/2021	613.4	67.4
MB18BHT0003	13/07/2021	613.4	67.4
MB18BHT0003	12/07/2021	613.4	67.4
MB18BHT0003	11/07/2021	613.5	67.4
MB18BHT0003	10/07/2021	613.4	67.4
MB18BHT0003	9/07/2021	613.4	67.4
MB18BHT0003	8/07/2021	613.5	67.4
MB18BHT0003	7/07/2021	613.4	67.4
MB18BHT0003	6/07/2021	613.4	67.4
MB18BHT0003	5/07/2021	613.4	67.4
MB18BHT0003	4/07/2021	613.5	67.4
MB18BHT0003	3/07/2021	613.5	67.4
MB18BHT0003	2/07/2021	613.5	67.3
MB18BHT0003	1/07/2021	613.5	67.4
MB18BHT0003	30/06/2021	613.5	67.4
MB18BHT0003	29/06/2021	613.4	67.4
MB18BHT0003	28/06/2021	613.4	67.4
MB18BHT0003	27/06/2021	613.4	67.4
MB18BHT0003	26/06/2021	613.4	67.4
MB18BHT0003	25/06/2021	613.5	67.4
MB18BHT0003	24/06/2021	613.4	67.4
MB18BHT0003	23/06/2021	613.4	67.4
MB18BHT0003	22/06/2021	613.4	67.4
MB18BHT0003	21/06/2021	613.3	67.5
MB18BHT0003	20/06/2021	613.3	67.5
MB18BHT0003	19/06/2021	613.3	67.5
MB18BHT0003	18/06/2021	613.3	67.5
MB18BHT0003	17/06/2021	613.3	67.5
MB18BHT0003	16/06/2021	613.2	67.6
MB18BHT0003	15/06/2021	613.1	67.7

ID	Date	WL mAHD	WL mbgl
MB15HD20004	29/03/2019	625.3	68.9
MB15HD20004	30/03/2019	625.3	68.9
MB15HD20004	31/03/2019	625.3	68.9
MB15HD20004	1/04/2019	625.3	68.9
MB15HD20004	2/04/2019	625.3	68.9
MB15HD20004	3/04/2019	625.3	68.9
MB15HD20004	4/04/2019	625.3	68.9
MB15HD20004	5/04/2019	625.3	68.9
MB15HD20004	6/04/2019	625.4	68.9
MB15HD20004	7/04/2019	625.3	68.9
MB15HD20004	8/04/2019	625.3	68.9
MB15HD20004	9/04/2019	625.3	68.9
MB15HD20004	10/04/2019	625.3	68.9
MB15HD20004	11/04/2019	625.3	68.9
MB15HD20004	12/04/2019	625.3	68.9
MB15HD20004	13/04/2019	625.3	68.9
MB15HD20004	14/04/2019	625.3	68.9
MB15HD20004	15/04/2019	625.3	68.9
MB15HD20004	16/04/2019	625.3	68.9
MB15HD20004	17/04/2019	625.3	68.9
MB15HD20004	18/04/2019	625.3	68.9
MB15HD20004	19/04/2019	625.3	68.9
MB15HD20004	20/04/2019	625.3	68.9
MB15HD20004	21/04/2019	625.4	68.9
MB15HD20004	22/04/2019	625.4	68.9
MB15HD20004	23/04/2019	625.4	68.9
MB15HD20004	24/04/2019	625.4	68.8
MB15HD20004	25/04/2019	625.4	68.8
MB15HD20004	26/04/2019	625.4	68.8
MB15HD20004	27/04/2019	625.4	68.8
MB15HD20004	28/04/2019	625.4	68.8
MB15HD20004	29/04/2019	625.4	68.9
MB15HD20004	30/04/2019	625.3	68.9
MB15HD20004	1/05/2019	625.3	68.9
MB15HD20004	2/05/2019	625.3	68.9
MB15HD20004	3/05/2019	625.4	68.9
MB15HD20004	4/05/2019	625.4	68.8
MB15HD20004	5/05/2019	625.4	68.8
MB15HD20004	6/05/2019	625.4	68.9
MB15HD20004	7/05/2019	625.4	68.9
MB15HD20004	8/05/2019	625.4	68.8
MB15HD20004	9/05/2019	625.4	68.8
MB15HD20004	10/05/2019	625.4	68.8
MB15HD20004	11/05/2019	625.4	68.8
MB15HD20004	12/05/2019	625.4	68.8
MB15HD20004	13/05/2019	625.4	68.8
MB15HD20004	14/05/2019	625.4	68.8
MB15HD20004	15/05/2019	625.4	68.8
MB15HD20004	16/05/2019	625.4	68.8
MB15HD20004	17/05/2019	625.4	68.9
MB15HD20004	18/05/2019	625.4	68.9
MB15HD20004	19/05/2019	625.4	68.8
MB15HD20004	20/05/2019	625.4	68.8
MB15HD20004	21/05/2019	625.4	68.8
MB15HD20004	22/05/2019	625.4	68.8
MB15HD20004	23/05/2019	625.4	68.8
MB15HD20004	24/05/2019	625.4	68.8
MB15HD20004	25/05/2019	625.4	68.8
MB15HD20004	26/05/2019	625.4	68.9
MB15HD20004	27/05/2019	625.4	68.8
MB15HD20004	28/05/2019	625.4	68.8
MB15HD20004	29/05/2019	625.4	68.8
MB15HD20004	30/05/2019	625.4	68.8
MB15HD20004	31/05/2019	625.4	68.8
MB15HD20004	1/06/2019	625.4	68.8
MB15HD20004	2/06/2019	625.4	68.8
MB15HD20004	3/06/2019	625.4	68.8
MB15HD20004	4/06/2019	625.4	68.8
MB15HD20004	5/06/2019	625.4	68.8
MB15HD20004	6/06/2019	625.4	68.8
MB15HD20004	7/06/2019	625.4	68.8
MB15HD20004	8/06/2019	625.4	68.9
MB15HD20004	9/06/2019	625.3	68.9
MB15HD20004	10/06/2019	625.3	68.9
MB15HD20004	11/06/2019	625.3	68.9
MB15HD20004	12/06/2019	625.4	68.8
MB15HD20004	13/06/2019	625.4	68.8
MB15HD20004	14/06/2019	625.4	68.8
MB15HD20004	15/06/2019	625.4	68.8
MB15HD20004	16/06/2019	625.4	68.8
MB15HD20004	17/06/2019	625.4	68.8
MB15HD20004	18/06/2019	625.4	68.8
MB15HD20004	19/06/2019	625.4	68.9
MB15HD20004	20/06/2019	625.3	68.9
MB15HD20004	21/06/2019	625.4	68.9
MB15HD20004	22/06/2019	625.4	68.9
MB15HD20004	23/06/2019	625.3	68.9
MB15HD20004	24/06/2019	625.4	68.9
MB15HD20004	25/06/2019	625.4	68.8
MB15HD20004	26/06/2019	625.4	68.9
MB15HD20004	27/06/2019	625.3	68.9
MB15HD20004	28/06/2019	625.4	68.9
MB15HD20004	29/06/2019	625.4	68.8
MB15HD20004	30/06/2019	625.4	68.8
MB15HD20004	1/07/2019	625.4	68.8
MB15HD20004	2/07/2019	625.4	68.9
MB15HD20004	3/07/2019	625.4	68.9
MB15HD20004	4/07/2019	625.4	68.9
MB15HD20004	5/07/2019	625.3	68.9
MB15HD20004	6/07/2019	625.4	68.9
MB15HD20004	7/07/2019	625.4	68.8
MB15HD20004	8/07/2019	625.4	68.8
MB15HD20004	9/07/2019	625.4	68.8
MB15HD20004	10/07/2019	625.4	68.8
MB15HD20004	11/07/2019	625.4	68.8
MB15HD20004	12/07/2019	625.4	68.8
MB15HD20004	13/07/2019	625.4	68.8
MB15HD20004	14/07/2019	625.4	68.8
MB15HD20004	15/07/2019	625.4	68.8
MB15HD20004	16/07/2019	625.4	68.8
MB15HD20004	17/07/2019	625.4	68.8
MB15HD20004	18/07/2019	625.4	68.8
MB15HD20004	19/07/2019	625.3	68.9
MB15HD20004	20/07/2019	625.3	68.9
MB15HD20004	21/07/2019	625.4	68.9
MB15HD20004	22/07/2019	625.4	68.9
MB15HD20004	23/07/2019	625.4	68.9
MB15HD20004	24/07/2019	625.4	68.8
MB15HD20004	25/07/2019	625.4	68.8
MB15HD20004	26/07/2019	625.4	68.9
MB15HD20004	27/07/2019	625.3	68.9
MB15HD20004	28/07/2019	625.4	68.9
MB15HD20004	29/07/2019	625.4	68.9
MB15HD20004	30/07/2019	625.4	68.9
MB15HD20004	31/07/2019	625.4	68.8
MB15HD20004	1/08/2019	625.4	68.8
MB15HD20004	2/08/2019	625.4	68.8
MB15HD20004	3/08/2019	625.4	68.8
MB15HD20004	4/08/2019	625.4	68.8
MB15HD20004	5/08/2019	625.4	68.8
MB15HD20004	6/08/2019	625.3	68.9
MB15HD20004	7/08/2019	625.3	68.9
MB15HD20004	8/08/2019	625.4	68.8
MB15HD20004	9/08/2019	625.4	68.8
MB15HD20004	10/08/2019	625.4	68.8
MB15HD20004	11/08/2019	625.4	68.8

ID	Date	WL mAHD	WL mbgl
MB18HD20007	9/05/2021	628.1	97.7
MB18HD20007	10/05/2021	628.1	97.7
MB18HD20007	11/05/2021	628.1	97.7
MB18HD20007	12/05/2021	628.1	97.7
MB18HD20007	13/05/2021	628.1	97.7
MB18HD20007	14/05/2021	628.1	97.7
MB18HD20007	15/05/2021	628.1	97.7
MB18HD20007	16/05/2021	628.1	97.7
MB18HD20007	17/05/2021	628.1	97.7
MB18HD20007	18/05/2021	628.0	97.7
MB18HD20007	19/05/2021	628.0	97.7
MB18HD20007	20/05/2021	628.0	97.7
MB18HD20007	21/05/2021	628.1	97.7
MB18HD20007	22/05/2021	628.0	97.7
MB18HD20007	23/05/2021	628.0	97.8
MB18HD20007	24/05/2021	628.0	97.8
MB18HD20007	25/05/2021	628.0	97.7
MB18HD20007	26/05/2021	628.1	97.7
MB18HD20007	27/05/2021	628.1	97.7
MB18HD20007	28/05/2021	628.1	97.7
MB18HD20007	29/05/2021	628.1	97.7
MB18HD20007	30/05/2021	628.0	97.7
MB18HD20007	31/05/2021	628.0	97.8
MB18HD20007	1/06/2021	628.0	97.8
MB18HD20007	2/06/2021	628.0	97.7
MB18HD20007	3/06/2021	628.0	97.7
MB18HD20007	4/06/2021	628.1	97.7
MB18HD20007	5/06/2021	628.1	97.7
MB18HD20007	6/06/2021	628.0	97.7
MB18HD20007	7/06/2021	628.0	97.7
MB18HD20007	8/06/2021	628.0	97.7
MB18HD20007	9/06/2021	628.0	97.7
MB18HD20007	10/06/2021	628.0	97.8
MB18HD20007	11/06/2021	628.0	97.8
MB18HD20007	12/06/2021	628.0	97.8
MB18HD20007	13/06/2021	628.0	97.8
MB18HD20007	14/06/2021	628.0	97.8
MB18HD20007	15/06/2021	628.0	97.8
MB18HD20007	16/06/2021	628.0	97.8
MB18HD20007	17/06/2021	628.0	97.7
MB18HD20007	18/06/2021	628.1	97.7
MB18HD20007	19/06/2021	628.0	97.7
MB18HD20007	20/06/2021	628.0	97.8
MB18HD20007	21/06/2021	628.0	97.8
MB18HD20007	22/06/2021	628.0	97.8
MB18HD20007	23/06/2021	628.0	97.8
MB18HD20007	24/06/2021	628.0	97.7
MB18HD20007	25/06/2021	628.0	97.7
MB18HD20007	26/06/2021	628.0	97.7
MB18HD20007	27/06/2021	628.0	97.8
MB18HD20007	28/06/2021	628.0	97.8
MB18HD20007	29/06/2021	628.0	97.8
MB18HD20007	30/06/2021	627.9	97.8
MB18HD20007	31/06/2021	628.0	97.8
MB18HD20007	1/07/2021	628.0	97.8
MB18HD20007	2/07/2021	628.0	97.8
MB18HD20007	3/07/2021	628.0	97.8
MB18HD20007	4/07/2021	628.0	97.8
MB18HD20007	5/07/2021	628.0	97.8
MB18HD20007	6/07/2021	628.0	97.8
MB18HD20007	7/07/2021	628.0	97.8
MB18HD20007	8/07/2021	628.0	97.8
MB18HD20007	9/07/2021	628.0	97.8
MB18HD20007	10/07/2021	628.0	97.8
MB18HD20007	11/07/2021	628.0	97.8
MB18HD20007	12/07/2021	628.0	97.8
MB18HD20007	13/07/2021	628.0	97.8
MB18HD20007	14/07/2021	628.0	97.8
MB18HD20007	15/07/2021	628.0	97.8
MB18HD20007	16/07/2021	628.0	97.8
MB18HD20007	17/07/2021	628.0	97.8
MB18HD20007	18/07/2021	628.0	97.8
MB18HD20007	19/07/2021	628.0	97.8
MB18HD20007	20/07/2021	628.0	97.8
MB18HD20007	21/07/2021	628.0	97.8
MB18HD20007	22/07/2021	628.0	97.8
MB18HD20007	23/07/2021	628.0	97.8
MB18HD20007	24/07/2021	628.0	97.8
MB18HD20007	25/07/2021	628.0	97.8
MB18HD20007	26/07/2021	628.0	97.8
MB18HD20007	27/07/2021	628.0	97.8
MB18HD20007	28/07/2021	628.0	97.8
MB18HD20007	29/07/2021	628.0	97.8
MB18HD20007	30/07/2021	627.9	97.8
MB18HD20007	31/07/2021	628.0	97.8
MB18HD20007	1/08/2021	628.0	97.8
MB18HD20007	2/08/2021	628.0	97.8
MB18HD20007	3/08/2021	628.0	97.8
MB18HD20007	4/08/2021	628.0	97.8
MB18HD20007	5/08/2021	628.0	97.8
MB18HD20007	6/08/2021	628.0	97.7
MB18HD20007	7/

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	15/06/2007	0.1	686.0
HDVP1	14/06/2007	0.1	686.0
HDVP1	13/06/2007	0.1	686.0
HDVP1	12/06/2007	0.1	686.0
HDVP1	11/06/2007	0.1	686.0
HDVP1	10/06/2007	0.1	686.0
HDVP1	9/06/2007	0.1	686.0
HDVP1	8/06/2007	0.1	686.0
HDVP1	7/06/2007	0.1	686.0
HDVP1	6/06/2007	0.1	686.0
HDVP1	5/06/2007	0.1	686.0
HDVP1	4/06/2007	0.1	686.0
HDVP1	3/06/2007	0.1	686.0
HDVP1	2/06/2007	0.1	686.0
HDVP1	1/06/2007	0.1	686.0
HDVP1	31/05/2007	0.0	686.2
HDVP1	30/05/2007	0.0	686.2
HDVP1	29/05/2007	0.0	686.2
HDVP1	28/05/2007	0.0	686.2
HDVP1	27/05/2007	0.0	686.2
HDVP1	26/05/2007	0.0	686.2
HDVP1	25/05/2007	0.0	686.2
HDVP1	24/05/2007	0.0	686.2
HDVP1	23/05/2007	0.0	686.2
HDVP1	22/05/2007	0.0	686.2
HDVP1	21/05/2007	0.0	686.2
HDVP1	20/05/2007	0.0	686.2
HDVP1	19/05/2007	0.0	686.2
HDVP1	18/05/2007	0.0	686.2
HDVP1	17/05/2007	0.0	686.2
HDVP1	16/05/2007	0.0	686.2
HDVP1	15/05/2007	0.0	686.2
HDVP1	14/05/2007	0.0	686.2
HDVP1	13/05/2007	0.0	686.2
HDVP1	12/05/2007	0.0	686.2
HDVP1	11/05/2007	0.0	686.2
HDVP1	10/05/2007	0.0	686.2
HDVP1	9/05/2007	0.0	686.2
HDVP1	8/05/2007	0.0	686.2
HDVP1	7/05/2007	0.0	686.2
HDVP1	6/05/2007	0.0	686.2
HDVP1	5/05/2007	0.0	686.2
HDVP1	4/05/2007	0.0	686.2
HDVP1	3/05/2007	0.0	686.2
HDVP1	2/05/2007	0.0	686.2
HDVP1	1/05/2007	0.0	686.2
HDVP1	29/04/2007	183.8	502.3
HDVP1	28/04/2007	183.8	502.3
HDVP1	27/04/2007	183.8	502.3
HDVP1	26/04/2007	183.8	502.3
HDVP1	25/04/2007	183.8	502.3
HDVP1	24/04/2007	183.8	502.3
HDVP1	23/04/2007	183.8	502.3
HDVP1	22/04/2007	183.8	502.3
HDVP1	21/04/2007	183.8	502.3
HDVP1	20/04/2007	183.8	502.3
HDVP1	19/04/2007	183.8	502.3
HDVP1	18/04/2007	183.8	502.3
HDVP1	17/04/2007	183.8	502.3
HDVP1	16/04/2007	183.8	502.3
HDVP1	15/04/2007	183.8	502.3
HDVP1	14/04/2007	183.8	502.3
HDVP1	13/04/2007	183.8	502.3
HDVP1	12/04/2007	183.8	502.3
HDVP1	11/04/2007	183.8	502.3
HDVP1	10/04/2007	183.8	502.3
HDVP1	9/04/2007	183.8	502.3
HDVP1	8/04/2007	183.8	502.3
HDVP1	7/04/2007	183.8	502.3
HDVP1	6/04/2007	183.8	502.3
HDVP1	5/04/2007	183.8	502.3
HDVP1	4/04/2007	183.8	502.3
HDVP1	3/04/2007	183.8	502.3
HDVP1	2/04/2007	183.8	502.3
HDVP1	1/04/2007	183.8	502.3
HDVP1	31/03/2007	172.0	514.2
HDVP1	30/03/2007	172.0	514.2
HDVP1	29/03/2007	172.0	514.2
HDVP1	28/03/2007	172.0	514.2
HDVP1	27/03/2007	172.0	514.2
HDVP1	26/03/2007	172.0	514.2
HDVP1	25/03/2007	172.0	514.2
HDVP1	24/03/2007	172.0	514.2
HDVP1	23/03/2007	172.0	514.2
HDVP1	22/03/2007	172.0	514.2
HDVP1	21/03/2007	172.0	514.2
HDVP1	20/03/2007	172.0	514.2
HDVP1	19/03/2007	172.0	514.2
HDVP1	18/03/2007	172.0	514.2
HDVP1	17/03/2007	172.0	514.2
HDVP1	16/03/2007	172.0	514.2
HDVP1	15/03/2007	172.0	514.2
HDVP1	14/03/2007	172.0	514.2
HDVP1	13/03/2007	172.0	514.2
HDVP1	12/03/2007	172.0	514.2
HDVP1	11/03/2007	172.0	514.2
HDVP1	10/03/2007	172.0	514.2
HDVP1	9/03/2007	172.0	514.2
HDVP1	8/03/2007	172.0	514.2
HDVP1	7/03/2007	172.0	514.2
HDVP1	6/03/2007	172.0	514.2
HDVP1	5/03/2007	172.0	514.2
HDVP1	4/03/2007	172.0	514.2
HDVP1	3/03/2007	172.0	514.2
HDVP1	2/03/2007	172.0	514.2
HDVP1	1/03/2007	172.0	514.2
HDVP1	28/02/2007	167.3	518.9
HDVP1	27/02/2007	167.3	518.9
HDVP1	26/02/2007	167.3	518.9
HDVP1	25/02/2007	167.3	518.9
HDVP1	24/02/2007	167.3	518.9
HDVP1	23/02/2007	167.3	518.9
HDVP1	22/02/2007	167.3	518.9
HDVP1	21/02/2007	167.3	518.9
HDVP1	20/02/2007	167.3	518.9
HDVP1	19/02/2007	167.3	518.9
HDVP1	18/02/2007	167.3	518.9
HDVP1	17/02/2007	167.3	518.9
HDVP1	16/02/2007	167.3	518.9
HDVP1	15/02/2007	167.3	518.9
HDVP1	14/02/2007	167.3	518.9
HDVP1	13/02/2007	167.3	518.9
HDVP1	12/02/2007	167.3	518.9
HDVP1	11/02/2007	167.3	518.9
HDVP1	10/02/2007	167.3	518.9
HDVP1	9/02/2007	167.3	518.9
HDVP1	8/02/2007	167.3	518.9
HDVP1	7/02/2007	167.3	518.9
HDVP1	6/02/2007	167.3	518.9
HDVP1	5/02/2007	167.3	518.9
HDVP1	4/02/2007	167.3	518.9
HDVP1	3/02/2007	167.3	518.9
HDVP1	2/02/2007	167.3	518.9
HDVP1	1/02/2007	167.3	518.9
HDVP1	31/01/2007	118.6	567.6
HDVP1	30/01/2007	118.6	567.6

ID	Date	WL mAHD	WL mbgl
MB18BHT0003	14/06/2021	613.0	67.9
MB18BHT0003	13/06/2021	612.8	68.1
MB18BHT0003	12/06/2021	611.6	69.2
MB18BHT0003	11/06/2021	606.1	74.8
MB18BHT0003	10/06/2021	613.4	67.4
MB18BHT0003	9/06/2021	613.5	67.3
MB18BHT0003	8/06/2021	613.5	67.3
MB18BHT0003	7/06/2021	613.5	67.3
MB18BHT0003	6/06/2021	613.5	67.3
MB18BHT0003	5/06/2021	613.5	67.3
MB18BHT0003	4/06/2021	613.5	67.3
MB18BHT0003	3/06/2021	613.5	67.3
MB18BHT0003	2/06/2021	613.5	67.3
MB18BHT0003	1/06/2021	613.5	67.4
MB18BHT0003	31/05/2021	613.4	67.4
MB18BHT0003	30/05/2021	613.4	67.4
MB18BHT0003	29/05/2021	613.5	67.4
MB18BHT0003	28/05/2021	613.5	67.3
MB18BHT0003	27/05/2021	613.5	67.3
MB18BHT0003	26/05/2021	613.5	67.3
MB18BHT0003	25/05/2021	613.5	67.3
MB18BHT0003	24/05/2021	613.5	67.4
MB18BHT0003	23/05/2021	613.4	67.4
MB18BHT0003	22/05/2021	613.4	67.4
MB18BHT0003	21/05/2021	613.5	67.4
MB18BHT0003	20/05/2021	613.5	67.3
MB18BHT0003	19/05/2021	613.5	67.4
MB18BHT0003	18/05/2021	613.4	67.4
MB18BHT0003	17/05/2021	613.5	67.4
MB18BHT0003	16/05/2021	613.5	67.4
MB18BHT0003	15/05/2021	613.5	67.4
MB18BHT0003	14/05/2021	613.5	67.4
MB18BHT0003	13/05/2021	613.5	67.4
MB18BHT0003	12/05/2021	613.5	67.4
MB18BHT0003	11/05/2021	613.5	67.4
MB18BHT0003	10/05/2021	613.5	67.4
MB18BHT0003	9/05/2021	613.5	67.4
MB18BHT0003	8/05/2021	613.4	67.4
MB18BHT0003	7/05/2021	613.4	67.4
MB18BHT0003	6/05/2021	613.4	67.4
MB18BHT0003	5/05/2021	613.4	67.4
MB18BHT0003	4/05/2021	613.4	67.4
MB18BHT0003	3/05/2021	613.4	67.4
MB18BHT0003	2/05/2021	613.4	67.4
MB18BHT0003	1/05/2021	613.4	67.4
MB18BHT0003	30/04/2021	613.4	67.4
MB18BHT0003	29/04/2021	613.4	67.4
MB18BHT0003	28/04/2021	613.5	67.4
MB18BHT0003	27/04/2021	613.5	67.4
MB18BHT0003	26/04/2021	613.5	67.4
MB18BHT0003	25/04/2021	613.5	67.4
MB18BHT0003	24/04/2021	613.5	67.4
MB18BHT0003	23/04/2021	613.5	67.4
MB18BHT0003	22/04/2021	613.5	67.4
MB18BHT0003	21/04/2021	613.5	67.4
MB18BHT0003	20/04/2021	613.4	67.4
MB18BHT0003	19/04/2021	613.4	67.4
MB18BHT0003	18/04/2021	613.5	67.4
MB18BHT0003	17/04/2021	613.5	67.4
MB18BHT0003	16/04/2021	613.5	67.4
MB18BHT0003	15/04/2021	613.5	67.4
MB18BHT0003	14/04/2021	613.4	67.4
MB18BHT0003	13/04/2021	613.4	67.4
MB18BHT0003	12/04/2021	613.4	67.4
MB18BHT0003	11/04/2021	613.4	67.4
MB18BHT0003	10/04/2021	613.4	67.4
MB18BHT0003	9/04/2021	613.4	67.4
MB18BHT0003	8/04/2021	613.4	67.4
MB18BHT0003	7/04/2021	613.4	67.4
MB18BHT0003	6/04/2021	613.4	67.4
MB18BHT0003	5/04/2021	613.4	67.4
MB18BHT0003	4/04/2021	613.4	67.4
MB18BHT0003	3/04/2021	613.4	67.4
MB18BHT0003	2/04/2021	613.4	67.4
MB18BHT0003	1/04/2021	613.4	67.4
MB18BHT0003	31/03/2021	613.4	67.4
MB18BHT0003	30/03/2021	613.4	67.4
MB18BHT0003	29/03/2021	613.4	67.4
MB18BHT0003	28/03/2021	613.4	67.4
MB18BHT0003	27/03/2021	613.4	67.4
MB18BHT0003	26/03/2021	613.4	67.4
MB18BHT0003	25/03/2021	613.4	67.5
MB18BHT0003	24/03/2021	613.4	67.5
MB18BHT0003	23/03/2021	613.4	67.4
MB18BHT0003	22/03/2021	613.4	67.4
MB18BHT0003	21/03/2021	613.4	67.4
MB18BHT0003	20/03/2021	613.4	67.4
MB18BHT0003	19/03/2021	613.4	67.4
MB18BHT0003	18/03/2021	613.4	67.4
MB18BHT0003	17/03/2021	613.4	67.4
MB18BHT0003	16/03/2021	613.4	67.4
MB18BHT0003	15/03/2021	613.4	67.4
MB18BHT0003	14/03/2021	613.4	67.4
MB18BHT0003	13/03/2021	613.4	67.4
MB18BHT0003	12/03/2021	613.4	67.4
MB18BHT0003	11/03/2021	613.4	67.4
MB18BHT0003	10/03/2021	613.4	67.4
MB18BHT0003	9/03/2021	613.4	67.4
MB18BHT0003	8/03/2021	613.4	67.5
MB18BHT0003	7/03/2021	613.4	67.5
MB18BHT0003	6/03/2021	613.4	67.5
MB18BHT0003	5/03/2021	613.4	67.5
MB18BHT0003	4/03/2021	613.4	67.5
MB18BHT0003	3/03/2021	613.4	67.5
MB18BHT0003	2/03/2021	613.4	67.5
MB18BHT0003	1/03/2021	613.4	67.5
MB18BHT0003	28/02/2021	613.3	67.5
MB18BHT0003	27/02/2021	613.3	67.5
MB18BHT0003	26/02/2021	613.3	67.5
MB18BHT0003	25/02/2021	613.4	67.5
MB18BHT0003	24/02/2021	613.4	67.4
MB18BHT0003	23/02/2021	613.4	67.4
MB18BHT0003	22/02/2021	613.4	67.4
MB18BHT0003	21/02/2021	613.4	67.5
MB18BHT0003	20/02/2021	613.4	67.5
MB18BHT0003	19/02/2021	613.4	67.5
MB18BHT0003	18/02/2021	613.3	67.5
MB18BHT0003	17/02/2021	613.3	67.5
MB18BHT0003	16/02/2021	613.4	67.5
MB18BHT0003	15/02/2021	613.3	67.5
MB18BHT0003	14/02/2021	613.3	67.5
MB18BHT0003	13/02/2021	613.4	67.5
MB18BHT0003	12/02/2021	613.4	67.5
MB18BHT0003	11/02/2021	613.3	67.5
MB18BHT0003	10/02/2021	613.3	67.5
MB18BHT0003	9/02/2021	613.3	67.5
MB18BHT0003	8/02/2021	613.3	67.5
MB18BHT0003	7/02/2021	613.3	67.5
MB18BHT0003	6/02/2021	613.3	67.5
MB18BHT0003	5/02/2021	613.3	67.5
MB18BHT0003	4/02/2021	613.3	67.5
MB18BHT0003	3/02/2021	613.3	67.5
MB18BHT0003	2/02/2021	613.3	67.5
MB18BHT0003	1/02/2021	613.3	67.5
MB18BHT0003	31/01/2021	613.3	67.5
MB18BHT0003	30/01/2021	613.3	67.5

ID	Date	WL mAHD	WL mbgl
MB15HD20004	12/08/2019	625.4	68.8
MB15HD20004	13/08/2019	625.4	68.9
MB15HD20004	14/08/2019	625.3	68.9
MB15HD20004	15/08/2019	625.3	68.9
MB15HD20004	16/08/2019	625.4	68.9
MB15HD20004	17/08/2019	625.4	68.9
MB15HD20004	18/08/2019	625.4	68.8
MB15HD20004	19/08/2019	625.4	68.8
MB15HD20004	20/08/2019	625.4	68.8
MB15HD20004	21/08/2019	625.4	68.8
MB15HD20004	22/08/2019	625.4	68.8
MB15HD20004	23/08/2019	625.4	68.9
MB15HD20004	24/08/2019	625.4	68.9
MB15HD20004	25/08/2019	625.3	68.9
MB15HD20004	26/08/2019	625.3	68.9
MB15HD20004	27/08/2019	625.3	68.9
MB15HD20004	28/08/2019	625.3	68.9
MB15HD20004	29/08/2019	625.3	68.9
MB15HD20004	30/08/2019	625.3	68.9
MB15HD20004	31/08/2019	625.3	68.9
MB15HD20004	1/09/2019	625.3	68.9
MB15HD20004	2/09/2019	625.3	68.9
MB15HD20004	3/09/2019	625.3	68.9
MB15HD20004	4/09/2019	625.3	68.9
MB15HD20004	5/09/2019	625.3	68.9
MB15HD20004	6/09/2019	625.3	68.9
MB15HD20004	7/09/2019	625.3	68.9
MB15HD20004	8/09/2019	625.3	68.9
MB15HD20004	9/09/2019	625.3	68.9
MB15HD20004	10/09/2019	625.3	68.9
MB15HD20004	11/09/2019	625.4	68.8
MB15HD20004	12/09/2019	625.4	68.8
MB15HD20004	13/09/2019	625.4	68.8
MB15HD20004	14/09/2019	625.4	68.9
MB15HD20004	15/09/2019	625.3	68.9
MB15HD20004	16/09/2019	625.3	68.9
MB15HD20004	17/09/2019	625.3	68.9
MB15HD20004	18/09/2019	625.3	68.9
MB15HD20004	19/09/2019	625.3	68.9
MB15HD20004	20/09/2019	625.3	68.9
MB15HD20004	21/09/2019	625.3	68.9
MB15HD20004	22/09/2019	625.4	68.9
MB15HD20004	23/09/2019	625.4	68.9
MB15HD20004	24/09/2019	625.4	68.9
MB15HD20004	25/09/2019	625.4	68.9
MB15HD20004	26/09/2019	625.3	68.9
MB15HD20004	27/09/2019	625.3	68.9
MB15HD20004	28/09/2019	625.3	68.9
MB15HD20004	29/09/2019	625.3	68.9
MB15HD20004	30/09/2019	625.3	68.9
MB15HD20004	1/10/2019	625.3	68.9
MB15HD20004	2/10/2019	625.3	68.9
MB15HD20004	3/10/2019	625.3	68.9
MB15HD20004	4/10/2019	625.3	68.9
MB15HD20004	5/10/2019	625.3	68.9
MB15HD20004	6/10/2019	625.3	68.9
MB15HD20004	7/10/2019	625.3	68.9
MB15HD20004	8/10/2019	625.3	68.9
MB15HD20004	9/10/2019	625.3	68.9
MB15HD20004	10/10/2019	625.3	68.9
MB15HD20004	11/10/2019	625.3	68.9
MB15HD20004	12/10/2019	625.3	68.9
MB15HD20004	13/10/2019	625.3	68.9
MB15HD20004	14/10/2019	625.3	68.9
MB15HD20004	15/10/2019	625.3	68.9
MB15HD20004	16/10/2019	625.3	68.9
MB15HD20004	17/10/2019	625.3	68.9
MB15HD20004	18/10/2019	625.3	68.9
MB15HD20004	19/10/2019	625.3	68.9
MB15HD20004	20/10/2019	625.3	68.9
MB15HD20004	21/10/2019	625.3	68.9
MB15HD20004	22/10/2019	625.3	68.9
MB15HD20004	23/10/2019	625.3	68.9
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MB15HD20004	25/10/2019	625.3	68.9
MB15HD20004	26/10/2019	625.3	68.9
MB15HD20004	27/10/2019	625.3	68.9
MB15HD20004	28/10/2019	625.3	68.9
MB15HD20004	29/10/2019	625.3	68.9
MB15HD20004	30/10/2019	625.3	68.9
MB15HD20004	31/10/2019	625.3	68.9
MB15HD20004	1/11/2019	625.3	69.0
MB15HD20004	2/11/2019	625.3	68.9
MB15HD20004	3/11/2019	625.3	68.9
MB15HD20004	4/11/2019	625.3	68.9
MB15HD20004	5/11/2019	625.3	68.9
MB15HD20004	6/11/2019	625.3	68.9
MB15HD20004	7/11/2019	625.3	68.9
MB15HD20004	8/11/2019	625.3	68.9
MB15HD20004	9/11/2019	625.3	68.9
MB15HD20004	10/11/2019	625.3	68.9
MB15HD20004	11/11/2019	625.3	68.9
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MB15HD20004	14/11/2019	625.3	68.9
MB15HD20004	15/11/2019	625.3	68.9
MB15HD20004	16/11/2019	625.3	68.9
MB15HD20004	17/11/2019	625.3	68.9
MB15HD20004	18/11/2019	625.3	68.9
MB15HD20004	19/11/2019	625.3	69.0
MB15HD20004	20/11/2019	625.3	69.0
MB15HD20004	21/11/2019	625.3	68.9
MB15HD20004	22/11/2019	625.3	68.9
MB15HD20004	23/11/2019	625.3	68.9
MB15HD20004	24/11/2019	625.3	68.9
MB15HD20004	25/11/2019	625.3	68.9
MB15HD20004	26/11/2019	625.3	69.0
MB15HD20004	27/11/2019	625.3	69.0
MB15HD20004	28/11/2019	625.3	69.0
MB15HD20004	29/11/2019	625.3	69.0
MB15HD20004	30/11/2019	625.3	68.9
MB15HD20004	1/12/2019	625.3	68.9
MB15HD20004	2/12/2019	625.3	68.9
MB15HD20004	3/12/2019	625.3	68.9
MB15HD20004	4/12/2019	625.3	68.9
MB15HD20004	5/12/2019	625.3	68.9
MB15HD20004	6/12/2019	625.3	68.9
MB15HD20004	7/12/2019	625.3	69.0
MB15HD20004	8/12/2019	625.3	68.9
MB15HD20004	9/12/2019	625.3	68.9
MB15HD20004	10/12/2019	625.3	69.0
MB15HD20004	11/12/2019	625.3	68.9
MB15HD20004	12/12/2019	625.3	68.9
MB15HD20004	13/12/2019	625.3	68.9
MB15HD20004	14/12/2019	625.3	68.9
MB15HD20004	15/12/2019	625.3	69.0
MB15HD20004	16/12/2019	625.3	69.0
MB15HD20004	17/12/2019	625.3	69.0
MB15HD20004	18/12/2019	625.3	69.0
MB15HD20004	19/12/2019	625.2	69.0
MB15HD20004	20/12/2019	625.3	69.0
MB15HD20004	21/12/2019	625.3	69.0
MB15HD20004	22/12/2019	625.3	69.0
MB15HD20004	23/12/2019	625.3	69.0
MB15HD20004	24/12/2019	625.3	68.9
MB15HD20004	25/12/2019	625.3	68.9

ID	Date	WL mAHD	WL mbgl
MB18HD20007	22/09/2021	628.0	97.8
MB18HD20007	23/09/2021	628.0	97.8
MB18HD20007	24/09/2021	627.9	97.8
MB18HD20007	25/09/2021	627.9	97.9
MB18HD20007	26/09/2021	627.9	97.9
MB18HD20007	27/09/2021	627.9	97.9
MB18HD20007	28/09/2021	627.9	97.9
MB18HD20007	29/09/2021	627.9	97.9
MB18HD20007	30/09/2021	627.9	97.9
MB18HD20007	1/10/2021	627.9	97.9
MB18HD20007	2/10/2021	627.9	97.9
MB18HD20007	3/10/2021	627.9	97.9
MB18HD20007	4/10/2021	627.9	97.9
MB18HD20007	5/10/2021	627.9	97.9
MB18HD20007	6/10/2021	627.9	97.9
MB18HD20007	7/10/2021	627.9	97.9
MB18HD20007	8/10/2021	627.9	97.9
MB18HD20007	9/10/2021	627.9	97.9
MB18HD20007	10/10/2021	627.9	97.9
MB18HD20007	11/10/2021	627.9	97.9
MB18HD20007	12/10/2021	627.9	97.9
MB18HD20007	13/10/2021	627.9	97.9
MB18HD20007	14/10/2021	627.9	97.9
MB18HD20007	15/10/2021	627.9	97.9
MB18HD20007	16/10/2021	627.9	97.9
MB18HD20007	17/10/2021	627.9	97.9
MB18HD20007	18/10/2021	627.9	97.9
MB18HD20007	19/10/2021	627.9	97.9
MB18HD20007	20/10/2021	627.9	97.9
MB18HD20007	21/10/2021	627.9	97.9
MB18HD20007	22/10/2021	627.9	97.9
MB18HD20007	23/10/2021	627.9	97.9
MB18HD20007	24/10/2021	627.9	97.9
MB18HD20007	25/10/2021	627.9	97.9
MB18HD20007	26/10/2021	627.9	97.9
MB18HD20007	27/10/2021	627.9	97.9
MB18HD20007	28/10/2021	627.9	97.9
MB18HD20007	1/11/2021	627.9	97.9
MB18HD20007	2/11/2021	627.9	97.9
MB18HD20007	3/11/2021	627.9	97.9
MB18HD20007	4/11/2021	627.9	97.9
MB18HD20007	5/11/2021	627.9	97.9
MB18HD20007	6/11/2021	627.9	97.9
MB18HD20007	7/11/2021	627.8	97.9
MB18HD20007	9/11/2021	627.8	98.0
MB18HD20007	10/11/2021	627.8	97.9
MB18HD20007	11/11/2021	627.9	97.9
MB18HD20007	12/11/2021	627.9	97.9
MB18HD20007	13/11/2021	627.9	97.9
MB18HD20007	14/11/2021	627.9	97.9
MB18HD20007	15/11/2021	627.9	97.9
MB18HD20007	16/11/2021	627.9	97.9
MB18HD20007	17/11/2021	627.9	97.9
MB18HD20007	18/11/2021	627.9	97.9
MB18HD20007	19/11/2021	627.8	97.9
MB18HD20007	20/11/2021	627.8	97.9
MB18HD20007	21/11/2021	627.9	97.9
MB18HD20007	22/11/2021	627.9	97.9
MB18HD20007	23/11/2021	627.9	97.9
MB18HD20007	24/11/2021	627.9	97.9
MB18HD20007	25/11/2021	627.9	97.9
MB18HD20007	26/11/2021	627.9	97.9
MB18HD20007	27/11/2021	627.9	97.9
MB18HD20007	28/11/2021	627.8	97.9
MB18HD20007	29/11/2021	627.9	97.9
MB18HD20007	30/11/2021	627.8	97.9
MB18HD20007	1/12/2021	627.8	97.9
MB18HD20007	2/12/2021	627.8	97.9
MB18HD20007	3/12/2021	627.8	97.9
MB18HD20007	4/12/2021	627.8	97.9
MB18HD20007	5/12/2021	627.8	97.9
MB18HD20007	6/12/2021	627.8	98.0
MB18HD20007	7/12/2021	627.8	98.0
MB18HD20007	8/12/2021	627.8	97.9
MB18HD20007	9/12/2021	627.8	97.9
MB18HD20007	10/12/2021	627.8	97.9
MB18HD20007	11/12/2021	627.8	98.0
MB18HD20007	12/12/2021	627.8	97.9
MB18HD20007	13/12/2021	627.8	98.0
MB18HD20007	14/12/2021	627.8	98.0
MB18HD20007	15/12/2021	627.8	98.0
MB18HD20007	16/12/2021	627.8	98.0
MB18HD20007	17/12/2021	627.8	98.0
MB18HD20007	18/12/2021	627.8	98.0
MB18HD20007	22/01/2022	627.8	97.9
MB18HD20007	23/01/2022	627.8	98.0
MB18HD20007	24/01/2022	627.8	98.0
MB18HD20007	25/01/2022	627.8	98.0
MB18HD20007	26/01/2022	627.8	98.0
MB18HD20007	27/01/2022	627.8	98.0
MB18HD20007	28/01/2022	627.8	98.0
MB18HD20007	29/

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	29/01/2007	118.6	567.6
HDVP1	28/01/2007	118.6	567.6
HDVP1	27/01/2007	118.6	567.6
HDVP1	26/01/2007	118.6	567.6
HDVP1	25/01/2007	118.6	567.6
HDVP1	24/01/2007	118.6	567.6
HDVP1	23/01/2007	118.6	567.6
HDVP1	22/01/2007	118.6	567.6
HDVP1	21/01/2007	118.6	567.6
HDVP1	20/01/2007	118.6	567.6
HDVP1	19/01/2007	118.6	567.6
HDVP1	18/01/2007	118.6	567.6
HDVP1	17/01/2007	118.6	567.6
HDVP1	16/01/2007	118.6	567.6
HDVP1	15/01/2007	118.6	567.6
HDVP1	14/01/2007	118.6	567.6
HDVP1	13/01/2007	118.6	567.6
HDVP1	12/01/2007	118.6	567.6
HDVP1	11/01/2007	118.6	567.6
HDVP1	10/01/2007	118.6	567.6
HDVP1	9/01/2007	118.6	567.6
HDVP1	8/01/2007	118.6	567.6
HDVP1	7/01/2007	118.6	567.6
HDVP1	6/01/2007	118.6	567.6
HDVP1	5/01/2007	118.6	567.6
HDVP1	4/01/2007	118.6	567.6
HDVP1	3/01/2007	118.6	567.6
HDVP1	2/01/2007	118.6	567.6
HDVP1	1/01/2007	118.6	567.6
HDVP1	31/12/2006	116.2	570.0
HDVP1	30/12/2006	116.2	570.0
HDVP1	29/12/2006	116.2	570.0
HDVP1	28/12/2006	116.2	570.0
HDVP1	27/12/2006	116.2	570.0
HDVP1	26/12/2006	116.2	570.0
HDVP1	25/12/2006	116.2	570.0
HDVP1	24/12/2006	116.2	570.0
HDVP1	23/12/2006	116.2	570.0
HDVP1	22/12/2006	116.2	570.0
HDVP1	21/12/2006	116.2	570.0
HDVP1	20/12/2006	116.2	570.0
HDVP1	19/12/2006	116.2	570.0
HDVP1	18/12/2006	116.2	570.0
HDVP1	17/12/2006	116.2	570.0
HDVP1	16/12/2006	116.2	570.0
HDVP1	15/12/2006	116.2	570.0
HDVP1	14/12/2006	116.2	570.0
HDVP1	13/12/2006	116.2	570.0
HDVP1	12/12/2006	116.2	570.0
HDVP1	11/12/2006	116.2	570.0
HDVP1	10/12/2006	116.2	570.0
HDVP1	9/12/2006	116.2	570.0
HDVP1	8/12/2006	116.2	570.0
HDVP1	7/12/2006	116.2	570.0
HDVP1	6/12/2006	116.2	570.0
HDVP1	5/12/2006	116.2	570.0
HDVP1	4/12/2006	116.2	570.0
HDVP1	3/12/2006	116.2	570.0
HDVP1	2/12/2006	116.2	570.0
HDVP1	1/12/2006	116.2	570.0
HDVP1	30/11/2006	120.0	566.1
HDVP1	29/11/2006	120.0	566.1
HDVP1	28/11/2006	120.0	566.1
HDVP1	27/11/2006	120.0	566.1
HDVP1	26/11/2006	120.0	566.1
HDVP1	25/11/2006	120.0	566.1
HDVP1	24/11/2006	120.0	566.1
HDVP1	23/11/2006	120.0	566.1
HDVP1	22/11/2006	120.0	566.1
HDVP1	21/11/2006	120.0	566.1
HDVP1	20/11/2006	120.0	566.1
HDVP1	19/11/2006	120.0	566.1
HDVP1	18/11/2006	120.0	566.1
HDVP1	17/11/2006	120.0	566.1
HDVP1	16/11/2006	120.0	566.1
HDVP1	15/11/2006	120.0	566.1
HDVP1	14/11/2006	120.0	566.1
HDVP1	13/11/2006	120.0	566.1
HDVP1	12/11/2006	120.0	566.1
HDVP1	11/11/2006	120.0	566.1
HDVP1	10/11/2006	120.0	566.1
HDVP1	9/11/2006	120.0	566.1
HDVP1	8/11/2006	120.0	566.1
HDVP1	7/11/2006	120.0	566.1
HDVP1	6/11/2006	120.0	566.1
HDVP1	5/11/2006	120.0	566.1
HDVP1	4/11/2006	120.0	566.1
HDVP1	3/11/2006	120.0	566.1
HDVP1	2/11/2006	120.0	566.1
HDVP1	1/11/2006	120.0	566.1
HDVP1	31/10/2006	67.4	618.8
HDVP1	30/10/2006	67.4	618.8
HDVP1	29/10/2006	67.4	618.8
HDVP1	28/10/2006	67.4	618.8
HDVP1	27/10/2006	67.4	618.8
HDVP1	26/10/2006	67.4	618.8
HDVP1	25/10/2006	67.4	618.8
HDVP1	24/10/2006	67.4	618.8
HDVP1	23/10/2006	67.4	618.8
HDVP1	22/10/2006	67.4	618.8
HDVP1	21/10/2006	67.4	618.8
HDVP1	20/10/2006	67.4	618.8
HDVP1	19/10/2006	67.4	618.8
HDVP1	18/10/2006	67.4	618.8
HDVP1	17/10/2006	67.4	618.8
HDVP1	16/10/2006	67.4	618.8
HDVP1	15/10/2006	67.4	618.8
HDVP1	14/10/2006	67.4	618.8
HDVP1	13/10/2006	67.4	618.8
HDVP1	12/10/2006	67.4	618.8
HDVP1	11/10/2006	67.4	618.8
HDVP1	10/10/2006	67.4	618.8
HDVP1	9/10/2006	67.4	618.8
HDVP1	8/10/2006	67.4	618.8
HDVP1	7/10/2006	67.4	618.8
HDVP1	6/10/2006	67.4	618.8
HDVP1	5/10/2006	67.4	618.8
HDVP1	4/10/2006	67.4	618.8
HDVP1	3/10/2006	67.4	618.8
HDVP1	2/10/2006	67.4	618.8
HDVP1	1/10/2006	67.4	618.8
HDVP1	30/09/2006	71.7	614.4
HDVP1	29/09/2006	71.7	614.4
HDVP1	28/09/2006	71.7	614.4
HDVP1	27/09/2006	71.7	614.4
HDVP1	26/09/2006	71.7	614.4
HDVP1	25/09/2006	71.7	614.4
HDVP1	24/09/2006	71.7	614.4
HDVP1	23/09/2006	71.7	614.4
HDVP1	22/09/2006	71.7	614.4
HDVP1	21/09/2006	71.7	614.4
HDVP1	20/09/2006	71.7	614.4
HDVP1	19/09/2006	71.7	614.4
HDVP1	18/09/2006	71.7	614.4
HDVP1	17/09/2006	71.7	614.4
HDVP1	16/09/2006	71.7	614.4

ID	Date	WL mAHD	WL mbgl
MB18BHT0003	29/01/2021	613.3	67.5
MB18BHT0003	28/01/2021	613.3	67.5
MB18BHT0003	27/01/2021	613.3	67.5
MB18BHT0003	26/01/2021	613.3	67.5
MB18BHT0003	25/01/2021	613.3	67.5
MB18BHT0003	24/01/2021	613.3	67.5
MB18BHT0003	23/01/2021	613.3	67.5
MB18BHT0003	22/01/2021	613.3	67.5
MB18BHT0003	21/01/2021	613.3	67.5
MB18BHT0003	20/01/2021	613.3	67.5
MB18BHT0003	19/01/2021	613.3	67.5
MB18BHT0003	18/01/2021	613.4	67.5
MB18BHT0003	17/01/2021	613.4	67.5
MB18BHT0003	16/01/2021	613.4	67.5
MB18BHT0003	15/01/2021	613.3	67.5
MB18BHT0003	14/01/2021	613.3	67.5
MB18BHT0003	13/01/2021	613.3	67.5
MB18BHT0003	12/01/2021	613.3	67.5
MB18BHT0003	11/01/2021	613.3	67.5
MB18BHT0003	10/01/2021	613.3	67.5
MB18BHT0003	9/01/2021	613.4	67.5
MB18BHT0003	8/01/2021	613.4	67.5
MB18BHT0003	7/01/2021	613.4	67.5
MB18BHT0003	6/01/2021	613.4	67.5
MB18BHT0003	5/01/2021	613.4	67.4
MB18BHT0003	4/01/2021	613.3	67.5
MB18BHT0003	3/01/2021	613.3	67.5
MB18BHT0003	2/01/2021	613.3	67.5
MB18BHT0003	1/01/2021	613.3	67.5
MB18BHT0003	31/12/2020	613.3	67.5
MB18BHT0003	30/12/2020	613.3	67.5
MB18BHT0003	29/12/2020	613.3	67.5
MB18BHT0003	28/12/2020	613.3	67.5
MB18BHT0003	27/12/2020	613.3	67.5
MB18BHT0003	26/12/2020	613.3	67.5
MB18BHT0003	25/12/2020	613.3	67.5
MB18BHT0003	24/12/2020	613.3	67.5
MB18BHT0003	23/12/2020	613.3	67.5
MB18BHT0003	22/12/2020	613.3	67.5
MB18BHT0003	21/12/2020	613.3	67.5
MB18BHT0003	20/12/2020	613.3	67.5
MB18BHT0003	19/12/2020	613.3	67.5
MB18BHT0003	18/12/2020	613.3	67.5
MB18BHT0003	17/12/2020	613.3	67.5
MB18BHT0003	16/12/2020	613.3	67.5
MB18BHT0003	15/12/2020	613.3	67.5
MB18BHT0003	14/12/2020	613.3	67.5
MB18BHT0003	13/12/2020	613.3	67.5
MB18BHT0003	12/12/2020	613.3	67.5
MB18BHT0003	11/12/2020	613.3	67.5
MB18BHT0003	10/12/2020	613.3	67.5
MB18BHT0003	9/12/2020	613.3	67.5
MB18BHT0003	8/12/2020	613.3	67.5
MB18BHT0003	7/12/2020	613.4	67.5
MB18BHT0003	6/12/2020	613.3	67.5
MB18BHT0003	5/12/2020	613.3	67.5
MB18BHT0003	4/12/2020	613.3	67.5
MB18BHT0003	3/12/2020	613.3	67.5
MB18BHT0003	2/12/2020	613.3	67.5
MB18BHT0003	1/12/2020	613.3	67.5
MB18BHT0003	30/11/2020	613.3	67.5
MB18BHT0003	29/11/2020	613.3	67.5
MB18BHT0003	28/11/2020	613.3	67.5
MB18BHT0003	27/11/2020	613.3	67.5
MB18BHT0003	26/11/2020	613.3	67.5
MB18BHT0003	25/11/2020	613.3	67.5
MB18BHT0003	24/11/2020	613.4	67.5
MB18BHT0003	23/11/2020	613.3	67.5
MB18BHT0003	22/11/2020	613.3	67.5
MB18BHT0003	21/11/2020	613.3	67.5
MB18BHT0003	20/11/2020	613.3	67.5
MB18BHT0003	19/11/2020	613.3	67.5
MB18BHT0003	18/11/2020	613.3	67.5
MB18BHT0003	17/11/2020	613.3	67.5
MB18BHT0003	16/11/2020	613.4	67.5
MB18BHT0003	15/11/2020	613.4	67.5
MB18BHT0003	14/11/2020	613.3	67.5
MB18BHT0003	13/11/2020	613.3	67.5
MB18BHT0003	12/11/2020	613.3	67.5
MB18BHT0003	11/11/2020	613.4	67.5
MB18BHT0003	10/11/2020	613.4	67.5
MB18BHT0003	9/11/2020	613.3	67.5
MB18BHT0003	8/11/2020	613.3	67.5
MB18BHT0003	7/11/2020	613.3	67.5
MB18BHT0003	6/11/2020	613.3	67.5
MB18BHT0003	5/11/2020	613.4	67.5
MB18BHT0003	4/11/2020	613.4	67.5
MB18BHT0003	3/11/2020	613.4	67.5
MB18BHT0003	2/11/2020	613.3	67.5
MB18BHT0003	1/11/2020	613.3	67.5
MB18BHT0003	31/10/2020	613.3	67.5
MB18BHT0003	30/10/2020	613.4	67.5
MB18BHT0003	29/10/2020	613.3	67.5
MB18BHT0003	28/10/2020	613.3	67.5
MB18BHT0003	27/10/2020	613.3	67.5
MB18BHT0003	26/10/2020	613.3	67.5
MB18BHT0003	25/10/2020	613.3	67.5
MB18BHT0003	24/10/2020	613.3	67.5
MB18BHT0003	23/10/2020	613.3	67.5
MB18BHT0003	22/10/2020	613.3	67.5
MB18BHT0003	21/10/2020	613.3	67.5
MB18BHT0003	20/10/2020	613.3	67.5
MB18BHT0003	19/10/2020	613.3	67.5
MB18BHT0003	18/10/2020	613.3	67.5
MB18BHT0003	17/10/2020	613.3	67.5
MB18BHT0003	16/10/2020	613.3	67.5
MB18BHT0003	15/10/2020	613.3	67.5
MB18BHT0003	14/10/2020	613.3	67.5
MB18BHT0003	13/10/2020	613.4	67.5
MB18BHT0003	12/10/2020	613.3	67.5
MB18BHT0003	11/10/2020	613.3	67.5
MB18BHT0003	10/10/2020	613.3	67.5
MB18BHT0003	9/10/2020	613.4	67.5
MB18BHT0003	8/10/2020	613.4	67.5
MB18BHT0003	7/10/2020	613.4	67.5
MB18BHT0003	6/10/2020	613.4	67.4
MB18BHT0003	5/10/2020	613.4	67.4
MB18BHT0003	4/10/2020	613.4	67.4
MB18BHT0003	3/10/2020	613.4	67.4
MB18BHT0003	2/10/2020	613.3	67.5
MB18BHT0003	1/10/2020	613.3	67.5
MB18BHT0003	30/09/2020	613.4	67.5
MB18BHT0003	29/09/2020	613.4	67.5
MB18BHT0003	28/09/2020	613.3	67.5
MB18BHT0003	27/09/2020	613.3	67.5
MB18BHT0003	26/09/2020	613.3	67.5
MB18BHT0003	25/09/2020	613.3	67.5
MB18BHT0003	24/09/2020	613.4	67.5
MB18BHT0003	23/09/2020	613.4	67.4
MB18BHT0003	22/09/2020	613.4	67.4
MB18BHT0003	21/09/2020	613.4	67.5
MB18BHT0003	20/09/2020	613.4	67.5
MB18BHT0003	19/09/2020	613.3	67.5
MB18BHT0003	18/09/2020	613.3	67.5
MB18BHT0003	17/09/2020	613.3	67.5
MB18BHT0003	16/09/2020	613.3	67.5

ID	Date	WL mAHD	WL mbgl
MB15HD20004	26/12/2019	625.3	68.9
MB15HD20004	27/12/2019	625.3	69.0
MB15HD20004	28/12/2019	625.3	69.0
MB15HD20004	29/12/2019	625.2	69.0
MB15HD20004	30/12/2019	625.2	69.0
MB15HD20004	31/12/2019	625.3	69.0
MB15HD20004	1/01/2020	625.2	69.0
MB15HD20004	2/01/2020	625.3	69.0
MB15HD20004	3/01/2020	625.2	69.0
MB15HD20004	4/01/2020	625.2	69.0
MB15HD20004	5/01/2020	625.2	69.0
MB15HD20004	6/01/2020	625.2	69.0
MB15HD20004	7/01/2020	625.2	69.0
MB15HD20004	8/01/2020	625.2	69.0
MB15HD20004	9/01/2020	625.2	69.0
MB15HD20004	10/01/2020	625.2	69.0
MB15HD20004	11/01/2020	625.2	69.0
MB15HD20004	12/01/2020	625.2	69.0
MB15HD20004	13/01/2020	625.2	69.0
MB15HD20004	14/01/2020	625.2	69.0
MB15HD20004	15/01/2020	625.3	69.0
MB15HD20004	16/01/2020	625.3	68.9
MB15HD20004	17/01/2020	625.2	69.0
MB15HD20004	18/01/2020	625.2	69.0
MB15HD20004	19/01/2020	625.2	69.0
MB15HD20004	20/01/2020	625.2	69.0
MB15HD20004	21/01/2020	625.2	69.0
MB15HD20004	22/01/2020	625.2	69.0
MB15HD20004	23/01/2020	625.2	69.0
MB15HD20004	24/01/2020	625.3	69.0
MB15HD20004	25/01/2020	625.3	69.0
MB15HD20004	26/01/2020	625.3	69.0
MB15HD20004	27/01/2020	625.3	69.0
MB15HD20004	28/01/2020	625.2	69.0
MB15HD20004	29/01/2020	625.2	69.0
MB15HD20004	30/01/2020	625.2	69.0
MB15HD20004	31/01/2020	625.2	69.0
MB15HD20004	1/02/2020	625.2	69.0
MB15HD20004	2/02/2020	625.2	69.0
MB15HD20004	3/02/2020	625.3	69.0
MB15HD20004	4/02/2020	625.3	69.0
MB15HD20004	5/02/2020	625.3	69.0
MB15HD20004	6/02/2020	625.2	69.0
MB15HD20004	7/02/2020	625.2	69.0
MB15HD20004	8/02/2020	625.2	69.0
MB15HD20004	9/02/2020	625.2	69.0
MB15HD20004	10/02/2020	625.2	69.0
MB15HD20004	11/02/2020	625.2	69.0
MB15HD20004	12/02/2020	625.2	69.0
MB15HD20004	13/02/2020	625.2	69.0
MB15HD20004	14/02/2020	625.2	69.0
MB15HD20004	15/02/2020	625.2	69.0
MB15HD20004	16/02/2020	625.2	69.0
MB15HD20004	17/02/2020	625.3	69.0
MB15HD20004	18/02/2020	625.3	69.0
MB15HD20004	19/02/2020	625.3	69.0
MB15HD20004	20/02/2020	625.2	69.0
MB15HD20004	21/02/2020	625.2	69.0
MB15HD20004	22/02/2020	625.3	69.0
MB15HD20004	23/02/2020	625.2	69.0
MB15HD20004	24/02/2020	625.2	69.0
MB15HD20004	25/02/2020	625.2	69.0
MB15HD20004	26/02/2020	625.2	69.0
MB15HD20004	27/02/2020	625.2	69.0
MB15HD20004	28/02/2020	625.2	69.0
MB15HD20004	29/02/2020	625.2	69.0
MB15HD20004	1/03/2020	625.2	69.0
MB15HD20004	2/03/2020	625.2	69.0
MB15HD20004	3/03/2020	625.2	69.0
MB15HD20004	4/03/2020	625.2	69.0
MB15HD20004	5/03/2020	625.2	69.0
MB15HD20004	6/03/2020	625.2	69.0
MB15HD20004	7/03/2020	625.3	69.0
MB15HD20004	8/03/2020	625.3	69.0
MB15HD20004	9/03/2020	625.2	69.0
MB15HD20004	10/03/2020	625.2	69.0
MB15HD20004	11/03/2020	625.2	69.0
MB15HD20004	12/03/2020	625.2	69.0
MB15HD20004	13/03/2020	625.3	69.0
MB15HD20004	14/03/2020	625.3	69.0
MB15HD20004	15/03/2020	625.2	69.0
MB15HD20004	16/03/2020	625.3	69.0
MB15HD20004	17/03/2020	625.3	68.9
MB15HD20004	18/03/2020	625.3	68.9
MB15HD20004	19/03/2020	625.3	68.9
MB15HD20004	20/03/2020	625.3	68.9
MB15HD20004	21/03/2020	625.3	68.9
MB15HD20004	22/03/2020	625.3	68.9
MB15HD20004	23/03/2020	625.3	68.9
MB15HD20004	24/03/2020	625.3	68.9
MB15HD20004	25/03/2020	625.3	68.9
MB15HD20004	26/03/2020	625.3	68.9
MB15HD20004	27/03/2020	625.3	68.9
MB15HD20004	28/03/2020	625.3	68.9
MB15HD20004	29/03/2020	625.3	69.0
MB15HD20004	30/03/2020	625.3	69.0
MB15HD20004	31/03/2020	625.2	69.0
MB15HD20004	1/04/2020	625.2	69.0
MB15HD20004	2/04/2020	625.2	69.0
MB15HD20004	3/04/2020	625.2	69.0
MB15HD20004	4/04/2020	625.3	69.0
MB15HD20004	5/04/2020	625.3	69.0
MB15HD20004	6/04/2020	625.3	69.0
MB15HD20004	7/04/2020	625.3	69.0
MB15HD20004	8/04/2020	625.3	69.0
MB15HD20004	9/04/2020	625.3	69.0
MB15HD20004	10/04/2020	625.3	68.9
MB15HD20004	11/04/2020	625.3	68.9
MB15HD20004	12/04/2020	625.3	68.9
MB15HD20004	13/04/2020	625.3	68.9
MB15HD20004	14/04/2020	625.3	68.9
MB15HD20004	15/04/2020	625.3	68.9
MB15HD20004	16/04/2020	625.3	68.9
MB15HD20004	17/04/2020	625.3	68.9
MB15HD20004	18/04/2020	625.3	68.9
MB15HD20004	19/04/2020	625.3	69.0
MB15HD20004	20/04/2020	625.3	69.0
MB15HD20004	21/04/2020	625.3	68.9
MB15HD20004	22/04/2020	625.3	68.9
MB15HD20004	23/04/2020	625.3	68.9
MB15HD20004	24/04/2020	625.3	68.9
MB15HD20004	25/04/2020	625.3	68.9
MB15HD20004	26/04/2020	625.3	68.9
MB15HD20004	27/04/2020	625.3	68.9
MB15HD20004	28/04/2020	625.3	68.9
MB15HD20004	29/04/2020	625.3	68.9
MB15HD20004	30/04/2020	625.3	68.9
MB15HD20004	1/05/2020	625.3	68.9
MB15HD20004	2/05/2020	625.3	68.9
MB15HD20004	3/05/2020	625.3	68.9
MB15HD20004	4/05/2020	625.3	68.9
MB15HD20004	5/05/2020	625.3	68.9
MB15HD20004	6/05/2020	625.3	68.9
MB15HD20004	7/05/2020	625.3	68.9
MB15HD20004	8/05/2020	625.3	68.9
MB15HD20004	9/05/2020	625.3	68.9

ID	Date	WL mAHD	WL mbgl
MB18HD20007	15/03/2022	627.8	98.0
MB18HD20007	16/03/2022	627.8	98.0
MB18HD20008	21/11/2018	625.2	80.6
MB18HD20008	22/11/2018	625.2	80.7
MB18HD20008	23/11/2018	625.2	80.6
MB18HD20008	24/11/2018	625.3	80.6
MB18HD20008	25/11/2018	625.2	80.6
MB18HD20008	26/11/2018	625.3	80.6
MB18HD20008	27/11/2018	625.3	80.6
MB18HD20008	28/11/2018	625.3	80.6
MB18HD20008	29/11/2018	625.3	80.6
MB18HD20008	30/11/2018	625.3	80.6
MB18HD20008	1/12/2018	625.3	80.6
MB18HD20008	2/12/2018	625.3	80.6
MB18HD20008	3/12/2018	625.3	80.6
MB18HD20008	4/12/2018	625.3	80.6
MB18HD20008	5/12/2018	625.3	80.6
MB18HD20008	6/12/2018	625.3	80.6
MB18HD20008	7/12/2018	625.3	80.6
MB18HD20008	8/12/2018	625.2	80.6
MB18HD20008	9/12/2018	625.3	80.6
MB18HD20008	10/12/2018	625.3	80.6
MB18HD20008	11/12/2018	625.2	80.6
MB18HD20008	12/12/2018	625.3	80.6
MB18HD20008	13/12/2018	625.3	80.6
MB18HD20008	14/12/2018	625.3	80.6
MB18HD20008	15/12/2018	625.2	80.7
MB18HD20008	16/12/2018	625.2	80.7
MB18HD20008	17/12/2018	625.2	80.6
MB18HD20008	18/12/2018	625.3	80.6
MB18HD20008	19/12/2018	625.3	80.6
MB18HD20008	20/12/2018	625.3	80.6
MB18HD20008	21/12/2018	625.3	80.6
MB18HD20008	22/12/2018	625.3	80.6
MB18HD20008	23/12/2018	625.3	80.6
MB18HD20008	24/12/2018	625.3	80.6
MB18HD20008	25/12/2018	625.3	80.6
MB18HD20008	26/12/2018	625.3	80.6
MB18HD20008	27/12/2018	625.2	80.7
MB18HD20008	28/12/2018	625.2	80.7
MB18HD20008	29/12/2018	625.2	80.7
MB18HD20008	30/12/2018	625.2	80.7
MB18HD20008	31/12/2018	625.2	80.7
MB18HD20008	1/01/2019	625.2	80.6
MB18HD20008	2/01/2019	625.2	80.6
MB18HD20008	3/01/2019	625.3	80.6
MB18HD20008	4/01/2019	625.3	80.6
MB18HD20008	5/01/2019	625.3	80.6
MB18HD20008	6/01/2019	625.3	80.6
MB18HD20008	7/01/2019	625.3	80.6
MB18HD20008	8/01/2019	625.3	80.6
MB18HD20008	9/01/2019	625.3	80.6
MB18HD20008	10/01/2019	625.2	80.6
MB18HD20008	11/01/2019	625.2	80.6
MB18HD20008	12/01/2019	625.3	80.6
MB18HD20008	13/01/2019	625.3	80.6
MB18HD20008	14/01/2019	625.2	80.6
MB18HD20008	15/01/2019	625.2	80.6
MB18HD20008	16/01/2019	625.2	80.6
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MB18HD20008	18/01/2019	625.3	80.6
MB18HD20008	19/01/2019	625.3	80.6
MB18HD20008	20/01/2019	625.3	80.6
MB18HD20008	21/01/2019	625.2	80.6
MB18HD20008	22/01/2019	625.2	80.7
MB18HD20008	23/01/2019	625.2	80.7
MB18HD20008	24/01/2019	625.2	80.7
MB18HD20008	25/01/2019	625.2	80.7
MB18HD20008	26/01/2019	625.2	80.7
MB18HD20008	27/01/2019	625.2	80.7
MB18HD20008	28/01/2019	625.3	80.6
MB18HD20008	29/01/2019	625.3	80.6
MB18HD20008	30/01/2019	625.2	80.6
MB18HD20008	31/01/2019	625.2	80.6
MB18HD20008	1/02/2019	625.2	80.6
MB18HD20008	2/02/2019	625.2	80.7
MB18HD20008	3/02/2019	625.2	80.7
MB18HD20008	4/02/2019	625.2	80.7
MB18HD20008	5/02/2019	625.2	80.7
MB18HD20008	6/02/2019	625.2	80.7
MB18HD20008	7/02/2019	625.2	80.7
MB18HD20008	8/02/2019	625.3	80.6
MB18HD20008	9/02/2019	625.3	80.6
MB18HD20008	10/02/2019	625.3	80.6
MB18HD20008	11/02/2019	625.3	80.6
MB18HD20008	12/02/2019	625.3	80.6
MB18HD20008	13/02/2019	625.3	80.6
MB18HD20008	14/02/2019	625.3	80.6
MB18HD20008	15/02/2019	625.3	80.6
MB18HD20008	16/02/2019	625.3	80.6
MB18HD20008	17/02/2019	625.2	80.7
MB18HD20008	18/

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP1	15/09/2006	71.7	614.4
HDVP1	14/09/2006	71.7	614.4
HDVP1	13/09/2006	71.7	614.4
HDVP1	12/09/2006	71.7	614.4
HDVP1	11/09/2006	71.7	614.4
HDVP1	10/09/2006	71.7	614.4
HDVP1	9/09/2006	71.7	614.4
HDVP1	8/09/2006	71.7	614.4
HDVP1	7/09/2006	71.7	614.4
HDVP1	6/09/2006	71.7	614.4
HDVP1	5/09/2006	71.7	614.4
HDVP1	4/09/2006	71.7	614.4
HDVP1	3/09/2006	71.7	614.4
HDVP1	2/09/2006	71.7	614.4
HDVP1	1/09/2006	71.7	614.4
HDVP1	31/08/2006	122.6	563.6
HDVP1	30/08/2006	122.6	563.6
HDVP1	29/08/2006	122.6	563.6
HDVP1	28/08/2006	122.6	563.6
HDVP1	27/08/2006	122.6	563.6
HDVP1	26/08/2006	122.6	563.6
HDVP1	25/08/2006	122.6	563.6
HDVP1	24/08/2006	122.6	563.6
HDVP1	23/08/2006	122.6	563.6
HDVP1	22/08/2006	122.6	563.6
HDVP1	21/08/2006	122.6	563.6
HDVP1	20/08/2006	122.6	563.6
HDVP1	19/08/2006	122.6	563.6
HDVP1	18/08/2006	122.6	563.6
HDVP1	17/08/2006	122.6	563.6
HDVP1	16/08/2006	122.6	563.6
HDVP1	15/08/2006	122.6	563.6
HDVP1	14/08/2006	122.6	563.6
HDVP1	13/08/2006	122.6	563.6
HDVP1	12/08/2006	122.6	563.6
HDVP1	11/08/2006	122.6	563.6
HDVP1	10/08/2006	122.6	563.6
HDVP1	9/08/2006	122.6	563.6
HDVP1	8/08/2006	122.6	563.6
HDVP1	7/08/2006	122.6	563.6
HDVP1	6/08/2006	122.6	563.6
HDVP1	5/08/2006	122.6	563.6
HDVP1	4/08/2006	122.6	563.6
HDVP1	3/08/2006	122.6	563.6
HDVP1	2/08/2006	122.6	563.6
HDVP2	16/02/2022	624.1	62.4
HDVP2	15/02/2022	624.1	62.4
HDVP2	14/02/2022	624.1	62.4
HDVP2	13/02/2022	624.1	62.4
HDVP2	12/02/2022	624.1	62.4
HDVP2	11/02/2022	624.1	62.4
HDVP2	10/02/2022	624.1	62.4
HDVP2	9/02/2022	624.1	62.4
HDVP2	8/02/2022	624.1	62.4
HDVP2	7/02/2022	624.1	62.4
HDVP2	6/02/2022	624.1	62.4
HDVP2	5/02/2022	624.1	62.4
HDVP2	4/02/2022	624.1	62.4
HDVP2	3/02/2022	624.1	62.4
HDVP2	2/02/2022	624.1	62.4
HDVP2	1/02/2022	624.1	62.4
HDVP2	31/01/2022	624.1	62.4
HDVP2	30/01/2022	624.1	62.4
HDVP2	29/01/2022	624.1	62.4
HDVP2	28/01/2022	624.1	62.4
HDVP2	27/01/2022	624.1	62.4
HDVP2	26/01/2022	624.1	62.4
HDVP2	25/01/2022	624.1	62.4
HDVP2	24/01/2022	624.1	62.4
HDVP2	23/01/2022	624.1	62.4
HDVP2	22/01/2022	624.1	62.4
HDVP2	21/01/2022	624.1	62.4
HDVP2	20/01/2022	627.5	59.1
HDVP2	19/01/2022	627.5	59.1
HDVP2	18/01/2022	627.5	59.1
HDVP2	17/01/2022	627.5	59.1
HDVP2	16/01/2022	627.5	59.1
HDVP2	15/01/2022	627.5	59.1
HDVP2	14/01/2022	627.5	59.1
HDVP2	13/01/2022	627.5	59.1
HDVP2	12/01/2022	627.5	59.1
HDVP2	11/01/2022	627.5	59.1
HDVP2	10/01/2022	627.5	59.1
HDVP2	9/01/2022	627.5	59.1
HDVP2	8/01/2022	627.5	59.1
HDVP2	7/01/2022	627.5	59.1
HDVP2	6/01/2022	627.5	59.1
HDVP2	5/01/2022	627.5	59.1
HDVP2	4/01/2022	627.5	59.1
HDVP2	3/01/2022	627.5	59.1
HDVP2	2/01/2022	627.5	59.1
HDVP2	1/01/2022	627.5	59.1
HDVP2	31/12/2021	627.5	59.1
HDVP2	30/12/2021	627.5	59.1
HDVP2	29/12/2021	627.5	59.1
HDVP2	28/12/2021	627.5	59.1
HDVP2	27/12/2021	627.5	59.1
HDVP2	26/12/2021	627.5	59.1
HDVP2	25/12/2021	627.5	59.1
HDVP2	24/12/2021	627.5	59.1
HDVP2	23/12/2021	627.5	59.1
HDVP2	22/12/2021	627.5	59.1
HDVP2	21/12/2021	627.5	59.1
HDVP2	20/12/2021	627.5	59.1
HDVP2	19/12/2021	627.5	59.1
HDVP2	18/12/2021	627.5	59.1
HDVP2	17/12/2021	627.5	59.1
HDVP2	16/12/2021	627.5	59.1
HDVP2	15/12/2021	627.5	59.1
HDVP2	14/12/2021	627.5	59.1
HDVP2	13/12/2021	627.5	59.1
HDVP2	12/12/2021	627.5	59.1
HDVP2	11/12/2021	627.5	59.1
HDVP2	10/12/2021	627.5	59.1
HDVP2	9/12/2021	627.5	59.1
HDVP2	8/12/2021	627.5	59.1
HDVP2	7/12/2021	627.5	59.1
HDVP2	6/12/2021	627.5	59.1
HDVP2	5/12/2021	627.5	59.1
HDVP2	4/12/2021	627.5	59.1
HDVP2	3/12/2021	627.5	59.1
HDVP2	2/12/2021	627.5	59.1
HDVP2	1/12/2021	627.5	59.1
HDVP2	30/11/2021	627.5	59.1
HDVP2	29/11/2021	627.5	59.1
HDVP2	28/11/2021	627.5	59.1
HDVP2	27/11/2021	627.5	59.1
HDVP2	26/11/2021	627.5	59.1
HDVP2	25/11/2021	627.5	59.1
HDVP2	24/11/2021	627.5	59.1
HDVP2	23/11/2021	627.5	59.1
HDVP2	22/11/2021	627.5	59.1
HDVP2	21/11/2021	627.5	59.1
HDVP2	20/11/2021	627.5	59.1
HDVP2	19/11/2021	627.5	59.1
HDVP2	18/11/2021	627.5	59.1

ID	Date	WL mAHD	WL mbgl
MB18BHT0003	15/09/2020	613.4	67.4
MB18BHT0003	14/09/2020	613.4	67.4
MB18BHT0003	13/09/2020	613.4	67.4
MB18BHT0003	12/09/2020	613.4	67.5
MB18BHT0003	11/09/2020	613.4	67.5
MB18BHT0003	10/09/2020	613.3	67.5
MB18BHT0003	9/09/2020	613.3	67.5
MB18BHT0003	8/09/2020	613.4	67.5
MB18BHT0003	7/09/2020	613.3	67.5
MB18BHT0003	6/09/2020	613.3	67.5
MB18BHT0003	5/09/2020	613.3	67.5
MB18BHT0003	4/09/2020	613.4	67.5
MB18BHT0003	3/09/2020	613.4	67.5
MB18BHT0003	2/09/2020	613.4	67.5
MB18BHT0003	1/09/2020	613.3	67.5
MB18BHT0003	31/08/2020	613.4	67.5
MB18BHT0003	30/08/2020	613.4	67.4
MB18BHT0003	29/08/2020	613.4	67.4
MB18BHT0003	28/08/2020	613.4	67.5
MB18BHT0003	27/08/2020	613.4	67.4
MB18BHT0003	26/08/2020	613.4	67.4
MB18BHT0003	25/08/2020	613.4	67.5
MB18BHT0003	24/08/2020	613.4	67.5
MB18BHT0003	23/08/2020	613.4	67.5
MB18BHT0003	22/08/2020	613.4	67.4
MB18BHT0003	21/08/2020	613.4	67.4
MB18BHT0003	20/08/2020	613.4	67.5
MB18BHT0003	19/08/2020	613.4	67.5
MB18BHT0003	18/08/2020	613.4	67.5
MB18BHT0003	17/08/2020	613.3	67.5
MB18BHT0003	16/08/2020	613.3	67.5
MB18BHT0003	15/08/2020	613.3	67.5
MB18BHT0003	14/08/2020	613.4	67.5
MB18BHT0003	13/08/2020	613.4	67.5
MB18BHT0003	12/08/2020	613.3	67.5
MB18BHT0003	11/08/2020	613.3	67.5
MB18BHT0003	10/08/2020	613.3	67.5
MB18BHT0003	9/08/2020	613.3	67.5
MB18BHT0003	8/08/2020	613.4	67.5
MB18BHT0003	7/08/2020	613.4	67.4
MB18BHT0003	6/08/2020	613.4	67.5
MB18BHT0003	5/08/2020	613.3	67.5
MB18BHT0003	4/08/2020	613.3	67.5
MB18BHT0003	3/08/2020	613.3	67.5
MB18BHT0003	2/08/2020	613.3	67.5
MB18BHT0003	1/08/2020	613.4	67.5
MB18BHT0003	31/07/2020	613.4	67.5
MB18BHT0003	30/07/2020	613.4	67.5
MB18BHT0003	29/07/2020	613.4	67.4
MB18BHT0003	28/07/2020	613.4	67.4
MB18BHT0003	27/07/2020	613.4	67.4
MB18BHT0003	26/07/2020	613.4	67.4
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MB18BHT0003	23/07/2020	613.4	67.4
MB18BHT0003	22/07/2020	613.4	67.4
MB18BHT0003	21/07/2020	613.4	67.5
MB18BHT0003	20/07/2020	613.4	67.5
MB18BHT0003	19/07/2020	613.4	67.4
MB18BHT0003	18/07/2020	613.3	67.5
MB18BHT0003	17/07/2020	613.3	67.5
MB18BHT0003	16/07/2020	613.3	67.5
MB18BHT0003	15/07/2020	613.4	67.5
MB18BHT0003	14/07/2020	613.4	67.5
MB18BHT0003	13/07/2020	613.4	67.5
MB18BHT0003	12/07/2020	613.4	67.4
MB18BHT0003	11/07/2020	613.4	67.4
MB18BHT0003	10/07/2020	613.4	67.4
MB18BHT0003	9/07/2020	613.4	67.5
MB18BHT0003	8/07/2020	613.4	67.5
MB18BHT0003	7/07/2020	613.4	67.4
MB18BHT0003	6/07/2020	613.4	67.4
MB18BHT0003	5/07/2020	613.4	67.4
MB18BHT0003	4/07/2020	613.4	67.4
MB18BHT0003	3/07/2020	613.4	67.4
MB18BHT0003	2/07/2020	613.4	67.4
MB18BHT0003	1/07/2020	613.4	67.5
MB18BHT0003	30/06/2020	613.3	67.5
MB18BHT0003	29/06/2020	613.3	67.5
MB18BHT0003	28/06/2020	613.4	67.5
MB18BHT0003	27/06/2020	613.4	67.5
MB18BHT0003	26/06/2020	613.4	67.5
MB18BHT0003	25/06/2020	613.4	67.5
MB18BHT0003	24/06/2020	613.4	67.5
MB18BHT0003	23/06/2020	613.4	67.5
MB18BHT0003	22/06/2020	613.3	67.5
MB18BHT0003	21/06/2020	613.4	67.5
MB18BHT0003	20/06/2020	613.4	67.4
MB18BHT0003	19/06/2020	613.4	67.4
MB18BHT0003	18/06/2020	613.4	67.5
MB18BHT0003	17/06/2020	613.4	67.5
MB18BHT0003	16/06/2020	613.4	67.5
MB18BHT0003	15/06/2020	613.4	67.4
MB18BHT0003	14/06/2020	613.4	67.5
MB18BHT0003	13/06/2020	613.4	67.5
MB18BHT0003	12/06/2020	613.3	67.5
MB18BHT0003	11/06/2020	613.3	67.5
MB18BHT0003	10/06/2020	613.4	67.5
MB18BHT0003	9/06/2020	613.4	67.5
MB18BHT0003	8/06/2020	613.4	67.5
MB18BHT0003	7/06/2020	613.3	67.5
MB18BHT0003	6/06/2020	613.4	67.5
MB18BHT0003	5/06/2020	613.4	67.4
MB18BHT0003	4/06/2020	613.4	67.4
MB18BHT0003	3/06/2020	613.4	67.4
MB18BHT0003	2/06/2020	613.4	67.4
MB18BHT0003	1/06/2020	613.4	67.4
MB18BHT0003	31/05/2020	613.4	67.4
MB18BHT0003	30/05/2020	613.4	67.5
MB18BHT0003	29/05/2020	613.3	67.5
MB18BHT0003	28/05/2020	613.4	67.5
MB18BHT0003	27/05/2020	613.4	67.5
MB18BHT0003	26/05/2020	613.3	67.5
MB18BHT0003	25/05/2020	613.3	67.5
MB18BHT0003	24/05/2020	613.3	67.5
MB18BHT0003	23/05/2020	613.4	67.5
MB18BHT0003	22/05/2020	613.4	67.5
MB18BHT0003	21/05/2020	613.4	67.5
MB18BHT0003	20/05/2020	613.4	67.5
MB18BHT0003	19/05/2020	613.4	67.5
MB18BHT0003	18/05/2020	613.3	67.5
MB18BHT0003	17/05/2020	613.3	67.5
MB18BHT0003	16/05/2020	613.4	67.5
MB18BHT0003	15/05/2020	613.4	67.5
MB18BHT0003	14/05/2020	613.4	67.4
MB18BHT0003	13/05/2020	613.4	67.5
MB18BHT0003	12/05/2020	613.4	67.5
MB18BHT0003	11/05/2020	613.4	67.5
MB18BHT0003	10/05/2020	613.4	67.4
MB18BHT0003	9/05/2020	613.4	67.5
MB18BHT0003	8/05/2020	613.3	67.5
MB18BHT0003	7/05/2020	613.3	67.5
MB18BHT0003	6/05/2020	613.3	67.5
MB18BHT0003	5/05/2020	613.3	67.5
MB18BHT0003	4/05/2020	613.3	67.5
MB18BHT0003	3/05/2020	613.3	67.5

ID	Date	WL mAHD	WL mbgl
MB15HD20004	10/05/2020	625.3	68.9
MB15HD20004	11/05/2020	625.3	68.9
MB15HD20004	12/05/2020	625.3	68.9
MB15HD20004	13/05/2020	625.3	68.9
MB15HD20004	14/05/2020	625.3	68.9
MB15HD20004	15/05/2020	625.3	68.9
MB15HD20004	16/05/2020	625.3	68.9
MB15HD20004	17/05/2020	625.3	68.9
MB15HD20004	18/05/2020	625.3	68.9
MB15HD20004	19/05/2020	625.3	68.9
MB15HD20004	20/05/2020	625.3	68.9
MB15HD20004	21/05/2020	625.3	68.9
MB15HD20004	22/05/2020	625.3	68.9
MB15HD20004	23/05/2020	625.3	68.9
MB15HD20004	24/05/2020	625.3	68.9
MB15HD20004	25/05/2020	625.3	69.0
MB15HD20004	26/05/2020	625.3	68.9
MB15HD20004	27/05/2020	625.3	68.9
MB15HD20004	28/05/2020	625.3	68.9
MB15HD20004	29/05/2020	625.3	68.9
MB15HD20004	30/05/2020	625.3	68.9
MB15HD20004	31/05/2020	625.3	68.9
MB15HD20004	1/06/2020	625.3	68.9
MB15HD20004	2/06/2020	625.3	68.9
MB15HD20004	3/06/2020	625.3	68.9
MB15HD20004	4/06/2020	625.3	68.9
MB15HD20004	5/06/2020	625.3	68.9
MB15HD20004	6/06/2020	625.3	68.9
MB15HD20004	7/06/2020	625.3	68.9
MB15HD20004	8/06/2020	625.3	68.9
MB15HD20004	9/06/2020	625.3	68.9
MB15HD20004	10/06/2020	625.3	68.9
MB15HD20004	11/06/2020	625.3	68.9
MB15HD20004	12/06/2020	625.3	68.9
MB15HD20004	13/06/2020	625.3	68.9
MB15HD20004	14/06/2020	625.3	68.9
MB15HD20004	15/06/2020	625.3	68.9
MB15HD20004	16/06/2020	625.3	68.9
MB15HD20004	17/06/2020	625.3	68.9
MB15HD20004	18/06/2020	625.3	68.9
MB15HD20004	19/06/2020	625.3	68.9
MB15HD20004	20/06/2020	625.3	68.9
MB15HD20004	21/06/2020	625.3	68.9
MB15HD20004	22/06/2020	625.3	68.9
MB15HD20004	23/06/2020	625.3	68.9
MB15HD20004	24/06/2020	625.3	68.9
MB15HD20004	25/06/2020	625.3	68.9
MB15HD20004	26/06/2020	625.3	68.9
MB15HD20004	27/06/2020	625.3	68.9
MB15HD20004	28/06/2020	625.3	68.9
MB15HD20004	29/06/2020	625.3	68.9
MB15HD20004	30/06/2020	625.3	68.9
MB15HD20004	1/07/2020	625.3	68.9
MB15HD20004	2/07/2020	625.3	68.9
MB15HD20004	3/07/2020	625.3	68.9
MB15HD20004	4/07/2020	625.3	68.9
MB15HD20004	5/07/2020	625.3	68.9
MB15HD20004	6/07/2020	625.3	68.9
MB15HD20004	7/07/2020	625.3	68.9
MB15HD20004	8/07/2020	625.3	68.9
MB15HD20004	9/07/2020	625.3	68.9
MB15HD20004	10/07/2020	625.3	68.9
MB15HD20004	11/07/2020	625.3	68.9
MB15HD20004	12/07/2020	625.3	68.9
MB15HD20004	13/07/2020	625.3	68.9
MB15HD20004	14/07/2020	625.3	68.9
MB15HD20004	15/07/2020	625.3	68.9
MB15HD20004	16/07/2020	625.3	68.9
MB15HD20004	17/07/2020	625.3	68.9
MB15HD20004	18/07/2020	625.3	68.9
MB15HD20004	19/07/2020	625.3	68.9
MB15HD20004	20/07/2020	625.3	68.9
MB15HD20004	21/07/2020	625.3	68.9
MB15HD20004	22/07/2020	625.3	68.9
MB15HD20004	23/07/2020	625.3	68.9
MB15HD20004	24/07/2020	625.3	68.9
MB15HD20004	25/07/2020	625.3	68.9
MB15HD20004	26/07/2020	625.3	68.9
MB15HD20004	27/07/2020	625.3	68.9
MB15HD20004	28/07/2020	625.3	68.9
MB15HD20004	29/07/2020	625.3	68.9
MB15HD20004	30/07/2020	625.3	68.9
MB15HD20004	31/07/2020	625.3	68.9
MB15HD20004	1/08/2020	625.3	68.9
MB15HD20004	2/08/2020	625.3	68.9
MB15HD20004	3/08/2020	625.2	69.0
MB15HD20004	4/08/2020	625.2	69.0
MB15HD20004	5/08/2020	625.2	69.0
MB15HD20004	6/08/2020	625.3	68.9
MB15HD20004	7/08/2020	625.3	68.9
MB15HD20004	8/08/2020	625.3	68.9
MB15HD20004	9/08/2020	625.3	69.0
MB15HD20004	10/08/2020	625.2	69.0
MB15HD20004	11/08/2020	625.2	69.0
MB15HD20004	12/08/2020	625.3	69.0
MB15HD20004	13/08/2020	625.3	69.0
MB15HD20004	14/08/2020	625.3	68.9
MB15HD20004	15/08/2020	625.3	69.0
MB15HD20004	16/08/2020	625.2	69.0
MB15HD20004	17/08/2020	625.3	69.0
MB15HD20004	18/08/2020	625.3	69.0
MB15HD20004	19/08/2020	625.3	68.9
MB15HD20004	20/08/2020	625.3	68.9
MB15HD20004	21/08/2020	625.3	68.9
MB15HD20004	22/08/2020	625.3	68.9
MB15HD20004	23/08/2020	625.3	68.9
MB15HD20004	24/08/2020	625.3	68.9
MB15HD20004	25/08/2020	625.3	68.9
MB15HD20004	26/08/2020	625.3	68.9
MB15HD20004	27/08/2020	625.3	68.9
MB15HD20004	28/08/2020	625.3	68.9
MB15HD20004	29/08/2020	625.3	68.9
MB15HD20004	30/08/2020	625.3	68.9
MB15HD20004	31/08/2020	625.3	68.9
MB15HD20004	1/09/2020	625.3	68.9
MB15HD20004	2/09/2020	625.3	69.0
MB15HD20004	3/09/2020	625.3	68.9
MB15HD20004	4/09/2020	625.3	68.9
MB15HD20004	5/09/2020	625.3	69.0
MB15HD20004	6/09/2020	625.2	69.0
MB15HD20004	7/09/2020	625.2	69.0
MB15HD20004	8/09/2020	625.3	68.9
MB15HD20004	9/09/2020	625.3	68.9
MB15HD20004	10/09/2020	625.3	69.0
MB15HD20004	11/09/2020	625.3	69.0
MB15HD20004	12/09/2020	625.3	68.9
MB15HD20004	13/09/2020	625.3	68.9
MB15HD20004	14/09/2020	625.3	68.9
MB15HD20004	15/09/2020	625.3	68.9
MB15HD20004	16/09/2020	625.3	69.0
MB15HD20004	17/09/2020	625.2	69.0
MB15HD20004	18/09/2020	625.3	69.0
MB15HD20004	19/09/2020	625.2	69.0
MB15HD20004	20/09/2020	625.2	69.0
MB15HD20004	21/09/2020	625.3	69.0
MB15HD20004	22/09/2020	625.3	68.9

ID	Date	WL mAHD	WL mbgl
MB18HD20008	4/04/2019	625.3	80.6
MB18HD20008	5/04/2019	625.3	80.6
MB18HD20008	6/04/2019	625.3	80.6
MB18HD20008	7/04/2019	625.3	80.6
MB18HD20008	8/04/2019	625.3	80.6
MB18HD20008	9/04/2019	625.3	80.6
MB18HD20008	10/04/2019	625.3	80.6
MB18HD20008	11/04/2019	625.3	80.6
MB18HD20008	12/04/2019	625.3	80.6
MB18HD20008	13/04/2019	625.3	80.6
MB18HD20008	14/04/2019	625.3	80.6
MB18HD20008	15/04/2019	625.3	80.6
MB18HD20008	16/04/2019	625.3	80.6
MB18HD20008	17/04/2019	625.3	80.6
MB18HD20008	18/04/2019	625.3	80.6
MB18HD20008	19/04/2019	625.3	80.6
MB18HD20008	20/04/2019	625.3	80.6
MB18HD20008	21/04/2019	625.3	80.6
MB18HD20008	22/04/2019	625.3	80.6
MB18HD20008	23/04/2019	625.3	80.6
MB18HD20008	24/04/2019	625.3	80.6
MB18HD20008	25/04/2019	625.3	80.6
MB18HD20008	26/04/2019	625.3	80.6
MB18HD20008	27/04/2019	625.3	80.6
MB18HD20008	28/04/2019	625.3	80.6
MB18HD20008	29/04/2019	625.3	80.6
MB18HD20008	30/04/2019	625.3	80.6
MB18HD20008	1/05/2019	625.3	80.6
MB18HD20008	2/05/2019	625.3	80.6
MB18HD20008	3/05/2019	625.3	80.6
MB18HD20008	4/05/2019	625.3	80.6
MB18HD20008	5/05/2019	625.3	80.6
MB18HD20008	6/05/2019	625.3	80.6
MB18HD20008	7/05/2019	625.3	80.6
MB18HD20008	8/05/2019	625.3	80.6
MB18HD20008	9/05/2019	625.3	80.6
MB18HD20008	10/05/2019	625.3	80.5
MB18HD20008	11/05/2019	625.3	80.5
MB18HD20008	12/05/2019	625.3	80.6
MB18HD20008	13/05/2019	625.3	80.6
MB18HD20008	14/05/2019	625.3	80.6
MB18HD20008	15/05/2019	625.3	80.6
MB18HD20008	16/05/2019	625.3	80.6
MB18HD20008	17/05/2019	625.3	80.6
MB18HD20008	18/05/2019	625.3	80.6
MB18HD20008	19/05/2019	625.3	80.6
MB18HD20008	20/05/2019	625.3	80.6
MB18HD20008	21/05/2019	625.3	80.6
MB18HD20008	22/05/2019	625.3	80.6
MB18HD20008	23/05/2019	625.3	80.6
MB18HD20008	24/05/2019	625.3	80.6
MB18HD20008	25/05/2019	625.3	80.6
MB18HD20008	26/05/2019	625.3	80.6
MB18HD20008	27/05/2019	625.3	80.6
MB18HD20008	28/05/2019	625.3	80.6
MB18HD20008	29/05/2019	625.3	80.6
MB18HD20008	30/05/2019	625.3	80.6
MB18HD20008	31/05/2019	625.3	80.6
MB18HD20008	1/06/2019	625.3	80.6
MB18HD20008	2/06/2019	625.3	80.6
MB18HD20008	3/06/2019	625.3	80.6
MB18HD20008	4/06/2019	625.3	80.6
MB18HD20008	5/06/2019	625.3	80.6
MB18HD20008	6/06/2019	625.3	80.6
MB18HD20008	7/06/2019	625.3	80.6
MB18HD20008	8/06/2019	625.3	80.6
MB18HD20008	9/06/2019	625.3	80.6
MB18HD20008	10/06/2019	625.3	80.6
MB18HD20008	11/06/2019	625.3	80.6
MB18HD20008	12/06/2019	625.3	80.6
MB18HD20008	13/06/2019	625.3	80.6
MB18HD20008	14/06/2019	625.3	80.6
MB18HD20008	15/06/2019	625.3	80.6
MB18HD20008	16/06/2019	625.3	80.6
MB18HD20008	17/06/2019	625.3	80.6
MB18HD20008	18/06/2019	625.3	80.6
MB18HD20008	19/06/2019	625.3	80.6
MB18HD20008	20/06/2019	625.3	80.6
MB18HD20008	21/06/2019	625.3	80.6
MB18HD20008	22/06/2019	625.3	80.6
MB18HD20008	23/06/2019	625.3	80.6
MB18HD20008	24/06/2019	625.3	80.6
MB18HD20008	25/06/2019	625.3	80.6
MB18HD20008	26/06/2019	625.3	80.6
MB18HD20008	27/06/2019	625.3	80.6
MB18HD20008	28/06/2019	625.3	80.6
MB18HD20008	29/06/2019	625.3	80.6
MB18HD20008	30/06/2019	625.3	80.6
MB18HD20008	1/07/2019	625.3	80.6
MB18HD20008	2/07/2019	625.3	80.6
MB18HD20008	3/07/2019	625.3	80.6
MB18HD20008	4/

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	17/11/2021	627.5	59.1
HDVP2	16/11/2021	627.5	59.1
HDVP2	15/11/2021	627.5	59.1
HDVP2	14/11/2021	627.5	59.1
HDVP2	13/11/2021	627.5	59.1
HDVP2	12/11/2021	627.5	59.1
HDVP2	11/11/2021	627.5	59.1
HDVP2	10/11/2021	649.6	37.0
HDVP2	9/11/2021	649.6	37.0
HDVP2	8/11/2021	649.6	37.0
HDVP2	7/11/2021	649.6	37.0
HDVP2	6/11/2021	649.6	37.0
HDVP2	5/11/2021	649.6	37.0
HDVP2	4/11/2021	649.6	37.0
HDVP2	3/11/2021	649.6	37.0
HDVP2	2/11/2021	649.6	37.0
HDVP2	1/11/2021	649.6	37.0
HDVP2	31/10/2021	649.6	37.0
HDVP2	30/10/2021	649.6	37.0
HDVP2	29/10/2021	649.6	37.0
HDVP2	28/10/2021	649.6	37.0
HDVP2	27/10/2021	649.6	37.0
HDVP2	26/10/2021	649.6	37.0
HDVP2	25/10/2021	649.6	37.0
HDVP2	24/10/2021	649.6	37.0
HDVP2	23/10/2021	649.6	37.0
HDVP2	22/10/2021	649.6	37.0
HDVP2	21/10/2021	649.6	37.0
HDVP2	20/10/2021	649.6	37.0
HDVP2	19/10/2021	649.6	37.0
HDVP2	18/10/2021	649.6	37.0
HDVP2	17/10/2021	649.6	37.0
HDVP2	16/10/2021	649.6	37.0
HDVP2	15/10/2021	662.7	23.9
HDVP2	14/10/2021	662.7	23.9
HDVP2	13/10/2021	662.7	23.9
HDVP2	12/10/2021	662.7	23.9
HDVP2	11/10/2021	662.7	23.9
HDVP2	10/10/2021	662.7	23.9
HDVP2	9/10/2021	662.7	23.9
HDVP2	8/10/2021	662.7	23.9
HDVP2	7/10/2021	662.7	23.9
HDVP2	6/10/2021	662.7	23.9
HDVP2	5/10/2021	662.7	23.9
HDVP2	4/10/2021	662.7	23.9
HDVP2	3/10/2021	662.7	23.9
HDVP2	2/10/2021	662.7	23.9
HDVP2	1/10/2021	662.7	23.9
HDVP2	30/09/2021	662.7	23.9
HDVP2	29/09/2021	662.7	23.9
HDVP2	28/09/2021	662.7	23.9
HDVP2	27/09/2021	662.7	23.9
HDVP2	26/09/2021	662.7	23.9
HDVP2	25/09/2021	662.7	23.9
HDVP2	24/09/2021	662.7	23.9
HDVP2	23/09/2021	662.7	23.9
HDVP2	22/09/2021	662.7	23.9
HDVP2	21/09/2021	662.7	23.9
HDVP2	20/09/2021	662.7	23.9
HDVP2	19/09/2021	662.7	23.9
HDVP2	18/09/2021	662.7	23.9
HDVP2	17/09/2021	662.7	23.9
HDVP2	16/09/2021	662.7	23.9
HDVP2	15/09/2021	673.1	13.4
HDVP2	14/09/2021	673.1	13.4
HDVP2	13/09/2021	673.1	13.4
HDVP2	12/09/2021	673.1	13.4
HDVP2	11/09/2021	673.1	13.4
HDVP2	10/09/2021	673.1	13.4
HDVP2	9/09/2021	673.1	13.4
HDVP2	8/09/2021	673.1	13.4
HDVP2	7/09/2021	673.1	13.4
HDVP2	6/09/2021	673.1	13.4
HDVP2	5/09/2021	654.1	32.4
HDVP2	4/09/2021	654.1	32.4
HDVP2	3/09/2021	654.1	32.4
HDVP2	2/09/2021	654.1	32.4
HDVP2	1/09/2021	654.1	32.4
HDVP2	31/08/2021	654.1	32.4
HDVP2	30/08/2021	654.1	32.4
HDVP2	29/08/2021	654.1	32.4
HDVP2	28/08/2021	654.1	32.4
HDVP2	27/08/2021	654.1	32.4
HDVP2	26/08/2021	654.1	32.4
HDVP2	25/08/2021	654.1	32.4
HDVP2	24/08/2021	654.1	32.4
HDVP2	23/08/2021	654.1	32.4
HDVP2	22/08/2021	654.1	32.4
HDVP2	21/08/2021	654.1	32.4
HDVP2	20/08/2021	654.1	32.4
HDVP2	19/08/2021	654.1	32.4
HDVP2	18/08/2021	654.1	32.4
HDVP2	17/08/2021	654.1	32.4
HDVP2	16/08/2021	654.1	32.4
HDVP2	15/08/2021	654.1	32.4
HDVP2	14/08/2021	654.1	32.4
HDVP2	13/08/2021	654.1	32.4
HDVP2	12/08/2021	654.1	32.4
HDVP2	11/08/2021	654.1	32.4
HDVP2	10/08/2021	654.1	32.4
HDVP2	9/08/2021	654.1	32.4
HDVP2	8/08/2021	654.1	32.4
HDVP2	7/08/2021	654.1	32.4
HDVP2	6/08/2021	654.1	32.4
HDVP2	5/08/2021	654.1	32.4
HDVP2	4/08/2021	654.1	32.4
HDVP2	3/08/2021	654.1	32.4
HDVP2	2/08/2021	654.1	32.4
HDVP2	1/08/2021	654.1	32.4
HDVP2	31/07/2021	654.1	32.4
HDVP2	30/07/2021	654.1	32.4
HDVP2	29/07/2021	654.1	32.4
HDVP2	28/07/2021	654.1	32.4
HDVP2	27/07/2021	654.1	32.4
HDVP2	26/07/2021	654.1	32.4
HDVP2	25/07/2021	654.1	32.4
HDVP2	24/07/2021	654.1	32.4
HDVP2	23/07/2021	654.1	32.4
HDVP2	22/07/2021	663.6	23.0
HDVP2	21/07/2021	663.6	23.0
HDVP2	20/07/2021	663.6	23.0
HDVP2	19/07/2021	663.6	23.0
HDVP2	18/07/2021	663.6	23.0
HDVP2	17/07/2021	663.6	23.0
HDVP2	16/07/2021	663.6	23.0
HDVP2	15/07/2021	663.6	23.0
HDVP2	14/07/2021	663.6	23.0
HDVP2	13/07/2021	663.6	23.0
HDVP2	12/07/2021	663.6	23.0
HDVP2	11/07/2021	663.6	23.0
HDVP2	10/07/2021	663.6	23.0
HDVP2	9/07/2021	663.6	23.0
HDVP2	8/07/2021	663.6	23.0
HDVP2	7/07/2021	663.6	23.0
HDVP2	6/07/2021	663.6	23.0
HDVP2	5/07/2021	663.6	23.0

ID	Date	WL mAHD	WL mbgl
MB18BHT0003	2/05/2020	613.3	67.5
MB18BHT0003	1/05/2020	613.3	67.5
MB18BHT0003	30/04/2020	613.4	67.5
MB18BHT0003	29/04/2020	613.4	67.5
MB18BHT0003	28/04/2020	613.3	67.5
MB18BHT0003	27/04/2020	613.3	67.5
MB18BHT0003	26/04/2020	613.3	67.5
MB18BHT0003	25/04/2020	613.3	67.5
MB18BHT0003	24/04/2020	613.3	67.5
MB18BHT0003	23/04/2020	613.3	67.5
MB18BHT0003	22/04/2020	613.3	67.5
MB18BHT0003	21/04/2020	613.3	67.5
MB18BHT0003	20/04/2020	613.3	67.5
MB18BHT0003	19/04/2020	613.3	67.5
MB18BHT0003	18/04/2020	613.3	67.5
MB18BHT0003	17/04/2020	613.3	67.5
MB18BHT0003	16/04/2020	613.3	67.5
MB18BHT0003	15/04/2020	613.3	67.5
MB18BHT0003	14/04/2020	613.3	67.5
MB18BHT0003	13/04/2020	613.3	67.5
MB18BHT0003	12/04/2020	613.3	67.5
MB18BHT0003	11/04/2020	613.3	67.5
MB18BHT0003	10/04/2020	613.3	67.5
MB18BHT0003	9/04/2020	613.3	67.5
MB18BHT0003	8/04/2020	613.3	67.5
MB18BHT0003	7/04/2020	613.3	67.5
MB18BHT0003	6/04/2020	613.3	67.5
MB18BHT0003	5/04/2020	613.3	67.5
MB18BHT0003	4/04/2020	613.3	67.5
MB18BHT0003	3/04/2020	613.3	67.5
MB18BHT0003	2/04/2020	613.3	67.5
MB18BHT0003	1/04/2020	613.3	67.6
MB18BHT0003	31/03/2020	613.3	67.5
MB18BHT0003	30/03/2020	613.3	67.5
MB18BHT0003	29/03/2020	613.3	67.5
MB18BHT0003	28/03/2020	613.3	67.5
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MB18BHT0003	17/03/2020	613.3	67.5
MB18BHT0003	16/03/2020	613.3	67.5
MB18BHT0003	15/03/2020	613.3	67.5
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MB18BHT0003	12/03/2020	613.3	67.5
MB18BHT0003	11/03/2020	613.3	67.5
MB18BHT0003	10/03/2020	613.3	67.6
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MB18BHT0003	8/03/2020	613.3	67.5
MB18BHT0003	7/03/2020	613.3	67.5
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MB18BHT0003	5/03/2020	613.3	67.6
MB18BHT0003	4/03/2020	613.3	67.6
MB18BHT0003	3/03/2020	613.3	67.5
MB18BHT0003	2/03/2020	613.3	67.6
MB18BHT0003	1/03/2020	613.2	67.6
MB18BHT0003	29/02/2020	613.2	67.6
MB18BHT0003	28/02/2020	613.2	67.6
MB18BHT0003	27/02/2020	613.3	67.6
MB18BHT0003	26/02/2020	613.3	67.6
MB18BHT0003	25/02/2020	613.3	67.6
MB18BHT0003	24/02/2020	613.3	67.5
MB18BHT0003	23/02/2020	613.3	67.6
MB18BHT0003	22/02/2020	613.3	67.5
MB18BHT0003	21/02/2020	613.3	67.5
MB18BHT0003	20/02/2020	613.3	67.6
MB18BHT0003	19/02/2020	613.3	67.6
MB18BHT0003	18/02/2020	613.3	67.5
MB18BHT0003	17/02/2020	613.3	67.5
MB18BHT0003	16/02/2020	613.3	67.6
MB18BHT0003	15/02/2020	613.3	67.5
MB18BHT0003	14/02/2020	613.3	67.6
MB18BHT0003	13/02/2020	613.3	67.5
MB18BHT0003	12/02/2020	613.3	67.5
MB18BHT0003	11/02/2020	613.3	67.5
MB18BHT0003	10/02/2020	613.2	67.6
MB18BHT0003	9/02/2020	613.2	67.6
MB18BHT0003	8/02/2020	613.3	67.6
MB18BHT0003	7/02/2020	613.3	67.6
MB18BHT0003	6/02/2020	613.3	67.6
MB18BHT0003	5/02/2020	613.3	67.6
MB18BHT0003	4/02/2020	613.3	67.6
MB18BHT0003	3/02/2020	613.3	67.5
MB18BHT0003	2/02/2020	613.3	67.6
MB18BHT0003	1/02/2020	613.3	67.6
MB18BHT0003	31/01/2020	613.2	67.6
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MB18BHT0003	29/01/2020	613.2	67.6
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MB18BHT0003	27/01/2020	613.3	67.6
MB18BHT0003	26/01/2020	613.3	67.6
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MB18BHT0003	24/01/2020	613.3	67.6
MB18BHT0003	23/01/2020	613.3	67.6
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MB18BHT0003	21/01/2020	613.2	67.6
MB18BHT0003	20/01/2020	613.3	67.6
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MB18BHT0003	18/01/2020	613.2	67.6
MB18BHT0003	17/01/2020	613.2	67.6
MB18BHT0003	16/01/2020	613.3	67.6
MB18BHT0003	15/01/2020	613.3	67.6
MB18BHT0003	14/01/2020	613.3	67.6
MB18BHT0003	13/01/2020	613.2	67.6
MB18BHT0003	12/01/2020	613.2	67.6
MB18BHT0003	11/01/2020	613.3	67.6
MB18BHT0003	10/01/2020	613.2	67.6
MB18BHT0003	9/01/2020	613.2	67.6
MB18BHT0003	8/01/2020	613.2	67.6
MB18BHT0003	7/01/2020	613.2	67.6
MB18BHT0003	6/01/2020	613.2	67.6
MB18BHT0003	5/01/2020	613.2	67.6
MB18BHT0003	4/01/2020	613.2	67.6
MB18BHT0003	3/01/2020	613.2	67.6
MB18BHT0003	2/01/2020	613.2	67.6
MB18BHT0003	1/01/2020	613.2	67.6
MB18BHT0003	31/12/2019	613.2	67.6
MB18BHT0003	30/12/2019	613.2	67.6
MB18BHT0003	29/12/2019	613.2	67.6
MB18BHT0003	28/12/2019	613.2	67.6
MB18BHT0003	27/12/2019	613.2	67.6
MB18BHT0003	26/12/2019	613.2	67.6
MB18BHT0003	25/12/2019	613.2	67.6
MB18BHT0003	24/12/2019	613.2	67.6
MB18BHT0003	23/12/2019	613.2	67.7
MB18BHT0003	22/12/2019	613.1	67.7
MB18BHT0003	21/12/2019	613.1	67.7
MB18BHT0003	20/12/2019	613.0	67.8
MB18BHT0003	19/12/2019	612.9	67.9

ID	Date	WL mAHD	WL mbgl
MB15HD20004	23/09/2020	625.3	68.9
MB15HD20004	24/09/2020	625.3	68.9
MB15HD20004	25/09/2020	625.3	69.0
MB15HD20004	26/09/2020	625.2	69.0
MB15HD20004	27/09/2020	625.2	69.0
MB15HD20004	28/09/2020	625.2	69.0
MB15HD20004	29/09/2020	625.3	69.0
MB15HD20004	30/09/2020	625.3	69.0
MB15HD20004	1/10/2020	625.2	69.0
MB15HD20004	2/10/2020	625.2	69.0
MB15HD20004	3/10/2020	625.2	69.0
MB15HD20004	4/10/2020	625.3	68.9
MB15HD20004	5/10/2020	625.3	68.9
MB15HD20004	6/10/2020	625.3	68.9
MB15HD20004	7/10/2020	625.3	68.9
MB15HD20004	8/10/2020	625.3	69.0
MB15HD20004	9/10/2020	625.3	69.0
MB15HD20004	10/10/2020	625.2	69.0
MB15HD20004	11/10/2020	625.2	69.0
MB15HD20004	12/10/2020	625.2	69.0
MB15HD20004	13/10/2020	625.2	69.0
MB15HD20004	14/10/2020	625.2	69.0
MB15HD20004	15/10/2020	625.2	69.0
MB15HD20004	16/10/2020	625.2	69.0
MB15HD20004	17/10/2020	625.2	69.0
MB15HD20004	18/10/2020	625.2	69.0
MB15HD20004	19/10/2020	625.2	69.0
MB15HD20004	20/10/2020	625.2	69.0
MB15HD20004	21/10/2020	625.2	69.0
MB15HD20004	22/10/2020	625.2	69.0
MB15HD20004	23/10/2020	625.2	69.0
MB15HD20004	24/10/2020	625.2	69.0
MB15HD20004	25/10/2020	625.2	69.0
MB15HD20004	26/10/2020	625.2	69.0
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MB15HD20004	28/10/2020	625.2	69.0
MB15HD20004	29/10/2020	625.2	69.0
MB15HD20004	30/10/2020	625.2	69.0
MB15HD20004	31/10/2020	625.2	69.0
MB15HD20004	1/11/2020	625.2	69.0
MB15HD20004	2/11/2020	625.2	69.0
MB15HD20004	3/11/2020	625.2	69.0
MB15HD20004	4/11/2020	625.2	69.0
MB15HD20004	5/11/2020	625.2	69.0
MB15HD20004	6/11/2020	625.2	69.0
MB15HD20004	7/11/2020	625.2	69.0
MB15HD20004	8/11/2020	625.2	69.0
MB15HD20004	9/11/2020	625.2	69.0
MB15HD20004	10/11/2020	625.2	69.0
MB15HD20004	11/11/2020	625.2	69.0
MB15HD20004	12/11/2020	625.2	69.0
MB15HD20004	13/11/2020	625.2	69.0
MB15HD20004	14/11/2020	625.2	69.0
MB15HD20004	15/11/2020	625.2	69.0
MB15HD20004	16/11/2020	625.2	69.0
MB15HD20004	17/11/2020	625.2	69.0
MB15HD20004	18/11/2020	625.2	69.0
MB15HD20004	19/11/2020	625.2	69.0
MB15HD20004	20/11/2020	625.2	69.0
MB15HD20004	21/11/2020	625.2	69.0
MB15HD20004	22/11/2020	625.2	69.0
MB15HD20004	23/11/2020	625.2	69.0
MB15HD20004	24/11/2020	625.2	69.0
MB15HD20004	25/11/2020	625.2	69.0
MB15HD20004	26/11/2020	625.2	69.0
MB15HD20004	27/11/2020	625.2	69.0
MB15HD20004	28/11/2020	625.2	69.0
MB15HD20004	29/11/2020	625.2	69.0
MB15HD20004	30/11/2020	625.2	69.0
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MB15HD20004	2/12/2020	625.2	69.0
MB15HD20004	3/12/2020	625.2	69.0
MB15HD20004	4/12/2020	625.2	69.0
MB15HD20004	5/12/2020	625.2	69.0
MB15HD20004	6/12/2020	625.2	69.0
MB15HD20004	7/12/2020	625.2	69.0
MB15HD20004	8/12/2020	625.2	69.0
MB15HD20004	9/12/2020	625.2	69.0
MB15HD20004	10/12/2020	625.2	69.0
MB15HD20004	11/12/2020	625.2	69.0
MB15HD20004	12/12/2020	625.2	69.1
MB15HD20004	13/12/2020	625.2	69.1
MB15HD20004	14/12/2020	625.2	69.0
MB15HD20004	15/12/2020	625.2	69.0
MB15HD20004	16/12/2020	625.2	69.0
MB15HD20004	17/12/2020	625.2	69.0
MB15HD20004	18/12/2020	625.2	69.0
MB15HD20004	19/12/2020	625.2	69.1
MB15HD20004	20/12/2020	625.2	69.1
MB15HD20004	21/12/2020	625.2	69.0
MB15HD20004	22/12/2020	625.2	69.0
MB15HD20004	23/12/2020	625.2	69.0
MB15HD20004	24/12/2020	625.2	69.0
MB15HD20004	25/12/2020	625.2	69.0
MB15HD20004	26/12/2020	625.2	69.0
MB15HD20004	27/12/2020	625.2	69.0
MB15HD20004	28/12/2020	625.2	69.0
MB15HD20004	29/12/2020	625.2	69.0
MB15HD20004	30/12/2020	625.2	69.0
MB15HD20004	31/12/2020	625.2	69.0
MB15HD20004	1/01/2021	625.2	69.0
MB15HD20004	2/01/2021	625.2	69.0
MB15HD20004	3/01/2021	625.2	69.0
MB15HD20004	4/01/2021	625.2	69.0
MB15HD20004	5/01/2021	625.2	69.0
MB15HD20004	6/01/2021	625.2	69.0
MB15HD20004	7/01/2021	625.2	69.0
MB15HD20004	8/01/2021	625.2	69.0
MB15HD20004	9/01/2021	625.2	69.0
MB15HD20004	10/01/2021	625.2	69.0
MB15HD20004	11/01/2021	625.2	69.0
MB15HD20004	12/01/2021	625.2	69.0
MB15HD20004	13/01/2021	625.2	69.0
MB15HD20004	14/01/2021	625.2	69.0
MB15HD20004	15/01/2021	625.2	69.0
MB15HD20004	16/01/2021	625.2	69.0
MB15HD20004	17/01/2021	625.2	69.0
MB15HD20004	18/01/2021	625.2	69.0
MB15HD20004	19/01/2021	625.2	69.0
MB15HD20004	20/01/2021	625.2	69.0
MB15HD20004	21/01/2021	625.2	69.0
MB15HD20004	22/01/2021	625.2	69.0
MB15HD20004	23/01/2021	625.2	69.1
MB15HD20004	24/01/2021	625.2	69.1
MB15HD20004	25/01/2021	625.2	69.1
MB15HD20004	26/01/2021	625.2	69.1
MB15HD20004	27/01/2021	625.1	69.1
MB15HD20004	28/01/2021	625.1	69.1
MB15HD20004	29/01/2021	625.1	69.1
MB15HD20004	30/01/2021	625.2	69.1
MB15HD20004	31/01/2021	625.2	69.1
MB15HD20004	1/02/2021	625.1	69.1
MB15HD20004	2/02/2021	625.1	69.1
MB15HD20004	3/02/2021	625.1	69.1
MB15HD20004	4/02/2021	625.1	69.1
MB15HD20004	5/02/2021	625.1	69.1

ID	Date	WL mAHD	WL mbgl
MB18HD20008	18/08/2019	625.3	80.6
MB18HD20008	19/08/2019	625.3	80.6
MB18HD20008	20/08/2019	625.3	80.6
MB18HD20008	21/08/2019	625.3	80.6
MB18HD20008	22/08/2019	625.3	80.6
MB18HD20008	23/08/2019	625.3	80.6
MB18HD20008	24/08/2019	625.3	80.6
MB18HD20008	25/08/2019	625.3	80.6
MB18HD20008	26/08/2019	625.3	80.6
MB18HD20008	27/08/2019	625.3	80.6
MB18HD20008	28/08/2019	625.3	80.6
MB18HD20008	29/08/2019	625.3	80.6
MB18HD20008	30/08/2019	625.3	80.6
MB18HD20008	31/08/2019	625.3	80.6
MB18HD20008	1/09/2019	625.3	80.6
MB18HD20008	2/09/2019	625.3	80.6
MB18HD20008	3/09/2019	625.3	80.6
MB18HD20008	4/09/2019	625.3	80.6
MB18HD20008	5/09/2019	625.3	80.6
MB18HD20008	6/09/2019	625.3	80.6
MB18HD20008	7/09/2019	625.3	80.6
MB18HD20008	8/09/2019	625.3	80.6
MB18HD20008	9/09/2019	625.3	80.6
MB18HD20008	10/09/2019	625.3	80.6
MB18HD20008	11/09/2019	625.3	80.6
MB18HD20008	12/09/2019	625.3	80.6
MB18HD20008	13/09/2019	625.3	80.6
MB18HD20008	14/09/2019	625.3	80.6
MB18HD20008	15/09/2019	625.3	80.6
MB18HD20008	16/09/2019	625.3	80.6
MB18HD20008	17/09/2019	625.3	80.6
MB18HD20008	18/09/2019	625.3	80.6
MB18HD20008	19/09/2019	625.3	80.6
MB18HD20008	20/09/2019	625.3	80.6
MB18HD20008	21/09/2019	625.3	80.6
MB18HD20008	22/09/2019	625.3	80.6
MB18HD20008	23/09/2019	625.3	80.6
MB18HD20008	24/09/2019	625.3	80.6
MB18HD20008	25/09/2019	625.3	80.6
MB18HD20008	26/09/2019	625.3	80.6
MB18HD20008	27/09/2019	625.3	80.6
MB18HD20008	28/09/2019	625.3	80.6
MB18HD20008	29/09/2019	625.3	80.6
MB18HD20008	30/09/2019	625.3	80.6
MB18HD20008	1/10/2019	625.3	80.6
MB18HD20008	2/10/2019	625.3	80.6
MB18HD20008	3/10/2019	625.3	80.6
MB18HD20008	4/10/2019	625.3	80.6
MB18HD20008	5/10/2019	625.3	80.6
MB18HD20008	6/10/2019	625.3	80.6
MB18HD20008	7/10/2019	625.3	80.6
MB18HD20008	8/10/2019	625.3	80.6
MB18HD20008	9/10/2019	625.3	80.6
MB18HD20008	10/10/2019	625.3	80.6
MB18HD20008	11/10/2019	625.2	80.6
MB18HD20008	12/10/2019	625.2	80.7
MB18HD20008	13/10/2019	625.2	80.7
MB18HD20008	14/10/2019	625.2	80.7
MB18HD20008	15/10/2019	625.2	80.7
MB18HD20008	16/10/2019	625.2	80.7
MB18HD20008	17/10/2019	625.2	80.7
MB18HD20008	18/10/2019	625.2	80.7
MB18HD20008	19/10/2019	625.2	80.7
MB18HD20008	20/10/2019	625.2	80.7
MB18HD20008	21/10/2019	625.3	80.6
MB18HD20008	22/10/2019	625.3	80.6
MB18HD20008	23/10/2019	625.2	80.7
MB18HD20008	24/10/2019	625.2	80.7
MB18HD20008	25/10/2019	625.2	80.7
MB18HD20008	26/10/2019	625.2	80.7
MB18HD20008	27/10/2019	625.2	80.7
MB18HD20008	28/10/2019	625.2	80.7
MB18HD20008	29/10/2019	625.2	80.7
MB18HD20008	30/10/2019	625.2	80.7
MB18HD20008	31/10/2019	625.2	80.7
MB18HD20008	1/11/2019	625.2	80.7
MB18HD20008	2/11/2019	625.2	80.7
MB18HD20008	3/11/2019	625.2	80.7
MB18HD20008	4/11/2019	625.3	80.6
MB18HD20008	5/11/2019	625.3	80.6
MB18HD20008	6/11/2019	625.2	80.7
MB18HD20008	7/11/2019	625.2	80.7
MB18HD20008	8/11/2019	625.2	80.7
MB18HD20008	9/11/2019	625.2	80.7
MB18HD20008	10/11/2019	625.2	80.7
MB18HD20008	11/11/2019	625.2	80.7
MB18HD20008	12/11/2019	625.2	80.7
MB18HD20008	13/11/2019	625.2	80.7
MB18HD20008	14/11/2019	625.2	80.7
MB18HD20008	15/11/2019	625.2	80.7
MB18HD20008	16/11/2019	625.2	80.7
MB18HD20008	17/

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	4/07/2021	663.6	23.0
HDVP2	3/07/2021	663.6	23.0
HDVP2	2/07/2021	663.6	23.0
HDVP2	1/07/2021	663.6	23.0
HDVP2	30/06/2021	663.6	23.0
HDVP2	29/06/2021	663.6	23.0
HDVP2	28/06/2021	663.6	23.0
HDVP2	27/06/2021	663.6	23.0
HDVP2	26/06/2021	663.6	23.0
HDVP2	25/06/2021	663.6	23.0
HDVP2	24/06/2021	663.6	23.0
HDVP2	23/06/2021	663.6	23.0
HDVP2	22/06/2021	663.6	23.0
HDVP2	21/06/2021	663.6	23.0
HDVP2	20/06/2021	663.6	23.0
HDVP2	19/06/2021	663.6	23.0
HDVP2	18/06/2021	663.6	23.0
HDVP2	17/06/2021	663.6	23.0
HDVP2	16/06/2021	663.6	23.0
HDVP2	15/06/2021	663.6	23.0
HDVP2	14/06/2021	663.6	23.0
HDVP2	13/06/2021	663.6	23.0
HDVP2	12/06/2021	663.6	23.0
HDVP2	11/06/2021	664.2	22.3
HDVP2	10/06/2021	664.2	22.3
HDVP2	9/06/2021	664.2	22.3
HDVP2	8/06/2021	664.2	22.3
HDVP2	7/06/2021	664.2	22.3
HDVP2	6/06/2021	664.2	22.3
HDVP2	5/06/2021	664.2	22.3
HDVP2	4/06/2021	664.2	22.3
HDVP2	3/06/2021	664.2	22.3
HDVP2	2/06/2021	664.2	22.3
HDVP2	1/06/2021	664.2	22.3
HDVP2	31/05/2021	664.2	22.3
HDVP2	30/05/2021	664.2	22.3
HDVP2	29/05/2021	664.2	22.3
HDVP2	28/05/2021	664.2	22.3
HDVP2	27/05/2021	664.2	22.3
HDVP2	26/05/2021	664.2	22.3
HDVP2	25/05/2021	664.2	22.3
HDVP2	24/05/2021	664.2	22.3
HDVP2	23/05/2021	664.2	22.3
HDVP2	22/05/2021	664.2	22.3
HDVP2	21/05/2021	664.2	22.3
HDVP2	20/05/2021	664.2	22.3
HDVP2	19/05/2021	664.2	22.3
HDVP2	18/05/2021	664.2	22.3
HDVP2	17/05/2021	664.2	22.3
HDVP2	16/05/2021	664.2	22.3
HDVP2	15/05/2021	664.2	22.3
HDVP2	14/05/2021	664.2	22.3
HDVP2	13/05/2021	664.2	22.3
HDVP2	12/05/2021	664.2	22.3
HDVP2	11/05/2021	664.2	22.3
HDVP2	10/05/2021	664.2	22.3
HDVP2	9/05/2021	664.2	22.3
HDVP2	8/05/2021	664.2	22.3
HDVP2	7/05/2021	664.2	22.3
HDVP2	6/05/2021	664.2	22.3
HDVP2	5/05/2021	664.2	22.3
HDVP2	4/05/2021	664.2	22.3
HDVP2	3/05/2021	664.2	22.3
HDVP2	2/05/2021	664.2	22.3
HDVP2	1/05/2021	664.2	22.3
HDVP2	30/04/2021	664.2	22.3
HDVP2	29/04/2021	664.2	22.3
HDVP2	28/04/2021	664.2	22.3
HDVP2	27/04/2021	664.2	22.3
HDVP2	26/04/2021	664.2	22.3
HDVP2	25/04/2021	664.2	22.3
HDVP2	24/04/2021	664.2	22.3
HDVP2	23/04/2021	664.2	22.3
HDVP2	22/04/2021	664.2	22.3
HDVP2	21/04/2021	664.2	22.3
HDVP2	20/04/2021	664.2	22.3
HDVP2	19/04/2021	664.2	22.3
HDVP2	18/04/2021	664.2	22.3
HDVP2	17/04/2021	664.2	22.3
HDVP2	16/04/2021	664.2	22.3
HDVP2	15/04/2021	664.2	22.3
HDVP2	14/04/2021	664.2	22.3
HDVP2	13/04/2021	664.2	22.3
HDVP2	12/04/2021	664.2	22.3
HDVP2	11/04/2021	664.2	22.3
HDVP2	10/04/2021	664.2	22.3
HDVP2	9/04/2021	664.2	22.3
HDVP2	8/04/2021	664.2	22.3
HDVP2	7/04/2021	664.2	22.3
HDVP2	6/04/2021	664.2	22.3
HDVP2	5/04/2021	664.2	22.3
HDVP2	4/04/2021	664.2	22.3
HDVP2	3/04/2021	664.2	22.3
HDVP2	2/04/2021	664.2	22.3
HDVP2	1/04/2021	664.2	22.3
HDVP2	31/03/2021	664.2	22.3
HDVP2	30/03/2021	664.2	22.3
HDVP2	29/03/2021	664.2	22.3
HDVP2	28/03/2021	664.2	22.3
HDVP2	27/03/2021	664.2	22.3
HDVP2	26/03/2021	664.2	22.3
HDVP2	25/03/2021	664.2	22.3
HDVP2	24/03/2021	664.2	22.3
HDVP2	23/03/2021	664.2	22.3
HDVP2	22/03/2021	664.2	22.3
HDVP2	21/03/2021	664.2	22.3
HDVP2	20/03/2021	664.2	22.3
HDVP2	19/03/2021	664.2	22.3
HDVP2	18/03/2021	664.2	22.3
HDVP2	17/03/2021	664.2	22.3
HDVP2	16/03/2021	664.2	22.3
HDVP2	15/03/2021	664.2	22.3
HDVP2	14/03/2021	664.2	22.3
HDVP2	13/03/2021	664.2	22.3
HDVP2	12/03/2021	664.2	22.3
HDVP2	11/03/2021	664.2	22.3
HDVP2	10/03/2021	664.2	22.3
HDVP2	9/03/2021	664.2	22.3
HDVP2	8/03/2021	664.2	22.3
HDVP2	7/03/2021	664.2	22.3
HDVP2	6/03/2021	664.2	22.3
HDVP2	5/03/2021	664.2	22.3
HDVP2	4/03/2021	664.2	22.3
HDVP2	3/03/2021	664.2	22.3
HDVP2	2/03/2021	664.2	22.3
HDVP2	1/03/2021	664.2	22.3
HDVP2	28/02/2021	664.2	22.3
HDVP2	27/02/2021	664.2	22.3
HDVP2	26/02/2021	664.2	22.3
HDVP2	25/02/2021	664.2	22.3
HDVP2	24/02/2021	664.2	22.3
HDVP2	23/02/2021	664.2	22.3
HDVP2	22/02/2021	664.2	22.3
HDVP2	21/02/2021	664.2	22.3
HDVP2	20/02/2021	664.2	22.3
HDVP2	19/02/2021	664.2	22.3

ID	Date	WL mAHD	WL mbgl
MB18BHT0003	18/12/2019	612.8	68.0
MB18BHT0003	17/12/2019	612.7	68.1
MB18BHT0003	16/12/2019	612.3	68.5
MB18BHT0003	15/12/2019	609.5	71.3
MB18BHT0003	14/12/2019	604.2	76.7
MB18BHT0003	13/12/2019	613.3	67.5
MB18BHT0003	12/12/2019	613.3	67.5
MB18BHT0003	11/12/2019	613.3	67.5
MB18BHT0003	10/12/2019	613.3	67.5
MB18BHT0003	9/12/2019	613.3	67.6
MB18BHT0003	8/12/2019	613.3	67.6
MB18BHT0003	7/12/2019	613.3	67.6
MB18BHT0003	6/12/2019	613.3	67.6
MB18BHT0003	5/12/2019	613.3	67.6
MB18BHT0003	4/12/2019	613.3	67.6
MB18BHT0003	3/12/2019	613.3	67.5
MB18BHT0003	2/12/2019	613.3	67.5
MB18BHT0003	1/12/2019	613.3	67.5
MB18BHT0003	30/11/2019	613.3	67.5
MB18BHT0003	29/11/2019	613.2	67.6
MB18BHT0003	28/11/2019	613.3	67.6
MB18BHT0003	27/11/2019	613.3	67.6
MB18BHT0003	26/11/2019	613.2	67.6
MB18BHT0003	25/11/2019	613.2	67.6
MB18BHT0003	24/11/2019	613.2	67.6
MB18BHT0003	23/11/2019	613.3	67.6
MB18BHT0003	22/11/2019	613.3	67.5
MB18BHT0003	21/11/2019	613.3	67.6
MB18BHT0003	20/11/2019	613.3	67.6
MB18BHT0003	19/11/2019	613.2	67.6
MB18BHT0003	18/11/2019	613.3	67.6
MB18BHT0003	17/11/2019	613.3	67.5
MB18BHT0003	16/11/2019	613.3	67.5
MB18BHT0003	15/11/2019	613.3	67.5
MB18BHT0003	14/11/2019	613.3	67.5
MB18BHT0003	13/11/2019	613.3	67.5
MB18BHT0003	12/11/2019	613.3	67.5
MB18BHT0003	27/03/2019	613.4	67.4
MB18BHT0003	5/02/2019	613.4	67.4
MB18WON0001	2/03/2022	623.7	48.3
MB18WON0001	1/03/2022	623.8	48.3
MB18WON0001	28/02/2022	623.7	48.3
MB18WON0001	27/02/2022	623.8	48.3
MB18WON0001	26/02/2022	623.8	48.3
MB18WON0001	25/02/2022	623.8	48.3
MB18WON0001	24/02/2022	623.8	48.3
MB18WON0001	23/02/2022	623.8	48.3
MB18WON0001	22/02/2022	623.8	48.3
MB18WON0001	21/02/2022	623.8	48.3
MB18WON0001	20/02/2022	623.8	48.3
MB18WON0001	19/02/2022	623.8	48.2
MB18WON0001	18/02/2022	623.8	48.2
MB18WON0001	17/02/2022	623.8	48.3
MB18WON0001	16/02/2022	623.8	48.3
MB18WON0001	15/02/2022	623.8	48.3
MB18WON0001	14/02/2022	623.8	48.3
MB18WON0001	13/02/2022	623.8	48.3
MB18WON0001	12/02/2022	623.8	48.3
MB18WON0001	11/02/2022	623.8	48.3
MB18WON0001	10/02/2022	623.8	48.3
MB18WON0001	9/02/2022	623.7	48.3
MB18WON0001	8/02/2022	623.7	48.3
MB18WON0001	7/02/2022	623.7	48.3
MB18WON0001	6/02/2022	623.7	48.4
MB18WON0001	5/02/2022	623.7	48.3
MB18WON0001	4/02/2022	623.7	48.3
MB18WON0001	3/02/2022	623.7	48.3
MB18WON0001	2/02/2022	623.7	48.4
MB18WON0001	1/02/2022	623.7	48.4
MB18WON0001	31/01/2022	623.7	48.4
MB18WON0001	30/01/2022	623.7	48.4
MB18WON0001	29/01/2022	623.7	48.3
MB18WON0001	28/01/2022	623.7	48.4
MB18WON0001	27/01/2022	623.7	48.4
MB18WON0001	26/01/2022	623.7	48.4
MB18WON0001	25/01/2022	623.7	48.4
MB18WON0001	24/01/2022	623.7	48.4
MB18WON0001	23/01/2022	623.7	48.3
MB18WON0001	22/01/2022	623.8	48.3
MB18WON0001	21/01/2022	623.8	48.3
MB18WON0001	20/01/2022	623.8	48.3
MB18WON0001	19/01/2022	623.8	48.3
MB18WON0001	18/01/2022	623.8	48.3
MB18WON0001	17/01/2022	623.7	48.4
MB18WON0001	16/01/2022	623.7	48.4
MB18WON0001	15/01/2022	623.7	48.4
MB18WON0001	14/01/2022	623.7	48.4
MB18WON0001	13/01/2022	623.8	48.3
MB18WON0001	12/01/2022	623.8	48.3
MB18WON0001	11/01/2022	623.8	48.3
MB18WON0001	10/01/2022	623.8	48.3
MB18WON0001	9/01/2022	623.7	48.3
MB18WON0001	8/01/2022	623.8	48.3
MB18WON0001	7/01/2022	623.8	48.3
MB18WON0001	6/01/2022	623.8	48.3
MB18WON0001	5/01/2022	623.8	48.3
MB18WON0001	4/01/2022	623.8	48.3
MB18WON0001	3/01/2022	623.8	48.3
MB18WON0001	2/01/2022	623.7	48.3
MB18WON0001	1/01/2022	623.7	48.3
MB18WON0001	31/12/2021	623.7	48.4
MB18WON0001	30/12/2021	623.7	48.4
MB18WON0001	29/12/2021	623.7	48.3
MB18WON0001	28/12/2021	623.8	48.3
MB18WON0001	27/12/2021	623.8	48.3
MB18WON0001	26/12/2021	623.8	48.3
MB18WON0001	25/12/2021	623.8	48.3
MB18WON0001	24/12/2021	623.7	48.3
MB18WON0001	23/12/2021	623.7	48.3
MB18WON0001	22/12/2021	623.8	48.3
MB18WON0001	21/12/2021	623.8	48.3
MB18WON0001	11/12/2021	623.8	48.3
MB18WON0001	10/12/2021	623.8	48.3
MB18WON0001	9/12/2021	623.8	48.3
MB18WON0001	8/12/2021	623.8	48.3
MB18WON0001	7/12/2021	623.8	48.3
MB18WON0001	6/12/2021	623.8	48.3
MB18WON0001	5/12/2021	623.8	48.3
MB18WON0001	4/12/2021	623.8	48.3
MB18WON0001	3/12/2021	623.8	48.3
MB18WON0001	2/12/2021	623.8	48.3
MB18WON0001	1/12/2021	623.8	48.3
MB18WON0001	30/11/2021	623.8	48.3
MB18WON0001	29/11/2021	623.8	48.3
MB18WON0001	28/11/2021	623.8	48.3
MB18WON0001	27/11/2021	623.8	48.3
MB18WON0001	26/11/2021	623.8	48.3
MB18WON0001	25/11/2021	623.8	48.3
MB18WON0001	24/11/2021	623.8	48.3
MB18WON0001	23/11/2021	623.8	48.3
MB18WON0001	22/11/2021	623.8	48.3
MB18WON0001	21/11/2021	623.8	48.3
MB18WON0001	20/11/2021	623.8	48.3
MB18WON0001	19/11/2021	623.8	48.3
MB18WON0001	18/11/2021	623.8	48.3
MB18WON0001	17/11/2021	623.8	48.3

ID	Date	WL mAHD	WL mbgl
MB15HD20004	6/02/2021	625.1	69.1
MB15HD20004	7/02/2021	625.1	69.1
MB15HD20004	8/02/2021	625.2	69.1
MB15HD20004	9/02/2021	625.2	69.1
MB15HD20004	10/02/2021	625.1	69.1
MB15HD20004	11/02/2021	625.1	69.1
MB15HD20004	12/02/2021	625.2	69.1
MB15HD20004	13/02/2021	625.2	69.0
MB15HD20004	14/02/2021	625.2	69.0
MB15HD20004	15/02/2021	625.2	69.0
MB15HD20004	16/02/2021	625.2	69.0
MB15HD20004	17/02/2021	625.2	69.0
MB15HD20004	18/02/2021	625.2	69.0
MB15HD20004	19/02/2021	625.2	69.0
MB15HD20004	20/02/2021	625.2	69.0
MB15HD20004	21/02/2021	625.2	69.0
MB15HD20004	22/02/2021	625.2	69.0
MB15HD20004	23/02/2021	625.2	69.0
MB15HD20004	24/02/2021	625.2	69.0
MB15HD20004	25/02/2021	625.2	69.0
MB15HD20004	26/02/2021	625.2	69.0
MB15HD20004	27/02/2021	625.2	69.1
MB15HD20004	28/02/2021	625.2	69.0
MB15HD20004	1/03/2021	625.2	69.0
MB15HD20004	2/03/2021	625.2	69.0
MB15HD20004	3/03/2021	625.2	69.0
MB15HD20004	4/03/2021	625.2	69.0
MB15HD20004	5/03/2021	625.2	69.0
MB15HD20004	6/03/2021	625.2	69.0
MB15HD20004	7/03/2021	625.2	69.0
MB15HD20004	8/03/2021	625.2	69.0
MB15HD20004	9/03/2021	625.2	69.0
MB15HD20004	10/03/2021	625.2	69.0
MB15HD20004	11/03/2021	625.2	69.0
MB15HD20004	12/03/2021	625.2	69.0
MB15HD20004	13/03/2021	625.2	69.0
MB15HD20004	14/03/2021	625.2	69.0
MB15HD20004	15/03/2021	625.2	69.0
MB15HD20004	16/03/2021	625.2	69.0
MB15HD20004	17/03/2021	625.2	69.0
MB15HD20004	18/03/2021	625.2	69.0
MB15HD20004	19/03/2021	625.2	69.0
MB15HD20004	20/03/2021	625.2	69.0
MB15HD20004	21/03/2021	625.2	69.0
MB15HD20004	22/03/2021	625.2	69.0
MB15HD20004	23/03/2021	625.2	69.0
MB15HD20004	24/03/2021	625.2	69.0
MB15HD20004	25/03/2021	625.2	69.0
MB15HD20004	26/03/2021	625.2	69.0
MB15HD20004	27/03/2021	625.2	69.0
MB15HD20004	28/03/2021	625.2	69.0
MB15HD20004	29/03/2021	625.2	69.0
MB15HD20004	30/03/2021	625.2	69.0
MB15HD20004	31/03/2021	625.2	69.0
MB15HD20004	1/04/2021	625.2	69.0
MB15HD20004	2/04/2021	625.2	69.0
MB15HD20004	3/04/2021	625.2	69.0
MB15HD20004	4/04/2021	625.2	69.0
MB15HD20004	5/04/2021	625.2	69.0
MB15HD20004	6/04/2021	625.2	69.0
MB15HD20004	7/04/2021	625.2	69.0
MB15HD20004	8/04/2021	625.2	69.0
MB15HD20004	9/04/2021	625.2	69.0
MB15HD20004	10/04/2021	625.2	69.0
MB15HD20004	11/04/2021	625.2	69.0
MB15HD20004	12/04/2021	625.2	69.0
MB15HD20004	13/04/2021	625.2	69.0
MB15HD20004	14/04/2021	625.2	69.0
MB15HD20004	15/04/2021	625.2	69.0
MB15HD20004	16/04/2021	625.3	69.0
MB15HD20004	17/04/2021	625.3	69.0
MB15HD20004	18/04/2021	625.3	69.0
MB15HD20004	19/04/2021	625.2	69.0
MB15HD20004	20/04/2021	625.2	69.0
MB15HD20004	21/04/2021	625.2	69.0
MB15HD20004	22/04/2021	625.2	69.0
MB15HD20004	23/04/2021	625.2	69.0
MB15HD20004	24/04/2021	625.2	69.0
MB15HD20004	25/04/2021	625.3	69.0
MB15HD20004	26/04/2021	625.3	69.0
MB15HD20004	27/04/2021	625.3	69.0
MB15HD20004	28/04/2021	625.3	69.0
MB15HD20004	29/04/2021	625.2	69.0
MB15HD20004	30/04/2021	625.2	69.0
MB15HD20004	1/05/2021	625.2	69.0
MB15HD20004	2/05/2021	625.2	69.0
MB15HD20004	3/05/2021	625.2	69.0
MB15HD20004	4/05/2021	625.2	69.0
MB15HD20004	5/05/2021	625.2	69.0
MB15HD20004	6/05/2021	625.2	69.0
MB15HD20004	7/05/2021	625.2	69.0
MB15HD20004	8/05/2021	625.2	69.0
MB15HD20004	9/05/2021	625.2	69.0
MB15HD20004	10/05/2021	625.2	69.0
MB15HD20004	11/05/2021	625.2	69.0
MB15HD20004	12/05/2021	625.2	69.0
MB15HD20004	13/05/2021	625.2	69.0
MB15HD20004	14/05/2021	625.2	69.0
MB15HD20004	15/05/2021	625.2	69.0
MB15HD20004	16/05/2021	625.2	69.0
MB15HD20004	17/05/2021	625.2	69.0
MB15HD20004	18/05/2021	625.2	69.0
MB15HD20004	19/05/2021	625.2	69.0
MB15HD20004	20/05/2021	625.2	69.0
MB15HD20004	21/05/2021	625.2	69.0
MB15HD20004	22/05/2021	625.2	69.0
MB15HD20004	23/05/2021	625.2	69.0
MB15HD20004	24/05/2021	625.2	69.0
MB15HD20004	25/05/2021	625.2	69.0
MB15HD20004	26/05/2021	625.3	69.0
MB15HD20004	27/05/2021	625.3	68.9
MB15HD20004	28/05/2021	625.3	69.0
MB15HD20004	29/05/2021	625.2	69.0
MB15HD20004	30/05/2021	625.2	69.0
MB15HD20004	31/05/2021	625.2	69.0
MB15HD20004	1/06/2021	625.2	69.0
MB15HD20004	2/06/2021	625.2	69.0
MB15HD20004	3/06/2021	625.3	69.0
MB15HD20004	4/06/2021	625.3	69.0
MB15HD20004	5/06/2021	625.3	69.0
MB15HD20004	6/06/2021	625.2	69.0
MB15HD20004	7/06/2021	625.2	69.0
MB15HD20004	8/06/2021	625.3	69.0
MB15HD20004	9/06/2021	625.2	69.0
MB15HD20004	10/06/2021	625.2	69.0
MB15HD20004	11/06/2021	625.2	69.0
MB15HD20004	12/06/2021	625.2	69.0
MB15HD20004	13/06/2021	625.2	69.0
MB15HD20004	14/06/2021	625.2	69.0
MB15HD20004	15/06/2021	625.2	69.0
MB15HD20004	16/06/2021	625.2	69.0
MB15HD20004	17/06/2021	625.3	68.9
MB15HD20004	18/06/2021	625.3	68.9
MB15HD20004	19/06/2021	625.3	68.9
MB15HD20004	20/06/2021	625.2	69.0
MB15HD20004	21/06/2021	625.2	69.0

ID	Date	WL mAHD	WL mbgl
MB18HD20008	1/01/2020	625.2	80.7
MB18HD20008	2/01/2020	625.2	80.7
MB18HD20008	3/01/2020	625.2	80.7
MB18HD20008	4/01/2020	625.2	80.7
MB18HD20008	5/01/2020	625.2	80.7
MB18HD20008	6/01/2020	625.2	80.7
MB18HD20008	7/01/2020	625.2	80.7
MB18HD20008	8/01/2020	625.1	80.8
MB18HD20008	9/01/2020	625.1	80.8
MB18HD20008	10/01/2020	625.2	80.7
MB18HD20008	11/01/2020	625.2	80.7
MB18HD20008	12/01/2020	625.2	80.7
MB18HD20008	13/01/2020	625.2	80.7
MB18HD20008	14/01/2020	625.2	80.7
MB18HD20008	15/01/2020	625.2	80.7
MB18HD20008	16/01/2020	625.2	80.7
MB18HD20008	17/01/2020	625.2	80.7
MB18HD20008	18/01/2020	625.2	80.7
MB18HD20008	19/01/2020	625.2	80.7
MB18HD20008	20/01/2020	625.2	80.7
MB18HD20008	21/01/2020	625.2	80.7
MB18HD20008	22/01/2020	625.2	80.7
MB18HD20008	23/01/2020	625.2	80.7
MB18HD20008	24/01/2020	625.2	80.7
MB18HD20008	25/01/2020	625.2	80.7
MB18HD20008	26/01/2020	625.2	80.7
MB18HD20008	27/01/2020	625.2	80.7
MB18HD20008	28/01/2020	625.2	80.7
MB18HD20008	29/01/2020	625.2	80.7
MB18HD20008	30/01/2020	625.1	80.8
MB18HD20008	31/01/2020	625.1	80.8
MB18HD20008	1/02/2020	625.2	80.7
MB18HD20008	2/02/2020	625.2	80.7
MB18HD20008	3/02/2020	625.2	80.7
MB18HD20008	4/02/2020	625.2	80.7
MB18HD20008	5/02/2020	625.2	80.7
MB18HD20008	6/02/2020	625.2	80.7
MB18HD20008	7/02/2020	625.2	80.7
MB18HD20008	8/02/2020	625.2	80.7
MB18HD20008	9/02/2020	625.1	80.8
MB18HD20008	10/02/2020	625.1	80.8
MB18HD20008	11/02/2020	625.2	80.7
MB18HD20008	12/02/2020	625.2	80.7
MB18HD20008	13/02/2020	625.2	80.7
MB18HD20008	14/02/2020	625.2	80.7
MB18HD20008	15/02/2020	625.2	80.7
MB18HD20008	16/02/2020	625.2	80.7
MB18HD20008	17/02/2020	625.2	80.7
MB18HD20008	18/02/2020	625.2	80.7
MB18HD20008	19/02/2020	625.2	80.7
MB18HD20008	20/02/2020	625.2	80.7
MB18HD20008	21/02/2020	625.2	80.7
MB18HD20008	22/02/2020	625.2	80.7
MB18HD20008	23/02/2020	625.2	80.7
MB18HD20008	24/02/2020	625.2	80.7
MB18HD20008	25/02/2020	625.2	80.7
MB18HD20008	26/02/2020	625.2	80.7
MB18HD20008	27/02/2020	625.2	80.7
MB18HD20008	28/02/2020	625.2	80.7
MB18HD20008	29/02/2020	625.1	80.7
MB18HD20008	1/03/2020	625.1	80.8
MB18HD20008	2/03/2020	625.2	80.7
MB18HD20008	3/03/2020	625.2	80.7
MB18HD20008	4/03/2020	625.2	80.7
MB18HD20008	5/03/2020	625.2	80.7
MB18HD20008	6/03/2020	625.2	80.7
MB18HD20008	7/03/2020	625.2	80.7
MB18HD20008	8/03/2020	625.2	80.7
MB18HD20008	9/03/2020	625.2	80.7
MB18HD20008	10/03/2020	625.2	80.7
MB18HD20008	11/03/2020	625.2	80.7
MB18HD20008	12/03/2020	625.2	80.7
MB18HD20008	13/03/2020	625.2	80.7
MB18HD20008	14/03/2020	625.2	80.7
MB18HD20008	15/03/2020	625.2	80.7
MB18HD20008	16/03/2020	625.2	80.7
MB18HD20008	17/03/2020	625.2	80.7
MB18HD20008	18/03/2020	625.2	80.7
MB18HD20008	19/03/2020	625.2	80.7
MB18HD20008	20/03/2020	625.2	80.7
MB18HD20008	21/03/2020	625.2	80.7
MB18HD20008	22/03/2020	625.2	80.7
MB18HD20008	23/03/2020	625.2	80.7
MB18HD20008	24/03/2020	625.2	80.7
MB18HD20008	25/03/2020	625.2	80.7
MB18HD20008	26/03/2020	625.2	80.7
MB18HD20008	27/03/2020	625.2	80.7
MB18HD20008	28/03/2020	625.2	80.7
MB18HD20008	29/03/2020	625.2	80.7
MB18HD20008	30/03/2020	625.2	80.7
MB18HD20008	31/03/2020	625.2	80.7
MB18HD20008	1/04/2020	625.2	80.7
MB18HD20008	2/04/2020	625.2	80.7
MB18HD20008	3/04/2020	625.2	80.7
MB18HD20008	4/04

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	18/02/2021	664.2	22.3
HDVP2	17/02/2021	664.2	22.3
HDVP2	16/02/2021	664.2	22.3
HDVP2	15/02/2021	664.2	22.3
HDVP2	14/02/2021	664.2	22.3
HDVP2	13/02/2021	664.2	22.3
HDVP2	12/02/2021	664.2	22.3
HDVP2	11/02/2021	664.2	22.3
HDVP2	10/02/2021	664.2	22.3
HDVP2	9/02/2021	664.2	22.3
HDVP2	8/02/2021	664.2	22.3
HDVP2	7/02/2021	664.2	22.3
HDVP2	6/02/2021	664.2	22.3
HDVP2	5/02/2021	664.2	22.3
HDVP2	4/02/2021	664.2	22.3
HDVP2	3/02/2021	664.2	22.3
HDVP2	2/02/2021	664.2	22.3
HDVP2	1/02/2021	674.2	12.3
HDVP2	31/01/2021	674.2	12.3
HDVP2	30/01/2021	674.2	12.3
HDVP2	29/01/2021	674.2	12.3
HDVP2	28/01/2021	674.2	12.3
HDVP2	27/01/2021	674.2	12.3
HDVP2	26/01/2021	674.2	12.3
HDVP2	25/01/2021	674.2	12.3
HDVP2	24/01/2021	674.2	12.3
HDVP2	23/01/2021	674.2	12.3
HDVP2	22/01/2021	674.2	12.3
HDVP2	21/01/2021	674.2	12.3
HDVP2	20/01/2021	674.2	12.3
HDVP2	19/01/2021	674.2	12.3
HDVP2	18/01/2021	674.2	12.3
HDVP2	17/01/2021	674.2	12.3
HDVP2	16/01/2021	674.2	12.3
HDVP2	15/01/2021	674.2	12.3
HDVP2	14/01/2021	674.2	12.3
HDVP2	13/01/2021	674.2	12.3
HDVP2	12/01/2021	674.2	12.3
HDVP2	11/01/2021	674.2	12.3
HDVP2	10/01/2021	674.2	12.3
HDVP2	9/01/2021	674.2	12.3
HDVP2	8/01/2021	674.2	12.3
HDVP2	7/01/2021	674.2	12.3
HDVP2	6/01/2021	674.2	12.3
HDVP2	5/01/2021	674.2	12.3
HDVP2	4/01/2021	674.2	12.3
HDVP2	3/01/2021	674.2	12.3
HDVP2	2/01/2021	674.2	12.3
HDVP2	1/01/2021	534.4	152.1
HDVP2	31/12/2020	534.4	152.1
HDVP2	30/12/2020	534.4	152.1
HDVP2	29/12/2020	534.4	152.1
HDVP2	28/12/2020	534.4	152.1
HDVP2	27/12/2020	534.4	152.1
HDVP2	26/12/2020	534.4	152.1
HDVP2	25/12/2020	534.4	152.1
HDVP2	24/12/2020	534.4	152.1
HDVP2	23/12/2020	534.4	152.1
HDVP2	22/12/2020	534.4	152.1
HDVP2	21/12/2020	534.4	152.1
HDVP2	20/12/2020	534.4	152.1
HDVP2	19/12/2020	534.4	152.1
HDVP2	18/12/2020	534.4	152.1
HDVP2	17/12/2020	534.4	152.1
HDVP2	16/12/2020	534.4	152.1
HDVP2	15/12/2020	534.4	152.1
HDVP2	14/12/2020	534.4	152.1
HDVP2	13/12/2020	534.4	152.1
HDVP2	12/12/2020	534.4	152.1
HDVP2	11/12/2020	534.4	152.1
HDVP2	10/12/2020	534.4	152.1
HDVP2	9/12/2020	534.4	152.1
HDVP2	8/12/2020	534.4	152.1
HDVP2	7/12/2020	534.4	152.1
HDVP2	6/12/2020	534.4	152.1
HDVP2	5/12/2020	534.4	152.1
HDVP2	4/12/2020	534.4	152.1
HDVP2	3/12/2020	534.4	152.1
HDVP2	2/12/2020	534.4	152.1
HDVP2	1/12/2020	634.4	52.1
HDVP2	30/11/2020	634.4	52.1
HDVP2	29/11/2020	634.4	52.1
HDVP2	28/11/2020	634.4	52.1
HDVP2	27/11/2020	634.4	52.1
HDVP2	26/11/2020	634.4	52.1
HDVP2	25/11/2020	634.4	52.1
HDVP2	24/11/2020	634.4	52.1
HDVP2	23/11/2020	634.4	52.1
HDVP2	22/11/2020	634.4	52.1
HDVP2	21/11/2020	634.4	52.1
HDVP2	20/11/2020	634.4	52.1
HDVP2	19/11/2020	634.4	52.1
HDVP2	18/11/2020	634.4	52.1
HDVP2	17/11/2020	634.4	52.1
HDVP2	16/11/2020	634.4	52.1
HDVP2	15/11/2020	634.4	52.1
HDVP2	14/11/2020	634.4	52.1
HDVP2	13/11/2020	634.4	52.1
HDVP2	12/11/2020	634.4	52.1
HDVP2	11/11/2020	634.4	52.1
HDVP2	10/11/2020	634.4	52.1
HDVP2	9/11/2020	634.4	52.1
HDVP2	8/11/2020	634.4	52.1
HDVP2	7/11/2020	634.4	52.1
HDVP2	6/11/2020	634.4	52.1
HDVP2	5/11/2020	634.4	52.1
HDVP2	4/11/2020	634.4	52.1
HDVP2	3/11/2020	634.4	52.1
HDVP2	2/11/2020	634.4	52.1
HDVP2	1/11/2020	664.7	21.8
HDVP2	31/10/2020	664.7	21.8
HDVP2	30/10/2020	664.7	21.8
HDVP2	29/10/2020	664.7	21.8
HDVP2	28/10/2020	664.7	21.8
HDVP2	27/10/2020	664.7	21.8
HDVP2	26/10/2020	664.7	21.8
HDVP2	25/10/2020	664.7	21.8
HDVP2	24/10/2020	664.7	21.8
HDVP2	23/10/2020	664.7	21.8
HDVP2	22/10/2020	664.7	21.8
HDVP2	21/10/2020	664.7	21.8
HDVP2	20/10/2020	664.7	21.8
HDVP2	19/10/2020	664.7	21.8
HDVP2	18/10/2020	664.7	21.8
HDVP2	17/10/2020	664.7	21.8
HDVP2	16/10/2020	664.7	21.8
HDVP2	15/10/2020	664.7	21.8
HDVP2	14/10/2020	664.7	21.8
HDVP2	13/10/2020	664.7	21.8
HDVP2	12/10/2020	664.7	21.8
HDVP2	11/10/2020	664.7	21.8
HDVP2	10/10/2020	664.7	21.8
HDVP2	9/10/2020	664.7	21.8
HDVP2	8/10/2020	664.7	21.8
HDVP2	7/10/2020	664.7	21.8
HDVP2	6/10/2020	664.7	21.8

ID	Date	WL mAHD	WL mbgl
MB18WON0001	16/11/2021	623.8	48.3
MB18WON0001	15/11/2021	623.8	48.3
MB18WON0001	13/11/2021	623.8	48.3
MB18WON0001	12/11/2021	623.8	48.3
MB18WON0001	11/11/2021	623.8	48.3
MB18WON0001	10/11/2021	623.8	48.3
MB18WON0001	9/11/2021	623.8	48.3
MB18WON0001	7/11/2021	623.8	48.3
MB18WON0001	6/11/2021	623.8	48.3
MB18WON0001	5/11/2021	623.8	48.3
MB18WON0001	4/11/2021	623.8	48.3
MB18WON0001	3/11/2021	623.8	48.3
MB18WON0001	2/11/2021	623.8	48.3
MB18WON0001	1/11/2021	623.8	48.3
MB18WON0001	31/10/2021	623.8	48.3
MB18WON0001	30/10/2021	623.8	48.3
MB18WON0001	29/10/2021	623.8	48.3
MB18WON0001	28/10/2021	623.8	48.3
MB18WON0001	27/10/2021	623.8	48.3
MB18WON0001	26/10/2021	623.8	48.3
MB18WON0001	25/10/2021	623.8	48.3
MB18WON0001	24/10/2021	623.8	48.3
MB18WON0001	23/10/2021	623.8	48.2
MB18WON0001	22/10/2021	623.8	48.2
MB18WON0001	21/10/2021	623.8	48.3
MB18WON0001	20/10/2021	623.8	48.2
MB18WON0001	19/10/2021	623.8	48.3
MB18WON0001	18/10/2021	623.8	48.3
MB18WON0001	17/10/2021	623.8	48.3
MB18WON0001	16/10/2021	623.8	48.3
MB18WON0001	15/10/2021	623.8	48.3
MB18WON0001	14/10/2021	623.8	48.3
MB18WON0001	13/10/2021	623.8	48.3
MB18WON0001	12/10/2021	623.8	48.3
MB18WON0001	11/10/2021	623.8	48.3
MB18WON0001	10/10/2021	623.8	48.3
MB18WON0001	9/10/2021	623.8	48.3
MB18WON0001	8/10/2021	623.8	48.3
MB18WON0001	7/10/2021	623.8	48.3
MB18WON0001	6/10/2021	623.8	48.3
MB18WON0001	5/10/2021	623.8	48.3
MB18WON0001	4/10/2021	623.8	48.3
MB18WON0001	3/10/2021	623.8	48.3
MB18WON0001	2/10/2021	623.8	48.3
MB18WON0001	1/10/2021	623.8	48.3
MB18WON0001	30/09/2021	623.8	48.3
MB18WON0001	29/09/2021	623.8	48.3
MB18WON0001	28/09/2021	623.8	48.3
MB18WON0001	27/09/2021	623.8	48.3
MB18WON0001	26/09/2021	623.8	48.3
MB18WON0001	25/09/2021	623.8	48.3
MB18WON0001	24/09/2021	623.8	48.2
MB18WON0001	23/09/2021	623.9	48.2
MB18WON0001	22/09/2021	623.9	48.2
MB18WON0001	21/09/2021	623.9	48.2
MB18WON0001	20/09/2021	623.9	48.2
MB18WON0001	19/09/2021	623.9	48.2
MB18WON0001	18/09/2021	623.9	48.2
MB18WON0001	17/09/2021	623.9	48.2
MB18WON0001	16/09/2021	623.8	48.2
MB18WON0001	15/09/2021	623.8	48.3
MB18WON0001	14/09/2021	623.8	48.2
MB18WON0001	13/09/2021	623.8	48.2
MB18WON0001	12/09/2021	623.8	48.3
MB18WON0001	11/09/2021	623.9	48.2
MB18WON0001	10/09/2021	623.9	48.2
MB18WON0001	9/09/2021	623.9	48.2
MB18WON0001	8/09/2021	623.9	48.2
MB18WON0001	7/09/2021	623.9	48.2
MB18WON0001	6/09/2021	623.9	48.2
MB18WON0001	5/09/2021	623.9	48.2
MB18WON0001	4/09/2021	623.9	48.2
MB18WON0001	3/09/2021	623.9	48.2
MB18WON0001	2/09/2021	623.8	48.2
MB18WON0001	1/09/2021	623.8	48.3
MB18WON0001	31/08/2021	623.8	48.2
MB18WON0001	30/08/2021	623.9	48.2
MB18WON0001	29/08/2021	623.9	48.2
MB18WON0001	28/08/2021	623.9	48.2
MB18WON0001	27/08/2021	623.9	48.2
MB18WON0001	26/08/2021	623.9	48.2
MB18WON0001	25/08/2021	623.9	48.2
MB18WON0001	24/08/2021	623.9	48.2
MB18WON0001	23/08/2021	623.9	48.2
MB18WON0001	22/08/2021	623.9	48.2
MB18WON0001	21/08/2021	623.9	48.2
MB18WON0001	20/08/2021	623.9	48.2
MB18WON0001	19/08/2021	623.9	48.2
MB18WON0001	18/08/2021	623.9	48.2
MB18WON0001	17/08/2021	623.9	48.2
MB18WON0001	16/08/2021	623.9	48.2
MB18WON0001	15/08/2021	623.9	48.2
MB18WON0001	14/08/2021	623.9	48.2
MB18WON0001	13/08/2021	623.9	48.2
MB18WON0001	12/08/2021	623.9	48.1
MB18WON0001	11/08/2021	623.9	48.2
MB18WON0001	10/08/2021	623.9	48.2
MB18WON0001	9/08/2021	623.9	48.2
MB18WON0001	8/08/2021	623.9	48.2
MB18WON0001	7/08/2021	623.9	48.2
MB18WON0001	6/08/2021	623.9	48.2
MB18WON0001	5/08/2021	623.9	48.1
MB18WON0001	4/08/2021	623.9	48.2
MB18WON0001	3/08/2021	623.9	48.2
MB18WON0001	2/08/2021	623.9	48.2
MB18WON0001	1/08/2021	623.9	48.2
MB18WON0001	31/07/2021	623.9	48.2
MB18WON0001	30/07/2021	623.8	48.2
MB18WON0001	29/07/2021	623.8	48.2
MB18WON0001	28/07/2021	623.8	48.2
MB18WON0001	27/07/2021	623.8	48.2
MB18WON0001	26/07/2021	623.9	48.2
MB18WON0001	25/07/2021	623.9	48.2
MB18WON0001	24/07/2021	623.9	48.2
MB18WON0001	23/07/2021	623.9	48.2
MB18WON0001	22/07/2021	623.9	48.2
MB18WON0001	21/07/2021	623.9	48.2
MB18WON0001	20/07/2021	623.9	48.2
MB18WON0001	19/07/2021	623.9	48.2
MB18WON0001	18/07/2021	623.9	48.2
MB18WON0001	17/07/2021	623.9	48.2
MB18WON0001	16/07/2021	623.9	48.2
MB18WON0001	15/07/2021	623.9	48.2
MB18WON0001	14/07/2021	623.8	48.2
MB18WON0001	13/07/2021	623.8	48.2
MB18WON0001	12/07/2021	623.9	48.2
MB18WON0001	11/07/2021	623.9	48.2
MB18WON0001	10/07/2021	623.9	48.2
MB18WON0001	9/07/2021	623.9	48.2
MB18WON0001	8/07/2021	623.9	48.2
MB18WON0001	7/07/2021	623.9	48.2
MB18WON0001	6/07/2021	623.9	48.2
MB18WON0001	5/07/2021	623.9	48.2
MB18WON0001	4/07/2021	623.9	48.2
MB18WON0001	3/07/2021	623.9	48.2
MB18WON0001	2/07/2021	623.9	48.2

ID	Date	WL mAHD	WL mbgl
MB15HD20004	22/06/2021	625.2	69.0
MB15HD20004	23/06/2021	625.2	69.0
MB15HD20004	24/06/2021	625.3	69.0
MB15HD20004	25/06/2021	625.3	68.9
MB15HD20004	26/06/2021	625.3	69.0
MB15HD20004	27/06/2021	625.2	69.0
MB15HD20004	28/06/2021	625.2	69.0
MB15HD20004	29/06/2021	625.2	69.0
MB15HD20004	30/06/2021	625.2	69.0
MB15HD20004	1/07/2021	625.3	69.0
MB15HD20004	2/07/2021	625.3	69.0
MB15HD20004	3/07/2021	625.3	69.0
MB15HD20004	4/07/2021	625.2	69.0
MB15HD20004	5/07/2021	625.2	69.0
MB15HD20004	6/07/2021	625.2	69.0
MB15HD20004	7/07/2021	625.2	69.0
MB15HD20004	8/07/2021	625.2	69.0
MB15HD20004	9/07/2021	625.2	69.0
MB15HD20004	10/07/2021	625.2	69.0
MB15HD20004	11/07/2021	625.2	69.0
MB15HD20004	12/07/2021	625.2	69.0
MB15HD20004	13/07/2021	625.2	69.0
MB15HD20004	14/07/2021	625.2	69.0
MB15HD20004	15/07/2021	625.2	69.0
MB15HD20004	16/07/2021	625.2	69.0
MB15HD20004	17/07/2021	625.3	69.0
MB15HD20004	18/07/2021	625.2	69.0
MB15HD20004	19/07/2021	625.2	69.0
MB15HD20004	20/07/2021	625.2	69.0
MB15HD20004	21/07/2021	625.2	69.0
MB15HD20004	22/07/2021	625.2	69.0
MB15HD20004	23/07/2021	625.2	69.0
MB15HD20004	24/07/2021	625.2	69.0
MB15HD20004	25/07/2021	625.2	69.0
MB15HD20004	26/07/2021	625.2	69.0
MB15HD20004	27/07/2021	625.2	69.0
MB15HD20004	28/07/2021	625.2	69.0
MB15HD20004	29/07/2021	625.2	69.0
MB15HD20004	30/07/2021	625.2	69.0
MB15HD20004	31/07/2021	625.2	69.0
MB15HD20004	1/08/2021	625.2	69.0
MB15HD20004	2/08/2021	625.2	69.0
MB15HD20004	3/08/2021	625.3	69.0
MB15HD20004	4/08/2021	625.3	68.9
MB15HD20004	5/08/2021	625.3	68.9
MB15HD20004	6/08/2021	625.3	68.9
MB15HD20004	7/08/2021	625.3	68.9
MB15HD20004	8/08/2021	625.3	69.0
MB15HD20004	9/08/2021	625.2	69.0
MB15HD20004	10/08/2021	625.2	69.0
MB15HD20004	11/08/2021	625.3	69.0
MB15HD20004	12/08/2021	625.3	68.9
MB15HD20004	13/08/2021	625.3	69.0
MB15HD20004	14/08/2021	625.2	69.0
MB15HD20004	15/08/2021	625.2	69.0
MB15HD20004	16/08/2021	625.3	68.9
MB15HD20004	17/08/2021	625.3	69.0
MB15HD20004	18/08/2021	625.2	69.0
MB15HD20004	19/08/2021	625.2	69.0
MB15HD20004	20/08/2021	625.2	69.0
MB15HD20004	21/08/2021	625.2	69.0
MB15HD20004	22/08/2021	625.2	69.0
MB15HD20004	23/08/2021	625.2	69.0
MB15HD20004	24/08/2021	625.2	69.0
MB15HD20004	25/08/2021	625.2	69.0
MB15HD20004	26/08/2021	625.2	69.0
MB15HD20004	27/08/2021	625.2	69.0
MB15HD20004	28/08/2021	625.2	69.0
MB15HD20004	29/08/2021	625.2	69.0
MB15HD20004	30/08/2021	625.2	69.0
MB15HD20004	31/08/2021	625.2	69.0
MB15HD20004	1/09/2021	625.2	69.0
MB15HD20004	2/09/2021	625.2	69.0
MB15HD20004	3/09/2021	625.2	69.0
MB15HD20004	4/09/2021	625.2	69.0
MB15HD20004	5/09/2021	625.3	69.0
MB15HD20004	6/09/2021	625.3	68.9
MB15HD20004	7/09/2021	625.3	68.9
MB15HD20004	8/09/2021	625.3	69.0
MB15HD20004	9/09/2021	625.3	69.0
MB15HD20004	10/09/2021	625.2	69.0
MB15HD20004	11/09/2021	625.2	69.0
MB15HD20004	12/09/2021	625.2	69.0
MB15HD20004	13/09/2021	625.2	69.0
MB15HD20004	14/09/2021	625.2	69.0
MB15HD20004	15/09/2021	625.2	69.0
MB15HD20004	16/09/2021	625.2	69.0
MB15HD20004	17/09/2021	625.2	69.0
MB15HD20004	18/09/2021	625.2	69.0
MB15HD20004	19/09/2021	625.2	69.0
MB15HD20004	20/09/2021	625.2	69.0
MB15HD20004	21/09/2021	625.3	69.0
MB15HD20004	22/09/2021	625.3	69.0
MB15HD20004	23/09/2021	625.2	69.0
MB15HD20004	24/09/2021	625.2	69.0
MB15HD20004	25/09/2021	625.2	69.0
MB15HD20004	26/09/2021	625.2	69.0
MB15HD20004	27/09/2021	625.2	69.0
MB15HD20004	28/09/2021	625.2	69.0
MB15HD20004	29/09/2021	625.2	69.0
MB15HD20004	30/09/2021	625.2	69.0
MB15HD20004	1/10/2021	625.2	69.0
MB15HD20004	2/10/2021	625.2	69.0
MB15HD20004	3/10/2021	625.2	69.0
MB15HD20004	4/10/2021	625.2	69.0
MB15HD20004	5/10/2021	625.2	69.1
MB15HD20004	6/10/2021	625.2	69.0
MB15HD20004	7/10/2021	625.2	69.0
MB15HD20004	8/10/2021	625.2	69.0
MB15HD20004	9/10/2021	625.2	69.0
MB15HD20004	10/10/2021	625.2	69.0
MB15HD20004	11/10/2021	625.2	69.0
MB15HD20004	12/10/2021	625.2	69.0
MB15HD20004	13/10/2021	625.2	69.0
MB15HD20004	14/10/2021	625.2	69.0
MB15HD20004	15/10/2021	625.2	69.0
MB15HD20004	16/10/2021	625.2	69.1
MB15HD20004	17/10/2021	625.2	69.1
MB15HD20004	18/10/2021	625.2	69.1
MB15HD20004	19/10/2021	625.2	69.0
MB15HD20004	20/10/2021	625.2	69.0
MB15HD20004	21/10/2021	625.2	69.0
MB15HD20004	22/10/2021	625.2	69.0
MB15HD20004	23/10/2021	625.2	69.0
MB15HD20004	24/10/2021	625.2	69.0
MB15HD20004	25/10/2021	625.2	69.0
MB15HD20004	26/10/2021	625.2	69.1
MB15HD20004	27/10/2021	625.2	69.0
MB15HD20004	28/10/2021	625.2	69.0
MB15HD20004	1/11/2021	625.2	69.1
MB15HD20004	2/11/2021	625.2	69.1
MB15HD20004	3/11/2021	625.2	69.0
MB15HD20004	4/11/2021	625.2	69.0
MB15HD20004	5/11/2021	625.2	69.0
MB15HD20004	6/11/2021	625.2	69.1
MB15HD20004	7/11/2021	625.1	69.1

ID	Date	WL mAHD	WL mbgl
MB18HD20008	16/05/2020	625.2	80.7
MB18HD20008	17/05/2020	625.2	80.7
MB18HD20008	18/05/2020	625.2	80.7
MB18HD20008	19/05/2020	625.2	80.7
MB18HD20008	20/05/2020	625.2	80.7
MB18HD20008	21/05/2020	625.2	80.7
MB18HD20008	22/05/2020	625.2	80.7
MB18HD20008	23/05/2020	625.2	80.7
MB18HD20008	24/05/2020	625.2	80.7
MB18HD20008	25/05/2020	625.2	80.7
MB18HD20008	26/05/2020	625.2	80.7
MB18HD20008	27/05/2020	625.2	80.7
MB18HD20008	28/05/2020	625.2	80.7
MB18HD20008	29/05/2020	625.2	80.7
MB18HD20008	30/05/2020	625.2	80.7
MB18HD20008	31/05/2020	625.2	80.6
MB18HD20008	1/06/2020	625.3	80.6
MB18HD20008	2/06/2020	625.2	80.6
MB18HD20008	3/06/2020	625.2	80.6
MB18HD20008	4/06/2020	625.2	80.6
MB18HD20008	5/06/2020	625.2	80.6
MB18HD20008	6/06/2020	625.2	80.7
MB18HD20008	7/06/2020	625.2	80.7
MB18HD20008	8/06/2020	625.2	80.7
MB18HD20008	9/06/2020	625.2	80.7
MB18HD20008	10/06/2020	625.2	80.7
MB18HD20008	11/06/2020	625.2	80.7
MB18HD20008	12/06/2020	625.2	80.7
MB18HD20008	13/06/2020	625.2	80.7
MB18HD20008	14/06/2020	625.2	80.7
MB18HD20008	15/06/2020	625.2	80.7
MB18HD20008	16/06/2020	625.2	80.7
MB18HD20008	17/06/2020	625.2	80.7
MB18HD20008	18/06/2020	625.2	80.7
MB18HD20008	19/06/2020	625.2	80.7
MB18HD20008	20/06/2020	625.2	80.7
MB18HD20008	21/06/2020	625.2	80.7
MB18HD20008	22/06/2020	625.2	80.7
MB18HD20008	23/06/2020	625.2	80.7
MB18HD20008	24/06/2020	625.2	80.7
MB18HD20008	25/06/2020	625.2	80.7
MB18HD20008	26/06/2020	625.2	80.7
MB18HD20008	27/06/2020	625.2	80.7
MB18HD20008	28/06/2020	625.2	80.7
MB18HD20008	29/06/2020	625.2	80.7
MB18HD20008	30/06/2020	625.2	80.7
MB18HD20008	1/07/2020	625.2	80.7
MB18HD20008	2/07/2020	625.2	80.7
MB18HD20008	3/07/2020	625.2	80.7
MB18HD20008	4/07/2020	625.2	80.6
MB18HD20008	5/07/2020	625.2	80.7
MB18HD20008	6/07/2020	625.2	80.7
MB18HD20008	7/07/2020	625.2	80.7
MB18HD20008	8/07/2020	625.2	80.7
MB18HD20008	9/07/2020	625.2	80.7
MB18HD20008	10/07/2020	625.2	80.7
MB18HD20008	11/07/2020	625.2	80.7
MB18HD20008	12/07/2020	625.2	80.7
MB18HD20008	13/07/2020	625.2	80.7
MB18HD20008	14/07/2020	625.2	80.7
MB18HD20008	15/07/2020	625.2	80.7
MB18HD20008	16/07/2020	625.2	80.7
MB18HD20008	17/07/2020	625.2	80.7
MB18HD20008	18/07/2020	625.2	80.7
MB18HD20008	19/07/2020	625.2	80.7
MB18HD20008	20/07/2020	625.2	80.7
MB18HD20008	21/07/2020	625.2	80.7
MB18HD20008	22/07/2020	625.2	80.7
MB18HD20008	23/07/2020	625.2	80.7
MB18HD20008	24/07/2020	625.2	80.7
MB18HD20008	25/07/2020	625.2	80.7
MB18HD20008	26/07/2020	625.2	80.7
MB18HD20008	27/07/2020	625.2	80.7
MB18HD20008	28/07/2020	625.2	80.7
MB18HD20008	29/07/2020	625.2	80.7
MB18HD20008	30/07/2020	625.2	80.7
MB18HD20008	31/07/2020	625.2	80.7
MB18HD20008	1/08/2020	625.2	80.7
MB18HD20008	2/08/2020	625.2	80.7
MB18HD20008	3/08/2020	625.2	80.7
MB18HD20008	4/08/2020	625.2	80.7
MB18HD20008	5/08/2020	625.2	80.7
MB18HD20008	6/08/2020	625.2	80.7
MB18HD20008	7/08/2020	625.2	80.7
MB18HD20008	8/08/2020	625.2	80.7
MB18HD20008	9/08/2020	625.2	80.7
MB18HD20008	10/08/2020	625.2	80.7
MB18HD20008	11/08/2020	625.2	80.7
MB18HD20008	12/08/2020	625.2	80.7
MB18HD20008	13/08/2020	625.2	80.7
MB18HD20008	14/08/2020	625.2	80.7
MB18HD20008	15/08/2020	625.2	80.7
MB18HD20008	16/08/2020	625.2	80.7
MB18HD20008	17/08/2020	625.2	80.7
MB18HD20008	18/08/2020	625.2	80.7
MB18HD20008	19/08/2020	625

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	5/10/2020	664.7	21.8
HDVP2	4/10/2020	664.7	21.8
HDVP2	3/10/2020	664.7	21.8
HDVP2	2/10/2020	664.7	21.8
HDVP2	1/10/2020	593.0	93.6
HDVP2	30/09/2020	593.0	93.6
HDVP2	29/09/2020	593.0	93.6
HDVP2	28/09/2020	593.0	93.6
HDVP2	27/09/2020	593.0	93.6
HDVP2	26/09/2020	593.0	93.6
HDVP2	25/09/2020	593.0	93.6
HDVP2	24/09/2020	593.0	93.6
HDVP2	23/09/2020	593.0	93.6
HDVP2	22/09/2020	593.0	93.6
HDVP2	21/09/2020	593.0	93.6
HDVP2	20/09/2020	593.0	93.6
HDVP2	19/09/2020	593.0	93.6
HDVP2	18/09/2020	593.0	93.6
HDVP2	17/09/2020	593.0	93.6
HDVP2	16/09/2020	593.0	93.6
HDVP2	15/09/2020	593.0	93.6
HDVP2	14/09/2020	593.0	93.6
HDVP2	13/09/2020	593.0	93.6
HDVP2	12/09/2020	593.0	93.6
HDVP2	11/09/2020	593.0	93.6
HDVP2	10/09/2020	593.0	93.6
HDVP2	9/09/2020	593.0	93.6
HDVP2	8/09/2020	593.0	93.6
HDVP2	7/09/2020	593.0	93.6
HDVP2	6/09/2020	593.0	93.6
HDVP2	5/09/2020	593.0	93.6
HDVP2	4/09/2020	593.0	93.6
HDVP2	3/09/2020	593.0	93.6
HDVP2	2/09/2020	593.0	93.6
HDVP2	1/09/2020	734.7	-48.2
HDVP2	31/08/2020	734.7	-48.2
HDVP2	30/08/2020	734.7	-48.2
HDVP2	29/08/2020	734.7	-48.2
HDVP2	28/08/2020	734.7	-48.2
HDVP2	27/08/2020	734.7	-48.2
HDVP2	26/08/2020	734.7	-48.2
HDVP2	25/08/2020	734.7	-48.2
HDVP2	24/08/2020	734.7	-48.2
HDVP2	23/08/2020	734.7	-48.2
HDVP2	22/08/2020	734.7	-48.2
HDVP2	21/08/2020	734.7	-48.2
HDVP2	20/08/2020	734.7	-48.2
HDVP2	19/08/2020	734.7	-48.2
HDVP2	18/08/2020	734.7	-48.2
HDVP2	17/08/2020	734.7	-48.2
HDVP2	16/08/2020	734.7	-48.2
HDVP2	15/08/2020	734.7	-48.2
HDVP2	14/08/2020	734.7	-48.2
HDVP2	13/08/2020	734.7	-48.2
HDVP2	12/08/2020	734.7	-48.2
HDVP2	11/08/2020	734.7	-48.2
HDVP2	10/08/2020	734.7	-48.2
HDVP2	9/08/2020	734.7	-48.2
HDVP2	8/08/2020	734.7	-48.2
HDVP2	7/08/2020	734.7	-48.2
HDVP2	6/08/2020	734.7	-48.2
HDVP2	5/08/2020	734.7	-48.2
HDVP2	4/08/2020	734.7	-48.2
HDVP2	3/08/2020	734.7	-48.2
HDVP2	2/08/2020	734.7	-48.2
HDVP2	1/08/2020	736.7	-50.2
HDVP2	31/07/2020	736.7	-50.2
HDVP2	30/07/2020	736.7	-50.2
HDVP2	29/07/2020	736.7	-50.2
HDVP2	28/07/2020	736.7	-50.2
HDVP2	27/07/2020	736.7	-50.2
HDVP2	26/07/2020	736.7	-50.2
HDVP2	25/07/2020	736.7	-50.2
HDVP2	24/07/2020	736.7	-50.2
HDVP2	23/07/2020	736.7	-50.2
HDVP2	22/07/2020	736.7	-50.2
HDVP2	21/07/2020	736.7	-50.2
HDVP2	20/07/2020	736.7	-50.2
HDVP2	19/07/2020	736.7	-50.2
HDVP2	18/07/2020	736.7	-50.2
HDVP2	17/07/2020	736.7	-50.2
HDVP2	16/07/2020	736.7	-50.2
HDVP2	15/07/2020	736.7	-50.2
HDVP2	14/07/2020	736.7	-50.2
HDVP2	13/07/2020	736.7	-50.2
HDVP2	12/07/2020	736.7	-50.2
HDVP2	11/07/2020	736.7	-50.2
HDVP2	10/07/2020	736.7	-50.2
HDVP2	9/07/2020	736.7	-50.2
HDVP2	8/07/2020	736.7	-50.2
HDVP2	7/07/2020	736.7	-50.2
HDVP2	6/07/2020	736.7	-50.2
HDVP2	5/07/2020	736.7	-50.2
HDVP2	4/07/2020	736.7	-50.2
HDVP2	3/07/2020	736.7	-50.2
HDVP2	2/07/2020	736.7	-50.2
HDVP2	1/07/2020	738.1	-51.6
HDVP2	30/06/2020	738.1	-51.6
HDVP2	29/06/2020	738.1	-51.6
HDVP2	28/06/2020	738.1	-51.6
HDVP2	27/06/2020	738.1	-51.6
HDVP2	26/06/2020	738.1	-51.6
HDVP2	25/06/2020	738.1	-51.6
HDVP2	24/06/2020	738.1	-51.6
HDVP2	23/06/2020	738.1	-51.6
HDVP2	22/06/2020	738.1	-51.6
HDVP2	21/06/2020	738.1	-51.6
HDVP2	20/06/2020	738.1	-51.6
HDVP2	19/06/2020	738.1	-51.6
HDVP2	18/06/2020	738.1	-51.6
HDVP2	17/06/2020	738.1	-51.6
HDVP2	16/06/2020	738.1	-51.6
HDVP2	15/06/2020	738.1	-51.6
HDVP2	14/06/2020	738.1	-51.6
HDVP2	13/06/2020	738.1	-51.6
HDVP2	12/06/2020	738.1	-51.6
HDVP2	11/06/2020	738.1	-51.6
HDVP2	10/06/2020	738.1	-51.6
HDVP2	9/06/2020	738.1	-51.6
HDVP2	8/06/2020	738.1	-51.6
HDVP2	7/06/2020	738.1	-51.6
HDVP2	6/06/2020	738.1	-51.6
HDVP2	5/06/2020	738.1	-51.6
HDVP2	4/06/2020	738.1	-51.6
HDVP2	3/06/2020	738.1	-51.6
HDVP2	2/06/2020	738.1	-51.6
HDVP2	1/06/2020	720.5	-34.0
HDVP2	31/05/2020	720.5	-34.0
HDVP2	30/05/2020	720.5	-34.0
HDVP2	29/05/2020	720.5	-34.0
HDVP2	28/05/2020	720.5	-34.0
HDVP2	27/05/2020	720.5	-34.0
HDVP2	26/05/2020	720.5	-34.0
HDVP2	25/05/2020	720.5	-34.0
HDVP2	24/05/2020	720.5	-34.0
HDVP2	23/05/2020	720.5	-34.0

ID	Date	WL mAHD	WL mbgl
MB18WON0001	1/07/2021	623.9	48.2
MB18WON0001	30/06/2021	623.9	48.2
MB18WON0001	29/06/2021	623.9	48.2
MB18WON0001	28/06/2021	623.9	48.2
MB18WON0001	27/06/2021	623.9	48.2
MB18WON0001	26/06/2021	623.9	48.2
MB18WON0001	25/06/2021	623.9	48.2
MB18WON0001	24/06/2021	623.9	48.2
MB18WON0001	23/06/2021	623.9	48.2
MB18WON0001	22/06/2021	623.9	48.2
MB18WON0001	21/06/2021	623.9	48.2
MB18WON0001	20/06/2021	623.9	48.2
MB18WON0001	19/06/2021	623.9	48.2
MB18WON0001	18/06/2021	623.9	48.2
MB18WON0001	17/06/2021	623.9	48.2
MB18WON0001	16/06/2021	623.9	48.2
MB18WON0001	15/06/2021	623.9	48.2
MB18WON0001	14/06/2021	623.9	48.2
MB18WON0001	13/06/2021	623.9	48.2
MB18WON0001	12/06/2021	623.9	48.2
MB18WON0001	11/06/2021	623.9	48.2
MB18WON0001	10/06/2021	623.9	48.2
MB18WON0001	9/06/2021	623.9	48.2
MB18WON0001	8/06/2021	623.9	48.2
MB18WON0001	7/06/2021	623.9	48.2
MB18WON0001	6/06/2021	623.9	48.2
MB18WON0001	5/06/2021	623.9	48.2
MB18WON0001	4/06/2021	623.9	48.2
MB18WON0001	3/06/2021	623.9	48.2
MB18WON0001	2/06/2021	623.9	48.2
MB18WON0001	1/06/2021	623.9	48.2
MB18WON0001	31/05/2021	623.9	48.2
MB18WON0001	30/05/2021	623.9	48.2
MB18WON0001	29/05/2021	623.9	48.2
MB18WON0001	28/05/2021	623.9	48.2
MB18WON0001	27/05/2021	623.9	48.2
MB18WON0001	26/05/2021	623.9	48.2
MB18WON0001	25/05/2021	623.9	48.2
MB18WON0001	24/05/2021	623.9	48.2
MB18WON0001	23/05/2021	623.8	48.2
MB18WON0001	22/05/2021	623.9	48.2
MB18WON0001	21/05/2021	623.9	48.2
MB18WON0001	20/05/2021	623.9	48.2
MB18WON0001	19/05/2021	623.9	48.2
MB18WON0001	18/05/2021	623.9	48.2
MB18WON0001	17/05/2021	623.9	48.2
MB18WON0001	16/05/2021	623.9	48.2
MB18WON0001	15/05/2021	623.9	48.2
MB18WON0001	14/05/2021	623.9	48.2
MB18WON0001	13/05/2021	623.9	48.2
MB18WON0001	12/05/2021	623.9	48.2
MB18WON0001	11/05/2021	623.9	48.2
MB18WON0001	10/05/2021	623.9	48.2
MB18WON0001	9/05/2021	623.9	48.2
MB18WON0001	8/05/2021	623.9	48.2
MB18WON0001	7/05/2021	623.9	48.2
MB18WON0001	6/05/2021	623.9	48.2
MB18WON0001	5/05/2021	623.9	48.2
MB18WON0001	4/05/2021	623.9	48.2
MB18WON0001	3/05/2021	623.9	48.2
MB18WON0001	2/05/2021	623.9	48.2
MB18WON0001	1/05/2021	623.9	48.2
MB18WON0001	30/04/2021	623.9	48.2
MB18WON0001	29/04/2021	623.9	48.2
MB18WON0001	28/04/2021	623.9	48.2
MB18WON0001	27/04/2021	623.9	48.2
MB18WON0001	26/04/2021	623.9	48.2
MB18WON0001	25/04/2021	623.9	48.2
MB18WON0001	24/04/2021	623.9	48.2
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MB18WON0001	20/04/2021	623.9	48.2
MB18WON0001	19/04/2021	623.9	48.2
MB18WON0001	18/04/2021	623.9	48.2
MB18WON0001	17/04/2021	623.9	48.2
MB18WON0001	16/04/2021	623.9	48.2
MB18WON0001	15/04/2021	623.9	48.2
MB18WON0001	14/04/2021	623.9	48.2
MB18WON0001	13/04/2021	623.9	48.2
MB18WON0001	12/04/2021	623.8	48.2
MB18WON0001	11/04/2021	623.8	48.2
MB18WON0001	10/04/2021	623.8	48.2
MB18WON0001	9/04/2021	623.8	48.3
MB18WON0001	8/04/2021	623.8	48.3
MB18WON0001	7/04/2021	623.8	48.2
MB18WON0001	6/04/2021	623.8	48.2
MB18WON0001	5/04/2021	623.8	48.2
MB18WON0001	4/04/2021	623.8	48.2
MB18WON0001	3/04/2021	623.8	48.2
MB18WON0001	2/04/2021	623.9	48.2
MB18WON0001	1/04/2021	623.8	48.2
MB18WON0001	31/03/2021	623.9	48.2
MB18WON0001	30/03/2021	623.9	48.2
MB18WON0001	29/03/2021	623.9	48.2
MB18WON0001	28/03/2021	623.8	48.2
MB18WON0001	27/03/2021	623.8	48.2
MB18WON0001	26/03/2021	623.8	48.3
MB18WON0001	25/03/2021	623.8	48.3
MB18WON0001	24/03/2021	623.8	48.3
MB18WON0001	23/03/2021	623.8	48.3
MB18WON0001	22/03/2021	623.8	48.3
MB18WON0001	21/03/2021	623.8	48.3
MB18WON0001	20/03/2021	623.8	48.2
MB18WON0001	19/03/2021	623.9	48.2
MB18WON0001	18/03/2021	623.9	48.2
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MB18WON0001	12/03/2021	623.9	48.2
MB18WON0001	11/03/2021	623.9	48.2
MB18WON0001	10/03/2021	623.8	48.2
MB18WON0001	9/03/2021	623.8	48.2
MB18WON0001	8/03/2021	623.8	48.3
MB18WON0001	7/03/2021	623.8	48.3
MB18WON0001	6/03/2021	623.8	48.2
MB18WON0001	5/03/2021	623.8	48.2
MB18WON0001	4/03/2021	623.8	48.2
MB18WON0001	3/03/2021	623.8	48.2
MB18WON0001	2/03/2021	623.8	48.2
MB18WON0001	1/03/2021	623.8	48.2
MB18WON0001	28/02/2021	623.8	48.3
MB18WON0001	27/02/2021	623.8	48.3
MB18WON0001	26/02/2021	623.8	48.3
MB18WON0001	25/02/2021	623.9	48.2
MB18WON0001	24/02/2021	623.9	48.2
MB18WON0001	23/02/2021	623.9	48.2
MB18WON0001	22/02/2021	623.9	48.2
MB18WON0001	21/02/2021	623.8	48.2
MB18WON0001	20/02/2021	623.8	48.2
MB18WON0001	19/02/2021	623.8	48.3
MB18WON0001	18/02/2021	623.8	48.3
MB18WON0001	17/02/2021	623.8	48.3
MB18WON0001	16/02/2021	623.8	48.3

ID	Date	WL mAHD	WL mbgl
MB15HD20004	9/11/2021	625.1	69.1
MB15HD20004	10/11/2021	625.1	69.1
MB15HD20004	11/11/2021	625.2	69.1
MB15HD20004	12/11/2021	625.2	69.0
MB15HD20004	13/11/2021	625.2	69.0
MB15HD20004	14/11/2021	625.2	69.0
MB15HD20004	15/11/2021	625.2	69.0
MB15HD20004	16/11/2021	625.2	69.1
MB15HD20004	17/11/2021	625.2	69.1
MB15HD20004	18/11/2021	625.1	69.1
MB15HD20004	19/11/2021	625.1	69.1
MB15HD20004	20/11/2021	625.2	69.1
MB15HD20004	21/11/2021	625.2	69.1
MB15HD20004	22/11/2021	625.2	69.0
MB15HD20004	23/11/2021	625.2	69.1
MB15HD20004	24/11/2021	625.2	69.0
MB15HD20004	25/11/2021	625.2	69.0
MB15HD20004	26/11/2021	625.2	69.0
MB15HD20004	27/11/2021	625.2	69.0
MB15HD20004	28/11/2021	625.2	69.0
MB15HD20004	29/11/2021	625.2	69.0
MB15HD20004	30/11/2021	625.1	69.1
MB15HD20004	1/12/2021	625.1	69.1
MB15HD20004	2/12/2021	625.1	69.1
MB15HD20004	3/12/2021	625.1	69.1
MB15HD20004	4/12/2021	625.1	69.1
MB15HD20004	5/12/2021	625.1	69.1
MB15HD20004	6/12/2021	625.1	69.1
MB15HD20004	7/12/2021	625.1	69.1
MB15HD20004	8/12/2021	625.2	69.1
MB15HD20004	9/12/2021	625.1	69.1
MB15HD20004	10/12/2021	625.1	69.1
MB15HD20004	11/12/2021	625.1	69.1
MB15HD20004	12/12/2021	625.1	69.1
MB15HD20004	13/12/2021	625.1	69.1
MB15HD20004	14/12/2021	625.1	69.1
MB15HD20004	15/12/2021	625.1	69.1
MB15HD20004	16/12/2021	625.1	69.1
MB15HD20004	17/12/2021	625.1	69.1
MB15HD20004	18/12/2021	625.1	69.1
MB15HD20004	19/12/2021	625.2	69.1
MB15HD20004	20/12/2021	625.2	69.1
MB15HD20004	21/12/2021	625.1	69.1
MB15HD20004	22/12/2021	625.1	69.1
MB15HD20004	23/12/2021	625.1	69.1
MB15HD20004	24/12/2021	625.1	69.1
MB15HD20004	25/12/2021	625.1	69.1
MB15HD20004	26/12/2021	625.1	69.1
MB15HD20004	30/12/2021	625.1	69.1
MB15HD20004	31/12/2021	625.1	69.1
MB15HD20004	1/01/2022	625.1	69.1
MB15HD20004	2/01/2022	625.1	69.1
MB15HD20004	3/01/2022	625.1	69.1
MB15HD20004	4/01/2022	625.1	69.1
MB15HD20004	5/01/2022	625.1	69.1
MB15HD20004	6/01/2022	625.1	69.1
MB15HD20004	7/01/2022	625.1	69.1
MB15HD20004	8/01/2022	625.1	69.1
MB15HD20004	9/01/2022	625.1	69.1
MB15HD20004	10/01/2022	625.1	69.1
MB15HD20004	11/01/2022	625.2	69.1
MB15HD20004	12/01/2022	625.2	69.1
MB15HD20004	13/01/2022	625.1	69.1
MB15HD20004	14/01/2022	625.1	69.1
MB15HD20004	15/01/2022	625.1	69.1
MB15HD20004	16/01/2022	625.1	69.1
MB15HD20004	17/01/2022	625.1	69.1
MB15HD20004	18/01/2022	625.1	69.1
MB15HD20004	19/01/2022	625.1	69.1
MB15HD20004	20/01/2022	625.1	69.1
MB15HD20004	21/01/2022	625.1	69.1
MB15HD20004	22/01/2022	625.1	69.1
MB15HD20004	23/01/2022	625.1	69.1
MB15HD20004	25/01/2022	625.1	69.1
MB15HD20004	26/01/2022	625.1	69.1
MB15HD20004	27/01/2022	625.1	69.1
MB15HD20004	28/01/2022	625.1	69.1
MB15HD20004	29/01/2022	625.1	69.1
MB15HD20004	30/01/2022	625.1	69.1
MB15HD20004	31/01/2022	625.1	69.1
MB15HD20004	1/02/2022	625.1	69.1
MB15HD20004	2/02/2022	625.1	69.1
MB15HD20004	3/02/2022	625.1	69.1
MB15HD20004	4/02/2022	625.1	69.1
MB15HD20004	5/02/2022	625.1	69.1
MB15HD20004	6/02/2022	625.1	69.1
MB15HD20004	7/02/2022	625.1	69.1
MB15HD20004	8/02/2022	625.1	69.1
MB15HD20004	9/02/2022	625.1	69.1
MB15HD20004	10/02/2022	625.1	69.1
MB15HD20004	11/02/2022	625.2	69.1
MB15HD20004	12/02/2022	625.1	69.1
MB15HD20004	13/02/2022	625.2	69.0
MB15HD20004	14/02/2022	625.2	69.0
MB15HD20004	15/02/2022	625.2	69.0
MB15HD20004	16/02/2022	625.2	69.1
MB15HD20004	17/02/2022	625.2	69.0
MB15HD20004	18/02/2022	625.2	69.0
MB15HD20004	19/02/2022	625.2	69.0
MB15HD20004	20/02/2022	625.2	69.1
MB15HD20004	21/02/2022	625.1	69.1
MB15HD20004	22/02/2022	625.1	69.1
MB15HD20004	23/02/2022	625.1	69.1
MB15HD20004	24/02/2022	625.1	69.1
MB15HD20004	25/02/2022	625.1	69.1
MB15HD20004	26/02/2022	625.1	69.1
MB15HD20004	27/02/2022	625.1	69.1
MB15HD20004	28/02/2022	625.1	69.1
MB15HD20004	1/03/2022	625.1	69.1
MB15HD20004	2/03/2022	625.1	69.1
MB15HD20004	3/03/2022	625.1	69.1
MB15HD20004	4/03/2022	625.1	69.1
MB15HD20004	5/03/2022	625.2	69.1
MB15HD20004	6/03/2022	625.2	69.1
MB15HD20004	7/03/2022	625.2	69.1
MB15HD20004	8/03/2022	625.2	69.1
MB15HD20004	9/03/2022	625.2	69.1
MB15HD20004	10/03/2022	625.2	69.1
MB15HD20004	11/03/2022	625.2	69.1
MB15HD20004	12/03/2022	625.1	69.1
MB15HD20004	13/03/2022	625.1	69.1
MB15HD20004	14/03/2022	625.1	69.1
MB15HD20004	15/03/2022	625.1	69.1
MB15HD20004	16/03/2022	625.1	69.1
MB15HD20005	4/02/2016	626.2	78.2
MB15HD20005	2/05/2016	626.2	78.2
MB15HD20005	30/10/2016	626.2	78.1
MB15HD20005	19/02/2017	626.2	78.1
MB15HD20005	13/05/2017	626.2	78.1
MB15HD20005	21/08/2017	626.2	78.1
MB15HD20005	9/11/2017	626.3	78.1
MB15HD20005	12/04/2018	626.3	78.1
MB15HD20005	21/11/2018	626.1	78.3
MB15HD20005	22/11/2018	626.1	78.3
MB15HD20005	23/11/2018	626.1	78.3
MB15HD20005	24/11/2018	626.1	78.3

ID	Date	WL mAHD	WL mbgl
MB18HD20008	29/09/2020	625.2	80.7
MB18HD20008	30/09/2020	625.2	80.7
MB18HD20008	1/10/2020	625.2	80.7
MB18HD20008	2/10/2020	625.2	80.7
MB18HD20008	3/10/2020	625.2	80.7
MB18HD20008	4/10/2020	625.2	80.7
MB18HD20008	5/10/2020	625.2	80.7
MB18HD20008	6/10/2020	625.2	80.7
MB18HD20008	7/10/2020	625.2	80.7
MB18HD20008	8/10/2020	625.2	80.7
MB18HD20008	9/10/2020	625.2	80.7
MB18HD20008	10/10/2020	625.2	80.7
MB18HD20008	11/10/2020	625.2	80.7
MB18HD20008	12/10/2020	625.2	80.7
MB18HD20008	13/10/2020	625.2	80.7
MB18HD20008	14/10/2020	625.2	80.7
MB18HD20008	15/10/2020	625.2	80.7
MB18HD20008	16/10/2020	625.1	80.8
MB18HD20008	17/10/2020	625.1	80.8
MB18HD20008	18/10/2020	625.1	80.8
MB18HD20008	19/10/2020	625.1	80.8
MB18HD20008	20/10/2020	625.1	80.8
MB18HD20008	21/10/2020	625.1	80.8
MB18HD20008	22/10/2020	625.1	80.8
MB18HD20008	23/10/2020	625.1	80.8
MB18HD20008	24/10/2020	625.1	80.8
MB18HD20008	25/10/2020	625.1	80.8
MB18HD20008	26/10/2020	625.1	80.8
MB18HD20008	27/10/2020	625.1	80.8
MB18HD20008	28/10/2020	625.1	80.7
MB18HD20008	29/10/2020	625.2	80.7
MB18HD20008	30/10/2020	625.2	80.7
MB18HD20008	31/10/2020	625.1	80.8
MB18HD20008	1/11/2020	625.1	80.8
MB18HD20008	2/11/2020	625.1	80.8
MB18HD20008	3/11/2020	625.2	80.7
MB18HD20008	4/11/2020	625.2	80.7
MB18HD20008	5/11/2020	625.2	80.7
MB18HD20008	6/11/2020	625.1	80.7
MB18HD20008	7/11/2020	625.1	80.8
MB18HD20008	8/11/2020	625.1	80.8
MB18HD20008	9/11/2020	625.1	80.8
MB18HD20008	10/11/2020	625.2	80.7
MB18HD20008	11/11/2020	625.2	80.7
MB18HD20008	12/11/2020	625.2	80.7
MB18HD20008	13/11/2020	625.1	80.8
MB18HD20008	14/11/2020	625.1	80.8
MB18HD20008	15/11/2020	625.1	80.8
MB18HD20008	16/11/2020	625.1	80.7
MB18HD20008	17/11/2020	625.2	80.8
MB18HD20008	18/11/2020	625.1	80.8
MB18HD20008	19/11/2020	625.1	80.8
MB18HD20008	20/11/2020	625.1	80.8
MB18HD20008	21/11/2020	625.1	80.8
MB18HD20008	22/11/2020	625.1	80.8
MB18HD20008	23/11/2020	625.1	80.7
MB18HD20008	24/11/2020	625.1	80.8
MB18HD20008	25/11/2020	625.1	80.8
MB18HD20008	26/11/2020	625.1	80.8
MB18HD20008	27/11/2020	625.1	80.8
MB18HD20008	28/11/2020	625.1	80.8
MB18HD20008	29/11/2020	625.1	80.8
MB18HD20008	30/11/2020	625.1	80.8
MB18HD20008	1/12/2020	625.1	80.8
MB18HD20008	2/12/2020	625.1	80.8
MB18HD20008	3/12/2020	625.1	80.8
MB18HD20008	4/12/2020	625.1	80.8
MB18HD20008	5/12/2020	625.1	80.8
MB18HD20008	6/12/2020	625.1	80.8
MB18HD20008	7/12/2020	625.1	80.8
MB18HD20008	8/12/2020	625.1	80.8
MB18HD20008	9/12/2020	625.1	80.8
MB18HD20008	10/12/2020	625.1	80.8
MB18HD20008	11/12/2020	625.1	80.8
MB18HD20008	12/12/2020	625.1	80.8
MB18HD20008	13/12/2020	625.1	80.8
MB18HD20008	14/12/2020	625.1	80.8
MB18HD20008	15/12/2020	625.1	80.8
MB18HD20008	16/12/2020	625.1	80.8
MB18HD20008	17/12/2020	625.1	80.8
MB18HD20008	18/12/2020	625.1	80.8
MB18HD20008	19/12/2020	625.1	80.8
MB18HD20008	20/12/2020	625.1	80.8
MB18HD20008	21/12/2020	625.1	80.8
MB18HD20008	22/12/2020	625.1	80.8
MB18HD20008	23/12/2020	625.1	80.8
MB18HD20008	24/12/2020	625.1	80.8
MB18HD20008	25/12/2020	625.1	80.8
MB18HD20008	26/12/2020	625.1	80.8
MB18HD20008	27/12/2020	625.1	80.8
MB18HD20008	28/12/2020	625.1	80.8
MB18HD20008	29/12/2020	625.1	80.8
MB18HD20008	30/12/2020	625.1	80.8
MB18HD20008	31/12/2020	625.1	80.8
MB18HD20008	1/01/2021	625.1	80.8
MB18HD20008	2/01/2021	625

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	22/05/2020	720.5	-34.0
HDVP2	21/05/2020	720.5	-34.0
HDVP2	20/05/2020	720.5	-34.0
HDVP2	19/05/2020	720.5	-34.0
HDVP2	18/05/2020	720.5	-34.0
HDVP2	17/05/2020	720.5	-34.0
HDVP2	16/05/2020	720.5	-34.0
HDVP2	15/05/2020	720.5	-34.0
HDVP2	14/05/2020	720.5	-34.0
HDVP2	13/05/2020	720.5	-34.0
HDVP2	12/05/2020	720.5	-34.0
HDVP2	11/05/2020	720.5	-34.0
HDVP2	10/05/2020	720.5	-34.0
HDVP2	9/05/2020	720.5	-34.0
HDVP2	8/05/2020	720.5	-34.0
HDVP2	7/05/2020	720.5	-34.0
HDVP2	6/05/2020	720.5	-34.0
HDVP2	5/05/2020	720.5	-34.0
HDVP2	4/05/2020	720.5	-34.0
HDVP2	3/05/2020	720.5	-34.0
HDVP2	2/05/2020	720.5	-34.0
HDVP2	1/05/2020	737.1	-50.6
HDVP2	30/04/2020	737.1	-50.6
HDVP2	29/04/2020	737.1	-50.6
HDVP2	28/04/2020	737.1	-50.6
HDVP2	27/04/2020	737.1	-50.6
HDVP2	26/04/2020	737.1	-50.6
HDVP2	25/04/2020	737.1	-50.6
HDVP2	24/04/2020	737.1	-50.6
HDVP2	23/04/2020	737.1	-50.6
HDVP2	22/04/2020	737.1	-50.6
HDVP2	21/04/2020	737.1	-50.6
HDVP2	20/04/2020	737.1	-50.6
HDVP2	19/04/2020	737.1	-50.6
HDVP2	18/04/2020	737.1	-50.6
HDVP2	17/04/2020	737.1	-50.6
HDVP2	16/04/2020	737.1	-50.6
HDVP2	15/04/2020	737.1	-50.6
HDVP2	14/04/2020	737.1	-50.6
HDVP2	13/04/2020	737.1	-50.6
HDVP2	12/04/2020	737.1	-50.6
HDVP2	11/04/2020	737.1	-50.6
HDVP2	10/04/2020	737.1	-50.6
HDVP2	9/04/2020	737.1	-50.6
HDVP2	8/04/2020	737.1	-50.6
HDVP2	7/04/2020	737.1	-50.6
HDVP2	6/04/2020	737.1	-50.6
HDVP2	5/04/2020	737.1	-50.6
HDVP2	4/04/2020	737.1	-50.6
HDVP2	3/04/2020	737.1	-50.6
HDVP2	2/04/2020	737.1	-50.6
HDVP2	1/04/2020	737.1	-50.6
HDVP2	31/03/2020	737.1	-50.6
HDVP2	30/03/2020	737.1	-50.6
HDVP2	29/03/2020	737.1	-50.6
HDVP2	28/03/2020	737.1	-50.6
HDVP2	27/03/2020	737.1	-50.6
HDVP2	26/03/2020	737.1	-50.6
HDVP2	25/03/2020	737.1	-50.6
HDVP2	24/03/2020	737.1	-50.6
HDVP2	23/03/2020	737.1	-50.6
HDVP2	22/03/2020	737.1	-50.6
HDVP2	21/03/2020	737.1	-50.6
HDVP2	20/03/2020	737.1	-50.6
HDVP2	19/03/2020	737.1	-50.6
HDVP2	18/03/2020	737.1	-50.6
HDVP2	17/03/2020	737.1	-50.6
HDVP2	16/03/2020	737.1	-50.6
HDVP2	15/03/2020	737.1	-50.6
HDVP2	14/03/2020	737.1	-50.6
HDVP2	13/03/2020	737.1	-50.6
HDVP2	12/03/2020	737.1	-50.6
HDVP2	11/03/2020	737.1	-50.6
HDVP2	10/03/2020	737.1	-50.6
HDVP2	9/03/2020	737.1	-50.6
HDVP2	8/03/2020	737.1	-50.6
HDVP2	7/03/2020	737.1	-50.6
HDVP2	6/03/2020	737.1	-50.6
HDVP2	5/03/2020	737.1	-50.6
HDVP2	4/03/2020	737.1	-50.6
HDVP2	3/03/2020	737.1	-50.6
HDVP2	2/03/2020	737.1	-50.6
HDVP2	1/03/2020	723.4	-36.9
HDVP2	29/02/2020	723.4	-36.9
HDVP2	28/02/2020	723.4	-36.9
HDVP2	27/02/2020	723.4	-36.9
HDVP2	26/02/2020	723.4	-36.9
HDVP2	25/02/2020	723.4	-36.9
HDVP2	24/02/2020	723.4	-36.9
HDVP2	23/02/2020	723.4	-36.9
HDVP2	22/02/2020	723.4	-36.9
HDVP2	21/02/2020	723.4	-36.9
HDVP2	20/02/2020	723.4	-36.9
HDVP2	19/02/2020	723.4	-36.9
HDVP2	18/02/2020	723.4	-36.9
HDVP2	17/02/2020	723.4	-36.9
HDVP2	16/02/2020	723.4	-36.9
HDVP2	15/02/2020	723.4	-36.9
HDVP2	14/02/2020	723.4	-36.9
HDVP2	13/02/2020	723.4	-36.9
HDVP2	12/02/2020	723.4	-36.9
HDVP2	11/02/2020	723.4	-36.9
HDVP2	10/02/2020	723.4	-36.9
HDVP2	9/02/2020	723.4	-36.9
HDVP2	8/02/2020	723.4	-36.9
HDVP2	7/02/2020	723.4	-36.9
HDVP2	6/02/2020	723.4	-36.9
HDVP2	5/02/2020	723.4	-36.9
HDVP2	4/02/2020	723.4	-36.9
HDVP2	3/02/2020	723.4	-36.9
HDVP2	2/02/2020	723.4	-36.9
HDVP2	1/02/2020	739.5	-52.9
HDVP2	31/01/2020	739.5	-52.9
HDVP2	30/01/2020	739.5	-52.9
HDVP2	29/01/2020	739.5	-52.9
HDVP2	28/01/2020	739.5	-52.9
HDVP2	27/01/2020	739.5	-52.9
HDVP2	26/01/2020	739.5	-52.9
HDVP2	25/01/2020	739.5	-52.9
HDVP2	24/01/2020	739.5	-52.9
HDVP2	23/01/2020	739.5	-52.9
HDVP2	22/01/2020	739.5	-52.9
HDVP2	21/01/2020	739.5	-52.9
HDVP2	20/01/2020	739.5	-52.9
HDVP2	19/01/2020	739.5	-52.9
HDVP2	18/01/2020	739.5	-52.9
HDVP2	17/01/2020	739.5	-52.9
HDVP2	16/01/2020	739.5	-52.9
HDVP2	15/01/2020	739.5	-52.9
HDVP2	14/01/2020	739.5	-52.9
HDVP2	13/01/2020	739.5	-52.9
HDVP2	12/01/2020	739.5	-52.9
HDVP2	11/01/2020	739.5	-52.9
HDVP2	10/01/2020	739.5	-52.9
HDVP2	9/01/2020	739.5	-52.9
HDVP2	8/01/2020	739.5	-52.9

ID	Date	WL mAHD	WL mbgl
MB18WON0001	15/02/2021	623.8	48.3
MB18WON0001	14/02/2021	623.8	48.3
MB18WON0001	13/02/2021	623.8	48.3
MB18WON0001	12/02/2021	623.8	48.3
MB18WON0001	11/02/2021	623.8	48.3
MB18WON0001	10/02/2021	623.7	48.3
MB18WON0001	9/02/2021	623.8	48.3
MB18WON0001	8/02/2021	623.8	48.3
MB18WON0001	7/02/2021	623.8	48.3
MB18WON0001	6/02/2021	623.7	48.3
MB18WON0001	5/02/2021	623.7	48.3
MB18WON0001	4/02/2021	623.7	48.3
MB18WON0001	3/02/2021	623.7	48.3
MB18WON0001	2/02/2021	623.7	48.3
MB18WON0001	1/02/2021	623.7	48.3
MB18WON0001	31/01/2021	623.8	48.3
MB18WON0001	30/01/2021	623.8	48.3
MB18WON0001	29/01/2021	623.8	48.3
MB18WON0001	28/01/2021	623.8	48.3
MB18WON0001	27/01/2021	623.8	48.3
MB18WON0001	26/01/2021	623.7	48.3
MB18WON0001	25/01/2021	623.8	48.3
MB18WON0001	24/01/2021	623.8	48.3
MB18WON0001	23/01/2021	623.8	48.3
MB18WON0001	22/01/2021	623.8	48.3
MB18WON0001	21/01/2021	623.8	48.3
MB18WON0001	20/01/2021	623.8	48.3
MB18WON0001	19/01/2021	623.8	48.3
MB18WON0001	18/01/2021	623.8	48.3
MB18WON0001	17/01/2021	623.8	48.3
MB18WON0001	16/01/2021	623.8	48.3
MB18WON0001	15/01/2021	623.8	48.3
MB18WON0001	14/01/2021	623.8	48.3
MB18WON0001	13/01/2021	623.8	48.3
MB18WON0001	12/01/2021	623.8	48.3
MB18WON0001	11/01/2021	623.8	48.3
MB18WON0001	10/01/2021	623.8	48.3
MB18WON0001	9/01/2021	623.8	48.3
MB18WON0001	8/01/2021	623.8	48.3
MB18WON0001	7/01/2021	623.8	48.3
MB18WON0001	6/01/2021	623.8	48.3
MB18WON0001	5/01/2021	623.8	48.3
MB18WON0001	4/01/2021	623.8	48.3
MB18WON0001	3/01/2021	623.8	48.3
MB18WON0001	2/01/2021	623.8	48.3
MB18WON0001	1/01/2021	623.8	48.3
MB18WON0001	31/12/2020	623.8	48.3
MB18WON0001	30/12/2020	623.8	48.3
MB18WON0001	29/12/2020	623.8	48.3
MB18WON0001	28/12/2020	623.8	48.3
MB18WON0001	27/12/2020	623.8	48.3
MB18WON0001	26/12/2020	623.8	48.3
MB18WON0001	25/12/2020	623.8	48.3
MB18WON0001	24/12/2020	623.8	48.3
MB18WON0001	23/12/2020	623.8	48.3
MB18WON0001	22/12/2020	623.8	48.3
MB18WON0001	21/12/2020	623.8	48.3
MB18WON0001	20/12/2020	623.8	48.3
MB18WON0001	19/12/2020	623.8	48.3
MB18WON0001	18/12/2020	623.8	48.3
MB18WON0001	17/12/2020	623.8	48.3
MB18WON0001	16/12/2020	623.8	48.3
MB18WON0001	15/12/2020	623.8	48.3
MB18WON0001	14/12/2020	623.8	48.3
MB18WON0001	13/12/2020	623.8	48.3
MB18WON0001	12/12/2020	623.8	48.3
MB18WON0001	11/12/2020	623.8	48.3
MB18WON0001	10/12/2020	623.8	48.3
MB18WON0001	9/12/2020	623.8	48.3
MB18WON0001	8/12/2020	623.8	48.3
MB18WON0001	7/12/2020	623.8	48.3
MB18WON0001	6/12/2020	623.8	48.3
MB18WON0001	5/12/2020	623.8	48.3
MB18WON0001	4/12/2020	623.8	48.2
MB18WON0001	3/12/2020	623.8	48.2
MB18WON0001	2/12/2020	623.8	48.2
MB18WON0001	1/12/2020	623.8	48.2
MB18WON0001	30/11/2020	623.8	48.3
MB18WON0001	29/11/2020	623.8	48.3
MB18WON0001	28/11/2020	623.8	48.3
MB18WON0001	27/11/2020	623.8	48.3
MB18WON0001	26/11/2020	623.8	48.3
MB18WON0001	25/11/2020	623.8	48.3
MB18WON0001	24/11/2020	623.8	48.2
MB18WON0001	23/11/2020	623.8	48.2
MB18WON0001	22/11/2020	623.8	48.3
MB18WON0001	21/11/2020	623.8	48.3
MB18WON0001	20/11/2020	623.8	48.3
MB18WON0001	19/11/2020	623.8	48.3
MB18WON0001	18/11/2020	623.8	48.3
MB18WON0001	17/11/2020	623.8	48.3
MB18WON0001	16/11/2020	623.8	48.2
MB18WON0001	15/11/2020	623.8	48.3
MB18WON0001	14/11/2020	623.8	48.3
MB18WON0001	13/11/2020	623.8	48.3
MB18WON0001	12/11/2020	623.8	48.3
MB18WON0001	11/11/2020	623.8	48.2
MB18WON0001	10/11/2020	623.8	48.3
MB18WON0001	9/11/2020	623.8	48.3
MB18WON0001	8/11/2020	623.8	48.3
MB18WON0001	7/11/2020	623.8	48.3
MB18WON0001	6/11/2020	623.8	48.3
MB18WON0001	5/11/2020	623.8	48.2
MB18WON0001	4/11/2020	623.9	48.2
MB18WON0001	3/11/2020	623.9	48.2
MB18WON0001	2/11/2020	623.8	48.3
MB18WON0001	1/11/2020	623.8	48.3
MB18WON0001	31/10/2020	623.8	48.3
MB18WON0001	30/10/2020	623.8	48.2
MB18WON0001	29/10/2020	623.8	48.2
MB18WON0001	28/10/2020	623.8	48.3
MB18WON0001	27/10/2020	623.8	48.3
MB18WON0001	26/10/2020	623.8	48.3
MB18WON0001	25/10/2020	623.8	48.3
MB18WON0001	24/10/2020	623.8	48.3
MB18WON0001	23/10/2020	623.8	48.3
MB18WON0001	22/10/2020	623.8	48.3
MB18WON0001	21/10/2020	623.8	48.3
MB18WON0001	20/10/2020	623.8	48.3
MB18WON0001	19/10/2020	623.8	48.3
MB18WON0001	18/10/2020	623.8	48.3
MB18WON0001	17/10/2020	623.8	48.3
MB18WON0001	16/10/2020	623.8	48.3
MB18WON0001	15/10/2020	623.8	48.3
MB18WON0001	14/10/2020	623.8	48.2
MB18WON0001	13/10/2020	623.9	48.2
MB18WON0001	12/10/2020	623.8	48.2
MB18WON0001	11/10/2020	623.8	48.2
MB18WON0001	10/10/2020	623.8	48.2
MB18WON0001	9/10/2020	623.9	48.2
MB18WON0001	8/10/2020	623.9	48.2
MB18WON0001	7/10/2020	623.9	48.2
MB18WON0001	6/10/2020	623.9	48.2
MB18WON0001	5/10/2020	623.9	48.2
MB18WON0001	4/10/2020	623.9	48.2
MB18WON0001	3/10/2020	623.9	48.2

ID	Date	WL mAHD	WL mbgl
MB15HD20005	25/11/2018	626.1	78.3
MB15HD20005	26/11/2018	626.1	78.3
MB15HD20005	27/11/2018	626.1	78.3
MB15HD20005	28/11/2018	626.1	78.3
MB15HD20005	29/11/2018	626.1	78.3
MB15HD20005	30/11/2018	626.1	78.3
MB15HD20005	1/12/2018	626.1	78.3
MB15HD20005	2/12/2018	626.1	78.3
MB15HD20005	3/12/2018	626.1	78.3
MB15HD20005	4/12/2018	626.1	78.3
MB15HD20005	5/12/2018	626.1	78.3
MB15HD20005	6/12/2018	626.1	78.3
MB15HD20005	7/12/2018	626.1	78.3
MB15HD20005	8/12/2018	626.1	78.3
MB15HD20005	9/12/2018	626.1	78.3
MB15HD20005	10/12/2018	626.1	78.3
MB15HD20005	11/12/2018	626.1	78.3
MB15HD20005	12/12/2018	626.1	78.3
MB15HD20005	13/12/2018	626.1	78.3
MB15HD20005	14/12/2018	626.1	78.3
MB15HD20005	15/12/2018	626.1	78.3
MB15HD20005	16/12/2018	626.0	78.3
MB15HD20005	17/12/2018	626.1	78.3
MB15HD20005	18/12/2018	626.1	78.3
MB15HD20005	19/12/2018	626.1	78.3
MB15HD20005	20/12/2018	626.1	78.3
MB15HD20005	21/12/2018	626.1	78.3
MB15HD20005	22/12/2018	626.1	78.3
MB15HD20005	23/12/2018	626.1	78.3
MB15HD20005	24/12/2018	626.1	78.3
MB15HD20005	25/12/2018	626.1	78.3
MB15HD20005	26/12/2018	626.1	78.3
MB15HD20005	27/12/2018	626.1	78.3
MB15HD20005	28/12/2018	626.1	78.3
MB15HD20005	29/12/2018	626.1	78.3
MB15HD20005	30/12/2018	626.1	78.3
MB15HD20005	31/12/2018	626.1	78.3
MB15HD20005	1/01/2019	626.1	78.3
MB15HD20005	2/01/2019	626.1	78.3
MB15HD20005	3/01/2019	626.1	78.3
MB15HD20005	4/01/2019	626.1	78.3
MB15HD20005	5/01/2019	626.1	78.3
MB15HD20005	6/01/2019	626.1	78.3
MB15HD20005	7/01/2019	626.1	78.3
MB15HD20005	8/01/2019	626.1	78.3
MB15HD20005	9/01/2019	626.1	78.3
MB15HD20005	10/01/2019	626.1	78.3
MB15HD20005	11/01/2019	626.1	78.3
MB15HD20005	12/01/2019	626.1	78.3
MB15HD20005	13/01/2019	626.1	78.3
MB15HD20005	14/01/2019	626.1	78.3
MB15HD20005	15/01/2019	626.1	78.3
MB15HD20005	16/01/2019	626.1	78.3
MB15HD20005	17/01/2019	626.1	78.3
MB15HD20005	18/01/2019	626.1	78.3
MB15HD20005	19/01/2019	626.1	78.3
MB15HD20005	20/01/2019	626.1	78.3
MB15HD20005	21/01/2019	626.1	78.3
MB15HD20005	22/01/2019	626.1	78.3
MB15HD20005	23/01/2019	626.1	78.3
MB15HD20005	24/01/2019	626.1	78.3
MB15HD20005	25/01/2019	626.1	78.3
MB15HD20005	26/01/2019	626.1	78.3
MB15HD20005	27/01/2019	626.1	78.3
MB15HD20005	28/01/2019	626.1	78.3
MB15HD20005	29/01/2019	626.1	78.3
MB15HD20005	30/01/2019	626.1	78.3
MB15HD20005	31/01/2019	626.1	78.3
MB15HD20005	1/02/2019	626.1	78.3
MB15HD20005	2/02/2019	626.1	78.3
MB15HD20005	3/02/2019	626.1	78.3
MB15HD20005	4/02/2019	626.1	78.3
MB15HD20005	5/02/2019	626.1	78.3
MB15HD20005	6/02/2019	626.1	78.3
MB15HD20005	7/02/2019	626.1	78.3
MB15HD20005	8/02/2019	626.1	78.3
MB15HD20005	9/02/2019	626.1	78.3
MB15HD20005	10/02/2019	626.1	78.3
MB15HD20005	11/02/2019	626.1	78.3
MB15HD20005	12/02/2019	626.1	78.3
MB15HD20005	13/02/2019	626.1	78.3
MB15HD20005	14/02/2019	626.1	78.3
MB15HD20005	15/02/2019	626.1	78.3
MB15HD20005	16/02/2019	626.1	78.3
MB15HD20005	17/02/2019	626.1	78.3
MB15HD20005	18/02/2019	626.1	78.3
MB15HD20005	19/02/2019	626.1	78.3
MB15HD20005	20/02/2019	626.1	78.3
MB15HD20005	21/02/2019	626.1	78.3
MB15HD20005	22/02/2019	626.1	78.3
MB15HD20005	23/02/2019	626.1	78.3
MB15HD20005	24/02/2019	626.1	78.3
MB15HD20005	25/02/2019	626.1	78.3
MB15HD20005	26/02/2019	626.1	78.3
MB15HD20005	27/02/2019	626.1	78.3
MB15HD20005	28/02/2019	626.1	78.3
MB15HD20005	1/03/2019	626.1	78.3
MB15HD20005	2/03/2019	626.1	78.3
MB15HD20005	3/03/2019	626.1	78.3
MB15HD20005	4/03/2019	626.1	78.3
MB15HD20005	5/03/2019	626.1	78.3
MB15HD20005	6/03/2019	626.1	78.3
MB15HD20005	7/03/2019	626.1	78.3
MB15HD20005	8/03/2019	626.1	78.3
MB15HD20005	9/03/2019	626.1	78.3
MB15HD20005	10/03/2019	626.1	78.3
MB15HD20005	11/03/2019	626.1	78.3
MB15HD20005	12/03/2019	626.1	78.3
MB15HD20005	13/03/2019	626.1	78.3
MB15HD20005	14/03/2019	626.1	78.2
MB15HD20005	15/03/2019	626.1	78.2
MB15HD20005	16/03/2019	626.1	78.3
MB15HD20005	17/03/2019	626.1	78.3
MB15HD20005	18/03/2019	626.1	78.3
MB15HD20005	19/03/2019	626.1	78.3
MB15HD20005	20/03/2019	626.1	78.3
MB15HD20005	21/03/2019	626.1	78.3
MB15HD20005	22/03/2019	626.1	78.3
MB15HD20005	23/03/2019	626.1	78.3
MB15HD20005	24/03/2019	626.1	78.3
MB15HD20005	25/03/2019	626.1	78.3
MB15HD20005	26/03/2019	626.1	78.3
MB15HD20005	27/03/2019	626.1	78.3
MB15HD20005	28/03/2019	626.1	78.3
MB15HD20005	29/03/2019	626.1	78.3
MB15HD20005	30/03/2019	626.1	78.3
MB15HD20005	31/03/2019	626.1	78.2
MB15HD20005	1/04/2019	626.1	78.2
MB15HD20005	2/04/2019	626.1	78.2
MB15HD20005	3/04/2019	626.1	78.2
MB15HD20005	4/04/2019	626.1	78.2
MB15HD20005	5/04/2019	626.1	78.2
MB15HD20005	6/04/2019	626.1	78.2
MB15HD20005	7/04/2019	626.1	78.2
MB15HD20005	8/04/2019	626.1	78.2
MB15HD20005	9/04/2019	626.1	78.2

ID	Date	WL mAHD	WL mbgl
MB18HD20008	12/02/2021	625.1	80.8
MB18HD20008	13/02/2021	625.1	80.8
MB18HD20008	14/02/2021	625.1	80.8
MB18HD20008	15/02/2021	625.1	80.8
MB18HD20008	16/02/2021	625.1	80.8
MB18HD20008	17/02/2021	625.1	80.8
MB18HD20008	18/02/2021	625.1	80.8
MB18HD20008	19/02/2021	625.1	80.8
MB18HD20008	20/02/2021	625.1	80.8
MB18HD20008	21/02/2021	625.1	80.8
MB18HD20008	22/02/2021	625.1	80.8
MB18HD20008	23/02/2021	625.1	80.8
MB18HD20008	24/02/2021	625.1	80.8
MB18HD20008	25/02/2021	625.1	80.8
MB18HD20008	26/02/2021	625.1	80.8
MB18HD20008	27/02/2021	625.1	80.8
MB18HD20008	28/02/2021	625.1	80.8
MB18HD20008	1/03/2021	625.1	80.8
MB18HD20008	2/03/2021	625.1	80.8
MB18HD20008	3/03/2021	625.1	80.8
MB18HD20008	4/03/2021	625.1	80.8
MB18HD20008	5/03/2021	625.1	80.8
MB18HD20008	6/03/2021	625.1	80.8
MB18HD20008	7/03/2021	625.1	80.8
MB18HD20008	8/03/2021	625.1	80.8
MB18HD20008	9/03/2021	625.1	80.8
MB18HD20008	10/03/2021	625.1	80.8
MB18HD20008	11/03/2021	625.1	80.8
MB18HD20008	12/03/2021	625.1	80.8
MB18HD20008	13/03/2021	625.1	80.8
MB18HD20008	14/03/2021	625.1	80.8
MB18HD20008	15/03/2021	625.1	80.8
MB18HD20008	16/03/2021	625.1	80.8
MB18HD20008	17/03/2021	625.1	80.8
MB18HD20008	18/03/2021	625.1	80.8
MB18HD20008	19/03/2021	625.1	80.8
MB18HD20008	20/03/2021	625.1	80.8
MB18HD20008	21/03/2021	625.1	80.8
MB18HD20008	22/03/2021	625.1	80.8
MB18HD20008	23/03/2021	625.1	80.8
MB18HD20008	24/03/2021	625.1	80.8
MB18HD20008	25/03/2021	625.1	80.8
MB18HD20008	26/03/2021	625.1	80.8
MB18HD20008	27/03/2021	625.1	80.8
MB18HD20008	28/03/2021	625.1	80.8
MB18HD20008	29/03/2021	625.1	80.8
MB18HD20008	30/03/2021	625.1	80.8
MB18HD20008	31/03/2021	625.1	80.8
MB18HD20008	1/04/2021	625.1	80.8
MB18HD20008	2/04/2021	625.1	80.8
MB18HD20008	3/04/2021	625.1	80.8
MB18HD20008	4/04/2021	625.1	80.8
MB18HD20008	5/04/2021	625.1	80.8
MB18HD20008	6/04/2021	625.1	80.8
MB18HD20008	7/04/2021	625.1	80.8
MB18HD20008	8/04/2021	625.1	80.8
MB18HD20008	9/04/2021	625.1	80.8
MB18HD20008	10/04/2021	625.1	80.8
MB18HD20008	11/04/2021	625.1	80.8
MB18HD20008	12/04/2021	625.1	80.8
MB18HD20008	13/04/2021	625.1	80.8
MB18HD20008	14/04/2021	625.2	80.7
MB18HD20008	15/04/2021	625.2	80.7
MB18HD20008	16/04/2021	625.2	80.7
MB18HD20008	17/04/2021	625.2	80.7
MB18HD20008	18/04/2021	625.2	80.7
MB18HD20008	19/04/2021	625.2	80.7
MB18HD20008	20/04/2021	625.1	80.7
MB18HD20008	21/04/2021	625.2	80.7
MB18HD20008	22/04/2021	625.2	80.7
MB18HD20008	23/04/2021	625.1	80.7
MB18HD20008	24/04/2021	625.2	80.7
MB18HD20008	25/04/2021	625.2	80.7
MB18HD20008	26/04/2021	625.2	80.7
MB18HD20008	27/04/2021	625.2	80.7
MB18HD20008	28/04/2021	625.2	80.7
MB18HD20008	29/04/2021	625.2	80.7
MB18HD20008	30/04/2021	625.1	80.8
MB18HD20008	1/05/2021	625.1	80.7
MB18HD20008	2/05/2021	625.1	80.7
MB18HD20008	3/05/2021	625.1	80.7
MB18HD20008	4/05/2021	625.1	80.8
MB18HD20008	5/05/2021	625.1	80.8
MB18HD20008	6/05/2021	625.1	80.8
MB18HD20008	7/05/2021	625.1	80.8
MB18HD20008	8/05/2021	625.1	80.8
MB18HD20008	9/05/2021	625.2	80.7
MB18HD20008	10/05/2021	625.2	80.7
MB18HD20008	11/05/2021	625.2	80.7
MB18HD20008	12/05/2021	625.2	80.7
MB18HD20008	13/05/2021	625.2	80.7
MB18HD20008	14/05/2021	625.2	80.7
MB18HD20008	15/05/2021	625.2	80.7
MB18HD20008	16/05/2021	625.2	80.7
MB18HD20008	17/05/2021	625.2	80.7
MB18HD20008	18/05/2021	625

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	7/01/2020	739.5	-52.9
HDVP2	6/01/2020	739.5	-52.9
HDVP2	5/01/2020	739.5	-52.9
HDVP2	4/01/2020	739.5	-52.9
HDVP2	3/01/2020	739.5	-52.9
HDVP2	2/01/2020	739.5	-52.9
HDVP2	1/01/2020	714.6	-28.0
HDVP2	31/12/2019	714.6	-28.0
HDVP2	30/12/2019	714.6	-28.0
HDVP2	29/12/2019	714.6	-28.0
HDVP2	28/12/2019	714.6	-28.0
HDVP2	27/12/2019	714.6	-28.0
HDVP2	26/12/2019	714.6	-28.0
HDVP2	25/12/2019	714.6	-28.0
HDVP2	24/12/2019	714.6	-28.0
HDVP2	23/12/2019	714.6	-28.0
HDVP2	22/12/2019	714.6	-28.0
HDVP2	21/12/2019	714.6	-28.0
HDVP2	20/12/2019	714.6	-28.0
HDVP2	19/12/2019	714.6	-28.0
HDVP2	18/12/2019	714.6	-28.0
HDVP2	17/12/2019	714.6	-28.0
HDVP2	16/12/2019	714.6	-28.0
HDVP2	15/12/2019	714.6	-28.0
HDVP2	14/12/2019	714.6	-28.0
HDVP2	13/12/2019	714.6	-28.0
HDVP2	12/12/2019	714.6	-28.0
HDVP2	11/12/2019	714.6	-28.0
HDVP2	10/12/2019	714.6	-28.0
HDVP2	9/12/2019	714.6	-28.0
HDVP2	8/12/2019	714.6	-28.0
HDVP2	7/12/2019	714.6	-28.0
HDVP2	6/12/2019	714.6	-28.0
HDVP2	5/12/2019	714.6	-28.0
HDVP2	4/12/2019	714.6	-28.0
HDVP2	3/12/2019	714.6	-28.0
HDVP2	2/12/2019	742.3	-55.8
HDVP2	1/12/2019	742.3	-55.8
HDVP2	30/11/2019	742.3	-55.8
HDVP2	29/11/2019	742.3	-55.8
HDVP2	28/11/2019	742.3	-55.8
HDVP2	27/11/2019	742.3	-55.8
HDVP2	26/11/2019	742.3	-55.8
HDVP2	25/11/2019	742.3	-55.8
HDVP2	24/11/2019	742.3	-55.8
HDVP2	23/11/2019	742.3	-55.8
HDVP2	22/11/2019	742.3	-55.8
HDVP2	21/11/2019	742.3	-55.8
HDVP2	20/11/2019	742.3	-55.8
HDVP2	19/11/2019	742.3	-55.8
HDVP2	18/11/2019	742.3	-55.8
HDVP2	17/11/2019	742.3	-55.8
HDVP2	16/11/2019	742.3	-55.8
HDVP2	15/11/2019	742.3	-55.8
HDVP2	14/11/2019	742.3	-55.8
HDVP2	13/11/2019	742.3	-55.8
HDVP2	12/11/2019	742.3	-55.8
HDVP2	11/11/2019	742.3	-55.8
HDVP2	10/11/2019	742.3	-55.8
HDVP2	9/11/2019	742.3	-55.8
HDVP2	8/11/2019	742.3	-55.8
HDVP2	7/11/2019	742.3	-55.8
HDVP2	6/11/2019	742.3	-55.8
HDVP2	5/11/2019	742.3	-55.8
HDVP2	4/11/2019	742.3	-55.8
HDVP2	3/11/2019	742.3	-55.8
HDVP2	2/11/2019	742.3	-55.8
HDVP2	1/11/2019	739.3	-52.8
HDVP2	31/10/2019	739.3	-52.8
HDVP2	30/10/2019	739.3	-52.8
HDVP2	29/10/2019	739.3	-52.8
HDVP2	28/10/2019	739.3	-52.8
HDVP2	27/10/2019	739.3	-52.8
HDVP2	26/10/2019	739.3	-52.8
HDVP2	25/10/2019	739.3	-52.8
HDVP2	24/10/2019	739.3	-52.8
HDVP2	23/10/2019	739.3	-52.8
HDVP2	22/10/2019	739.3	-52.8
HDVP2	21/10/2019	739.3	-52.8
HDVP2	20/10/2019	739.3	-52.8
HDVP2	19/10/2019	739.3	-52.8
HDVP2	18/10/2019	739.3	-52.8
HDVP2	17/10/2019	739.3	-52.8
HDVP2	16/10/2019	739.3	-52.8
HDVP2	15/10/2019	739.3	-52.8
HDVP2	14/10/2019	739.3	-52.8
HDVP2	13/10/2019	739.3	-52.8
HDVP2	12/10/2019	739.3	-52.8
HDVP2	11/10/2019	739.3	-52.8
HDVP2	10/10/2019	739.3	-52.8
HDVP2	9/10/2019	739.3	-52.8
HDVP2	8/10/2019	739.3	-52.8
HDVP2	7/10/2019	739.3	-52.8
HDVP2	6/10/2019	739.3	-52.8
HDVP2	5/10/2019	739.3	-52.8
HDVP2	4/10/2019	739.3	-52.8
HDVP2	3/10/2019	739.3	-52.8
HDVP2	2/10/2019	739.3	-52.8
HDVP2	1/10/2019	738.4	-51.9
HDVP2	30/09/2019	738.4	-51.9
HDVP2	29/09/2019	738.4	-51.9
HDVP2	28/09/2019	738.4	-51.9
HDVP2	27/09/2019	738.4	-51.9
HDVP2	26/09/2019	738.4	-51.9
HDVP2	25/09/2019	738.4	-51.9
HDVP2	24/09/2019	738.4	-51.9
HDVP2	23/09/2019	738.4	-51.9
HDVP2	22/09/2019	738.4	-51.9
HDVP2	21/09/2019	738.4	-51.9
HDVP2	20/09/2019	738.4	-51.9
HDVP2	19/09/2019	738.4	-51.9
HDVP2	18/09/2019	738.4	-51.9
HDVP2	17/09/2019	738.4	-51.9
HDVP2	16/09/2019	738.4	-51.9
HDVP2	15/09/2019	738.4	-51.9
HDVP2	14/09/2019	738.4	-51.9
HDVP2	13/09/2019	738.4	-51.9
HDVP2	12/09/2019	738.4	-51.9
HDVP2	11/09/2019	738.4	-51.9
HDVP2	10/09/2019	738.4	-51.9
HDVP2	9/09/2019	738.4	-51.9
HDVP2	8/09/2019	738.4	-51.9
HDVP2	7/09/2019	738.4	-51.9
HDVP2	6/09/2019	738.4	-51.9
HDVP2	5/09/2019	738.4	-51.9
HDVP2	4/09/2019	738.4	-51.9
HDVP2	3/09/2019	738.4	-51.9
HDVP2	2/09/2019	738.4	-51.9
HDVP2	1/09/2019	760.1	-73.5
HDVP2	31/08/2019	760.1	-73.5
HDVP2	30/08/2019	760.1	-73.5
HDVP2	29/08/2019	760.1	-73.5
HDVP2	28/08/2019	760.1	-73.5
HDVP2	27/08/2019	760.1	-73.5
HDVP2	26/08/2019	760.1	-73.5
HDVP2	25/08/2019	760.1	-73.5

ID	Date	WL mAHD	WL mbgl
MB18WON0001	2/10/2020	623.8	48.2
MB18WON0001	1/10/2020	623.9	48.2
MB18WON0001	30/09/2020	623.9	48.2
MB18WON0001	29/09/2020	623.9	48.2
MB18WON0001	28/09/2020	623.8	48.2
MB18WON0001	27/09/2020	623.9	48.2
MB18WON0001	26/09/2020	623.8	48.2
MB18WON0001	25/09/2020	623.9	48.2
MB18WON0001	24/09/2020	623.9	48.2
MB18WON0001	23/09/2020	623.9	48.2
MB18WON0001	22/09/2020	623.9	48.2
MB18WON0001	21/09/2020	623.9	48.2
MB18WON0001	20/09/2020	623.9	48.2
MB18WON0001	19/09/2020	623.8	48.2
MB18WON0001	18/09/2020	623.9	48.2
MB18WON0001	17/09/2020	623.9	48.2
MB18WON0001	16/09/2020	623.9	48.2
MB18WON0001	15/09/2020	623.9	48.2
MB18WON0001	14/09/2020	623.9	48.2
MB18WON0001	13/09/2020	623.9	48.2
MB18WON0001	12/09/2020	623.9	48.2
MB18WON0001	11/09/2020	623.9	48.2
MB18WON0001	10/09/2020	623.9	48.2
MB18WON0001	9/09/2020	623.9	48.2
MB18WON0001	8/09/2020	623.9	48.2
MB18WON0001	7/09/2020	623.9	48.2
MB18WON0001	6/09/2020	623.9	48.2
MB18WON0001	5/09/2020	623.9	48.2
MB18WON0001	4/09/2020	623.9	48.2
MB18WON0001	3/09/2020	623.9	48.2
MB18WON0001	2/09/2020	623.9	48.2
MB18WON0001	1/09/2020	623.9	48.2
MB18WON0001	31/08/2020	623.9	48.2
MB18WON0001	30/08/2020	623.9	48.2
MB18WON0001	29/08/2020	623.9	48.2
MB18WON0001	28/08/2020	623.9	48.2
MB18WON0001	27/08/2020	623.9	48.2
MB18WON0001	26/08/2020	623.9	48.2
MB18WON0001	25/08/2020	623.9	48.2
MB18WON0001	24/08/2020	623.9	48.2
MB18WON0001	23/08/2020	623.9	48.2
MB18WON0001	22/08/2020	623.9	48.2
MB18WON0001	21/08/2020	623.9	48.2
MB18WON0001	20/08/2020	623.9	48.2
MB18WON0001	19/08/2020	623.9	48.2
MB18WON0001	18/08/2020	623.9	48.2
MB18WON0001	17/08/2020	623.9	48.2
MB18WON0001	16/08/2020	623.9	48.2
MB18WON0001	15/08/2020	623.9	48.2
MB18WON0001	14/08/2020	623.9	48.2
MB18WON0001	13/08/2020	623.9	48.2
MB18WON0001	12/08/2020	623.9	48.2
MB18WON0001	11/08/2020	623.9	48.2
MB18WON0001	10/08/2020	623.8	48.2
MB18WON0001	9/08/2020	623.9	48.2
MB18WON0001	8/08/2020	623.9	48.2
MB18WON0001	7/08/2020	623.9	48.2
MB18WON0001	6/08/2020	623.9	48.2
MB18WON0001	5/08/2020	623.9	48.2
MB18WON0001	4/08/2020	623.8	48.2
MB18WON0001	3/08/2020	623.8	48.2
MB18WON0001	2/08/2020	623.9	48.2
MB18WON0001	1/08/2020	623.9	48.2
MB18WON0001	31/07/2020	623.9	48.2
MB18WON0001	30/07/2020	623.9	48.2
MB18WON0001	29/07/2020	623.9	48.2
MB18WON0001	28/07/2020	623.9	48.2
MB18WON0001	27/07/2020	623.9	48.2
MB18WON0001	26/07/2020	623.9	48.1
MB18WON0001	25/07/2020	623.9	48.1
MB18WON0001	24/07/2020	623.9	48.2
MB18WON0001	23/07/2020	623.9	48.2
MB18WON0001	22/07/2020	623.9	48.2
MB18WON0001	21/07/2020	623.9	48.2
MB18WON0001	20/07/2020	623.9	48.2
MB18WON0001	19/07/2020	623.9	48.2
MB18WON0001	18/07/2020	623.9	48.2
MB18WON0001	17/07/2020	623.9	48.2
MB18WON0001	16/07/2020	623.9	48.2
MB18WON0001	15/07/2020	623.9	48.2
MB18WON0001	14/07/2020	623.9	48.2
MB18WON0001	13/07/2020	623.9	48.2
MB18WON0001	12/07/2020	623.9	48.1
MB18WON0001	11/07/2020	624.0	48.1
MB18WON0001	10/07/2020	623.9	48.1
MB18WON0001	9/07/2020	623.9	48.2
MB18WON0001	8/07/2020	623.9	48.2
MB18WON0001	7/07/2020	623.9	48.1
MB18WON0001	6/07/2020	623.9	48.1
MB18WON0001	5/07/2020	623.9	48.1
MB18WON0001	4/07/2020	624.0	48.1
MB18WON0001	3/07/2020	624.0	48.1
MB18WON0001	2/07/2020	623.9	48.2
MB18WON0001	1/07/2020	623.9	48.2
MB18WON0001	30/06/2020	623.9	48.2
MB18WON0001	29/06/2020	623.9	48.2
MB18WON0001	28/06/2020	623.9	48.2
MB18WON0001	27/06/2020	623.9	48.2
MB18WON0001	26/06/2020	623.9	48.2
MB18WON0001	25/06/2020	623.9	48.2
MB18WON0001	24/06/2020	623.9	48.2
MB18WON0001	23/06/2020	623.9	48.2
MB18WON0001	22/06/2020	623.9	48.2
MB18WON0001	21/06/2020	623.9	48.1
MB18WON0001	20/06/2020	624.0	48.1
MB18WON0001	19/06/2020	623.9	48.1
MB18WON0001	18/06/2020	623.9	48.2
MB18WON0001	17/06/2020	623.9	48.2
MB18WON0001	16/06/2020	623.9	48.1
MB18WON0001	15/06/2020	624.0	48.1
MB18WON0001	14/06/2020	623.9	48.1
MB18WON0001	13/06/2020	623.9	48.2
MB18WON0001	12/06/2020	623.9	48.2
MB18WON0001	11/06/2020	623.9	48.2
MB18WON0001	10/06/2020	623.9	48.2
MB18WON0001	9/06/2020	623.9	48.2
MB18WON0001	8/06/2020	623.9	48.2
MB18WON0001	7/06/2020	623.9	48.2
MB18WON0001	6/06/2020	623.9	48.1
MB18WON0001	5/06/2020	624.0	48.1
MB18WON0001	4/06/2020	624.0	48.1
MB18WON0001	3/06/2020	624.0	48.1
MB18WON0001	2/06/2020	624.0	48.1
MB18WON0001	1/06/2020	624.0	48.1
MB18WON0001	31/05/2020	624.0	48.1
MB18WON0001	30/05/2020	623.9	48.1
MB18WON0001	29/05/2020	623.9	48.2
MB18WON0001	28/05/2020	623.9	48.2
MB18WON0001	27/05/2020	623.9	48.2
MB18WON0001	26/05/2020	623.9	48.2
MB18WON0001	25/05/2020	623.9	48.2
MB18WON0001	24/05/2020	623.9	48.2
MB18WON0001	23/05/2020	623.9	48.1
MB18WON0001	22/05/2020	623.9	48.1
MB18WON0001	21/05/2020	623.9	48.1
MB18WON0001	20/05/2020	623.9	48.1

ID	Date	WL mAHD	WL mbgl
MB15HD20005	10/04/2019	626.1	78.2
MB15HD20005	11/04/2019	626.1	78.2
MB15HD20005	12/04/2019	626.1	78.2
MB15HD20005	13/04/2019	626.1	78.2
MB15HD20005	14/04/2019	626.1	78.2
MB15HD20005	15/04/2019	626.1	78.3
MB15HD20005	16/04/2019	626.1	78.2
MB15HD20005	17/04/2019	626.1	78.2
MB15HD20005	18/04/2019	626.1	78.2
MB15HD20005	19/04/2019	626.1	78.2
MB15HD20005	20/04/2019	626.1	78.2
MB15HD20005	21/04/2019	626.1	78.2
MB15HD20005	22/04/2019	626.1	78.2
MB15HD20005	23/04/2019	626.1	78.2
MB15HD20005	24/04/2019	626.2	78.2
MB15HD20005	25/04/2019	626.2	78.2
MB15HD20005	26/04/2019	626.2	78.2
MB15HD20005	27/04/2019	626.2	78.2
MB15HD20005	28/04/2019	626.2	78.2
MB15HD20005	29/04/2019	626.1	78.2
MB15HD20005	30/04/2019	626.1	78.2
MB15HD20005	1/05/2019	626.1	78.2
MB15HD20005	2/05/2019	626.1	78.2
MB15HD20005	3/05/2019	626.1	78.2
MB15HD20005	4/05/2019	626.1	78.2
MB15HD20005	5/05/2019	626.2	78.2
MB15HD20005	6/05/2019	626.2	78.2
MB15HD20005	7/05/2019	626.2	78.2
MB15HD20005	8/05/2019	626.2	78.2
MB15HD20005	9/05/2019	626.2	78.2
MB15HD20005	10/05/2019	626.2	78.2
MB15HD20005	11/05/2019	626.2	78.2
MB15HD20005	12/05/2019	626.2	78.2
MB15HD20005	13/05/2019	626.2	78.2
MB15HD20005	14/05/2019	626.2	78.2
MB15HD20005	15/05/2019	626.2	78.2
MB15HD20005	16/05/2019	626.2	78.2
MB15HD20005	17/05/2019	626.2	78.2
MB15HD20005	18/05/2019	626.2	78.2
MB15HD20005	19/05/2019	626.2	78.2
MB15HD20005	20/05/2019	626.2	78.2
MB15HD20005	21/05/2019	626.2	78.2
MB15HD20005	22/05/2019	626.2	78.2
MB15HD20005	23/05/2019	626.2	78.2
MB15HD20005	24/05/2019	626.2	78.2
MB15HD20005	25/05/2019	626.2	78.2
MB15HD20005	26/05/2019	626.2	78.2
MB15HD20005	27/05/2019	626.2	78.2
MB15HD20005	28/05/2019	626.2	78.2
MB15HD20005	29/05/2019	626.2	78.2
MB15HD20005	30/05/2019	626.2	78.2
MB15HD20005	31/05/2019	626.2	78.2
MB15HD20005	1/06/2019	626.2	78.2
MB15HD20005	2/06/2019	626.2	78.2
MB15HD20005	3/06/2019	626.2	78.2
MB15HD20005	4/06/2019	626.2	78.2
MB15HD20005	5/06/2019	626.2	78.2
MB15HD20005	6/06/2019	626.2	78.2
MB15HD20005	7/06/2019	626.2	78.2
MB15HD20005	8/06/2019	626.2	78.2
MB15HD20005	9/06/2019	626.1	78.2
MB15HD20005	10/06/2019	626.1	78.2
MB15HD20005	11/06/2019	626.1	78.2
MB15HD20005	12/06/2019	626.1	78.2
MB15HD20005	13/06/2019	626.2	78.2
MB15HD20005	14/06/2019	626.2	78.2
MB15HD20005	15/06/2019	626.2	78.2
MB15HD20005	16/06/2019	626.2	78.2
MB15HD20005	17/06/2019	626.2	78.2
MB15HD20005	18/06/2019	626.2	78.2
MB15HD20005	19/06/2019	626.2	78.2
MB15HD20005	20/06/2019	626.1	78.2
MB15HD20005	21/06/2019	626.1	78.2
MB15HD20005	22/06/2019	626.1	78.2
MB15HD20005	23/06/2019	626.1	78.2
MB15HD20005	24/06/2019	626.2	78.2
MB15HD20005	25/06/2019	626.2	78.2
MB15HD20005	26/06/2019	626.2	78.2
MB15HD20005	27/06/2019	626.2	78.2
MB15HD20005	28/06/2019	626.2	78.2
MB15HD20005	29/06/2019	626.2	78.2
MB15HD20005	30/06/2019	626.2	78.2
MB15HD20005	1/07/2019	626.2	78.2
MB15HD20005	2/07/2019	626.2	78.2
MB15HD20005	3/07/2019	626.2	78.2
MB15HD20005	4/07/2019	626.2	78.2
MB15HD20005	5/07/2019	626.1	78.2
MB15HD20005	6/07/2019	626.1	78.2
MB15HD20005	7/07/2019	626.2	78.2
MB15HD20005	8/07/2019	626.2	78.2
MB15HD20005	9/07/2019	626.2	78.2
MB15HD20005	10/07/2019	626.2	78.2
MB15HD20005	11/07/2019	626.2	78.2
MB15HD20005	12/07/2019	626.2	78.2
MB15HD20005	13/07/2019	626.2	78.2
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MB15HD20005	15/07/2019	626.2	78.2
MB15HD20005	16/07/2019	626.2	78.2
MB15HD20005	17/07/2019	626.2	78.2
MB15HD20005	18/07/2019	626.2	78.2
MB15HD20005	19/07/2019	626.2	78.2
MB15HD20005	20/07/2019	626.1	78.2
MB15HD20005	21/07/2019	626.2	78.2
MB15HD20005	22/07/2019	626.1	78.2
MB15HD20005	23/07/2019	626.2	78.2
MB15HD20005	24/07/2019	626.2	78.2
MB15HD20005	25/07/2019	626.2	78.2
MB15HD20005	26/07/2019	626.2	78.2
MB15HD20005	27/07/2019	626.1	78.2
MB15HD20005	28/07/2019	626.1	78.2
MB15HD20005	29/07/2019	626.1	78.2
MB15HD20005	30/07/2019	626.2	78.2
MB15HD20005	31/07/2019	626.2	78.2
MB15HD20005	1/08/2019	626.2	78.2
MB15HD20005	2/08/2019	626.2	78.2
MB15HD20005	3/08/2019	626.2	78.2
MB15HD20005	4/08/2019	626.2	78.2
MB15HD20005	5/08/2019	626.2	78.2
MB15HD20005	6/08/2019	626.2	78.2
MB15HD20005	7/08/2019	626.1	78.2
MB15HD20005	8/08/2019	626.2	78.2
MB15HD20005	9/08/2019	626.2	78.2
MB15HD20005	10/08/2019	626.2	78.2
MB15HD20005	11/08/2019	626.2	78.2
MB15HD20005	12/08/2019	626.2	78.2
MB15HD20005	13/08/2019	626.2	78.2
MB15HD20005	14/08/2019	626.1	78.2
MB15HD20005	15/08/2019	626.1	78.2
MB15HD20005	16/08/2019	626.1	78.2
MB15HD20005	17/08/2019	626.1	78.2
MB15HD20005	18/08/2019	626.2	78.2
MB15HD20005	19/08/2019	626.2	78.2
MB15HD20005	20/08/2019	626.2	78.2
MB15HD20005	21/08/2019	626.2	78.2
MB15HD20005	22/08/2019	626.2	78.2
MB15HD20005	23/08/2019	626.2	78.2

ID	Date	WL mAHD	WL mbgl
MB18HD20008	28/06/2021	625.1	80.8
MB18HD20008	29/06/2021	625.1	80.7
MB18HD20008	30/06/2021	625.2	80.7
MB18HD20008	1/07/2021	625.2	80.7
MB18HD20008	2/07/2021	625.2	80.7
MB18HD20008	3/07/2021	625.2	80.7
MB18HD20008	4/07/2021	625.2	80.7
MB18HD20008	5/07/2021	625.2	80.7
MB18HD20008	6/07/2021	625.1	80.8
MB18HD20008	7/07/2021	625.1	80.8
MB18HD20008	8/07/2021	625.1	80.7
MB18HD20008	9/07/2021	625.1	80.8
MB18HD20008	10/07/2021	625.1	80.8
MB18HD20008	11/07/2021	625.1	80.8
MB18HD20008	12/07/2021	625.1	80.8
MB18HD20008	13/07/2021	625.1	80.8
MB18HD20008	14/07/2021	625.1	80.8
MB18HD20008	15/07/2021	625.1	80.8
MB18HD20008	16/07/2021	625.2	80.7
MB18HD20008	17/07/2021	625.2	80.7
MB18HD20008	18/07/2021	625.1	80.7
MB18HD20008	19/07/2021	625.2	80.7
MB18HD20008	20/07/2021	625.2	80.7
MB18HD20008	21/07/2021	625.1	80.7
MB18HD20008	22/07/2021	625.1	80.8
MB18HD20008	23/07/2021	625.1	80.8
MB18HD20008	24/07/2021	625.2	80.7
MB18HD20008	25/07/2021	625.2	80.7
MB18HD20008	26/07/2021	625.1	80.8
MB18HD20008	27/07/2021	625.1	80.8
MB18HD20008	28/07/2021	625.1	80.8
MB18HD20008	29/07/2021	625.1	80.8
MB18HD20008	30/07/2021	625.1	80.8
MB18HD20008	31/07/2021	625.1	80.8
MB18HD20008	1/08/2021	625.1	80.8
MB18HD20008	2/08/2021	625.2	80.7
MB18HD20008	3/08/2021	625.2	80.7
MB18HD20008	4/08/2021	625.2	80.7
MB18HD20008	5/08/2021	625.2	80.7
MB18HD20008	6/08/2021	625.2	80.7
MB18HD20008	7/08/2021	625.2	80.7
MB18HD20008	8/08/2021	625.2	80.7
MB18HD20008	9/08/2021	625.1	80.7
MB18HD20008	10/08/2021	625.1	80.7
MB18HD20008	11/08/2021	625.2	80.7
MB18HD20008	12/08/2021	625.2	80.7
MB18HD20008	13/08/2021	625.2	80.7
MB18HD20008	14/08/2021	625.1	80.7
MB18HD20008	15/08/2021	625.2	80.7
MB18HD20008	16/08/2021	625.2	80.7
MB18HD20008	17/08/2021	625.2	80.7
MB18HD20008	18/08/2021	625.2	80.7
MB18HD20008	19/08/2021	625.1	80.8
MB18HD20008	20/08/2021	625.1	80.8
MB18HD20008	21/08/2021	625.1	80.8
MB18HD20008	22/08/2021	625.1	80.8
MB18HD20008	23/08/2021	625.1	80.7
MB18HD20008	24/08/2021	625.1	80.7
MB18HD20008	25/08/2021	625.1	80.8
MB18HD20008	26/08/2021	625.1	80.8
MB18HD20008	27/08/2021	625.1	80.8
MB18HD20008	28/08/2021	625.1	80.8
MB18HD20008	29/08/2021	625.1	80.7
MB18HD20008	30/08/2021	625.1	80.8
MB18HD20008	31/08/2021	625.1	80.8
MB18HD20008	1/09/2021	625.1	80.8
MB18HD20008	2/09/2021	625.1	80.8
MB18HD20008	3/09/2021	625.1	80.7
MB18HD20008	4/09/2021	625.2	80.7
MB18HD20008	5/09/2021	625.2	80.7
MB18HD20008	6/09/2021	625.2	80.7
MB18HD20008	7/09/2021	625.2	80.7
MB18HD20008	8/09/2021	625.2	80.7
MB18HD20008	9/09/2021	625.2	80.7
MB18HD20008	10/09/2021	625.2	80.7
MB18HD20008	11/09/2021	625.1	80.8
MB18HD20008	12/09/2021	625.1	80.8
MB18HD20008	13/09/2021	625.1	80.8
MB18HD20008	14/09/2021	625.1	80.8
MB18HD20008	15/09/2021	625.1	80.8
MB18HD20008	16/09/2021	625.1	80.8
MB18HD20008	17/09/2021	625.1	80.8
MB18HD20008	18/09/2021	625.1	80.7
MB18HD20008	19/09/2021	625.2	80.7
MB18HD20008	20/09/2021	625.2	80.7
MB18HD20008	21/09/2021	625.2	80.7
MB18HD20008	22/09/2021	625.2	80.7
MB18HD20008	23/09/2021	625.2	80.7
MB18HD20008	24/09/2021	625.1	80.8
MB18HD20008	25/09/2021	625.1	80.8
MB18HD20008	26/09/2021	625.1	80.8
MB18HD20008	27/09/2021	625.1	80.8
MB18HD20008	28/09/2021	625.1	80.8
MB18HD20008	29/09/2021	625.1	80.8
MB18HD20008	30/09/2021	625.1	80.8
MB18HD20008	1/10/2021	625

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	24/08/2019	760.1	-73.5
HDVP2	23/08/2019	760.1	-73.5
HDVP2	22/08/2019	760.1	-73.5
HDVP2	21/08/2019	760.1	-73.5
HDVP2	20/08/2019	760.1	-73.5
HDVP2	19/08/2019	760.1	-73.5
HDVP2	18/08/2019	760.1	-73.5
HDVP2	17/08/2019	760.1	-73.5
HDVP2	16/08/2019	760.1	-73.5
HDVP2	15/08/2019	760.1	-73.5
HDVP2	14/08/2019	760.1	-73.5
HDVP2	13/08/2019	760.1	-73.5
HDVP2	12/08/2019	760.1	-73.5
HDVP2	11/08/2019	760.1	-73.5
HDVP2	10/08/2019	760.1	-73.5
HDVP2	9/08/2019	760.1	-73.5
HDVP2	8/08/2019	760.1	-73.5
HDVP2	7/08/2019	760.1	-73.5
HDVP2	6/08/2019	760.1	-73.5
HDVP2	5/08/2019	760.1	-73.5
HDVP2	4/08/2019	760.1	-73.5
HDVP2	3/08/2019	760.1	-73.5
HDVP2	2/08/2019	637.5	49.0
HDVP2	1/08/2019	637.5	49.0
HDVP2	31/07/2019	637.5	49.0
HDVP2	30/07/2019	637.5	49.0
HDVP2	29/07/2019	637.5	49.0
HDVP2	28/07/2019	637.5	49.0
HDVP2	27/07/2019	637.5	49.0
HDVP2	26/07/2019	637.5	49.0
HDVP2	25/07/2019	637.5	49.0
HDVP2	24/07/2019	637.5	49.0
HDVP2	23/07/2019	637.5	49.0
HDVP2	22/07/2019	637.5	49.0
HDVP2	21/07/2019	637.5	49.0
HDVP2	20/07/2019	637.5	49.0
HDVP2	19/07/2019	637.5	49.0
HDVP2	18/07/2019	637.5	49.0
HDVP2	17/07/2019	637.5	49.0
HDVP2	16/07/2019	637.5	49.0
HDVP2	15/07/2019	637.5	49.0
HDVP2	14/07/2019	637.5	49.0
HDVP2	13/07/2019	637.5	49.0
HDVP2	12/07/2019	637.5	49.0
HDVP2	11/07/2019	637.5	49.0
HDVP2	10/07/2019	637.5	49.0
HDVP2	9/07/2019	637.5	49.0
HDVP2	8/07/2019	637.5	49.0
HDVP2	7/07/2019	637.5	49.0
HDVP2	6/07/2019	637.5	49.0
HDVP2	5/07/2019	313.1	373.4
HDVP2	4/07/2019	313.1	373.4
HDVP2	3/07/2019	313.1	373.4
HDVP2	2/07/2019	313.1	373.4
HDVP2	1/07/2019	313.1	373.4
HDVP2	30/06/2019	313.1	373.4
HDVP2	29/06/2019	313.1	373.4
HDVP2	28/06/2019	313.1	373.4
HDVP2	27/06/2019	313.1	373.4
HDVP2	26/06/2019	313.1	373.4
HDVP2	25/06/2019	313.1	373.4
HDVP2	24/06/2019	313.1	373.4
HDVP2	23/06/2019	313.1	373.4
HDVP2	22/06/2019	313.1	373.4
HDVP2	21/06/2019	313.1	373.4
HDVP2	20/06/2019	313.1	373.4
HDVP2	19/06/2019	313.1	373.4
HDVP2	18/06/2019	313.1	373.4
HDVP2	17/06/2019	313.1	373.4
HDVP2	16/06/2019	313.1	373.4
HDVP2	15/06/2019	313.1	373.4
HDVP2	14/06/2019	313.1	373.4
HDVP2	13/06/2019	313.1	373.4
HDVP2	12/06/2019	313.1	373.4
HDVP2	11/06/2019	313.1	373.4
HDVP2	10/06/2019	313.1	373.4
HDVP2	9/06/2019	313.1	373.4
HDVP2	8/06/2019	313.1	373.4
HDVP2	7/06/2019	313.1	373.4
HDVP2	6/06/2019	313.1	373.4
HDVP2	5/06/2019	313.1	373.4
HDVP2	4/06/2019	313.1	373.4
HDVP2	3/06/2019	313.1	373.4
HDVP2	2/06/2019	313.1	373.4
HDVP2	1/06/2019	402.2	284.3
HDVP2	31/05/2019	402.2	284.3
HDVP2	30/05/2019	402.2	284.3
HDVP2	29/05/2019	402.2	284.3
HDVP2	28/05/2019	402.2	284.3
HDVP2	27/05/2019	402.2	284.3
HDVP2	26/05/2019	402.2	284.3
HDVP2	25/05/2019	402.2	284.3
HDVP2	24/05/2019	402.2	284.3
HDVP2	23/05/2019	402.2	284.3
HDVP2	22/05/2019	402.2	284.3
HDVP2	21/05/2019	402.2	284.3
HDVP2	20/05/2019	402.2	284.3
HDVP2	19/05/2019	402.2	284.3
HDVP2	18/05/2019	402.2	284.3
HDVP2	17/05/2019	402.2	284.3
HDVP2	16/05/2019	402.2	284.3
HDVP2	15/05/2019	402.2	284.3
HDVP2	14/05/2019	402.2	284.3
HDVP2	13/05/2019	402.2	284.3
HDVP2	12/05/2019	402.2	284.3
HDVP2	11/05/2019	402.2	284.3
HDVP2	10/05/2019	402.2	284.3
HDVP2	9/05/2019	402.2	284.3
HDVP2	8/05/2019	402.2	284.3
HDVP2	7/05/2019	402.2	284.3
HDVP2	6/05/2019	402.2	284.3
HDVP2	5/05/2019	402.2	284.3
HDVP2	4/05/2019	402.2	284.3
HDVP2	3/05/2019	402.2	284.3
HDVP2	2/05/2019	402.2	284.3
HDVP2	1/05/2019	412.1	274.4
HDVP2	30/04/2019	412.1	274.4
HDVP2	29/04/2019	412.1	274.4
HDVP2	28/04/2019	412.1	274.4
HDVP2	27/04/2019	412.1	274.4
HDVP2	26/04/2019	412.1	274.4
HDVP2	25/04/2019	412.1	274.4
HDVP2	24/04/2019	412.1	274.4
HDVP2	23/04/2019	412.1	274.4
HDVP2	22/04/2019	412.1	274.4
HDVP2	21/04/2019	412.1	274.4
HDVP2	20/04/2019	412.1	274.4
HDVP2	19/04/2019	412.1	274.4
HDVP2	18/04/2019	412.1	274.4
HDVP2	17/04/2019	412.1	274.4
HDVP2	16/04/2019	412.1	274.4
HDVP2	15/04/2019	412.1	274.4
HDVP2	14/04/2019	412.1	274.4
HDVP2	13/04/2019	412.1	274.4
HDVP2	12/04/2019	412.1	274.4
HDVP2	11/04/2019	412.1	274.4

ID	Date	WL mAHD	WL mbgl
MB18WON0001	19/05/2020	623.9	48.2
MB18WON0001	18/05/2020	623.9	48.2
MB18WON0001	17/05/2020	623.9	48.1
MB18WON0001	16/05/2020	623.9	48.1
MB18WON0001	15/05/2020	624.0	48.1
MB18WON0001	14/05/2020	624.0	48.1
MB18WON0001	13/05/2020	624.0	48.1
MB18WON0001	12/05/2020	624.0	48.1
MB18WON0001	11/05/2020	624.0	48.1
MB18WON0001	10/05/2020	624.0	48.1
MB18WON0001	9/05/2020	623.9	48.1
MB18WON0001	8/05/2020	623.9	48.2
MB18WON0001	7/05/2020	623.9	48.2
MB18WON0001	6/05/2020	623.9	48.2
MB18WON0001	5/05/2020	623.9	48.2
MB18WON0001	4/05/2020	623.9	48.1
MB18WON0001	3/05/2020	623.9	48.2
MB18WON0001	2/05/2020	623.9	48.2
MB18WON0001	1/05/2020	623.9	48.1
MB18WON0001	30/04/2020	624.0	48.1
MB18WON0001	29/04/2020	623.9	48.1
MB18WON0001	28/04/2020	623.9	48.2
MB18WON0001	27/04/2020	623.9	48.2
MB18WON0001	26/04/2020	623.9	48.2
MB18WON0001	25/04/2020	623.9	48.2
MB18WON0001	24/04/2020	623.9	48.2
MB18WON0001	23/04/2020	623.9	48.2
MB18WON0001	22/04/2020	623.9	48.2
MB18WON0001	21/04/2020	623.9	48.2
MB18WON0001	20/04/2020	623.9	48.2
MB18WON0001	19/04/2020	623.9	48.2
MB18WON0001	18/04/2020	623.9	48.2
MB18WON0001	17/04/2020	623.9	48.2
MB18WON0001	16/04/2020	623.9	48.2
MB18WON0001	15/04/2020	623.9	48.2
MB18WON0001	14/04/2020	623.9	48.2
MB18WON0001	13/04/2020	623.9	48.2
MB18WON0001	12/04/2020	623.9	48.2
MB18WON0001	11/04/2020	623.9	48.1
MB18WON0001	10/04/2020	623.9	48.1
MB18WON0001	9/04/2020	623.9	48.2
MB18WON0001	8/04/2020	623.9	48.2
MB18WON0001	7/04/2020	623.9	48.2
MB18WON0001	6/04/2020	623.9	48.2
MB18WON0001	5/04/2020	623.9	48.2
MB18WON0001	4/04/2020	623.9	48.2
MB18WON0001	3/04/2020	623.9	48.2
MB18WON0001	12/12/2019	623.8	48.3
MB18WON0001	2/12/2019	623.8	48.3
MB18WON0001	11/04/2019	622.5	49.6
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MB18WON0001	9/04/2019	622.5	49.6
MB18WON0001	8/04/2019	622.5	49.6
MB18WON0001	7/04/2019	622.5	49.6
MB18WON0001	6/04/2019	622.6	49.5
MB18WON0001	5/04/2019	622.6	49.5
MB18WON0001	4/04/2019	622.6	49.5
MB18WON0001	3/04/2019	622.6	49.5
MB18WON0001	2/04/2019	622.6	49.5
MB18WON0001	1/04/2019	622.6	49.5
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MB18WON0001	30/03/2019	622.6	49.4
MB18WON0001	29/03/2019	622.6	49.4
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MB18WON0001	25/03/2019	622.7	49.4
MB18WON0001	24/03/2019	622.7	49.4
MB18WON0001	23/03/2019	622.7	49.4
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MB18WON0001	21/03/2019	622.7	49.4
MB18WON0001	20/03/2019	622.7	49.3
MB18WON0001	19/03/2019	622.8	49.3
MB18WON0001	18/03/2019	622.8	49.3
MB18WON0001	17/03/2019	622.8	49.3
MB18WON0001	16/03/2019	622.8	49.3
MB18WON0001	15/03/2019	622.8	49.2
MB18WON0001	14/03/2019	622.9	49.2
MB18WON0001	13/03/2019	622.9	49.2
MB18WON0001	12/03/2019	622.9	49.2
MB18WON0001	11/03/2019	622.9	49.2
MB18WON0001	10/03/2019	622.9	49.2
MB18WON0001	9/03/2019	622.9	49.2
MB18WON0001	8/03/2019	622.9	49.2
MB18WON0001	7/03/2019	622.9	49.1
MB18WON0001	6/03/2019	623.0	49.1
MB18WON0001	5/03/2019	623.0	49.1
MB18WON0001	4/03/2019	623.0	49.1
MB18WON0001	3/03/2019	623.0	49.1
MB18WON0001	2/03/2019	623.0	49.1
MB18WON0001	1/03/2019	623.0	49.1
MB18WON0001	28/02/2019	623.0	49.1
MB18WON0001	27/02/2019	623.0	49.0
MB18WON0001	26/02/2019	623.1	49.0
MB18WON0001	25/02/2019	623.1	49.0
MB18WON0001	24/02/2019	623.1	49.0
MB18WON0001	23/02/2019	623.1	49.0
MB18WON0001	22/02/2019	623.1	49.0
MB18WON0001	21/02/2019	623.1	48.9
MB18WON0001	20/02/2019	623.2	48.9
MB18WON0001	19/02/2019	623.2	48.9
MB18WON0001	18/02/2019	623.2	48.9
MB18WON0001	17/02/2019	623.2	48.9
MB18WON0001	16/02/2019	623.2	48.9
MB18WON0001	15/02/2019	623.2	48.9
MB18WON0001	14/02/2019	623.2	48.9
MB18WON0001	13/02/2019	623.2	48.8
MB18WON0001	12/02/2019	623.2	48.8
MB18WON0001	11/02/2019	623.3	48.8
MB18WON0001	10/02/2019	623.3	48.8
MB18WON0001	9/02/2019	623.3	48.8
MB18WON0001	8/02/2019	623.3	48.8
MB18WON0001	7/02/2019	623.3	48.8
MB18WON0001	6/02/2019	623.3	48.8
MB18WON0001	5/02/2019	623.3	48.8
MB18WON0001	4/02/2019	623.3	48.8
MB18WON0001	3/02/2019	623.3	48.8
MB18WON0001	2/02/2019	623.3	48.7
MB18WON0001	1/02/2019	623.4	48.7
MB18WON0001	31/01/2019	623.4	48.7
MB18WON0001	30/01/2019	623.4	48.7
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MB18WON0001	25/01/2019	623.4	48.7
MB18WON0001	24/01/2019	623.4	48.7
MB18WON0001	23/01/2019	623.4	48.6
MB18WON0001	22/01/2019	623.4	48.6
MB18WON0001	21/01/2019	623.5	48.6
MB18WON0001	20/01/2019	623.5	48.6
MB18WON0001	19/01/2019	623.5	48.6
MB18WON0001	18/01/2019	623.5	48.6
MB18WON0001	17/01/2019	623.5	48.5
MB18WON0001	16/01/2019	623.5	48.6
MB18WON0001	15/01/2019	623.5	48.5

ID	Date	WL mAHD	WL mbgl
MB15HD20005	24/08/2019	626.2	78.2
MB15HD20005	25/08/2019	626.1	78.2
MB15HD20005	26/08/2019	626.1	78.2
MB15HD20005	27/08/2019	626.1	78.2
MB15HD20005	28/08/2019	626.1	78.2
MB15HD20005	29/08/2019	626.1	78.2
MB15HD20005	30/08/2019	626.1	78.2
MB15HD20005	31/08/2019	626.1	78.2
MB15HD20005	1/09/2019	626.1	78.2
MB15HD20005	2/09/2019	626.1	78.2
MB15HD20005	3/09/2019	626.1	78.2
MB15HD20005	4/09/2019	626.1	78.2
MB15HD20005	5/09/2019	626.1	78.2
MB15HD20005	6/09/2019	626.1	78.3
MB15HD20005	7/09/2019	626.1	78.2
MB15HD20005	8/09/2019	626.1	78.2
MB15HD20005	9/09/2019	626.1	78.2
MB15HD20005	10/09/2019	626.1	78.2
MB15HD20005	11/09/2019	626.2	78.2
MB15HD20005	12/09/2019	626.2	78.2
MB15HD20005	13/09/2019	626.2	78.2
MB15HD20005	14/09/2019	626.2	78.2
MB15HD20005	15/09/2019	626.2	78.2
MB15HD20005	16/09/2019	626.1	78.2
MB15HD20005	17/09/2019	626.1	78.2
MB15HD20005	18/09/2019	626.1	78.2
MB15HD20005	19/09/2019	626.1	78.2
MB15HD20005	20/09/2019	626.1	78.2
MB15HD20005	21/09/2019	626.1	78.2
MB15HD20005	22/09/2019	626.1	78.2
MB15HD20005	23/09/2019	626.2	78.2
MB15HD20005	24/09/2019	626.2	78.2
MB15HD20005	25/09/2019	626.2	78.2
MB15HD20005	26/09/2019	626.1	78.2
MB15HD20005	27/09/2019	626.1	78.2
MB15HD20005	28/09/2019	626.1	78.2
MB15HD20005	29/09/2019	626.1	78.2
MB15HD20005	30/09/2019	626.1	78.2
MB15HD20005	1/10/2019	626.1	78.2
MB15HD20005	2/10/2019	626.1	78.2
MB15HD20005	3/10/2019	626.1	78.2
MB15HD20005	4/10/2019	626.1	78.2
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MB15HD20005	7/10/2019	626.1	78.2
MB15HD20005	8/10/2019	626.1	78.3
MB15HD20005	9/10/2019	626.1	78.3
MB15HD20005	10/10/2019	626.1	78.3
MB15HD20005	11/10/2019	626.1	78.2
MB15HD20005	12/10/2019	626.1	78.3
MB15HD20005	13/10/2019	626.1	78.3
MB15HD20005	14/10/2019	626.1	78.3
MB15HD20005	15/10/2019	626.1	78.3
MB15HD20005	16/10/2019	626.1	78.3
MB15HD20005	17/10/2019	626.1	78.3
MB15HD20005	18/10/2019	626.1	78.3
MB15HD20005	19/10/2019	626.1	78.3
MB15HD20005	20/10/2019	626.1	78.3
MB15HD20005	21/10/2019	626.1	78.3
MB15HD20005	22/10/2019	626.1	78.2
MB15HD20005	23/10/2019	626.1	78.3
MB15HD20005	24/10/2019	626.1	78.3
MB15HD20005	25/10/2019	626.1	78.3
MB15HD20005	26/10/2019	626.1	78.3
MB15HD20005	27/10/2019	626.1	78.3
MB15HD20005	28/10/2019	626.1	78.3
MB15HD20005	29/10/2019	626.1	78.3
MB15HD20005	30/10/2019	626.1	78.3
MB15HD20005	31/10/2019	626.1	78.3
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MB15HD20005	2/11/2019	626.1	78.3
MB15HD20005	3/11/2019	626.1	78.3
MB15HD20005	4/11/2019	626.1	78.3
MB15HD20005	5/11/2019	626.1	78.2
MB15HD20005	6/11/2019	626.1	78.3
MB15HD20005	7/11/2019	626.1	78.3
MB15HD20005	8/11/2019	626.1	78.3
MB15HD20005	9/11/2019	626.1	78.3
MB15HD20005	10/11/2019	626.1	78.3
MB15HD20005	11/11/2019	626.1	78.3
MB15HD20005	12/11/2019	626.1	78.3
MB15HD20005	13/11/2019	626.1	78.3
MB15HD20005	14/11/2019	626.1	78.3
MB15HD20005	15/11/2019	626.1	78.3
MB15HD20005	16/11/2019	626.1	78.3
MB15HD20005	17/11/2019	626.1	78.3
MB15HD20005	18/11/2019	626.1	78.3
MB15HD20005	19/11/2019	626.1	78.3
MB15HD20005	20/11/2019	626.1	78.3
MB15HD20005	21/11/2019	626.1	78.3
MB15HD20005	22/11/2019	626.1	78.3
MB15HD20005	23/11/2019	626.1	78.3
MB15HD20005	24/11/2019	626.1	78.3
MB15HD20005	25/11/2019	626.1	78.3
MB15HD20005	26/11/2019	626.1	78.3
MB15HD20005	27/11/2019	626.1	78.3
MB15HD20005	28/11/2019	626.1	78.3
MB15HD20005	29/11/2019	626.0	78.3
MB15HD20005	30/11/2019	626.1	78.3
MB15HD20005	1/12/2019	626.1	78.3
MB15HD20005	2/12/2019	626.1	78.3
MB15HD20005	3/12/2019	626.1	78.3
MB15HD20005	4/12/2019	626.1	78.3
MB15HD20005	5/12/2019	626.1	78.3
MB15HD20005	6/12/2019	626.1	78.3
MB15HD20005	7/12/2019	626.1	78.3
MB15HD20005	8/12/2019	626.1	78.3
MB15HD20005	9/12/2019	626.1	78.3
MB15HD20005	10/12/2019	626.1	78.3
MB15HD20005	11/12/2019	626.1	78.3
MB15HD20005	12/12/2019	626.1	78.3
MB15HD20005	13/12/2019	626.1	78.3
MB15HD20005	14/12/2019	626.1	78.3
MB15HD20005	15/12/2019	626.1	78.3
MB15HD20005	16/12/2019	626.1	78.3
MB15HD20005	17/12/2019	626.1	78.3
MB15HD20005	18/12/2019	626.1	78.3
MB15HD20005	19/12/2019	626.1	78.3
MB15HD20005	20/12/2019	626.1	78.3
MB15HD20005	21/12/2019	626.1	78.3
MB15HD20005	22/12/2019	626.1	78.3
MB15HD20005	23/12/2019	626.1	78.3
MB15HD20005	24/12/2019	626.1	78.3
MB15HD20005	25/12/2019	626.1	78.3
MB15HD20005	26/12/2019	626.1	78.3
MB15HD20005	27/12/2019	626.1	78.3
MB15HD20005	28/12/2019	626.1	78.3
MB15HD20005	29/12/2019	626.0	78.3
MB15HD20005	30/12/2019	626.0	78.3
MB15HD20005	31/12/2019	626.0	78.3
MB15HD20005	1/01/2020	626.0	78.3
MB15HD20005	2/01/2020	626.1	78.3
MB15HD20005	3/01/2020	626.0	78.3
MB15HD20005	4/01/2020	626.0	78.3
MB15HD20005	5/01/2020	626.0	78.3
MB15HD20005	6/01/2020	626.0	78.3

ID	Date	WL mAHD	WL mbgl
MB18HD20008	15/11/2021	625.1	80.8
MB18HD20008	16/11/2021	625.1	80.8
MB18HD20008	17/11/2021	625.1	80.8
MB18HD20008	18/11/2021	625.1	80.8
MB18HD20008	19/11/2021	625.1	80.8
MB18HD20008	20/11/2021	625.1	80.8
MB18HD20008	21/11/2021	625.1	80.8
MB18HD20008	22/11/2021	625.1	80.8
MB18HD20008	23/11/2021	625.1	80.8
MB18HD20008	24/11/2021	625.1	80.8
MB18HD20008	25/11/2021	625.1	80.8
MB18HD20008	26/11/2021	625.1	80.8
MB18HD20008	27/11/2021	625.1	80.8
MB18HD20008	28/11/2021	625.1	80.8
MB18HD20008	29/11/2021	625.1	80.8
MB18HD20008	30/11/2021	625.1	80.8
MB18HD20008	1/12/2021	625.1	80.8
MB18HD20008	2/12/2021	625.1	80.8
MB18HD20008	3/12/2021	625.1	80.8
MB18HD20008	4/12/2021	625.1	80.8
MB18HD20008	5/12/2021	625.1	80.8
MB18HD20008	6/12/2021	625.1	80.8
MB18HD20008	7/12/2021	625.1	80.8
MB18HD20008	8/12/2021	625.1	80.8
MB18HD20008	9/12/2021	625.1	80.8
MB18HD20008	10/12/2021	625.1	80.8
MB18HD20008	11/12/2021	625.1	80.8
MB18HD20008	12/12/2021	625.1	80.8
MB18HD20008	13/12/2021	625.0	80.9
MB18HD20008	14/12/2021	625.0	80.9
MB18HD20008	15/12/2021	625.0	80.8
MB18HD20008	16/12/2021	625.1	80.8
MB18HD20008	17/12/2021	625.1	80.8
MB18HD20008	18/12/2021	625.1	80.8
MB18HD20008	19/12/2021	625.1	80.8
MB18HD20008	20/12/2021	625.1	80.8
MB18HD20008	21/12/2021	625.1	80.8
MB18HD20008	22/12/2021	625.1	80.8
MB18HD20008	23/12/2021	625.0	80.9
MB18HD20008	24/12/2021	625.0	80.9
MB18HD20008	25/12/2021	625.1	80.8
MB18HD20008	26/12/2021	625.1	80.8
MB18HD20008	30/12/2021	625.0	80.9
MB18HD20008	31/12/2021	625.0	80.9
MB18HD20008	1/01/2022	625.0	80.9
MB18HD20008	2/01/2022	625.0	80.8
MB18HD20008	3/01/2022	625.1	80.8
MB18HD20008	4/01/2022	625.1	80.8
MB18HD20008	5/01/2022	625.1	80.8
MB18HD20008	6/01/2022	625.0	80.8
MB18HD20008	7/01/2022	625.1	80.8
MB18HD20008	8/01/2022	625.1	80.8
MB18HD20008	9/01/2022	625.0	80.9
MB18HD20008	10/01/2022	625.1	80.8
MB18HD20008	11/01/2022	625.1	80.8
MB18HD20008	12/01/2022	625.1	80.8
MB18HD20008	13/01/2022	625.1	80.8
MB18HD20008	14/01/2022	625.0	80.9
MB18HD20008	15/01/2022	625.0	80.9
MB18HD20008	16/01/2022	625.0	80.9
MB18HD20008	17/01/2022	625.0	80.9
MB18HD20008	18/01/2022	625.0	80.8
MB18HD20008	19/01/2022	625.1	80.8
MB18HD20008	20/01/2022	625.1	80.8
MB18HD20008	21/01/2022	625.1	80.8
MB18HD20008	22/01/2022	625.3	80.6
MB18HD20008	23/01/2022	625.2	80.6
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MB18HD20008	25/01/2022	625.2	80.7
MB18HD20008	26/01/2022	625.2	80.7
MB18HD20008	27/01/2022	625.2	80.7
MB18HD20008	28/01/2022	625.2	80.7
MB18HD20008	29/01/2022	625.2	80.7
MB18HD20008	30/01/2022	625.2	80.7
MB18HD20008	31/01/2022	625.2	80.7
MB18HD20008	1/02/2022	625.2	80.7
MB18HD20008	2/02/2022	625.2	80.7
MB18HD20008	3/02/2022	625.2	80.6
MB18HD20008	4/02/2022	625.2	80.6
MB18HD20008	5/02/2022	625.2	80.7
MB18HD20008	6/02/2022	625.2	80.7
MB18HD20008	7/02/2022	625.2	80.7
MB18HD20008	8/02/2022	625.2	80.6
MB18HD20008	9/02/2022	625.3	80.6
MB18HD20008	10/02/2022	625.3	80.6
MB18HD20008	11/02/2022	625.3	80.6
MB18HD20008	12/02/2022	625.3	80.6
MB18HD20008	13/02/2022	625.3	80.6
MB18HD20008	14/02/2022	625.3	80.6
MB18HD20008	15/02/2022	625.3	80.6
MB18HD20008	16/02/2022	625.3	80.6
MB18HD20008	17/02/2022	625.3	80.6
MB18HD20008	18/02/2022	625.3	80.6
MB18HD20008	19/02/2022	625.3	80.6
MB18HD20008	20/02/2022	625.3	80.6
MB18HD20008	21/02/2022	625

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	10/04/2019	412.1	274.4
HDVP2	9/04/2019	412.1	274.4
HDVP2	8/04/2019	412.1	274.4
HDVP2	7/04/2019	412.1	274.4
HDVP2	6/04/2019	412.1	274.4
HDVP2	5/04/2019	412.1	274.4
HDVP2	4/04/2019	412.1	274.4
HDVP2	3/04/2019	412.1	274.4
HDVP2	2/04/2019	412.1	274.4
HDVP2	1/04/2019	463.6	222.9
HDVP2	31/03/2019	463.6	222.9
HDVP2	30/03/2019	463.6	222.9
HDVP2	29/03/2019	463.6	222.9
HDVP2	28/03/2019	463.6	222.9
HDVP2	27/03/2019	463.6	222.9
HDVP2	26/03/2019	463.6	222.9
HDVP2	25/03/2019	463.6	222.9
HDVP2	24/03/2019	463.6	222.9
HDVP2	23/03/2019	463.6	222.9
HDVP2	22/03/2019	463.6	222.9
HDVP2	21/03/2019	463.6	222.9
HDVP2	20/03/2019	463.6	222.9
HDVP2	19/03/2019	463.6	222.9
HDVP2	18/03/2019	463.6	222.9
HDVP2	17/03/2019	463.6	222.9
HDVP2	16/03/2019	463.6	222.9
HDVP2	15/03/2019	463.6	222.9
HDVP2	14/03/2019	463.6	222.9
HDVP2	13/03/2019	463.6	222.9
HDVP2	12/03/2019	463.6	222.9
HDVP2	11/03/2019	463.6	222.9
HDVP2	10/03/2019	463.6	222.9
HDVP2	9/03/2019	463.6	222.9
HDVP2	8/03/2019	463.6	222.9
HDVP2	7/03/2019	463.6	222.9
HDVP2	6/03/2019	463.6	222.9
HDVP2	5/03/2019	463.6	222.9
HDVP2	4/03/2019	463.6	222.9
HDVP2	3/03/2019	463.6	222.9
HDVP2	2/03/2019	463.6	222.9
HDVP2	1/03/2019	497.4	189.2
HDVP2	28/02/2019	497.4	189.2
HDVP2	27/02/2019	497.4	189.2
HDVP2	26/02/2019	497.4	189.2
HDVP2	25/02/2019	497.4	189.2
HDVP2	24/02/2019	497.4	189.2
HDVP2	23/02/2019	497.4	189.2
HDVP2	22/02/2019	497.4	189.2
HDVP2	21/02/2019	497.4	189.2
HDVP2	20/02/2019	497.4	189.2
HDVP2	19/02/2019	497.4	189.2
HDVP2	18/02/2019	497.4	189.2
HDVP2	17/02/2019	497.4	189.2
HDVP2	16/02/2019	497.4	189.2
HDVP2	15/02/2019	497.4	189.2
HDVP2	14/02/2019	497.4	189.2
HDVP2	13/02/2019	497.4	189.2
HDVP2	12/02/2019	497.4	189.2
HDVP2	11/02/2019	497.4	189.2
HDVP2	10/02/2019	497.4	189.2
HDVP2	9/02/2019	497.4	189.2
HDVP2	8/02/2019	497.4	189.2
HDVP2	7/02/2019	497.4	189.2
HDVP2	6/02/2019	497.4	189.2
HDVP2	5/02/2019	497.4	189.2
HDVP2	4/02/2019	497.4	189.2
HDVP2	3/02/2019	497.4	189.2
HDVP2	2/02/2019	497.4	189.2
HDVP2	1/02/2019	458.2	228.4
HDVP2	31/01/2019	458.2	228.4
HDVP2	30/01/2019	458.2	228.4
HDVP2	29/01/2019	458.2	228.4
HDVP2	28/01/2019	458.2	228.4
HDVP2	27/01/2019	458.2	228.4
HDVP2	26/01/2019	458.2	228.4
HDVP2	25/01/2019	458.2	228.4
HDVP2	24/01/2019	458.2	228.4
HDVP2	23/01/2019	458.2	228.4
HDVP2	22/01/2019	458.2	228.4
HDVP2	21/01/2019	458.2	228.4
HDVP2	20/01/2019	458.2	228.4
HDVP2	19/01/2019	458.2	228.4
HDVP2	18/01/2019	458.2	228.4
HDVP2	17/01/2019	458.2	228.4
HDVP2	16/01/2019	458.2	228.4
HDVP2	15/01/2019	458.2	228.4
HDVP2	14/01/2019	458.2	228.4
HDVP2	13/01/2019	458.2	228.4
HDVP2	12/01/2019	458.2	228.4
HDVP2	11/01/2019	458.2	228.4
HDVP2	10/01/2019	458.2	228.4
HDVP2	9/01/2019	458.2	228.4
HDVP2	8/01/2019	458.2	228.4
HDVP2	7/01/2019	458.2	228.4
HDVP2	6/01/2019	458.2	228.4
HDVP2	5/01/2019	458.2	228.4
HDVP2	4/01/2019	458.2	228.4
HDVP2	3/01/2019	458.2	228.4
HDVP2	2/01/2019	458.2	228.4
HDVP2	1/01/2019	503.3	183.2
HDVP2	31/12/2018	503.3	183.2
HDVP2	30/12/2018	503.3	183.2
HDVP2	29/12/2018	503.3	183.2
HDVP2	28/12/2018	503.3	183.2
HDVP2	27/12/2018	503.3	183.2
HDVP2	26/12/2018	503.3	183.2
HDVP2	25/12/2018	503.3	183.2
HDVP2	24/12/2018	503.3	183.2
HDVP2	23/12/2018	503.3	183.2
HDVP2	22/12/2018	503.3	183.2
HDVP2	21/12/2018	503.3	183.2
HDVP2	20/12/2018	503.3	183.2
HDVP2	19/12/2018	503.3	183.2
HDVP2	18/12/2018	503.3	183.2
HDVP2	17/12/2018	503.3	183.2
HDVP2	16/12/2018	503.3	183.2
HDVP2	15/12/2018	503.3	183.2
HDVP2	14/12/2018	503.3	183.2
HDVP2	13/12/2018	503.3	183.2
HDVP2	12/12/2018	503.3	183.2
HDVP2	11/12/2018	503.3	183.2
HDVP2	10/12/2018	503.3	183.2
HDVP2	9/12/2018	503.3	183.2
HDVP2	8/12/2018	503.3	183.2
HDVP2	7/12/2018	503.3	183.2
HDVP2	6/12/2018	503.3	183.2
HDVP2	5/12/2018	503.3	183.2
HDVP2	4/12/2018	503.3	183.2
HDVP2	3/12/2018	503.3	183.2
HDVP2	2/12/2018	503.3	183.2
HDVP2	1/12/2018	441.4	245.2
HDVP2	30/11/2018	441.4	245.2
HDVP2	29/11/2018	441.4	245.2
HDVP2	28/11/2018	441.4	245.2
HDVP2	27/11/2018	441.4	245.2
HDVP2	26/11/2018	441.4	245.2

ID	Date	WL mAHD	WL mbgl
MB18WON0001	14/01/2019	623.6	48.5
MB18WON0001	13/01/2019	623.6	48.5
MB18WON0001	12/01/2019	623.6	48.5
MB18WON0001	11/01/2019	623.6	48.5
MB18WON0001	10/01/2019	623.6	48.5
MB18WON0001	9/01/2019	623.6	48.5
MB18WON0001	8/01/2019	623.7	48.4
MB18WON0001	7/01/2019	623.7	48.4
MB18WON0001	6/01/2019	623.7	48.4
MB18WON0001	5/01/2019	623.7	48.4
MB18WON0001	4/01/2019	623.7	48.4
MB18WON0001	3/01/2019	623.7	48.4
MB18WON0001	2/01/2019	623.7	48.4
MB18WON0001	1/01/2019	623.7	48.4
MB18WON0001	31/12/2018	623.7	48.4
MB18WON0001	30/12/2018	623.7	48.4
MB18WON0001	29/12/2018	623.7	48.4
MB18WON0001	28/12/2018	623.7	48.4
MB18WON0001	27/12/2018	623.7	48.4
MB18WON0001	26/12/2018	623.8	48.3
MB18WON0001	25/12/2018	623.8	48.3
MB18WON0001	24/12/2018	623.8	48.3
MB18WON0001	23/12/2018	623.8	48.3
MB18WON0001	22/12/2018	623.8	48.3
MB18WON0001	21/12/2018	623.8	48.2
MB18WON0001	20/12/2018	623.8	48.2
MB18WON0001	19/12/2018	623.8	48.2
MB18WON0001	18/12/2018	623.8	48.2
MB18WON0001	17/12/2018	623.8	48.3
MB18WON0001	16/12/2018	623.8	48.3
MB18WON0001	15/12/2018	623.8	48.3
MB18WON0001	14/12/2018	623.9	48.2
MB18WON0001	13/12/2018	623.9	48.2
MB18WON0002	9/02/2022	626.0	38.6
MB18WON0002	8/02/2022	626.0	38.6
MB18WON0002	7/02/2022	626.0	38.6
MB18WON0002	6/02/2022	626.0	38.6
MB18WON0002	5/02/2022	626.0	38.6
MB18WON0002	4/02/2022	626.0	38.6
MB18WON0002	3/02/2022	626.0	38.6
MB18WON0002	2/02/2022	626.0	38.6
MB18WON0002	1/02/2022	626.0	38.7
MB18WON0002	31/01/2022	626.0	38.7
MB18WON0002	30/01/2022	626.0	38.7
MB18WON0002	29/01/2022	626.0	38.6
MB18WON0002	28/01/2022	626.0	38.7
MB18WON0002	27/01/2022	626.0	38.7
MB18WON0002	26/01/2022	626.0	38.7
MB18WON0002	25/01/2022	626.0	38.7
MB18WON0002	24/01/2022	626.0	38.6
MB18WON0002	23/01/2022	626.0	38.6
MB18WON0002	22/01/2022	626.0	38.6
MB18WON0002	21/01/2022	626.0	38.6
MB18WON0002	20/01/2022	626.0	38.6
MB18WON0002	19/01/2022	626.0	38.6
MB18WON0002	18/01/2022	626.0	38.6
MB18WON0002	17/01/2022	626.0	38.6
MB18WON0002	16/01/2022	626.0	38.7
MB18WON0002	15/01/2022	626.0	38.6
MB18WON0002	14/01/2022	626.0	38.6
MB18WON0002	13/01/2022	626.0	38.6
MB18WON0002	12/01/2022	626.0	38.6
MB18WON0002	11/01/2022	626.0	38.6
MB18WON0002	10/01/2022	626.0	38.6
MB18WON0002	9/01/2022	626.0	38.6
MB18WON0002	8/01/2022	626.0	38.6
MB18WON0002	7/01/2022	626.0	38.6
MB18WON0002	6/01/2022	626.0	38.6
MB18WON0002	5/01/2022	626.0	38.6
MB18WON0002	4/01/2022	626.0	38.6
MB18WON0002	3/01/2022	626.0	38.6
MB18WON0002	2/01/2022	626.0	38.6
MB18WON0002	1/01/2022	626.0	38.6
MB18WON0002	31/12/2021	626.0	38.6
MB18WON0002	30/12/2021	626.0	38.6
MB18WON0002	29/12/2021	626.0	38.6
MB18WON0002	28/12/2021	626.0	38.6
MB18WON0002	27/12/2021	626.0	38.6
MB18WON0002	26/12/2021	626.0	38.6
MB18WON0002	25/12/2021	626.0	38.6
MB18WON0002	24/12/2021	626.0	38.6
MB18WON0002	23/12/2021	626.0	38.6
MB18WON0002	22/12/2021	626.0	38.6
MB18WON0002	21/12/2021	626.0	38.6
MB18WON0002	20/12/2021	626.0	38.6
MB18WON0002	19/12/2021	626.0	38.6
MB18WON0002	18/12/2021	626.0	38.6
MB18WON0002	17/12/2021	626.0	38.6
MB18WON0002	16/12/2021	626.0	38.6
MB18WON0002	15/12/2021	626.0	38.6
MB18WON0002	14/12/2021	626.0	38.6
MB18WON0002	13/12/2021	626.0	38.6
MB18WON0002	12/12/2021	626.0	38.6
MB18WON0002	11/12/2021	626.0	38.6
MB18WON0002	10/12/2021	626.0	38.6
MB18WON0002	9/12/2021	626.0	38.6
MB18WON0002	8/12/2021	626.0	38.6
MB18WON0002	7/12/2021	626.0	38.6
MB18WON0002	6/12/2021	626.0	38.6
MB18WON0002	5/12/2021	626.0	38.6
MB18WON0002	4/12/2021	626.0	38.6
MB18WON0002	3/12/2021	626.0	38.6
MB18WON0002	2/12/2021	626.0	38.6
MB18WON0002	1/12/2021	626.0	38.6
MB18WON0002	30/11/2021	626.0	38.6
MB18WON0002	29/11/2021	626.0	38.6
MB18WON0002	28/11/2021	626.0	38.6
MB18WON0002	27/11/2021	626.0	38.6
MB18WON0002	26/11/2021	626.0	38.6
MB18WON0002	25/11/2021	626.0	38.6
MB18WON0002	24/11/2021	626.0	38.6
MB18WON0002	23/11/2021	626.0	38.6
MB18WON0002	22/11/2021	626.0	38.6
MB18WON0002	21/11/2021	626.0	38.6
MB18WON0002	20/11/2021	626.0	38.6
MB18WON0002	19/11/2021	626.0	38.6
MB18WON0002	18/11/2021	626.0	38.6
MB18WON0002	17/11/2021	626.0	38.6
MB18WON0002	16/11/2021	626.0	38.6
MB18WON0002	15/11/2021	626.0	38.6
MB18WON0002	14/11/2021	626.0	38.6
MB18WON0002	13/11/2021	626.0	38.6
MB18WON0002	12/11/2021	626.0	38.6
MB18WON0002	11/11/2021	626.0	38.6
MB18WON0002	10/11/2021	626.0	38.6
MB18WON0002	9/11/2021	626.0	38.6
MB18WON0002	8/11/2021	626.0	38.6
MB18WON0002	7/11/2021	626.0	38.6
MB18WON0002	6/11/2021	626.0	38.6
MB18WON0002	5/11/2021	626.0	38.6
MB18WON0002	4/11/2021	626.0	38.6
MB18WON0002	3/11/2021	626.0	38.6
MB18WON0002	2/11/2021	626.0	38.6
MB18WON0002	1/11/2021	626.0	38.6
MB18WON0002	31/10/2021	626.0	38.6
MB18WON0002	30/10/2021	626.0	38.6

ID	Date	WL mAHD	WL mbgl
MB15HD20005	7/01/2020	626.0	78.3
MB15HD20005	8/01/2020	626.0	78.4
MB15HD20005	9/01/2020	626.0	78.4
MB15HD20005	10/01/2020	626.0	78.4
MB15HD20005	11/01/2020	626.0	78.3
MB15HD20005	12/01/2020	626.0	78.3
MB15HD20005	13/01/2020	626.0	78.3
MB15HD20005	14/01/2020	626.0	78.3
MB15HD20005	15/01/2020	626.0	78.3
MB15HD20005	16/01/2020	626.1	78.3
MB15HD20005	17/01/2020	626.0	78.3
MB15HD20005	18/01/2020	626.0	78.3
MB15HD20005	19/01/2020	626.0	78.3
MB15HD20005	20/01/2020	626.0	78.3
MB15HD20005	21/01/2020	626.0	78.3
MB15HD20005	22/01/2020	626.0	78.3
MB15HD20005	23/01/2020	626.0	78.3
MB15HD20005	24/01/2020	626.0	78.3
MB15HD20005	25/01/2020	626.1	78.3
MB15HD20005	26/01/2020	626.1	78.3
MB15HD20005	27/01/2020	626.0	78.3
MB15HD20005	28/01/2020	626.0	78.3
MB15HD20005	29/01/2020	626.0	78.3
MB15HD20005	30/01/2020	626.0	78.3
MB15HD20005	31/01/2020	626.0	78.4
MB15HD20005	1/02/2020	626.0	78.3
MB15HD20005	2/02/2020	626.0	78.3
MB15HD20005	3/02/2020	626.0	78.3
MB15HD20005	4/02/2020	626.0	78.3
MB15HD20005	5/02/2020	626.0	78.3
MB15HD20005	6/02/2020	626.0	78.3
MB15HD20005	7/02/2020	626.0	78.3
MB15HD20005	8/02/2020	626.0	78.3
MB15HD20005	9/02/2020	626.0	78.3
MB15HD20005	10/02/2020	626.0	78.4
MB15HD20005	11/02/2020	626.0	78.4
MB15HD20005	12/02/2020	626.0	78.3
MB15HD20005	13/02/2020	626.0	78.3
MB15HD20005	14/02/2020	626.0	78.3
MB15HD20005	15/02/2020	626.0	78.3
MB15HD20005	16/02/2020	626.0	78.3
MB15HD20005	17/02/2020	626.0	78.3
MB15HD20005	18/02/2020	626.1	78.3
MB15HD20005	19/02/2020	626.1	78.3
MB15HD20005	20/02/2020	626.0	78.3
MB15HD20005	21/02/2020	626.0	78.3
MB15HD20005	22/02/2020	626.0	78.3
MB15HD20005	23/02/2020	626.0	78.3
MB15HD20005	24/02/2020	626.0	78.3
MB15HD20005	25/02/2020	626.0	78.3
MB15HD20005	26/02/2020	626.0	78.3
MB15HD20005	27/02/2020	626.0	78.3
MB15HD20005	28/02/2020	626.0	78.3
MB15HD20005	29/02/2020	626.0	78.3
MB15HD20005	1/03/2020	626.0	78.4
MB15HD20005	2/03/2020	626.0	78.4
MB15HD20005	3/03/2020	626.0	78.3
MB15HD20005	4/03/2020	626.0	78.3
MB15HD20005	5/03/2020	626.0	78.3
MB15HD20005	6/03/2020	626.0	78.3
MB15HD20005	7/03/2020	626.0	78.3
MB15HD20005	8/03/2020	626.1	78.3
MB15HD20005	9/03/2020	626.0	78.3
MB15HD20005	10/03/2020	626.0	78.3
MB15HD20005	11/03/2020	626.0	78.3
MB15HD20005	12/03/2020	626.0	78.3
MB15HD20005	13/03/2020	626.1	78.3
MB15HD20005	14/03/2020	626.1	78.3
MB15HD20005	15/03/2020	626.0	78.3
MB15HD20005	16/03/2020	626.0	78.3
MB15HD20005	17/03/2020	626.1	78.3
MB15HD20005	18/03/2020	626.1	78.3
MB15HD20005	19/03/2020	626.1	78.3
MB15HD20005	20/03/2020	626.1	78.3
MB15HD20005	21/03/2020	626.1	78.3
MB15HD20005	22/03/2020	626.1	78.3
MB15HD20005	23/03/2020	626.1	78.3
MB15HD20005	24/03/2020	626.1	78.3
MB15HD20005	25/03/2020	626.1	78.3
MB15HD20005	26/03/2020	626.1	78.3
MB15HD20005	27/03/2020	626.1	78.3
MB15HD20005	28/03/2020	626.1	78.3
MB15HD20005	29/03/2020	626.1	78.3
MB15HD20005	30/03/2020	626.1	78.3
MB15HD20005	31/03/2020	626.0	78.3
MB15HD20005	1/04/2020	626.0	78.3
MB15HD20005	2/04/2020	626.0	78.3
MB15HD20005	3/04/2020	626.0	78.3
MB15HD20005	4/04/2020	626.0	78.3
MB15HD20005	5/04/2020	626.1	78.3
MB15HD20005	6/04/2020	626.1	78.3
MB15HD20005	7/04/2020	626.1	78.3
MB15HD20005	8/04/2020	626.1	78.3
MB15HD20005	9/04/2020	626.1	78.3
MB15HD20005	10/04/2020	626.1	78.3
MB15HD20005	11/04/2020	626.1	78.3
MB15HD20005	12/04/2020	626.1	78.3
MB15HD20005	13/04/2020	626.1	78.3
MB15HD20005	14/04/2020	626.1	78.3
MB15HD20005	15/04/2020	626.1	78.3
MB15HD20005	16/04/2020	626.1	78.3
MB15HD20005	17/04/2020	626.1	78.3
MB15HD20005	18/04/2020	626.1	78.3
MB15HD20005	19/04/2020	626.1	78.3
MB15HD20005	20/04/2020	626.1	78.3
MB15HD20005	21/04/2020	626.1	78.3
MB15HD20005	22/04/2020	626.1	78.3
MB15HD20005	23/04/2020	626.1	78.3
MB15HD20005	24/04/2020	626.1	78.3
MB15HD20005	25/04/2020	626.1	78.3
MB15HD20005	26/04/2020	626.1	78.3
MB15HD20005	27/04/2020	626.1	78.3
MB15HD20005	28/04/2020	626.1	78.3
MB15HD20005	29/04/2020	626.1	78.3
MB15HD20005	30/04/2020	626.1	78.3
MB15HD20005	1/05/2020	626.1	78.3
MB15HD20005	2/05/2020	626.1	78.3
MB15HD20005	3/05/2020	626.1	78.3
MB15HD20005	4/05/2020	626.1	78.3
MB15HD20005	5/05/2020	626.1	78.3
MB15HD20005	6/05/2020	626.1	78.3
MB15HD20005	7/05/2020	626.1	78.3
MB15HD20005	8/05/2020	626.1	78.3
MB15HD20005	9/05/2020	626.1	78.3
MB15HD20005	10/05/2020	626.1	78.3
MB15HD20005	11/05/2020	626.1	78.3
MB15HD20005	12/05/2020	626.1	78.3
MB15HD20005	13/05/2020	626.1	78.3
MB15HD20005	14/05/2020	626.1	78.3
MB15HD20005	15/05/2020	626.1	78.3
MB15HD20005	16/05/2020	626.1	78.3
MB15HD20005	17/05/2020	626.1	78.3
MB15HD20005	18/05/2020	626.1	78.3
MB15HD20005	19/05/2020	626.1	78.3
MB15HD20005	20/05/2020	626.1	78.3
MB15HD20005	21/05/2020	626.1	78.3

ID	Date	WL mAHD	WL mbgl
MB18HD20009	1/10/2018	627.9	74.5
MB18HD20009	2/10/2018	627.9	74.5
MB18HD20009	3/10/2018	627.9	74.5
MB18HD20009	4/10/2018	627.9	74.5
MB18HD20009	5/10/2018	627.9	74.5
MB18HD20009	6/10/2018	627.9	74.5
MB18HD20009	7/10/2018	627.9	74.5
MB18HD20009	8/10/2018	627.9	74.5
MB18HD20009	9/10/2018	627.9	74.5
MB18HD20009	10/10/2018	627.9	74.6
MB18HD20009	11/10/2018	627.9	74.6
MB18HD20009	12/10/2018	627.9	74.6
MB18HD20009	13/10/2018	627.9	74.6
MB18HD20009	14/10/2018	627.9	74.6
MB18HD20009	15/10/2018	627.9	74.5
MB18HD20009	16/10/2018	627.9	74.5
MB18HD20009	18/10/2018	627.9	74.6
MB18HD20009	19/10/2018	627.9	74.5
MB18HD20009	20/10/2018	627.9	74.5
MB18HD20009	21/10/2018	627.9	74.6
MB18HD20009	22/10/2018	627.9	74.6
MB18HD20009	23/10/2018	627.9	74.6
MB18HD20009	24/10/2018	627.9	74.6
MB18HD20009	25/10/2018	627.9	74.6
MB18HD20009	26/10/2018	627.9	74.6
MB18HD20009	27/10/2018	627.9	74.6
MB18HD20009	28/10/2018	627.9	74.6
MB18HD20009	29/10/2018	627.9	74.6
MB18HD20009	30/10/2018	627.9	74.6
MB18HD20009	31/10/2018	627.9	74.6
MB18HD20009	1/11/2018	627.9	74.6
MB18HD20009	2/11/2018	627.9	74.6
MB18HD20009	4/11/2018	627.9	74.6
MB18HD20009	5/11/2018	627.9	74.6
MB18HD20009	6/11/2018	627.9	74.6
MB18HD20009	7/11/2018	627.9	74.6
MB18HD20009	8/11/2018	627.9	74.6
MB18HD20009	9/11/2018	627.9	74.6
MB18HD20009	10/11/2018	627.9	74.6
MB18HD20009	11/11/2018	627.9	74.6
MB18HD20009	12/11/2018	627.9	74.6
MB18HD20009	13/11/2018	627.9	74.6
MB18HD20009	14/11/2018	627.9	74.6
MB18HD20009	15/11/2018	627.9	74.6
MB18HD20009	16/11/2018	627.9	74.6
MB18HD20009	17/11/2018	627.9	74.6
MB18HD20009	18/11/2018	627.9	74.6
MB18HD20009	19/11/2018	627.9	74.6
MB18HD20009	20/11/2018	627.9	74.6
MB18HD20009	21/11/2018	627.9	74.6
MB18HD20009	22/11/2018	627.8	74.6
MB18HD20009	23/11/2018	627.9	74.6
MB18HD20009	24/11/2018	627.9	74.6
MB18HD20009	25/11/2018	627.9	74.6
MB18HD20009	26/11/2018	627.9	74.6
MB18HD20009	27/11/2018	627.9	74.6
MB18HD20009	28/11/2018	627.9	74.6
MB18HD20009	29/11/2018	627.8	74.6
MB18HD20009	30/11/2018	627.8	74.6
MB18HD20009	1/12/2018	627.8	74.6
MB18HD20009	2/12/2018	627.8	74.6
MB18HD20009	3/12/2018	627.9	74.6
MB18HD20009	4/12/2018	627.9	74.6
MB18HD20009	5/12/2018	627.9	74.6
MB18HD20009	6/12/2018	627.8	74.6
MB18HD20009	7/12/2018	627.9	74.6
MB18HD20009	8/12/2018	627.8	74.6
MB18HD20009	9/12/2018	627.8	74.6
MB18HD20009	10/12/2018	627.8	74.6
MB18HD20009	11/12/2018	627.8	74.6
MB18HD20009	12/12/2018	627.8	74.6
MB18HD20009	13/12/2018	627.8	74.6
MB18HD20009	14/12/2018	627.8	74.6
MB18HD20009	15/12/2018	627.8	74.7
MB18HD20009	16/12/2018	627.8	74.7
MB18HD20009	17/12/2018	627.8	74.7
MB18HD20009	18/12/2018	627.8	74.6
MB18HD20009	19/12/2018	627.9	74.6
MB18HD20009	20/12/2018	627.9	74.6
MB18HD20009	21/12/2018	627.9	74.6
MB18HD20009	22/12/2018	627.9	74.6
MB18HD20009	23/12/2018	627.9	74.6
MB18HD20009	24/12/2018	627.8	74.6
MB18HD20009	25/12/2018	627.8	74.6
MB18HD20009	26/12/2018	627.8	74.6
MB18HD20009	27/12/2018	627.8	74.7
MB18HD20009	28/12/2018	627.8	74.7
MB18HD20009	29/12/2018	627.8	74.7
MB18HD20009	30/12/2018	627.8	74.7
MB18HD20009	31/12/2018	627.8	74.7
MB18HD20009	1/01/2019	627.8	74.7
MB18HD20009	2/01/2019	627.8	74.7
MB18HD20009	3/01/2019	627.8	74.7
MB18HD20009	4/01/2019	627.9	74.6
MB18HD20009	5/01/2019	627.9	74.6
MB18HD20009	6/01/2019	627

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	25/11/2018	441.4	245.2
HDVP2	24/11/2018	441.4	245.2
HDVP2	23/11/2018	441.4	245.2
HDVP2	22/11/2018	441.4	245.2
HDVP2	21/11/2018	441.4	245.2
HDVP2	20/11/2018	441.4	245.2
HDVP2	19/11/2018	441.4	245.2
HDVP2	18/11/2018	441.4	245.2
HDVP2	17/11/2018	441.4	245.2
HDVP2	16/11/2018	441.4	245.2
HDVP2	15/11/2018	441.4	245.2
HDVP2	14/11/2018	441.4	245.2
HDVP2	13/11/2018	441.4	245.2
HDVP2	12/11/2018	441.4	245.2
HDVP2	11/11/2018	441.4	245.2
HDVP2	10/11/2018	441.4	245.2
HDVP2	9/11/2018	441.4	245.2
HDVP2	8/11/2018	441.4	245.2
HDVP2	7/11/2018	441.4	245.2
HDVP2	6/11/2018	441.4	245.2
HDVP2	5/11/2018	441.4	245.2
HDVP2	4/11/2018	441.4	245.2
HDVP2	3/11/2018	441.4	245.2
HDVP2	2/11/2018	441.4	245.2
HDVP2	1/11/2018	400.8	285.8
HDVP2	31/10/2018	400.8	285.8
HDVP2	30/10/2018	400.8	285.8
HDVP2	29/10/2018	400.8	285.8
HDVP2	28/10/2018	400.8	285.8
HDVP2	27/10/2018	400.8	285.8
HDVP2	26/10/2018	400.8	285.8
HDVP2	25/10/2018	400.8	285.8
HDVP2	24/10/2018	400.8	285.8
HDVP2	23/10/2018	400.8	285.8
HDVP2	22/10/2018	400.8	285.8
HDVP2	21/10/2018	400.8	285.8
HDVP2	20/10/2018	400.8	285.8
HDVP2	19/10/2018	400.8	285.8
HDVP2	18/10/2018	400.8	285.8
HDVP2	17/10/2018	400.8	285.8
HDVP2	16/10/2018	400.8	285.8
HDVP2	15/10/2018	400.8	285.8
HDVP2	14/10/2018	400.8	285.8
HDVP2	13/10/2018	400.8	285.8
HDVP2	12/10/2018	400.8	285.8
HDVP2	11/10/2018	400.8	285.8
HDVP2	10/10/2018	400.8	285.8
HDVP2	9/10/2018	400.8	285.8
HDVP2	8/10/2018	400.8	285.8
HDVP2	7/10/2018	400.8	285.8
HDVP2	6/10/2018	400.8	285.8
HDVP2	5/10/2018	400.8	285.8
HDVP2	4/10/2018	400.8	285.8
HDVP2	3/10/2018	400.8	285.8
HDVP2	2/10/2018	400.8	285.8
HDVP2	1/10/2018	53.3	633.2
HDVP2	30/09/2018	53.3	633.2
HDVP2	29/09/2018	53.3	633.2
HDVP2	28/09/2018	53.3	633.2
HDVP2	27/09/2018	53.3	633.2
HDVP2	26/09/2018	53.3	633.2
HDVP2	25/09/2018	53.3	633.2
HDVP2	24/09/2018	53.3	633.2
HDVP2	23/09/2018	53.3	633.2
HDVP2	22/09/2018	53.3	633.2
HDVP2	21/09/2018	53.3	633.2
HDVP2	20/09/2018	53.3	633.2
HDVP2	19/09/2018	53.3	633.2
HDVP2	18/09/2018	53.3	633.2
HDVP2	17/09/2018	53.3	633.2
HDVP2	16/09/2018	53.3	633.2
HDVP2	15/09/2018	53.3	633.2
HDVP2	14/09/2018	53.3	633.2
HDVP2	13/09/2018	53.3	633.2
HDVP2	12/09/2018	53.3	633.2
HDVP2	11/09/2018	53.3	633.2
HDVP2	10/09/2018	53.3	633.2
HDVP2	9/09/2018	53.3	633.2
HDVP2	8/09/2018	53.3	633.2
HDVP2	7/09/2018	53.3	633.2
HDVP2	6/09/2018	53.3	633.2
HDVP2	5/09/2018	53.3	633.2
HDVP2	4/09/2018	53.3	633.2
HDVP2	3/09/2018	53.3	633.2
HDVP2	2/09/2018	53.3	633.2
HDVP2	1/09/2018	53.3	633.2
HDVP2	31/08/2018	53.3	633.2
HDVP2	30/08/2018	53.3	633.2
HDVP2	29/08/2018	53.3	633.2
HDVP2	28/08/2018	53.3	633.2
HDVP2	27/08/2018	53.3	633.2
HDVP2	26/08/2018	53.3	633.2
HDVP2	25/08/2018	53.3	633.2
HDVP2	24/08/2018	53.3	633.2
HDVP2	23/08/2018	53.3	633.2
HDVP2	22/08/2018	53.3	633.2
HDVP2	21/08/2018	53.3	633.2
HDVP2	20/08/2018	53.3	633.2
HDVP2	19/08/2018	53.3	633.2
HDVP2	18/08/2018	53.3	633.2
HDVP2	17/08/2018	53.3	633.2
HDVP2	16/08/2018	53.3	633.2
HDVP2	15/08/2018	53.3	633.2
HDVP2	14/08/2018	53.3	633.2
HDVP2	13/08/2018	53.3	633.2
HDVP2	12/08/2018	53.3	633.2
HDVP2	11/08/2018	53.3	633.2
HDVP2	10/08/2018	53.3	633.2
HDVP2	9/08/2018	53.3	633.2
HDVP2	8/08/2018	53.3	633.2
HDVP2	7/08/2018	53.3	633.2
HDVP2	6/08/2018	53.3	633.2
HDVP2	5/08/2018	53.3	633.2
HDVP2	4/08/2018	53.3	633.2
HDVP2	3/08/2018	53.3	633.2
HDVP2	2/08/2018	53.3	633.2
HDVP2	1/08/2018	53.3	633.2
HDVP2	31/07/2018	53.3	633.2
HDVP2	30/07/2018	53.3	633.2
HDVP2	29/07/2018	53.3	633.2
HDVP2	28/07/2018	53.3	633.2
HDVP2	27/07/2018	53.3	633.2
HDVP2	26/07/2018	53.3	633.2
HDVP2	25/07/2018	53.3	633.2
HDVP2	24/07/2018	53.3	633.2
HDVP2	23/07/2018	53.3	633.2
HDVP2	22/07/2018	53.3	633.2
HDVP2	21/07/2018	53.3	633.2
HDVP2	20/07/2018	53.3	633.2
HDVP2	19/07/2018	53.3	633.2
HDVP2	18/07/2018	53.3	633.2
HDVP2	17/07/2018	53.3	633.2
HDVP2	16/07/2018	53.3	633.2
HDVP2	15/07/2018	53.3	633.2
HDVP2	14/07/2018	53.3	633.2
HDVP2	13/07/2018	53.3	633.2

ID	Date	WL mAHD	WL mbgl
MB18WON0002	29/10/2021	626.0	38.6
MB18WON0002	28/10/2021	626.0	38.6
MB18WON0002	27/10/2021	626.0	38.6
MB18WON0002	26/10/2021	626.0	38.6
MB18WON0002	25/10/2021	626.0	38.6
MB18WON0002	24/10/2021	626.0	38.6
MB18WON0002	23/10/2021	626.0	38.6
MB18WON0002	22/10/2021	626.0	38.6
MB18WON0002	21/10/2021	626.0	38.6
MB18WON0002	20/10/2021	626.0	38.6
MB18WON0002	19/10/2021	626.0	38.6
MB18WON0002	18/10/2021	626.0	38.6
MB18WON0002	17/10/2021	626.0	38.6
MB18WON0002	16/10/2021	626.0	38.6
MB18WON0002	15/10/2021	626.0	38.6
MB18WON0002	14/10/2021	626.0	38.6
MB18WON0002	13/10/2021	626.0	38.6
MB18WON0002	12/10/2021	626.0	38.6
MB18WON0002	11/10/2021	626.0	38.6
MB18WON0002	10/10/2021	626.0	38.6
MB18WON0002	9/10/2021	626.0	38.6
MB18WON0002	8/10/2021	626.0	38.6
MB18WON0002	7/10/2021	626.0	38.6
MB18WON0002	6/10/2021	626.0	38.6
MB18WON0002	5/10/2021	626.0	38.6
MB18WON0002	4/10/2021	626.0	38.6
MB18WON0002	3/10/2021	626.0	38.6
MB18WON0002	2/10/2021	626.0	38.6
MB18WON0002	1/10/2021	626.0	38.6
MB18WON0002	30/09/2021	626.0	38.6
MB18WON0002	29/09/2021	626.0	38.6
MB18WON0002	28/09/2021	626.0	38.6
MB18WON0002	27/09/2021	626.0	38.6
MB18WON0002	26/09/2021	626.0	38.6
MB18WON0002	25/09/2021	626.0	38.6
MB18WON0002	24/09/2021	626.0	38.6
MB18WON0002	23/09/2021	626.0	38.6
MB18WON0002	22/09/2021	626.0	38.6
MB18WON0002	21/09/2021	626.0	38.6
MB18WON0002	20/09/2021	626.0	38.6
MB18WON0002	19/09/2021	626.0	38.6
MB18WON0002	18/09/2021	626.0	38.6
MB18WON0002	17/09/2021	626.0	38.6
MB18WON0002	16/09/2021	626.0	38.6
MB18WON0002	15/09/2021	626.0	38.6
MB18WON0002	14/09/2021	626.0	38.6
MB18WON0002	13/09/2021	626.0	38.6
MB18WON0002	12/09/2021	626.0	38.6
MB18WON0002	11/09/2021	626.0	38.6
MB18WON0002	10/09/2021	626.0	38.6
MB18WON0002	9/09/2021	626.0	38.6
MB18WON0002	8/09/2021	626.0	38.6
MB18WON0002	7/09/2021	626.0	38.6
MB18WON0002	6/09/2021	626.0	38.6
MB18WON0002	5/09/2021	626.0	38.6
MB18WON0002	4/09/2021	626.0	38.6
MB18WON0002	3/09/2021	626.0	38.6
MB18WON0002	2/09/2021	626.0	38.6
MB18WON0002	1/09/2021	626.0	38.7
MB18WON0002	31/08/2021	626.0	38.7
MB18WON0002	30/08/2021	626.0	38.6
MB18WON0002	29/08/2021	626.0	38.6
MB18WON0002	28/08/2021	626.0	38.6
MB18WON0002	27/08/2021	626.0	38.7
MB18WON0002	26/08/2021	626.0	38.7
MB18WON0002	25/08/2021	626.0	38.6
MB18WON0002	24/08/2021	626.0	38.6
MB18WON0002	23/08/2021	626.0	38.6
MB18WON0002	22/08/2021	626.0	38.7
MB18WON0002	21/08/2021	626.0	38.7
MB18WON0002	20/08/2021	626.0	38.7
MB18WON0002	19/08/2021	626.0	38.7
MB18WON0002	18/08/2021	626.0	38.7
MB18WON0002	17/08/2021	626.0	38.6
MB18WON0002	16/08/2021	626.0	38.6
MB18WON0002	15/08/2021	626.0	38.6
MB18WON0002	14/08/2021	626.0	38.7
MB18WON0002	13/08/2021	626.0	38.7
MB18WON0002	12/08/2021	626.0	38.6
MB18WON0002	11/08/2021	626.0	38.6
MB18WON0002	10/08/2021	626.0	38.7
MB18WON0002	9/08/2021	626.0	38.7
MB18WON0002	8/08/2021	626.0	38.7
MB18WON0002	7/08/2021	626.0	38.7
MB18WON0002	6/08/2021	626.0	38.6
MB18WON0002	5/08/2021	626.0	38.6
MB18WON0002	4/08/2021	626.0	38.6
MB18WON0002	3/08/2021	626.0	38.7
MB18WON0002	2/08/2021	626.0	38.7
MB18WON0002	1/08/2021	625.9	38.7
MB18WON0002	31/07/2021	625.9	38.7
MB18WON0002	30/07/2021	625.9	38.7
MB18WON0002	29/07/2021	625.9	38.7
MB18WON0002	28/07/2021	625.9	38.7
MB18WON0002	27/07/2021	625.9	38.7
MB18WON0002	26/07/2021	625.9	38.7
MB18WON0002	25/07/2021	625.9	38.7
MB18WON0002	24/07/2021	625.9	38.7
MB18WON0002	23/07/2021	625.9	38.7
MB18WON0002	22/07/2021	625.9	38.7
MB18WON0002	21/07/2021	625.9	38.7
MB18WON0002	20/07/2021	625.9	38.7
MB18WON0002	19/07/2021	625.9	38.7
MB18WON0002	18/07/2021	625.9	38.7
MB18WON0002	17/07/2021	625.9	38.7
MB18WON0002	16/07/2021	625.9	38.7
MB18WON0002	15/07/2021	625.9	38.7
MB18WON0002	14/07/2021	625.9	38.7
MB18WON0002	13/07/2021	625.9	38.7
MB18WON0002	12/07/2021	625.9	38.7
MB18WON0002	11/07/2021	625.9	38.7
MB18WON0002	10/07/2021	625.9	38.7
MB18WON0002	9/07/2021	625.9	38.7
MB18WON0002	8/07/2021	625.9	38.7
MB18WON0002	7/07/2021	625.9	38.7
MB18WON0002	6/07/2021	625.9	38.7
MB18WON0002	5/07/2021	625.9	38.7
MB18WON0002	4/07/2021	625.9	38.7
MB18WON0002	3/07/2021	625.9	38.7
MB18WON0002	2/07/2021	625.9	38.7
MB18WON0002	1/07/2021	625.9	38.7
MB18WON0002	30/06/2021	625.9	38.7
MB18WON0002	29/06/2021	625.9	38.8
MB18WON0002	28/06/2021	625.9	38.8
MB18WON0002	27/06/2021	625.9	38.8
MB18WON0002	26/06/2021	625.9	38.7
MB18WON0002	25/06/2021	625.9	38.7
MB18WON0002	24/06/2021	625.9	38.8
MB18WON0002	23/06/2021	625.9	38.8
MB18WON0002	22/06/2021	625.8	38.8
MB18WON0002	21/06/2021	625.8	38.8
MB18WON0002	20/06/2021	625.8	38.8
MB18WON0002	19/06/2021	625.8	38.8
MB18WON0002	18/06/2021	625.9	38.8
MB18WON0002	17/06/2021	625.8	38.8
MB18WON0002	16/06/2021	625.8	38.8

ID	Date	WL mAHD	WL mbgl
MB15HD20005	22/05/2020	626.1	78.3
MB15HD20005	23/05/2020	626.1	78.3
MB15HD20005	24/05/2020	626.1	78.3
MB15HD20005	25/05/2020	626.1	78.3
MB15HD20005	26/05/2020	626.1	78.3
MB15HD20005	27/05/2020	626.1	78.3
MB15HD20005	28/05/2020	626.1	78.3
MB15HD20005	29/05/2020	626.1	78.3
MB15HD20005	30/05/2020	626.1	78.3
MB15HD20005	31/05/2020	626.1	78.3
MB15HD20005	1/06/2020	626.1	78.2
MB15HD20005	2/06/2020	626.1	78.2
MB15HD20005	3/06/2020	626.1	78.2
MB15HD20005	4/06/2020	626.1	78.2
MB15HD20005	5/06/2020	626.1	78.2
MB15HD20005	6/06/2020	626.1	78.2
MB15HD20005	7/06/2020	626.1	78.3
MB15HD20005	8/06/2020	626.1	78.3
MB15HD20005	9/06/2020	626.1	78.3
MB15HD20005	10/06/2020	626.1	78.3
MB15HD20005	11/06/2020	626.1	78.3
MB15HD20005	12/06/2020	626.1	78.3
MB15HD20005	13/06/2020	626.1	78.3
MB15HD20005	14/06/2020	626.1	78.3
MB15HD20005	15/06/2020	626.1	78.3
MB15HD20005	16/06/2020	626.1	78.3
MB15HD20005	17/06/2020	626.1	78.3
MB15HD20005	18/06/2020	626.1	78.3
MB15HD20005	19/06/2020	626.1	78.3
MB15HD20005	20/06/2020	626.1	78.3
MB15HD20005	21/06/2020	626.1	78.3
MB15HD20005	22/06/2020	626.1	78.3
MB15HD20005	23/06/2020	626.1	78.3
MB15HD20005	24/06/2020	626.1	78.3
MB15HD20005	25/06/2020	626.1	78.3
MB15HD20005	26/06/2020	626.1	78.3
MB15HD20005	27/06/2020	626.1	78.3
MB15HD20005	28/06/2020	626.1	78.3
MB15HD20005	29/06/2020	626.1	78.3
MB15HD20005	30/06/2020	626.1	78.3
MB15HD20005	1/07/2020	626.1	78.3
MB15HD20005	2/07/2020	626.1	78.3
MB15HD20005	3/07/2020	626.1	78.3
MB15HD20005	4/07/2020	626.1	78.3
MB15HD20005	5/07/2020	626.1	78.3
MB15HD20005	6/07/2020	626.1	78.3
MB15HD20005	7/07/2020	626.1	78.3
MB15HD20005	8/07/2020	626.1	78.3
MB15HD20005	9/07/2020	626.1	78.3
MB15HD20005	10/07/2020	626.1	78.3
MB15HD20005	11/07/2020	626.1	78.3
MB15HD20005	22/08/2021	626.0	78.4
MB15HD20005	23/08/2021	626.0	78.4
MB15HD20005	24/08/2021	626.0	78.4
MB15HD20005	25/08/2021	626.0	78.4
MB15HD20005	26/08/2021	626.0	78.4
MB15HD20005	27/08/2021	626.0	78.4
MB15HD20005	28/08/2021	626.0	78.4
MB15HD20005	29/08/2021	626.0	78.4
MB15HD20005	30/08/2021	626.0	78.4
MB15HD20005	31/08/2021	626.0	78.4
MB15HD20005	1/09/2021	626.0	78.4
MB15HD20005	2/09/2021	626.0	78.4
MB15HD20005	3/09/2021	626.0	78.4
MB15HD20005	4/09/2021	626.0	78.4
MB15HD20005	5/09/2021	626.0	78.4
MB15HD20005	6/09/2021	626.0	78.3
MB15HD20005	7/09/2021	626.0	78.3
MB15HD20005	8/09/2021	626.0	78.3
MB15HD20005	9/09/2021	626.0	78.3
MB15HD20005	10/09/2021	626.0	78.3
MB15HD20005	11/09/2021	626.0	78.4
MB15HD20005	12/09/2021	626.0	78.4
MB15HD20005	13/09/2021	626.0	78.4
MB15HD20005	14/09/2021	626.0	78.4
MB15HD20005	15/09/2021	626.0	78.4
MB15HD20005	16/09/2021	626.0	78.4
MB15HD20005	17/09/2021	626.0	78.4
MB15HD20005	18/09/2021	626.0	78.4
MB15HD20005	19/09/2021	626.0	78.4
MB15HD20005	20/09/2021	626.0	78.4
MB15HD20005	21/09/2021	626.0	78.3
MB15HD20005	22/09/2021	626.0	78.3
MB15HD20005	23/09/2021	626.0	78.4
MB15HD20005	24/09/2021	626.0	78.4
MB15HD20005	25/09/2021	626.0	78.4
MB15HD20005	26/09/2021	626.0	78.4
MB15HD20005	27/09/2021	626.0	78.4
MB15HD20005	28/09/2021	626.0	78.4
MB15HD20005	29/09/2021	626.0	78.4
MB15HD20005	30/09/2021	626.0	78.4
MB15HD20005	1/10/2021	625.9	78.4
MB15HD20005	4/10/2021	625.9	78.4
MB15HD20005	5/10/2021	625.9	78.4
MB15HD20005	6/10/2021	625.9	78.4
MB15HD20005	7/10/2021	625.9	78.4
MB15HD20005	8/10/2021	625.9	78.4
MB15HD20005	9/10/2021	625.9	78.4
MB15HD20005	10/10/2021	626.0	78.4
MB15HD20005	11/10/2021	625.9	78.4
MB15HD20005	12/10/2021	625.9	78.4
MB15HD20005	13/10/2021	625.9	78.4
MB15HD20005	14/10/2021	625.9	78.4
MB15HD20005	15/10/2021	625.9	78.4
MB15HD20005	16/10/2021	625.9	78.4
MB15HD20005	17/10/2021	625.9	78.4
MB15HD20005	18/10/2021	625.9	78.4
MB15HD20005	19/10/2021	625.9	78.4
MB15HD20005	20/10/2021	626.0	78.4
MB15HD20005	21/10/2021	626.0	78.4
MB15HD20005	22/10/2021	626.0	78.4
MB15HD20005	23/10/2021	626.0	78.4
MB15HD20005	24/10/2021	626.0	78.4
MB15HD20005	25/10/2021	625.9	78.4
MB15HD20005	26/10/2021	625.9	78.4
MB15HD20005	27/10/2021	625.9	78.4
MB15HD20005	28/10/2021	625.9	78.4
MB15HD20005	1/11/2021	625.9	78.4
MB15HD20005	2/11/2021	625.9	78.4
MB15HD20005	3/11/2021	625.9	78.4
MB15HD20005	4/11/2021	625.9	78.4
MB15HD20005	5/11/2021	625.9	78.4
MB15HD20005	6/11/2021	625.9	78.4
MB15HD20005	7/11/2021	625.9	78.5
MB15HD20005	8/11/2021	625.9	78.5
MB15HD20005	9/11/2021	625.9	78.5
MB15HD20005	10/11/2021	625.9	78.5
MB15HD20005	11/11/2021	625.9	78.4
MB15HD20005	12/11/2021	626.0	78.4
MB15HD20005	13/11/2021	626.0	78.4
MB15HD20005	14/11/2021	626.0	78.4
MB15HD20005	15/11/2021	626.0	78.4
MB15HD20005	16/11/2021	626.0	78.4
MB15HD20005	17/11/2021	626.0	78.4
MB15HD20005	18/11/2021	626.0	78.4
MB15HD20005	19/11/2021	625.9	78.4

ID	Date	WL mAHD	WL mbgl
MB18HD20009	16/02/2019	627.8	74.6
MB18HD20009	17/02/2019	627.8	74.7
MB18HD20009	18/02/2019	627.8	74.7
MB18HD20009	19/02/2019	627.8	74.7
MB18HD20009	20/02/2019	627.8	74.6
MB18HD20009	21/02/2019	627.8	74.6
MB18HD20009	22/02/2019	627.8	74.6
MB18HD20009	23/02/2019	627.8	74.6
MB18HD20009	24/02/2019	627.8	74.6
MB18HD20009	25/02/2019	627.8	74.6
MB18HD20009	26/02/2019	627.8	74.6
MB18HD20009	27/02/2019	627.8	74.7
MB18HD20009	28/02/2019	627.8	74.7
MB18HD20009	1/03/2019	627.8	74.7
MB18HD20009	2/03/2019	627.8	74.7
MB18HD20009	3/03/2019	627.8	74.7
MB18HD20009	4/03/2019	627.8	74.6
MB18HD20009	5/03/2019	627.8	74.7
MB18HD20009	6/03/2019	627.8	74.7
MB18HD20009	7/03/2019	627.8	74.7
MB18HD20009	8/03/2019	627.8	74.7
MB18HD20009	9/03/2019	627.8	74.6
MB18HD20009	10/03/2019	627.8	74.7
MB18HD20009	11/03/2019	627.8	74.7
MB18HD20009	12/03/2019	627.8	74.6
MB18HD20009	13/03/2019	627.8	74.6
MB18HD20009	14/03/2019	627.8	74.6
MB18HD20009	15/03/2019	627.8	74.7
MB18HD20009	16/03/2019	627.8	74.7
MB18HD20009	17/03/2019	627.8	74.7
MB18HD20009	18/03/2019	627.8	74.7
MB18HD20009	19/03/2019	627.8	74.7
MB18HD20009	20/03/2019	627.8	74.7
MB18HD20009	21/03/2019	627.8	74.7
MB18HD20009	22/03/2019	627.8	74.7
MB18HD20009	23/03/2019	627.8	74.7
MB18HD20009	24/03/2019	627.8	74.7
MB18HD20009	25/03/2019	627.8	74.7
MB18HD20009	26/03/2019	627.8	74.7
MB18HD20009	27/03/2019	627.8	74.7
MB18HD20009	28/03/2019	627.8	74.7
MB18HD20009	29/03/2019	627.8	74.7
MB18HD20009	30/03/2019	627.8	74.6
MB18HD20009	31/03/2019	627.8	74.6
MB18HD20009	1/04/2019	627.8	74.6
MB18HD20009	2/04/2019	627.8	74.7
MB18HD20009	3/04/2019	627.8	74.6
MB18HD20009	4/04/2019	627.8	74.6
MB18HD20009	5/04/2019	627.8	74.6
MB18HD20009	6/04/2019	627.8	74.6
MB18HD20009	7/04/2019	627.8	74.7
MB18HD20009	8/04/2019	627.8	74.7
MB18HD20009	9/04/2019	627.8	74.7
MB18HD20009	10/04/2019	627.8	74.7
MB18HD20009	11/04/2019	627.8	74.7
MB18HD20009	12/04/2019	627.8	74.7
MB18HD20009	13/04/2019	627.8	74.7
MB18HD20009	14/04/2019	627.8	74.7
MB18HD20009	15/04/2019	627.8	74.7
MB18HD20009	16/04/2019	627.8	74.7
MB18HD20009	17/04/2019	627.8	74.6
MB18HD20009	18/04/2019	627.8	74.7
MB18HD20009	19/04/2019	627.8	74.7
MB18HD20009	20/04/2019	627.8	74.6
MB18HD20009	21/04/2019	627.9	74.6
MB18HD20009	22/04/2019	627.8	74.6
MB18HD20009	23/04/2019	627.8	74.6
MB18HD20009	24/04/2019	627.9	74.6
MB18HD20009	25/04/2019	627.8	74.6
MB18HD20009	26/04/2019	627.8	74.6
MB18HD20009	27/04/2019	627.9	74.6
MB18HD20009	28/04/2019	627.9	74.6
MB18HD20009	29/04/2019	627.8	74.7
MB18HD20009	30/04/2019	627.8	74.7
MB18HD20009	1/05/2019	627.8	74.7
MB18HD20009	2/05/2019	627.8	74.7
MB18HD20009	3/05/2019	627.8	74.6
MB18HD20009	4/05/2019	627.9	74.6
MB18HD20009	5/05/2019	627.8	74.6
MB18HD20009	6/05/2019	627.8	74.6
MB18HD20009	7/05/2019	627.8	74.6
MB18HD20009	8/05/2019	627.9	74.6
MB18HD20009	9/05/2019	627.9	74.6
MB18HD20009	10/05/2019	627.9	74.6
MB18HD20009	11/05/2019	627.9	74.6
MB18HD20009	12/05/2019	627.9	74.6
MB18HD20009	13/05/2019	627.9	74.6
MB18HD20009	14/05/2019	627.9	74.6
MB18HD20009	15/05/2019	627.9	74.6
MB18HD20009	16/05/2019	627.8	74.6
MB18HD20009	17/05/2019	627.8	74.7
MB18HD20009	18/05/2019	627.8	74.6
MB18HD20009	19/05/2019	627.8	74.6
MB18HD20009	20/05/2019	627.8	74.6
MB18HD20009	21/05/2019	627.8	74.6
MB18HD20009	22/05/2019	627

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	12/07/2018	53.3	633.2
HDVP2	11/07/2018	53.3	633.2
HDVP2	10/07/2018	53.3	633.2
HDVP2	9/07/2018	53.3	633.2
HDVP2	8/07/2018	53.3	633.2
HDVP2	7/07/2018	53.3	633.2
HDVP2	6/07/2018	53.3	633.2
HDVP2	5/07/2018	53.3	633.2
HDVP2	4/07/2018	53.3	633.2
HDVP2	3/07/2018	53.3	633.2
HDVP2	2/07/2018	53.3	633.2
HDVP2	1/07/2018	765.3	-78.7
HDVP2	30/06/2018	765.3	-78.7
HDVP2	29/06/2018	765.3	-78.7
HDVP2	28/06/2018	765.3	-78.7
HDVP2	27/06/2018	765.3	-78.7
HDVP2	26/06/2018	765.3	-78.7
HDVP2	25/06/2018	765.3	-78.7
HDVP2	24/06/2018	765.3	-78.7
HDVP2	23/06/2018	765.3	-78.7
HDVP2	22/06/2018	765.3	-78.7
HDVP2	21/06/2018	765.3	-78.7
HDVP2	20/06/2018	765.3	-78.7
HDVP2	19/06/2018	765.3	-78.7
HDVP2	18/06/2018	765.3	-78.7
HDVP2	17/06/2018	765.3	-78.7
HDVP2	16/06/2018	765.3	-78.7
HDVP2	15/06/2018	765.3	-78.7
HDVP2	14/06/2018	765.3	-78.7
HDVP2	13/06/2018	765.3	-78.7
HDVP2	12/06/2018	765.3	-78.7
HDVP2	11/06/2018	765.3	-78.7
HDVP2	10/06/2018	765.3	-78.7
HDVP2	9/06/2018	765.3	-78.7
HDVP2	8/06/2018	765.3	-78.7
HDVP2	7/06/2018	765.3	-78.7
HDVP2	6/06/2018	765.3	-78.7
HDVP2	5/06/2018	765.3	-78.7
HDVP2	4/06/2018	765.3	-78.7
HDVP2	3/06/2018	765.3	-78.7
HDVP2	2/06/2018	765.3	-78.7
HDVP2	1/06/2018	525.6	160.9
HDVP2	31/05/2018	525.6	160.9
HDVP2	30/05/2018	525.6	160.9
HDVP2	29/05/2018	525.6	160.9
HDVP2	28/05/2018	525.6	160.9
HDVP2	27/05/2018	525.6	160.9
HDVP2	26/05/2018	525.6	160.9
HDVP2	25/05/2018	525.6	160.9
HDVP2	24/05/2018	525.6	160.9
HDVP2	23/05/2018	525.6	160.9
HDVP2	22/05/2018	525.6	160.9
HDVP2	21/05/2018	525.6	160.9
HDVP2	20/05/2018	525.6	160.9
HDVP2	19/05/2018	525.6	160.9
HDVP2	18/05/2018	525.6	160.9
HDVP2	17/05/2018	525.6	160.9
HDVP2	16/05/2018	525.6	160.9
HDVP2	15/05/2018	525.6	160.9
HDVP2	14/05/2018	525.6	160.9
HDVP2	13/05/2018	525.6	160.9
HDVP2	12/05/2018	525.6	160.9
HDVP2	11/05/2018	525.6	160.9
HDVP2	10/05/2018	525.6	160.9
HDVP2	9/05/2018	525.6	160.9
HDVP2	8/05/2018	525.6	160.9
HDVP2	7/05/2018	525.6	160.9
HDVP2	6/05/2018	525.6	160.9
HDVP2	5/05/2018	525.6	160.9
HDVP2	4/05/2018	525.6	160.9
HDVP2	3/05/2018	525.6	160.9
HDVP2	2/05/2018	525.6	160.9
HDVP2	1/05/2018	488.7	197.8
HDVP2	30/04/2018	488.7	197.8
HDVP2	29/04/2018	488.7	197.8
HDVP2	28/04/2018	488.7	197.8
HDVP2	27/04/2018	488.7	197.8
HDVP2	26/04/2018	488.7	197.8
HDVP2	25/04/2018	488.7	197.8
HDVP2	24/04/2018	488.7	197.8
HDVP2	23/04/2018	488.7	197.8
HDVP2	22/04/2018	488.7	197.8
HDVP2	21/04/2018	488.7	197.8
HDVP2	20/04/2018	488.7	197.8
HDVP2	19/04/2018	488.7	197.8
HDVP2	18/04/2018	488.7	197.8
HDVP2	17/04/2018	488.7	197.8
HDVP2	16/04/2018	488.7	197.8
HDVP2	15/04/2018	488.7	197.8
HDVP2	14/04/2018	488.7	197.8
HDVP2	13/04/2018	488.7	197.8
HDVP2	12/04/2018	488.7	197.8
HDVP2	11/04/2018	488.7	197.8
HDVP2	10/04/2018	488.7	197.8
HDVP2	9/04/2018	488.7	197.8
HDVP2	8/04/2018	488.7	197.8
HDVP2	7/04/2018	488.7	197.8
HDVP2	6/04/2018	488.7	197.8
HDVP2	5/04/2018	488.7	197.8
HDVP2	4/04/2018	488.7	197.8
HDVP2	3/04/2018	488.7	197.8
HDVP2	2/04/2018	488.7	197.8
HDVP2	1/04/2018	541.0	145.6
HDVP2	31/03/2018	541.0	145.6
HDVP2	30/03/2018	541.0	145.6
HDVP2	29/03/2018	541.0	145.6
HDVP2	28/03/2018	541.0	145.6
HDVP2	27/03/2018	541.0	145.6
HDVP2	26/03/2018	541.0	145.6
HDVP2	25/03/2018	541.0	145.6
HDVP2	24/03/2018	541.0	145.6
HDVP2	23/03/2018	541.0	145.6
HDVP2	22/03/2018	541.0	145.6
HDVP2	21/03/2018	541.0	145.6
HDVP2	20/03/2018	541.0	145.6
HDVP2	19/03/2018	541.0	145.6
HDVP2	18/03/2018	541.0	145.6
HDVP2	17/03/2018	541.0	145.6
HDVP2	16/03/2018	541.0	145.6
HDVP2	15/03/2018	541.0	145.6
HDVP2	14/03/2018	541.0	145.6
HDVP2	13/03/2018	541.0	145.6
HDVP2	12/03/2018	541.0	145.6
HDVP2	11/03/2018	541.0	145.6
HDVP2	10/03/2018	541.0	145.6
HDVP2	9/03/2018	541.0	145.6
HDVP2	8/03/2018	541.0	145.6
HDVP2	7/03/2018	541.0	145.6
HDVP2	6/03/2018	541.0	145.6
HDVP2	5/03/2018	541.0	145.6
HDVP2	4/03/2018	541.0	145.6
HDVP2	3/03/2018	541.0	145.6
HDVP2	2/03/2018	541.0	145.6
HDVP2	1/03/2018	484.3	202.3
HDVP2	28/02/2018	484.3	202.3
HDVP2	27/02/2018	484.3	202.3

ID	Date	WL mAHD	WL mbgl
MB18WON0002	15/06/2021	625.8	38.8
MB18WON0002	14/06/2021	625.8	38.8
MB18WON0002	13/06/2021	625.8	38.8
MB18WON0002	12/06/2021	625.8	38.8
MB18WON0002	11/06/2021	625.8	38.8
MB18WON0002	10/06/2021	625.8	38.8
MB18WON0002	9/06/2021	625.8	38.8
MB18WON0002	8/06/2021	625.8	38.8
MB18WON0002	7/06/2021	625.8	38.8
MB18WON0002	6/06/2021	625.8	38.9
MB18WON0002	5/06/2021	625.8	38.9
MB18WON0002	4/06/2021	625.8	38.9
MB18WON0002	3/06/2021	625.7	38.9
MB18WON0002	2/06/2021	625.7	38.9
MB18WON0002	1/06/2021	625.7	38.9
MB18WON0002	31/05/2021	625.7	38.9
MB18WON0002	30/05/2021	625.7	39.0
MB18WON0002	29/05/2021	625.6	39.0
MB18WON0002	28/05/2021	625.6	39.0
MB18WON0002	27/05/2021	625.6	39.1
MB18WON0002	26/05/2021	625.5	39.1
MB18WON0002	25/05/2021	625.3	39.3
MB18WON0002	24/05/2021	623.6	41.0
MB18WON0002	23/05/2021	626.1	38.6
MB18WON0002	22/05/2021	626.1	38.6
MB18WON0002	21/05/2021	626.1	38.5
MB18WON0002	20/05/2021	626.1	38.5
MB18WON0002	19/05/2021	626.1	38.6
MB18WON0002	18/05/2021	626.1	38.6
MB18WON0002	17/05/2021	626.1	38.5
MB18WON0002	16/05/2021	626.1	38.5
MB18WON0002	15/05/2021	626.1	38.5
MB18WON0002	14/05/2021	626.1	38.5
MB18WON0002	13/05/2021	626.1	38.5
MB18WON0002	12/05/2021	626.1	38.6
MB18WON0002	11/05/2021	626.1	38.6
MB18WON0002	10/05/2021	626.1	38.5
MB18WON0002	9/05/2021	626.1	38.6
MB18WON0002	8/05/2021	626.1	38.6
MB18WON0002	7/05/2021	626.1	38.6
MB18WON0002	6/05/2021	626.1	38.6
MB18WON0002	5/05/2021	626.0	38.6
MB18WON0002	4/05/2021	626.0	38.6
MB18WON0002	3/05/2021	626.1	38.6
MB18WON0002	2/05/2021	626.1	38.6
MB18WON0002	1/05/2021	626.1	38.6
MB18WON0002	30/04/2021	626.1	38.6
MB18WON0002	29/04/2021	626.1	38.6
MB18WON0002	28/04/2021	626.1	38.6
MB18WON0002	27/04/2021	626.1	38.6
MB18WON0002	26/04/2021	626.1	38.6
MB18WON0002	25/04/2021	626.1	38.6
MB18WON0002	24/04/2021	626.1	38.6
MB18WON0002	23/04/2021	626.1	38.6
MB18WON0002	22/04/2021	626.1	38.6
MB18WON0002	21/04/2021	626.1	38.6
MB18WON0002	20/04/2021	626.1	38.6
MB18WON0002	19/04/2021	626.0	38.6
MB18WON0002	18/04/2021	626.1	38.6
MB18WON0002	17/04/2021	626.1	38.6
MB18WON0002	16/04/2021	626.1	38.6
MB18WON0002	15/04/2021	626.1	38.6
MB18WON0002	14/04/2021	626.0	38.6
MB18WON0002	13/04/2021	626.0	38.6
MB18WON0002	12/04/2021	626.0	38.6
MB18WON0002	11/04/2021	626.0	38.6
MB18WON0002	10/04/2021	626.0	38.6
MB18WON0002	9/04/2021	626.0	38.6
MB18WON0002	8/04/2021	626.0	38.6
MB18WON0002	7/04/2021	626.0	38.6
MB18WON0002	6/04/2021	626.0	38.6
MB18WON0002	5/04/2021	626.0	38.6
MB18WON0002	4/04/2021	626.0	38.6
MB18WON0002	3/04/2021	626.0	38.6
MB18WON0002	2/04/2021	626.0	38.6
MB18WON0002	1/04/2021	626.0	38.6
MB18WON0002	31/03/2021	626.0	38.6
MB18WON0002	30/03/2021	626.0	38.6
MB18WON0002	29/03/2021	626.0	38.6
MB18WON0002	28/03/2021	626.0	38.6
MB18WON0002	27/03/2021	626.0	38.6
MB18WON0002	26/03/2021	626.0	38.6
MB18WON0002	25/03/2021	626.0	38.6
MB18WON0002	24/03/2021	626.0	38.6
MB18WON0002	23/03/2021	626.0	38.6
MB18WON0002	22/03/2021	626.0	38.6
MB18WON0002	21/03/2021	626.0	38.6
MB18WON0002	20/03/2021	626.0	38.6
MB18WON0002	19/03/2021	626.0	38.6
MB18WON0002	18/03/2021	626.0	38.6
MB18WON0002	17/03/2021	626.0	38.6
MB18WON0002	16/03/2021	626.0	38.6
MB18WON0002	15/03/2021	626.0	38.6
MB18WON0002	14/03/2021	626.0	38.6
MB18WON0002	13/03/2021	626.0	38.6
MB18WON0002	12/03/2021	626.0	38.6
MB18WON0002	11/03/2021	626.0	38.6
MB18WON0002	10/03/2021	626.0	38.6
MB18WON0002	9/03/2021	626.0	38.6
MB18WON0002	8/03/2021	626.0	38.6
MB18WON0002	7/03/2021	626.0	38.6
MB18WON0002	6/03/2021	626.0	38.6
MB18WON0002	5/03/2021	626.0	38.6
MB18WON0002	4/03/2021	626.0	38.6
MB18WON0002	3/03/2021	626.0	38.6
MB18WON0002	2/03/2021	626.0	38.6
MB18WON0002	1/03/2021	626.0	38.6
MB18WON0002	28/02/2021	626.0	38.6
MB18WON0002	27/02/2021	626.0	38.6
MB18WON0002	26/02/2021	626.0	38.6
MB18WON0002	25/02/2021	626.0	38.6
MB18WON0002	24/02/2021	626.0	38.6
MB18WON0002	23/02/2021	626.0	38.6
MB18WON0002	22/02/2021	626.0	38.6
MB18WON0002	21/02/2021	626.0	38.6
MB18WON0002	20/02/2021	626.0	38.6
MB18WON0002	19/02/2021	626.0	38.6
MB18WON0002	18/02/2021	626.0	38.6
MB18WON0002	17/02/2021	626.0	38.6
MB18WON0002	16/02/2021	626.0	38.6
MB18WON0002	15/02/2021	626.0	38.6
MB18WON0002	14/02/2021	626.0	38.6
MB18WON0002	13/02/2021	626.0	38.6
MB18WON0002	12/02/2021	626.0	38.6
MB18WON0002	11/02/2021	626.0	38.7
MB18WON0002	10/02/2021	626.0	38.7
MB18WON0002	9/02/2021	626.0	38.7
MB18WON0002	8/02/2021	626.0	38.7
MB18WON0002	7/02/2021	626.0	38.7
MB18WON0002	6/02/2021	626.0	38.7
MB18WON0002	5/02/2021	626.0	38.7
MB18WON0002	4/02/2021	626.0	38.7
MB18WON0002	3/02/2021	626.0	38.7
MB18WON0002	2/02/2021	626.0	38.7
MB18WON0002	1/02/2021	626.0	38.7
MB18WON0002	31/01/2021	626.0	38.7

ID	Date	WL mAHD	WL mbgl
MB15HD20005	20/11/2021	625.9	78.4
MB15HD20005	21/11/2021	626.0	78.4
MB15HD20005	22/11/2021	626.0	78.4
MB15HD20005	23/11/2021	626.0	78.4
MB15HD20005	24/11/2021	626.0	78.4
MB15HD20005	25/11/2021	626.0	78.4
MB15HD20005	26/11/2021	626.0	78.4
MB15HD20005	27/11/2021	626.0	78.4
MB15HD20005	28/11/2021	626.0	78.4
MB15HD20005	29/11/2021	626.0	78.4
MB15HD20005	30/11/2021	626.0	78.4
MB15HD20005	1/12/2021	625.9	78.4
MB15HD20005	2/12/2021	625.9	78.4
MB15HD20005	3/12/2021	625.9	78.4
MB15HD20005	4/12/2021	625.9	78.4
MB15HD20005	5/12/2021	625.9	78.4
MB15HD20005	6/12/2021	625.9	78.4
MB15HD20005	7/12/2021	625.9	78.4
MB15HD20005	8/12/2021	626.0	78.4
MB15HD20005	9/12/2021	626.0	78.4
MB15HD20005	10/12/2021	626.0	78.4
MB15HD20005	11/12/2021	625.9	78.4
MB15HD20005	12/12/2021	626.0	78.4
MB15HD20005	13/12/2021	625.9	78.4
MB15HD20005	14/12/2021	625.9	78.4
MB15HD20005	15/12/2021	625.9	78.4
MB15HD20005	16/12/2021	625.9	78.4
MB15HD20005	17/12/2021	625.9	78.4
MB15HD20005	18/12/2021	625.9	78.4
MB15HD20005	19/12/2021	626.0	78.4
MB15HD20005	20/12/2021	626.0	78.4
MB15HD20005	21/12/2021	626.0	78.4
MB15HD20005	22/12/2021	625.9	78.4
MB15HD20005	23/12/2021	625.9	78.4
MB15HD20005	24/12/2021	625.9	78.4
MB15HD20005	25/12/2021	625.9	78.4
MB15HD20005	26/12/2021	625.9	78.4
MB15HD20005	30/12/2021	625.9	78.4
MB15HD20005	31/12/2021	625.9	78.4
MB15HD20005	1/01/2022	625.9	78.5
MB15HD20005	2/01/2022	625.9	78.4
MB15HD20005	3/01/2022	625.9	78.4
MB15HD20005	4/01/2022	625.9	78.4
MB15HD20005	5/01/2022	625.9	78.4
MB15HD20005	6/01/2022	625.9	78.4
MB15HD20005	7/01/2022	625.9	78.4
MB15HD20005	8/01/2022	625.9	78.4
MB15HD20005	9/01/2022	625.9	78.4
MB15HD20005	10/01/2022	625.9	78.4
MB15HD20005	11/01/2022	625.9	78.4
MB15HD20005	12/01/2022	626.0	78.4
MB15HD20005	13/01/2022	625.9	78.4
MB15HD20005	14/01/2022	625.9	78.4
MB15HD20005	15/01/2022	625.9	78.5
MB15HD20005	16/01/2022	625.9	78.5
MB15HD20005	17/01/2022	625.9	78.5
MB15HD20005	18/01/2022	625.9	78.5
MB15HD20005	19/01/2022	625.9	78.4
MB15HD20005	20/01/2022	625.9	78.4
MB15HD20005	21/01/2022	625.9	78.4
MB15HD20005	22/01/2022	625.9	78.4
MB15HD20005	23/01/2022	625.9	78.4
MB15HD20005	24/01/2022	625.9	78.5
MB15HD20005	25/01/2022	625.9	78.5
MB15HD20005	26/01/2022	625.9	78.5
MB15HD20005	27/01/2022	625.9	78.5
MB15HD20005	28/01/2022	625.9	78.5
MB15HD20005	29/01/2022	625.9	78.5
MB15HD20005	30/01/2022	625.9	78.5
MB15HD20005	31/01/2022	625.9	78.5
MB15HD20005	1/02/2022	625.9	78.5
MB15HD20005	2/02/2022	625.9	78.5
MB15HD20005	3/02/2022	625.9	78.5
MB15HD20005	4/02/2022	625.9	78.5
MB15HD20005	5/02/2022	625.9	78.5
MB15HD20005	6/02/2022	625.9	78.5
MB15HD20005	7/02/2022	625.9	78.5
MB15HD20005	8/02/2022	625.9	78.4
MB15HD20005	9/02/2022	625.9	78.4
MB15HD20005	10/02/2022	625.9	78.4
MB15HD20005	11/02/2022	625.9	78.4
MB15HD20005	12/02/2022	625.9	78.4
MB15HD20005	13/02/2022	626.0	78.4
MB15HD20005	14/02/2022	626.0	78.4
MB15HD20005	15/02/2022	626.0	78.4
MB15HD20005	16/02/2022	626.0	78.4
MB15HD20005	17/02/2022	626.0	78.4
MB15HD20005	18/02/2022	626.0	78.4
MB15HD20005	19/02/2022	626.0	78.4
MB15HD20005	20/02/2022	626.0	78.4
MB15HD20005	21/02/2022	625.9	78.4
MB15HD20005	22/02/2022	625.9	78.4
MB15HD20005	23/02/2022	625.9	78.4
MB15HD20005	24/02/2022	625.9	78.4
MB15HD20005	25/02/2022	625.9	78.4
MB15HD20005	26/02/2022	625.9	78.4
MB15HD20005	27/02/2022	625.9	78.5
MB15HD20005	28/02/2022	625.9	78.5
MB15HD20005	1/03/2022	625.9	78.5
MB15HD20005	2/03/2022	625.9	78.5
MB15HD20005	3/03/2022	625.9	78.5
MB15HD20005	4/03/2022	625.9	78.5
MB15HD20005	5/03/2022	625.9	78.4
MB15HD20005	6/03/2022	625.9	78.4
MB15HD20005	7/03/2022	625.9	78.4
MB15HD20005	8/03/2022	625.9	78.4
MB15HD20005	9/03/2022	625.9	78.4
MB15HD20005	10/03/2022	625.9	78.4
MB15HD20005	11/03/2022	625.9	78.4
MB15HD20005	12/03/2022	625.9	78.4
MB15HD20005	13/03/2022	625.9	78.4
MB15HD20005	14/03/2022	625.9	78.4
MB15HD20005	15/03/2022	625.9	78.4
MB15HD20005	16/03/2022	625.9	78.4
MB15HD20006	4/02/2016	625.4	76.7
MB15HD20006	2/05/2016	625.4	76.7
MB15HD20006	30/10/2016	625.4	76.7
MB15HD20006	19/02/2017	625.4	76.7
MB15HD20006	14/05/2017	625.4	76.7
MB15HD20006	21/08/2017	625.4	76.7
MB15HD20006	9/11/2017	625.4	76.6
MB15HD20006	12/04/2018	625.4	76.6
MB15HD20006	21/11/2018	625.3	76.8
MB15HD20006	22/11/2018	625.3	76.8
MB15HD20006	23/11/2018	625.3	76.8
MB15HD20006	24/11/2018	625.3	76.8
MB15HD20006	25/11/2018	625.3	76.8
MB15HD20006	26/11/2018	625.3	76.8
MB15HD20006	27/11/2018	625.3	76.8
MB15HD20006	28/11/2018	625.3	76.8
MB15HD20006	29/11/2018	625.3	76.8
MB15HD20006	30/11/2018	625.3	76.8
MB15HD20006	1/12/2018	625.3	76.8
MB15HD20006	2/12/2018	625.3	76.8
MB15HD20006	3/12/2018	625.3	76.8
MB15HD20006	4/12/2018	625.3	76.8

ID	Date	WL mAHD	WL mbgl
MB18HD20009	4/07/2019	627.8	74.7
MB18HD20009	5/07/2019	627.8	74.7
MB18HD20009	6/07/2019	627.8	74.7
MB18HD20009	7/07/2019	627.8	74.6
MB18HD20009	8/07/2019	627.8	74.6
MB18HD20009	9/07/2019	627.8	74.6
MB18HD20009	10/07/2019	627.8	74.6
MB18HD20009	11/07/2019	627.9	74.6
MB18HD20009	12/07/2019	627.9	74.6
MB18HD20009	13/07/2019	627.9	74.6
MB18HD20009	14/07/2019	627.9	74.6
MB18HD20009	15/07/2019	627.9	74.6
MB18HD20009	16/07/2019	627.9	74.6
MB18HD20009	18/07/2019	627.8	74.6
MB18HD20009	19/07/2019	627.8	74.7
MB18HD20009	20/07/2019	627.8	74.7
MB18HD20009	21/07/2019	627.8	74.7
MB18HD20009	23/07/2019	627.8	74.6
MB18HD20009	24/07/2019	627.9	74.6
MB18HD20009	25/07/2019	627.8	74.6
MB18HD20009	26/07/2019	627.8	74.7
MB18HD20009	27/07/2019	627.8	74.7
MB18HD20009	28/07/2019	627.8	74.7
MB18HD20009	29/07/2019	627.8	74.7
MB18HD20009	30/07/2019	627.8	74.6
MB18HD20009	31/07/2019	627.9	74.6
MB18HD20009	1/08/2019	627.9	74.6
MB18HD20009	2/08/2019	627.9	74.6
MB18HD20009	3/08/2019	627.9	74.6
MB18HD20009	4/08/2019	627.9	74.6
MB18HD20009	5/08/2019	627.8	74.6
MB18HD20009	6/08/2019	627.8	74.7
MB18HD20009	7/08/2019	627.8	74.6
MB18HD20009	8/08/2019	627.9	74.6
MB18HD20009	10/08/2019	627.9	74.6
MB18HD20009	12/08/2019	627.8	74.6
MB18HD20009	13/08/2019	627.8	74.6
MB18HD20009	14/08/2019	627.8	74.7
MB18HD20009	15/08/2019	627.8	74.7
MB18HD20009	16/08/2019	627.8	74.6
MB18HD20009	17/08/2019	627.8	74.6
MB18HD20009	18/08/2019	627.9	74.6
MB18HD20009	19/08/2019	627.9	74.6
MB18HD20009	20/08/2019	627.9	74.6
MB18HD20009	21/08/2019	627.9	74.6
MB18HD20009	22/08/2019	627.9	74.6
MB18HD20009	23/08/2019	627.8	74.6
MB18HD20009	24/08/2019	627.8	74.7
MB18HD20009	25/08/2019	627.8	74.7
MB18HD20009	26/08/2019	627.8	74.7
MB18HD20009	27/08/2019	627.8	74.7
MB18HD20009	28/08/2019	627.8	74.7
MB18HD20009	29/08/2019	627.8	74.7
MB18HD20009	30/08/2019	627.8	74.7
MB18HD20009	31/08/2019	627.8	74.7
MB18HD20009	1/09/2019	627.8	74.7
MB18HD20009	2/09/2019	627.8	74.7
MB18HD20009	3/09/2019	627.8	74.7
MB18HD20009	4/09/2019	627.8	74.7
MB18HD20009	5/09/2019	627.8	74.7
MB18HD20009	6/09/2019	627.8	74.7
MB18HD20009	7/09/2019	627.8	74.7
MB18HD20009	8/09/2019	627.8	74.7
MB18HD20009	9/09/2019	627.8	74.7
MB18HD20009	10/09/2019	627.8	74.7
MB18HD20009	11/09/2019	627.8	74.6
MB18HD20009	12/09/2019	627.8	74.6
MB18HD20009	13/09/2019	627.8	74.6
MB18HD20009	14/09/2019	627.8	74.7
MB18HD20009	15/09/2019	627.8	74.7
MB18HD20009	16/09/2019	627.8	74.7
MB18HD20009	17/09/2019	627.8	74.7
MB18HD20009	18/09/2019	627.8	74.7
MB18HD20009	19/09/2019	627.8	74.7
MB18HD20009	20/09/2019	627.8	74.7
MB18HD20009	21/09/2019	627.8	74.7
MB18HD20009	22/09/2019	627.8	74.7
MB18HD20009	23/09/2019	627.8	74.7
MB18HD20009	24/09/2019	627.8	74.7
MB18HD20009	25/09/2019	627.8	74.7
MB18HD20009	26/09/2019	627.8	74.7
MB18HD20009	27/09/2019	627.8	74.7
MB18HD20009	28/09/2019	627.8	74.7
MB18HD20009	29/09/2019	627.8	74.7
MB18HD20009	30/09/2019	627.8	74.7
MB18HD20009	1/10/2019	627.8	74.7
MB18HD20009	2/10/2019	627.8	74.7
MB18HD20009	3/10/2019	627.8	74.7
MB18HD20009	4/10/2019	627.8	74.7
MB18HD20009	5/10/2019	627.8	74.7
MB18HD20009	6/10/2019	627.8	74.7
MB18HD20009	7/10/2019	627.8	74.7
MB18HD20009	8/10/2019	627.8	74.7
MB18HD20009	9/10/2019	627.8	74.7
MB18HD20009	10/10/2019	627.8	74.7
MB18HD20009	11/10/2019	627

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	26/02/2018	484.3	202.3
HDVP2	25/02/2018	484.3	202.3
HDVP2	24/02/2018	484.3	202.3
HDVP2	23/02/2018	484.3	202.3
HDVP2	22/02/2018	484.3	202.3
HDVP2	21/02/2018	484.3	202.3
HDVP2	20/02/2018	484.3	202.3
HDVP2	19/02/2018	484.3	202.3
HDVP2	18/02/2018	484.3	202.3
HDVP2	17/02/2018	484.3	202.3
HDVP2	16/02/2018	484.3	202.3
HDVP2	15/02/2018	484.3	202.3
HDVP2	14/02/2018	484.3	202.3
HDVP2	13/02/2018	484.3	202.3
HDVP2	12/02/2018	484.3	202.3
HDVP2	11/02/2018	484.3	202.3
HDVP2	10/02/2018	484.3	202.3
HDVP2	9/02/2018	484.3	202.3
HDVP2	8/02/2018	484.3	202.3
HDVP2	7/02/2018	484.3	202.3
HDVP2	6/02/2018	484.3	202.3
HDVP2	5/02/2018	484.3	202.3
HDVP2	4/02/2018	484.3	202.3
HDVP2	3/02/2018	484.3	202.3
HDVP2	2/02/2018	484.3	202.3
HDVP2	1/02/2018	484.3	202.3
HDVP2	31/01/2018	484.3	202.3
HDVP2	30/01/2018	484.3	202.3
HDVP2	29/01/2018	484.3	202.3
HDVP2	28/01/2018	484.3	202.3
HDVP2	27/01/2018	484.3	202.3
HDVP2	26/01/2018	484.3	202.3
HDVP2	25/01/2018	484.3	202.3
HDVP2	24/01/2018	484.3	202.3
HDVP2	23/01/2018	484.3	202.3
HDVP2	22/01/2018	484.3	202.3
HDVP2	21/01/2018	484.3	202.3
HDVP2	20/01/2018	484.3	202.3
HDVP2	19/01/2018	484.3	202.3
HDVP2	18/01/2018	484.3	202.3
HDVP2	17/01/2018	484.3	202.3
HDVP2	16/01/2018	484.3	202.3
HDVP2	15/01/2018	484.3	202.3
HDVP2	14/01/2018	484.3	202.3
HDVP2	13/01/2018	484.3	202.3
HDVP2	12/01/2018	484.3	202.3
HDVP2	11/01/2018	484.3	202.3
HDVP2	10/01/2018	484.3	202.3
HDVP2	9/01/2018	484.3	202.3
HDVP2	8/01/2018	484.3	202.3
HDVP2	7/01/2018	484.3	202.3
HDVP2	6/01/2018	484.3	202.3
HDVP2	5/01/2018	484.3	202.3
HDVP2	4/01/2018	484.3	202.3
HDVP2	3/01/2018	484.3	202.3
HDVP2	2/01/2018	465.9	220.6
HDVP2	1/01/2018	465.9	220.6
HDVP2	31/12/2017	465.9	220.6
HDVP2	30/12/2017	465.9	220.6
HDVP2	29/12/2017	465.9	220.6
HDVP2	28/12/2017	465.9	220.6
HDVP2	27/12/2017	465.9	220.6
HDVP2	26/12/2017	465.9	220.6
HDVP2	25/12/2017	465.9	220.6
HDVP2	24/12/2017	465.9	220.6
HDVP2	23/12/2017	465.9	220.6
HDVP2	22/12/2017	465.9	220.6
HDVP2	21/12/2017	465.9	220.6
HDVP2	20/12/2017	465.9	220.6
HDVP2	19/12/2017	465.9	220.6
HDVP2	18/12/2017	465.9	220.6
HDVP2	17/12/2017	465.9	220.6
HDVP2	16/12/2017	465.9	220.6
HDVP2	15/12/2017	465.9	220.6
HDVP2	14/12/2017	465.9	220.6
HDVP2	13/12/2017	465.9	220.6
HDVP2	12/12/2017	465.9	220.6
HDVP2	11/12/2017	465.9	220.6
HDVP2	10/12/2017	465.9	220.6
HDVP2	9/12/2017	465.9	220.6
HDVP2	8/12/2017	465.9	220.6
HDVP2	7/12/2017	465.9	220.6
HDVP2	6/12/2017	465.9	220.6
HDVP2	5/12/2017	465.9	220.6
HDVP2	4/12/2017	465.9	220.6
HDVP2	3/12/2017	465.9	220.6
HDVP2	2/12/2017	465.9	220.6
HDVP2	1/12/2017	465.9	220.6
HDVP2	30/11/2017	465.9	220.6
HDVP2	29/11/2017	465.9	220.6
HDVP2	28/11/2017	465.9	220.6
HDVP2	27/11/2017	465.9	220.6
HDVP2	26/11/2017	465.9	220.6
HDVP2	25/11/2017	465.9	220.6
HDVP2	24/11/2017	465.9	220.6
HDVP2	23/11/2017	465.9	220.6
HDVP2	22/11/2017	465.9	220.6
HDVP2	21/11/2017	465.9	220.6
HDVP2	20/11/2017	465.9	220.6
HDVP2	19/11/2017	465.9	220.6
HDVP2	18/11/2017	465.9	220.6
HDVP2	17/11/2017	465.9	220.6
HDVP2	16/11/2017	465.9	220.6
HDVP2	15/11/2017	465.9	220.6
HDVP2	14/11/2017	465.9	220.6
HDVP2	13/11/2017	465.9	220.6
HDVP2	12/11/2017	465.9	220.6
HDVP2	11/11/2017	465.9	220.6
HDVP2	10/11/2017	465.9	220.6
HDVP2	9/11/2017	465.9	220.6
HDVP2	8/11/2017	465.9	220.6
HDVP2	7/11/2017	465.9	220.6
HDVP2	6/11/2017	465.9	220.6
HDVP2	5/11/2017	465.9	220.6
HDVP2	4/11/2017	465.9	220.6
HDVP2	3/11/2017	465.9	220.6
HDVP2	2/11/2017	465.9	220.6
HDVP2	1/11/2017	500.0	186.5
HDVP2	31/10/2017	500.0	186.5
HDVP2	30/10/2017	500.0	186.5
HDVP2	29/10/2017	500.0	186.5
HDVP2	28/10/2017	500.0	186.5
HDVP2	27/10/2017	500.0	186.5
HDVP2	26/10/2017	500.0	186.5
HDVP2	25/10/2017	500.0	186.5
HDVP2	24/10/2017	500.0	186.5
HDVP2	23/10/2017	500.0	186.5
HDVP2	22/10/2017	500.0	186.5
HDVP2	21/10/2017	500.0	186.5
HDVP2	20/10/2017	500.0	186.5
HDVP2	19/10/2017	500.0	186.5
HDVP2	18/10/2017	500.0	186.5
HDVP2	17/10/2017	500.0	186.5
HDVP2	16/10/2017	500.0	186.5
HDVP2	15/10/2017	500.0	186.5
HDVP2	14/10/2017	500.0	186.5

ID	Date	WL mAHD	WL mbgl
MB18WON0002	30/01/2021	626.0	38.7
MB18WON0002	29/01/2021	626.0	38.7
MB18WON0002	28/01/2021	625.9	38.7
MB18WON0002	27/01/2021	626.0	38.7
MB18WON0002	26/01/2021	626.0	38.7
MB18WON0002	25/01/2021	626.0	38.7
MB18WON0002	24/01/2021	626.0	38.7
MB18WON0002	23/01/2021	626.0	38.7
MB18WON0002	22/01/2021	626.0	38.7
MB18WON0002	21/01/2021	626.0	38.7
MB18WON0002	20/01/2021	626.0	38.7
MB18WON0002	19/01/2021	626.0	38.6
MB18WON0002	18/01/2021	626.0	38.6
MB18WON0002	17/01/2021	626.0	38.6
MB18WON0002	16/01/2021	626.0	38.6
MB18WON0002	15/01/2021	626.0	38.7
MB18WON0002	14/01/2021	626.0	38.7
MB18WON0002	13/01/2021	626.0	38.7
MB18WON0002	12/01/2021	626.0	38.7
MB18WON0002	11/01/2021	626.0	38.7
MB18WON0002	10/01/2021	626.0	38.7
MB18WON0002	9/01/2021	626.0	38.6
MB18WON0002	8/01/2021	626.0	38.6
MB18WON0002	7/01/2021	626.0	38.6
MB18WON0002	6/01/2021	626.0	38.6
MB18WON0002	5/01/2021	626.0	38.6
MB18WON0002	4/01/2021	626.0	38.7
MB18WON0002	3/01/2021	626.0	38.7
MB18WON0002	2/01/2021	626.0	38.7
MB18WON0002	1/01/2021	626.0	38.7
MB18WON0002	31/12/2020	626.0	38.7
MB18WON0002	30/12/2020	626.0	38.7
MB18WON0002	29/12/2020	626.0	38.7
MB18WON0002	28/12/2020	626.0	38.7
MB18WON0002	27/12/2020	625.9	38.7
MB18WON0002	26/12/2020	625.9	38.7
MB18WON0002	25/12/2020	626.0	38.7
MB18WON0002	24/12/2020	626.0	38.7
MB18WON0002	23/12/2020	626.0	38.7
MB18WON0002	22/12/2020	625.9	38.7
MB18WON0002	21/12/2020	625.9	38.7
MB18WON0002	20/12/2020	625.9	38.7
MB18WON0002	19/12/2020	625.9	38.7
MB18WON0002	18/12/2020	625.9	38.7
MB18WON0002	17/12/2020	625.9	38.7
MB18WON0002	16/12/2020	625.9	38.7
MB18WON0002	15/12/2020	625.9	38.7
MB18WON0002	14/12/2020	625.9	38.7
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MB18WON0002	11/12/2020	625.9	38.7
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MB18WON0002	8/12/2020	625.9	38.7
MB18WON0002	7/12/2020	625.9	38.7
MB18WON0002	6/12/2020	625.9	38.7
MB18WON0002	5/12/2020	625.9	38.7
MB18WON0002	4/12/2020	625.9	38.7
MB18WON0002	3/12/2020	625.9	38.7
MB18WON0002	2/12/2020	625.9	38.7
MB18WON0002	1/12/2020	625.9	38.7
MB18WON0002	30/11/2020	625.9	38.7
MB18WON0002	29/11/2020	625.9	38.7
MB18WON0002	28/11/2020	625.9	38.7
MB18WON0002	27/11/2020	625.9	38.7
MB18WON0002	26/11/2020	625.9	38.7
MB18WON0002	25/11/2020	625.9	38.7
MB18WON0002	24/11/2020	625.9	38.7
MB18WON0002	23/11/2020	625.9	38.7
MB18WON0002	22/11/2020	625.9	38.7
MB18WON0002	20/11/2020	625.7	38.9
MB18WON0002	5/10/2020	625.6	39.0
MB18WON0002	4/10/2020	625.6	39.0
MB18WON0002	3/10/2020	625.6	39.0
MB18WON0002	2/10/2020	625.6	39.1
MB18WON0002	1/10/2020	625.6	39.1
MB18WON0002	30/09/2020	625.6	39.1
MB18WON0002	29/09/2020	625.6	39.1
MB18WON0002	28/09/2020	625.5	39.1
MB18WON0002	27/09/2020	625.5	39.1
MB18WON0002	26/09/2020	625.5	39.1
MB18WON0002	25/09/2020	625.5	39.1
MB18WON0002	24/09/2020	625.5	39.1
MB18WON0002	23/09/2020	625.5	39.1
MB18WON0002	22/09/2020	625.5	39.1
MB18WON0002	21/09/2020	625.5	39.1
MB18WON0002	20/09/2020	625.5	39.1
MB18WON0002	19/09/2020	625.5	39.1
MB18WON0002	18/09/2020	625.5	39.1
MB18WON0002	17/09/2020	625.5	39.1
MB18WON0002	16/09/2020	625.5	39.1
MB18WON0002	15/09/2020	625.5	39.1
MB18WON0002	14/09/2020	625.5	39.1
MB18WON0002	13/09/2020	625.5	39.1
MB18WON0002	12/09/2020	625.5	39.1
MB18WON0002	11/09/2020	625.5	39.2
MB18WON0002	10/09/2020	625.4	39.2
MB18WON0002	9/09/2020	625.4	39.2
MB18WON0002	8/09/2020	625.4	39.2
MB18WON0002	7/09/2020	625.4	39.2
MB18WON0002	6/09/2020	625.4	39.2
MB18WON0002	5/09/2020	625.4	39.2
MB18WON0002	4/09/2020	625.4	39.2
MB18WON0002	3/09/2020	625.4	39.2
MB18WON0002	2/09/2020	625.4	39.2
MB18WON0002	1/09/2020	625.4	39.3
MB18WON0002	31/08/2020	625.4	39.3
MB18WON0002	30/08/2020	625.4	39.3
MB18WON0002	29/08/2020	625.3	39.3
MB18WON0002	28/08/2020	625.3	39.3
MB18WON0002	27/08/2020	625.3	39.3
MB18WON0002	26/08/2020	625.3	39.3
MB18WON0002	25/08/2020	625.3	39.3
MB18WON0002	24/08/2020	625.3	39.4
MB18WON0002	23/08/2020	625.2	39.4
MB18WON0002	22/08/2020	625.2	39.4
MB18WON0002	21/08/2020	625.2	39.4
MB18WON0002	20/08/2020	625.2	39.5
MB18WON0002	19/08/2020	625.1	39.5
MB18WON0002	18/08/2020	625.1	39.5
MB18WON0002	17/08/2020	625.1	39.6
MB18WON0002	16/08/2020	625.0	39.6
MB18WON0002	15/08/2020	624.9	39.7
MB18WON0002	14/08/2020	624.9	39.8
MB18WON0002	13/08/2020	624.7	39.9
MB18WON0002	12/08/2020	624.5	40.1
MB18WON0002	11/08/2020	624.0	40.6
MB18WON0002	10/08/2020	626.0	38.7
MB18WON0002	9/08/2020	625.9	38.7
MB18WON0002	8/08/2020	625.9	38.7
MB18WON0002	7/08/2020	625.9	38.7
MB18WON0002	6/08/2020	625.9	38.7
MB18WON0002	5/08/2020	625.9	38.7
MB18WON0002	4/08/2020	625.9	38.7
MB18WON0002	3/08/2020	625.9	38.7
MB18WON0002	2/08/2020	625.9	38.7

ID	Date	WL mAHD	WL mbgl
MB15HD20006	5/12/2018	625.3	76.8
MB15HD20006	6/12/2018	625.3	76.8
MB15HD20006	7/12/2018	625.3	76.8
MB15HD20006	8/12/2018	625.3	76.8
MB15HD20006	9/12/2018	625.3	76.8
MB15HD20006	10/12/2018	625.3	76.8
MB15HD20006	11/12/2018	625.3	76.8
MB15HD20006	12/12/2018	625.3	76.8
MB15HD20006	13/12/2018	625.3	76.8
MB15HD20006	14/12/2018	625.3	76.8
MB15HD20006	15/12/2018	625.2	76.8
MB15HD20006	16/12/2018	625.2	76.8
MB15HD20006	17/12/2018	625.3	76.8
MB15HD20006	18/12/2018	625.3	76.8
MB15HD20006	19/12/2018	625.3	76.8
MB15HD20006	20/12/2018	625.3	76.8
MB15HD20006	21/12/2018	625.3	76.8
MB15HD20006	22/12/2018	625.3	76.8
MB15HD20006	23/12/2018	625.3	76.8
MB15HD20006	24/12/2018	625.3	76.8
MB15HD20006	25/12/2018	625.3	76.8
MB15HD20006	26/12/2018	625.3	76.8
MB15HD20006	27/12/2018	625.3	76.8
MB15HD20006	28/12/2018	625.2	76.8
MB15HD20006	29/12/2018	625.2	76.8
MB15HD20006	30/12/2018	625.2	76.8
MB15HD20006	31/12/2018	625.2	76.8
MB15HD20006	1/01/2019	625.3	76.8
MB15HD20006	2/01/2019	625.3	76.8
MB15HD20006	3/01/2019	625.3	76.8
MB15HD20006	4/01/2019	625.3	76.8
MB15HD20006	5/01/2019	625.3	76.8
MB15HD20006	6/01/2019	625.3	76.8
MB15HD20006	7/01/2019	625.3	76.8
MB15HD20006	8/01/2019	625.3	76.8
MB15HD20006	9/01/2019	625.3	76.8
MB15HD20006	10/01/2019	625.3	76.8
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MB15HD20006	12/01/2019	625.3	76.8
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MB15HD20006	15/01/2019	625.3	76.8
MB15HD20006	16/01/2019	625.3	76.8
MB15HD20006	17/01/2019	625.3	76.8
MB15HD20006	18/01/2019	625.3	76.8
MB15HD20006	19/01/2019	625.3	76.8
MB15HD20006	20/01/2019	625.3	76.8
MB15HD20006	21/01/2019	625.3	76.8
MB15HD20006	22/01/2019	625.2	76.8
MB15HD20006	23/01/2019	625.2	76.8
MB15HD20006	24/01/2019	625.2	76.8
MB15HD20006	25/01/2019	625.2	76.8
MB15HD20006	26/01/2019	625.2	76.8
MB15HD20006	27/01/2019	625.3	76.8
MB15HD20006	28/01/2019	625.3	76.8
MB15HD20006	29/01/2019	625.3	76.8
MB15HD20006	30/01/2019	625.3	76.8
MB15HD20006	31/01/2019	625.3	76.8
MB15HD20006	1/02/2019	625.3	76.8
MB15HD20006	2/02/2019	625.3	76.8
MB15HD20006	3/02/2019	625.3	76.8
MB15HD20006	4/02/2019	625.2	76.8
MB15HD20006	5/02/2019	625.3	76.8
MB15HD20006	6/02/2019	625.2	76.8
MB15HD20006	7/02/2019	625.3	76.8
MB15HD20006	8/02/2019	625.3	76.8
MB15HD20006	9/02/2019	625.3	76.8
MB15HD20006	10/02/2019	625.3	76.8
MB15HD20006	11/02/2019	625.3	76.8
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MB15HD20006	14/02/2019	625.3	76.8
MB15HD20006	15/02/2019	625.3	76.8
MB15HD20006	16/02/2019	625.3	76.8
MB15HD20006	17/02/2019	625.3	76.8
MB15HD20006	18/02/2019	625.3	76.8
MB15HD20006	19/02/2019	625.3	76.8
MB15HD20006	20/02/2019	625.3	76.8
MB15HD20006	21/02/2019	625.3	76.8
MB15HD20006	22/02/2019	625.3	76.8
MB15HD20006	23/02/2019	625.3	76.8
MB15HD20006	24/02/2019	625.3	76.8
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MB15HD20006	27/02/2019	625.3	76.8
MB15HD20006	28/02/2019	625.3	76.8
MB15HD20006	1/03/2019	625.3	76.8
MB15HD20006	2/03/2019	625.3	76.8
MB15HD20006	3/03/2019	625.3	76.8
MB15HD20006	4/03/2019	625.3	76.8
MB15HD20006	5/03/2019	625.3	76.8
MB15HD20006	6/03/2019	625.3	76.8
MB15HD20006	7/03/2019	625.3	76.8
MB15HD20006	8/03/2019	625.3	76.8
MB15HD20006	9/03/2019	625.3	76.8
MB15HD20006	10/03/2019	625.3	76.8
MB15HD20006	11/03/2019	625.3	76.8
MB15HD20006	12/03/2019	625.3	76.8
MB15HD20006	13/03/2019	625.3	76.8
MB15HD20006	14/03/2019	625.3	76.8
MB15HD20006	15/03/2019	625.3	76.8
MB15HD20006	16/03/2019	625.3	76.8
MB15HD20006	17/03/2019	625.3	76.8
MB15HD20006	18/03/2019	625.3	76.8
MB15HD20006	19/03/2019	625.3	76.8
MB15HD20006	20/03/2019	625.3	76.8
MB15HD20006	21/03/2019	625.3	76.8
MB15HD20006	22/03/2019	625.3	76.8
MB15HD20006	23/03/2019	625.3	76.8
MB15HD20006	24/03/2019	625.2	76.8
MB15HD20006	25/03/2019	625.2	76.8
MB15HD20006	26/03/2019	625.3	76.8
MB15HD20006	27/03/2019	625.3	76.8
MB15HD20006	28/03/2019	625.3	76.8
MB15HD20006	29/03/2019	625.3	76.8
MB15HD20006	30/03/2019	625.3	76.8
MB15HD20006	31/03/2019	625.3	76.8
MB15HD20006	1/04/2019	625.3	76.8
MB15HD20006	2/04/2019	625.3	76.8
MB15HD20006	3/04/2019	625.3	76.8
MB15HD20006	4/04/2019	625.3	76.8
MB15HD20006	5/04/2019	625.3	76.8
MB15HD20006	6/04/2019	625.3	76.8
MB15HD20006	7/04/2019	625.3	76.8
MB15HD20006	8/04/2019	625.3	76.8
MB15HD20006	9/04/2019	625.3	76.8
MB15HD20006	10/04/2019	625.3	76.8
MB15HD20006	11/04/2019	625.3	76.8
MB15HD20006	12/04/2019	625.3	76.8
MB15HD20006	13/04/2019	625.3	76.8
MB15HD20006	14/04/2019	625.3	76.8
MB15HD20006	15/04/2019	625.3	76.8
MB15HD20006	16/04/2019	625.3	76.8
MB15HD20006	17/04/2019	625.3	76.8
MB15HD20006	18/04/2019	625.3	76.8
MB15HD20006	19/04/2019	625.3	76.8

ID	Date	WL mAHD	WL mbgl
MB18HD20009	21/11/2019	627.7	74.8
MB18HD20009	22/11/2019	627.7	74.8
MB18HD20009	23/11/2019	627.7	74.8
MB18HD20009	24/11/2019	627.7	74.8
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MB18HD20009	8/12/2019	627.7	74.8
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MB18HD20009	10/12/2019	627.7	74.8
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MB18HD20009	13/12/2019	627.7	74.8
MB18HD20009	14/12/2019	627.7	74.8
MB18HD20009	15/12/2019	627.7	74.8
MB18HD20009	16/12/2019	627.7	74.8
MB18HD20009	17/12/2019	627.7	74.8
MB18HD20009	18/12/2019	627.7	74.8
MB18HD20009	19/12/2019	627.7	74.8
MB18HD20009	20/12/2019	627.7	74.8
MB18HD20009	21/12/2019	627.7	74.8
MB18HD20009	22/12/2019	627.7	74.8
MB18HD20009	23/12/2019	627.7	74.8
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MB18HD20009	7/01/2020	627.6	74.8
MB18HD20009	8/01/2020	627.6	74.9
MB18HD20009	9/01/2020	627.6	74.9
MB18HD20009	10/01/2020	627.7	74.8
MB18HD20009	11/01/2020	627.7	74.8
MB18HD20009	12/01/2020	627.7	74.8
MB18HD20009	13/01/2020	627.6	74.8
MB18HD20009	14/01/2020	627.7	74.8
MB18HD20009	15/01/2020	627.7	74.8
MB18HD20009	16/01/2020	627.7	74.8
MB18HD20009	17/01/2020	627.7	74.8
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MB18HD20009	25/01/2020	627.7	74.8
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MB18HD20009	27/01/2020	627.7	74.8
MB18HD20009	28/01/2020	627.7	74.8
MB18HD20009	29/01/2020	627.6	74.8
MB18HD20009	30/01/2020	627.6	74.8
MB18HD20009	31/01/2020	627.6	74.8
MB18HD20009	1/02/2020	627.7	74.8
MB18HD20009	2/02/2020	627.7	74.8
MB18HD20009	3/02/2020	627.7	74.8
MB18HD20009	4/02/2020	627.7	74.8
MB18HD20009	5/02/2020	627.7	74.8
MB18HD20009	6/02/2020	627.7	74.8
MB18HD20009	7/02/2020	627.7	74.8
MB18HD20009	8/02/2020	627.7	74.8
MB18HD20009	9/02/2020	627.6	74.9
MB18HD20009	10/02/2020	627.6	74.9
MB18HD20009	11/02/2020	627.7	74.8
MB18HD20009	12/02/2020	627.7	74.8
MB18HD20009	13/02/2020	627.7	74.8
MB18HD20009	14/02/2020	627.7	74.8
MB18HD20009	15/02/2020	627.7	74.8
MB18HD20009	16/02/2020	627.7	74.8
MB18HD20009	17/02/2020	627.7	74.8
MB18HD20009	18/02/2020	627.7	74.8
MB18HD20009	19/02/2020	627.7	74.8
MB18HD20009	20/02/2020	627.7	74.8
MB18HD20009	21/02/2020	627.7	74.8
MB18HD20009	22/02/2020	627.7	74.8
MB18HD20009	23/02/2020	627.7	74.8
MB18HD20009	24/02/2020	627

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	13/10/2017	500.0	186.5
HDVP2	12/10/2017	500.0	186.5
HDVP2	11/10/2017	500.0	186.5
HDVP2	10/10/2017	500.0	186.5
HDVP2	9/10/2017	500.0	186.5
HDVP2	8/10/2017	500.0	186.5
HDVP2	7/10/2017	500.0	186.5
HDVP2	6/10/2017	500.0	186.5
HDVP2	5/10/2017	500.0	186.5
HDVP2	4/10/2017	500.0	186.5
HDVP2	3/10/2017	500.0	186.5
HDVP2	2/10/2017	500.0	186.5
HDVP2	1/10/2017	433.8	252.7
HDVP2	30/09/2017	433.8	252.7
HDVP2	29/09/2017	433.8	252.7
HDVP2	28/09/2017	433.8	252.7
HDVP2	27/09/2017	433.8	252.7
HDVP2	26/09/2017	433.8	252.7
HDVP2	25/09/2017	433.8	252.7
HDVP2	24/09/2017	433.8	252.7
HDVP2	23/09/2017	433.8	252.7
HDVP2	22/09/2017	433.8	252.7
HDVP2	21/09/2017	433.8	252.7
HDVP2	20/09/2017	433.8	252.7
HDVP2	19/09/2017	433.8	252.7
HDVP2	18/09/2017	433.8	252.7
HDVP2	17/09/2017	433.8	252.7
HDVP2	16/09/2017	433.8	252.7
HDVP2	15/09/2017	433.8	252.7
HDVP2	14/09/2017	433.8	252.7
HDVP2	13/09/2017	433.8	252.7
HDVP2	12/09/2017	433.8	252.7
HDVP2	11/09/2017	433.8	252.7
HDVP2	10/09/2017	433.8	252.7
HDVP2	9/09/2017	433.8	252.7
HDVP2	8/09/2017	433.8	252.7
HDVP2	7/09/2017	433.8	252.7
HDVP2	6/09/2017	433.8	252.7
HDVP2	5/09/2017	433.8	252.7
HDVP2	4/09/2017	433.8	252.7
HDVP2	3/09/2017	433.8	252.7
HDVP2	2/09/2017	433.8	252.7
HDVP2	1/09/2017	512.6	174.0
HDVP2	31/08/2017	512.6	174.0
HDVP2	30/08/2017	512.6	174.0
HDVP2	29/08/2017	512.6	174.0
HDVP2	28/08/2017	512.6	174.0
HDVP2	27/08/2017	512.6	174.0
HDVP2	26/08/2017	512.6	174.0
HDVP2	25/08/2017	512.6	174.0
HDVP2	24/08/2017	512.6	174.0
HDVP2	23/08/2017	512.6	174.0
HDVP2	22/08/2017	512.6	174.0
HDVP2	21/08/2017	512.6	174.0
HDVP2	20/08/2017	512.6	174.0
HDVP2	19/08/2017	512.6	174.0
HDVP2	18/08/2017	512.6	174.0
HDVP2	17/08/2017	512.6	174.0
HDVP2	16/08/2017	512.6	174.0
HDVP2	15/08/2017	512.6	174.0
HDVP2	14/08/2017	512.6	174.0
HDVP2	13/08/2017	512.6	174.0
HDVP2	12/08/2017	512.6	174.0
HDVP2	11/08/2017	512.6	174.0
HDVP2	10/08/2017	512.6	174.0
HDVP2	9/08/2017	512.6	174.0
HDVP2	8/08/2017	512.6	174.0
HDVP2	7/08/2017	512.6	174.0
HDVP2	6/08/2017	512.6	174.0
HDVP2	5/08/2017	512.6	174.0
HDVP2	4/08/2017	512.6	174.0
HDVP2	3/08/2017	512.6	174.0
HDVP2	2/08/2017	512.6	174.0
HDVP2	1/08/2017	442.3	244.3
HDVP2	31/07/2017	442.3	244.3
HDVP2	30/07/2017	442.3	244.3
HDVP2	29/07/2017	442.3	244.3
HDVP2	28/07/2017	442.3	244.3
HDVP2	27/07/2017	442.3	244.3
HDVP2	26/07/2017	442.3	244.3
HDVP2	25/07/2017	442.3	244.3
HDVP2	24/07/2017	442.3	244.3
HDVP2	23/07/2017	442.3	244.3
HDVP2	22/07/2017	442.3	244.3
HDVP2	21/07/2017	442.3	244.3
HDVP2	20/07/2017	442.3	244.3
HDVP2	19/07/2017	442.3	244.3
HDVP2	18/07/2017	442.3	244.3
HDVP2	17/07/2017	442.3	244.3
HDVP2	16/07/2017	442.3	244.3
HDVP2	15/07/2017	442.3	244.3
HDVP2	14/07/2017	442.3	244.3
HDVP2	13/07/2017	442.3	244.3
HDVP2	12/07/2017	442.3	244.3
HDVP2	11/07/2017	442.3	244.3
HDVP2	10/07/2017	442.3	244.3
HDVP2	9/07/2017	442.3	244.3
HDVP2	8/07/2017	442.3	244.3
HDVP2	7/07/2017	442.3	244.3
HDVP2	6/07/2017	442.3	244.3
HDVP2	5/07/2017	442.3	244.3
HDVP2	4/07/2017	442.3	244.3
HDVP2	3/07/2017	442.3	244.3
HDVP2	2/07/2017	442.3	244.3
HDVP2	1/07/2017	355.9	330.7
HDVP2	30/06/2017	355.9	330.7
HDVP2	29/06/2017	355.9	330.7
HDVP2	28/06/2017	355.9	330.7
HDVP2	27/06/2017	355.9	330.7
HDVP2	26/06/2017	355.9	330.7
HDVP2	25/06/2017	355.9	330.7
HDVP2	24/06/2017	355.9	330.7
HDVP2	23/06/2017	355.9	330.7
HDVP2	22/06/2017	355.9	330.7
HDVP2	21/06/2017	355.9	330.7
HDVP2	20/06/2017	355.9	330.7
HDVP2	19/06/2017	355.9	330.7
HDVP2	18/06/2017	355.9	330.7
HDVP2	17/06/2017	355.9	330.7
HDVP2	16/06/2017	355.9	330.7
HDVP2	15/06/2017	355.9	330.7
HDVP2	14/06/2017	355.9	330.7
HDVP2	13/06/2017	355.9	330.7
HDVP2	12/06/2017	355.9	330.7
HDVP2	11/06/2017	355.9	330.7
HDVP2	10/06/2017	355.9	330.7
HDVP2	9/06/2017	355.9	330.7
HDVP2	8/06/2017	355.9	330.7
HDVP2	7/06/2017	355.9	330.7
HDVP2	6/06/2017	355.9	330.7
HDVP2	5/06/2017	355.9	330.7
HDVP2	4/06/2017	355.9	330.7
HDVP2	3/06/2017	355.9	330.7
HDVP2	2/06/2017	355.9	330.7
HDVP2	1/06/2017	490.8	195.7
HDVP2	31/05/2017	490.8	195.7

ID	Date	WL mAHD	WL mbgl
MB18WON0002	1/08/2020	625.9	38.7
MB18WON0002	31/07/2020	625.9	38.7
MB18WON0002	30/07/2020	625.9	38.7
MB18WON0002	29/07/2020	626.0	38.7
MB18WON0002	28/07/2020	625.9	38.7
MB18WON0002	27/07/2020	626.0	38.7
MB18WON0002	26/07/2020	626.0	38.7
MB18WON0002	25/07/2020	626.0	38.7
MB18WON0002	24/07/2020	626.0	38.7
MB18WON0002	23/07/2020	625.9	38.7
MB18WON0002	22/07/2020	625.9	38.7
MB18WON0002	21/07/2020	625.9	38.7
MB18WON0002	20/07/2020	625.9	38.7
MB18WON0002	19/07/2020	625.9	38.7
MB18WON0002	18/07/2020	625.9	38.7
MB18WON0002	17/07/2020	625.9	38.7
MB18WON0002	16/07/2020	625.9	38.7
MB18WON0002	15/07/2020	625.9	38.7
MB18WON0002	14/07/2020	625.9	38.7
MB18WON0002	13/07/2020	625.9	38.7
MB18WON0002	12/07/2020	625.9	38.7
MB18WON0002	11/07/2020	626.0	38.7
MB18WON0002	10/07/2020	625.9	38.7
MB18WON0002	9/07/2020	625.9	38.7
MB18WON0002	8/07/2020	625.9	38.7
MB18WON0002	7/07/2020	625.9	38.7
MB18WON0002	6/07/2020	625.9	38.7
MB18WON0002	5/07/2020	625.9	38.7
MB18WON0002	4/07/2020	625.9	38.7
MB18WON0002	3/07/2020	625.9	38.7
MB18WON0002	2/07/2020	625.9	38.7
MB18WON0002	1/07/2020	625.9	38.7
MB18WON0002	30/06/2020	625.9	38.7
MB18WON0002	29/06/2020	625.9	38.7
MB18WON0002	28/06/2020	625.9	38.7
MB18WON0002	27/06/2020	625.9	38.7
MB18WON0002	26/06/2020	625.9	38.7
MB18WON0002	25/06/2020	625.9	38.7
MB18WON0002	24/06/2020	625.9	38.7
MB18WON0002	23/06/2020	625.9	38.7
MB18WON0002	22/06/2020	625.9	38.7
MB18WON0002	21/06/2020	625.9	38.7
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MB18WON0002	19/06/2020	625.9	38.7
MB18WON0002	18/06/2020	625.9	38.7
MB18WON0002	17/06/2020	625.9	38.7
MB18WON0002	16/06/2020	625.9	38.7
MB18WON0002	15/06/2020	625.9	38.7
MB18WON0002	14/06/2020	625.9	38.7
MB18WON0002	13/06/2020	625.9	38.7
MB18WON0002	12/06/2020	625.9	38.7
MB18WON0002	11/06/2020	625.9	38.7
MB18WON0002	10/06/2020	625.9	38.7
MB18WON0002	9/06/2020	625.9	38.7
MB18WON0002	8/06/2020	625.9	38.7
MB18WON0002	7/06/2020	625.9	38.7
MB18WON0002	6/06/2020	625.9	38.7
MB18WON0002	5/06/2020	625.9	38.7
MB18WON0002	4/06/2020	625.9	38.7
MB18WON0002	3/06/2020	625.9	38.7
MB18WON0002	2/06/2020	625.9	38.7
MB18WON0002	1/06/2020	625.9	38.7
MB18WON0002	31/05/2020	625.9	38.7
MB18WON0002	30/05/2020	625.9	38.7
MB18WON0002	29/05/2020	625.9	38.7
MB18WON0002	28/05/2020	625.9	38.7
MB18WON0002	27/05/2020	625.9	38.7
MB18WON0002	26/05/2020	625.9	38.7
MB18WON0002	25/05/2020	625.9	38.7
MB18WON0002	24/05/2020	625.9	38.7
MB18WON0002	23/05/2020	625.9	38.7
MB18WON0002	22/05/2020	625.9	38.7
MB18WON0002	21/05/2020	625.9	38.7
MB18WON0002	20/05/2020	625.9	38.7
MB18WON0002	19/05/2020	625.9	38.7
MB18WON0002	18/05/2020	625.9	38.7
MB18WON0002	17/05/2020	625.9	38.7
MB18WON0002	16/05/2020	625.9	38.7
MB18WON0002	15/05/2020	625.9	38.7
MB18WON0002	14/05/2020	625.9	38.7
MB18WON0002	13/05/2020	625.9	38.7
MB18WON0002	12/05/2020	625.9	38.7
MB18WON0002	11/05/2020	625.9	38.7
MB18WON0002	10/05/2020	625.9	38.7
MB18WON0002	9/05/2020	625.9	38.7
MB18WON0002	8/05/2020	625.9	38.7
MB18WON0002	7/05/2020	625.9	38.7
MB18WON0002	6/05/2020	625.9	38.7
MB18WON0002	5/05/2020	625.9	38.7
MB18WON0002	4/05/2020	625.9	38.7
MB18WON0002	3/05/2020	625.9	38.7
MB18WON0002	2/05/2020	625.9	38.7
MB18WON0002	1/05/2020	625.9	38.7
MB18WON0002	30/04/2020	625.9	38.7
MB18WON0002	29/04/2020	625.9	38.8
MB18WON0002	28/04/2020	625.9	38.8
MB18WON0002	27/04/2020	625.9	38.8
MB18WON0002	26/04/2020	625.9	38.8
MB18WON0002	25/04/2020	625.9	38.8
MB18WON0002	24/04/2020	625.9	38.8
MB18WON0002	23/04/2020	625.9	38.8
MB18WON0002	22/04/2020	625.9	38.8
MB18WON0002	21/04/2020	625.8	38.8
MB18WON0002	20/04/2020	625.8	38.8
MB18WON0002	19/04/2020	625.8	38.8
MB18WON0002	18/04/2020	625.8	38.8
MB18WON0002	17/04/2020	625.8	38.8
MB18WON0002	16/04/2020	625.8	38.8
MB18WON0002	15/04/2020	625.8	38.8
MB18WON0002	14/04/2020	625.8	38.8
MB18WON0002	13/04/2020	625.8	38.8
MB18WON0002	12/04/2020	625.8	38.8
MB18WON0002	11/04/2020	625.8	38.8
MB18WON0002	10/04/2020	625.8	38.8
MB18WON0002	9/04/2020	625.8	38.8
MB18WON0002	8/04/2020	625.8	38.8
MB18WON0002	7/04/2020	625.8	38.8
MB18WON0002	6/04/2020	625.8	38.8
MB18WON0002	5/04/2020	625.8	38.8
MB18WON0002	4/04/2020	625.8	38.8
MB18WON0002	3/04/2020	625.8	38.8
MB18WON0002	2/04/2020	625.8	38.8
MB18WON0002	1/04/2020	625.8	38.8
MB18WON0002	31/03/2020	625.8	38.8
MB18WON0002	30/03/2020	625.8	38.8
MB18WON0002	29/03/2020	625.8	38.8
MB18WON0002	28/03/2020	625.8	38.8
MB18WON0002	27/03/2020	625.8	38.8
MB18WON0002	26/03/2020	625.8	38.8
MB18WON0002	25/03/2020	625.8	38.8
MB18WON0002	24/03/2020	625.8	38.8
MB18WON0002	23/03/2020	625.8	38.8
MB18WON0002	22/03/2020	625.8	38.8
MB18WON0002	21/03/2020	625.8	38.8
MB18WON0002	20/03/2020	625.8	38.8
MB18WON0002	19/03/2020	625.8	38.8

ID	Date	WL mAHD	WL mbgl
MB15HD20006	20/04/2019	625.3	76.8
MB15HD20006	21/04/2019	625.3	76.8
MB15HD20006	22/04/2019	625.3	76.7
MB15HD20006	23/04/2019	625.3	76.7
MB15HD20006	24/04/2019	625.3	76.7
MB15HD20006	25/04/2019	625.3	76.7
MB15HD20006	26/04/2019	625.3	76.7
MB15HD20006	27/04/2019	625.3	76.7
MB15HD20006	28/04/2019	625.3	76.7
MB15HD20006	29/04/2019	625.3	76.8
MB15HD20006	30/04/2019	625.3	76.8
MB15HD20006	1/05/2019	625.3	76.8
MB15HD20006	2/05/2019	625.3	76.8
MB15HD20006	3/05/2019	625.3	76.8
MB15HD20006	4/05/2019	625.3	76.7
MB15HD20006	5/05/2019	625.3	76.7
MB15HD20006	6/05/2019	625.3	76.8
MB15HD20006	7/05/2019	625.3	76.7
MB15HD20006	8/05/2019	625.3	76.7
MB15HD20006	9/05/2019	625.3	76.7
MB15HD20006	10/05/2019	625.4	76.7
MB15HD20006	11/05/2019	625.4	76.7
MB15HD20006	12/05/2019	625.4	76.7
MB15HD20006	13/05/2019	625.3	76.7
MB15HD20006	14/05/2019	625.3	76.7
MB15HD20006	15/05/2019	625.3	76.7
MB15HD20006	16/05/2019	625.3	76.7
MB15HD20006	17/05/2019	625.3	76.8
MB15HD20006	18/05/2019	625.3	76.8
MB15HD20006	19/05/2019	625.3	76.7
MB15HD20006	20/05/2019	625.3	76.7
MB15HD20006	21/05/2019	625.3	76.7
MB15HD20006	22/05/2019	625.3	76.7
MB15HD20006	23/05/2019	625.3	76.7
MB15HD20006	24/05/2019	625.3	76.7
MB15HD20006	25/05/2019	625.3	76.7
MB15HD20006	26/05/2019	625.3	76.7
MB15HD20006	27/05/2019	625.3	76.7
MB15HD20006	28/05/2019	625.3	76.7
MB15HD20006	29/05/2019	625.3	76.7
MB15HD20006	30/05/2019	625.3	76.7
MB15HD20006	31/05/2019	625.3	76.7
MB15HD20006	1/06/2019	625.4	76.7
MB15HD20006	2/06/2019	625.4	76.7
MB15HD20006	3/06/2019	625.4	76.7
MB15HD20006	4/06/2019	625.4	76.7
MB15HD20006	5/06/2019	625.4	76.7
MB15HD20006	6/06/2019	625.3	76.7
MB15HD20006	7/06/2019	625.3	76.7
MB15HD20006	8/06/2019	625.3	76.8
MB15HD20006	9/06/2019	625.3	76.8
MB15HD20006	10/06/2019	625.3	76.8
MB15HD20006	11/06/2019	625.3	76.8
MB15HD20006	12/06/2019	625.3	76.8
MB15HD20006	13/06/2019	625.3	76.7
MB15HD20006	14/06/2019	625.3	76.7
MB15HD20006	15/06/2019	625.3	76.7
MB15HD20006	16/06/2019	625.3	76.7
MB15HD20006	17/06/2019	625.3	76.7
MB15HD20006	18/06/2019	625.3	76.7
MB15HD20006	19/06/2019	625.3	76.8
MB15HD20006	20/06/2019	625.3	76.8
MB15HD20006	21/06/2019	625.3	76.8
MB15HD20006	22/06/2019	625.3	76.8
MB15HD20006	23/06/2019	625.3	76.8
MB15HD20006	24/06/2019	625.3	76.8
MB15HD20006	25/06/2019	625.3	76.7
MB15HD20006	26/06/2019	625.3	76.7
MB15HD20006	27/06/2019	625.3	76.8
MB15HD20006	28/06/2019	625.3	76.8
MB15HD20006	29/06/2019	625.3	76.7
MB15HD20006	30/06/2019	625.3	76.7
MB15HD20006	1/07/2019	625.3	76.7
MB15HD20006	2/07/2019	625.3	76.8
MB15HD20006	3/07/2019	625.3	76.8
MB15HD20006	4/07/2019	625.3	76.7
MB15HD20006	5/07/2019	625.3	76.8
MB15HD20006	6/07/2019	625.3	76.8
MB15HD20006	7/07/2019	625.3	76.7
MB15HD20006	8/07/2019	625.3	76.7
MB15HD20006	9/07/2019	625.3	76.7
MB15HD20006	10/07/2019	625.3	76.7
MB15HD20006	11/07/2019	625.4	76.7
MB15HD20006	12/07/2019	625.4	76.7
MB15HD20006	13/07/2019	625.4	76.7
MB15HD20006	14/07/2019	625.4	76.7
MB15HD20006	15/07/2019	625.4	76.7
MB15HD20006	16/07/2019	625.4	76.7
MB15HD20006	17/07/2019	625.4	76.7
MB15HD20006	18/07/2019	625.3	76.7
MB15HD20006	19/07/2019	625.3	76.8
MB15HD20006	20/07/2019	625.3	76.8
MB15HD20006	21/07/2019	625.3	76.8
MB15HD20006	22/07/2019	625.3	76.8
MB15HD20006	23/07/2019	625.3	76.7
MB15HD20006	24/07/2019	625.3	76.7
MB15HD20006	25/07/2019	625.3	76.7
MB15HD20006	26/07/2019	625.3	76.7
MB15HD20006	27/07/2019	625.3	76.8
MB15HD20006	28/07/2019	625.3	76.8
MB15HD20006	29/07/2019	625.3	76.8
MB15HD20006	30/07/2019	625.3	76.7
MB15HD20006	31/07/2019	625.3	76.7
MB15HD20006	1/08/2019	625.4	76.7
MB15HD20006	2/08/2019	625.4	76.7
MB15HD20006	3/08/2019	625.4	76.7
MB15HD20006	4/08/2019	625.4	76.7
MB15HD20006	5/08/2019	625.3	76.7
MB15HD20006	6/08/2019	625.3	76.8
MB15HD20006	7/08/2019	625.3	76.8
MB15HD20006	8/08/2019	625.3	76.7
MB15HD20006	9/08/2019	625.3	76.7
MB15HD20006	10/08/2019	625.4	76.7
MB15HD20006	11/08/2019	625.3	76.7
MB15HD20006	12/08/2019	625.3	76.7
MB15HD20006	13/08/2019	625.3	76.7
MB15HD20006	14/08/2019	625.3	76.8
MB15HD20006	15/08/2019	625.3	76.8
MB15HD20006	16/08/2019	625.3	76.8
MB15HD20006	17/08/2019	625.3	76.7
MB15HD20006	18/08/2019	625.3	76.7
MB15HD20006	19/08/2019	625.4	76.7
MB15HD20006	20/08/2019	625.4	76.7
MB15HD20006	21/08/2019	625.4	76.7
MB15HD20006	22/08/2019	625.4	76.7
MB15HD20006	23/08/2019	625.3	76.7
MB15HD20006	24/08/2019	625.3	76.7
MB15HD20006	25/08/2019	625.3	76.8
MB15HD20006	26/08/2019	625.3	76.8
MB15HD20006	27/08/2019	625.3	76.8
MB15HD20006	28/08/2019	625.3	76.8
MB15HD20006	29/08/2019	625.3	76.8
MB15HD20006	30/08/2019	625.3	76.8
MB15HD20006	31/08/2019	625.3	76.8
MB15HD20006	1/09/2019	625.3	76.8
MB15HD20006	2/09/2019	625.3	76.8

ID	Date	WL mAHD	WL mbgl
MB18HD20009	5/04/2020	627.7	74.8
MB18HD20009	6/04/2020	627.7	74.8
MB18HD20009	7/04/2020	627.7	74.8
MB18HD20009	8/04/2020	627.7	74.8
MB18HD20009	9/04/2020	627.7	74.8
MB18HD20009	10/04/2020	627.7	74.8
MB18HD20009	11/04/2020	627.7	74.8
MB18HD20009	12/04/2020	627.7	74.8
MB18HD20009	13/04/2020	627.7	74.8
MB18HD20009	14/04/2020	627.7	74.8
MB18HD20009	15/04/2020	627.7	74.8
MB18HD20009	16/04/2020	627.7	74.8
MB18HD20009	17/04/2020	627.7	74.8
MB18HD20009	18/04/2020	627.7	74.8
MB18HD20009	19/04/2020	627.7	74.8
MB18HD20009	20/04/2020	627.7	74.8
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MB18HD20009	22/04/2020	627.7	74.8
MB18HD20009	23/04/2020	627.7	74.8
MB18HD20009	24/04/2020	627.7	74.8
MB18HD20009	25/04/2020	627.7	74.8
MB18HD20009	26/04/2020	627.7	74.8
MB18HD20009	27/04/2020	627.7	74.8
MB18HD20009	28/04/2020	627.7	74.8
MB18HD20009	29/04/2020	627.7	74.8
MB18HD20009	30/04/2020	627.7	74.7
MB18HD20009	1/05/2020	627.7	74.7
MB18HD20009	2/05/2020	627.7	74.8
MB18HD20009	3/05/2020	627.7	74.8
MB18HD20009	4/05/2020	627.7	74.8
MB18HD20009	5/05/2020	627.7	74.8
MB18HD20009	6/05/2020	627.7	74.8
MB18HD20009	7/05/2020	627.7	74.8
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MB18HD20009	9/05/2020	627.7	74.8
MB18HD20009	10/05/2020	627.7	74.7
MB18HD20009	11/05/2020	627.7	74.7
MB18HD20009	12/05/2020	627.7	74.7
MB18HD20009	13/05/2020	627.7	74.7
MB18HD20009	14/05/2020	627.7	74.7
MB18HD20009	15/05/2020	627.7	74.7
MB18HD20009	16/05/2020	627.7	74.7
MB18HD20009	17/05/2020	627.7	74.8
MB18HD20009	18/05/2020	627.7	74.8
MB18HD20009	19/05/2020	627.7	74.8
MB18HD20009	20/05/2020	627.7	74.7
MB18HD20009	21/05/2020	627.7	74.7
MB18HD20009	22/05/2020	627.7	74.8
MB18HD20009	23/05/2020	627.7	74.8
MB18HD20009	24/05/2020	627.7	74.8
MB18HD20009	25/05/2020	627.7	74.8
MB18HD20009	26/05/2020	627.7	74.8
MB18HD20009	27/05/2020	627.7	74.8
MB18HD20009	28/05/2020	627.7	74.8
MB18HD20009	29/05/2020	627.7	74.8
MB18HD20009	30/05/2020	627.7	74.8
MB18HD20009	31/05/2020	627.7	74.7
MB18HD20009	1/06/2020	627.7	74.7
MB18HD20009	2/06/2020	627.7	74.7
MB18HD20009	3/06/2020	627.7	74.7
MB18HD20009	4/06/2020	627.7	74.7
MB18HD20009	5/06/2020	627.7	74.7
MB18HD20009	6/06/2020	627.7	74.8
MB18HD20009	7/06/2020	627.7	74.8
MB18HD20009	8/06/2020	627.7	74.8
MB18HD20009	9/06/2020	627.7	74.8
MB18HD20009	10/06/2020	627.7	74.8
MB18HD20009	11/06/2020	627.7	74.8
MB18HD20009	12/06/2020	627.7	74.8
MB18HD20009	13/06/2020	627.7	74.8
MB18HD20009	14/06/2020	627.7	74.8
MB18HD20009	15/06/2020	627.7	74.7
MB18HD20009	16/06/2020	627.7	74.8
MB18HD20009	17/06/2020	627.7	74.8
MB18HD20009	18/06/2020	627.7	74.8
MB18HD20009	19/06/2020	627.7	74.8
MB18HD20009	20/06/2020	627.7	74.7
MB18HD20009	21/06/2020	627.7	74.8
MB18HD20009	22/06/2020	627.7	74.8
MB18HD20009	23/06/2020	627.7	74.8
MB18HD20009	24/06/2020	627.7	74.8
MB18HD20009	25/06/2020	627.7	74.8
MB18HD20009	26/06/2020	627.7	74.8
MB18HD20009	27/06/2020	627.7	74.8
MB18HD20009	28/06/2020	627.7	74.8
MB18HD20009	29/06/2020	627.7	74.8
MB18HD20009	30/06/2020	627.7	74.8
MB18HD20009	1/07/2020	627.7	74.8
MB18HD20009	2/07/2020	627.7	74.8
MB18HD20009	3/07/2020	627.7	74.7
MB18HD20009	4/07/2020	627.7	74.7
MB18HD20009	5/07/2020	627.7	74.8
MB18HD20009	6/07/2020	627.7	74.8
MB18HD20009	7/07/2020	627.7	74.8
MB18HD20009	8/07/2020	627.7	74.8
MB18HD20009	9/07/2020	627

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	30/05/2017	490.8	195.7
HDVP2	29/05/2017	490.8	195.7
HDVP2	28/05/2017	490.8	195.7
HDVP2	27/05/2017	490.8	195.7
HDVP2	26/05/2017	490.8	195.7
HDVP2	25/05/2017	490.8	195.7
HDVP2	24/05/2017	490.8	195.7
HDVP2	23/05/2017	490.8	195.7
HDVP2	22/05/2017	490.8	195.7
HDVP2	21/05/2017	490.8	195.7
HDVP2	20/05/2017	490.8	195.7
HDVP2	19/05/2017	490.8	195.7
HDVP2	18/05/2017	490.8	195.7
HDVP2	17/05/2017	490.8	195.7
HDVP2	16/05/2017	490.8	195.7
HDVP2	15/05/2017	490.8	195.7
HDVP2	14/05/2017	490.8	195.7
HDVP2	13/05/2017	490.8	195.7
HDVP2	12/05/2017	490.8	195.7
HDVP2	11/05/2017	490.8	195.7
HDVP2	10/05/2017	490.8	195.7
HDVP2	9/05/2017	490.8	195.7
HDVP2	8/05/2017	490.8	195.7
HDVP2	7/05/2017	490.8	195.7
HDVP2	6/05/2017	490.8	195.7
HDVP2	5/05/2017	490.8	195.7
HDVP2	4/05/2017	490.8	195.7
HDVP2	3/05/2017	490.8	195.7
HDVP2	2/05/2017	490.8	195.7
HDVP2	1/05/2017	423.9	262.7
HDVP2	30/04/2017	423.9	262.7
HDVP2	29/04/2017	423.9	262.7
HDVP2	28/04/2017	423.9	262.7
HDVP2	27/04/2017	423.9	262.7
HDVP2	26/04/2017	423.9	262.7
HDVP2	25/04/2017	423.9	262.7
HDVP2	24/04/2017	423.9	262.7
HDVP2	23/04/2017	423.9	262.7
HDVP2	22/04/2017	423.9	262.7
HDVP2	21/04/2017	423.9	262.7
HDVP2	20/04/2017	423.9	262.7
HDVP2	19/04/2017	423.9	262.7
HDVP2	18/04/2017	423.9	262.7
HDVP2	17/04/2017	423.9	262.7
HDVP2	16/04/2017	423.9	262.7
HDVP2	15/04/2017	423.9	262.7
HDVP2	14/04/2017	423.9	262.7
HDVP2	13/04/2017	423.9	262.7
HDVP2	12/04/2017	423.9	262.7
HDVP2	11/04/2017	423.9	262.7
HDVP2	10/04/2017	423.9	262.7
HDVP2	9/04/2017	423.9	262.7
HDVP2	8/04/2017	423.9	262.7
HDVP2	7/04/2017	423.9	262.7
HDVP2	6/04/2017	423.9	262.7
HDVP2	5/04/2017	423.9	262.7
HDVP2	4/04/2017	423.9	262.7
HDVP2	3/04/2017	423.9	262.7
HDVP2	2/04/2017	423.9	262.7
HDVP2	1/04/2017	414.5	272.1
HDVP2	31/03/2017	414.5	272.1
HDVP2	30/03/2017	414.5	272.1
HDVP2	29/03/2017	414.5	272.1
HDVP2	28/03/2017	414.5	272.1
HDVP2	27/03/2017	414.5	272.1
HDVP2	26/03/2017	414.5	272.1
HDVP2	25/03/2017	414.5	272.1
HDVP2	24/03/2017	414.5	272.1
HDVP2	23/03/2017	414.5	272.1
HDVP2	22/03/2017	414.5	272.1
HDVP2	21/03/2017	414.5	272.1
HDVP2	20/03/2017	414.5	272.1
HDVP2	19/03/2017	414.5	272.1
HDVP2	18/03/2017	414.5	272.1
HDVP2	17/03/2017	414.5	272.1
HDVP2	16/03/2017	414.5	272.1
HDVP2	15/03/2017	414.5	272.1
HDVP2	14/03/2017	414.5	272.1
HDVP2	13/03/2017	414.5	272.1
HDVP2	12/03/2017	414.5	272.1
HDVP2	11/03/2017	414.5	272.1
HDVP2	10/03/2017	414.5	272.1
HDVP2	9/03/2017	414.5	272.1
HDVP2	8/03/2017	414.5	272.1
HDVP2	7/03/2017	414.5	272.1
HDVP2	6/03/2017	414.5	272.1
HDVP2	5/03/2017	414.5	272.1
HDVP2	4/03/2017	414.5	272.1
HDVP2	3/03/2017	414.5	272.1
HDVP2	2/03/2017	414.5	272.1
HDVP2	1/03/2017	366.1	320.5
HDVP2	28/02/2017	366.1	320.5
HDVP2	27/02/2017	366.1	320.5
HDVP2	26/02/2017	366.1	320.5
HDVP2	25/02/2017	366.1	320.5
HDVP2	24/02/2017	366.1	320.5
HDVP2	23/02/2017	366.1	320.5
HDVP2	22/02/2017	366.1	320.5
HDVP2	21/02/2017	366.1	320.5
HDVP2	20/02/2017	366.1	320.5
HDVP2	19/02/2017	366.1	320.5
HDVP2	18/02/2017	366.1	320.5
HDVP2	17/02/2017	366.1	320.5
HDVP2	16/02/2017	366.1	320.5
HDVP2	15/02/2017	366.1	320.5
HDVP2	14/02/2017	366.1	320.5
HDVP2	13/02/2017	366.1	320.5
HDVP2	12/02/2017	366.1	320.5
HDVP2	11/02/2017	366.1	320.5
HDVP2	10/02/2017	366.1	320.5
HDVP2	9/02/2017	366.1	320.5
HDVP2	8/02/2017	366.1	320.5
HDVP2	7/02/2017	366.1	320.5
HDVP2	6/02/2017	366.1	320.5
HDVP2	5/02/2017	366.1	320.5
HDVP2	4/02/2017	366.1	320.5
HDVP2	3/02/2017	366.1	320.5
HDVP2	2/02/2017	366.1	320.5
HDVP2	1/02/2017	341.2	345.3
HDVP2	31/01/2017	341.2	345.3
HDVP2	30/01/2017	341.2	345.3
HDVP2	29/01/2017	341.2	345.3
HDVP2	28/01/2017	341.2	345.3
HDVP2	27/01/2017	341.2	345.3
HDVP2	26/01/2017	341.2	345.3
HDVP2	25/01/2017	341.2	345.3
HDVP2	24/01/2017	341.2	345.3
HDVP2	23/01/2017	341.2	345.3
HDVP2	22/01/2017	341.2	345.3
HDVP2	21/01/2017	341.2	345.3
HDVP2	20/01/2017	341.2	345.3
HDVP2	19/01/2017	341.2	345.3
HDVP2	18/01/2017	341.2	345.3
HDVP2	17/01/2017	341.2	345.3
HDVP2	16/01/2017	341.2	345.3
HDVP2	15/01/2017	341.2	345.3

ID	Date	WL mAHD	WL mbgl
MB18WON0002	18/03/2020	625.8	38.8
MB18WON0002	17/03/2020	625.8	38.9
MB18WON0002	16/03/2020	625.8	38.9
MB18WON0002	15/03/2020	625.8	38.9
MB18WON0002	14/03/2020	625.8	38.9
MB18WON0002	13/03/2020	625.8	38.9
MB18WON0002	12/03/2020	625.8	38.9
MB18WON0002	11/03/2020	625.8	38.9
MB18WON0002	10/03/2020	625.7	38.9
MB18WON0002	9/03/2020	625.7	38.9
MB18WON0002	8/03/2020	625.7	38.9
MB18WON0002	7/03/2020	625.7	38.9
MB18WON0002	6/03/2020	625.7	38.9
MB18WON0002	5/03/2020	625.7	38.9
MB18WON0002	4/03/2020	625.7	38.9
MB18WON0002	3/03/2020	625.7	38.9
MB18WON0002	2/03/2020	625.7	38.9
MB18WON0002	1/03/2020	625.7	38.9
MB18WON0002	29/02/2020	625.7	38.9
MB18WON0002	28/02/2020	625.7	38.9
MB18WON0002	27/02/2020	625.7	38.9
MB18WON0002	26/02/2020	625.7	38.9
MB18WON0002	25/02/2020	625.7	38.9
MB18WON0002	24/02/2020	625.7	38.9
MB18WON0002	23/02/2020	625.7	38.9
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MB18WON0002	21/02/2020	625.7	38.9
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MB18WON0002	19/02/2020	625.7	38.9
MB18WON0002	18/02/2020	625.7	38.9
MB18WON0002	17/02/2020	625.7	38.9
MB18WON0002	16/02/2020	625.7	39.0
MB18WON0002	15/02/2020	625.7	39.0
MB18WON0002	14/02/2020	625.7	39.0
MB18WON0002	13/02/2020	625.7	39.0
MB18WON0002	12/02/2020	625.7	39.0
MB18WON0002	11/02/2020	625.6	39.0
MB18WON0002	10/02/2020	625.6	39.0
MB18WON0002	9/02/2020	625.6	39.0
MB18WON0002	8/02/2020	625.6	39.0
MB18WON0002	7/02/2020	625.6	39.0
MB18WON0002	6/02/2020	625.6	39.0
MB18WON0002	5/02/2020	625.6	39.0
MB18WON0002	4/02/2020	625.6	39.0
MB18WON0002	3/02/2020	625.6	39.0
MB18WON0002	2/02/2020	625.6	39.0
MB18WON0002	1/02/2020	625.6	39.0
MB18WON0002	31/01/2020	625.6	39.0
MB18WON0002	30/01/2020	625.6	39.0
MB18WON0002	29/01/2020	625.6	39.0
MB18WON0002	28/01/2020	625.6	39.0
MB18WON0002	27/01/2020	625.6	39.0
MB18WON0002	26/01/2020	625.6	39.0
MB18WON0002	25/01/2020	625.6	39.0
MB18WON0002	24/01/2020	625.6	39.0
MB18WON0002	23/01/2020	625.6	39.0
MB18WON0002	22/01/2020	625.6	39.1
MB18WON0002	21/01/2020	625.6	39.1
MB18WON0002	20/01/2020	625.6	39.1
MB18WON0002	19/01/2020	625.6	39.1
MB18WON0002	18/01/2020	625.5	39.1
MB18WON0002	17/01/2020	625.5	39.1
MB18WON0002	16/01/2020	625.6	39.1
MB18WON0002	15/01/2020	625.5	39.1
MB18WON0002	14/01/2020	625.5	39.1
MB18WON0002	13/01/2020	625.5	39.1
MB18WON0002	12/01/2020	625.5	39.1
MB18WON0002	11/01/2020	625.5	39.1
MB18WON0002	10/01/2020	625.5	39.1
MB18WON0002	9/01/2020	625.5	39.1
MB18WON0002	8/01/2020	625.5	39.2
MB18WON0002	7/01/2020	625.5	39.1
MB18WON0002	6/01/2020	625.5	39.1
MB18WON0002	5/01/2020	625.5	39.1
MB18WON0002	4/01/2020	625.5	39.2
MB18WON0002	3/01/2020	625.5	39.2
MB18WON0002	2/01/2020	625.4	39.2
MB18WON0002	1/01/2020	625.4	39.2
MB18WON0002	31/12/2019	625.4	39.2
MB18WON0002	30/12/2019	625.4	39.2
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MB18WON0002	28/12/2019	625.4	39.2
MB18WON0002	27/12/2019	625.4	39.2
MB18WON0002	26/12/2019	625.4	39.3
MB18WON0002	25/12/2019	625.3	39.3
MB18WON0002	24/12/2019	625.3	39.3
MB18WON0002	23/12/2019	625.3	39.3
MB18WON0002	22/12/2019	625.3	39.3
MB18WON0002	21/12/2019	625.3	39.4
MB18WON0002	20/12/2019	625.2	39.4
MB18WON0002	19/12/2019	625.2	39.4
MB18WON0002	18/12/2019	625.1	39.5
MB18WON0002	17/12/2019	625.1	39.5
MB18WON0002	16/12/2019	625.0	39.6
MB18WON0002	15/12/2019	624.8	39.8
MB18WON0002	14/12/2019	624.5	40.1
MB18WON0002	13/12/2019	621.3	43.3
MB18WON0002	12/12/2019	625.9	38.7
MB18WON0002	11/12/2019	625.9	38.7
MB18WON0002	10/12/2019	625.9	38.7
MB18WON0002	9/12/2019	625.9	38.7
MB18WON0002	8/12/2019	625.9	38.7
MB18WON0002	7/12/2019	625.9	38.7
MB18WON0002	6/12/2019	625.9	38.7
MB18WON0002	5/12/2019	625.9	38.7
MB18WON0002	4/12/2019	625.9	38.7
MB18WON0002	3/12/2019	625.9	38.7
MB18WON0002	2/12/2019	625.9	38.7
MB18WON0002	1/12/2019	625.9	38.7
MB18WON0002	30/11/2019	625.9	38.7
MB18WON0002	29/11/2019	625.9	38.7
MB18WON0002	28/11/2019	625.9	38.7
MB18WON0002	27/11/2019	625.9	38.7
MB18WON0002	26/11/2019	625.9	38.7
MB18WON0002	25/11/2019	625.9	38.7
MB18WON0002	24/11/2019	625.9	38.7
MB18WON0002	23/11/2019	625.9	38.7
MB18WON0002	22/11/2019	625.9	38.7
MB18WON0002	21/11/2019	625.9	38.7
MB18WON0002	20/11/2019	625.9	38.7
MB18WON0002	19/11/2019	625.9	38.7
MB18WON0002	18/11/2019	625.9	38.7
MB18WON0002	17/11/2019	625.9	38.7
MB18WON0002	16/11/2019	625.9	38.7
MB18WON0002	15/11/2019	625.9	38.7
MB18WON0002	14/11/2019	625.9	38.7
MB18WON0002	13/11/2019	625.9	38.7
MB18WON0002	12/11/2019	625.9	38.7
MB18WON0002	11/11/2019	625.9	38.7
MB18WON0002	10/11/2019	625.9	38.7
MB18WON0002	9/11/2019	625.9	38.7
MB18WON0002	8/11/2019	625.9	38.7
MB18WON0002	7/11/2019	625.9	38.7
MB18WON0002	6/11/2019	625.9	38.7
MB18WON0002	5/11/2019	625.9	38.7
MB18WON0002	4/11/2019	625.9	38.7

ID	Date	WL mAHD	WL mbgl
MB15HD20006	3/09/2019	625.3	76.8
MB15HD20006	4/09/2019	625.3	76.8
MB15HD20006	5/09/2019	625.3	76.8
MB15HD20006	6/09/2019	625.3	76.8
MB15HD20006	7/09/2019	625.3	76.8
MB15HD20006	8/09/2019	625.3	76.8
MB15HD20006	9/09/2019	625.3	76.8
MB15HD20006	10/09/2019	625.3	76.8
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MB15HD20006	25/09/2019	625.3	76.7
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MB15HD20006	27/09/2019	625.3	76.8
MB15HD20006	28/09/2019	625.3	76.8
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MB15HD20006	4/10/2019	625.3	76.8
MB15HD20006	5/10/2019	625.3	76.8
MB15HD20006	6/10/2019	625.3	76.8
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MB15HD20006	8/10/2019	625.3	76.8
MB15HD20006	9/10/2019	625.3	76.8
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MB15HD20006	15/10/2019	625.3	76.8
MB15HD20006	16/10/2019	625.3	76.8
MB15HD20006	17/10/2019	625.3	76.8
MB15HD20006	18/10/2019	625.3	76.8
MB15HD20006	19/10/2019	625.3	76.8
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MB15HD20006	23/10/2019	625.3	76.8
MB15HD20006	24/10/2019	625.3	76.8
MB15HD20006	25/10/2019	625.3	76.8
MB15HD20006	26/10/2019	625.3	76.8
MB15HD20006	27/10/2019	625.3	76.8
MB15HD20006	28/10/2019	625.3	76.8
MB15HD20006	29/10/2019	625.3	76.8
MB15HD20006	30/10/2019	625.3	76.8
MB15HD20006	31/10/2019	625.2	76.8
MB15HD20006	1/11/2019	625.2	76.8
MB15HD20006	2/11/2019	625.2	76.8
MB15HD20006	3/11/2019	625.3	76.8
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MB15HD20006	5/11/2019	625.3	76.8
MB15HD20006	6/11/2019	625.3	76.8
MB15HD20006	7/11/2019	625.3	76.8
MB15HD20006	8/11/2019	625.3	76.8
MB15HD20006	9/11/2019	625.3	76.8
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MB15HD20006	11/11/2019	625.3	76.8
MB15HD20006	12/11/2019	625.2	76.8
MB15HD20006	13/11/2019	625.3	76.8
MB15HD20006	14/11/2019	625.3	76.8
MB15HD20006	15/11/2019	625.3	76.8
MB15HD20006	16/11/2019	625.3	76.8
MB15HD20006	17/11/2019	625.3	76.8
MB15HD20006	18/11/2019	625.3	76.8
MB15HD20006	19/11/2019	625.2	76.8
MB15HD20006	20/11/2019	625.2	76.9
MB15HD20006	21/11/2019	625.2	76.8
MB15HD20006	22/11/2019	625.2	76.8
MB15HD20006	23/11/2019	625.2	76.8
MB15HD20006	24/11/2019	625.2	76.8
MB15HD20006	25/11/2019	625.2	76.8
MB15HD20006	26/11/2019	625.2	76.8
MB15HD20006	27/11/2019	625.2	76.8
MB15HD20006	28/11/2019	625.2	76.8
MB15HD20006	29/11/2019	625.2	76.9
MB15HD20006	30/11/2019	625.2	76.8
MB15HD20006	1/12/2019	625.3	76.8
MB15HD20006	2/12/2019	625.3	76.8
MB15HD20006	3/12/2019	625.3	76.8
MB15HD20006	4/12/2019	625.2	76.8
MB15HD20006	5/12/2019	625.2	76.8
MB15HD20006	6/12/2019	625.2	76.8
MB15HD20006	7/12/2019	625.2	76.8
MB15HD20006	8/12/2019	625.2	76.8
MB15HD20006	9/12/2019	625.2	76.8
MB15HD20006	10/12/2019	625.2	76.8
MB15HD20006	11/12/2019	625.2	76.8
MB15HD20006	12/12/2019	625.2	76.8
MB15HD20006	13/12/2019	625.2	76.8
MB15HD20006	14/12/2019	625.2	76.8
MB15HD20006	15/12/2019	625.2	76.8
MB15HD20006	16/12/2019	625.2	76.8
MB15HD20006	17/12/2019	625.2	76.8
MB15HD20006	18/12/2019	625.2	76.8
MB15HD20006	19/12/2019	625.2	76.9
MB15HD20006	20/12/2019	625.2	76.9
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MB15HD20006	24/12/2019	625.2	76.8
MB15HD20006	25/12/2019	625.2	76.8
MB15HD20006	26/12/2019	625.2	76.8
MB15HD20006	27/12/2019	625.2	76.8
MB15HD20006	28/12/2019	625.2	76.8
MB15HD20006	29/12/2019	625.2	76.9
MB15HD20006	30/12/2019	625.2	76.9
MB15HD20006	31/12/2019	625.2	76.9
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MB15HD20006	7/01/2020	625.2	76.9
MB15HD20006	8/01/2020	625.2	76.9
MB15HD20006	9/01/2020	625.1	76.9
MB15HD20006	10/01/2020	625.2	76.9
MB15HD20006	11/01/2020	625.2	76.9
MB15HD20006	12/01/2020	625.2	76.9
MB15HD20006	13/01/2020	625.2	76.9
MB15HD20006	14/01/2020	625.2	76.9
MB15HD20006	15/01/2020	625.2	76.9
MB15HD20006	16/01/2020	625.2	76.8

ID	Date	WL mAHD	WL mbgl
MB18HD20009	19/08/2020	627.7	74.8
MB18HD20009	20/08/2020	627.7	74.8
MB18HD20009	21/08/2020	627.7	74.8
MB18HD20009	22/08/2020	627.7	74.8
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MB18HD20009	24/08/2020	627.7	74.8
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MB18HD20009	28/08/2020	627.7	74.8
MB18HD20009	29/08/2020	627.7	74.8
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MB18HD20009	2/09/2020	627.7	74.8
MB18HD20009	3/09/2020	627.7	74.8
MB18HD20009	4/09/2020	627.7	74.8
MB18HD20009	5/09/2020	627.6	74.8
MB18HD20009	6/09/2020	627.6	74.9
MB18HD20009	7/09/2020	627.6	74.8
MB18HD20009	8/09/2020	627.7	74.8
MB18HD20009	9/09/2020	627.6	74.8
MB18HD20009	10/09/2020	627.6	74.8
MB18HD20009	11/09/2020	627.6	74.8
MB18HD20009	12/09/2020	627.7	74.8
MB18HD20009	13/09/2020	627.7	74.8
MB18HD20009	14/09/2020	627.7	74.8
MB18HD20009	15/09/2020	627.7	74.8
MB18HD20009	16/09/2020	627.6	74.8
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MB18HD20009	18/09/2020	627.6	74.9
MB18HD20009	19/09/2020	627.6	74.9
MB18HD20009	20/09/2020	627.6	74.8
MB18HD20009	21/09/2020	627.7	74.8
MB18HD20009	22/09/2020	627.7	74.8
MB18HD20009	23/09/2020	627.7	74.8
MB18HD20009	24/09/2020	627.7	74.8
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MB18HD20009	26/09/2020	627.6	74.9
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MB18HD20009	28/09/2020	627.6	74.9
MB18HD20009	29/09/2020	627.6	74.8
MB18HD20009	30/09/2020	627.6	74.9
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MB18HD20009	2/10/2020	627.6	74.9
MB18HD20009	3/10/2020	627.6	74.8
MB18HD20009	4/10/2020	627.7	74.8
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MB18HD20009	6/10/2020	627.7	74.8
MB18HD20009	7/10/2020	627.6	74.8
MB18HD20009	8/10/2020	627.6	74.8
MB18HD20009	9/10/2020	627.6	74.9
MB18HD20009	10/10/2020	627.6	74.9
MB18HD20009	11/10/2020	627.6	74.9
MB18HD20009	12/10/2020	627.6	74.9
MB18HD20009	13/10/2020	627.6	74.9
MB18HD20009	14/10/2020	627.6	74.9
MB18HD20009	15/10/2020	627.6	74.9
MB18HD20009	16/10/2020	627.6	74.9
MB18HD20009	17/10/2020	627.6	74.9
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MB18HD20009	19/10/2020	627.6	74.9
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MB18HD20009	26/10/2020	627.6	74.9
MB18HD20009	27/10/2020	627.6	74.9
MB18HD20009	28/10/2020	627.6	74.9
MB18HD20009	29/10/2020	627.6	74.9
MB18HD20009	30/10/2020	627.6	74.9
MB18HD20009	31/10/2020	627.6	74.9
MB18HD20009	1/11/2020	627.6	74.9
MB18HD20009	2/11/2020	627.6	74.9
MB18HD20009	3/11/2020	627.6	74.9
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MB18HD20009	5/11/2020	627.6	74.9
MB18HD20009	6/11/2020	627.6	74.9
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MB18HD20009	8/11/2020	627.6	74.9
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MB18HD20009	14/11/2020	627.6	74.9
MB18HD20009	15/11/2020	627.6	74.9
MB18HD20009	16/11/2020	627.6	74.9
MB18HD20009	17/11/2020	627.6	74.9
MB18HD20009	18/11/2020	627.6	74.9
MB18HD20009	19/11/2020	627.6	74.9
MB18HD20009	20/11/2020	627.6	74.9
MB18HD20009	21/11/2020	627.6	74.9
MB18HD20009	22/11/2020	627

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	14/01/2017	341.2	345.3
HDVP2	13/01/2017	341.2	345.3
HDVP2	12/01/2017	341.2	345.3
HDVP2	11/01/2017	341.2	345.3
HDVP2	10/01/2017	341.2	345.3
HDVP2	9/01/2017	341.2	345.3
HDVP2	8/01/2017	341.2	345.3
HDVP2	7/01/2017	341.2	345.3
HDVP2	6/01/2017	341.2	345.3
HDVP2	5/01/2017	341.2	345.3
HDVP2	4/01/2017	341.2	345.3
HDVP2	3/01/2017	341.2	345.3
HDVP2	2/01/2017	341.2	345.3
HDVP2	1/01/2017	513.8	172.8
HDVP2	31/12/2016	513.8	172.8
HDVP2	30/12/2016	513.8	172.8
HDVP2	29/12/2016	513.8	172.8
HDVP2	28/12/2016	513.8	172.8
HDVP2	27/12/2016	513.8	172.8
HDVP2	26/12/2016	513.8	172.8
HDVP2	25/12/2016	513.8	172.8
HDVP2	24/12/2016	513.8	172.8
HDVP2	23/12/2016	513.8	172.8
HDVP2	22/12/2016	513.8	172.8
HDVP2	21/12/2016	513.8	172.8
HDVP2	20/12/2016	513.8	172.8
HDVP2	19/12/2016	513.8	172.8
HDVP2	18/12/2016	513.8	172.8
HDVP2	17/12/2016	513.8	172.8
HDVP2	16/12/2016	513.8	172.8
HDVP2	15/12/2016	513.8	172.8
HDVP2	14/12/2016	513.8	172.8
HDVP2	13/12/2016	513.8	172.8
HDVP2	12/12/2016	513.8	172.8
HDVP2	11/12/2016	513.8	172.8
HDVP2	10/12/2016	513.8	172.8
HDVP2	9/12/2016	513.8	172.8
HDVP2	8/12/2016	513.8	172.8
HDVP2	7/12/2016	513.8	172.8
HDVP2	6/12/2016	513.8	172.8
HDVP2	5/12/2016	513.8	172.8
HDVP2	4/12/2016	513.8	172.8
HDVP2	3/12/2016	513.8	172.8
HDVP2	2/12/2016	513.8	172.8
HDVP2	1/12/2016	467.8	218.7
HDVP2	30/11/2016	467.8	218.7
HDVP2	29/11/2016	467.8	218.7
HDVP2	28/11/2016	467.8	218.7
HDVP2	27/11/2016	467.8	218.7
HDVP2	26/11/2016	467.8	218.7
HDVP2	25/11/2016	467.8	218.7
HDVP2	24/11/2016	467.8	218.7
HDVP2	23/11/2016	467.8	218.7
HDVP2	22/11/2016	467.8	218.7
HDVP2	21/11/2016	467.8	218.7
HDVP2	20/11/2016	467.8	218.7
HDVP2	19/11/2016	467.8	218.7
HDVP2	18/11/2016	467.8	218.7
HDVP2	17/11/2016	467.8	218.7
HDVP2	16/11/2016	467.8	218.7
HDVP2	15/11/2016	467.8	218.7
HDVP2	14/11/2016	467.8	218.7
HDVP2	13/11/2016	467.8	218.7
HDVP2	12/11/2016	467.8	218.7
HDVP2	11/11/2016	467.8	218.7
HDVP2	10/11/2016	467.8	218.7
HDVP2	9/11/2016	467.8	218.7
HDVP2	8/11/2016	467.8	218.7
HDVP2	7/11/2016	467.8	218.7
HDVP2	6/11/2016	467.8	218.7
HDVP2	5/11/2016	467.8	218.7
HDVP2	4/11/2016	467.8	218.7
HDVP2	3/11/2016	467.8	218.7
HDVP2	2/11/2016	467.8	218.7
HDVP2	1/11/2016	490.1	196.5
HDVP2	31/10/2016	490.1	196.5
HDVP2	30/10/2016	490.1	196.5
HDVP2	29/10/2016	490.1	196.5
HDVP2	28/10/2016	490.1	196.5
HDVP2	27/10/2016	490.1	196.5
HDVP2	26/10/2016	490.1	196.5
HDVP2	25/10/2016	490.1	196.5
HDVP2	24/10/2016	490.1	196.5
HDVP2	23/10/2016	490.1	196.5
HDVP2	22/10/2016	490.1	196.5
HDVP2	21/10/2016	490.1	196.5
HDVP2	20/10/2016	490.1	196.5
HDVP2	19/10/2016	490.1	196.5
HDVP2	18/10/2016	490.1	196.5
HDVP2	17/10/2016	490.1	196.5
HDVP2	16/10/2016	490.1	196.5
HDVP2	15/10/2016	490.1	196.5
HDVP2	14/10/2016	490.1	196.5
HDVP2	13/10/2016	490.1	196.5
HDVP2	12/10/2016	490.1	196.5
HDVP2	11/10/2016	490.1	196.5
HDVP2	10/10/2016	490.1	196.5
HDVP2	9/10/2016	490.1	196.5
HDVP2	8/10/2016	490.1	196.5
HDVP2	7/10/2016	490.1	196.5
HDVP2	6/10/2016	490.1	196.5
HDVP2	5/10/2016	490.1	196.5
HDVP2	4/10/2016	490.1	196.5
HDVP2	3/10/2016	490.1	196.5
HDVP2	2/10/2016	490.1	196.5
HDVP2	1/10/2016	470.5	216.0
HDVP2	30/09/2016	470.5	216.0
HDVP2	29/09/2016	470.5	216.0
HDVP2	28/09/2016	470.5	216.0
HDVP2	27/09/2016	470.5	216.0
HDVP2	26/09/2016	470.5	216.0
HDVP2	25/09/2016	470.5	216.0
HDVP2	24/09/2016	470.5	216.0
HDVP2	23/09/2016	470.5	216.0
HDVP2	22/09/2016	470.5	216.0
HDVP2	21/09/2016	470.5	216.0
HDVP2	20/09/2016	470.5	216.0
HDVP2	19/09/2016	470.5	216.0
HDVP2	18/09/2016	470.5	216.0
HDVP2	17/09/2016	470.5	216.0
HDVP2	16/09/2016	470.5	216.0
HDVP2	15/09/2016	470.5	216.0
HDVP2	14/09/2016	470.5	216.0
HDVP2	13/09/2016	470.5	216.0
HDVP2	12/09/2016	470.5	216.0
HDVP2	11/09/2016	470.5	216.0
HDVP2	10/09/2016	470.5	216.0
HDVP2	9/09/2016	470.5	216.0
HDVP2	8/09/2016	470.5	216.0
HDVP2	7/09/2016	470.5	216.0
HDVP2	6/09/2016	470.5	216.0
HDVP2	5/09/2016	470.5	216.0
HDVP2	4/09/2016	470.5	216.0
HDVP2	3/09/2016	470.5	216.0
HDVP2	2/09/2016	470.5	216.0
HDVP2	1/09/2016	523.6	163.0

ID	Date	WL mAHD	WL mbgl
MB18WON0002	3/11/2019	625.9	38.7
MB18WON0002	2/11/2019	625.9	38.7
MB18WON0002	1/11/2019	625.9	38.7
MB18WON0002	31/10/2019	625.9	38.7
MB18WON0002	30/10/2019	625.9	38.7
MB18WON0002	29/10/2019	625.9	38.7
MB18WON0002	28/10/2019	625.9	38.7
MB18WON0002	27/10/2019	625.9	38.7
MB18WON0002	26/10/2019	625.9	38.7
MB18WON0002	25/10/2019	625.9	38.7
MB18WON0002	24/10/2019	625.9	38.7
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MB18WON0002	22/10/2019	625.9	38.7
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MB18WON0002	19/10/2019	625.9	38.7
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MB18WON0002	17/10/2019	625.9	38.7
MB18WON0002	16/10/2019	625.9	38.7
MB18WON0002	15/10/2019	625.9	38.7
MB18WON0002	14/10/2019	625.9	38.7
MB18WON0002	13/10/2019	625.9	38.7
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MB18WON0002	8/10/2019	625.9	38.7
MB18WON0002	7/10/2019	625.9	38.7
MB18WON0002	6/10/2019	625.9	38.7
MB18WON0002	5/10/2019	625.9	38.7
MB18WON0002	4/10/2019	625.9	38.7
MB18WON0002	3/10/2019	625.9	38.7
MB18WON0002	2/10/2019	625.9	38.7
MB18WON0002	1/10/2019	625.9	38.7
MB18WON0002	30/09/2019	625.9	38.7
MB18WON0002	29/09/2019	625.9	38.7
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MB18WON0002	27/09/2019	625.9	38.7
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MB18WON0002	25/09/2019	625.9	38.7
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MB18WON0002	17/09/2019	625.9	38.8
MB18WON0002	16/09/2019	625.9	38.8
MB18WON0002	15/09/2019	625.9	38.8
MB18WON0002	14/09/2019	625.9	38.8
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MB18WON0002	8/08/2019	625.7	38.9
MB18WON0002	7/08/2019	625.7	38.9
MB18WON0002	6/08/2019	625.6	39.0
MB18WON0002	5/08/2019	625.6	39.0
MB18WON0002	4/08/2019	625.6	39.0
MB18WON0002	3/08/2019	625.5	39.2
MB18WON0002	2/08/2019	624.8	39.8
MB18WON0002	1/08/2019	626.0	38.7
MB18WON0002	31/07/2019	626.0	38.7
MB18WON0002	30/07/2019	626.0	38.7
MB18WON0002	29/07/2019	625.9	38.7
MB18WON0002	28/07/2019	625.9	38.7
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MB18WON0002	19/07/2019	625.9	38.7
MB18WON0002	18/07/2019	625.9	38.7
MB18WON0002	17/07/2019	625.9	38.7
MB18WON0002	16/07/2019	626.0	38.7
MB18WON0002	15/07/2019	626.0	38.7
MB18WON0002	14/07/2019	626.0	38.7
MB18WON0002	13/07/2019	626.0	38.7
MB18WON0002	12/07/2019	625.9	38.7
MB18WON0002	11/07/2019	625.9	38.7
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MB18WON0002	25/06/2019	625.9	38.7
MB18WON0002	24/06/2019	625.9	38.7
MB18WON0002	23/06/2019	625.9	38.7
MB18WON0002	22/06/2019	625.9	38.7
MB18WON0002	21/06/2019	625.9	38.7

ID	Date	WL mAHD	WL mbgl
MB15HD20006	17/01/2020	625.2	76.9
MB15HD20006	18/01/2020	625.2	76.9
MB15HD20006	19/01/2020	625.2	76.9
MB15HD20006	20/01/2020	625.2	76.9
MB15HD20006	21/01/2020	625.2	76.9
MB15HD20006	22/01/2020	625.2	76.9
MB15HD20006	23/01/2020	625.2	76.9
MB15HD20006	24/01/2020	625.2	76.9
MB15HD20006	25/01/2020	625.2	76.9
MB15HD20006	26/01/2020	625.2	76.9
MB15HD20006	27/01/2020	625.2	76.9
MB15HD20006	28/01/2020	625.2	76.9
MB15HD20006	29/01/2020	625.2	76.9
MB15HD20006	30/01/2020	625.2	76.9
MB15HD20006	31/01/2020	625.2	76.9
MB15HD20006	1/02/2020	625.2	76.9
MB15HD20006	2/02/2020	625.2	76.9
MB15HD20006	3/02/2020	625.2	76.9
MB15HD20006	4/02/2020	625.2	76.9
MB15HD20006	5/02/2020	625.2	76.9
MB15HD20006	6/02/2020	625.2	76.9
MB15HD20006	7/02/2020	625.2	76.9
MB15HD20006	8/02/2020	625.2	76.9
MB15HD20006	9/02/2020	625.2	76.9
MB15HD20006	10/02/2020	625.2	76.9
MB15HD20006	11/02/2020	625.2	76.9
MB15HD20006	12/02/2020	625.2	76.9
MB15HD20006	13/02/2020	625.2	76.9
MB15HD20006	14/02/2020	625.2	76.9
MB15HD20006	15/02/2020	625.2	76.9
MB15HD20006	16/02/2020	625.2	76.9
MB15HD20006	17/02/2020	625.2	76.9
MB15HD20006	18/02/2020	625.2	76.8
MB15HD20006	19/02/2020	625.2	76.8
MB15HD20006	20/02/2020	625.2	76.9
MB15HD20006	21/02/2020	625.2	76.9
MB15HD20006	22/02/2020	625.2	76.9
MB15HD20006	23/02/2020	625.2	76.9
MB15HD20006	24/02/2020	625.2	76.9
MB15HD20006	25/02/2020	625.2	76.9
MB15HD20006	26/02/2020	625.2	76.9
MB15HD20006	27/02/2020	625.2	76.9
MB15HD20006	28/02/2020	625.2	76.9
MB15HD20006	29/02/2020	625.2	76.9
MB15HD20006	1/03/2020	625.2	76.9
MB15HD20006	2/03/2020	625.2	76.9
MB15HD20006	3/03/2020	625.2	76.9
MB15HD20006	4/03/2020	625.2	76.9
MB15HD20006	5/03/2020	625.2	76.9
MB15HD20006	6/03/2020	625.2	76.9
MB15HD20006	7/03/2020	625.2	76.9
MB15HD20006	8/03/2020	625.2	76.8
MB15HD20006	9/03/2020	625.2	76.9
MB15HD20006	10/03/2020	625.2	76.9
MB15HD20006	11/03/2020	625.2	76.9
MB15HD20006	12/03/2020	625.2	76.9
MB15HD20006	13/03/2020	625.2	76.8
MB15HD20006	14/03/2020	625.2	76.8
MB15HD20006	15/03/2020	625.2	76.9
MB15HD20006	16/03/2020	625.2	76.9
MB15HD20006	17/03/2020	625.2	76.8
MB15HD20006	18/03/2020	625.2	76.8
MB15HD20006	19/03/2020	625.3	76.8
MB15HD20006	20/03/2020	625.3	76.8
MB15HD20006	21/03/2020	625.3	76.8
MB15HD20006	22/03/2020	625.3	76.8
MB15HD20006	23/03/2020	625.2	76.8
MB15HD20006	24/03/2020	625.2	76.8
MB15HD20006	25/03/2020	625.2	76.8
MB15HD20006	26/03/2020	625.2	76.8
MB15HD20006	27/03/2020	625.2	76.8
MB15HD20006	28/03/2020	625.2	76.8
MB15HD20006	29/03/2020	625.2	76.8
MB15HD20006	30/03/2020	625.2	76.8
MB15HD20006	31/03/2020	625.2	76.9
MB15HD20006	1/04/2020	625.2	76.9
MB15HD20006	2/04/2020	625.2	76.9
MB15HD20006	3/04/2020	625.2	76.9
MB15HD20006	4/04/2020	625.2	76.8
MB15HD20006	5/04/2020	625.2	76.8
MB15HD20006	6/04/2020	625.2	76.8
MB15HD20006	7/04/2020	625.2	76.8
MB15HD20006	8/04/2020	625.2	76.9
MB15HD20006	9/04/2020	625.2	76.8
MB15HD20006	10/04/2020	625.3	76.8
MB15HD20006	11/04/2020	625.3	76.8
MB15HD20006	12/04/2020	625.3	76.8
MB15HD20006	13/04/2020	625.3	76.8
MB15HD20006	14/04/2020	625.2	76.8
MB15HD20006	15/04/2020	625.2	76.8
MB15HD20006	16/04/2020	625.2	76.8
MB15HD20006	17/04/2020	625.2	76.8
MB15HD20006	18/04/2020	625.2	76.8
MB15HD20006	19/04/2020	625.2	76.8
MB15HD20006	20/04/2020	625.2	76.8
MB15HD20006	21/04/2020	625.2	76.8
MB15HD20006	22/04/2020	625.3	76.8
MB15HD20006	23/04/2020	625.3	76.8
MB15HD20006	24/04/2020	625.2	76.8
MB15HD20006	25/04/2020	625.3	76.8
MB15HD20006	26/04/2020	625.3	76.8
MB15HD20006	27/04/2020	625.3	76.8
MB15HD20006	28/04/2020	625.3	76.8
MB15HD20006	29/04/2020	625.3	76.8
MB15HD20006	30/04/2020	625.3	76.8
MB15HD20006	1/05/2020	625.3	76.8
MB15HD20006	2/05/2020	625.3	76.8
MB15HD20006	3/05/2020	625.3	76.8
MB15HD20006	4/05/2020	625.3	76.8
MB15HD20006	5/05/2020	625.3	76.8
MB15HD20006	6/05/2020	625.3	76.8
MB15HD20006	7/05/2020	625.3	76.8
MB15HD20006	8/05/2020	625.3	76.8
MB15HD20006	9/05/2020	625.3	76.8
MB15HD20006	10/05/2020	625.3	76.8
MB15HD20006	11/05/2020	625.3	76.8
MB15HD20006	12/05/2020	625.3	76.8
MB15HD20006	13/05/2020	625.3	76.8
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MB15HD20006	15/05/2020	625.3	76.8
MB15HD20006	16/05/2020	625.3	76.8
MB15HD20006	17/05/2020	625.3	76.8
MB15HD20006	18/05/2020	625.3	76.8
MB15HD20006	19/05/2020	625.3	76.8
MB15HD20006	20/05/2020	625.3	76.8
MB15HD20006	21/05/2020	625.3	76.8
MB15HD20006	22/05/2020	625.3	76.8
MB15HD20006	23/05/2020	625.3	76.8
MB15HD20006	24/05/2020	625.3	76.8
MB15HD20006	25/05/2020	625.2	76.8
MB15HD20006	26/05/2020	625.2	76.8
MB15HD20006	27/05/2020	625.3	76.8
MB15HD20006	28/05/2020	625.3	76.8
MB15HD20006	29/05/2020	625.3	76.8
MB15HD20006	30/05/2020	625.3	76.8
MB15HD20006	31/05/2020	625.3	76.8

ID	Date	WL mAHD	WL mbgl
MB18HD20009	2/01/2021	627.5	74.9
MB18HD20009	3/01/2021	627.5	74.9
MB18HD20009	4/01/2021	627.5	75.0
MB18HD20009	5/01/2021	627.6	74.9
MB18HD20009	6/01/2021	627.6	74.9
MB18HD20009	7/01/2021	627.6	74.9
MB18HD20009	8/01/2021	627.6	74.9
MB18HD20009	9/01/2021	627.6	74.9
MB18HD20009	10/01/2021	627.6	74.9
MB18HD20009	11/01/2021	627.5	74.9
MB18HD20009	12/01/2021	627.5	74.9
MB18HD20009	13/01/2021	627.5	74.9
MB18HD20009	14/01/2021	627.5	74.9
MB18HD20009	15/01/2021	627.5	74.9
MB18HD20009	16/01/2021	627.6	74.9
MB18HD20009	17/01/2021	627.6	74.9
MB18HD20009	18/01/2021	627.6	74.9
MB18HD20009	19/01/2021	627.6	74.9
MB18HD20009	20/01/2021	627.5	74.9
MB18HD20009	21/01/2021	627.5	75.0
MB18HD20009	22/01/2021	627.5	75.0
MB18HD20009	23/01/2021	627.5	75.0
MB18HD20009	24/01/2021	627.5	75.0
MB18HD20009	25/01/2021	627.5	75.0
MB18HD20009	26/01/2021	627.5	75.0
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MB18HD20009	28/01/2021	627.5	75.0
MB18HD20009	29/01/2021	627.5	75.0
MB18HD20009	30/01/2021	627.5	75.0
MB18HD20009	31/01/2021	627.5	75.0
MB18HD20009	1/02/2021	627.5	75.0
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MB18HD20009	6/02/2021	627.5	75.0
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MB18HD20009	13/02/2021	627.5	75.0
MB18HD20009	14/02/2021	627.5	75.0
MB18HD20009	15/02/2021	627.5	75.0
MB18HD20009	16/02/2021	627.5	75.0
MB18HD20009	17/02/2021	627.5	75.0
MB18HD20009	18/02/2021	627.5	75.0
MB18HD20009	19/02/2021	627.5	75.0
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MB18HD20009	21/08/2021	627.3	75.2
MB18HD20009	22/08/2021	627.3	75.2
MB18HD20009	23/08/2021	627.3	75.2
MB18HD20009	24/08/2021	627.3	75.2
MB18HD20009	25/08/2021	627.3	75.2
MB18HD20009	26/08/2021	627.3	75.2
MB18HD20009	27/08/2021	627.3	75.2
MB18HD20009	28/08/2021	627.3	75.2
MB18HD20009	29/08/2021	627.3	75.2
MB18HD20009	30/08/2021	627.3	75.2
MB18HD20009	31/08/2021	627.3	75.2
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MB18HD20009	4/09/2021	627.3	75.2
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MB18HD20009	7/09/2021	627.3	75.1
MB18HD20009	8/09/2021	627.3	75.2
MB18HD20009	9/09/2021	627.3	75.2
MB18HD20009	10/09/2021	627.3	75.2
MB18HD20009	11/09/2021	627.3	75.2
MB18HD20009	12/09/2021	627.2	75.2
MB18HD20009	13/09/2021	627.3	75.2
MB18HD20009	14/09/2021	627.3	75.2
MB18HD20009	15/09/2021	627.2	75.2
MB18HD20009	16/09/2021	627.3	75.2
MB18HD20009	17/09/2021	627.3	75.2
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MB18HD20009	19/09/2021	627.3	75.2
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MB18HD20009	22/09/2021	627.3	75.2
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MB18HD20009	24/09/2021	627.3	75.2
MB18HD20009	25/09/2021	627.2	75.2
MB18HD20009	26/09/2021	627.2	75.2
MB18HD20009	27/09/2021	627.2	75.2
MB18HD20009	28/09/2021	627.2	75.2
MB18HD20009	29/09/2021	627.2	75.2
MB18HD20009	30/09/2021	627.2	75.2
MB18HD20009	1/10/2021	627.2	75.3
MB18HD20009	2/10/2021	627.2	75.3
MB18HD20009	3/10/2021	627.2	75.2
MB18HD20009	4/10/2021	627.2	75.3
MB18HD20009	5/10/2021	627

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
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HDVP2	30/08/2016	523.6	163.0
HDVP2	29/08/2016	523.6	163.0
HDVP2	28/08/2016	523.6	163.0
HDVP2	27/08/2016	523.6	163.0
HDVP2	26/08/2016	523.6	163.0
HDVP2	25/08/2016	523.6	163.0
HDVP2	24/08/2016	523.6	163.0
HDVP2	23/08/2016	523.6	163.0
HDVP2	22/08/2016	523.6	163.0
HDVP2	21/08/2016	523.6	163.0
HDVP2	20/08/2016	523.6	163.0
HDVP2	19/08/2016	523.6	163.0
HDVP2	18/08/2016	523.6	163.0
HDVP2	17/08/2016	523.6	163.0
HDVP2	16/08/2016	523.6	163.0
HDVP2	15/08/2016	523.6	163.0
HDVP2	14/08/2016	523.6	163.0
HDVP2	13/08/2016	523.6	163.0
HDVP2	12/08/2016	523.6	163.0
HDVP2	11/08/2016	523.6	163.0
HDVP2	10/08/2016	523.6	163.0
HDVP2	9/08/2016	523.6	163.0
HDVP2	8/08/2016	523.6	163.0
HDVP2	7/08/2016	523.6	163.0
HDVP2	6/08/2016	523.6	163.0
HDVP2	5/08/2016	523.6	163.0
HDVP2	4/08/2016	523.6	163.0
HDVP2	3/08/2016	523.6	163.0
HDVP2	2/08/2016	523.6	163.0
HDVP2	1/08/2016	427.7	258.9
HDVP2	31/07/2016	427.7	258.9
HDVP2	30/07/2016	427.7	258.9
HDVP2	29/07/2016	427.7	258.9
HDVP2	28/07/2016	427.7	258.9
HDVP2	27/07/2016	427.7	258.9
HDVP2	26/07/2016	427.7	258.9
HDVP2	25/07/2016	427.7	258.9
HDVP2	24/07/2016	427.7	258.9
HDVP2	23/07/2016	427.7	258.9
HDVP2	22/07/2016	427.7	258.9
HDVP2	21/07/2016	427.7	258.9
HDVP2	20/07/2016	427.7	258.9
HDVP2	19/07/2016	427.7	258.9
HDVP2	18/07/2016	427.7	258.9
HDVP2	17/07/2016	427.7	258.9
HDVP2	16/07/2016	427.7	258.9
HDVP2	15/07/2016	427.7	258.9
HDVP2	14/07/2016	427.7	258.9
HDVP2	13/07/2016	427.7	258.9
HDVP2	12/07/2016	427.7	258.9
HDVP2	11/07/2016	427.7	258.9
HDVP2	10/07/2016	427.7	258.9
HDVP2	9/07/2016	427.7	258.9
HDVP2	8/07/2016	427.7	258.9
HDVP2	7/07/2016	427.7	258.9
HDVP2	6/07/2016	427.7	258.9
HDVP2	5/07/2016	427.7	258.9
HDVP2	4/07/2016	427.7	258.9
HDVP2	3/07/2016	427.7	258.9
HDVP2	2/07/2016	427.7	258.9
HDVP2	1/07/2016	539.8	146.8
HDVP2	30/06/2016	539.8	146.8
HDVP2	29/06/2016	539.8	146.8
HDVP2	28/06/2016	539.8	146.8
HDVP2	27/06/2016	539.8	146.8
HDVP2	26/06/2016	539.8	146.8
HDVP2	25/06/2016	539.8	146.8
HDVP2	24/06/2016	539.8	146.8
HDVP2	23/06/2016	539.8	146.8
HDVP2	22/06/2016	539.8	146.8
HDVP2	21/06/2016	539.8	146.8
HDVP2	20/06/2016	539.8	146.8
HDVP2	19/06/2016	539.8	146.8
HDVP2	18/06/2016	539.8	146.8
HDVP2	17/06/2016	539.8	146.8
HDVP2	16/06/2016	539.8	146.8
HDVP2	15/06/2016	539.8	146.8
HDVP2	14/06/2016	539.8	146.8
HDVP2	13/06/2016	539.8	146.8
HDVP2	12/06/2016	539.8	146.8
HDVP2	11/06/2016	539.8	146.8
HDVP2	10/06/2016	539.8	146.8
HDVP2	9/06/2016	539.8	146.8
HDVP2	8/06/2016	539.8	146.8
HDVP2	7/06/2016	539.8	146.8
HDVP2	6/06/2016	539.8	146.8
HDVP2	5/06/2016	539.8	146.8
HDVP2	4/06/2016	539.8	146.8
HDVP2	3/06/2016	539.8	146.8
HDVP2	2/06/2016	539.8	146.8
HDVP2	1/06/2016	599.3	87.2
HDVP2	31/05/2016	599.3	87.2
HDVP2	30/05/2016	599.3	87.2
HDVP2	29/05/2016	599.3	87.2
HDVP2	28/05/2016	599.3	87.2
HDVP2	27/05/2016	599.3	87.2
HDVP2	26/05/2016	599.3	87.2
HDVP2	25/05/2016	599.3	87.2
HDVP2	24/05/2016	599.3	87.2
HDVP2	23/05/2016	599.3	87.2
HDVP2	22/05/2016	599.3	87.2
HDVP2	21/05/2016	599.3	87.2
HDVP2	20/05/2016	599.3	87.2
HDVP2	19/05/2016	599.3	87.2
HDVP2	18/05/2016	599.3	87.2
HDVP2	17/05/2016	599.3	87.2
HDVP2	16/05/2016	599.3	87.2
HDVP2	15/05/2016	599.3	87.2
HDVP2	14/05/2016	599.3	87.2
HDVP2	13/05/2016	599.3	87.2
HDVP2	12/05/2016	599.3	87.2
HDVP2	11/05/2016	599.3	87.2
HDVP2	10/05/2016	599.3	87.2
HDVP2	9/05/2016	599.3	87.2
HDVP2	8/05/2016	599.3	87.2
HDVP2	7/05/2016	599.3	87.2
HDVP2	6/05/2016	599.3	87.2
HDVP2	5/05/2016	599.3	87.2
HDVP2	4/05/2016	599.3	87.2
HDVP2	3/05/2016	599.3	87.2
HDVP2	2/05/2016	599.3	87.2
HDVP2	1/05/2016	638.4	48.2
HDVP2	30/04/2016	638.4	48.2
HDVP2	29/04/2016	638.4	48.2
HDVP2	28/04/2016	638.4	48.2
HDVP2	27/04/2016	638.4	48.2
HDVP2	26/04/2016	638.4	48.2
HDVP2	25/04/2016	638.4	48.2
HDVP2	24/04/2016	638.4	48.2
HDVP2	23/04/2016	638.4	48.2
HDVP2	22/04/2016	638.4	48.2
HDVP2	21/04/2016	638.4	48.2
HDVP2	20/04/2016	638.4	48.2
HDVP2	19/04/2016	638.4	48.2
HDVP2	18/04/2016	638.4	48.2

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MB18WON0002	20/06/2019	625.9	38.7
MB18WON0002	19/06/2019	625.9	38.7
MB18WON0002	18/06/2019	625.9	38.7
MB18WON0002	17/06/2019	625.9	38.7
MB18WON0002	16/06/2019	625.9	38.7
MB18WON0002	15/06/2019	625.9	38.7
MB18WON0002	14/06/2019	625.9	38.7
MB18WON0002	13/06/2019	625.9	38.7
MB18WON0002	12/06/2019	625.9	38.7
MB18WON0002	11/06/2019	625.9	38.8
MB18WON0002	10/06/2019	625.9	38.8
MB18WON0002	9/06/2019	625.9	38.8
MB18WON0002	8/06/2019	625.9	38.8
MB18WON0002	7/06/2019	625.9	38.8
MB18WON0002	6/06/2019	625.9	38.7
MB18WON0002	5/06/2019	625.9	38.7
MB18WON0002	4/06/2019	625.9	38.7
MB18WON0002	3/06/2019	625.9	38.7
MB18WON0002	2/06/2019	625.9	38.7
MB18WON0002	1/06/2019	625.9	38.8
MB18WON0002	31/05/2019	625.9	38.8
MB18WON0002	30/05/2019	625.9	38.8
MB18WON0002	29/05/2019	625.8	38.8
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MB18WON0002	27/05/2019	625.8	38.8
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MB18WON0002	24/05/2019	625.8	38.8
MB18WON0002	23/05/2019	625.8	38.8
MB18WON0002	22/05/2019	625.8	38.8
MB18WON0002	21/05/2019	625.8	38.8
MB18WON0002	20/05/2019	625.8	38.8
MB18WON0002	19/05/2019	625.8	38.8
MB18WON0002	18/05/2019	625.8	38.8
MB18WON0002	17/05/2019	625.8	38.8
MB18WON0002	16/05/2019	625.8	38.8
MB18WON0002	15/05/2019	625.8	38.8
MB18WON0002	14/05/2019	625.8	38.8
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MB18WON0002	12/05/2019	625.8	38.8
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MB18WON0002	10/05/2019	625.8	38.8
MB18WON0002	9/05/2019	625.8	38.8
MB18WON0002	8/05/2019	625.8	38.8
MB18WON0002	7/05/2019	625.8	38.8
MB18WON0002	6/05/2019	625.8	38.8
MB18WON0002	5/05/2019	625.8	38.8
MB18WON0002	4/05/2019	625.8	38.8
MB18WON0002	3/05/2019	625.8	38.8
MB18WON0002	2/05/2019	625.8	38.9
MB18WON0002	1/05/2019	625.8	38.9
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MB18WON0002	29/04/2019	625.8	38.9
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MB18WON0002	24/04/2019	625.8	38.9
MB18WON0002	23/04/2019	625.7	38.9
MB18WON0002	22/04/2019	625.7	38.9
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MB18WON0002	19/04/2019	625.7	38.9
MB18WON0002	18/04/2019	625.7	38.9
MB18WON0002	17/04/2019	625.7	38.9
MB18WON0002	16/04/2019	625.7	38.9
MB18WON0002	15/04/2019	625.7	38.9
MB18WON0002	14/04/2019	625.7	38.9
MB18WON0002	13/04/2019	625.7	38.9
MB18WON0002	12/04/2019	625.7	38.9
MB18WON0002	11/04/2019	625.7	38.9
MB18WON0002	10/04/2019	625.7	38.9
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MB18WON0002	8/04/2019	625.7	38.9
MB18WON0002	7/04/2019	625.7	38.9
MB18WON0002	6/04/2019	625.7	38.9
MB18WON0002	5/04/2019	625.7	38.9
MB18WON0002	4/04/2019	625.7	39.0
MB18WON0002	3/04/2019	625.7	39.0
MB18WON0002	2/04/2019	625.7	39.0
MB18WON0002	1/04/2019	625.7	39.0
MB18WON0002	31/03/2019	625.7	39.0
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MB18WON0002	29/03/2019	625.6	39.0
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MB18WON0002	17/03/2019	625.6	39.0
MB18WON0002	16/03/2019	625.6	39.0
MB18WON0002	15/03/2019	625.6	39.0
MB18WON0002	14/03/2019	625.6	39.0
MB18WON0002	13/03/2019	625.6	39.0
MB18WON0002	12/03/2019	625.6	39.1
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MB18WON0002	10/03/2019	625.6	39.1
MB18WON0002	9/03/2019	625.6	39.1
MB18WON0002	8/03/2019	625.5	39.1
MB18WON0002	7/03/2019	625.5	39.1
MB18WON0002	6/03/2019	625.5	39.1
MB18WON0002	5/03/2019	625.5	39.1
MB18WON0002	4/03/2019	625.5	39.1
MB18WON0002	3/03/2019	625.5	39.1
MB18WON0002	2/03/2019	625.5	39.1
MB18WON0002	1/03/2019	625.5	39.1
MB18WON0002	28/02/2019	625.5	39.1
MB18WON0002	27/02/2019	625.5	39.1
MB18WON0002	26/02/2019	625.5	39.1
MB18WON0002	25/02/2019	625.5	39.1
MB18WON0002	24/02/2019	625.5	39.1
MB18WON0002	23/02/2019	625.5	39.2
MB18WON0002	22/02/2019	625.5	39.2
MB18WON0002	21/02/2019	625.5	39.2
MB18WON0002	20/02/2019	625.4	39.2
MB18WON0002	19/02/2019	625.4	39.2
MB18WON0002	18/02/2019	625.4	39.2
MB18WON0002	17/02/2019	625.4	39.2
MB18WON0002	16/02/2019	625.4	39.2
MB18WON0002	15/02/2019	625.4	39.2
MB18WON0002	14/02/2019	625.4	39.2
MB18WON0002	13/02/2019	625.4	39.2
MB18WON0002	12/02/2019	625.4	39.3
MB18WON0002	11/02/2019	625.4	39.3
MB18WON0002	10/02/2019	625.3	39.3
MB18WON0002	9/02/2019	625.3	39.3
MB18WON0002	8/02/2019	625.3	39.3
MB18WON0002	7/02/2019	625.3	39.3
MB18WON0002	6/02/2019	625.3	39.4
MB18WON0002	5/02/2019	625.2	39.4

ID	Date	WL mAHD	WL mbgl
MB15HD20006	1/06/2020	625.3	76.8
MB15HD20006	2/06/2020	625.3	76.8
MB15HD20006	3/06/2020	625.3	76.8
MB15HD20006	4/06/2020	625.3	76.8
MB15HD20006	5/06/2020	625.3	76.8
MB15HD20006	6/06/2020	625.3	76.8
MB15HD20006	7/06/2020	625.3	76.8
MB15HD20006	8/06/2020	625.3	76.8
MB15HD20006	9/06/2020	625.3	76.8
MB15HD20006	10/06/2020	625.3	76.8
MB15HD20006	11/06/2020	625.3	76.8
MB15HD20006	12/06/2020	625.2	76.8
MB15HD20006	13/06/2020	625.2	76.8
MB15HD20006	14/06/2020	625.3	76.8
MB15HD20006	15/06/2020	625.3	76.8
MB15HD20006	16/06/2020	625.3	76.8
MB15HD20006	17/06/2020	625.3	76.8
MB15HD20006	18/06/2020	625.3	76.8
MB15HD20006	19/06/2020	625.3	76.8
MB15HD20006	20/06/2020	625.3	76.8
MB15HD20006	21/06/2020	625.3	76.8
MB15HD20006	22/06/2020	625.3	76.8
MB15HD20006	23/06/2020	625.3	76.8
MB15HD20006	24/06/2020	625.3	76.8
MB15HD20006	25/06/2020	625.3	76.8
MB15HD20006	26/06/2020	625.3	76.8
MB15HD20006	27/06/2020	625.3	76.8
MB15HD20006	28/06/2020	625.3	76.8
MB15HD20006	29/06/2020	625.3	76.8
MB15HD20006	30/06/2020	625.3	76.8
MB15HD20006	1/07/2020	625.3	76.8
MB15HD20006	2/07/2020	625.3	76.8
MB15HD20006	3/07/2020	625.3	76.8
MB15HD20006	4/07/2020	625.3	76.8
MB15HD20006	5/07/2020	625.3	76.8
MB15HD20006	6/07/2020	625.3	76.8
MB15HD20006	7/07/2020	625.3	76.8
MB15HD20006	8/07/2020	625.3	76.8
MB15HD20006	9/07/2020	625.3	76.8
MB15HD20006	10/07/2020	625.3	76.8
MB15HD20006	11/07/2020	625.3	76.8
MB15HD20006	12/07/2020	625.3	76.8
MB15HD20006	13/07/2020	625.3	76.8
MB15HD20006	14/07/2020	625.3	76.8
MB15HD20006	15/07/2020	625.3	76.8
MB15HD20006	16/07/2020	625.3	76.8
MB15HD20006	17/07/2020	625.2	76.8
MB15HD20006	18/07/2020	625.2	76.8
MB15HD20006	19/07/2020	625.2	76.8
MB15HD20006	20/07/2020	625.3	76.8
MB15HD20006	21/07/2020	625.3	76.8
MB15HD20006	22/07/2020	625.3	76.8
MB15HD20006	23/07/2020	625.3	76.8
MB15HD20006	24/07/2020	625.3	76.8
MB15HD20006	25/07/2020	625.3	76.8
MB15HD20006	26/07/2020	625.3	76.8
MB15HD20006	27/07/2020	625.3	76.8
MB15HD20006	28/07/2020	625.3	76.8
MB15HD20006	29/07/2020	625.3	76.8
MB15HD20006	30/07/2020	625.3	76.8
MB15HD20006	31/07/2020	625.3	76.8
MB15HD20006	1/08/2020	625.3	76.8
MB15HD20006	2/08/2020	625.3	76.8
MB15HD20006	3/08/2020	625.2	76.8
MB15HD20006	4/08/2020	625.2	76.9
MB15HD20006	5/08/2020	625.2	76.9
MB15HD20006	6/08/2020	625.2	76.8
MB15HD20006	7/08/2020	625.3	76.8
MB15HD20006	8/08/2020	625.3	76.8
MB15HD20006	9/08/2020	625.2	76.8
MB15HD20006	10/08/2020	625.2	76.9
MB15HD20006	11/08/2020	625.2	76.9
MB15HD20006	12/08/2020	625.2	76.8
MB15HD20006	13/08/2020	625.2	76.8
MB15HD20006	14/08/2020	625.2	76.8
MB15HD20006	15/08/2020	625.2	76.8
MB15HD20006	16/08/2020	625.2	76.8
MB15HD20006	17/08/2020	625.2	76.8
MB15HD20006	18/08/2020	625.2	76.8
MB15HD20006	19/08/2020	625.2	76.8
MB15HD20006	20/08/2020	625.3	76.8
MB15HD20006	21/08/2020	625.3	76.8
MB15HD20006	22/08/2020	625.3	76.8
MB15HD20006	23/08/2020	625.3	76.8
MB15HD20006	24/08/2020	625.3	76.8
MB15HD20006	25/08/2020	625.3	76.8
MB15HD20006	26/08/2020	625.3	76.8
MB15HD20006	27/08/2020	625.3	76.8
MB15HD20006	28/08/2020	625.3	76.8
MB15HD20006	29/08/2020	625.3	76.8
MB15HD20006	30/08/2020	625.3	76.8
MB15HD20006	31/08/2020	625.3	76.8
MB15HD20006	1/09/2020	625.2	76.8
MB15HD20006	2/09/2020	625.2	76.8
MB15HD20006	3/09/2020	625.3	76.8
MB15HD20006	4/09/2020	625.3	76.8
MB15HD20006	5/09/2020	625.2	76.8
MB15HD20006	6/09/2020	625.2	76.8
MB15HD20006	7/09/2020	625.2	76.9
MB15HD20006	8/09/2020	625.2	76.8
MB15HD20006	9/09/2020	625.3	76.8
MB15HD20006	10/09/2020	625.2	76.8
MB15HD20006	11/09/2020	625.2	76.8
MB15HD20006	12/09/2020	625.2	76.8
MB15HD20006	13/09/2020	625.3	76.8
MB15HD20006	14/09/2020	625.3	76.8
MB15HD20006	15/09/2020	625.2	76.8
MB15HD20006	16/09/2020	625.2	76.8
MB15HD20006	17/09/2020	625.2	76.8
MB15HD20006	18/09/2020	625.2	76.8
MB15HD20006	19/09/2020	625.2	76.9
MB15HD20006	20/09/2020	625.2	76.9
MB15HD20006	21/09/2020	625.2	76.8
MB15HD20006	22/09/2020	625.2	76.8
MB15HD20006	23/09/2020	625.3	76.8
MB15HD20006	24/09/2020	625.3	76.8
MB15HD20006	25/09/2020	625.2	76.8
MB15HD20006	26/09/2020	625.2	76.9
MB15HD20006	27/09/2020	625.2	76.9
MB15HD20006	28/09/2020	625.2	76.9
MB15HD20006	29/09/2020	625.2	76.8
MB15HD20006	30/09/2020	625.2	76.8
MB15HD20006	1/10/2020	625.2	76.9
MB15HD20006	2/10/2020	625.2	76.9
MB15HD20006	3/10/2020	625.2	76.9
MB15HD20006	4/10/2020	625.3	76.8
MB15HD20006	5/10/2020	625.3	76.8
MB15HD20006	6/10/2020	625.3	76.8
MB15HD20006	7/10/2020	625.3	76.8
MB15HD20006	8/10/2020	625.2	76.8
MB15HD20006	9/10/2020	625.2	76.8
MB15HD20006	10/10/2020	625.2	76.9
MB15HD20006	11/10/2020	625.2	76.9
MB15HD20006	12/10/2020	625.2	76.9
MB15HD20006	13/10/2020	625.2	76.9
MB15HD20006	14/10/2020	625.2	76.9

ID	Date	WL mAHD	WL mbgl
MB18HD20009	18/11/2021	627.2	75.3
MB18HD20009	19/11/2021	627.2	75.3
MB18HD20009	20/11/2021	627.2	75.3
MB18HD20009	21/11/2021	627.2	75.3
MB18HD20009	22/11/2021	627.2	75.3
MB18HD20009	23/11/2021	627.2	75.3
MB18HD20009	24/11/2021	627.2	75.3
MB18HD20009	25/11/2021	627.2	75.2
MB18HD20009	26/11/2021	627.2	75.3
MB18HD20009	27/11/2021	627.2	75.3
MB18HD20009	28/11/2021	627.2	75.3
MB18HD20009	29/11/2021	627.2	75.3
MB18HD20009	30/11/2021	627.2	75.3
MB18HD20009	1/12/2021	627.2	75.3
MB18HD20009	2/12/2021	627.2	75.3
MB18HD20009	3/12/2021	627.2	75.3
MB18HD20009	4/12/2021	627.2	75.3
MB18HD20009	5/12/2021	627.2	75.3
MB18HD20009	6/12/2021	627.2	75.3
MB18HD20009	7/12/2021	627.2	75.3
MB18HD20009	8/12/2021	627.2	75.3
MB18HD20009	9/12/2021	627.2	75.3
MB18HD20009	10/12/2021	627.2	75.3
MB18HD20009	11/12/2021	627.2	75.3
MB18HD20009	12/12/2021	627.2	75.3
MB18HD20009	13/12/2021	627.2	75.3
MB18HD20009	14/12/2021	627.2	75.3
MB18HD20009	15/12/2021	627.2	75.3
MB18HD20009	16/12/2021	627.2	75.3
MB18HD20009	17/12/2021	627.2	75.3
MB18HD20009	18/12/2021	627.2	75.3
MB18HD20009	19/12/2021	627.2	75.3
MB18HD20009	20/12/2021	627.2	75.3
MB18HD20009	21/12/2021	627.2	75.3
MB18HD20009	22/12/2021	627.2	75.3
MB18HD20009	23/12/2021	627.1	75.3
MB18HD20009	24/12/2021	627.1	75.3
MB18HD20009	25/12/2021	627.2	75.3
MB18HD20009	26/12/2021	627.2	75.3
MB18HD20009	30/12/2021	627.1	75.4
MB18HD20009	31/12/2021	627.1	75.3
MB18HD20009	1/01/2022	627.1	75.3
MB18HD20009	2/01/2022	627.1	75.3
MB18HD20009	3/01/2022	627.2	75.3
MB18HD20009	4/01/2022	627.2	75.3
MB18HD20009	5/01/2022	627.2	75.3
MB18HD20009	6/01/2022	627.2	75.3
MB18HD20009	7/01/2022	627.2	75.3
MB18HD20009	8/01/2022	627.2	75.3
MB18HD20009	9/01/2022	627.1	75.3
MB18HD20009	10/01/2022	627.2	75.3
MB18HD20009	11/01/2022	627.2	75.3
MB18HD20009	12/01/2022	627.2	75.3
MB18HD20009	13/01/2022	627.2	75.3
MB18HD20009	14/01/2022	627.1	75.4
MB18HD20009	15/01/2022	627.1	75.4
MB18HD20009	16/01/2022	627.1	75.4
MB18HD20009	17/01/2022	627.1	75.4
MB18HD20009	18/01/2022	627.1	75.3
MB18HD20009	19/01/2022	627.1	75.3
MB18HD20009	20/01/2022	627.2	75.3
MB18HD20009	21/01/2022	627.2	75.3
MB18HD20009	22/01/2022	627.1	75.3
MB18HD20009	24/01/2022	627.3	75.2
MB18HD20009	25/01/2022	627.3	75.2
MB18HD20009	26/01/2022	627.3	75.2
MB18HD20009	27/01/2022	627.3	75.2
MB18HD20009	28/01/2022	627.3	75.2
MB18HD20009	29/01/2022	627.3	75.2
MB18HD20009	30/01/2022	627.3	75.2
MB18HD20009	31/01/2022	627.3	75.2
MB18HD20009	1/02/2022	627.3	75.2
MB18HD20009	2/02/2022	627.3	75.2
MB18HD20009	3/02/2022	627.3	75.2
MB18HD20009	4/02/2022	627.3	75.2
MB18HD20009	5/02/2022	627.3	75.2
MB18HD20009	6/02/2022	627.3	75.2
MB18HD20009	7/02/2022	627.3	75.2
MB18HD20009	8/02/2022	627.3	75.2
MB18HD20009	9/02/2022	627.3	75.2
MB18HD20009	10/02/2022	627.3	75.2
MB18HD20009	11/02/2022	627.3	75.1
MB18HD20009	12/02/2022	627.3	75.1
MB18HD20009	13/02/2022	627.4	75.1
MB18HD20009	14/02/2022	627.4	75.1
MB18HD20009	15/02/2022	627.4	75.1
MB18HD20009	16/02/2022	627.3	75.1
MB18HD20009	17/02/2022	627.3	75.1
MB18HD20009	18/02/2022	627.4	75.1
MB18HD20009	19/02/2022	627.4	75.1
MB18HD20009	20/02/2022	627.3	75.1
MB18HD20009	21/02/2022	627.3	75.2
MB18HD20009	22/02/2022	627.3	75.2
MB18HD20009	23/02/2022	627.3	75.2
MB18HD20009	24/02/2022	627.3	75.2
MB18HD20009	25/02/2022	627

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	17/04/2016	638.4	48.2
HDVP2	16/04/2016	638.4	48.2
HDVP2	15/04/2016	638.4	48.2
HDVP2	14/04/2016	638.4	48.2
HDVP2	13/04/2016	638.4	48.2
HDVP2	12/04/2016	638.4	48.2
HDVP2	11/04/2016	638.4	48.2
HDVP2	10/04/2016	638.4	48.2
HDVP2	9/04/2016	638.4	48.2
HDVP2	8/04/2016	638.4	48.2
HDVP2	7/04/2016	638.4	48.2
HDVP2	6/04/2016	638.4	48.2
HDVP2	5/04/2016	638.4	48.2
HDVP2	4/04/2016	638.4	48.2
HDVP2	3/04/2016	638.4	48.2
HDVP2	2/04/2016	638.4	48.2
HDVP2	1/04/2016	626.8	59.8
HDVP2	31/03/2016	626.8	59.8
HDVP2	30/03/2016	626.8	59.8
HDVP2	29/03/2016	626.8	59.8
HDVP2	28/03/2016	626.8	59.8
HDVP2	27/03/2016	626.8	59.8
HDVP2	26/03/2016	626.8	59.8
HDVP2	25/03/2016	626.8	59.8
HDVP2	24/03/2016	626.8	59.8
HDVP2	23/03/2016	626.8	59.8
HDVP2	22/03/2016	626.8	59.8
HDVP2	21/03/2016	626.8	59.8
HDVP2	20/03/2016	626.8	59.8
HDVP2	19/03/2016	626.8	59.8
HDVP2	18/03/2016	626.8	59.8
HDVP2	17/03/2016	626.8	59.8
HDVP2	16/03/2016	626.8	59.8
HDVP2	15/03/2016	626.8	59.8
HDVP2	14/03/2016	626.8	59.8
HDVP2	13/03/2016	626.8	59.8
HDVP2	12/03/2016	626.8	59.8
HDVP2	11/03/2016	626.8	59.8
HDVP2	10/03/2016	626.8	59.8
HDVP2	9/03/2016	626.8	59.8
HDVP2	8/03/2016	626.8	59.8
HDVP2	7/03/2016	626.8	59.8
HDVP2	6/03/2016	626.8	59.8
HDVP2	5/03/2016	626.8	59.8
HDVP2	4/03/2016	626.8	59.8
HDVP2	3/03/2016	626.8	59.8
HDVP2	2/03/2016	626.8	59.8
HDVP2	1/03/2016	624.4	62.1
HDVP2	29/02/2016	624.4	62.1
HDVP2	28/02/2016	624.4	62.1
HDVP2	27/02/2016	624.4	62.1
HDVP2	26/02/2016	624.4	62.1
HDVP2	25/02/2016	624.4	62.1
HDVP2	24/02/2016	624.4	62.1
HDVP2	23/02/2016	624.4	62.1
HDVP2	22/02/2016	624.4	62.1
HDVP2	21/02/2016	624.4	62.1
HDVP2	20/02/2016	624.4	62.1
HDVP2	19/02/2016	624.4	62.1
HDVP2	18/02/2016	624.4	62.1
HDVP2	17/02/2016	624.4	62.1
HDVP2	16/02/2016	624.4	62.1
HDVP2	15/02/2016	624.4	62.1
HDVP2	14/02/2016	624.4	62.1
HDVP2	13/02/2016	624.4	62.1
HDVP2	12/02/2016	624.4	62.1
HDVP2	11/02/2016	624.4	62.1
HDVP2	10/02/2016	624.4	62.1
HDVP2	9/02/2016	624.4	62.1
HDVP2	8/02/2016	624.4	62.1
HDVP2	7/02/2016	624.4	62.1
HDVP2	6/02/2016	624.4	62.1
HDVP2	5/02/2016	624.4	62.1
HDVP2	4/02/2016	624.4	62.1
HDVP2	3/02/2016	624.4	62.1
HDVP2	2/02/2016	624.4	62.1
HDVP2	1/02/2016	633.1	53.4
HDVP2	31/01/2016	633.1	53.4
HDVP2	30/01/2016	633.1	53.4
HDVP2	29/01/2016	633.1	53.4
HDVP2	28/01/2016	633.1	53.4
HDVP2	27/01/2016	633.1	53.4
HDVP2	26/01/2016	633.1	53.4
HDVP2	25/01/2016	633.1	53.4
HDVP2	24/01/2016	633.1	53.4
HDVP2	23/01/2016	633.1	53.4
HDVP2	22/01/2016	633.1	53.4
HDVP2	21/01/2016	633.1	53.4
HDVP2	20/01/2016	633.1	53.4
HDVP2	19/01/2016	633.1	53.4
HDVP2	18/01/2016	633.1	53.4
HDVP2	17/01/2016	633.1	53.4
HDVP2	16/01/2016	633.1	53.4
HDVP2	15/01/2016	633.1	53.4
HDVP2	14/01/2016	633.1	53.4
HDVP2	13/01/2016	633.1	53.4
HDVP2	12/01/2016	633.1	53.4
HDVP2	11/01/2016	633.1	53.4
HDVP2	10/01/2016	633.1	53.4
HDVP2	9/01/2016	633.1	53.4
HDVP2	8/01/2016	633.1	53.4
HDVP2	7/01/2016	633.1	53.4
HDVP2	6/01/2016	633.1	53.4
HDVP2	5/01/2016	633.1	53.4
HDVP2	4/01/2016	633.1	53.4
HDVP2	3/01/2016	633.1	53.4
HDVP2	2/01/2016	633.1	53.4
HDVP2	1/01/2016	578.2	108.3
HDVP2	31/12/2015	578.2	108.3
HDVP2	30/12/2015	578.2	108.3
HDVP2	29/12/2015	578.2	108.3
HDVP2	28/12/2015	578.2	108.3
HDVP2	27/12/2015	578.2	108.3
HDVP2	26/12/2015	578.2	108.3
HDVP2	25/12/2015	578.2	108.3
HDVP2	24/12/2015	578.2	108.3
HDVP2	23/12/2015	578.2	108.3
HDVP2	22/12/2015	578.2	108.3
HDVP2	21/12/2015	578.2	108.3
HDVP2	20/12/2015	578.2	108.3
HDVP2	19/12/2015	578.2	108.3
HDVP2	18/12/2015	578.2	108.3
HDVP2	17/12/2015	578.2	108.3
HDVP2	16/12/2015	578.2	108.3
HDVP2	15/12/2015	578.2	108.3
HDVP2	14/12/2015	578.2	108.3
HDVP2	13/12/2015	578.2	108.3
HDVP2	12/12/2015	578.2	108.3
HDVP2	11/12/2015	578.2	108.3
HDVP2	10/12/2015	578.2	108.3
HDVP2	9/12/2015	578.2	108.3
HDVP2	8/12/2015	578.2	108.3
HDVP2	7/12/2015	578.2	108.3
HDVP2	6/12/2015	578.2	108.3
HDVP2	5/12/2015	578.2	108.3
HDVP2	4/12/2015	578.2	108.3

ID	Date	WL mAHD	WL mbgl
MB18WON0002	4/02/2019	625.2	39.4
MB18WON0002	3/02/2019	625.1	39.5
MB18WON0002	2/02/2019	624.7	40.0
MB18WON0002	1/02/2019	625.4	39.2
MB18WON0002	31/01/2019	625.4	39.2
MB18WON0002	30/01/2019	625.4	39.2
MB18WON0002	29/01/2019	625.4	39.2
MB18WON0002	28/01/2019	625.4	39.2
MB18WON0002	27/01/2019	625.4	39.2
MB18WON0002	26/01/2019	625.4	39.3
MB18WON0002	25/01/2019	625.4	39.3
MB18WON0002	24/01/2019	625.3	39.3
MB18WON0002	23/01/2019	625.3	39.3
MB18WON0002	22/01/2019	625.3	39.3
MB18WON0002	21/01/2019	625.3	39.3
MB18WON0002	20/01/2019	625.3	39.3
MB18WON0002	19/01/2019	625.3	39.3
MB18WON0002	18/01/2019	625.3	39.3
MB18WON0002	17/01/2019	625.3	39.3
MB18WON0002	16/01/2019	625.3	39.4
MB18WON0002	15/01/2019	625.3	39.4
MB18WON0002	14/01/2019	625.2	39.4
MB18WON0002	13/01/2019	625.2	39.4
MB18WON0002	12/01/2019	625.2	39.4
MB18WON0002	11/01/2019	625.2	39.4
MB18WON0002	10/01/2019	625.2	39.4
MB18WON0002	9/01/2019	625.2	39.4
MB18WON0002	8/01/2019	625.2	39.4
MB18WON0002	7/01/2019	625.2	39.4
MB18WON0002	6/01/2019	625.2	39.5
MB18WON0002	5/01/2019	625.1	39.5
MB18WON0002	4/01/2019	625.1	39.5
MB18WON0002	3/01/2019	625.1	39.5
MB18WON0002	2/01/2019	625.1	39.5
MB18WON0002	1/01/2019	625.1	39.6
MB18WON0002	31/12/2018	625.0	39.6
MB18WON0002	30/12/2018	625.0	39.6
MB18WON0002	29/12/2018	625.0	39.6
MB18WON0002	28/12/2018	625.0	39.6
MB18WON0002	27/12/2018	625.0	39.7
MB18WON0002	26/12/2018	625.0	39.7
MB18WON0002	25/12/2018	624.9	39.7
MB18WON0002	24/12/2018	624.9	39.7
MB18WON0002	23/12/2018	624.9	39.7
MB18WON0002	22/12/2018	624.9	39.7
MB18WON0002	21/12/2018	624.9	39.8
MB18WON0002	20/12/2018	624.8	39.8
MB18WON0002	19/12/2018	624.8	39.8
MB18WON0002	18/12/2018	624.8	39.9
MB18WON0002	17/12/2018	624.7	39.9
MB18WON0002	16/12/2018	624.7	40.0
MB18WON0002	15/12/2018	624.6	40.0
MB18WON0002	14/12/2018	624.6	40.1
MB18WON0002	13/12/2018	624.5	40.1
MB18WON0002	11/12/2018	625.0	39.6
MB18WON0003	2/03/2022	605.9	46.7
MB18WON0003	1/03/2022	605.8	46.8
MB18WON0003	28/02/2022	605.3	47.3
MB18WON0003	27/02/2022	604.8	47.8
MB18WON0003	26/02/2022	604.4	48.2
MB18WON0003	25/02/2022	603.9	48.7
MB18WON0003	24/02/2022	603.4	49.2
MB18WON0003	23/02/2022	602.9	49.7
MB18WON0003	22/02/2022	602.3	50.3
MB18WON0003	21/02/2022	601.6	51.0
MB18WON0003	20/02/2022	615.3	37.3
MB18WON0003	19/02/2022	615.3	37.3
MB18WON0003	18/02/2022	615.3	37.3
MB18WON0003	17/02/2022	615.3	37.3
MB18WON0003	16/02/2022	615.3	37.3
MB18WON0003	15/02/2022	615.3	37.3
MB18WON0003	14/02/2022	615.3	37.3
MB18WON0003	13/02/2022	615.3	37.3
MB18WON0003	12/02/2022	615.3	37.3
MB18WON0003	11/02/2022	615.3	37.3
MB18WON0003	10/02/2022	615.3	37.3
MB18WON0003	9/02/2022	615.3	37.3
MB18WON0003	8/02/2022	615.3	37.3
MB18WON0003	7/02/2022	615.3	37.3
MB18WON0003	6/02/2022	615.3	37.3
MB18WON0003	5/02/2022	615.3	37.3
MB18WON0003	4/02/2022	615.3	37.3
MB18WON0003	3/02/2022	615.3	37.3
MB18WON0003	2/02/2022	615.3	37.3
MB18WON0003	1/02/2022	615.3	37.3
MB18WON0003	31/01/2022	615.2	37.4
MB18WON0003	30/01/2022	615.2	37.4
MB18WON0003	29/01/2022	615.3	37.3
MB18WON0003	28/01/2022	615.3	37.3
MB18WON0003	27/01/2022	615.3	37.3
MB18WON0003	26/01/2022	615.3	37.3
MB18WON0003	25/01/2022	615.2	37.4
MB18WON0003	24/01/2022	615.2	37.4
MB18WON0003	23/01/2022	615.3	37.3
MB18WON0003	22/01/2022	615.3	37.3
MB18WON0003	21/01/2022	615.3	37.3
MB18WON0003	20/01/2022	615.3	37.3
MB18WON0003	19/01/2022	615.3	37.3
MB18WON0003	18/01/2022	615.3	37.3
MB18WON0003	17/01/2022	615.3	37.3
MB18WON0003	16/01/2022	615.2	37.4
MB18WON0003	15/01/2022	615.2	37.4
MB18WON0003	14/01/2022	615.2	37.4
MB18WON0003	13/01/2022	615.3	37.3
MB18WON0003	12/01/2022	615.3	37.3
MB18WON0003	11/01/2022	615.3	37.3
MB18WON0003	10/01/2022	615.3	37.3
MB18WON0003	9/01/2022	615.3	37.3
MB18WON0003	8/01/2022	615.3	37.3
MB18WON0003	7/01/2022	615.3	37.3
MB18WON0003	6/01/2022	615.3	37.3
MB18WON0003	5/01/2022	615.3	37.3
MB18WON0003	4/01/2022	615.3	37.3
MB18WON0003	3/01/2022	615.3	37.3
MB18WON0003	2/01/2022	615.3	37.3
MB18WON0003	1/01/2022	615.3	37.3
MB18WON0003	31/12/2021	615.3	37.3
MB18WON0003	30/12/2021	615.3	37.3
MB18WON0003	29/12/2021	615.3	37.3
MB18WON0003	28/12/2021	615.3	37.3
MB18WON0003	27/12/2021	615.3	37.3
MB18WON0003	26/12/2021	615.3	37.3
MB18WON0003	25/12/2021	615.3	37.3
MB18WON0003	24/12/2021	615.3	37.3
MB18WON0003	23/12/2021	615.3	37.3
MB18WON0003	22/12/2021	615.3	37.3
MB18WON0003	21/12/2021	615.3	37.3
MB18WON0003	20/12/2021	615.3	37.3
MB18WON0003	19/12/2021	615.3	37.3
MB18WON0003	18/12/2021	615.3	37.3
MB18WON0003	17/12/2021	615.3	37.3
MB18WON0003	16/12/2021	615.3	37.3
MB18WON0003	15/12/2021	615.3	37.3
MB18WON0003	14/12/2021	615.3	37.3
MB18WON0003	13/12/2021	615.3	37.3
MB18WON0003	12/12/2021	615.3	37.3

ID	Date	WL mAHD	WL mbgl
MB15HD20006	15/10/2020	625.2	76.9
MB15HD20006	16/10/2020	625.2	76.9
MB15HD20006	17/10/2020	625.2	76.9
MB15HD20006	18/10/2020	625.2	76.9
MB15HD20006	19/10/2020	625.2	76.9
MB15HD20006	20/10/2020	625.2	76.9
MB15HD20006	21/10/2020	625.2	76.9
MB15HD20006	22/10/2020	625.2	76.9
MB15HD20006	23/10/2020	625.2	76.9
MB15HD20006	24/10/2020	625.2	76.9
MB15HD20006	25/10/2020	625.2	76.9
MB15HD20006	26/10/2020	625.2	76.9
MB15HD20006	27/10/2020	625.2	76.9
MB15HD20006	28/10/2020	625.2	76.9
MB15HD20006	29/10/2020	625.2	76.9
MB15HD20006	30/10/2020	625.2	76.9
MB15HD20006	31/10/2020	625.2	76.9
MB15HD20006	1/11/2020	625.2	76.9
MB15HD20006	2/11/2020	625.2	76.9
MB15HD20006	3/11/2020	625.2	76.9
MB15HD20006	4/11/2020	625.2	76.8
MB15HD20006	5/11/2020	625.2	76.9
MB15HD20006	6/11/2020	625.2	76.9
MB15HD20006	7/11/2020	625.2	76.9
MB15HD20006	8/11/2020	625.2	76.9
MB15HD20006	9/11/2020	625.2	76.9
MB15HD20006	10/11/2020	625.2	76.9
MB15HD20006	11/11/2020	625.2	76.9
MB15HD20006	12/11/2020	625.2	76.9
MB15HD20006	13/11/2020	625.2	76.9
MB15HD20006	14/11/2020	625.2	76.9
MB15HD20006	15/11/2020	625.2	76.9
MB15HD20006	16/11/2020	625.2	76.9
MB15HD20006	17/11/2020	625.2	76.9
MB15HD20006	18/11/2020	625.2	76.9
MB15HD20006	19/11/2020	625.2	76.9
MB15HD20006	20/11/2020	625.2	76.9
MB15HD20006	21/11/2020	625.2	76.9
MB15HD20006	22/11/2020	625.2	76.9
MB15HD20006	23/11/2020	625.2	76.9
MB15HD20006	24/11/2020	625.2	76.9
MB15HD20006	25/11/2020	625.2	76.9
MB15HD20006	26/11/2020	625.2	76.9
MB15HD20006	27/11/2020	625.2	76.9
MB15HD20006	28/11/2020	625.2	76.9
MB15HD20006	29/11/2020	625.2	76.9
MB15HD20006	30/11/2020	625.2	76.9
MB15HD20006	1/12/2020	625.2	76.9
MB15HD20006	2/12/2020	625.2	76.9
MB15HD20006	3/12/2020	625.2	76.9
MB15HD20006	4/12/2020	625.2	76.9
MB15HD20006	5/12/2020	625.2	76.9
MB15HD20006	6/12/2020	625.2	76.9
MB15HD20006	7/12/2020	625.2	76.9
MB15HD20006	8/12/2020	625.2	76.9
MB15HD20006	9/12/2020	625.2	76.9
MB15HD20006	10/12/2020	625.2	76.9
MB15HD20006	11/12/2020	625.2	76.9
MB15HD20006	12/12/2020	625.1	76.9
MB15HD20006	13/12/2020	625.1	76.9
MB15HD20006	14/12/2020	625.1	76.9
MB15HD20006	15/12/2020	625.2	76.9
MB15HD20006	16/12/2020	625.2	76.9
MB15HD20006	17/12/2020	625.2	76.9
MB15HD20006	18/12/2020	625.1	76.9
MB15HD20006	19/12/2020	625.1	76.9
MB15HD20006	20/12/2020	625.1	76.9
MB15HD20006	21/12/2020	625.1	76.9
MB15HD20006	22/12/2020	625.2	76.9
MB15HD20006	23/12/2020	625.2	76.9
MB15HD20006	24/12/2020	625.2	76.9
MB15HD20006	25/12/2020	625.2	76.9
MB15HD20006	26/12/2020	625.2	76.9
MB15HD20006	27/12/2020	625.2	76.9
MB15HD20006	28/12/2020	625.2	76.9
MB15HD20006	29/12/2020	625.2	76.9
MB15HD20006	30/12/2020	625.2	76.9
MB15HD20006	31/12/2020	625.2	76.9
MB15HD20006	1/01/2021	625.2	76.9
MB15HD20006	2/01/2021	625.2	76.9
MB15HD20006	3/01/2021	625.2	76.9
MB15HD20006	4/01/2021	625.1	76.9
MB15HD20006	5/01/2021	625.2	76.9
MB15HD20006	6/01/2021	625.2	76.9
MB15HD20006	7/01/2021	625.2	76.9
MB15HD20006	8/01/2021	625.2	76.9
MB15HD20006	9/01/2021	625.2	76.9
MB15HD20006	10/01/2021	625.2	76.9
MB15HD20006	11/01/2021	625.2	76.9
MB15HD20006	12/01/2021	625.2	76.9
MB15HD20006	13/01/2021	625.2	76.9
MB15HD20006	14/01/2021	625.2	76.9
MB15HD20006	15/01/2021	625.2	76.9
MB15HD20006	16/01/2021	625.2	76.9
MB15HD20006	17/01/2021	625.2	76.9
MB15HD20006	18/01/2021	625.2	76.9
MB15HD20006	19/01/2021	625.2	76.9
MB15HD20006	20/01/2021	625.2	76.9
MB15HD20006	21/01/2021	625.2	76.9
MB15HD20006	22/01/2021	625.2	76.9
MB15HD20006	23/01/2021	625.1	76.9
MB15HD20006	24/01/2021	625.1	76.9
MB15HD20006	25/01/2021	625.1	76.9
MB15HD20006	26/01/2021	625.1	76.9
MB15HD20006	27/01/2021	625.1	77.0
MB15HD20006	28/01/2021	625.1	77.0
MB15HD20006	29/01/2021	625.1	77.0
MB15HD20006	30/01/2021	625.1	76.9
MB15HD20006	31/01/2021	625.1	76.9
MB15HD20006	1/02/2021	625.1	76.9
MB15HD20006	2/02/2021	625.1	77.0
MB15HD20006	3/02/2021	625.1	77.0
MB15HD20006	4/02/2021	625.1	77.0
MB15HD20006	5/02/2021	625.1	77.0
MB15HD20006	6/02/2021	625.1	77.0
MB15HD20006	7/02/2021	625.1	77.0
MB15HD20006	8/02/2021	625.1	76.9
MB15HD20006	9/02/2021	625.1	76.9
MB15HD20006	10/02/2021	625.1	77.0
MB15HD20006	11/02/2021	625.1	77.0
MB15HD20006	12/02/2021	625.1	76.9
MB15HD20006	13/02/2021	625.2	76.9
MB15HD20006	14/02/2021	625.2	76.9
MB15HD20006	15/02/2021	625.2	76.9
MB15HD20006	16/02/2021	625.2	76.9
MB15HD20006	17/02/2021	625.2	76.9
MB15HD20006	18/02/2021	625.2	76.9
MB15HD20006	19/02/2021	625.2	76.9
MB15HD20006	20/02/2021	625.2	76.9
MB15HD20006	21/02/2021	625.2	76.9
MB15HD20006	22/02/2021	625.2	76.9
MB15HD20006	23/02/2021	625.2	76.9
MB15HD20006	24/02/2021	625.2	76.9
MB15HD20006	25/02/2021	625.2	76.9
MB15HD20006	26/02/2021	625.2	76.9
MB15HD20006	27/02/2021	625.1	76.9

ID	Date	WL mAHD	WL mbgl
MB18HD20010	12/12/2018	625.2	68.2
MB18HD20010	13/12/2018	625.2	68.2
MB18HD20010	14/12/2018	625.2	68.2
MB18HD20010	15/12/2018	625.1	68.2
MB18HD20010	16/12/2018	625.1	68.2
MB18HD20010	17/12/2018	625.1	68.2
MB18HD20010	18/12/2018	625.2	68.2
MB18HD20010	19/12/2018	625.2	68.2
MB18HD20010	20/12/2018	625.2	68.2
MB18HD20010	21/12/2018	625.2	68.2
MB18HD20010	22/12/2018	625.2	68.2
MB18HD20010	23/12/2018	625.2	68.2
MB18HD20010	24/12/2018	625.2	68.2
MB18HD20010	25/12/2018	625.2	68.2
MB18HD20010	26/12/2018	625.2	68.2
MB18HD20010	27/12/2018	625.1	68.2
MB18HD20010	28/12/2018	625.1	68.2
MB18HD20010	29/12/2018	625.1	68.2
MB18HD20010	30/12/2018	625.1	68.2
MB18HD20010	31/12/2018	625.1	68.2
MB18HD20010	1/01/2019	625.1	68.2
MB18HD20010	2/01/2019	625.1	68.2
MB18HD20010	3/01/2019	625.2	68.2
MB18HD20010	4/01/2019	625.2	68.2
MB18HD20010	5/01/2019	625.2	68.2
MB18HD20010	6/01/2019	625.2	68.2
MB18HD20010	7/01/2019	625.2	68.2
MB18HD20010	8/01/2019	625.2	68.2
MB18HD20010	9/01/2019	625.2	68.2
MB18HD20010	10/01/2019	625.2	68.2
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MB18HD20010	13/01/2019	625.2	68.2
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MB18HD20010	16/01/2019	625.2	68.2
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MB18HD20010	18/01/2019	625.2	68.2
MB18HD20010	19/01/2019	625.2	68.2
MB18HD20010	20/01/2019	625.2	68.2
MB18HD20010	21/01/2019	625.2	68.2
MB18HD20010	22/01/2019	625.1	68.2
MB18HD20010	23/01/2019	625.1	68.2
MB18HD20010	24/01/2019	625.1	68.2
MB18HD20010	25/01/2019	625.1	68.2
MB18HD20010	26/01/2019	625.1	68.2
MB18HD20010	27/01/2019	625.1	68.2
MB18HD20010	28/01/2019	625.2	68.2
MB18HD20010	29/01/2019	625.2	68.2
MB18HD20010	30/01/2019	625.2	68.2
MB18HD20010	31/01/2019	625.2	68.2
MB18HD20010	1/02/2019	625.2	68.2
MB18HD20010	2/02/2019	625.2	68.2
MB18HD20010	3/02/2019	625.1	68.2
MB18HD20010	4/02/2019	625.1	68.2
MB18HD20010	5/02/2019	625.1	68.2
MB18HD20010	6/02/2019	625.1	68.2
MB18HD20010	7/02/2019	625.2	68.2
MB18HD20010	8/02/2019	625.2	68.2
MB18HD20010	9/02/2019	625.2	68.2
MB18HD20010	10/02/2019	625.2	68.2
MB18HD20010	11/02/2019	625.2	68.2
MB18HD20010	12/02/2019	625.2	68.2
MB18HD20010	13/02/2019	625.2	68.2
MB18HD20010	14/02/2019	625.2	68.2
MB18HD20010	15/02/2019	625.2	68.2
MB18HD20010	16/02/2019	625.2	68.2
MB18HD20010	17/02/2019	625.2	68.2
MB18HD20010	18/02/2019	625.2	68.2
MB18HD20010	19/02/2019	625.2	68.2
MB18HD20010	20/02/2019	625.2	68.2
MB18HD20010	21/02/2019	625.2	68.2
MB18HD20010	22/02/2019	625.2	68.2
MB18HD20010	23/02/2019	625.2	68.2
MB18HD20010	24/02/2019	625.2	68.2
MB18HD20010	25/02/2019	625.2	68.2
MB18HD20010	26/02/2019	625.2	68.2
MB18HD20010	27/02/2019	625.2	68.2
MB18HD20010	28/02/2019	625.2	68.2
MB18HD20010	1/03/2019	625.2	68.2
MB18HD20010	2/03/2019	625.2	68.2
MB18HD20010	3/03/2019	625.2	68.2
MB18HD20010	4/03/2019	625.2	68.2
MB18HD20010	5/03/2019	625.2	68.2
MB18HD20010	6/03/2019	625.2	68.2
MB18HD20010	7/03/2019	625.2	68.2
MB18HD20010	8/03/2019	625.2	68.2
MB18HD20010	9/03/2019	625.2	68.2
MB18HD20010	10/03/2019	625.2	68.2
MB18HD20010	11/03/2019	625.2	68.2
MB18HD20010	12/03/2019	625.2	68.2
MB18HD20010	13/03/2019	625.2	68.2
MB18HD20010	14/03/2019	625.2	68.2
MB18HD20010	15/03/2019	625.2	68.2
MB18HD20010	16/03/2019	625.2	68.2
MB18HD20010	17/03/2019	625

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	3/12/2015	578.2	108.3
HDVP2	2/12/2015	578.2	108.3
HDVP2	1/12/2015	629.8	56.7
HDVP2	30/11/2015	629.8	56.7
HDVP2	29/11/2015	629.8	56.7
HDVP2	28/11/2015	629.8	56.7
HDVP2	27/11/2015	629.8	56.7
HDVP2	26/11/2015	629.8	56.7
HDVP2	25/11/2015	629.8	56.7
HDVP2	24/11/2015	629.8	56.7
HDVP2	23/11/2015	629.8	56.7
HDVP2	22/11/2015	629.8	56.7
HDVP2	21/11/2015	629.8	56.7
HDVP2	20/11/2015	629.8	56.7
HDVP2	19/11/2015	629.8	56.7
HDVP2	18/11/2015	629.8	56.7
HDVP2	17/11/2015	629.8	56.7
HDVP2	16/11/2015	629.8	56.7
HDVP2	15/11/2015	629.8	56.7
HDVP2	14/11/2015	629.8	56.7
HDVP2	13/11/2015	629.8	56.7
HDVP2	12/11/2015	629.8	56.7
HDVP2	11/11/2015	629.8	56.7
HDVP2	10/11/2015	629.8	56.7
HDVP2	9/11/2015	629.8	56.7
HDVP2	8/11/2015	629.8	56.7
HDVP2	7/11/2015	629.8	56.7
HDVP2	6/11/2015	629.8	56.7
HDVP2	5/11/2015	629.8	56.7
HDVP2	4/11/2015	629.8	56.7
HDVP2	3/11/2015	629.8	56.7
HDVP2	2/11/2015	629.8	56.7
HDVP2	1/11/2015	540.6	145.9
HDVP2	31/10/2015	540.6	145.9
HDVP2	30/10/2015	540.6	145.9
HDVP2	29/10/2015	540.6	145.9
HDVP2	28/10/2015	540.6	145.9
HDVP2	27/10/2015	540.6	145.9
HDVP2	26/10/2015	540.6	145.9
HDVP2	25/10/2015	540.6	145.9
HDVP2	24/10/2015	540.6	145.9
HDVP2	23/10/2015	540.6	145.9
HDVP2	22/10/2015	540.6	145.9
HDVP2	21/10/2015	540.6	145.9
HDVP2	20/10/2015	540.6	145.9
HDVP2	19/10/2015	540.6	145.9
HDVP2	18/10/2015	540.6	145.9
HDVP2	17/10/2015	540.6	145.9
HDVP2	16/10/2015	540.6	145.9
HDVP2	15/10/2015	540.6	145.9
HDVP2	14/10/2015	540.6	145.9
HDVP2	13/10/2015	540.6	145.9
HDVP2	12/10/2015	540.6	145.9
HDVP2	11/10/2015	540.6	145.9
HDVP2	10/10/2015	540.6	145.9
HDVP2	9/10/2015	540.6	145.9
HDVP2	8/10/2015	540.6	145.9
HDVP2	7/10/2015	540.6	145.9
HDVP2	6/10/2015	540.6	145.9
HDVP2	5/10/2015	540.6	145.9
HDVP2	4/10/2015	540.6	145.9
HDVP2	3/10/2015	540.6	145.9
HDVP2	2/10/2015	540.6	145.9
HDVP2	1/10/2015	485.6	201.0
HDVP2	30/09/2015	485.6	201.0
HDVP2	29/09/2015	485.6	201.0
HDVP2	28/09/2015	485.6	201.0
HDVP2	27/09/2015	485.6	201.0
HDVP2	26/09/2015	485.6	201.0
HDVP2	25/09/2015	485.6	201.0
HDVP2	24/09/2015	485.6	201.0
HDVP2	23/09/2015	485.6	201.0
HDVP2	22/09/2015	485.6	201.0
HDVP2	21/09/2015	485.6	201.0
HDVP2	20/09/2015	485.6	201.0
HDVP2	19/09/2015	485.6	201.0
HDVP2	18/09/2015	485.6	201.0
HDVP2	17/09/2015	485.6	201.0
HDVP2	16/09/2015	485.6	201.0
HDVP2	15/09/2015	485.6	201.0
HDVP2	14/09/2015	485.6	201.0
HDVP2	13/09/2015	485.6	201.0
HDVP2	12/09/2015	485.6	201.0
HDVP2	11/09/2015	485.6	201.0
HDVP2	10/09/2015	485.6	201.0
HDVP2	9/09/2015	485.6	201.0
HDVP2	8/09/2015	485.6	201.0
HDVP2	7/09/2015	485.6	201.0
HDVP2	6/09/2015	485.6	201.0
HDVP2	5/09/2015	485.6	201.0
HDVP2	4/09/2015	485.6	201.0
HDVP2	3/09/2015	485.6	201.0
HDVP2	2/09/2015	485.6	201.0
HDVP2	1/09/2015	485.6	201.0
HDVP2	31/08/2015	485.6	201.0
HDVP2	30/08/2015	485.6	201.0
HDVP2	29/08/2015	485.6	201.0
HDVP2	28/08/2015	485.6	201.0
HDVP2	27/08/2015	485.6	201.0
HDVP2	26/08/2015	485.6	201.0
HDVP2	25/08/2015	485.6	201.0
HDVP2	24/08/2015	485.6	201.0
HDVP2	23/08/2015	485.6	201.0
HDVP2	22/08/2015	485.6	201.0
HDVP2	21/08/2015	485.6	201.0
HDVP2	20/08/2015	485.6	201.0
HDVP2	19/08/2015	485.6	201.0
HDVP2	18/08/2015	485.6	201.0
HDVP2	17/08/2015	485.6	201.0
HDVP2	16/08/2015	485.6	201.0
HDVP2	15/08/2015	485.6	201.0
HDVP2	14/08/2015	485.6	201.0
HDVP2	13/08/2015	485.6	201.0
HDVP2	12/08/2015	485.6	201.0
HDVP2	11/08/2015	485.6	201.0
HDVP2	10/08/2015	485.6	201.0
HDVP2	9/08/2015	485.6	201.0
HDVP2	8/08/2015	485.6	201.0
HDVP2	7/08/2015	485.6	201.0
HDVP2	6/08/2015	485.6	201.0
HDVP2	5/08/2015	485.6	201.0
HDVP2	4/08/2015	485.6	201.0
HDVP2	3/08/2015	485.6	201.0
HDVP2	2/08/2015	485.6	201.0
HDVP2	1/08/2015	432.6	254.0
HDVP2	31/07/2015	432.6	254.0
HDVP2	30/07/2015	432.6	254.0
HDVP2	29/07/2015	432.6	254.0
HDVP2	28/07/2015	432.6	254.0
HDVP2	27/07/2015	432.6	254.0
HDVP2	26/07/2015	432.6	254.0
HDVP2	25/07/2015	432.6	254.0
HDVP2	24/07/2015	432.6	254.0
HDVP2	23/07/2015	432.6	254.0
HDVP2	22/07/2015	432.6	254.0
HDVP2	21/07/2015	432.6	254.0

ID	Date	WL mAHD	WL mbgl
MB18WON0003	11/12/2021	615.3	37.3
MB18WON0003	10/12/2021	615.3	37.3
MB18WON0003	9/12/2021	615.3	37.3
MB18WON0003	8/12/2021	615.3	37.3
MB18WON0003	7/12/2021	615.3	37.3
MB18WON0003	6/12/2021	615.3	37.3
MB18WON0003	5/12/2021	615.3	37.3
MB18WON0003	4/12/2021	615.3	37.3
MB18WON0003	3/12/2021	615.3	37.3
MB18WON0003	2/12/2021	615.3	37.3
MB18WON0003	1/12/2021	615.3	37.3
MB18WON0003	30/11/2021	615.3	37.3
MB18WON0003	29/11/2021	615.3	37.3
MB18WON0003	28/11/2021	615.3	37.3
MB18WON0003	27/11/2021	615.3	37.3
MB18WON0003	26/11/2021	615.3	37.3
MB18WON0003	25/11/2021	615.3	37.3
MB18WON0003	24/11/2021	615.3	37.3
MB18WON0003	23/11/2021	615.3	37.3
MB18WON0003	22/11/2021	615.3	37.3
MB18WON0003	21/11/2021	615.3	37.3
MB18WON0003	20/11/2021	615.3	37.3
MB18WON0003	19/11/2021	615.3	37.3
MB18WON0003	18/11/2021	615.3	37.3
MB18WON0003	17/11/2021	615.3	37.3
MB18WON0003	16/11/2021	615.3	37.3
MB18WON0003	15/11/2021	615.3	37.3
MB18WON0003	14/11/2021	615.3	37.3
MB18WON0003	24/05/2021	616.8	35.8
MB18WON0003	5/02/2021	616.8	35.8
MB18WON0003	4/02/2021	616.8	35.8
MB18WON0003	3/02/2021	616.8	35.8
MB18WON0003	2/02/2021	616.8	35.8
MB18WON0003	1/02/2021	616.8	35.8
MB18WON0003	31/01/2021	616.8	35.8
MB18WON0003	30/01/2021	616.8	35.8
MB18WON0003	29/01/2021	616.8	35.8
MB18WON0003	28/01/2021	616.8	35.8
MB18WON0003	27/01/2021	616.8	35.8
MB18WON0003	26/01/2021	616.8	35.8
MB18WON0003	25/01/2021	616.8	35.8
MB18WON0003	24/01/2021	616.8	35.8
MB18WON0003	23/01/2021	616.8	35.8
MB18WON0003	22/01/2021	616.8	35.8
MB18WON0003	21/01/2021	616.8	35.8
MB18WON0003	20/01/2021	616.8	35.8
MB18WON0003	19/01/2021	616.8	35.8
MB18WON0003	18/01/2021	616.8	35.8
MB18WON0003	17/01/2021	616.8	35.8
MB18WON0003	16/01/2021	616.8	35.8
MB18WON0003	15/01/2021	616.8	35.8
MB18WON0003	14/01/2021	616.8	35.8
MB18WON0003	13/01/2021	616.8	35.8
MB18WON0003	12/01/2021	616.8	35.8
MB18WON0003	11/01/2021	616.8	35.8
MB18WON0003	10/01/2021	616.8	35.8
MB18WON0003	9/01/2021	616.8	35.8
MB18WON0003	8/01/2021	616.8	35.8
MB18WON0003	7/01/2021	616.8	35.8
MB18WON0003	6/01/2021	616.8	35.8
MB18WON0003	5/01/2021	616.8	35.8
MB18WON0003	4/01/2021	616.8	35.8
MB18WON0003	3/01/2021	616.7	35.9
MB18WON0003	2/01/2021	616.8	35.8
MB18WON0003	1/01/2021	616.8	35.8
MB18WON0003	31/12/2020	616.7	35.9
MB18WON0003	30/12/2020	616.7	35.9
MB18WON0003	29/12/2020	616.7	35.9
MB18WON0003	28/12/2020	616.7	35.9
MB18WON0003	27/12/2020	616.7	35.9
MB18WON0003	26/12/2020	616.7	35.9
MB18WON0003	25/12/2020	616.7	35.9
MB18WON0003	24/12/2020	616.7	35.9
MB18WON0003	23/12/2020	616.7	35.9
MB18WON0003	22/12/2020	616.7	35.9
MB18WON0003	21/12/2020	616.7	35.9
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MB18WON0003	18/12/2020	616.6	36.0
MB18WON0003	17/12/2020	616.6	36.0
MB18WON0003	16/12/2020	616.6	36.0
MB18WON0003	15/12/2020	616.6	36.0
MB18WON0003	14/12/2020	616.6	36.0
MB18WON0003	13/12/2020	616.6	36.0
MB18WON0003	12/12/2020	616.5	36.1
MB18WON0003	11/12/2020	616.5	36.1
MB18WON0003	10/12/2020	616.5	36.1
MB18WON0003	9/12/2020	616.5	36.1
MB18WON0003	8/12/2020	616.5	36.1
MB18WON0003	7/12/2020	616.5	36.1
MB18WON0003	6/12/2020	616.5	36.1
MB18WON0003	5/12/2020	616.5	36.1
MB18WON0003	4/12/2020	616.5	36.1
MB18WON0003	3/12/2020	616.5	36.1
MB18WON0003	2/12/2020	616.5	36.1
MB18WON0003	1/12/2020	616.5	36.1
MB18WON0003	30/11/2020	616.5	36.1
MB18WON0003	29/11/2020	616.4	36.2
MB18WON0003	28/11/2020	616.4	36.2
MB18WON0003	27/11/2020	616.4	36.2
MB18WON0003	26/11/2020	616.4	36.2
MB18WON0003	25/11/2020	616.4	36.2
MB18WON0003	24/11/2020	616.5	36.1
MB18WON0003	23/11/2020	616.5	36.1
MB18WON0003	22/11/2020	616.4	36.2
MB18WON0003	21/11/2020	616.4	36.2
MB18WON0003	20/11/2020	616.4	36.2
MB18WON0003	19/11/2020	616.4	36.2
MB18WON0003	18/11/2020	616.4	36.2
MB18WON0003	17/11/2020	616.4	36.2
MB18WON0003	16/11/2020	616.4	36.2
MB18WON0003	15/11/2020	616.4	36.2
MB18WON0003	14/11/2020	616.3	36.3
MB18WON0003	13/11/2020	616.3	36.3
MB18WON0003	12/11/2020	616.3	36.3
MB18WON0003	11/11/2020	616.3	36.3
MB18WON0003	10/11/2020	616.3	36.3
MB18WON0003	9/11/2020	616.3	36.3
MB18WON0003	8/11/2020	616.3	36.3
MB18WON0003	7/11/2020	616.2	36.4
MB18WON0003	6/11/2020	616.2	36.4
MB18WON0003	5/11/2020	616.2	36.4
MB18WON0003	4/11/2020	616.2	36.4
MB18WON0003	3/11/2020	616.2	36.4
MB18WON0003	2/11/2020	616.2	36.4
MB18WON0003	1/11/2020	616.1	36.5
MB18WON0003	31/10/2020	616.1	36.5
MB18WON0003	30/10/2020	616.1	36.5
MB18WON0003	29/10/2020	616.1	36.5
MB18WON0003	28/10/2020	616.1	36.5
MB18WON0003	27/10/2020	616.1	36.5
MB18WON0003	26/10/2020	616.0	36.6
MB18WON0003	25/10/2020	616.0	36.6
MB18WON0003	24/10/2020	616.0	36.6
MB18WON0003	23/10/2020	616.0	36.6
MB18WON0003	22/10/2020	616.0	36.6

ID	Date	WL mAHD	WL mbgl
MB15HD20006	28/02/2021	625.1	76.9
MB15HD20006	1/03/2021	625.2	76.9
MB15HD20006	2/03/2021	625.2	76.9
MB15HD20006	3/03/2021	625.2	76.9
MB15HD20006	4/03/2021	625.2	76.9
MB15HD20006	5/03/2021	625.2	76.9
MB15HD20006	6/03/2021	625.2	76.9
MB15HD20006	7/03/2021	625.2	76.9
MB15HD20006	8/03/2021	625.2	76.9
MB15HD20006	9/03/2021	625.2	76.9
MB15HD20006	10/03/2021	625.2	76.9
MB15HD20006	11/03/2021	625.2	76.9
MB15HD20006	12/03/2021	625.2	76.9
MB15HD20006	13/03/2021	625.2	76.9
MB15HD20006	14/03/2021	625.2	76.9
MB15HD20006	15/03/2021	625.2	76.9
MB15HD20006	16/03/2021	625.2	76.9
MB15HD20006	17/03/2021	625.2	76.9
MB15HD20006	18/03/2021	625.2	76.9
MB15HD20006	19/03/2021	625.2	76.9
MB15HD20006	20/03/2021	625.2	76.9
MB15HD20006	21/03/2021	625.2	76.9
MB15HD20006	22/03/2021	625.2	76.9
MB15HD20006	23/03/2021	625.2	76.9
MB15HD20006	24/03/2021	625.2	76.9
MB15HD20006	25/03/2021	625.2	76.9
MB15HD20006	26/03/2021	625.2	76.9
MB15HD20006	27/03/2021	625.2	76.9
MB15HD20006	28/03/2021	625.2	76.9
MB15HD20006	29/03/2021	625.2	76.9
MB15HD20006	30/03/2021	625.2	76.9
MB15HD20006	31/03/2021	625.2	76.9
MB15HD20006	1/04/2021	625.2	76.9
MB15HD20006	2/04/2021	625.2	76.9
MB15HD20006	3/04/2021	625.2	76.9
MB15HD20006	4/04/2021	625.2	76.9
MB15HD20006	5/04/2021	625.2	76.9
MB15HD20006	6/04/2021	625.2	76.9
MB15HD20006	7/04/2021	625.2	76.9
MB15HD20006	8/04/2021	625.2	76.9
MB15HD20006	9/04/2021	625.2	76.9
MB15HD20006	10/04/2021	625.2	76.9
MB15HD20006	11/04/2021	625.2	76.9
MB15HD20006	12/04/2021	625.2	76.9
MB15HD20006	13/04/2021	625.2	76.9
MB15HD20006	14/04/2021	625.2	76.9
MB15HD20006	15/04/2021	625.2	76.9
MB15HD20006	16/04/2021	625.2	76.8
MB15HD20006	17/04/2021	625.2	76.8
MB15HD20006	18/04/2021	625.2	76.8
MB15HD20006	19/04/2021	625.2	76.8
MB15HD20006	20/04/2021	625.2	76.9
MB15HD20006	21/04/2021	625.2	76.9
MB15HD20006	22/04/2021	625.2	76.8
MB15HD20006	23/04/2021	625.2	76.8
MB15HD20006	24/04/2021	625.2	76.8
MB15HD20006	25/04/2021	625.2	76.8
MB15HD20006	26/04/2021	625.2	76.8
MB15HD20006	27/04/2021	625.2	76.8
MB15HD20006	28/04/2021	625.2	76.8
MB15HD20006	29/04/2021	625.2	76.8
MB15HD20006	30/04/2021	625.2	76.9
MB15HD20006	1/05/2021	625.2	76.9
MB15HD20006	2/05/2021	625.2	76.9
MB15HD20006	3/05/2021	625.2	76.9
MB15HD20006	4/05/2021	625.2	76.9
MB15HD20006	5/05/2021	625.2	76.9
MB15HD20006	6/05/2021	625.2	76.9
MB15HD20006	7/05/2021	625.2	76.9
MB15HD20006	8/05/2021	625.2	76.9
MB15HD20006	9/05/2021	625.2	76.9
MB15HD20006	10/05/2021	625.2	76.9
MB15HD20006	11/05/2021	625.2	76.8
MB15HD20006	12/05/2021	625.2	76.9
MB15HD20006	13/05/2021	625.2	76.9
MB15HD20006	14/05/2021	625.2	76.8
MB15HD20006	15/05/2021	625.2	76.8
MB15HD20006	16/05/2021	625.2	76.8
MB15HD20006	17/05/2021	625.2	76.9
MB15HD20006	18/05/2021	625.2	76.9
MB15HD20006	19/05/2021	625.2	76.9
MB15HD20006	20/05/2021	625.2	76.9
MB15HD20006	21/05/2021	625.2	76.8
MB15HD20006	22/05/2021	625.2	76.9
MB15HD20006	23/05/2021	625.2	76.9
MB15HD20006	24/05/2021	625.2	76.9
MB15HD20006	25/05/2021	625.2	76.9
MB15HD20006	26/05/2021	625.2	76.8
MB15HD20006	27/05/2021	625.2	76.8
MB15HD20006	28/05/2021	625.2	76.8
MB15HD20006	29/05/2021	625.2	76.8
MB15HD20006	30/05/2021	625.2	76.9
MB15HD20006	31/05/2021	625.2	76.9
MB15HD20006	1/06/2021	625.2	76.9
MB15HD20006	2/06/2021	625.2	76.9
MB15HD20006	3/06/2021	625.2	76.8
MB15HD20006	4/06/2021	625.2	76.8
MB15HD20006	5/06/2021	625.2	76.8
MB15HD20006	6/06/2021	625.2	76.8
MB15HD20006	7/06/2021	625.2	76.8
MB15HD20006	8/06/2021	625.2	76.8
MB15HD20006	9/06/2021	625.2	76.8
MB15HD20006	10/06/2021	625.2	76.9
MB15HD20006	11/06/2021	625.2	76.9
MB15HD20006	12/06/2021	625.2	76.9
MB15HD20006	13/06/2021	625.2	76.9
MB15HD20006	14/06/2021	625.2	76.9
MB15HD20006	15/06/2021	625.2	76.9
MB15HD20006	16/06/2021	625.2	76.9
MB15HD20006	17/06/2021	625.2	76.8
MB15HD20006	18/06/2021	625.3	76.8
MB15HD20006	19/06/2021	625.3	76.8
MB15HD20006	20/06/2021	625.2	76.8
MB15HD20006	21/06/2021	625.2	76.9
MB15HD20006	22/06/2021	625.2	76.9
MB15HD20006	23/06/2021	625.2	76.8
MB15HD20006	24/06/2021	625.2	76.8
MB15HD20006	25/06/2021	625.3	76.8
MB15HD20006	26/06/2021	625.2	76.8
MB15HD20006	27/06/2021	625.2	76.8
MB15HD20006	28/06/2021	625.2	76.9
MB15HD20006	29/06/2021	625.2	76.9
MB15HD20006	30/06/2021	625.2	76.8
MB15HD20006	1/07/2021	625.2	76.8
MB15HD20006	2/07/2021	625.2	76.8
MB15HD20006	3/07/2021	625.2	76.8
MB15HD20006	4/07/2021	625.2	76.8
MB15HD20006	5/07/2021	625.2	76.9
MB15HD20006	6/07/2021	625.2	76.9
MB15HD20006	7/07/2021	625.2	76.9
MB15HD20006	8/07/2021	625.2	76.9
MB15HD20006	9/07/2021	625.2	76.9
MB15HD20006	10/07/2021	625.2	76.9
MB15HD20006	11/07/2021	625.2	76.9
MB15HD20006	12/07/2021	625.2	76.9
MB15HD20006	13/07/2021	625.2	76.9

ID	Date	WL mAHD	WL mbgl
MB18HD20010	27/04/2019	625.2	68.1
MB18HD20010	28/04/2019	625.2	68.1
MB18HD20010	29/04/2019	625.2	68.2
MB18HD20010	30/04/2019	625.2	68.2
MB18HD20010	1/05/2019	625.2	68.2
MB18HD20010	2/05/2019	625.2	68.2
MB18HD20010	3/05/2019	625.2	68.2
MB18HD20010	4/05/2019	625.2	68.1
MB18HD20010	5/05/2019	625.2	68.1
MB18HD20010	6/05/2019	625.2	68.1
MB18HD20010	7/05/2019	625.2	68.1
MB18HD20010	8/05/2019	625.2	68.1
MB18HD20010	9/05/2019	625.3	68.1
MB18HD20010	10/05/2019	625.3	68.1
MB18HD20010	11/05/2019	625.3	68.1
MB18HD20010	12/05/2019	625.3	68.1
MB18HD20010	13/05/2019	625.2	68.1
MB18HD20010	14/05/2019	625.2	68.1
MB18HD20010	15/05/2019	625.2	68.1
MB18HD20010	16/05/2019	625.2	68.1
MB18HD20010	17/05/2019	625.2	68.2
MB18HD20010	18/05/2019	625.2	68.2
MB18HD20010	19/05/2019	625.2	68.1
MB18HD20010	20/05/2019	625.2	68.1
MB18HD20010	21/05/2019	625.2	68.1
MB18HD20010	22/05/2019	625.2	68.1
MB18HD20010	23/05/2019	625.2	68.1
MB18HD20010	24/05/2019	625.2	68.1
MB18HD20010	25/05/2019	625.2	68.1
MB18HD20010	26/05/2019	625.2	68.1
MB18HD20010	27/05/2019	625.2	68.1
MB18HD20010	28/05/2019	625.2	68.1
MB18HD20010	29/05/2019	625.2	68.1
MB18HD20010	30/05/2019	625.2	68.1
MB18HD20010	31/05/2019	625.2	68.1
MB18HD20010	1/06/2019	625.3	68.1
MB18HD20010	2/06/2019	625.3	68.1
MB18HD20010	3/06/2019	625.3	68.1
MB18HD20010	4/06/2019	625.3	68.1
MB18HD20010	5/06/2019	625.2	68.1
MB18HD20010	6/06/2019	625.2	68.1
MB18HD20010	7/06/2019	625.2	68.1
MB18HD20010	8/06/2019	625.2	68.2
MB18HD20010	9/06/2019	625.2	68.2
MB18HD20010	10/06/2019	625.2	68.2
MB18HD20010	11/06/2019	625.2	68.2
MB18HD20010	12/06/2019	625.2	68.1
MB18HD20010	13/06/2019	625.2	68.1
MB18HD20010	14/06/2019	625.2	68.1
MB18HD20010	15/06/2019	625.2	68.2
MB18HD20010	16/06/2019	625.2	68.2
MB18HD20010	17/06/2019	625.2	68.2
MB18HD20010	18/06/2019	625.2	68.1
MB18HD20010	19/06/2019	625.3	68.1
MB18HD20010	20/06/2019	625.3	68.1
MB18HD20010	21/06/2019	625.3	68.1
MB18HD20010	22/06/2019	625.2	68.1
MB18HD20010	23/06/2019	625.2	68.1
MB18HD20010	24/06/2019	625.2	68.2
MB18HD20010	25/06/2019	625.2	68.2
MB18HD20010	26/06/2019	625.2	68.2
MB18HD20010	27/06/2019	625.2	68.2
MB18HD20010	28/06/2019	625.2	68.2
MB18HD20010	29/06/2019	625.2	68.2
MB18HD20010	30/06/2019	625.2	68.2
MB18HD20010	1/07/2019	625.2	68.1
MB18HD20010	2/07/2019	625.2	68.2
MB18HD20010	3/07/2019	625.2	68.1
MB18HD20010	4/07/2019	625.2	68.1
MB18HD20010	5/07/2019	625.2	68.2
MB18HD20010	6/07/2019	625.2	68.2
MB18HD20010	7/07/2019	625.2	68.1
MB18HD20010	8/07/2019	625.2	68.1
MB18HD20010	9/07/2019	625.2	68.1
MB18HD20010	10/07/2019	625.2	68.1
MB18HD20010	11/07/2019	625.3	68.1
MB18HD20010	12/07/2019	625.3	68.1
MB18HD20010	13/07/2019	625.3	68.1
MB18HD20010	14/07/2019	625.3	68.1
MB18HD20010	15/07/2019	625.3	68.1
MB18HD20010	16/07/2019	625.3	68.1
MB18HD20010	17/07/2019	625.2	68.1
MB18HD20010	18/07/2019	625.2	68.1
MB18HD20010	19/07/2019	625.2	68.2
MB18HD20010	20/07/2019	625.2	68.2
MB18HD20010	21/07/2019	625.2	68.2
MB18HD20010	22/07/2019	625.2	68.2
MB18HD20010	23/07/2019	625.2	68.2
MB18HD20010	24/07/2019	625.2	68.1
MB18HD20010	25/07/2019	625.2	68.1
MB18HD20010	26/07/2019	625.2	68.2
MB18HD20010	27/07/2019	625.2	68.2
MB18HD20010	28/07/2019	625.2	68.2
MB18HD20010	29/07/2019	625.2	68.2
MB18HD20010	30/07/2019	625.2	68.1
MB18HD20010	31/07/2019	625

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	20/07/2015	432.6	254.0
HDVP2	19/07/2015	432.6	254.0
HDVP2	18/07/2015	432.6	254.0
HDVP2	17/07/2015	432.6	254.0
HDVP2	16/07/2015	432.6	254.0
HDVP2	15/07/2015	432.6	254.0
HDVP2	14/07/2015	432.6	254.0
HDVP2	13/07/2015	432.6	254.0
HDVP2	12/07/2015	432.6	254.0
HDVP2	11/07/2015	432.6	254.0
HDVP2	10/07/2015	432.6	254.0
HDVP2	9/07/2015	432.6	254.0
HDVP2	8/07/2015	432.6	254.0
HDVP2	7/07/2015	432.6	254.0
HDVP2	6/07/2015	432.6	254.0
HDVP2	5/07/2015	432.6	254.0
HDVP2	4/07/2015	432.6	254.0
HDVP2	3/07/2015	432.6	254.0
HDVP2	2/07/2015	401.2	285.3
HDVP2	1/07/2015	401.2	285.3
HDVP2	30/06/2015	401.2	285.3
HDVP2	29/06/2015	401.2	285.3
HDVP2	28/06/2015	401.2	285.3
HDVP2	27/06/2015	401.2	285.3
HDVP2	26/06/2015	401.2	285.3
HDVP2	25/06/2015	401.2	285.3
HDVP2	24/06/2015	401.2	285.3
HDVP2	23/06/2015	401.2	285.3
HDVP2	22/06/2015	401.2	285.3
HDVP2	21/06/2015	401.2	285.3
HDVP2	20/06/2015	401.2	285.3
HDVP2	19/06/2015	401.2	285.3
HDVP2	18/06/2015	401.2	285.3
HDVP2	17/06/2015	401.2	285.3
HDVP2	16/06/2015	401.2	285.3
HDVP2	15/06/2015	401.2	285.3
HDVP2	14/06/2015	401.2	285.3
HDVP2	13/06/2015	401.2	285.3
HDVP2	12/06/2015	401.2	285.3
HDVP2	11/06/2015	401.2	285.3
HDVP2	10/06/2015	401.2	285.3
HDVP2	9/06/2015	401.2	285.3
HDVP2	8/06/2015	401.2	285.3
HDVP2	7/06/2015	401.2	285.3
HDVP2	6/06/2015	401.2	285.3
HDVP2	5/06/2015	401.2	285.3
HDVP2	4/06/2015	401.2	285.3
HDVP2	3/06/2015	401.2	285.3
HDVP2	2/06/2015	401.2	285.3
HDVP2	1/06/2015	415.8	270.7
HDVP2	31/05/2015	415.8	270.7
HDVP2	30/05/2015	415.8	270.7
HDVP2	29/05/2015	415.8	270.7
HDVP2	28/05/2015	415.8	270.7
HDVP2	27/05/2015	415.8	270.7
HDVP2	26/05/2015	415.8	270.7
HDVP2	25/05/2015	415.8	270.7
HDVP2	24/05/2015	415.8	270.7
HDVP2	23/05/2015	415.8	270.7
HDVP2	22/05/2015	415.8	270.7
HDVP2	21/05/2015	415.8	270.7
HDVP2	20/05/2015	415.8	270.7
HDVP2	19/05/2015	415.8	270.7
HDVP2	18/05/2015	415.8	270.7
HDVP2	17/05/2015	415.8	270.7
HDVP2	16/05/2015	415.8	270.7
HDVP2	15/05/2015	415.8	270.7
HDVP2	14/05/2015	415.8	270.7
HDVP2	13/05/2015	415.8	270.7
HDVP2	12/05/2015	415.8	270.7
HDVP2	11/05/2015	415.8	270.7
HDVP2	10/05/2015	415.8	270.7
HDVP2	9/05/2015	415.8	270.7
HDVP2	8/05/2015	415.8	270.7
HDVP2	7/05/2015	415.8	270.7
HDVP2	6/05/2015	415.8	270.7
HDVP2	5/05/2015	415.8	270.7
HDVP2	4/05/2015	415.8	270.7
HDVP2	3/05/2015	415.8	270.7
HDVP2	2/05/2015	415.8	270.7
HDVP2	1/05/2015	443.1	243.5
HDVP2	30/04/2015	443.1	243.5
HDVP2	29/04/2015	443.1	243.5
HDVP2	28/04/2015	443.1	243.5
HDVP2	27/04/2015	443.1	243.5
HDVP2	26/04/2015	443.1	243.5
HDVP2	25/04/2015	443.1	243.5
HDVP2	24/04/2015	443.1	243.5
HDVP2	23/04/2015	443.1	243.5
HDVP2	22/04/2015	443.1	243.5
HDVP2	21/04/2015	443.1	243.5
HDVP2	20/04/2015	443.1	243.5
HDVP2	19/04/2015	443.1	243.5
HDVP2	18/04/2015	443.1	243.5
HDVP2	17/04/2015	443.1	243.5
HDVP2	16/04/2015	443.1	243.5
HDVP2	15/04/2015	443.1	243.5
HDVP2	14/04/2015	443.1	243.5
HDVP2	13/04/2015	443.1	243.5
HDVP2	12/04/2015	443.1	243.5
HDVP2	11/04/2015	443.1	243.5
HDVP2	10/04/2015	443.1	243.5
HDVP2	9/04/2015	443.1	243.5
HDVP2	8/04/2015	443.1	243.5
HDVP2	7/04/2015	443.1	243.5
HDVP2	6/04/2015	443.1	243.5
HDVP2	5/04/2015	443.1	243.5
HDVP2	4/04/2015	443.1	243.5
HDVP2	3/04/2015	443.1	243.5
HDVP2	2/04/2015	443.1	243.5
HDVP2	1/04/2015	387.0	299.5
HDVP2	31/03/2015	387.0	299.5
HDVP2	30/03/2015	387.0	299.5
HDVP2	29/03/2015	387.0	299.5
HDVP2	28/03/2015	387.0	299.5
HDVP2	27/03/2015	387.0	299.5
HDVP2	26/03/2015	387.0	299.5
HDVP2	25/03/2015	387.0	299.5
HDVP2	24/03/2015	387.0	299.5
HDVP2	23/03/2015	387.0	299.5
HDVP2	22/03/2015	387.0	299.5
HDVP2	21/03/2015	387.0	299.5
HDVP2	20/03/2015	387.0	299.5
HDVP2	19/03/2015	387.0	299.5
HDVP2	18/03/2015	387.0	299.5
HDVP2	17/03/2015	387.0	299.5
HDVP2	16/03/2015	387.0	299.5
HDVP2	15/03/2015	387.0	299.5
HDVP2	14/03/2015	387.0	299.5
HDVP2	13/03/2015	387.0	299.5
HDVP2	12/03/2015	387.0	299.5
HDVP2	11/03/2015	387.0	299.5
HDVP2	10/03/2015	387.0	299.5
HDVP2	9/03/2015	387.0	299.5
HDVP2	8/03/2015	387.0	299.5
HDVP2	7/03/2015	387.0	299.5

ID	Date	WL mAHD	WL mbgl
MB18WON0003	21/10/2020	615.9	36.7
MB18WON0003	20/10/2020	615.9	36.7
MB18WON0003	19/10/2020	615.9	36.7
MB18WON0003	18/10/2020	615.8	36.8
MB18WON0003	17/10/2020	615.8	36.8
MB18WON0003	16/10/2020	615.8	36.8
MB18WON0003	15/10/2020	615.7	36.9
MB18WON0003	14/10/2020	615.7	36.9
MB18WON0003	13/10/2020	615.7	36.9
MB18WON0003	12/10/2020	615.7	36.9
MB18WON0003	11/10/2020	615.7	36.9
MB18WON0003	10/10/2020	615.6	37.0
MB18WON0003	9/10/2020	615.6	37.0
MB18WON0003	8/10/2020	615.5	37.1
MB18WON0003	7/10/2020	615.5	37.1
MB18WON0003	6/10/2020	615.5	37.1
MB18WON0003	5/10/2020	615.5	37.1
MB18WON0003	4/10/2020	615.4	37.2
MB18WON0003	3/10/2020	615.4	37.2
MB18WON0003	2/10/2020	615.3	37.3
MB18WON0003	1/10/2020	615.2	37.4
MB18WON0003	30/09/2020	615.2	37.4
MB18WON0003	29/09/2020	615.2	37.4
MB18WON0003	28/09/2020	615.1	37.5
MB18WON0003	27/09/2020	615.0	37.6
MB18WON0003	26/09/2020	615.0	37.6
MB18WON0003	25/09/2020	614.9	37.7
MB18WON0003	24/09/2020	614.9	37.7
MB18WON0003	23/09/2020	614.8	37.8
MB18WON0003	22/09/2020	614.8	37.8
MB18WON0003	21/09/2020	614.7	37.9
MB18WON0003	20/09/2020	614.6	38.0
MB18WON0003	19/09/2020	614.5	38.1
MB18WON0003	18/09/2020	614.4	38.2
MB18WON0003	17/09/2020	614.3	38.3
MB18WON0003	16/09/2020	614.2	38.4
MB18WON0003	15/09/2020	614.2	38.4
MB18WON0003	14/09/2020	614.0	38.6
MB18WON0003	13/09/2020	613.9	38.7
MB18WON0003	12/09/2020	613.8	38.8
MB18WON0003	11/09/2020	613.7	38.9
MB18WON0003	10/09/2020	613.6	39.0
MB18WON0003	9/09/2020	613.4	39.2
MB18WON0003	8/09/2020	613.3	39.3
MB18WON0003	7/09/2020	613.2	39.4
MB18WON0003	6/09/2020	612.9	39.7
MB18WON0003	5/09/2020	612.8	39.8
MB18WON0003	4/09/2020	612.6	40.0
MB18WON0003	3/09/2020	612.4	40.2
MB18WON0003	2/09/2020	612.2	40.4
MB18WON0003	1/09/2020	611.9	40.7
MB18WON0003	31/08/2020	611.7	40.9
MB18WON0003	30/08/2020	611.4	41.2
MB18WON0003	29/08/2020	611.1	41.5
MB18WON0003	28/08/2020	610.8	41.8
MB18WON0003	27/08/2020	610.5	42.1
MB18WON0003	26/08/2020	610.1	42.5
MB18WON0003	25/08/2020	609.7	42.9
MB18WON0003	24/08/2020	609.3	43.3
MB18WON0003	23/08/2020	608.9	43.7
MB18WON0003	22/08/2020	608.5	44.1
MB18WON0003	21/08/2020	607.9	44.7
MB18WON0003	20/08/2020	607.6	45.0
MB18WON0003	19/08/2020	607.1	45.5
MB18WON0003	18/08/2020	606.6	46.0
MB18WON0003	17/08/2020	606.2	46.4
MB18WON0003	16/08/2020	605.6	47.0
MB18WON0003	15/08/2020	605.1	47.5
MB18WON0003	14/08/2020	604.7	47.9
MB18WON0003	13/08/2020	604.1	48.5
MB18WON0003	12/08/2020	603.6	49.0
MB18WON0003	11/08/2020	603.0	49.6
MB18WON0003	10/08/2020	602.2	50.4
MB18WON0003	9/08/2020	617.1	35.5
MB18WON0003	8/08/2020	617.1	35.5
MB18WON0003	7/08/2020	617.1	35.5
MB18WON0003	6/08/2020	617.1	35.5
MB18WON0003	5/08/2020	617.1	35.5
MB18WON0003	4/08/2020	617.1	35.5
MB18WON0003	3/08/2020	617.1	35.5
MB18WON0003	2/08/2020	617.1	35.5
MB18WON0003	1/08/2020	617.1	35.5
MB18WON0003	31/07/2020	617.1	35.5
MB18WON0003	30/07/2020	617.1	35.5
MB18WON0003	29/07/2020	617.1	35.5
MB18WON0003	28/07/2020	617.1	35.5
MB18WON0003	27/07/2020	617.1	35.5
MB18WON0003	26/07/2020	617.1	35.5
MB18WON0003	25/07/2020	617.1	35.5
MB18WON0003	24/07/2020	617.1	35.5
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MB18WON0003	22/07/2020	617.1	35.5
MB18WON0003	21/07/2020	617.1	35.5
MB18WON0003	20/07/2020	617.1	35.5
MB18WON0003	19/07/2020	617.1	35.5
MB18WON0003	18/07/2020	617.1	35.5
MB18WON0003	17/07/2020	617.1	35.5
MB18WON0003	16/07/2020	617.0	35.6
MB18WON0003	15/07/2020	617.1	35.5
MB18WON0003	14/07/2020	617.1	35.5
MB18WON0003	13/07/2020	617.0	35.6
MB18WON0003	12/07/2020	617.0	35.6
MB18WON0003	11/07/2020	617.1	35.5
MB18WON0003	10/07/2020	617.1	35.5
MB18WON0003	9/07/2020	617.0	35.6
MB18WON0003	8/07/2020	617.0	35.6
MB18WON0003	7/07/2020	617.0	35.6
MB18WON0003	6/07/2020	617.0	35.6
MB18WON0003	5/07/2020	617.0	35.6
MB18WON0003	4/07/2020	617.0	35.6
MB18WON0003	3/07/2020	617.1	35.5
MB18WON0003	2/07/2020	617.1	35.5
MB18WON0003	1/07/2020	617.0	35.6
MB18WON0003	30/06/2020	617.0	35.6
MB18WON0003	29/06/2020	617.0	35.6
MB18WON0003	28/06/2020	617.0	35.6
MB18WON0003	27/06/2020	617.0	35.6
MB18WON0003	26/06/2020	617.0	35.6
MB18WON0003	25/06/2020	617.0	35.6
MB18WON0003	24/06/2020	617.0	35.6
MB18WON0003	23/06/2020	617.0	35.6
MB18WON0003	22/06/2020	617.0	35.6
MB18WON0003	21/06/2020	617.0	35.6
MB18WON0003	20/06/2020	617.0	35.6
MB18WON0003	19/06/2020	617.0	35.6
MB18WON0003	18/06/2020	617.0	35.6
MB18WON0003	17/06/2020	617.0	35.6
MB18WON0003	16/06/2020	617.0	35.6
MB18WON0003	15/06/2020	617.0	35.6
MB18WON0003	14/06/2020	617.0	35.6
MB18WON0003	13/06/2020	617.0	35.6
MB18WON0003	12/06/2020	617.0	35.6
MB18WON0003	11/06/2020	616.9	35.7
MB18WON0003	10/06/2020	617.0	35.6
MB18WON0003	9/06/2020	617.0	35.6
MB18WON0003	8/06/2020	617.0	35.6

ID	Date	WL mAHD	WL mbgl
MB15HD20006	14/07/2021	625.2	76.9
MB15HD20006	15/07/2021	625.2	76.9
MB15HD20006	16/07/2021	625.2	76.8
MB15HD20006	17/07/2021	625.2	76.8
MB15HD20006	18/07/2021	625.2	76.9
MB15HD20006	19/07/2021	625.2	76.9
MB15HD20006	20/07/2021	625.2	76.9
MB15HD20006	21/07/2021	625.2	76.9
MB15HD20006	22/07/2021	625.2	76.9
MB15HD20006	23/07/2021	625.2	76.9
MB15HD20006	24/07/2021	625.2	76.9
MB15HD20006	25/07/2021	625.2	76.9
MB15HD20006	26/07/2021	625.2	76.9
MB15HD20006	27/07/2021	625.2	76.9
MB15HD20006	28/07/2021	625.2	76.9
MB15HD20006	29/07/2021	625.2	76.9
MB15HD20006	30/07/2021	625.2	76.9
MB15HD20006	31/07/2021	625.2	76.9
MB15HD20006	1/08/2021	625.2	76.9
MB15HD20006	2/08/2021	625.2	76.9
MB15HD20006	3/08/2021	625.2	76.8
MB15HD20006	4/08/2021	625.3	76.8
MB15HD20006	5/08/2021	625.3	76.8
MB15HD20006	6/08/2021	625.3	76.8
MB15HD20006	7/08/2021	625.3	76.8
MB15HD20006	8/08/2021	625.2	76.8
MB15HD20006	9/08/2021	625.2	76.8
MB15HD20006	10/08/2021	625.2	76.9
MB15HD20006	11/08/2021	625.2	76.8
MB15HD20006	12/08/2021	625.3	76.8
MB15HD20006	13/08/2021	625.3	76.8
MB15HD20006	14/08/2021	625.2	76.9
MB15HD20006	15/08/2021	625.2	76.9
MB15HD20006	16/08/2021	625.2	76.8
MB15HD20006	17/08/2021	625.3	76.8
MB15HD20006	18/08/2021	625.2	76.8
MB15HD20006	19/08/2021	625.2	76.9
MB15HD20006	20/08/2021	625.2	76.9
MB15HD20006	21/08/2021	625.2	76.9
MB15HD20006	22/08/2021	625.2	76.9
MB15HD20006	23/08/2021	625.2	76.9
MB15HD20006	24/08/2021	625.2	76.9
MB15HD20006	25/08/2021	625.2	76.9
MB15HD20006	26/08/2021	625.2	76.9
MB15HD20006	27/08/2021	625.2	76.9
MB15HD20006	28/08/2021	625.2	76.9
MB15HD20006	29/08/2021	625.2	76.9
MB15HD20006	30/08/2021	625.2	76.9
MB15HD20006	31/08/2021	625.2	76.9
MB15HD20006	1/09/2021	625.2	76.9
MB15HD20006	2/09/2021	625.2	76.9
MB15HD20006	3/09/2021	625.2	76.9
MB15HD20006	4/09/2021	625.2	76.9
MB15HD20006	5/09/2021	625.2	76.8
MB15HD20006	6/09/2021	625.2	76.8
MB15HD20006	7/09/2021	625.3	76.8
MB15HD20006	8/09/2021	625.2	76.8
MB15HD20006	9/09/2021	625.2	76.8
MB15HD20006	10/09/2021	625.2	76.8
MB15HD20006	11/09/2021	625.2	76.9
MB15HD20006	12/09/2021	625.2	76.9
MB15HD20006	13/09/2021	625.2	76.9
MB15HD20006	14/09/2021	625.2	76.9
MB15HD20006	15/09/2021	625.2	76.9
MB15HD20006	16/09/2021	625.2	76.9
MB15HD20006	17/09/2021	625.2	76.9
MB15HD20006	18/09/2021	625.2	76.9
MB15HD20006	19/09/2021	625.2	76.9
MB15HD20006	20/09/2021	625.2	76.8
MB15HD20006	21/09/2021	625.2	76.8
MB15HD20006	22/09/2021	625.2	76.8
MB15HD20006	23/09/2021	625.2	76.8
MB15HD20006	24/09/2021	625.2	76.9
MB15HD20006	25/09/2021	625.2	76.9
MB15HD20006	26/09/2021	625.2	76.9
MB15HD20006	27/09/2021	625.2	76.9
MB15HD20006	28/09/2021	625.2	76.9
MB15HD20006	29/09/2021	625.2	76.9
MB15HD20006	30/09/2021	625.2	76.9
MB15HD20006	1/10/2021	625.2	76.9
MB15HD20006	2/10/2021	625.2	76.9
MB15HD20006	3/10/2021	625.2	76.9
MB15HD20006	4/10/2021	625.2	76.9
MB15HD20006	5/10/2021	625.1	76.9
MB15HD20006	6/10/2021	625.1	76.9
MB15HD20006	7/10/2021	625.2	76.9
MB15HD20006	8/10/2021	625.2	76.9
MB15HD20006	9/10/2021	625.2	76.9
MB15HD20006	10/10/2021	625.2	76.9
MB15HD20006	11/10/2021	625.2	76.9
MB15HD20006	12/10/2021	625.2	76.9
MB15HD20006	13/10/2021	625.2	76.9
MB15HD20006	14/10/2021	625.2	76.9
MB15HD20006	15/10/2021	625.2	76.9
MB15HD20006	16/10/2021	625.1	76.9
MB15HD20006	17/10/2021	625.1	76.9
MB15HD20006	18/10/2021	625.1	76.9
MB15HD20006	19/10/2021	625.2	76.9
MB15HD20006	20/10/2021	625.2	76.9
MB15HD20006	21/10/2021	625.2	76.9
MB15HD20006	22/10/2021	625.2	76.9
MB15HD20006	23/10/2021	625.2	76.9
MB15HD20006	24/10/2021	625.2	76.9
MB15HD20006	25/10/2021	625.2	76.9
MB15HD20006	26/10/2021	625.1	76.9
MB15HD20006	27/10/2021	625.2	76.9
MB15HD20006	28/10/2021	625.2	76.9
MB15HD20006	1/11/2021	625.1	76.9
MB15HD20006	2/11/2021	625.1	76.9
MB15HD20006	3/11/2021	625.1	76.9
MB15HD20006	4/11/2021	625.2	76.9
MB15HD20006	5/11/2021	625.2	76.9
MB15HD20006	6/11/2021	625.1	76.9
MB15HD20006	7/11/2021	625.1	77.0
MB15HD20006	9/11/2021	625.1	77.0
MB15HD20006	10/11/2021	625.1	77.0
MB15HD20006	11/11/2021	625.1	76.9
MB15HD20006	12/11/2021	625.2	76.9
MB15HD20006	13/11/2021	625.2	76.9
MB15HD20006	14/11/2021	625.2	76.9
MB15HD20006	15/11/2021	625.2	76.9
MB15HD20006	16/11/2021	625.1	76.9
MB15HD20006	17/11/2021	625.1	76.9
MB15HD20006	18/11/2021	625.1	76.9
MB15HD20006	19/11/2021	625.1	76.9
MB15HD20006	20/11/2021	625.1	76.9
MB15HD20006	21/11/2021	625.1	76.9
MB15HD20006	22/11/2021	625.1	76.9
MB15HD20006	23/11/2021	625.1	76.9
MB15HD20006	24/11/2021	625.2	76.9
MB15HD20006	25/11/2021	625.2	76.9
MB15HD20006	26/11/2021	625.2	76.9
MB15HD20006	27/11/2021	625.2	76.9
MB15HD20006	28/11/2021	625.2	76.9
MB15HD20006	29/11/2021	625.2	76.9
MB15HD20006	30/11/2021	625.1	76.9

ID	Date	WL mAHD	WL mbgl
MB18HD20010	10/09/2019	625.2	68.2
MB18HD20010	11/09/2019	625.2	68.1
MB18HD20010	12/09/2019	625.2	68.1
MB18HD20010	13/09/2019	625.2	68.1
MB18HD20010	14/09/2019	625.2	68.1
MB18HD20010	15/09/2019	625.2	68.2
MB18HD20010	16/09/2019	625.2	68.2
MB18HD20010	17/09/2019	625.2	68.2
MB18HD20010	18/09/2019	625.2	68.2
MB18HD20010	19/09/2019	625.2	68.2
MB18HD20010	20/09/2019	625.2	68.2
MB18HD20010	21/09/2019	625.2	68.2
MB18HD20010	22/09/2019	625.2	68.2
MB18HD20010	23/09/2019	625.2	68.1
MB18HD20010	24/09/2019	625.2	68.1
MB18HD20010	25/09/2019	625.2	68.2
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MB18HD20010	27/09/2019	625.2	68.2
MB18HD20010	28/09/2019	625.2	68.2
MB18HD20010	29/09/2019	625.2	68.2
MB18HD20010	30/09/2019	625.2	68.2
MB18HD20010	1/10/2019	625.2	68.2
MB18HD20010	2/10/2019	625.2	68.2
MB18HD20010	3/10/2019	625.2	68.2
MB18HD20010	4/10/2019	625.2	68.2
MB18HD20010	5/10/2019	625.2	68.2
MB18HD20010	6/10/2019	625.2	68.2
MB18HD20010	7/10/2019	625.2	68.2
MB18HD20010	8/10/2019	625.2	68.2
MB18HD20010	9/10/2019	625.2	68.2
MB18HD20010	10/10/2019	625.2	68.2
MB18HD20010	11/10/2019	625.2	68.2
MB18HD20010	12/10/2019	625.1	68.2
MB18HD20010	13/10/2019	625.1	68.2
MB18HD20010	14/10/2019	625.1	68.2
MB18HD20010	15/10/2019	625.1	68.2
MB18HD20010	16/10/2019	625.1	68.2
MB18HD20010	17/10/2019	625.1	68.2
MB18HD20010	18/10/2019	625.1	68.2
MB18HD20010	19/10/2019	625.2	68.2
MB18HD20010	20/10/2019	625.2	68.2
MB18HD20010	21/10/2019	625.2	68.2
MB18HD20010	22/10/2019	625.2	68.2
MB18HD20010	23/10/2019	625.2	68.2
MB18HD20010	24/10/2019	625.1	68.2
MB18HD20010	25/10/2019	625.1	68.2
MB18HD20010	26/10/2019	625.1	68.2
MB18HD20010	27/10/2019	625.1	68.2
MB18HD20010	28/10/2019	625.1	68.2
MB18HD20010	29/10/2019	625.1	68.2
MB18HD20010	30/10/2019	625.1	68.2
MB18HD20010	31/10/2019	625.1	68.2
MB18HD20010	1/11/2019	625.1	68.3
MB18HD20010	2/11/2019	625.1	68.2
MB18HD20010	3/11/2019	625.2	68.2
MB18HD20010	4/11/2019	625.2	68.2
MB18HD20010	5/11/2019	625.2	68.2
MB18HD20010	6/11/2019	625.2	68.2
MB18HD20010	7/11/2019	625.2	68.2
MB18HD20010	8/11/2019	625.1	68.2
MB18HD20010	9/11/2019	625.2	68.2
MB18HD20010	10/11/2019	625.1	68.2
MB18HD20010	11/11/2019	625.1	68.2
MB18HD20010	12/11/2019	625.1	68.2
MB18HD20010	13/11/2019	625.2	68.2
MB18HD20010	14/11/2019	625.2	68.2
MB18HD20010	15/11/2019	625.1	68.2
MB18HD20010	16/11/2019	625.1	68.2
MB18HD20010	17/11/2019	625.2	68.2
MB18HD20010	18/11/2019	625.1	68.2
MB18HD20010	19/11/2019	625.1	68.3
MB18HD20010	20/11/2019	625.1	68.3
MB18HD20010	21/11/2019	625.1	68.2
MB18HD20010	22/11/2019	625.1	68.2
MB18HD20010	23/11/2019	625.1	68.2
MB18HD20010	24/11/2019	625.1	68.3
MB18HD20010	25/11/2019	625.1	68.3
MB18HD20010	26/11/2019	625.1	68.3
MB18HD20010	27/11/2019	625.1	68.3
MB18HD20010	28/11/2019	625.1	68.3
MB18HD20010	29/11/2019	625.1	68.3
MB18HD20010	30/11/2019	625.1	68.2
MB18HD20010	1/12/2019	625.2	68.2
MB18HD20010	2/12/2019	625.2	68.2
MB18HD20010	3/12/2019	625.1	68.2
MB18HD20010	4/12/2019	625.1	68.2
MB18HD20010	5/12/2019	625.1	68.3
MB18HD20010	6/12/2019	625.1	68.3
MB18HD20010	7/12/2019	625.1	68.3
MB18HD20010	8/12/2019	625.1	68.2
MB18HD20010	9/12/2019	625.1	68.3
MB18HD20010	10/12/2019	625.1	68.3
MB18HD20010	11/12/2019	625.1	68.2
MB18HD20010	12/12/2019	625.1	68.2
MB18HD20010	13/12/2019	625.1	68.2
MB18HD20010	14/12/2019	625

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	6/03/2015	387.0	299.5
HDVP2	5/03/2015	387.0	299.5
HDVP2	4/03/2015	387.0	299.5
HDVP2	3/03/2015	387.0	299.5
HDVP2	2/03/2015	387.0	299.5
HDVP2	1/03/2015	375.7	310.9
HDVP2	28/02/2015	375.7	310.9
HDVP2	27/02/2015	375.7	310.9
HDVP2	26/02/2015	375.7	310.9
HDVP2	25/02/2015	375.7	310.9
HDVP2	24/02/2015	375.7	310.9
HDVP2	23/02/2015	375.7	310.9
HDVP2	22/02/2015	375.7	310.9
HDVP2	21/02/2015	375.7	310.9
HDVP2	20/02/2015	375.7	310.9
HDVP2	19/02/2015	375.7	310.9
HDVP2	18/02/2015	375.7	310.9
HDVP2	17/02/2015	375.7	310.9
HDVP2	16/02/2015	375.7	310.9
HDVP2	15/02/2015	375.7	310.9
HDVP2	14/02/2015	375.7	310.9
HDVP2	13/02/2015	375.7	310.9
HDVP2	12/02/2015	375.7	310.9
HDVP2	11/02/2015	375.7	310.9
HDVP2	10/02/2015	375.7	310.9
HDVP2	9/02/2015	375.7	310.9
HDVP2	8/02/2015	375.7	310.9
HDVP2	7/02/2015	375.7	310.9
HDVP2	6/02/2015	375.7	310.9
HDVP2	5/02/2015	375.7	310.9
HDVP2	4/02/2015	375.7	310.9
HDVP2	3/02/2015	375.7	310.9
HDVP2	2/02/2015	375.7	310.9
HDVP2	1/02/2015	350.9	335.6
HDVP2	31/01/2015	350.9	335.6
HDVP2	30/01/2015	350.9	335.6
HDVP2	29/01/2015	350.9	335.6
HDVP2	28/01/2015	350.9	335.6
HDVP2	27/01/2015	350.9	335.6
HDVP2	26/01/2015	350.9	335.6
HDVP2	25/01/2015	350.9	335.6
HDVP2	24/01/2015	350.9	335.6
HDVP2	23/01/2015	350.9	335.6
HDVP2	22/01/2015	350.9	335.6
HDVP2	21/01/2015	350.9	335.6
HDVP2	20/01/2015	350.9	335.6
HDVP2	19/01/2015	350.9	335.6
HDVP2	18/01/2015	350.9	335.6
HDVP2	17/01/2015	350.9	335.6
HDVP2	16/01/2015	350.9	335.6
HDVP2	15/01/2015	350.9	335.6
HDVP2	14/01/2015	350.9	335.6
HDVP2	13/01/2015	350.9	335.6
HDVP2	12/01/2015	350.9	335.6
HDVP2	11/01/2015	350.9	335.6
HDVP2	10/01/2015	350.9	335.6
HDVP2	9/01/2015	350.9	335.6
HDVP2	8/01/2015	350.9	335.6
HDVP2	7/01/2015	350.9	335.6
HDVP2	6/01/2015	350.9	335.6
HDVP2	5/01/2015	350.9	335.6
HDVP2	4/01/2015	350.9	335.6
HDVP2	3/01/2015	350.9	335.6
HDVP2	2/01/2015	350.9	335.6
HDVP2	1/01/2015	353.4	333.2
HDVP2	31/12/2014	353.4	333.2
HDVP2	30/12/2014	353.4	333.2
HDVP2	29/12/2014	353.4	333.2
HDVP2	28/12/2014	353.4	333.2
HDVP2	27/12/2014	353.4	333.2
HDVP2	26/12/2014	353.4	333.2
HDVP2	25/12/2014	353.4	333.2
HDVP2	24/12/2014	353.4	333.2
HDVP2	23/12/2014	353.4	333.2
HDVP2	22/12/2014	353.4	333.2
HDVP2	21/12/2014	353.4	333.2
HDVP2	20/12/2014	353.4	333.2
HDVP2	19/12/2014	353.4	333.2
HDVP2	18/12/2014	353.4	333.2
HDVP2	17/12/2014	353.4	333.2
HDVP2	16/12/2014	353.4	333.2
HDVP2	15/12/2014	353.4	333.2
HDVP2	14/12/2014	353.4	333.2
HDVP2	13/12/2014	353.4	333.2
HDVP2	12/12/2014	353.4	333.2
HDVP2	11/12/2014	353.4	333.2
HDVP2	10/12/2014	353.4	333.2
HDVP2	9/12/2014	353.4	333.2
HDVP2	8/12/2014	353.4	333.2
HDVP2	7/12/2014	353.4	333.2
HDVP2	6/12/2014	353.4	333.2
HDVP2	5/12/2014	353.4	333.2
HDVP2	4/12/2014	353.4	333.2
HDVP2	3/12/2014	353.4	333.2
HDVP2	2/12/2014	353.4	333.2
HDVP2	1/12/2014	313.4	373.2
HDVP2	30/11/2014	313.4	373.2
HDVP2	29/11/2014	313.4	373.2
HDVP2	28/11/2014	313.4	373.2
HDVP2	27/11/2014	313.4	373.2
HDVP2	26/11/2014	313.4	373.2
HDVP2	25/11/2014	313.4	373.2
HDVP2	24/11/2014	313.4	373.2
HDVP2	23/11/2014	313.4	373.2
HDVP2	22/11/2014	313.4	373.2
HDVP2	21/11/2014	313.4	373.2
HDVP2	20/11/2014	313.4	373.2
HDVP2	19/11/2014	313.4	373.2
HDVP2	18/11/2014	313.4	373.2
HDVP2	17/11/2014	313.4	373.2
HDVP2	16/11/2014	313.4	373.2
HDVP2	15/11/2014	313.4	373.2
HDVP2	14/11/2014	313.4	373.2
HDVP2	13/11/2014	313.4	373.2
HDVP2	12/11/2014	313.4	373.2
HDVP2	11/11/2014	313.4	373.2
HDVP2	10/11/2014	313.4	373.2
HDVP2	9/11/2014	313.4	373.2
HDVP2	8/11/2014	313.4	373.2
HDVP2	7/11/2014	313.4	373.2
HDVP2	6/11/2014	313.4	373.2
HDVP2	5/11/2014	313.4	373.2
HDVP2	4/11/2014	313.4	373.2
HDVP2	3/11/2014	313.4	373.2
HDVP2	2/11/2014	313.4	373.2
HDVP2	1/11/2014	260.0	426.5
HDVP2	31/10/2014	260.0	426.5
HDVP2	30/10/2014	260.0	426.5
HDVP2	29/10/2014	260.0	426.5
HDVP2	28/10/2014	260.0	426.5
HDVP2	27/10/2014	260.0	426.5
HDVP2	26/10/2014	260.0	426.5
HDVP2	25/10/2014	260.0	426.5
HDVP2	24/10/2014	260.0	426.5
HDVP2	23/10/2014	260.0	426.5
HDVP2	22/10/2014	260.0	426.5

ID	Date	WL mAHD	WL mbgl
MB18WON0003	7/06/2020	616.9	35.7
MB18WON0003	6/06/2020	616.9	35.7
MB18WON0003	5/06/2020	617.0	35.6
MB18WON0003	4/06/2020	617.0	35.6
MB18WON0003	3/06/2020	617.0	35.6
MB18WON0003	2/06/2020	617.0	35.6
MB18WON0003	1/06/2020	617.0	35.6
MB18WON0003	31/05/2020	617.0	35.6
MB18WON0003	30/05/2020	617.0	35.6
MB18WON0003	29/05/2020	616.9	35.7
MB18WON0003	28/05/2020	617.0	35.6
MB18WON0003	27/05/2020	617.0	35.6
MB18WON0003	26/05/2020	617.0	35.6
MB18WON0003	25/05/2020	616.9	35.7
MB18WON0003	24/05/2020	616.9	35.7
MB18WON0003	23/05/2020	616.9	35.7
MB18WON0003	22/05/2020	616.9	35.7
MB18WON0003	21/05/2020	616.9	35.7
MB18WON0003	20/05/2020	616.9	35.7
MB18WON0003	19/05/2020	616.9	35.7
MB18WON0003	18/05/2020	616.9	35.7
MB18WON0003	17/05/2020	616.9	35.7
MB18WON0003	16/05/2020	616.9	35.7
MB18WON0003	15/05/2020	616.9	35.7
MB18WON0003	14/05/2020	616.9	35.7
MB18WON0003	13/05/2020	616.9	35.7
MB18WON0003	12/05/2020	616.9	35.7
MB18WON0003	11/05/2020	616.9	35.7
MB18WON0003	10/05/2020	616.9	35.7
MB18WON0003	9/05/2020	616.9	35.7
MB18WON0003	8/05/2020	616.9	35.7
MB18WON0003	7/05/2020	616.9	35.7
MB18WON0003	6/05/2020	616.9	35.7
MB18WON0003	5/05/2020	616.8	35.8
MB18WON0003	4/05/2020	616.9	35.7
MB18WON0003	3/05/2020	616.9	35.7
MB18WON0003	2/05/2020	616.8	35.8
MB18WON0003	1/05/2020	616.8	35.8
MB18WON0003	30/04/2020	616.9	35.7
MB18WON0003	29/04/2020	616.9	35.7
MB18WON0003	28/04/2020	616.8	35.8
MB18WON0003	27/04/2020	616.8	35.8
MB18WON0003	26/04/2020	616.8	35.8
MB18WON0003	25/04/2020	616.8	35.8
MB18WON0003	24/04/2020	616.8	35.8
MB18WON0003	23/04/2020	616.8	35.8
MB18WON0003	22/04/2020	616.8	35.8
MB18WON0003	21/04/2020	616.8	35.8
MB18WON0003	20/04/2020	616.8	35.8
MB18WON0003	19/04/2020	616.8	35.8
MB18WON0003	18/04/2020	616.7	35.9
MB18WON0003	17/04/2020	616.8	35.8
MB18WON0003	16/04/2020	616.8	35.8
MB18WON0003	15/04/2020	616.8	35.8
MB18WON0003	14/04/2020	616.8	35.8
MB18WON0003	13/04/2020	616.7	35.9
MB18WON0003	12/04/2020	616.7	35.9
MB18WON0003	11/04/2020	616.7	35.9
MB18WON0003	10/04/2020	616.8	35.8
MB18WON0003	9/04/2020	616.7	35.9
MB18WON0003	8/04/2020	616.7	35.9
MB18WON0003	7/04/2020	616.7	35.9
MB18WON0003	6/04/2020	616.7	35.9
MB18WON0003	5/04/2020	616.7	35.9
MB18WON0003	4/04/2020	616.7	35.9
MB18WON0003	3/04/2020	616.7	35.9
MB18WON0003	2/04/2020	616.6	36.0
MB18WON0003	1/04/2020	616.6	36.0
MB18WON0003	31/03/2020	616.6	36.0
MB18WON0003	30/03/2020	616.6	36.0
MB18WON0003	29/03/2020	616.6	36.0
MB18WON0003	28/03/2020	616.6	36.0
MB18WON0003	27/03/2020	616.6	36.0
MB18WON0003	26/03/2020	616.6	36.0
MB18WON0003	25/03/2020	616.6	36.0
MB18WON0003	24/03/2020	616.5	36.1
MB18WON0003	23/03/2020	616.5	36.1
MB18WON0003	22/03/2020	616.5	36.1
MB18WON0003	21/03/2020	616.5	36.1
MB18WON0003	20/03/2020	616.5	36.1
MB18WON0003	19/03/2020	616.5	36.1
MB18WON0003	18/03/2020	616.5	36.1
MB18WON0003	17/03/2020	616.5	36.1
MB18WON0003	16/03/2020	616.5	36.1
MB18WON0003	15/03/2020	616.4	36.2
MB18WON0003	14/03/2020	616.4	36.2
MB18WON0003	13/03/2020	616.4	36.2
MB18WON0003	12/03/2020	616.4	36.2
MB18WON0003	11/03/2020	616.4	36.2
MB18WON0003	10/03/2020	616.4	36.2
MB18WON0003	9/03/2020	616.3	36.3
MB18WON0003	8/03/2020	616.3	36.3
MB18WON0003	7/03/2020	616.3	36.3
MB18WON0003	6/03/2020	616.3	36.3
MB18WON0003	5/03/2020	616.3	36.3
MB18WON0003	4/03/2020	616.2	36.4
MB18WON0003	3/03/2020	616.2	36.4
MB18WON0003	2/03/2020	616.2	36.4
MB18WON0003	1/03/2020	616.2	36.4
MB18WON0003	29/02/2020	616.1	36.5
MB18WON0003	28/02/2020	616.1	36.5
MB18WON0003	27/02/2020	616.1	36.5
MB18WON0003	26/02/2020	616.1	36.5
MB18WON0003	25/02/2020	616.1	36.5
MB18WON0003	24/02/2020	616.1	36.5
MB18WON0003	23/02/2020	616.0	36.6
MB18WON0003	22/02/2020	616.0	36.6
MB18WON0003	21/02/2020	616.0	36.6
MB18WON0003	20/02/2020	616.0	36.6
MB18WON0003	19/02/2020	615.9	36.7
MB18WON0003	18/02/2020	615.9	36.7
MB18WON0003	17/02/2020	615.9	36.7
MB18WON0003	16/02/2020	615.8	36.8
MB18WON0003	15/02/2020	615.8	36.8
MB18WON0003	14/02/2020	615.8	36.8
MB18WON0003	13/02/2020	615.8	36.8
MB18WON0003	12/02/2020	615.8	36.8
MB18WON0003	11/02/2020	615.7	36.9
MB18WON0003	10/02/2020	615.7	36.9
MB18WON0003	9/02/2020	615.6	37.0
MB18WON0003	8/02/2020	615.6	37.0
MB18WON0003	7/02/2020	615.6	37.0
MB18WON0003	6/02/2020	615.5	37.1
MB18WON0003	5/02/2020	615.5	37.1
MB18WON0003	4/02/2020	615.5	37.1
MB18WON0003	3/02/2020	615.4	37.2
MB18WON0003	2/02/2020	615.4	37.2
MB18WON0003	1/02/2020	615.4	37.2
MB18WON0003	31/01/2020	615.3	37.3
MB18WON0003	30/01/2020	615.2	37.4
MB18WON0003	29/01/2020	615.2	37.4
MB18WON0003	28/01/2020	615.2	37.4
MB18WON0003	27/01/2020	615.1	37.5
MB18WON0003	26/01/2020	615.1	37.5
MB18WON0003	25/01/2020	615.0	37.6
MB18WON0003	24/01/2020	615.0	37.6

ID	Date	WL mAHD	WL mbgl
MB15HD20006	1/12/2021	625.1	77.0
MB15HD20006	2/12/2021	625.1	76.9
MB15HD20006	3/12/2021	625.1	76.9
MB15HD20006	4/12/2021	625.1	76.9
MB15HD20006	5/12/2021	625.1	77.0
MB15HD20006	6/12/2021	625.1	77.0
MB15HD20006	7/12/2021	625.1	77.0
MB15HD20006	8/12/2021	625.1	76.9
MB15HD20006	9/12/2021	625.1	76.9
MB15HD20006	10/12/2021	625.1	77.0
MB15HD20006	11/12/2021	625.1	77.0
MB15HD20006	12/12/2021	625.1	76.9
MB15HD20006	13/12/2021	625.1	77.0
MB15HD20006	14/12/2021	625.1	77.0
MB15HD20006	15/12/2021	625.1	77.0
MB15HD20006	16/12/2021	625.1	77.0
MB15HD20006	17/12/2021	625.1	77.0
MB15HD20006	18/12/2021	625.1	77.0
MB15HD20006	19/12/2021	625.1	76.9
MB15HD20006	20/12/2021	625.1	76.9
MB15HD20006	21/12/2021	625.1	76.9
MB15HD20006	22/12/2021	625.1	77.0
MB15HD20006	23/12/2021	625.1	77.0
MB15HD20006	24/12/2021	625.1	77.0
MB15HD20006	25/12/2021	625.1	77.0
MB15HD20006	26/12/2021	625.1	77.0
MB15HD20006	30/12/2021	625.1	77.0
MB15HD20006	31/12/2021	625.1	77.0
MB15HD20006	1/01/2022	625.1	77.0
MB15HD20006	2/01/2022	625.1	77.0
MB15HD20006	3/01/2022	625.1	77.0
MB15HD20006	4/01/2022	625.1	77.0
MB15HD20006	5/01/2022	625.1	77.0
MB15HD20006	6/01/2022	625.1	77.0
MB15HD20006	7/01/2022	625.1	77.0
MB15HD20006	8/01/2022	625.1	77.0
MB15HD20006	9/01/2022	625.1	77.0
MB15HD20006	10/01/2022	625.1	77.0
MB15HD20006	11/01/2022	625.1	76.9
MB15HD20006	12/01/2022	625.1	76.9
MB15HD20006	13/01/2022	625.1	77.0
MB15HD20006	14/01/2022	625.1	77.0
MB15HD20006	15/01/2022	625.1	77.0
MB15HD20006	16/01/2022	625.1	77.0
MB15HD20006	17/01/2022	625.1	77.0
MB15HD20006	18/01/2022	625.1	77.0
MB15HD20006	19/01/2022	625.1	77.0
MB15HD20006	20/01/2022	625.1	77.0
MB15HD20006	21/01/2022	625.1	77.0
MB15HD20006	22/01/2022	625.1	77.0
MB15HD20006	23/01/2022	625.1	77.0
MB15HD20006	24/01/2022	625.1	77.0
MB15HD20006	25/01/2022	625.1	77.0
MB15HD20006	26/01/2022	625.1	77.0
MB15HD20006	27/01/2022	625.1	77.0
MB15HD20006	28/01/2022	625.1	77.0
MB15HD20006	29/01/2022	625.1	76.9
MB15HD20006	30/01/2022	625.1	77.0
MB15HD20006	31/01/2022	625.1	77.0
MB15HD20006	1/02/2022	625.1	77.0
MB15HD20006	2/02/2022	625.1	77.0
MB15HD20006	3/02/2022	625.1	76.9
MB15HD20006	4/02/2022	625.1	76.9
MB15HD20006	5/02/2022	625.1	76.9
MB15HD20006	6/02/2022	625.1	76.9
MB15HD20006	7/02/2022	625.1	77.0
MB15HD20006	8/02/2022	625.1	76.9
MB15HD20006	9/02/2022	625.1	76.9
MB15HD20006	10/02/2022	625.1	76.9
MB15HD20006	11/02/2022	625.2	76.9
MB15HD20006	12/02/2022	625.2	76.9
MB15HD20006	13/02/2022	625.2	76.9
MB15HD20006	14/02/2022	625.2	76.9
MB15HD20006	15/02/2022	625.2	76.9
MB15HD20006	16/02/2022	625.2	76.9
MB15HD20006	17/02/2022	625.2	76.9
MB15HD20006	18/02/2022	625.2	76.9
MB15HD20006	19/02/2022	625.2	76.9
MB15HD20006	20/02/2022	625.2	76.9
MB15HD20006	21/02/2022	625.2	76.9
MB15HD20006	22/02/2022	625.1	76.9
MB15HD20006	23/02/2022	625.1	76.9
MB15HD20006	24/02/2022	625.1	76.9
MB15HD20006	25/02/2022	625.1	76.9
MB15HD20006	26/02/2022	625.1	76.9
MB15HD20006	27/02/2022	625.1	76.9
MB15HD20006	28/02/2022	625.1	77.0
MB15HD20006	1/03/2022	625.1	77.0
MB15HD20006	2/03/2022	625.1	77.0
MB15HD20006	3/03/2022	625.1	77.0
MB15HD20006	4/03/2022	625.1	76.9
MB15HD20006	5/03/2022	625.2	76.9
MB15HD20006	6/03/2022	625.2	76.9
MB15HD20006	7/03/2022	625.2	76.9
MB15HD20006	8/03/2022	625.2	76.9
MB15HD20006	9/03/2022	625.2	76.9
MB15HD20006	10/03/2022	625.2	76.9
MB15HD20006	11/03/2022	625.2	76.9
MB15HD20006	12/03/2022	625.2	76.9
MB15HD20006	13/03/2022	625.2	76.9
MB15HD20006	14/03/2022	625.2	76.9
MB15HD20006	15/03/2022	625.2	76.9
MB15HD20006	16/03/2022	625.2	76.9
MB15HD20007	4/02/2016	626.0	86.8
MB15HD20007	25/02/2016	626.0	86.8
MB15HD20007	2/05/2016	626.0	86.8
MB15HD20007	4/08/2016	626.0	86.8
MB15HD20007	5/08/2016	626.0	86.8
MB15HD20007	6/08/2016	626.0	86.8
MB15HD20007	7/08/2016	626.0	86.8
MB15HD20007	8/08/2016	626.0	86.8
MB15HD20007	9/08/2016	626.0	86.8
MB15HD20007	10/08/2016	626.0	86.8
MB15HD20007	11/08/2016	626.0	86.8
MB15HD20007	12/08/2016	626.0	86.8
MB15HD20007	13/08/2016	626.0	86.8
MB15HD20007	14/08/2016	626.0	86.8
MB15HD20007	15/08/2016	626.0	86.8
MB15HD20007	16/08/2016	626.0	86.8
MB15HD20007	17/08/2016	626.0	86.8
MB15HD20007	18/08/2016	626.0	86.8
MB15HD20007	19/08/2016	626.0	86.8
MB15HD20007	20/08/2016	626.0	86.8
MB15HD20007	21/08/2016	626.0	86.8
MB15HD20007	22/08/2016	626.0	86.8
MB15HD20007	23/08/2016	626.0	86.8
MB15HD20007	24/08/2016	626.0	86.8
MB15HD20007	25/08/2016	626.0	86.8
MB15HD20007	26/08/2016	626.0	86.8
MB15HD20007	27/08/2016	626.0	86.8
MB15HD20007	28/08/2016	626.0	86.8
MB15HD20007	29/08/2016	626.0	86.8
MB15HD20007	30/08/2016	626.0	86.8
MB15HD20007	31/08/2016	626.0	86.8
MB15HD20007	1/09/2016	626.0	86.8
MB15HD20007	2/09/2016	626.0	86.8

ID	Date	WL mAHD	WL mbgl
MB18HD20010	24/01/2020	625.1	68.3
MB18HD20010	25/01/2020	625.1	68.3
MB18HD20010	26/01/2020	625.1	68.3
MB18HD20010	27/01/2020	625.1	68.3
MB18HD20010	28/01/2020	625.1	68.3
MB18HD20010	29/01/2020	625.1	68.3
MB18HD20010	30/01/2020	625.1	68.3
MB18HD20010	31/01/2020	625.1	68.3
MB18HD20010	1/02/2020	625.1	68.3
MB18HD20010	2/02/2020	625.1	68.3
MB18HD20010	3/02/2020	625.1	68.3
MB18HD20010	4/02/2020	625.1	68.3
MB18HD20010	5/02/2020	625.1	68.3
MB18HD20010	6/02/2020	625.1	68.3
MB18HD20010	7/02/2020	625.1	68.3
MB18HD20010	8/02/2020	625.1	68.3
MB18HD20010	9/02/2020	625.1	68.3
MB18HD20010	10/02/2020	625.0	68.3
MB18HD20010	11/02/2020	625.1	68.3
MB18HD20010	12/02/2020	625.1	68.3
MB18HD20010	13/02/2020	625.1	68.3
MB18HD20010	14/02/2020	625.1	68.3
MB18HD20010	15/02/2020	625.1	68.3
MB18HD20010	16/02/2020	625.1	68.3
MB18HD20010	17/02/2020	625.1	68.3
MB18HD20010	18/02/2020	625.1	68.3
MB18HD20010	19/02/2020	625.1	68.3
MB18HD20010	20/02/2020	625.1	68.3
MB18HD20010	21/02/2020	625.1	68.3
MB18HD20010	22/02/2020	625.1	68.3
MB18HD20010	23/02/2020	625.1	68.3
MB18HD20010	24/02/2020	625.1	68.3
MB18HD20010	25/02/2020	625.1	68.3
MB18HD20010	26/02/2020	625.1	68.3
MB18HD20010	27/02/2020	625.1	68.3
MB18HD20010	28/02/2020	625.1	68.3
MB18HD20010	29/02/2020	625.1	68.3
MB18HD20010	1/03/2020	625.1	68.3
MB18HD20010	2/03/2020	625.1	68.3
MB18HD20010	3/03/2020	625.1	68.3
MB18HD20010	4/03/2020	625.1	68.3
MB18HD20010	5/03/2020	625.1	68.3
MB18HD20010	6/03/2020	625.1	68.3
MB18HD20010	7/03/2020	625.1	68.3
MB18HD20010	8/03/2020	625.1	68.2
MB18HD20010	9/03/2020	625.1	68.3
MB18HD20010	10/03/2020	625.1	68.3
MB18HD20010	11/03/2020	625.1	68.3
MB18HD20010	12/03/2020	625.1	68.3
MB18HD20010	13/03/2020	625.1	68.2
MB18HD20010	14/03/2020	625.1	68.3
MB18HD20010	15/03/2020	625.1	68.3
MB18HD20010	16/03/2020	625.1	68.3
MB18HD20010	17/03/2020	625.1	68.2
MB18HD20010	18/03/2020	625.1	68.2
MB18HD20010	19/03/2020	625.1	68.2
MB18HD20010	20/03/2020	625.1	68.2
MB18HD20010	21/03/2020	625.1	68.2
MB18HD20010	22/03/2020	625.1	68.2
MB18HD20010	23/03/2020	625.1	68.2
MB18HD20010	24/03/2020	625.1	68.2
MB18HD20010	25/03/2020	625.1	68.2
MB18HD20010	26/03/2020	625.1	68.2
MB18HD20010	27/03/2020	625.1	68.2
MB18HD20010	28/03/2020	625.1	68.2
MB18HD20010	29/03/2020	625.1	68.3
MB18HD20010	30/03/2020	625.1	68.3
MB18HD20010	31/03/2020	625.1	68.3
MB18HD20010	1/04/2020	625.1	68.3
MB18HD20010	2/04/2020	625.1	68.3
MB18HD20010	3/04/2020	625.1	68.3
MB18HD20010	4/04/2020	625.1	68.3
MB18HD20010	5/04/2020	625.1	68.2
MB18HD20010	6/04/2020	625.1	68.3
MB18HD20010	7/04/2020	625.1	68.3
MB18HD20010	8/04/2020	625.1	68.3
MB18HD20010	9/04/2020	625.1	68.2
MB18HD20010	10/04/2020	625.1	68.2
MB18HD20010	11/04/2020	625.1	68.2
MB18HD20010	12/04/2020	625.1	68.2
MB18HD20010	13/04/2020	625.1	68.2
MB18HD20010	14/04/2020	625.1	68.2
MB18HD20010	15/04/2020	625.1	68.2
MB18HD20010	16/04/2020	625.1	68.2
MB18HD20010	17/04/2020	625.1	68.2
MB18HD20010	18/04/2020	625.1	68.2
MB18HD20010	19/04/2020	625.1	68.3
MB18HD20010	20/04/2020	625.1	68.2
MB18HD20010	21/04/2020	625.1	68.2
MB18HD20010	22/04/2020	625.1	68.2
MB18HD20010	23/04/2020	625.1	68.2
MB18HD20010	24/04/2020	625.1	68.2
MB18HD20010	25/04/2020	625.1	68.2
MB18HD20010	26/04/2020	625.1	68.2
MB18HD20010	27/04/2020	625.1	68.2
MB18HD20010	28/04/2020	625

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	21/10/2014	260.0	426.5
HDVP2	20/10/2014	260.0	426.5
HDVP2	19/10/2014	260.0	426.5
HDVP2	18/10/2014	260.0	426.5
HDVP2	17/10/2014	260.0	426.5
HDVP2	16/10/2014	260.0	426.5
HDVP2	15/10/2014	260.0	426.5
HDVP2	14/10/2014	260.0	426.5
HDVP2	13/10/2014	260.0	426.5
HDVP2	12/10/2014	260.0	426.5
HDVP2	11/10/2014	260.0	426.5
HDVP2	10/10/2014	260.0	426.5
HDVP2	9/10/2014	260.0	426.5
HDVP2	8/10/2014	260.0	426.5
HDVP2	7/10/2014	260.0	426.5
HDVP2	6/10/2014	260.0	426.5
HDVP2	5/10/2014	260.0	426.5
HDVP2	4/10/2014	260.0	426.5
HDVP2	3/10/2014	260.0	426.5
HDVP2	2/10/2014	260.0	426.5
HDVP2	1/10/2014	117.6	568.9
HDVP2	30/09/2014	117.6	568.9
HDVP2	29/09/2014	117.6	568.9
HDVP2	28/09/2014	117.6	568.9
HDVP2	27/09/2014	117.6	568.9
HDVP2	26/09/2014	117.6	568.9
HDVP2	25/09/2014	117.6	568.9
HDVP2	24/09/2014	117.6	568.9
HDVP2	23/09/2014	117.6	568.9
HDVP2	22/09/2014	117.6	568.9
HDVP2	21/09/2014	117.6	568.9
HDVP2	20/09/2014	117.6	568.9
HDVP2	19/09/2014	117.6	568.9
HDVP2	18/09/2014	117.6	568.9
HDVP2	17/09/2014	117.6	568.9
HDVP2	16/09/2014	117.6	568.9
HDVP2	15/09/2014	117.6	568.9
HDVP2	14/09/2014	117.6	568.9
HDVP2	13/09/2014	117.6	568.9
HDVP2	12/09/2014	117.6	568.9
HDVP2	11/09/2014	117.6	568.9
HDVP2	10/09/2014	117.6	568.9
HDVP2	9/09/2014	117.6	568.9
HDVP2	8/09/2014	117.6	568.9
HDVP2	7/09/2014	117.6	568.9
HDVP2	6/09/2014	117.6	568.9
HDVP2	5/09/2014	117.6	568.9
HDVP2	4/09/2014	117.6	568.9
HDVP2	3/09/2014	117.6	568.9
HDVP2	2/09/2014	117.6	568.9
HDVP2	1/09/2014	117.6	568.9
HDVP2	31/08/2014	85.4	601.1
HDVP2	30/08/2014	85.4	601.1
HDVP2	29/08/2014	85.4	601.1
HDVP2	28/08/2014	85.4	601.1
HDVP2	27/08/2014	85.4	601.1
HDVP2	26/08/2014	85.4	601.1
HDVP2	25/08/2014	85.4	601.1
HDVP2	24/08/2014	85.4	601.1
HDVP2	23/08/2014	85.4	601.1
HDVP2	22/08/2014	85.4	601.1
HDVP2	21/08/2014	85.4	601.1
HDVP2	20/08/2014	85.4	601.1
HDVP2	19/08/2014	85.4	601.1
HDVP2	18/08/2014	85.4	601.1
HDVP2	17/08/2014	85.4	601.1
HDVP2	16/08/2014	85.4	601.1
HDVP2	15/08/2014	85.4	601.1
HDVP2	14/08/2014	85.4	601.1
HDVP2	13/08/2014	85.4	601.1
HDVP2	12/08/2014	85.4	601.1
HDVP2	11/08/2014	85.4	601.1
HDVP2	10/08/2014	85.4	601.1
HDVP2	9/08/2014	85.4	601.1
HDVP2	8/08/2014	85.4	601.1
HDVP2	7/08/2014	85.4	601.1
HDVP2	6/08/2014	85.4	601.1
HDVP2	5/08/2014	85.4	601.1
HDVP2	4/08/2014	85.4	601.1
HDVP2	3/08/2014	85.4	601.1
HDVP2	2/08/2014	85.4	601.1
HDVP2	1/08/2014	85.4	601.1
HDVP2	31/07/2014	276.2	410.3
HDVP2	30/07/2014	276.2	410.3
HDVP2	29/07/2014	276.2	410.3
HDVP2	28/07/2014	276.2	410.3
HDVP2	27/07/2014	276.2	410.3
HDVP2	26/07/2014	276.2	410.3
HDVP2	25/07/2014	276.2	410.3
HDVP2	24/07/2014	276.2	410.3
HDVP2	23/07/2014	276.2	410.3
HDVP2	22/07/2014	276.2	410.3
HDVP2	21/07/2014	276.2	410.3
HDVP2	20/07/2014	276.2	410.3
HDVP2	19/07/2014	276.2	410.3
HDVP2	18/07/2014	276.2	410.3
HDVP2	17/07/2014	276.2	410.3
HDVP2	16/07/2014	276.2	410.3
HDVP2	15/07/2014	276.2	410.3
HDVP2	14/07/2014	276.2	410.3
HDVP2	13/07/2014	276.2	410.3
HDVP2	12/07/2014	276.2	410.3
HDVP2	11/07/2014	276.2	410.3
HDVP2	10/07/2014	276.2	410.3
HDVP2	9/07/2014	276.2	410.3
HDVP2	8/07/2014	276.2	410.3
HDVP2	7/07/2014	276.2	410.3
HDVP2	6/07/2014	276.2	410.3
HDVP2	5/07/2014	276.2	410.3
HDVP2	4/07/2014	276.2	410.3
HDVP2	3/07/2014	276.2	410.3
HDVP2	2/07/2014	276.2	410.3
HDVP2	1/07/2014	276.2	410.3
HDVP2	30/06/2014	335.5	351.0
HDVP2	29/06/2014	335.5	351.0
HDVP2	28/06/2014	335.5	351.0
HDVP2	27/06/2014	335.5	351.0
HDVP2	26/06/2014	335.5	351.0
HDVP2	25/06/2014	335.5	351.0
HDVP2	24/06/2014	335.5	351.0
HDVP2	23/06/2014	335.5	351.0
HDVP2	22/06/2014	335.5	351.0
HDVP2	21/06/2014	335.5	351.0
HDVP2	20/06/2014	335.5	351.0
HDVP2	19/06/2014	335.5	351.0
HDVP2	18/06/2014	335.5	351.0
HDVP2	17/06/2014	335.5	351.0
HDVP2	16/06/2014	335.5	351.0
HDVP2	15/06/2014	335.5	351.0
HDVP2	14/06/2014	335.5	351.0
HDVP2	13/06/2014	335.5	351.0
HDVP2	12/06/2014	335.5	351.0
HDVP2	11/06/2014	335.5	351.0
HDVP2	10/06/2014	335.5	351.0
HDVP2	9/06/2014	335.5	351.0
HDVP2	8/06/2014	335.5	351.0

ID	Date	WL mAHD	WL mbgl
MB18WON0003	23/01/2020	614.9	37.7
MB18WON0003	22/01/2020	614.8	37.8
MB18WON0003	21/01/2020	614.8	37.8
MB18WON0003	20/01/2020	614.7	37.9
MB18WON0003	19/01/2020	614.7	37.9
MB18WON0003	18/01/2020	614.5	38.1
MB18WON0003	17/01/2020	614.4	38.2
MB18WON0003	16/01/2020	614.4	38.2
MB18WON0003	15/01/2020	614.3	38.3
MB18WON0003	14/01/2020	614.2	38.4
MB18WON0003	13/01/2020	614.1	38.5
MB18WON0003	12/01/2020	614.0	38.6
MB18WON0003	11/01/2020	613.9	38.7
MB18WON0003	10/01/2020	613.8	38.8
MB18WON0003	9/01/2020	613.6	39.0
MB18WON0003	8/01/2020	613.5	39.1
MB18WON0003	7/01/2020	613.4	39.2
MB18WON0003	6/01/2020	613.3	39.3
MB18WON0003	5/01/2020	613.1	39.5
MB18WON0003	4/01/2020	612.9	39.7
MB18WON0003	3/01/2020	612.8	39.8
MB18WON0003	2/01/2020	612.6	40.0
MB18WON0003	1/01/2020	612.4	40.2
MB18WON0003	31/12/2019	612.1	40.5
MB18WON0003	30/12/2019	611.9	40.7
MB18WON0003	29/12/2019	611.6	41.0
MB18WON0003	28/12/2019	611.3	41.3
MB18WON0003	27/12/2019	611.0	41.6
MB18WON0003	26/12/2019	610.7	41.9
MB18WON0003	25/12/2019	610.3	42.3
MB18WON0003	24/12/2019	609.9	42.7
MB18WON0003	23/12/2019	609.5	43.1
MB18WON0003	22/12/2019	609.0	43.6
MB18WON0003	21/12/2019	608.6	44.0
MB18WON0003	20/12/2019	608.1	44.5
MB18WON0003	19/12/2019	607.5	45.1
MB18WON0003	18/12/2019	607.0	45.6
MB18WON0003	17/12/2019	606.5	46.1
MB18WON0003	16/12/2019	606.0	46.6
MB18WON0003	15/12/2019	605.4	47.2
MB18WON0003	14/12/2019	604.9	47.7
MB18WON0003	13/12/2019	604.1	48.5
MB18WON0003	12/12/2019	616.8	35.8
MB18WON0003	11/12/2019	616.8	35.8
MB18WON0003	10/12/2019	616.8	35.8
MB18WON0003	9/12/2019	616.8	35.8
MB18WON0003	8/12/2019	616.8	35.8
MB18WON0003	7/12/2019	616.8	35.8
MB18WON0003	6/12/2019	616.8	35.8
MB18WON0003	5/12/2019	616.8	35.8
MB18WON0003	4/12/2019	616.8	35.8
MB18WON0003	3/12/2019	616.8	35.8
MB18WON0003	2/12/2019	616.8	35.8
MB18WON0003	1/12/2019	616.8	35.8
MB18WON0003	30/11/2019	616.8	35.8
MB18WON0003	29/11/2019	616.7	35.9
MB18WON0003	28/11/2019	616.7	35.9
MB18WON0003	27/11/2019	616.7	35.9
MB18WON0003	26/11/2019	616.7	35.9
MB18WON0003	25/11/2019	616.7	35.9
MB18WON0003	24/11/2019	616.7	35.9
MB18WON0003	23/11/2019	616.7	35.9
MB18WON0003	22/11/2019	616.7	35.9
MB18WON0003	21/11/2019	616.7	35.9
MB18WON0003	20/11/2019	616.7	35.9
MB18WON0003	19/11/2019	616.6	36.0
MB18WON0003	18/11/2019	616.6	36.0
MB18WON0003	17/11/2019	616.7	35.9
MB18WON0003	16/11/2019	616.7	35.9
MB18WON0003	15/11/2019	616.7	35.9
MB18WON0003	28/03/2019	616.3	36.3
MB18WON0003	1/02/2019	615.0	37.6
MB18WON0003	12/12/2018	612.6	40.0
MB18WON0004	2/03/2022	614.6	62.8
MB18WON0004	1/03/2022	614.6	62.8
MB18WON0004	28/02/2022	614.6	62.8
MB18WON0004	27/02/2022	614.6	62.9
MB18WON0004	26/02/2022	614.6	62.8
MB18WON0004	25/02/2022	614.6	62.8
MB18WON0004	24/02/2022	614.6	62.8
MB18WON0004	23/02/2022	614.6	62.8
MB18WON0004	22/02/2022	614.6	62.8
MB18WON0004	21/02/2022	614.6	62.8
MB18WON0004	20/02/2022	614.6	62.8
MB18WON0004	19/02/2022	614.6	62.8
MB18WON0004	18/02/2022	614.7	62.8
MB18WON0004	17/02/2022	614.6	62.8
MB18WON0004	16/02/2022	614.6	62.8
MB18WON0004	15/02/2022	614.6	62.8
MB18WON0004	14/02/2022	614.7	62.8
MB18WON0004	13/02/2022	614.6	62.8
MB18WON0004	12/02/2022	614.6	62.8
MB18WON0004	11/02/2022	614.6	62.8
MB18WON0004	10/02/2022	614.6	62.8
MB18WON0004	9/02/2022	614.6	62.8
MB18WON0004	8/02/2022	614.6	62.8
MB18WON0004	7/02/2022	614.6	62.8
MB18WON0004	6/02/2022	614.6	62.9
MB18WON0004	5/02/2022	614.6	62.8
MB18WON0004	4/02/2022	614.6	62.8
MB18WON0004	3/02/2022	614.6	62.8
MB18WON0004	2/02/2022	614.6	62.8
MB18WON0004	1/02/2022	614.6	62.9
MB18WON0004	31/01/2022	614.5	62.9
MB18WON0004	30/01/2022	614.6	62.9
MB18WON0004	29/01/2022	614.6	62.8
MB18WON0004	28/01/2022	614.6	62.9
MB18WON0004	27/01/2022	614.6	62.9
MB18WON0004	26/01/2022	614.5	62.9
MB18WON0004	25/01/2022	614.5	62.9
MB18WON0004	24/01/2022	614.6	62.9
MB18WON0004	23/01/2022	614.6	62.8
MB18WON0004	22/01/2022	614.6	62.8
MB18WON0004	21/01/2022	614.6	62.8
MB18WON0004	20/01/2022	614.6	62.8
MB18WON0004	19/01/2022	614.6	62.8
MB18WON0004	18/01/2022	614.6	62.8
MB18WON0004	17/01/2022	614.6	62.9
MB18WON0004	16/01/2022	614.6	62.9
MB18WON0004	15/01/2022	614.6	62.9
MB18WON0004	14/01/2022	614.6	62.9
MB18WON0004	13/01/2022	614.6	62.8
MB18WON0004	12/01/2022	614.6	62.8
MB18WON0004	11/01/2022	614.7	62.8
MB18WON0004	10/01/2022	614.6	62.8
MB18WON0004	9/01/2022	614.6	62.8
MB18WON0004	8/01/2022	614.6	62.8
MB18WON0004	7/01/2022	614.6	62.8
MB18WON0004	6/01/2022	614.6	62.8
MB18WON0004	5/01/2022	614.6	62.8
MB18WON0004	4/01/2022	614.6	62.8
MB18WON0004	3/01/2022	614.6	62.8
MB18WON0004	2/01/2022	614.6	62.8
MB18WON0004	1/01/2022	614.6	62.8
MB18WON0004	31/12/2021	614.6	62.8
MB18WON0004	30/12/2021	614.6	62.8

ID	Date	WL mAHD	WL mbgl
MB15HD20007	3/09/2016	626.0	86.8
MB15HD20007	4/09/2016	626.0	86.8
MB15HD20007	5/09/2016	626.0	86.8
MB15HD20007	6/09/2016	626.0	86.8
MB15HD20007	7/09/2016	626.0	86.8
MB15HD20007	8/09/2016	626.0	86.8
MB15HD20007	9/09/2016	626.0	86.8
MB15HD20007	10/09/2016	626.0	86.8
MB15HD20007	11/09/2016	626.0	86.8
MB15HD20007	12/09/2016	626.0	86.8
MB15HD20007	13/09/2016	626.0	86.8
MB15HD20007	14/09/2016	626.0	86.8
MB15HD20007	15/09/2016	626.0	86.8
MB15HD20007	16/09/2016	626.0	86.8
MB15HD20007	17/09/2016	626.0	86.8
MB15HD20007	18/09/2016	626.0	86.8
MB15HD20007	19/09/2016	626.0	86.8
MB15HD20007	20/09/2016	626.0	86.8
MB15HD20007	21/09/2016	626.0	86.8
MB15HD20007	22/09/2016	626.0	86.8
MB15HD20007	23/09/2016	626.0	86.8
MB15HD20007	24/09/2016	626.0	86.8
MB15HD20007	25/09/2016	626.0	86.8
MB15HD20007	26/09/2016	626.0	86.8
MB15HD20007	27/09/2016	626.0	86.8
MB15HD20007	28/09/2016	626.0	86.8
MB15HD20007	29/09/2016	626.0	86.8
MB15HD20007	30/09/2016	626.0	86.8
MB15HD20007	1/10/2016	626.0	86.8
MB15HD20007	2/10/2016	626.0	86.8
MB15HD20007	3/10/2016	626.0	86.8
MB15HD20007	4/10/2016	626.0	86.8
MB15HD20007	5/10/2016	626.0	86.8
MB15HD20007	6/10/2016	626.0	86.8
MB15HD20007	7/10/2016	626.0	86.8
MB15HD20007	8/10/2016	626.0	86.8
MB15HD20007	9/10/2016	626.0	86.8
MB15HD20007	10/10/2016	626.0	86.8
MB15HD20007	11/10/2016	626.0	86.8
MB15HD20007	12/10/2016	626.0	86.8
MB15HD20007	13/10/2016	626.0	86.8
MB15HD20007	14/10/2016	626.0	86.8
MB15HD20007	15/10/2016	626.0	86.8
MB15HD20007	16/10/2016	626.0	86.8
MB15HD20007	17/10/2016	626.0	86.8
MB15HD20007	18/10/2016	626.0	86.8
MB15HD20007	19/10/2016	626.0	86.8
MB15HD20007	20/10/2016	626.0	86.8
MB15HD20007	21/10/2016	626.0	86.8
MB15HD20007	22/10/2016	626.0	86.8
MB15HD20007	23/10/2016	626.0	86.8
MB15HD20007	24/10/2016	626.0	86.8
MB15HD20007	25/10/2016	626.0	86.8
MB15HD20007	26/10/2016	626.0	86.8
MB15HD20007	27/10/2016	626.0	86.8
MB15HD20007	28/10/2016	626.0	86.8
MB15HD20007	29/10/2016	626.0	86.8
MB15HD20007	30/10/2016	626.0	86.8
MB15HD20007	31/10/2016	626.0	86.8
MB15HD20007	1/11/2016	626.0	86.8
MB15HD20007	2/11/2016	626.0	86.8
MB15HD20007	3/11/2016	626.0	86.8
MB15HD20007	4/11/2016	626.0	86.8
MB15HD20007	5/11/2016	626.0	86.8
MB15HD20007	6/11/2016	626.0	86.8
MB15HD20007	7/11/2016	626.0	86.8
MB15HD20007	8/11/2016	626.0	86.8
MB15HD20007	9/11/2016	626.0	86.8
MB15HD20007	10/11/2016	626.0	86.8
MB15HD20007	11/11/2016	626.0	86.8
MB15HD20007	12/11/2016	626.0	86.8
MB15HD20007	13/11/2016	626.0	86.8
MB15HD20007	14/11/2016	626.0	86.8
MB15HD20007	15/11/2016	626.0	86.8
MB15HD20007	16/11/2016	626.0	86.8
MB15HD20007	17/11/2016	626.0	86.8
MB15HD20007	18/11/2016	626.0	86.8
MB15HD20007	19/11/2016	626.0	86.8
MB15HD20007	20/11/2016	626.0	86.8
MB15HD20007	21/11/2016	626.0	86.8
MB15HD20007	22/11/2016	626.0	86.8
MB15HD20007	23/11/2016	626.0	86.8
MB15HD20007	24/11/2016	626.0	86.8
MB15HD20007	25/11/2016	626.0	86.8
MB15HD20007	26/11/2016	626.0	86.8
MB15HD20007	27/11/2016	626.0	86.8
MB15HD20007	28/11/2016	626.0	86.8
MB15HD20007	29/11/2016	626.0	86.8
MB15HD20007	30/11/2016	626.0	86.8
MB15HD20007	1/12/2016	626.0	86.8
MB15HD20007	2/12/2016	626.0	86.8
MB15HD20007	3/12/2016	626.0	86.8
MB15HD20007	4/12/2016	626.0	86.8
MB15HD20007	5/12/2016	626.0	86.8
MB15HD20007	6/12/2016	626.0	86.8
MB15HD20007	7/12/2016	626.0	86.8
MB15HD20007	8/12/2016	626.0	86.8
MB15HD20007	9/12/2016	626.0	86.8
MB15HD20007	10/12/2016	626.0	86.8
MB15HD20007	11/12/2016	626.0	86.8
MB15HD20007	12/12/2016	626.0	86.8
MB15HD20007	13/12/2016	626.0	86.8
MB15HD20007	14/12/2016	626.0	86.8
MB15HD20007	15/12/2016	626.0	86.8
MB15HD20007	16/12/2016	626.0	86.8
MB15HD20007	17/12/2016	626.0	86.8
MB15HD20007	18/12/2016	626.0	86.8
MB15HD20007	19/12/2016	626.0	86.8
MB15HD20007	20/12/2016	626.0	86.8
MB15HD20007	21/12/2016	626.0	86.8
MB15HD20007	22/12/2016	626.0	86.8
MB15HD20007	23/12/2016	626.0	86.8
MB15HD20007	24/12/2016	626.0	86.8
MB15HD20007	25/12/2016	626.0	86.8
MB15HD20007	26/12/2016	626.0	86.8
MB15HD20007	27/12/2016	626.0	86.8
MB15HD20007	28/12/2016	625.9	86.9
MB15HD20007	29/12/2016	626.0	86.8
MB15HD20007	30/12/2016	626.0	86.8
MB15HD20007	31/12/2016	626.0	86.8
MB15HD20007	1/01/2017	626.0	86.8
MB15HD20007	2/01/2017	626.0	86.8
MB15HD20007	3/01/2017	626.0	86.8
MB15HD20007	4/01/2017	626.0	86.8
MB15HD20007	5/01/2017	626.0	86.8
MB15HD20007	6/01/2017	626.0	86.8
MB15HD20007	7/01/2017	626.0	86.8
MB15HD20007	8/01/2017	626.0	86.8
MB15HD20007	9/01/2017	626.0	86.8
MB15HD20007	10/01/2017	626.0	86.8
MB15HD20007	11/01/2017	626.0	86.8
MB15HD20007	12/01/2017	626.0	86.8
MB15HD20007	13/01/2017	626.0	86.8
MB15HD20007	14/01/2017	626.0	86.8
MB15HD20007	15/01/2017	626.0	86.8
MB15HD20007	16/01/2017	626.0	86.8

ID	Date	WL mAHD	WL mbgl
MB18HD20010	8/06/2020	625.1	68.2
MB18HD20010	9/06/2020	625.2	68.2
MB18HD20010	10/06/2020	625.2	68.2
MB18HD20010	11/06/2020	625.1	68.2
MB18HD20010	12/06/2020	625.1	68.2
MB18HD20010	13/06/2020	625.1	68.2
MB18HD20010	14/06/2020	625.2	68.2
MB18HD20010	15/06/2020	625.2	68.2
MB18HD20010	16/06/2020	625.2	68.2
MB18HD20010	17/06/2020	625.2	68.2
MB18HD20010	18/06/2020	625.2	68.2
MB18HD20010	19/06/2020	625.2	68.2
MB18HD20010	20/06/2020	625.2	68.2
MB18HD20010	21/06/2020	625.2	68.2
MB18HD20010	22/06/2020	625.2	68.2
MB18HD20010	23/06/2020	625.1	68.2
MB18HD20010	24/06/2020	625.2	68.2
MB18HD20010	25/06/2020	625.2	68.2
MB18HD20010	26/06/2020	625.2	68.2
MB18HD20010	27/06/2020	625.2	68.2
MB18HD20010	28/06/2020	625.2	68.2
MB18HD20010	29/06/2020	625.1	68.2
MB18HD20010	30/06/2020	625.1	68.2
MB18HD20010	1/07/2020	625.1	68.2
MB18HD20010	2/07/2020	625.2	68.2
MB18HD20010	3/07/2020	625.2	68.2
MB18HD20010	4/07/2020	625.2	68.2
MB18HD20010	5/07/2020	625.2	68.2
MB18HD20010	6/07/2020	625.2	68.2
MB18HD20010	7/07/2020	625.2	68.2
MB18HD20010	8/07/2020	625.2	68.2
MB18HD20010	9/07/2020	625.2	68.2
MB18HD20010	10/07/2020	625.2	68.2
MB18HD20010	11/07/2020	625.2	68.2
MB18HD20010	12/07/2020	625.2	68.2
MB18HD20010	13/07/2020	625.2	68.2
MB18HD20010	14/07/2020	625.2	68.2
MB18HD20010	15/07/2020	625.2	68.2
MB18HD20010	16/07/2020	625.1	68.2
MB18HD20010	17/07/2020	625.1	68.2
MB18HD20010	18/07/2020	625.1	68.2
MB18HD20010	19/07/2020	625.1	68.2
MB18HD20010	20/07/2020	625.2	68.2
MB18HD20010	21/07/2020	625.2	68.2
MB18HD20010	22/07/2020	625.2	68.2
MB18HD20010	23/07/2020	625.2	68.2
MB18HD20010	24/07/2020	625.2	68.2
MB18HD20010	25/07/2020	625.2	68.2
MB18HD20010	26/07/2020	625.2	68.2
MB18HD20010	27/07/2020	625.2	68.2
MB18HD20010	28/07/2020	625.2	68.2
MB18HD20010	29/07/2020	625.2	68.2
MB18HD20010	30/07/2020	625.2	68.2
MB18HD20010	31/07/2020	625.2	68.2
MB18HD20010	1/08/2020	625.1	68.2
MB18HD20010	2/08/2020	625.1	68.2
MB18HD20010	3/08/2020	625.1	68.3
MB18HD20010	4/08/2020	625.1	68.3
MB18HD20010	5/08/2020	625.1	68.3
MB18HD20010	6/08/2020	625.1	68.2
MB18HD20010	7/08/2020	625.1	68.2
MB18HD20010	8/08/2020	625.1	68.2
MB18HD20010	9/08/2020	625.1	68.2
MB18HD20010	10/08/2020	625.1	68.3
MB18HD20010	11/08/2020	625.1	68.3
MB18HD20010	12/08/2020	625.1	68.3
MB18HD20010	13/08/2020	625.1	68.2
MB18HD20010	14/08/2020	625.1	68.2
MB18HD20010	15/08/2020	625.1	68.2
MB18HD20010	16/08/2020	625.1	68.3
MB18HD20010	17/08/2020	625.1	68.2
MB18HD20010	18/08/2020	625.1	68.2
MB18HD20010	19/08/2020	625.1	68.2
MB18HD20010	20/08/2020	625.1	68.2
MB18HD20010	21/08/2020	625.1	68.2
MB18HD20010	22/08/2020	625.2	68.2
MB18HD20010	23/08/2020	625.2	68.2
MB18HD20010	24/08/2020	625.1	68.2
MB18HD20010	25/08/2020	625.1	68.2
MB18HD20010	26/08/2020	625.2	68.2
MB18HD20010	27/08/2020	625.2	68.2
MB18HD20010	28/08/2020	625.1	68.2
MB18HD20010	29/08/2020	625.1	68.2
MB18HD20010	30/08/2020	625.2	68.2
MB18HD20010	31/08/2020	625.2	68.2
MB18HD20010	1/09/2020	625.1	68.2
MB18HD20010	2/09/2020	625.1	68.2
MB18HD20010	3/09/2020	625.1	68.2
MB18HD20010	4/09/2020	625.1	68.2
MB18HD20010	5/09/2020	625.1	68.2
MB18HD20010	6/09/2020	625.1	68.3
MB18HD20010	7/09/2020	625.1	68.3
MB18HD20010	8/09/2020	625.1	68.2
MB18HD20010	9/09/2020	625.1	68.2
MB18HD20010	10/09/2020	625.1	68.3
MB18HD20010	11/09/2020	625

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	7/06/2014	335.5	351.0
HDVP2	6/06/2014	335.5	351.0
HDVP2	5/06/2014	335.5	351.0
HDVP2	4/06/2014	335.5	351.0
HDVP2	3/06/2014	335.5	351.0
HDVP2	2/06/2014	335.5	351.0
HDVP2	1/06/2014	335.5	351.0
HDVP2	31/05/2014	324.3	362.2
HDVP2	30/05/2014	324.3	362.2
HDVP2	29/05/2014	324.3	362.2
HDVP2	28/05/2014	324.3	362.2
HDVP2	27/05/2014	324.3	362.2
HDVP2	26/05/2014	324.3	362.2
HDVP2	25/05/2014	324.3	362.2
HDVP2	24/05/2014	324.3	362.2
HDVP2	23/05/2014	324.3	362.2
HDVP2	22/05/2014	324.3	362.2
HDVP2	21/05/2014	324.3	362.2
HDVP2	20/05/2014	324.3	362.2
HDVP2	19/05/2014	324.3	362.2
HDVP2	18/05/2014	324.3	362.2
HDVP2	17/05/2014	324.3	362.2
HDVP2	16/05/2014	324.3	362.2
HDVP2	15/05/2014	324.3	362.2
HDVP2	14/05/2014	324.3	362.2
HDVP2	13/05/2014	324.3	362.2
HDVP2	12/05/2014	324.3	362.2
HDVP2	11/05/2014	324.3	362.2
HDVP2	10/05/2014	324.3	362.2
HDVP2	9/05/2014	324.3	362.2
HDVP2	8/05/2014	324.3	362.2
HDVP2	7/05/2014	324.3	362.2
HDVP2	6/05/2014	324.3	362.2
HDVP2	5/05/2014	324.3	362.2
HDVP2	4/05/2014	324.3	362.2
HDVP2	3/05/2014	324.3	362.2
HDVP2	2/05/2014	324.3	362.2
HDVP2	1/05/2014	324.3	362.2
HDVP2	30/04/2014	328.8	357.8
HDVP2	29/04/2014	328.8	357.8
HDVP2	28/04/2014	328.8	357.8
HDVP2	27/04/2014	328.8	357.8
HDVP2	26/04/2014	328.8	357.8
HDVP2	25/04/2014	328.8	357.8
HDVP2	24/04/2014	328.8	357.8
HDVP2	23/04/2014	328.8	357.8
HDVP2	22/04/2014	328.8	357.8
HDVP2	21/04/2014	328.8	357.8
HDVP2	20/04/2014	328.8	357.8
HDVP2	19/04/2014	328.8	357.8
HDVP2	18/04/2014	328.8	357.8
HDVP2	17/04/2014	328.8	357.8
HDVP2	16/04/2014	328.8	357.8
HDVP2	15/04/2014	328.8	357.8
HDVP2	14/04/2014	328.8	357.8
HDVP2	13/04/2014	328.8	357.8
HDVP2	12/04/2014	328.8	357.8
HDVP2	11/04/2014	328.8	357.8
HDVP2	10/04/2014	328.8	357.8
HDVP2	9/04/2014	328.8	357.8
HDVP2	8/04/2014	328.8	357.8
HDVP2	7/04/2014	328.8	357.8
HDVP2	6/04/2014	328.8	357.8
HDVP2	5/04/2014	328.8	357.8
HDVP2	4/04/2014	328.8	357.8
HDVP2	3/04/2014	328.8	357.8
HDVP2	2/04/2014	308.5	378.0
HDVP2	1/04/2014	308.5	378.0
HDVP2	31/03/2014	308.5	378.0
HDVP2	30/03/2014	308.5	378.0
HDVP2	29/03/2014	308.5	378.0
HDVP2	28/03/2014	308.5	378.0
HDVP2	27/03/2014	308.5	378.0
HDVP2	26/03/2014	308.5	378.0
HDVP2	25/03/2014	308.5	378.0
HDVP2	24/03/2014	308.5	378.0
HDVP2	23/03/2014	308.5	378.0
HDVP2	22/03/2014	308.5	378.0
HDVP2	21/03/2014	308.5	378.0
HDVP2	20/03/2014	308.5	378.0
HDVP2	19/03/2014	308.5	378.0
HDVP2	18/03/2014	308.5	378.0
HDVP2	17/03/2014	308.5	378.0
HDVP2	16/03/2014	308.5	378.0
HDVP2	15/03/2014	308.5	378.0
HDVP2	14/03/2014	308.5	378.0
HDVP2	13/03/2014	308.5	378.0
HDVP2	12/03/2014	308.5	378.0
HDVP2	11/03/2014	308.5	378.0
HDVP2	10/03/2014	308.5	378.0
HDVP2	9/03/2014	308.5	378.0
HDVP2	8/03/2014	308.5	378.0
HDVP2	7/03/2014	308.5	378.0
HDVP2	6/03/2014	308.5	378.0
HDVP2	5/03/2014	308.5	378.0
HDVP2	4/03/2014	308.5	378.0
HDVP2	3/03/2014	308.5	378.0
HDVP2	2/03/2014	308.5	378.0
HDVP2	1/03/2014	308.5	378.0
HDVP2	28/02/2014	319.5	367.1
HDVP2	27/02/2014	319.5	367.1
HDVP2	26/02/2014	319.5	367.1
HDVP2	25/02/2014	319.5	367.1
HDVP2	24/02/2014	319.5	367.1
HDVP2	23/02/2014	319.5	367.1
HDVP2	22/02/2014	319.5	367.1
HDVP2	21/02/2014	319.5	367.1
HDVP2	20/02/2014	319.5	367.1
HDVP2	19/02/2014	319.5	367.1
HDVP2	18/02/2014	319.5	367.1
HDVP2	17/02/2014	319.5	367.1
HDVP2	16/02/2014	319.5	367.1
HDVP2	15/02/2014	319.5	367.1
HDVP2	14/02/2014	319.5	367.1
HDVP2	13/02/2014	319.5	367.1
HDVP2	12/02/2014	319.5	367.1
HDVP2	11/02/2014	319.5	367.1
HDVP2	10/02/2014	319.5	367.1
HDVP2	9/02/2014	319.5	367.1
HDVP2	8/02/2014	319.5	367.1
HDVP2	7/02/2014	319.5	367.1
HDVP2	6/02/2014	319.5	367.1
HDVP2	5/02/2014	319.5	367.1
HDVP2	4/02/2014	319.5	367.1
HDVP2	3/02/2014	319.5	367.1
HDVP2	2/02/2014	319.5	367.1
HDVP2	1/02/2014	319.5	367.1
HDVP2	31/01/2014	352.5	334.1
HDVP2	30/01/2014	352.5	334.1
HDVP2	29/01/2014	352.5	334.1
HDVP2	28/01/2014	352.5	334.1
HDVP2	27/01/2014	352.5	334.1
HDVP2	26/01/2014	352.5	334.1
HDVP2	25/01/2014	352.5	334.1
HDVP2	24/01/2014	352.5	334.1
HDVP2	23/01/2014	352.5	334.1

ID	Date	WL mAHD	WL mbgl
MB18WON0004	29/12/2021	614.6	62.8
MB18WON0004	28/12/2021	614.6	62.8
MB18WON0004	27/12/2021	614.6	62.8
MB18WON0004	26/12/2021	614.6	62.8
MB18WON0004	25/12/2021	614.6	62.8
MB18WON0004	24/12/2021	614.6	62.8
MB18WON0004	23/12/2021	614.6	62.8
MB18WON0004	22/12/2021	614.6	62.8
MB18WON0004	21/12/2021	614.7	62.8
MB18WON0004	20/12/2021	614.7	62.8
MB18WON0004	19/12/2021	614.7	62.8
MB18WON0004	18/12/2021	614.7	62.8
MB18WON0004	17/12/2021	614.6	62.8
MB18WON0004	16/12/2021	614.7	62.8
MB18WON0004	15/12/2021	614.6	62.8
MB18WON0004	14/12/2021	614.6	62.8
MB18WON0004	13/12/2021	614.6	62.8
MB18WON0004	12/12/2021	614.7	62.8
MB18WON0004	11/12/2021	614.7	62.8
MB18WON0004	10/12/2021	614.7	62.8
MB18WON0004	9/12/2021	614.7	62.8
MB18WON0004	8/12/2021	614.7	62.8
MB18WON0004	7/12/2021	614.7	62.8
MB18WON0004	6/12/2021	614.6	62.8
MB18WON0004	5/12/2021	614.7	62.8
MB18WON0004	4/12/2021	614.7	62.8
MB18WON0004	3/12/2021	614.7	62.8
MB18WON0004	2/12/2021	614.7	62.8
MB18WON0004	1/12/2021	614.7	62.8
MB18WON0004	30/11/2021	614.7	62.8
MB18WON0004	29/11/2021	614.7	62.8
MB18WON0004	28/11/2021	614.7	62.7
MB18WON0004	27/11/2021	614.7	62.7
MB18WON0004	26/11/2021	614.7	62.7
MB18WON0004	25/11/2021	614.7	62.7
MB18WON0004	24/11/2021	614.7	62.7
MB18WON0004	23/11/2021	614.7	62.7
MB18WON0004	22/11/2021	614.7	62.7
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MB18WON0004	18/11/2021	614.7	62.8
MB18WON0004	17/11/2021	614.7	62.7
MB18WON0004	16/11/2021	614.7	62.7
MB18WON0004	15/11/2021	614.7	62.7
MB18WON0004	14/11/2021	614.7	62.7
MB18WON0004	13/11/2021	614.7	62.7
MB18WON0004	12/11/2021	614.7	62.7
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MB18WON0004	8/11/2021	614.7	62.8
MB18WON0004	7/11/2021	614.7	62.8
MB18WON0004	6/11/2021	614.7	62.7
MB18WON0004	5/11/2021	614.7	62.7
MB18WON0004	4/11/2021	614.7	62.7
MB18WON0004	3/11/2021	614.7	62.7
MB18WON0004	2/11/2021	614.7	62.7
MB18WON0004	1/11/2021	614.7	62.7
MB18WON0004	31/10/2021	614.7	62.7
MB18WON0004	30/10/2021	614.7	62.7
MB18WON0004	29/10/2021	614.7	62.7
MB18WON0004	28/10/2021	614.7	62.7
MB18WON0004	27/10/2021	614.7	62.7
MB18WON0004	26/10/2021	614.7	62.7
MB18WON0004	25/10/2021	614.7	62.7
MB18WON0004	24/10/2021	614.7	62.7
MB18WON0004	23/10/2021	614.8	62.7
MB18WON0004	22/10/2021	614.8	62.7
MB18WON0004	21/10/2021	614.8	62.7
MB18WON0004	20/10/2021	614.8	62.7
MB18WON0004	19/10/2021	614.7	62.7
MB18WON0004	18/10/2021	614.7	62.7
MB18WON0004	17/10/2021	614.7	62.7
MB18WON0004	16/10/2021	614.7	62.7
MB18WON0004	15/10/2021	614.7	62.7
MB18WON0004	14/10/2021	614.7	62.7
MB18WON0004	13/10/2021	614.8	62.7
MB18WON0004	12/10/2021	614.7	62.7
MB18WON0004	11/10/2021	614.7	62.7
MB18WON0004	10/10/2021	614.8	62.7
MB18WON0004	9/10/2021	614.7	62.7
MB18WON0004	8/10/2021	614.7	62.7
MB18WON0004	7/10/2021	614.8	62.7
MB18WON0004	6/10/2021	614.8	62.7
MB18WON0004	5/10/2021	614.7	62.7
MB18WON0004	4/10/2021	614.7	62.7
MB18WON0004	3/10/2021	614.7	62.7
MB18WON0004	2/10/2021	614.8	62.7
MB18WON0004	1/10/2021	614.7	62.7
MB18WON0004	30/09/2021	614.8	62.7
MB18WON0004	29/09/2021	614.8	62.7
MB18WON0004	28/09/2021	614.8	62.7
MB18WON0004	27/09/2021	614.8	62.7
MB18WON0004	26/09/2021	614.8	62.7
MB18WON0004	25/09/2021	614.7	62.7
MB18WON0004	24/09/2021	614.8	62.7
MB18WON0004	23/09/2021	614.8	62.6
MB18WON0004	22/09/2021	614.8	62.6
MB18WON0004	21/09/2021	614.8	62.6
MB18WON0004	20/09/2021	614.8	62.6
MB18WON0004	19/09/2021	614.8	62.6
MB18WON0004	18/09/2021	614.8	62.6
MB18WON0004	17/09/2021	614.8	62.6
MB18WON0004	16/09/2021	614.8	62.7
MB18WON0004	15/09/2021	614.8	62.7
MB18WON0004	14/09/2021	614.8	62.7
MB18WON0004	13/09/2021	614.8	62.7
MB18WON0004	12/09/2021	614.8	62.7
MB18WON0004	11/09/2021	614.8	62.7
MB18WON0004	10/09/2021	614.8	62.6
MB18WON0004	9/09/2021	614.8	62.6
MB18WON0004	8/09/2021	614.8	62.6
MB18WON0004	7/09/2021	614.9	62.6
MB18WON0004	6/09/2021	614.9	62.6
MB18WON0004	5/09/2021	614.9	62.6
MB18WON0004	4/09/2021	614.9	62.6
MB18WON0004	3/09/2021	614.8	62.6
MB18WON0004	2/09/2021	614.8	62.6
MB18WON0004	1/09/2021	614.8	62.7
MB18WON0004	31/08/2021	614.8	62.6
MB18WON0004	30/08/2021	614.8	62.6
MB18WON0004	29/08/2021	614.8	62.6
MB18WON0004	28/08/2021	614.8	62.6
MB18WON0004	27/08/2021	614.8	62.6
MB18WON0004	26/08/2021	614.8	62.6
MB18WON0004	25/08/2021	614.8	62.6
MB18WON0004	24/08/2021	614.8	62.6
MB18WON0004	23/08/2021	614.8	62.6
MB18WON0004	22/08/2021	614.8	62.6
MB18WON0004	21/08/2021	614.8	62.6
MB18WON0004	20/08/2021	614.8	62.6
MB18WON0004	19/08/2021	614.8	62.6
MB18WON0004	18/08/2021	614.8	62.6
MB18WON0004	17/08/2021	614.9	62.6
MB18WON0004	16/08/2021	614.9	62.6

ID	Date	WL mAHD	WL mbgl
MB15HD20007	17/01/2017	626.0	86.8
MB15HD20007	18/01/2017	626.0	86.8
MB15HD20007	19/01/2017	626.0	86.8
MB15HD20007	20/01/2017	626.0	86.8
MB15HD20007	21/01/2017	626.0	86.8
MB15HD20007	22/01/2017	626.0	86.8
MB15HD20007	23/01/2017	626.0	86.8
MB15HD20007	24/01/2017	626.0	86.8
MB15HD20007	25/01/2017	626.0	86.8
MB15HD20007	26/01/2017	626.0	86.8
MB15HD20007	27/01/2017	626.0	86.8
MB15HD20007	28/01/2017	626.0	86.8
MB15HD20007	29/01/2017	626.0	86.8
MB15HD20007	30/01/2017	626.0	86.8
MB15HD20007	31/01/2017	626.0	86.8
MB15HD20007	1/02/2017	626.0	86.8
MB15HD20007	2/02/2017	626.0	86.8
MB15HD20007	3/02/2017	626.0	86.8
MB15HD20007	4/02/2017	626.0	86.8
MB15HD20007	5/02/2017	626.0	86.8
MB15HD20007	6/02/2017	626.0	86.8
MB15HD20007	7/02/2017	626.0	86.8
MB15HD20007	8/02/2017	626.0	86.8
MB15HD20007	9/02/2017	625.9	86.9
MB15HD20007	10/02/2017	626.0	86.8
MB15HD20007	11/02/2017	626.0	86.8
MB15HD20007	12/02/2017	626.0	86.8
MB15HD20007	13/02/2017	626.0	86.8
MB15HD20007	14/02/2017	626.0	86.8
MB15HD20007	15/02/2017	626.0	86.8
MB15HD20007	16/02/2017	626.0	86.8
MB15HD20007	17/02/2017	626.0	86.8
MB15HD20007	18/02/2017	626.1	86.7
MB15HD20007	19/02/2017	626.1	86.7
MB15HD20007	20/02/2017	626.1	86.7
MB15HD20007	21/02/2017	626.0	86.8
MB15HD20007	22/02/2017	626.1	86.7
MB15HD20007	23/02/2017	626.1	86.7
MB15HD20007	24/02/2017	626.1	86.7
MB15HD20007	25/02/2017	626.1	86.7
MB15HD20007	26/02/2017	626.1	86.7
MB15HD20007	27/02/2017	626.1	86.7
MB15HD20007	28/02/2017	626.1	86.7
MB15HD20007	1/03/2017	626.1	86.7
MB15HD20007	2/03/2017	626.1	86.7
MB15HD20007	3/03/2017	626.0	86.8
MB15HD20007	4/03/2017	626.1	86.7
MB15HD20007	5/03/2017	626.0	86.8
MB15HD20007	6/03/2017	626.0	86.8
MB15HD20007	7/03/2017	626.0	86.8
MB15HD20007	8/03/2017	626.0	86.8
MB15HD20007	9/03/2017	626.0	86.8
MB15HD20007	10/03/2017	626.0	86.8
MB15HD20007	11/03/2017	626.0	86.8
MB15HD20007	12/03/2017	626.0	86.8
MB15HD20007	13/03/2017	626.0	86.8
MB15HD20007	14/03/2017	626.0	86.8
MB15HD20007	15/03/2017	626.0	86.8
MB15HD20007	16/03/2017	626.0	86.8
MB15HD20007	17/03/2017	626.0	86.8
MB15HD20007	18/03/2017	626.0	86.8
MB15HD20007	19/03/2017	626.0	86.8
MB15HD20007	20/03/2017	626.0	86.8
MB15HD20007	21/03/2017	626.0	86.8
MB15HD20007	22/03/2017	626.0	86.8
MB15HD20007	23/03/2017	626.0	86.8
MB15HD20007	24/03/2017	626.0	86.8
MB15HD20007	25/03/2017	626.0	86.8
MB15HD20007	26/03/2017	626.0	86.8
MB15HD20007	27/03/2017	626.0	86.8
MB15HD20007	28/03/2017	626.0	86.8
MB15HD20007	29/03/2017	626.0	86.8
MB15HD20007	30/03/2017	626.0	86.8
MB15HD20007	31/03/2017	626.1	86.7
MB15HD20007	1/04/2017	626.1	86.7
MB15HD20007	2/04/2017	626.1	86.7
MB15HD20007	3/04/2017	626.1	86.7
MB15HD20007	4/04/2017	626.1	86.7
MB15HD20007	5/04/2017	626.1	86.7
MB15HD20007	6/04/2017	626.1	86.7
MB15HD20007	7/04/2017	626.1	86.7
MB15HD20007	8/04/2017	626.1	86.7
MB15HD20007	9/04/2017	626.1	86.7
MB15HD20007	10/04/2017	626.1	86.7
MB15HD20007	11/04/2017	626.1	86.7
MB15HD20007	12/04/2017	626.1	86.7
MB15HD20007	13/04/2017	626.1	86.7
MB15HD20007	14/04/2017	626.1	86.7
MB15HD20007	15/04/2017	626.1	86.7
MB15HD20007	16/04/2017	626.1	86.7
MB15HD20007	17/04/2017	626.0	86.8
MB15HD20007	18/04/2017	626.0	86.8
MB15HD20007	19/04/2017	626.0	86.8
MB15HD20007	20/04/2017	626.0	86.8
MB15HD20007	21/04/2017	626.0	86.8
MB15HD20007	22/04/2017	626.1	86.7
MB15HD20007	23/04/2017	626.0	86.8
MB15HD20007	24/04/2017	626.0	86.8
MB15HD20007	25/04/2017	626.0	86.8
MB15HD20007	26/04/2017	626.1	86.7
MB15HD20007	27/04/2017	626.1	86.7
MB15HD20007	28/04/2017	626.1	86.7
MB15HD20007	29/04/2017	626.1	86.7
MB15HD20007	30/04/2017	626.1	86.7
MB15HD20007	1/05/2017	626.1	86.7
MB15HD20007	2/05/2017	626.1	86.7
MB15HD20007	3/05/2017	626.1	86.7
MB15HD20007	4/05/2017	626.1	86.7
MB15HD20007	5/05/2017	626.1	86.7
MB15HD20007	6/05/2017	626.1	86.7
MB15HD20007	7/05/2017	626.1	86.7
MB15HD20007	8/05/2017	626.1	86.7
MB15HD20007	9/05/2017	626.1	86.7
MB15HD20007	10/05/2017	626.1	86.7
MB15HD20007	11/05/2017	626.1	86.7
MB15HD20007	12/05/2017	626.1	86.7
MB15HD20007	13/05/2017	626.1	86.7
MB15HD20007	21/08/2017	626.1	86.7
MB15HD20007	22/08/2017	626.1	86.7
MB15HD20007	23/08/2017	626.1	86.7
MB15HD20007	24/08/2017	626.1	86.7
MB15HD20007	25/08/2017	626.1	86.7
MB15HD20007	26/08/2017	626.1	86.7
MB15HD20007	27/08/2017	626.1	86.7
MB15HD20007	28/08/2017	626.1	86.7
MB15HD20007	29/08/2017	626.1	86.7
MB15HD20007	30/08/2017	626.1	86.7
MB15HD20007	31/08/2017	626.1	86.7
MB15HD20007	1/09/2017	626.1	86.7
MB15HD20007	2/09/2017	626.1	86.7
MB15HD20007	3/09/2017	626.1	86.7
MB15HD20007	4/09/2017	626.1	86.7
MB15HD20007	5/09/2017	626.1	86.7
MB15HD20007	6/09/2017	626.1	86.7
MB15HD20007	7/09/2017	626.1	86.7
MB15HD20007	8/09/2017	626.1	86.7

ID	Date	WL mAHD	WL mbgl
MB18HD20010	22/10/2020	625.1	68.3
MB18HD20010	23/10/2020	625.1	68.3
MB18HD20010	24/10/2020	625.1	68.3
MB18HD20010	25/10/2020	625.1	68.3
MB18HD20010	26/10/2020	625.1	68.3
MB18HD20010	27/10/2020	625.1	68.3
MB18HD20010	28/10/2020	625.1	68.3
MB18HD20010	29/10/2020	625.1	68.3
MB18HD20010	30/10/2020	625.1	68.3
MB18HD20010	31/10/2020	625.1	68.3
MB18HD20010	1/11/2020	625.1	68.3
MB18HD20010	2/11/2020	625.1	68.3
MB18HD20010	3/11/2020	625.1	68.3
MB18HD20010	4/11/2020	625.1	68.2
MB18HD20010	5/11/2020	625.1	68.3
MB18HD20010	6/11/2020	625.1	68.3
MB18HD20010	7/11/2020	625.1	68.3
MB18HD20010	8/11/2020	625.1	68.3
MB18HD20010	9/11/2020	625.1	68.3
MB18HD20010	10/11/2020	625.1	68.3
MB18HD20010	11/11/2020	625.1	68.3
MB18HD20010	12/11/2020	625.1	68.3
MB18HD20010	13/11/2020	625.1	68.3
MB18HD20010	14/11/2020	625.1	68.3
MB18HD20010	15/11/2020	625.1	68.3
MB18HD20010	16/11/2020	625.1	68.3
MB18HD20010	17/11/2020	625.1	68.3
MB18HD20010	18/11/2020	625.1	68.3
MB18HD20010	19/11/2020	625.1	68.3
MB18HD20010	20/11/2020	625.1	68.3
MB18HD20010	21/11/2020	625.1	68.3
MB18HD20010	22/11/2020	625.1	68.3
MB18HD20010	23/11/2020	625.1	68.3
MB18HD20010	24/11/2020	625.1	68.3
MB18HD20010	25/11/2020	625.1	68.3
MB18HD20010	26/11/2020	625.1	68.3
MB18HD20010	27/11/2020	625.1	68.3
MB18HD20010	28/11/2020	625.1	68.3
MB18HD20010	29/11/2020	625.1	68.3
MB18HD20010	30/11/2020	625.0	68.3
MB18HD20010	1/12/2020	625.1	68.3
MB18HD20010	2/12/2020	625.1	68.3
MB18HD20010	3/12/2020	625.1	68.3
MB18HD20010	4/12/2020	625.1	68.3
MB18HD20010	5/12/2020	625.1	68.3
MB18HD20010	6/12/2020	625.1	68.3
MB18HD20010	7/12/2020	625.1	68.3
MB18HD20010	8/12/2020	625.1	68.3
MB18HD20010	9/12/2020	625.1	68.3
MB18HD20010	10/12/2020	625.0	68.3
MB18HD20010	11/12/2020	625.0	68.3
MB18HD20010	12/12/2020	625.0	68.4
MB18HD20010	13/12/2020	625.0	68.3
MB18HD20010	14/12/2020	625.0	68.3
MB18HD20010	15/12/2020	625.0	68.3
MB18HD20010	16/12/2020	625.0	68.3
MB18HD20010	17/12/2020	625.0	68.3
MB18HD20010	18/12/2020	625.0	68.3
MB18HD20010	19/12/2020	625.0	68.3
MB18HD20010	20/12/2020	625.0	68.4
MB18HD20010	21/12/2020	625.0	68.3
MB18HD20010	22/12/2020	625.1	68.3
MB18HD20010	23/12/2020	625.1	68.3
MB18HD20010	24/12/2020	625.1	68.3
MB18HD20010	25/12/2020	625.1	68.3
MB18HD20010	26/12/2020	625.1	68.3
MB18HD20010	27/12/2020	625.0	68.3
MB18HD20010	28/12/2020	625.0	68.3
MB18HD20010	29/12/2020	625.0	68.3
MB18HD20010	30/12/2020	625.0	68.3
MB18HD20010	31/12/2020	625.0	68.3
MB18HD20010	1/01/2021	625.0	68.3
MB18HD20010	2/01/2021	625.0	68.3
MB18HD20010	3/01/2021	625.0	68.3
MB18HD20010	4/01/2021	625.0	68.3
MB18HD20010	5/01/2021	625.1	68.3
MB18HD20010	6/01/2021	625.1	68.3
MB18HD20010	7/01/2021	625.1	68.3
MB18HD20010	8/01/2021	625.1	68.3
MB18HD20010	9/01/2021	625.1	68.3
MB18HD20010	10/01/2021	625.1	68.3
MB18HD20010	11/01/2021	625.1	68.3
MB18HD20010	12/01/2021	625.0	68.3
MB18HD20010	13/01/2021	625.0	68.3
MB18HD20010	14/01/2021	625.0	68.3
MB18HD20010	15/01/2021	625.0	68.3
MB18HD20010	16/01/2021	625.1	68.3
MB18HD20010	17/01/2021	625.1	68.3
MB18HD20010	18/01/2021	625.1	68.3
MB18HD20010	19/01/2021	625.1	68.3
MB18HD20010	20/01/2021	625.1	68.3
MB18HD20010	21/01/2021	625.0	68.3
MB18HD20010	22/01/2021	625.0	68.3
MB18HD20010	23/01/2021	625.0	68.4
MB18HD20010	24/01/2021	625.0	68.4
MB18HD20010	25/01/2021	625

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	22/01/2014	352.5	334.1
HDVP2	21/01/2014	352.5	334.1
HDVP2	20/01/2014	352.5	334.1
HDVP2	19/01/2014	352.5	334.1
HDVP2	18/01/2014	352.5	334.1
HDVP2	17/01/2014	352.5	334.1
HDVP2	16/01/2014	352.5	334.1
HDVP2	15/01/2014	352.5	334.1
HDVP2	14/01/2014	352.5	334.1
HDVP2	13/01/2014	352.5	334.1
HDVP2	12/01/2014	352.5	334.1
HDVP2	11/01/2014	352.5	334.1
HDVP2	10/01/2014	352.5	334.1
HDVP2	9/01/2014	352.5	334.1
HDVP2	8/01/2014	352.5	334.1
HDVP2	7/01/2014	352.5	334.1
HDVP2	6/01/2014	352.5	334.1
HDVP2	5/01/2014	352.5	334.1
HDVP2	4/01/2014	352.5	334.1
HDVP2	3/01/2014	352.5	334.1
HDVP2	2/01/2014	352.5	334.1
HDVP2	1/01/2014	352.5	334.1
HDVP2	31/12/2013	352.5	334.1
HDVP2	30/12/2013	359.9	326.7
HDVP2	29/12/2013	359.9	326.7
HDVP2	28/12/2013	359.9	326.7
HDVP2	27/12/2013	359.9	326.7
HDVP2	26/12/2013	359.9	326.7
HDVP2	25/12/2013	359.9	326.7
HDVP2	24/12/2013	359.9	326.7
HDVP2	23/12/2013	359.9	326.7
HDVP2	22/12/2013	359.9	326.7
HDVP2	21/12/2013	359.9	326.7
HDVP2	20/12/2013	359.9	326.7
HDVP2	19/12/2013	359.9	326.7
HDVP2	18/12/2013	359.9	326.7
HDVP2	17/12/2013	359.9	326.7
HDVP2	16/12/2013	359.9	326.7
HDVP2	15/12/2013	359.9	326.7
HDVP2	14/12/2013	359.9	326.7
HDVP2	13/12/2013	359.9	326.7
HDVP2	12/12/2013	359.9	326.7
HDVP2	11/12/2013	359.9	326.7
HDVP2	10/12/2013	359.9	326.7
HDVP2	9/12/2013	359.9	326.7
HDVP2	8/12/2013	359.9	326.7
HDVP2	7/12/2013	359.9	326.7
HDVP2	6/12/2013	359.9	326.7
HDVP2	5/12/2013	359.9	326.7
HDVP2	4/12/2013	359.9	326.7
HDVP2	3/12/2013	359.9	326.7
HDVP2	2/12/2013	359.9	326.7
HDVP2	1/12/2013	359.9	326.7
HDVP2	30/11/2013	328.3	358.2
HDVP2	29/11/2013	328.3	358.2
HDVP2	28/11/2013	328.3	358.2
HDVP2	27/11/2013	328.3	358.2
HDVP2	26/11/2013	328.3	358.2
HDVP2	25/11/2013	328.3	358.2
HDVP2	24/11/2013	328.3	358.2
HDVP2	23/11/2013	328.3	358.2
HDVP2	22/11/2013	328.3	358.2
HDVP2	21/11/2013	328.3	358.2
HDVP2	20/11/2013	328.3	358.2
HDVP2	19/11/2013	328.3	358.2
HDVP2	18/11/2013	328.3	358.2
HDVP2	17/11/2013	328.3	358.2
HDVP2	16/11/2013	328.3	358.2
HDVP2	15/11/2013	328.3	358.2
HDVP2	14/11/2013	328.3	358.2
HDVP2	13/11/2013	328.3	358.2
HDVP2	12/11/2013	328.3	358.2
HDVP2	11/11/2013	328.3	358.2
HDVP2	10/11/2013	328.3	358.2
HDVP2	9/11/2013	328.3	358.2
HDVP2	8/11/2013	328.3	358.2
HDVP2	7/11/2013	328.3	358.2
HDVP2	6/11/2013	328.3	358.2
HDVP2	5/11/2013	328.3	358.2
HDVP2	4/11/2013	328.3	358.2
HDVP2	3/11/2013	328.3	358.2
HDVP2	2/11/2013	328.3	358.2
HDVP2	1/11/2013	328.3	358.2
HDVP2	31/10/2013	278.3	408.2
HDVP2	30/10/2013	278.3	408.2
HDVP2	29/10/2013	278.3	408.2
HDVP2	28/10/2013	278.3	408.2
HDVP2	27/10/2013	278.3	408.2
HDVP2	26/10/2013	278.3	408.2
HDVP2	25/10/2013	278.3	408.2
HDVP2	24/10/2013	278.3	408.2
HDVP2	23/10/2013	278.3	408.2
HDVP2	22/10/2013	278.3	408.2
HDVP2	21/10/2013	278.3	408.2
HDVP2	20/10/2013	278.3	408.2
HDVP2	19/10/2013	278.3	408.2
HDVP2	18/10/2013	278.3	408.2
HDVP2	17/10/2013	278.3	408.2
HDVP2	16/10/2013	278.3	408.2
HDVP2	15/10/2013	278.3	408.2
HDVP2	14/10/2013	278.3	408.2
HDVP2	13/10/2013	278.3	408.2
HDVP2	12/10/2013	278.3	408.2
HDVP2	11/10/2013	278.3	408.2
HDVP2	10/10/2013	278.3	408.2
HDVP2	9/10/2013	278.3	408.2
HDVP2	8/10/2013	278.3	408.2
HDVP2	7/10/2013	278.3	408.2
HDVP2	6/10/2013	278.3	408.2
HDVP2	5/10/2013	278.3	408.2
HDVP2	4/10/2013	278.3	408.2
HDVP2	3/10/2013	278.3	408.2
HDVP2	2/10/2013	278.3	408.2
HDVP2	1/10/2013	278.3	408.2
HDVP2	30/09/2013	236.1	450.4
HDVP2	29/09/2013	236.1	450.4
HDVP2	28/09/2013	236.1	450.4
HDVP2	27/09/2013	236.1	450.4
HDVP2	26/09/2013	236.1	450.4
HDVP2	25/09/2013	236.1	450.4
HDVP2	24/09/2013	236.1	450.4
HDVP2	23/09/2013	236.1	450.4
HDVP2	22/09/2013	236.1	450.4
HDVP2	21/09/2013	236.1	450.4
HDVP2	20/09/2013	236.1	450.4
HDVP2	19/09/2013	236.1	450.4
HDVP2	18/09/2013	236.1	450.4
HDVP2	17/09/2013	236.1	450.4
HDVP2	16/09/2013	236.1	450.4
HDVP2	15/09/2013	236.1	450.4
HDVP2	14/09/2013	236.1	450.4
HDVP2	13/09/2013	236.1	450.4
HDVP2	12/09/2013	236.1	450.4
HDVP2	11/09/2013	236.1	450.4
HDVP2	10/09/2013	236.1	450.4
HDVP2	9/09/2013	236.1	450.4

ID	Date	WL mAHD	WL mbgl
MB18WON0004	15/08/2021	614.9	62.6
MB18WON0004	14/08/2021	614.8	62.6
MB18WON0004	13/08/2021	614.8	62.6
MB18WON0004	12/08/2021	614.9	62.5
MB18WON0004	11/08/2021	614.9	62.5
MB18WON0004	10/08/2021	614.8	62.6
MB18WON0004	9/08/2021	614.8	62.6
MB18WON0004	8/08/2021	614.9	62.6
MB18WON0004	7/08/2021	614.9	62.6
MB18WON0004	6/08/2021	614.9	62.6
MB18WON0004	5/08/2021	614.9	62.5
MB18WON0004	4/08/2021	614.9	62.5
MB18WON0004	3/08/2021	614.9	62.6
MB18WON0004	2/08/2021	614.9	62.6
MB18WON0004	1/08/2021	614.8	62.6
MB18WON0004	31/07/2021	614.8	62.6
MB18WON0004	30/07/2021	614.8	62.6
MB18WON0004	29/07/2021	614.8	62.6
MB18WON0004	28/07/2021	614.8	62.6
MB18WON0004	27/07/2021	614.8	62.6
MB18WON0004	26/07/2021	614.8	62.6
MB18WON0004	25/07/2021	614.9	62.6
MB18WON0004	24/07/2021	614.9	62.6
MB18WON0004	23/07/2021	614.8	62.6
MB18WON0004	22/07/2021	614.8	62.6
MB18WON0004	21/07/2021	614.8	62.6
MB18WON0004	20/07/2021	614.8	62.6
MB18WON0004	19/07/2021	614.8	62.6
MB18WON0004	18/07/2021	614.8	62.6
MB18WON0004	17/07/2021	614.9	62.6
MB18WON0004	16/07/2021	614.9	62.6
MB18WON0004	15/07/2021	614.9	62.6
MB18WON0004	14/07/2021	614.8	62.6
MB18WON0004	13/07/2021	614.8	62.6
MB18WON0004	12/07/2021	614.8	62.6
MB18WON0004	11/07/2021	614.8	62.6
MB18WON0004	10/07/2021	614.8	62.6
MB18WON0004	9/07/2021	614.8	62.6
MB18WON0004	8/07/2021	614.9	62.6
MB18WON0004	7/07/2021	614.8	62.6
MB18WON0004	6/07/2021	614.8	62.6
MB18WON0004	5/07/2021	614.8	62.6
MB18WON0004	4/07/2021	614.9	62.6
MB18WON0004	3/07/2021	614.9	62.6
MB18WON0004	2/07/2021	614.9	62.6
MB18WON0004	1/07/2021	614.9	62.5
MB18WON0004	30/06/2021	614.9	62.6
MB18WON0004	29/06/2021	614.9	62.6
MB18WON0004	28/06/2021	614.9	62.6
MB18WON0004	27/06/2021	614.9	62.6
MB18WON0004	26/06/2021	614.9	62.6
MB18WON0004	25/06/2021	614.9	62.6
MB18WON0004	24/06/2021	614.9	62.5
MB18WON0004	23/06/2021	614.9	62.6
MB18WON0004	22/06/2021	614.9	62.6
MB18WON0004	21/06/2021	614.8	62.6
MB18WON0004	20/06/2021	614.8	62.6
MB18WON0004	19/06/2021	614.9	62.6
MB18WON0004	18/06/2021	614.9	62.5
MB18WON0004	17/06/2021	614.9	62.5
MB18WON0004	16/06/2021	614.9	62.5
MB18WON0004	15/06/2021	614.9	62.6
MB18WON0004	14/06/2021	614.9	62.6
MB18WON0004	13/06/2021	614.9	62.6
MB18WON0004	12/06/2021	614.8	62.6
MB18WON0004	11/06/2021	614.8	62.6
MB18WON0004	10/06/2021	614.8	62.6
MB18WON0004	9/06/2021	614.9	62.6
MB18WON0004	8/06/2021	614.9	62.5
MB18WON0004	7/06/2021	614.9	62.6
MB18WON0004	6/06/2021	614.9	62.6
MB18WON0004	5/06/2021	614.9	62.6
MB18WON0004	4/06/2021	614.9	62.5
MB18WON0004	3/06/2021	614.9	62.5
MB18WON0004	2/06/2021	614.9	62.5
MB18WON0004	1/06/2021	614.9	62.6
MB18WON0004	31/05/2021	614.8	62.6
MB18WON0004	30/05/2021	614.8	62.6
MB18WON0004	29/05/2021	614.9	62.6
MB18WON0004	28/05/2021	614.9	62.6
MB18WON0004	27/05/2021	614.9	62.6
MB18WON0004	26/05/2021	614.9	62.5
MB18WON0004	25/05/2021	614.9	62.5
MB18WON0004	24/05/2021	614.9	62.6
MB18WON0004	23/05/2021	614.8	62.6
MB18WON0004	22/05/2021	614.8	62.6
MB18WON0004	21/05/2021	614.9	62.6
MB18WON0004	20/05/2021	614.9	62.6
MB18WON0004	19/05/2021	614.9	62.6
MB18WON0004	18/05/2021	614.8	62.6
MB18WON0004	17/05/2021	614.9	62.6
MB18WON0004	16/05/2021	614.9	62.6
MB18WON0004	15/05/2021	614.9	62.6
MB18WON0004	14/05/2021	614.9	62.6
MB18WON0004	13/05/2021	614.9	62.6
MB18WON0004	12/05/2021	614.9	62.6
MB18WON0004	11/05/2021	614.9	62.6
MB18WON0004	10/05/2021	614.9	62.6
MB18WON0004	9/05/2021	614.9	62.6
MB18WON0004	8/05/2021	614.8	62.6
MB18WON0004	7/05/2021	614.8	62.6
MB18WON0004	6/05/2021	614.8	62.6
MB18WON0004	5/05/2021	614.8	62.6
MB18WON0004	4/05/2021	614.8	62.6
MB18WON0004	3/05/2021	614.8	62.6
MB18WON0004	2/05/2021	614.8	62.6
MB18WON0004	1/05/2021	614.8	62.6
MB18WON0004	30/04/2021	614.8	62.6
MB18WON0004	29/04/2021	614.8	62.6
MB18WON0004	28/04/2021	614.9	62.6
MB18WON0004	27/04/2021	614.9	62.6
MB18WON0004	26/04/2021	614.9	62.6
MB18WON0004	25/04/2021	614.9	62.6
MB18WON0004	24/04/2021	614.8	62.6
MB18WON0004	23/04/2021	614.8	62.6
MB18WON0004	22/04/2021	614.8	62.6
MB18WON0004	21/04/2021	614.8	62.6
MB18WON0004	20/04/2021	614.8	62.6
MB18WON0004	19/04/2021	614.8	62.6
MB18WON0004	18/04/2021	614.8	62.6
MB18WON0004	17/04/2021	614.8	62.6
MB18WON0004	16/04/2021	614.8	62.6
MB18WON0004	15/04/2021	614.8	62.6
MB18WON0004	14/04/2021	614.8	62.6
MB18WON0004	13/04/2021	614.8	62.7
MB18WON0004	12/04/2021	614.8	62.7
MB18WON0004	11/04/2021	614.8	62.7
MB18WON0004	10/04/2021	614.8	62.7
MB18WON0004	9/04/2021	614.8	62.7
MB18WON0004	8/04/2021	614.7	62.7
MB18WON0004	7/04/2021	614.8	62.7
MB18WON0004	6/04/2021	614.8	62.7
MB18WON0004	5/04/2021	614.8	62.7
MB18WON0004	4/04/2021	614.8	62.7
MB18WON0004	3/04/2021	614.8	62.7
MB18WON0004	1/04/2021	614.8	62.7

ID	Date	WL mAHD	WL mbgl
MB15HD20007	9/09/2017	626.1	86.7
MB15HD20007	10/09/2017	626.1	86.7
MB15HD20007	11/09/2017	626.1	86.7
MB15HD20007	12/09/2017	626.1	86.7
MB15HD20007	13/09/2017	626.1	86.7
MB15HD20007	14/09/2017	626.1	86.7
MB15HD20007	15/09/2017	626.1	86.7
MB15HD20007	16/09/2017	626.1	86.7
MB15HD20007	17/09/2017	626.1	86.7
MB15HD20007	18/09/2017	626.1	86.7
MB15HD20007	19/09/2017	626.1	86.7
MB15HD20007	20/09/2017	626.1	86.7
MB15HD20007	21/09/2017	626.1	86.7
MB15HD20007	22/09/2017	626.1	86.7
MB15HD20007	23/09/2017	626.1	86.7
MB15HD20007	24/09/2017	626.1	86.7
MB15HD20007	25/09/2017	626.1	86.7
MB15HD20007	26/09/2017	626.1	86.7
MB15HD20007	27/09/2017	626.1	86.7
MB15HD20007	28/09/2017	626.1	86.7
MB15HD20007	29/09/2017	626.1	86.7
MB15HD20007	30/09/2017	626.1	86.7
MB15HD20007	1/10/2017	626.1	86.7
MB15HD20007	2/10/2017	626.1	86.7
MB15HD20007	3/10/2017	626.1	86.7
MB15HD20007	4/10/2017	626.1	86.7
MB15HD20007	5/10/2017	626.1	86.7
MB15HD20007	6/10/2017	626.1	86.7
MB15HD20007	7/10/2017	626.1	86.7
MB15HD20007	8/10/2017	626.1	86.7
MB15HD20007	9/10/2017	626.1	86.7
MB15HD20007	10/10/2017	626.1	86.7
MB15HD20007	11/10/2017	626.1	86.7
MB15HD20007	12/10/2017	626.1	86.7
MB15HD20007	13/10/2017	626.1	86.7
MB15HD20007	14/10/2017	626.1	86.7
MB15HD20007	15/10/2017	626.1	86.7
MB15HD20007	16/10/2017	626.1	86.7
MB15HD20007	17/10/2017	626.1	86.7
MB15HD20007	18/10/2017	626.1	86.7
MB15HD20007	19/10/2017	626.1	86.7
MB15HD20007	20/10/2017	626.1	86.7
MB15HD20007	21/10/2017	626.1	86.7
MB15HD20007	22/10/2017	626.1	86.7
MB15HD20007	23/10/2017	626.1	86.7
MB15HD20007	24/10/2017	626.1	86.7
MB15HD20007	25/10/2017	626.1	86.7
MB15HD20007	26/10/2017	626.1	86.7
MB15HD20007	27/10/2017	626.1	86.7
MB15HD20007	28/10/2017	626.1	86.7
MB15HD20007	29/10/2017	626.1	86.7
MB15HD20007	30/10/2017	626.1	86.7
MB15HD20007	31/10/2017	626.1	86.7
MB15HD20007	1/11/2017	626.1	86.7
MB15HD20007	2/11/2017	626.1	86.7
MB15HD20007	3/11/2017	626.1	86.7
MB15HD20007	4/11/2017	626.1	86.7
MB15HD20007	5/11/2017	626.1	86.7
MB15HD20007	6/11/2017	626.1	86.7
MB15HD20007	7/11/2017	626.1	86.7
MB15HD20007	8/11/2017	626.1	86.7
MB15HD20007	9/11/2017	626.1	86.7
MB15HD20007	10/11/2017	626.1	86.7
MB15HD20007	11/11/2017	626.1	86.7
MB15HD20007	12/11/2017	626.1	86.7
MB15HD20007	13/11/2017	626.1	86.7
MB15HD20007	14/11/2017	626.1	86.7
MB15HD20007	15/11/2017	626.1	86.7
MB15HD20007	16/11/2017	626.1	86.7
MB15HD20007	17/11/2017	626.1	86.7
MB15HD20007	18/11/2017	626.1	86.7
MB15HD20007	19/11/2017	626.1	86.7
MB15HD20007	20/11/2017	626.1	86.7
MB15HD20007	21/11/2017	626.1	86.7
MB15HD20007	22/11/2017	626.1	86.7
MB15HD20007	23/11/2017	626.1	86.7
MB15HD20007	24/11/2017	626.1	86.7
MB15HD20007	25/11/2017	626.1	86.7
MB15HD20007	26/11/2017	626.1	86.7
MB15HD20007	27/11/2017	626.1	86.7
MB15HD20007	28/11/2017	626.1	86.7
MB15HD20007	29/11/2017	626.1	86.7
MB15HD20007	30/11/2017	626.1	86.7
MB15HD20007	1/12/2017	626.1	86.7
MB15HD20007	2/12/2017	626.1	86.7
MB15HD20007	3/12/2017	626.1	86.7
MB15HD20007	4/12/2017	626.1	86.7
MB15HD20007	5/12/2017	626.1	86.7
MB15HD20007	6/12/2017	626.1	86.7
MB15HD20007	7/12/2017	626.1	86.7
MB15HD20007	8/12/2017	626.1	86.7
MB15HD20007	9/12/2017	626.1	86.7
MB15HD20007	10/12/2017	626.1	86.7
MB15HD20007	11/12/2017	626.1	86.7
MB15HD20007	12/12/2017	626.1	86.7
MB15HD20007	13/12/2017	626.1	86.7
MB15HD20007	14/12/2017	626.1	86.7
MB15HD20007	15/12/2017	626.1	86.7
MB15HD20007	16/12/2017	626.1	86.7
MB15HD20007	17/12/2017	626.1	86.7
MB15HD20007	18/12/2017	626.1	86.7
MB15HD20007	19/12/2017	626.1	86.7
MB15HD20007	20/12/2017	626.1	86.7
MB15HD20007	21/12/2017	626.1	86.7
MB15HD20007	22/12/2017	626.1	86.7
MB15HD20007	23/12/2017	626.1	86.7
MB15HD20007	24/12/2017	626.1	86.7
MB15HD20007	25/12/2017	626.1	86.7
MB15HD20007	26/12/2017	626.1	86.7
MB15HD20007	27/12/2017	626.1	86.7
MB15HD20007	28/12/2017	626.1	86.7
MB15HD20007	29/12/2017	626.1	86.7
MB15HD20007	30/12/2017	626.1	86.7
MB15HD20007	31/12/2017	626.1	86.7
MB15HD20007	1/01/2018	626.1	86.7
MB15HD20007	2/01/2018	626.1	86.7
MB15HD20007	3/01/2018	626.1	86.7
MB15HD20007	4/01/2018	626.1	86.7
MB15HD20007	5/01/2018	626.1	86.7
MB15HD20007	6/01/2018	626.1	86.7
MB15HD20007	7/01/2018	626.1	86.7
MB15HD20007	8/01/2018	626.1	86.7
MB15HD20007	9/01/2018	626.1	86.7
MB15HD20007	10/01/2018	626.1	86.7
MB15HD20007	11/01/2018	626.1	86.7
MB15HD20007	12/01/2018	626.1	86.7
MB15HD20007	13/01/2018	626.1	86.7
MB15HD20007	14/01/2018	626.1	86.7
MB15HD20007	15/01/2018	626.1	86.7
MB15HD20007	16/01/2018	626.1	86.7
MB15HD20007	17/01/2018	626.1	86.7
MB15HD20007	18/01/2018	626.1	86.7
MB15HD20007	19/01/2018	626.1	86.7
MB15HD20007	20/01/2018	626.1	86.7
MB15HD20007	21/01/2018	626.1	86.7
MB15HD20007	22/01/2018	626.1	86.7

ID	Date	WL mAHD	WL mbgl
MB18HD20010	7/03/2021	625.1	68.3
MB18HD20010	8/03/2021	625.0	68.3
MB18HD20010	9/03/2021	625.1	68.3
MB18HD20010	10/03/2021	625.1	68.3
MB18HD20010	11/03/2021	625.1	68.3
MB18HD20010	12/03/2021	625.1	68.3
MB18HD20010	13/03/2021	625.1	68.3
MB18HD20010	14/03/2021	625.1	68.3
MB18HD20010	15/03/2021	625.1	68.3
MB18HD20010	16/03/2021	625.1	68.3
MB18HD20010	17/03/2021	625.1	68.3
MB18HD20010	18/03/2021	625.1	68.3
MB18HD20010	19/03/2021	625.1	68.3
MB18HD20010	20/03/2021	625.1	68.3
MB18HD20010	21/03/2021	625.1	68.3
MB18HD20010	22/03/2021	625.1	68.3
MB18HD20010	23/03/2021	625.1	68.3
MB18HD20010	24/03/2021	625.0	68.3
MB18HD20010	25/03/2021	625.0	68.3
MB18HD20010	26/03/2021	625.1	68.3
MB18HD20010	27/03/2021	625.1	68.3
MB18HD20010	28/03/2021	625.1	68.3
MB18HD20010	29/03/2021	625.1	68.3
MB18HD20010	30/03/2021	625.1	68.3
MB18HD20010	31/03/2021	625.1	68.3
MB18HD20010	1/04/2021	625.1	68.3
MB18HD20010	2/04/2021	625.1	68.3
MB18HD20010	3/04/2021	625.1	68.3
MB18HD20010	4/04/2021	625.1	68.3
MB18HD20010	5/04/2021	625.1	68.3
MB18HD20010	6/04/2021	625.1	68.3
MB18HD20010	7/04/2021	625.1	68.3
MB18HD20010	8/04/2021	625.1	68.3
MB18HD20010	9/04/2021	625.1	68.3
MB18HD20010	10/04/2021	625.1	68.3
MB18HD20010	11/04/2021	625.1	68.3
MB18HD20010	12/04/2021	625.1	68.3
MB18HD20010	13/04/2021	625.1	68.3
MB18HD20010	14/04/2021	625.1	68.3
MB18HD20010	15/04/2021	625.1	68.3
MB18HD20010	16/04/2021	625.1	68.2
MB18HD20010	17/04/2021	625.1	68.2
MB18HD20010	18/04/2021	625.1	68.2
MB18HD20010	19/04/2021	625.1	68.3
MB18HD20010	20/04/2021	625.1	68.3
MB18HD20010	21/04/2021	625.1	68.3
MB18HD20010	22/04/2021	625.1	68.2
MB18HD20010	23/04/2021	625.1	68.2
MB18HD20010	24/04/2021	625.1	68.2
MB18HD20010	25/04/2021	625.1	68.2
MB18HD20010	26/04/2021	625.1	68.2
MB18HD20010	27/04/2021	625.1	68.2
MB18HD20010	28/04/2021	625.1	68.2
MB18HD20010	29/04/2021	625.1	68.2
MB18HD20010	30/04/2021	625.1	68.3
MB18HD20010	1/05/2021	625.1	68.3
MB18HD20010	2/05/2021	625.1	68.3
MB18HD20010	3/05/2021	625.1	68.3
MB18HD20010	4/05/2021	625.1	68.3
MB18HD20010	5/05/2021	625.1	68.3
MB18HD20010	6/05/2021	625.1	68.3
MB18HD20010	7/05/2021	625.1	68.3
MB18HD20010	8/05/2021	625.1	68.3
MB18HD20010	9/05/2021	625.1	68.3
MB18HD20010	10/05/2021	625.1	68.3
MB18HD20010	11/05/2021	625.1	68.2
MB18HD20010	12/05/2021	625.1	68.3
MB18HD20010	13/05/2021	625.1	68.3
MB18HD20010	14/05/2021	625.1	68.2
MB18HD20010	15/05/2021	625.1	68.2
MB18HD20010	16/05/2021	625.1	68.2
MB18HD20010	17/05/2021	625.1	68.3
MB18HD20010	18/05/2021	625.1	68.3
MB18HD20010	19/05/2021	625.1	68.3
MB18HD20010	20/05/2021	625.1	68.3
MB18HD20010	21/05/2021	625.1	68.2
MB18HD20010	22/05/2021	625.1	68.3
MB18HD20010	23/05/2021	625.1	68.3
MB18HD20010	24/05/2021	625.1	68.3
MB18HD20010	25/05/2021	625.1	68.3
MB18HD20010	26/05/2021	625.1	68.2
MB18HD20010	27/05/2021	625.1	68.2
MB18HD20010	28/05/2021	625.1	68.2
MB18HD20010	29/05/2021	625.1	68.2
MB18HD20010	30/05/2021	625.1	68.3
MB18HD20010	31/05/2021	625.1	68.3
MB18HD20010	1/06/2021	625.1	68.3
MB18HD20010	2/06/2021	625.1	68.3
MB18HD20010	3/06/2021	625.1	68.2
MB18HD20010	4/06/2021	625.1	68.2
MB18HD20010	5/06/2021	625.1	68.2
MB18HD20010	6/06/2021	625.1	68.3
MB18HD20010	7/06/2021	625.1	68.3
MB18HD20010	8/06/2021	625.1	68.2
MB18HD20010	9/06/2021	625.1	68.2
MB18HD20010	10/06/2021	625

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	8/09/2013	236.1	450.4
HDVP2	7/09/2013	236.1	450.4
HDVP2	6/09/2013	236.1	450.4
HDVP2	5/09/2013	236.1	450.4
HDVP2	4/09/2013	236.1	450.4
HDVP2	3/09/2013	236.1	450.4
HDVP2	2/09/2013	236.1	450.4
HDVP2	1/09/2013	236.1	450.4
HDVP2	31/08/2013	248.3	438.3
HDVP2	30/08/2013	248.3	438.3
HDVP2	29/08/2013	248.3	438.3
HDVP2	28/08/2013	248.3	438.3
HDVP2	27/08/2013	248.3	438.3
HDVP2	26/08/2013	248.3	438.3
HDVP2	25/08/2013	248.3	438.3
HDVP2	24/08/2013	248.3	438.3
HDVP2	23/08/2013	248.3	438.3
HDVP2	22/08/2013	248.3	438.3
HDVP2	21/08/2013	248.3	438.3
HDVP2	20/08/2013	248.3	438.3
HDVP2	19/08/2013	248.3	438.3
HDVP2	18/08/2013	248.3	438.3
HDVP2	17/08/2013	248.3	438.3
HDVP2	16/08/2013	248.3	438.3
HDVP2	15/08/2013	248.3	438.3
HDVP2	14/08/2013	248.3	438.3
HDVP2	13/08/2013	248.3	438.3
HDVP2	12/08/2013	248.3	438.3
HDVP2	11/08/2013	248.3	438.3
HDVP2	10/08/2013	248.3	438.3
HDVP2	9/08/2013	248.3	438.3
HDVP2	8/08/2013	248.3	438.3
HDVP2	7/08/2013	248.3	438.3
HDVP2	6/08/2013	248.3	438.3
HDVP2	5/08/2013	248.3	438.3
HDVP2	4/08/2013	248.3	438.3
HDVP2	3/08/2013	248.3	438.3
HDVP2	2/08/2013	248.3	438.3
HDVP2	1/08/2013	248.3	438.3
HDVP2	31/07/2013	293.7	392.8
HDVP2	30/07/2013	293.7	392.8
HDVP2	29/07/2013	293.7	392.8
HDVP2	28/07/2013	293.7	392.8
HDVP2	27/07/2013	293.7	392.8
HDVP2	26/07/2013	293.7	392.8
HDVP2	25/07/2013	293.7	392.8
HDVP2	24/07/2013	293.7	392.8
HDVP2	23/07/2013	293.7	392.8
HDVP2	22/07/2013	293.7	392.8
HDVP2	21/07/2013	293.7	392.8
HDVP2	20/07/2013	293.7	392.8
HDVP2	19/07/2013	293.7	392.8
HDVP2	18/07/2013	293.7	392.8
HDVP2	17/07/2013	293.7	392.8
HDVP2	16/07/2013	293.7	392.8
HDVP2	15/07/2013	293.7	392.8
HDVP2	14/07/2013	293.7	392.8
HDVP2	13/07/2013	293.7	392.8
HDVP2	12/07/2013	293.7	392.8
HDVP2	11/07/2013	293.7	392.8
HDVP2	10/07/2013	293.7	392.8
HDVP2	9/07/2013	293.7	392.8
HDVP2	8/07/2013	293.7	392.8
HDVP2	7/07/2013	293.7	392.8
HDVP2	6/07/2013	293.7	392.8
HDVP2	5/07/2013	293.7	392.8
HDVP2	4/07/2013	293.7	392.8
HDVP2	3/07/2013	293.7	392.8
HDVP2	2/07/2013	293.7	392.8
HDVP2	1/07/2013	293.7	392.8
HDVP2	30/06/2013	298.0	388.6
HDVP2	29/06/2013	298.0	388.6
HDVP2	28/06/2013	298.0	388.6
HDVP2	27/06/2013	298.0	388.6
HDVP2	26/06/2013	298.0	388.6
HDVP2	25/06/2013	298.0	388.6
HDVP2	24/06/2013	298.0	388.6
HDVP2	23/06/2013	298.0	388.6
HDVP2	22/06/2013	298.0	388.6
HDVP2	21/06/2013	298.0	388.6
HDVP2	20/06/2013	298.0	388.6
HDVP2	19/06/2013	298.0	388.6
HDVP2	18/06/2013	298.0	388.6
HDVP2	17/06/2013	298.0	388.6
HDVP2	16/06/2013	298.0	388.6
HDVP2	15/06/2013	298.0	388.6
HDVP2	14/06/2013	298.0	388.6
HDVP2	13/06/2013	298.0	388.6
HDVP2	12/06/2013	298.0	388.6
HDVP2	11/06/2013	298.0	388.6
HDVP2	10/06/2013	298.0	388.6
HDVP2	9/06/2013	298.0	388.6
HDVP2	8/06/2013	298.0	388.6
HDVP2	7/06/2013	298.0	388.6
HDVP2	6/06/2013	298.0	388.6
HDVP2	5/06/2013	298.0	388.6
HDVP2	4/06/2013	298.0	388.6
HDVP2	3/06/2013	298.0	388.6
HDVP2	2/06/2013	298.0	388.6
HDVP2	1/06/2013	298.0	388.6
HDVP2	31/05/2013	293.3	393.2
HDVP2	30/05/2013	293.3	393.2
HDVP2	29/05/2013	293.3	393.2
HDVP2	28/05/2013	293.3	393.2
HDVP2	27/05/2013	293.3	393.2
HDVP2	26/05/2013	293.3	393.2
HDVP2	25/05/2013	293.3	393.2
HDVP2	24/05/2013	293.3	393.2
HDVP2	23/05/2013	293.3	393.2
HDVP2	22/05/2013	293.3	393.2
HDVP2	21/05/2013	293.3	393.2
HDVP2	20/05/2013	293.3	393.2
HDVP2	19/05/2013	293.3	393.2
HDVP2	18/05/2013	293.3	393.2
HDVP2	17/05/2013	293.3	393.2
HDVP2	16/05/2013	293.3	393.2
HDVP2	15/05/2013	293.3	393.2
HDVP2	14/05/2013	293.3	393.2
HDVP2	13/05/2013	293.3	393.2
HDVP2	12/05/2013	293.3	393.2
HDVP2	11/05/2013	293.3	393.2
HDVP2	10/05/2013	293.3	393.2
HDVP2	9/05/2013	293.3	393.2
HDVP2	8/05/2013	293.3	393.2
HDVP2	7/05/2013	293.3	393.2
HDVP2	6/05/2013	293.3	393.2
HDVP2	5/05/2013	293.3	393.2
HDVP2	4/05/2013	293.3	393.2
HDVP2	3/05/2013	293.3	393.2
HDVP2	2/05/2013	293.3	393.2
HDVP2	1/05/2013	293.3	393.2
HDVP2	30/04/2013	310.1	376.4
HDVP2	29/04/2013	310.1	376.4
HDVP2	28/04/2013	310.1	376.4
HDVP2	27/04/2013	310.1	376.4
HDVP2	26/04/2013	310.1	376.4

ID	Date	WL mAHD	WL mbgl
MB18WON0004	31/03/2021	614.8	62.7
MB18WON0004	30/03/2021	614.8	62.7
MB18WON0004	29/03/2021	614.8	62.6
MB18WON0004	28/03/2021	614.8	62.7
MB18WON0004	27/03/2021	614.8	62.7
MB18WON0004	26/03/2021	614.8	62.7
MB18WON0004	25/03/2021	614.7	62.7
MB18WON0004	24/03/2021	614.7	62.7
MB18WON0004	23/03/2021	614.8	62.7
MB18WON0004	22/03/2021	614.8	62.7
MB18WON0004	21/03/2021	614.8	62.7
MB18WON0004	20/03/2021	614.8	62.7
MB18WON0004	19/03/2021	614.8	62.7
MB18WON0004	18/03/2021	614.8	62.7
MB18WON0004	17/03/2021	614.8	62.7
MB18WON0004	16/03/2021	614.8	62.6
MB18WON0004	15/03/2021	614.8	62.6
MB18WON0004	14/03/2021	614.8	62.6
MB18WON0004	13/03/2021	614.8	62.7
MB18WON0004	12/03/2021	614.8	62.6
MB18WON0004	11/03/2021	614.8	62.7
MB18WON0004	10/03/2021	614.8	62.7
MB18WON0004	9/03/2021	614.8	62.7
MB18WON0004	8/03/2021	614.7	62.7
MB18WON0004	7/03/2021	614.7	62.7
MB18WON0004	6/03/2021	614.7	62.7
MB18WON0004	5/03/2021	614.8	62.7
MB18WON0004	4/03/2021	614.8	62.7
MB18WON0004	3/03/2021	614.7	62.7
MB18WON0004	2/03/2021	614.7	62.7
MB18WON0004	1/03/2021	614.7	62.7
MB18WON0004	28/02/2021	614.7	62.7
MB18WON0004	27/02/2021	614.7	62.7
MB18WON0004	26/02/2021	614.7	62.7
MB18WON0004	25/02/2021	614.7	62.7
MB18WON0004	24/02/2021	614.7	62.7
MB18WON0004	23/02/2021	614.7	62.7
MB18WON0004	22/02/2021	614.7	62.7
MB18WON0004	21/02/2021	614.7	62.7
MB18WON0004	20/02/2021	614.7	62.7
MB18WON0004	19/02/2021	614.7	62.7
MB18WON0004	18/02/2021	614.7	62.8
MB18WON0004	17/02/2021	614.7	62.8
MB18WON0004	16/02/2021	614.7	62.8
MB18WON0004	15/02/2021	614.7	62.8
MB18WON0004	14/02/2021	614.7	62.8
MB18WON0004	13/02/2021	614.7	62.8
MB18WON0004	12/02/2021	614.7	62.8
MB18WON0004	11/02/2021	614.6	62.8
MB18WON0004	10/02/2021	614.6	62.8
MB18WON0004	9/02/2021	614.6	62.8
MB18WON0004	8/02/2021	614.6	62.8
MB18WON0004	7/02/2021	614.6	62.8
MB18WON0004	6/02/2021	614.6	62.8
MB18WON0004	5/02/2021	614.6	62.8
MB18WON0004	4/02/2021	614.6	62.8
MB18WON0004	3/02/2021	614.6	62.8
MB18WON0004	2/02/2021	614.6	62.8
MB18WON0004	1/02/2021	614.6	62.8
MB18WON0004	31/01/2021	614.6	62.8
MB18WON0004	30/01/2021	614.6	62.8
MB18WON0004	29/01/2021	614.6	62.8
MB18WON0004	28/01/2021	614.6	62.8
MB18WON0004	27/01/2021	614.6	62.8
MB18WON0004	26/01/2021	614.6	62.8
MB18WON0004	25/01/2021	614.6	62.8
MB18WON0004	24/01/2021	614.6	62.8
MB18WON0004	23/01/2021	614.6	62.8
MB18WON0004	22/01/2021	614.6	62.8
MB18WON0004	21/01/2021	614.6	62.8
MB18WON0004	20/01/2021	614.6	62.8
MB18WON0004	19/01/2021	614.6	62.8
MB18WON0004	18/01/2021	614.7	62.8
MB18WON0004	17/01/2021	614.7	62.8
MB18WON0004	16/01/2021	614.7	62.8
MB18WON0004	15/01/2021	614.6	62.8
MB18WON0004	14/01/2021	614.6	62.8
MB18WON0004	13/01/2021	614.6	62.8
MB18WON0004	12/01/2021	614.6	62.8
MB18WON0004	11/01/2021	614.6	62.8
MB18WON0004	10/01/2021	614.7	62.8
MB18WON0004	9/01/2021	614.7	62.8
MB18WON0004	8/01/2021	614.7	62.8
MB18WON0004	7/01/2021	614.7	62.8
MB18WON0004	6/01/2021	614.7	62.8
MB18WON0004	5/01/2021	614.7	62.7
MB18WON0004	4/01/2021	614.6	62.8
MB18WON0004	3/01/2021	614.6	62.8
MB18WON0004	2/01/2021	614.6	62.8
MB18WON0004	1/01/2021	614.6	62.8
MB18WON0004	31/12/2020	614.6	62.8
MB18WON0004	30/12/2020	614.6	62.8
MB18WON0004	29/12/2020	614.6	62.8
MB18WON0004	28/12/2020	614.6	62.8
MB18WON0004	27/12/2020	614.6	62.8
MB18WON0004	26/12/2020	614.6	62.8
MB18WON0004	25/12/2020	614.6	62.8
MB18WON0004	24/12/2020	614.7	62.8
MB18WON0004	23/12/2020	614.7	62.8
MB18WON0004	22/12/2020	614.7	62.8
MB18WON0004	21/12/2020	614.6	62.8
MB18WON0004	20/12/2020	614.6	62.8
MB18WON0004	19/12/2020	614.6	62.8
MB18WON0004	18/12/2020	614.6	62.8
MB18WON0004	17/12/2020	614.6	62.8
MB18WON0004	16/12/2020	614.6	62.8
MB18WON0004	15/12/2020	614.6	62.8
MB18WON0004	14/12/2020	614.7	62.8
MB18WON0004	13/12/2020	614.6	62.8
MB18WON0004	12/12/2020	614.6	62.8
MB18WON0004	11/12/2020	614.6	62.8
MB18WON0004	10/12/2020	614.6	62.8
MB18WON0004	9/12/2020	614.6	62.8
MB18WON0004	8/12/2020	614.7	62.8
MB18WON0004	7/12/2020	614.7	62.7
MB18WON0004	6/12/2020	614.7	62.8
MB18WON0004	5/12/2020	614.7	62.8
MB18WON0004	4/12/2020	614.7	62.8
MB18WON0004	3/12/2020	614.7	62.8
MB18WON0004	2/12/2020	614.7	62.8
MB18WON0004	1/12/2020	614.7	62.8
MB18WON0004	30/11/2020	614.7	62.8
MB18WON0004	29/11/2020	614.6	62.8
MB18WON0004	28/11/2020	614.7	62.8
MB18WON0004	27/11/2020	614.7	62.8
MB18WON0004	26/11/2020	614.7	62.8
MB18WON0004	25/11/2020	614.7	62.8
MB18WON0004	24/11/2020	614.7	62.7
MB18WON0004	23/11/2020	614.7	62.7
MB18WON0004	22/11/2020	614.7	62.8
MB18WON0004	10/08/2020	614.8	62.7
MB18WON0004	18/03/2020	614.9	62.6
MB18WON0004	17/03/2020	614.8	62.6
MB18WON0004	16/03/2020	614.8	62.6
MB18WON0004	15/03/2020	614.8	62.6
MB18WON0004	14/03/2020	614.8	62.6

ID	Date	WL mAHD	WL mbgl
MB15HD20007	23/01/2018	626.1	86.7
MB15HD20007	24/01/2018	626.1	86.7
MB15HD20007	25/01/2018	626.0	86.7
MB15HD20007	26/01/2018	626.0	86.8
MB15HD20007	27/01/2018	626.0	86.8
MB15HD20007	28/01/2018	626.0	86.8
MB15HD20007	29/01/2018	626.0	86.8
MB15HD20007	30/01/2018	626.0	86.8
MB15HD20007	31/01/2018	626.0	86.8
MB15HD20007	1/02/2018	626.0	86.8
MB15HD20007	2/02/2018	626.0	86.8
MB15HD20007	3/02/2018	626.0	86.8
MB15HD20007	4/02/2018	626.0	86.7
MB15HD20007	5/02/2018	626.1	86.7
MB15HD20007	6/02/2018	626.1	86.7
MB15HD20007	7/02/2018	626.1	86.7
MB15HD20007	8/02/2018	626.1	86.7
MB15HD20007	9/02/2018	626.1	86.7
MB15HD20007	10/02/2018	626.1	86.7
MB15HD20007	11/02/2018	626.1	86.7
MB15HD20007	12/02/2018	626.1	86.7
MB15HD20007	13/02/2018	626.1	86.7
MB15HD20007	14/02/2018	626.1	86.7
MB15HD20007	15/02/2018	626.1	86.7
MB15HD20007	16/02/2018	626.1	86.7
MB15HD20007	17/02/2018	626.1	86.7
MB15HD20007	18/02/2018	626.1	86.7
MB15HD20007	19/02/2018	626.1	86.7
MB15HD20007	20/02/2018	626.0	86.8
MB15HD20007	21/02/2018	626.0	86.8
MB15HD20007	22/02/2018	626.0	86.8
MB15HD20007	23/02/2018	626.1	86.7
MB15HD20007	24/02/2018	626.1	86.7
MB15HD20007	25/02/2018	626.1	86.7
MB15HD20007	26/02/2018	626.1	86.7
MB15HD20007	27/02/2018	626.1	86.7
MB15HD20007	28/02/2018	626.1	86.7
MB15HD20007	1/03/2018	626.1	86.7
MB15HD20007	2/03/2018	626.1	86.7
MB15HD20007	3/03/2018	626.1	86.7
MB15HD20007	4/03/2018	626.1	86.7
MB15HD20007	5/03/2018	626.1	86.7
MB15HD20007	6/03/2018	626.1	86.7
MB15HD20007	7/03/2018	626.1	86.7
MB15HD20007	8/03/2018	626.1	86.7
MB15HD20007	9/03/2018	626.1	86.7
MB15HD20007	10/03/2018	626.1	86.7
MB15HD20007	11/03/2018	626.1	86.7
MB15HD20007	12/03/2018	626.1	86.7
MB15HD20007	13/03/2018	626.1	86.7
MB15HD20007	14/03/2018	626.1	86.7
MB15HD20007	15/03/2018	626.1	86.7
MB15HD20007	16/03/2018	626.1	86.7
MB15HD20007	17/03/2018	626.1	86.7
MB15HD20007	18/03/2018	626.1	86.7
MB15HD20007	19/03/2018	626.1	86.7
MB15HD20007	20/03/2018	626.1	86.7
MB15HD20007	21/03/2018	626.1	86.7
MB15HD20007	22/03/2018	626.1	86.7
MB15HD20007	23/03/2018	626.1	86.7
MB15HD20007	24/03/2018	626.2	86.6
MB15HD20007	25/03/2018	626.2	86.6
MB15HD20007	26/03/2018	626.2	86.6
MB15HD20007	27/03/2018	626.1	86.7
MB15HD20007	28/03/2018	626.1	86.7
MB15HD20007	29/03/2018	626.1	86.7
MB15HD20007	30/03/2018	626.1	86.7
MB15HD20007	31/03/2018	626.1	86.7
MB15HD20007	1/04/2018	626.1	86.7
MB15HD20007	2/04/2018	626.1	86.7
MB15HD20007	3/04/2018	626.1	86.7
MB15HD20007	4/04/2018	626.1	86.7
MB15HD20007	5/04/2018	626.1	86.7
MB15HD20007	6/04/2018	626.1	86.7
MB15HD20007	7/04/2018	626.1	86.7
MB15HD20007	8/04/2018	626.1	86.7
MB15HD20007	9/04/2018	626.1	86.7
MB15HD20007	10/04/2018	626.1	86.7
MB15HD20007	11/04/2018	626.1	86.7
MB15HD20007	12/04/2018	626.1	86.7
MB15HD20007	24/11/2018	625.9	86.9
MB15HD20007	25/11/2018	625.9	86.9
MB15HD20007	26/11/2018	625.9	86.9
MB15HD20007	27/11/2018	625.9	86.9
MB15HD20007	28/11/2018	625.9	86.9
MB15HD20007	29/11/2018	625.9	86.9
MB15HD20007	30/11/2018	625.9	86.9
MB15HD20007	1/12/2018	625.9	86.9
MB15HD20007	2/12/2018	625.9	86.9
MB15HD20007	3/12/2018	625.9	86.9
MB15HD20007	4/12/2018	625.9	86.9
MB15HD20007	5/12/2018	625.9	86.9
MB15HD20007	6/12/2018	625.9	86.9
MB15HD20007	7/12/2018	625.9	86.9
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MB15HD20007	9/12/2018	625.9	86.9
MB15HD20007	10/12/2018	625.9	86.9
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MB15HD20007	14/12/2018	625.9	86.9
MB15HD20007	15/12/2018	625.9	86.9
MB15HD20007	16/12/2018	625.9	86.9
MB15HD20007	17/12/2018	625.9	86.9
MB15HD20007	18/12/2018	625.9	86.9
MB15HD20007	19/12/2018	625.9	86.9
MB15HD20007	20/12/2018	625.9	86.9
MB15HD20007	21/12/2018	625.9	86.9
MB15HD20007	22/12/2018	625.9	86.9
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MB15HD20007	24/12/2018	625.9	86.9
MB15HD20007	25/12/2018	625.9	86.9
MB15HD20007	26/12/2018	625.9	86.9
MB15HD20007	27/12/2018	625.9	86.9
MB15HD20007	28/12/2018	625.9	86.9
MB15HD20007	29/12/2018	625.9	86.9
MB15HD20007	30/12/2018	625.9	86.9
MB15HD20007	31/12/2018	625.9	86.9
MB15HD20007	1/01/2019	625.9	86.9
MB15HD20007	2/01/2019	625.9	86.9
MB15HD20007	3/01/2019	625.9	86.9
MB15HD20007	4/01/2019	625.9	86.9
MB15HD20007	5/01/2019	625.9	86.9
MB15HD20007	6/01/2019	625.9	86.9
MB15HD20007	7/01/2019	625.9	86.9
MB15HD20007	8/01/2019	625.9	86.9
MB15HD20007	9/01/2019	625.9	86.9
MB15HD20007	10/01/2019	625.9	86.9
MB15HD20007	11/01/2019	625.9	86.9
MB15HD20007	12/01/2019	625.9	86.9
MB15HD20007	13/01/2019	625.9	86.9
MB15HD20007	14/01/2019	625.9	86.9
MB15HD20007	15/01/2019	625.9	86.9
MB15HD20007	16/01/2019	625.9	86.9
MB15HD20007	17/01/2019	625.9	86.9
MB15HD20007	18/01/2019	625.9	86.9

ID	Date	WL mAHD	WL mbgl
MB18HD20010	21/07/2021	625.1	68.3
MB18HD20010	22/07/2021	625.1	68.3
MB18HD20010	23/07/2021	625.1	68.3
MB18HD20010	24/07/2021	625.1	68.3
MB18HD20010	25/07/2021	625.1	68.3
MB18HD20010	26/07/2021	625.1	68.3
MB18HD20010	27/07/2021	625.1	68.3
MB18HD20010	28/07/2021	625.1	68.3
MB18HD20010	29/07/2021	625.1	68.3
MB18HD20010	30/07/2021	625.1	68.3
MB18HD20010	31/07/2021	625.1	68.3
MB18HD20010	1/08/2021	625.1	68.3
MB18HD20010	2/08/2021	625.1	68.3
MB18HD20010	3/08/2021	625.1	68.2
MB18HD20010	4/08/2021	625.2	68.2
MB18HD20010	5/08/2021	625.2	68.2
MB18HD20010	6/08/2021	625.2	68.2
MB18HD20010	7/08/2021	625.1	68.2
MB18HD20010	8/08/2021	625.1	68.2
MB18HD20010	9/08/2021	625.1	68.3
MB18HD20010	10/08/2021	625.1	68.3
MB18HD20010	11/08/2021	625.1	68.2
MB18HD20010	12/08/2021	625.2	68.2
MB18HD20010	13/08/2021	625.1	68.2
MB18HD20010	14/08/2021	625.1	68.3
MB18HD20010	15/08/2021	625.1	68.3
MB18HD20010	16/08/2021	625.1	68.2
MB18HD20010	17/08/2021	625.1	68.2
MB18HD20010	18/08/2021	625.1	68.3
MB18HD20010	19/08/2021	625.1	68.3
MB18HD20010	20/08/2021	625.1	68.3
MB18HD20010	21/08/2021	625.1	68.3
MB18HD20010	22/08/2021	625.1	68.3
MB18HD20010	23/08/2021	625.1	68.3
MB18HD20010	24/08/2021	625.1	68.3
MB18HD20010	25/08/2021	625.1	68.3
MB18HD20010	26/08/2021	625.1	68.3
MB18HD20010	27/08/2021	625.1	68.3
MB18HD20010	28/08/2021	625.1	68.3
MB18HD20010	29/08/2021	625.1	68.3
MB18HD20010	30/08/2021	625.1	68.3
MB18HD20010	31/08/2021	625.1	68.3
MB18HD20010	1/09/2021	625.1	68.3
MB18HD20010	2/09/2021	625.1	68.3
MB18HD20010	3/09/2021	625.1	68.3
MB18HD20010	4/09/2021	625.1	68.3
MB18HD20010	5/09/2021	625.1	68.2
MB18HD20010	6/09/2021	625.1	68.2
MB18HD20010	7/09/2021	625.1	68.2
MB18HD20010	8/09/2021	625.1	68.2
MB18HD20010	9/09/2021	625.1	68.2
MB18HD20010	10/09/2021	625.1	68.3
MB18HD20010	11/09/2021	625.1	68.3
MB18HD20010	12/09/2021	625.1	68.3
MB18HD20010	13/09/2021	625.1	68.3
MB18HD20010	14/09/2021	625.1	68.3
MB18HD20010	15/09/2021	625.1	68.3
MB18HD20010	16/09/2021	625.1	68.3
MB18HD20010	17/09/2021	625.1	68.3
MB18HD20010	18/09/2021	625.1	68.3
MB18HD20010	19/09/2021	625.1	68.3
MB18HD20010	20/09/2021	625.1	68.2
MB18HD20010	21/09/2021	625.1	68.2
MB18HD20010	22/09/2021	625.1	68.2
MB18HD20010	23/09/2021	625.1	68.3
MB18HD20010	24/09/2021	625.1	68.3
MB18HD20010	25/09/2021	625.0	68.3
MB18HD20010	26/09/2021	625.0	68.3
MB18HD20010	27/09/2021	625.0	68.3
MB18HD20010	28/09/2021	625.1	68.3
MB18HD20010	29/09/2021	625.1	68.3
MB18HD20010	30/09/2021	625.0	68.3
MB18HD20010	1/10/2021	625.0	68.3
MB18HD20010	2/10/2021	625.0	68.3
MB18HD20010	3/10/2021	625.0	68.3
MB18HD20010	4/10/2021	625.0	68.3
MB18HD20010	5/10/2021	625.0	68.4
MB18HD20010	6/10/2021	625.0	68.3
MB18HD20010	7/10/2021	625.0	68.3
MB18HD20010	8/10/2021	625.0	68.3
MB18HD20010	9/10/2021	625.0	68.3
MB18HD20010	10/10/2021	625.1	68.3
MB18HD20010	11/10/2021	625.0	68.3
MB18HD20010	12/10/2021	625.0	68.3
MB18HD20010	13/10/2021	625.1	68.3
MB18HD20010	14/10/2021	625.1	68.3
MB18HD20010	15/10/2021	625.0	68.3
MB18HD20010	16/10/2021	625.0	68.3
MB18HD20010	17/10/2021	625.0	68.3
MB18HD20010	18/10/2021	625.0	68.3
MB18HD20010	19/10/2021	625.0	68.3
MB18HD20010	20/10/2021	625.1	68.3
MB18HD20010	21/10/2021	625.1	68.3
MB18HD20010	22/10/2021	625.1	68.3
MB18HD20010	23/10/2021	625.1	68.3
MB18HD20010	24/10/2021	625

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	25/04/2013	310.1	376.4
HDVP2	24/04/2013	310.1	376.4
HDVP2	23/04/2013	310.1	376.4
HDVP2	22/04/2013	310.1	376.4
HDVP2	21/04/2013	310.1	376.4
HDVP2	20/04/2013	310.1	376.4
HDVP2	19/04/2013	310.1	376.4
HDVP2	18/04/2013	310.1	376.4
HDVP2	17/04/2013	310.1	376.4
HDVP2	16/04/2013	310.1	376.4
HDVP2	15/04/2013	310.1	376.4
HDVP2	14/04/2013	310.1	376.4
HDVP2	13/04/2013	310.1	376.4
HDVP2	12/04/2013	310.1	376.4
HDVP2	11/04/2013	310.1	376.4
HDVP2	10/04/2013	310.1	376.4
HDVP2	9/04/2013	310.1	376.4
HDVP2	8/04/2013	310.1	376.4
HDVP2	7/04/2013	310.1	376.4
HDVP2	6/04/2013	310.1	376.4
HDVP2	5/04/2013	310.1	376.4
HDVP2	4/04/2013	310.1	376.4
HDVP2	3/04/2013	310.1	376.4
HDVP2	2/04/2013	310.1	376.4
HDVP2	1/04/2013	310.1	376.4
HDVP2	31/03/2013	270.4	416.1
HDVP2	30/03/2013	270.4	416.1
HDVP2	29/03/2013	270.4	416.1
HDVP2	28/03/2013	270.4	416.1
HDVP2	27/03/2013	270.4	416.1
HDVP2	26/03/2013	270.4	416.1
HDVP2	25/03/2013	270.4	416.1
HDVP2	24/03/2013	270.4	416.1
HDVP2	23/03/2013	270.4	416.1
HDVP2	22/03/2013	270.4	416.1
HDVP2	21/03/2013	270.4	416.1
HDVP2	20/03/2013	270.4	416.1
HDVP2	19/03/2013	270.4	416.1
HDVP2	18/03/2013	270.4	416.1
HDVP2	17/03/2013	270.4	416.1
HDVP2	16/03/2013	270.4	416.1
HDVP2	15/03/2013	270.4	416.1
HDVP2	14/03/2013	270.4	416.1
HDVP2	13/03/2013	270.4	416.1
HDVP2	12/03/2013	270.4	416.1
HDVP2	11/03/2013	270.4	416.1
HDVP2	10/03/2013	270.4	416.1
HDVP2	9/03/2013	270.4	416.1
HDVP2	8/03/2013	270.4	416.1
HDVP2	7/03/2013	270.4	416.1
HDVP2	6/03/2013	270.4	416.1
HDVP2	5/03/2013	270.4	416.1
HDVP2	4/03/2013	270.4	416.1
HDVP2	3/03/2013	270.4	416.1
HDVP2	2/03/2013	270.4	416.1
HDVP2	1/03/2013	244.5	442.0
HDVP2	28/02/2013	244.5	442.0
HDVP2	27/02/2013	244.5	442.0
HDVP2	26/02/2013	244.5	442.0
HDVP2	25/02/2013	244.5	442.0
HDVP2	24/02/2013	244.5	442.0
HDVP2	23/02/2013	244.5	442.0
HDVP2	22/02/2013	244.5	442.0
HDVP2	21/02/2013	244.5	442.0
HDVP2	20/02/2013	244.5	442.0
HDVP2	19/02/2013	244.5	442.0
HDVP2	18/02/2013	244.5	442.0
HDVP2	17/02/2013	244.5	442.0
HDVP2	16/02/2013	244.5	442.0
HDVP2	15/02/2013	244.5	442.0
HDVP2	14/02/2013	244.5	442.0
HDVP2	13/02/2013	244.5	442.0
HDVP2	12/02/2013	244.5	442.0
HDVP2	11/02/2013	244.5	442.0
HDVP2	10/02/2013	244.5	442.0
HDVP2	9/02/2013	244.5	442.0
HDVP2	8/02/2013	244.5	442.0
HDVP2	7/02/2013	244.5	442.0
HDVP2	6/02/2013	244.5	442.0
HDVP2	5/02/2013	244.5	442.0
HDVP2	4/02/2013	244.5	442.0
HDVP2	3/02/2013	244.5	442.0
HDVP2	2/02/2013	244.5	442.0
HDVP2	1/02/2013	244.5	442.0
HDVP2	31/01/2013	201.7	484.8
HDVP2	30/01/2013	201.7	484.8
HDVP2	29/01/2013	201.7	484.8
HDVP2	28/01/2013	201.7	484.8
HDVP2	27/01/2013	201.7	484.8
HDVP2	26/01/2013	201.7	484.8
HDVP2	25/01/2013	201.7	484.8
HDVP2	24/01/2013	201.7	484.8
HDVP2	23/01/2013	201.7	484.8
HDVP2	22/01/2013	201.7	484.8
HDVP2	21/01/2013	201.7	484.8
HDVP2	20/01/2013	201.7	484.8
HDVP2	19/01/2013	201.7	484.8
HDVP2	18/01/2013	201.7	484.8
HDVP2	17/01/2013	201.7	484.8
HDVP2	16/01/2013	201.7	484.8
HDVP2	15/01/2013	201.7	484.8
HDVP2	14/01/2013	201.7	484.8
HDVP2	13/01/2013	201.7	484.8
HDVP2	12/01/2013	201.7	484.8
HDVP2	11/01/2013	201.7	484.8
HDVP2	10/01/2013	201.7	484.8
HDVP2	9/01/2013	201.7	484.8
HDVP2	8/01/2013	201.7	484.8
HDVP2	7/01/2013	201.7	484.8
HDVP2	6/01/2013	201.7	484.8
HDVP2	5/01/2013	201.7	484.8
HDVP2	4/01/2013	201.7	484.8
HDVP2	3/01/2013	201.7	484.8
HDVP2	2/01/2013	201.7	484.8
HDVP2	1/01/2013	201.7	484.8
HDVP2	31/12/2012	194.0	492.6
HDVP2	30/12/2012	194.0	492.6
HDVP2	29/12/2012	194.0	492.6
HDVP2	28/12/2012	194.0	492.6
HDVP2	27/12/2012	194.0	492.6
HDVP2	26/12/2012	194.0	492.6
HDVP2	25/12/2012	194.0	492.6
HDVP2	24/12/2012	194.0	492.6
HDVP2	23/12/2012	194.0	492.6
HDVP2	22/12/2012	194.0	492.6
HDVP2	21/12/2012	194.0	492.6
HDVP2	20/12/2012	194.0	492.6
HDVP2	19/12/2012	194.0	492.6
HDVP2	18/12/2012	194.0	492.6
HDVP2	17/12/2012	194.0	492.6
HDVP2	16/12/2012	194.0	492.6
HDVP2	15/12/2012	194.0	492.6
HDVP2	14/12/2012	194.0	492.6
HDVP2	13/12/2012	194.0	492.6
HDVP2	12/12/2012	194.0	492.6
HDVP2	11/12/2012	194.0	492.6

ID	Date	WL mAHD	WL mbgl
MB18WON0004	13/03/2020	614.8	62.6
MB18WON0004	12/03/2020	614.8	62.6
MB18WON0004	11/03/2020	614.8	62.6
MB18WON0004	10/03/2020	614.8	62.6
MB18WON0004	9/03/2020	614.8	62.6
MB18WON0004	8/03/2020	614.8	62.6
MB18WON0004	7/03/2020	614.8	62.6
MB18WON0004	6/03/2020	614.8	62.6
MB18WON0004	5/03/2020	614.8	62.7
MB18WON0004	4/03/2020	614.8	62.7
MB18WON0004	3/03/2020	614.8	62.6
MB18WON0004	2/03/2020	614.8	62.7
MB18WON0004	1/03/2020	614.7	62.7
MB18WON0004	29/02/2020	614.7	62.7
MB18WON0004	28/02/2020	614.8	62.7
MB18WON0004	27/02/2020	614.8	62.7
MB18WON0004	26/02/2020	614.8	62.7
MB18WON0004	25/02/2020	614.8	62.7
MB18WON0004	24/02/2020	614.8	62.7
MB18WON0004	23/02/2020	614.8	62.7
MB18WON0004	22/02/2020	614.8	62.7
MB18WON0004	21/02/2020	614.8	62.7
MB18WON0004	20/02/2020	614.8	62.7
MB18WON0004	19/02/2020	614.8	62.7
MB18WON0004	18/02/2020	614.8	62.7
MB18WON0004	17/02/2020	614.8	62.7
MB18WON0004	16/02/2020	614.8	62.7
MB18WON0004	15/02/2020	614.8	62.7
MB18WON0004	14/02/2020	614.7	62.7
MB18WON0004	13/02/2020	614.7	62.7
MB18WON0004	12/02/2020	614.7	62.7
MB18WON0004	11/02/2020	614.7	62.7
MB18WON0004	10/02/2020	614.7	62.8
MB18WON0004	9/02/2020	614.6	62.8
MB18WON0004	8/02/2020	614.7	62.7
MB18WON0004	7/02/2020	614.7	62.7
MB18WON0004	6/02/2020	614.7	62.7
MB18WON0004	5/02/2020	614.7	62.7
MB18WON0004	4/02/2020	614.7	62.7
MB18WON0004	3/02/2020	614.7	62.7
MB18WON0004	2/02/2020	614.7	62.7
MB18WON0004	1/02/2020	614.7	62.7
MB18WON0004	31/01/2020	614.7	62.8
MB18WON0004	30/01/2020	614.7	62.8
MB18WON0004	29/01/2020	614.7	62.8
MB18WON0004	28/01/2020	614.7	62.7
MB18WON0004	27/01/2020	614.7	62.7
MB18WON0004	26/01/2020	614.7	62.7
MB18WON0004	25/01/2020	614.7	62.7
MB18WON0004	24/01/2020	614.7	62.7
MB18WON0004	23/01/2020	614.7	62.8
MB18WON0004	22/01/2020	614.7	62.8
MB18WON0004	21/01/2020	614.6	62.8
MB18WON0004	20/01/2020	614.6	62.8
MB18WON0004	19/01/2020	614.7	62.8
MB18WON0004	18/01/2020	614.6	62.8
MB18WON0004	17/01/2020	614.6	62.8
MB18WON0004	16/01/2020	614.6	62.8
MB18WON0004	15/01/2020	614.6	62.8
MB18WON0004	14/01/2020	614.6	62.8
MB18WON0004	13/01/2020	614.6	62.8
MB18WON0004	12/01/2020	614.6	62.8
MB18WON0004	11/01/2020	614.6	62.8
MB18WON0004	10/01/2020	614.6	62.8
MB18WON0004	9/01/2020	614.5	62.9
MB18WON0004	8/01/2020	614.5	62.9
MB18WON0004	7/01/2020	614.6	62.9
MB18WON0004	6/01/2020	614.6	62.8
MB18WON0004	5/01/2020	614.6	62.8
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MB18WON0004	3/01/2020	614.6	62.8
MB18WON0004	2/01/2020	614.6	62.8
MB18WON0004	1/01/2020	614.6	62.8
MB18WON0004	31/12/2019	614.6	62.8
MB18WON0004	30/12/2019	614.6	62.8
MB18WON0004	29/12/2019	614.6	62.8
MB18WON0004	28/12/2019	614.6	62.8
MB18WON0004	27/12/2019	614.6	62.8
MB18WON0004	26/12/2019	614.6	62.8
MB18WON0004	25/12/2019	614.6	62.8
MB18WON0004	24/12/2019	614.6	62.8
MB18WON0004	23/12/2019	614.6	62.8
MB18WON0004	22/12/2019	614.6	62.8
MB18WON0004	21/12/2019	614.6	62.8
MB18WON0004	20/12/2019	614.6	62.8
MB18WON0004	19/12/2019	614.6	62.8
MB18WON0004	18/12/2019	614.6	62.8
MB18WON0004	17/12/2019	614.6	62.8
MB18WON0004	16/12/2019	614.6	62.8
MB18WON0004	15/12/2019	614.6	62.8
MB18WON0004	14/12/2019	614.6	62.8
MB18WON0004	13/12/2019	614.6	62.8
MB18WON0004	12/12/2019	614.7	62.8
MB18WON0004	11/12/2019	614.7	62.8
MB18WON0004	10/12/2019	614.7	62.8
MB18WON0004	9/12/2019	614.7	62.8
MB18WON0004	8/12/2019	614.7	62.8
MB18WON0004	7/12/2019	614.6	62.8
MB18WON0004	6/12/2019	614.6	62.8
MB18WON0004	5/12/2019	614.7	62.8
MB18WON0004	4/12/2019	614.7	62.8
MB18WON0004	3/12/2019	614.7	62.8
MB18WON0004	2/12/2019	614.7	62.8
MB18WON0004	1/12/2019	614.7	62.7
MB18WON0004	30/11/2019	614.7	62.7
MB18WON0004	29/11/2019	614.6	62.8
MB18WON0004	28/11/2019	614.6	62.8
MB18WON0004	27/11/2019	614.6	62.8
MB18WON0004	26/11/2019	614.6	62.8
MB18WON0004	25/11/2019	614.6	62.8
MB18WON0004	24/11/2019	614.6	62.8
MB18WON0004	23/11/2019	614.7	62.8
MB18WON0004	22/11/2019	614.7	62.8
MB18WON0004	21/11/2019	614.7	62.8
MB18WON0004	20/11/2019	614.7	62.8
MB18WON0004	19/11/2019	614.6	62.8
MB18WON0004	18/11/2019	614.7	62.8
MB18WON0004	17/11/2019	614.7	62.7
MB18WON0004	16/11/2019	614.7	62.7
MB18WON0004	15/11/2019	614.7	62.7
MB18WON0004	14/11/2019	614.7	62.8
MB18WON0004	13/11/2019	614.7	62.7
MB18WON0004	12/11/2019	614.7	62.7
MB18WON0004	11/11/2019	614.7	62.8
MB18WON0004	10/11/2019	614.7	62.8
MB18WON0004	9/11/2019	614.7	62.7
MB18WON0004	8/11/2019	614.7	62.7
MB18WON0004	7/11/2019	614.7	62.7
MB18WON0004	6/11/2019	614.7	62.7
MB18WON0004	5/11/2019	614.7	62.7
MB18WON0004	4/11/2019	614.7	62.7
MB18WON0004	3/11/2019	614.7	62.7
MB18WON0004	2/11/2019	614.7	62.7
MB18WON0004	1/11/2019	614.7	62.8
MB18WON0004	31/10/2019	614.7	62.8
MB18WON0004	30/10/2019	614.7	62.8

ID	Date	WL mAHD	WL mbgl
MB15HD20007	19/01/2019	625.9	86.9
MB15HD20007	20/01/2019	625.9	86.9
MB15HD20007	21/01/2019	625.9	86.9
MB15HD20007	22/01/2019	625.9	86.9
MB15HD20007	23/01/2019	625.9	86.9
MB15HD20007	24/01/2019	625.9	86.9
MB15HD20007	25/01/2019	625.9	86.9
MB15HD20007	26/01/2019	625.9	86.9
MB15HD20007	27/01/2019	625.9	86.9
MB15HD20007	28/01/2019	625.9	86.9
MB15HD20007	29/01/2019	625.9	86.9
MB15HD20007	30/01/2019	625.9	86.9
MB15HD20007	31/01/2019	625.9	86.9
MB15HD20007	1/02/2019	625.9	86.9
MB15HD20007	2/02/2019	625.9	86.9
MB15HD20007	3/02/2019	625.9	86.9
MB15HD20007	4/02/2019	625.9	86.9
MB15HD20007	5/02/2019	625.9	86.9
MB15HD20007	6/02/2019	625.9	86.9
MB15HD20007	7/02/2019	625.9	86.9
MB15HD20007	8/02/2019	625.9	86.9
MB15HD20007	9/02/2019	625.9	86.9
MB15HD20007	10/02/2019	625.9	86.9
MB15HD20007	11/02/2019	625.9	86.9
MB15HD20007	12/02/2019	625.9	86.9
MB15HD20007	13/02/2019	625.9	86.9
MB15HD20007	14/02/2019	625.9	86.9
MB15HD20007	15/02/2019	625.9	86.9
MB15HD20007	16/02/2019	625.9	86.9
MB15HD20007	17/02/2019	625.9	86.9
MB15HD20007	18/02/2019	625.9	86.9
MB15HD20007	19/02/2019	625.9	86.9
MB15HD20007	20/02/2019	625.9	86.9
MB15HD20007	21/02/2019	625.9	86.9
MB15HD20007	22/02/2019	625.9	86.9
MB15HD20007	23/02/2019	625.9	86.9
MB15HD20007	24/02/2019	625.9	86.9
MB15HD20007	25/02/2019	625.9	86.9
MB15HD20007	26/02/2019	625.9	86.9
MB15HD20007	27/02/2019	625.9	86.9
MB15HD20007	28/02/2019	625.9	86.9
MB15HD20007	1/03/2019	625.9	86.9
MB15HD20007	2/03/2019	625.9	86.9
MB15HD20007	3/03/2019	625.9	86.9
MB15HD20007	4/03/2019	625.9	86.9
MB15HD20007	5/03/2019	625.9	86.9
MB15HD20007	6/03/2019	625.9	86.9
MB15HD20007	7/03/2019	625.9	86.9
MB15HD20007	8/03/2019	625.9	86.9
MB15HD20007	9/03/2019	625.9	86.9
MB15HD20007	10/03/2019	625.9	86.9
MB15HD20007	11/03/2019	625.9	86.9
MB15HD20007	12/03/2019	625.9	86.9
MB15HD20007	13/03/2019	625.9	86.9
MB15HD20007	14/03/2019	625.9	86.8
MB15HD20007	15/03/2019	625.9	86.9
MB15HD20007	16/03/2019	625.9	86.9
MB15HD20007	17/03/2019	625.9	86.9
MB15HD20007	18/03/2019	625.9	86.9
MB15HD20007	19/03/2019	625.9	86.9
MB15HD20007	20/03/2019	625.9	86.9
MB15HD20007	21/03/2019	625.9	86.9
MB15HD20007	22/03/2019	625.9	86.9
MB15HD20007	23/03/2019	625.9	86.9
MB15HD20007	24/03/2019	625.9	86.9
MB15HD20007	25/03/2019	625.9	86.9
MB15HD20007	26/03/2019	625.9	86.9
MB15HD20007	27/03/2019	625.9	86.9
MB15HD20007	28/03/2019	625.9	86.9
MB15HD20007	29/03/2019	625.9	86.9
MB15HD20007	30/03/2019	625.9	86.9
MB15HD20007	31/03/2019	625.9	86.8
MB15HD20007	1/04/2019	626.0	86.8
MB15HD20007	2/04/2019	626.0	86.8
MB15HD20007	3/04/2019	626.0	86.8
MB15HD20007	4/04/2019	626.0	86.8
MB15HD20007	5/04/2019	626.0	86.8
MB15HD20007	6/04/2019	626.0	86.8
MB15HD20007	7/04/2019	626.0	86.8
MB15HD20007	8/04/2019	625.9	86.8
MB15HD20007	9/04/2019	625.9	86.8
MB15HD20007	10/04/2019	625.9	86.8
MB15HD20007	11/04/2019	625.9	86.8
MB15HD20007	12/04/2019	625.9	86.8
MB15HD20007	13/04/2019	626.0	86.8
MB15HD20007	14/04/2019	626.0	86.8
MB15HD20007	15/04/2019	625.9	86.8
MB15HD20007	16/04/2019	625.9	86.8
MB15HD20007	17/04/2019	625.9	86.8
MB15HD20007	18/04/2019	626.0	86.8
MB15HD20007	19/04/2019	625.9	86.8
MB15HD20007	20/04/2019	625.9	86.8
MB15HD20007	21/04/2019	626.0	86.8
MB15HD20007	22/04/2019	626.0	86.8
MB15HD20007	23/04/2019	626.0	86.8
MB15HD20007	24/04/2019	626.0	86.8
MB15HD20007	25/04/2019	626.0	86.8
MB15HD20007	26/04/2019	626.0	86.8
MB15HD20007	27/04/2019	626.0	86.8
MB15HD20007	28/04/2019	626.0	86.8
MB15HD20007	29/04/2019	626.0	86.8
MB15HD20007	30/04/2019	626.0	86.8
MB15HD20007	1/05/2019	626.0	86.8
MB15HD20007	2/05/2019	626.0	86.8
MB15HD20007	3/05/2019	626.0	86.8
MB15HD20007	4/05/2019	626.0	86.8
MB15HD20007	5/05/2019	626.0	86.8
MB15HD20007	6/05/2019	626.0	86.8
MB15HD20007	7/05/2019	626.0	86.8
MB15HD20007	8/05/2019	626.0	86.8
MB15HD20007	9/05/2019	626.0	86.8
MB15HD20007	10/05/2019	626.0	86.8
MB15HD20007	11/05/2019	626.0	86.8
MB15HD20007	12/05/2019	626.0	86.8
MB15HD20007	13/05/2019	626.0	86.8
MB15HD20007	14/05/2019	626.0	86.8
MB15HD20007	15/05/2019	626.0	86.8
MB15HD20007	16/05/2019	626.0	86.8
MB15HD20007	17/05/2019	626.0	86.8
MB15HD20007	18/05/2019	626.0	86.8
MB15HD20007	19/05/2019	626.0	86.8
MB15HD20007	20/05/2019	626.0	86.8
MB15HD20007	21/05/2019	626.0	86.8
MB15HD20007	22/05/2019	626.0	86.8
MB15HD20007	23/05/2019	626.0	86.8
MB15HD20007	24/05/2019	626.0	86.8
MB15HD20007	25/05/2019	626.0	86.8
MB15HD20007	26/05/2019	626.0	86.8
MB15HD20007	27/05/2019	626.0	86.8
MB15HD20007	28/05/2019	626.0	86.8
MB15HD20007	29/05/2019	626.0	86.8
MB15HD20007	30/05/2019	626.0	86.8
MB15HD20007	31/05/2019	626.0	86.8
MB15HD20007	1/06/2019	626.0	86.8
MB15HD20007	2/06/2019	626.0	86.8
MB15HD20007	3/06/2019	626.0	86.8

ID	Date	WL mAHD	WL mbgl
MB18HD20010	8/12/2021	625.0	68.4
MB18HD20010	9/12/2021	625.0	68.4
MB18HD20010	10/12/2021	625.0	68.4
MB18HD20010	11/12/2021	625.0	68.4
MB18HD20010	12/12/2021	625.0	68.4
MB18HD20010	13/12/2021	625.0	68.4
MB18HD20010	14/12/2021	625.0	68.4
MB18HD20010	15/12/2021	625.0	68.4
MB18HD20010	16/12/2021	625.0	68.4
MB18HD20010	17/12/2021	625.0	68.4
MB18HD20010	18/12/2021	625.0	68.4
MB18HD20010	19/12/2021	625.0	68.3
MB18HD20010	20/12/2021	625.0	68.3
MB18HD20010	21/12/2021	625.0	68.4
MB18HD20010	22/12/2021	625.0	68.4
MB18HD20010	23/12/2021	625.0	68.4
MB18HD20010	24/12/2021	625.0	68.4
MB18HD20010	25/12/2021	625.0	68.4
MB18HD20010	26/12/2021	625.0	68.4
MB18HD20010	30/12/2021	625.0	68.4
MB18HD20010	31/12/2021	625.0	68.4
MB18HD20010	1/01/2022	625.0	68.4
MB18HD20010	2/01/2022	625.0	68.4
MB18HD20010	3/01/2022	625.0	68.4
MB18HD20010	4/01/2022	625.0	68.4
MB18HD20010	5/01/2022	625.0	68.4
MB18HD20010	6/01/2022	625.0	68.4
MB18HD20010	7/01/2022	625.0	68.4
MB18HD20010	8/01/2022	625.0	68.4
MB18HD20010	9/01/2022	625.0	68.4
MB18HD20010	10/01/2022	625.0	68.4
MB18HD20010	11/01/2022	625.0	68.3
MB18HD20010	12/01/2022	625.0	68.3
MB18HD20010	13/01/2022	625.0	68.4
MB18HD20010	14/01/2022	625.0	68.4
MB18HD20010	15/01/2022	625.0	68.4
MB18HD20010	16/01/2022	624.9	68.4
MB18HD20010	17/01/2022	624.9	68.4
MB18HD20010	18/01/2022	625.0	68.4
MB18HD20010	19/01/2022	625.0	68.4
MB18HD20010	20/01/2022	625.0	68.4
MB18HD20010	21/01/2022	625.0	68.4
MB18HD20010	22/01/2022	625.0	68.4
MB18HD20010	23/01/2022	625.0	68.4
MB18HD20010	24/01/2022	624.9	68.5
MB18HD20010	31/01/2022	624.8	68.5
MB18HD20010	1/02/2022	624.8	68.5
MB18HD20010	2/02/2022	624.8	68.5
MB18HD20010	18/02/2022	624.9	68.5
MB18HD20010	19/02/2022	624.9	68.5
MB18HD20010	20/02/2022	624.9	68.5
MB18HD20010	21/02/2022	624.8	68.5
MB18HD20010	22/02/2022	624.8	68.6
MB18HD20010	23/02/2022	624.8	68.5
MB18HD20010	24/02/2022	624.8	68.5
MB18HD20010	25/02/2022	624.8	68.5
MB18HD20010	26/02/2022	624.8	68.5
MB18HD20010	27/02/2022	624.8	68.6
MB18HD20010	28/02/2022	624.8	68.6
MB18HD20010	1/03/2022	624.8	68.6
MB18HD20010	2/03/2022	624.8	68.6
MB18HD20010	3/03/2022	624.8	68.6
MB18HD20010	4/03/2022	624.8	68.5
MB18HD20010	5/03/2022	624.9	68.5
MB18HD20010	6/03/2022	624.9	68.5
MB18HD20010	7/03/2022	624.9	68.5
MB18HD20010	8/03/2022	624.8	68.5
MB18HD20010	9/03/2022	624.9	68.5
MB18HD20010	10/03/2022	624.8	68.5
MB18HD20010	11/03/2022	624.8	68.5
MB18HD20010	12/03/2022	624.8	68.5
MB18HD20010	13/03/2022	624.8	68.5
MB18HD20010	14/03/2022	624.8	68.5
MB18HD20010	15/03/2022	624.8	68.5
MB18HD20010	16/03/2022	624.8	68.5
MB18HD20012	3/02/2019	691.7	37.9
MB18HD20012	12/12/2019	691.5	38.1
MB18HD20012	2/09/2020	691.6	38.0
MB18HD20012	29/11/2020	691.6	38.0
MB18HD20012	25/07/2021	691.6	38.0
MB18HD20012	26/07/2021	691.6	38.0
MB18HD20012	27/07/2021	691.6	38.0
MB18HD20012	28/07/2021	691.6	38.0
MB18HD20012	29/07/2021	691.6	38.0
MB18HD20012	30/07/2021	691.6	38.0
MB18HD20012	31/07/2021	691.6	38.0
MB18HD20012	1/08/2021	691.6	38.0
MB18HD20012	2/08/2021	691.6	37.9
MB18HD20012	3/08/2021	691.6	37.9
MB18HD20012	4/08/2021	691.6	37.9
MB18HD20012	5/08/2021	691.6	37.9
MB18HD20012	6/08/2021	691.6	37.9
MB18HD20012	7/08/2021	691.6	37.9
MB18HD20012	8/08/2021	691.6	37.9
MB18HD20012	9/08/2021	691.6	37.9
MB18HD20012	10/08/2021	691

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	10/12/2012	194.0	492.6
HDVP2	9/12/2012	194.0	492.6
HDVP2	8/12/2012	194.0	492.6
HDVP2	7/12/2012	194.0	492.6
HDVP2	6/12/2012	194.0	492.6
HDVP2	5/12/2012	194.0	492.6
HDVP2	4/12/2012	194.0	492.6
HDVP2	3/12/2012	194.0	492.6
HDVP2	2/12/2012	194.0	492.6
HDVP2	1/12/2012	194.0	492.6
HDVP2	30/11/2012	220.5	466.0
HDVP2	29/11/2012	220.5	466.0
HDVP2	28/11/2012	220.5	466.0
HDVP2	27/11/2012	220.5	466.0
HDVP2	26/11/2012	220.5	466.0
HDVP2	25/11/2012	220.5	466.0
HDVP2	24/11/2012	220.5	466.0
HDVP2	23/11/2012	220.5	466.0
HDVP2	22/11/2012	220.5	466.0
HDVP2	21/11/2012	220.5	466.0
HDVP2	20/11/2012	220.5	466.0
HDVP2	19/11/2012	220.5	466.0
HDVP2	18/11/2012	220.5	466.0
HDVP2	17/11/2012	220.5	466.0
HDVP2	16/11/2012	220.5	466.0
HDVP2	15/11/2012	220.5	466.0
HDVP2	14/11/2012	220.5	466.0
HDVP2	13/11/2012	220.5	466.0
HDVP2	12/11/2012	220.5	466.0
HDVP2	11/11/2012	220.5	466.0
HDVP2	10/11/2012	220.5	466.0
HDVP2	9/11/2012	220.5	466.0
HDVP2	8/11/2012	220.5	466.0
HDVP2	7/11/2012	220.5	466.0
HDVP2	6/11/2012	220.5	466.0
HDVP2	5/11/2012	220.5	466.0
HDVP2	4/11/2012	220.5	466.0
HDVP2	3/11/2012	220.5	466.0
HDVP2	2/11/2012	220.5	466.0
HDVP2	1/11/2012	220.5	466.0
HDVP2	31/10/2012	205.9	480.6
HDVP2	30/10/2012	205.9	480.6
HDVP2	29/10/2012	205.9	480.6
HDVP2	28/10/2012	205.9	480.6
HDVP2	27/10/2012	205.9	480.6
HDVP2	26/10/2012	205.9	480.6
HDVP2	25/10/2012	205.9	480.6
HDVP2	24/10/2012	205.9	480.6
HDVP2	23/10/2012	205.9	480.6
HDVP2	22/10/2012	205.9	480.6
HDVP2	21/10/2012	205.9	480.6
HDVP2	20/10/2012	205.9	480.6
HDVP2	19/10/2012	205.9	480.6
HDVP2	18/10/2012	205.9	480.6
HDVP2	17/10/2012	205.9	480.6
HDVP2	16/10/2012	205.9	480.6
HDVP2	15/10/2012	205.9	480.6
HDVP2	14/10/2012	205.9	480.6
HDVP2	13/10/2012	205.9	480.6
HDVP2	12/10/2012	205.9	480.6
HDVP2	11/10/2012	205.9	480.6
HDVP2	10/10/2012	205.9	480.6
HDVP2	9/10/2012	205.9	480.6
HDVP2	8/10/2012	205.9	480.6
HDVP2	7/10/2012	205.9	480.6
HDVP2	6/10/2012	205.9	480.6
HDVP2	5/10/2012	205.9	480.6
HDVP2	4/10/2012	205.9	480.6
HDVP2	3/10/2012	205.9	480.6
HDVP2	2/10/2012	205.9	480.6
HDVP2	1/10/2012	205.9	480.6
HDVP2	30/09/2012	190.0	496.5
HDVP2	29/09/2012	190.0	496.5
HDVP2	28/09/2012	190.0	496.5
HDVP2	27/09/2012	190.0	496.5
HDVP2	26/09/2012	190.0	496.5
HDVP2	25/09/2012	190.0	496.5
HDVP2	24/09/2012	190.0	496.5
HDVP2	23/09/2012	190.0	496.5
HDVP2	22/09/2012	190.0	496.5
HDVP2	21/09/2012	190.0	496.5
HDVP2	20/09/2012	190.0	496.5
HDVP2	19/09/2012	190.0	496.5
HDVP2	18/09/2012	190.0	496.5
HDVP2	17/09/2012	190.0	496.5
HDVP2	16/09/2012	190.0	496.5
HDVP2	15/09/2012	190.0	496.5
HDVP2	14/09/2012	190.0	496.5
HDVP2	13/09/2012	190.0	496.5
HDVP2	12/09/2012	190.0	496.5
HDVP2	11/09/2012	190.0	496.5
HDVP2	10/09/2012	190.0	496.5
HDVP2	9/09/2012	190.0	496.5
HDVP2	8/09/2012	190.0	496.5
HDVP2	7/09/2012	190.0	496.5
HDVP2	6/09/2012	190.0	496.5
HDVP2	5/09/2012	190.0	496.5
HDVP2	4/09/2012	190.0	496.5
HDVP2	3/09/2012	190.0	496.5
HDVP2	2/09/2012	190.0	496.5
HDVP2	1/09/2012	155.2	531.3
HDVP2	31/08/2012	155.2	531.3
HDVP2	30/08/2012	155.2	531.3
HDVP2	29/08/2012	155.2	531.3
HDVP2	28/08/2012	155.2	531.3
HDVP2	27/08/2012	155.2	531.3
HDVP2	26/08/2012	155.2	531.3
HDVP2	25/08/2012	155.2	531.3
HDVP2	24/08/2012	155.2	531.3
HDVP2	23/08/2012	155.2	531.3
HDVP2	22/08/2012	155.2	531.3
HDVP2	21/08/2012	155.2	531.3
HDVP2	20/08/2012	155.2	531.3
HDVP2	19/08/2012	155.2	531.3
HDVP2	18/08/2012	155.2	531.3
HDVP2	17/08/2012	155.2	531.3
HDVP2	16/08/2012	155.2	531.3
HDVP2	15/08/2012	155.2	531.3
HDVP2	14/08/2012	155.2	531.3
HDVP2	13/08/2012	155.2	531.3
HDVP2	12/08/2012	155.2	531.3
HDVP2	11/08/2012	155.2	531.3
HDVP2	10/08/2012	155.2	531.3
HDVP2	9/08/2012	155.2	531.3
HDVP2	8/08/2012	155.2	531.3
HDVP2	7/08/2012	155.2	531.3
HDVP2	6/08/2012	155.2	531.3
HDVP2	5/08/2012	155.2	531.3
HDVP2	4/08/2012	155.2	531.3
HDVP2	3/08/2012	155.2	531.3
HDVP2	2/08/2012	155.2	531.3
HDVP2	1/08/2012	155.2	531.3
HDVP2	31/07/2012	158.6	528.0
HDVP2	30/07/2012	158.6	528.0
HDVP2	29/07/2012	158.6	528.0
HDVP2	28/07/2012	158.6	528.0

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MB18WON0004	28/10/2019	614.7	62.7
MB18WON0004	27/10/2019	614.7	62.7
MB18WON0004	26/10/2019	614.7	62.7
MB18WON0004	25/10/2019	614.7	62.7
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MB18WON0004	23/10/2019	614.7	62.7
MB18WON0004	22/10/2019	614.7	62.7
MB18WON0004	21/10/2019	614.7	62.7
MB18WON0004	20/10/2019	614.7	62.7
MB18WON0004	19/10/2019	614.7	62.7
MB18WON0004	18/10/2019	614.7	62.7
MB18WON0004	17/10/2019	614.7	62.7
MB18WON0004	16/10/2019	614.7	62.7
MB18WON0004	15/10/2019	614.7	62.7
MB18WON0004	14/10/2019	614.7	62.7
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MB18WON0004	11/10/2019	614.7	62.7
MB18WON0004	10/10/2019	614.7	62.7
MB18WON0004	9/10/2019	614.7	62.7
MB18WON0004	8/10/2019	614.7	62.7
MB18WON0004	7/10/2019	614.7	62.8
MB18WON0004	6/10/2019	614.7	62.7
MB18WON0004	5/10/2019	614.7	62.7
MB18WON0004	4/10/2019	614.7	62.7
MB18WON0004	3/10/2019	614.7	62.7
MB18WON0004	2/10/2019	614.7	62.7
MB18WON0004	1/10/2019	614.7	62.7
MB18WON0004	30/09/2019	614.7	62.7
MB18WON0004	29/09/2019	614.7	62.7
MB18WON0004	28/09/2019	614.7	62.7
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MB18WON0004	25/09/2019	614.7	62.7
MB18WON0004	24/09/2019	614.7	62.7
MB18WON0004	23/09/2019	614.8	62.7
MB18WON0004	22/09/2019	614.8	62.7
MB18WON0004	21/09/2019	614.7	62.7
MB18WON0004	20/09/2019	614.7	62.7
MB18WON0004	19/09/2019	614.7	62.7
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MB18WON0004	16/09/2019	614.7	62.7
MB18WON0004	15/09/2019	614.7	62.7
MB18WON0004	14/09/2019	614.7	62.7
MB18WON0004	13/09/2019	614.8	62.7
MB18WON0004	12/09/2019	614.8	62.7
MB18WON0004	11/09/2019	614.8	62.7
MB18WON0004	10/09/2019	614.7	62.7
MB18WON0004	9/09/2019	614.7	62.7
MB18WON0004	8/09/2019	614.7	62.7
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MB18WON0004	30/08/2019	614.7	62.7
MB18WON0004	29/08/2019	614.7	62.7
MB18WON0004	28/08/2019	614.7	62.7
MB18WON0004	27/08/2019	614.7	62.7
MB18WON0004	26/08/2019	614.7	62.7
MB18WON0004	25/08/2019	614.7	62.7
MB18WON0004	24/08/2019	614.7	62.7
MB18WON0004	23/08/2019	614.8	62.7
MB18WON0004	22/08/2019	614.8	62.7
MB18WON0004	21/08/2019	614.8	62.7
MB18WON0004	20/08/2019	614.8	62.6
MB18WON0004	19/08/2019	614.8	62.6
MB18WON0004	18/08/2019	614.8	62.6
MB18WON0004	17/08/2019	614.8	62.7
MB18WON0004	16/08/2019	614.8	62.7
MB18WON0004	15/08/2019	614.7	62.7
MB18WON0004	14/08/2019	614.7	62.7
MB18WON0004	13/08/2019	614.8	62.7
MB18WON0004	12/08/2019	614.8	62.7
MB18WON0004	11/08/2019	614.8	62.7
MB18WON0004	10/08/2019	614.8	62.7
MB18WON0004	9/08/2019	614.8	62.7
MB18WON0004	8/08/2019	614.8	62.7
MB18WON0004	7/08/2019	614.8	62.7
MB18WON0004	6/08/2019	614.7	62.7
MB18WON0004	5/08/2019	614.8	62.7
MB18WON0004	4/08/2019	614.8	62.7
MB18WON0004	3/08/2019	614.8	62.7
MB18WON0004	2/08/2019	614.8	62.6
MB18WON0004	1/08/2019	614.8	62.6
MB18WON0004	31/07/2019	614.8	62.6
MB18WON0004	30/07/2019	614.8	62.6
MB18WON0004	29/07/2019	614.8	62.6
MB18WON0004	28/07/2019	614.8	62.6
MB18WON0004	27/07/2019	614.8	62.7
MB18WON0004	26/07/2019	614.8	62.7
MB18WON0004	25/07/2019	614.8	62.6
MB18WON0004	24/07/2019	614.8	62.6
MB18WON0004	23/07/2019	614.8	62.6
MB18WON0004	22/07/2019	614.8	62.6
MB18WON0004	21/07/2019	614.8	62.6
MB18WON0004	20/07/2019	614.8	62.6
MB18WON0004	19/07/2019	614.8	62.7
MB18WON0004	18/07/2019	614.8	62.6
MB18WON0004	17/07/2019	614.8	62.6
MB18WON0004	16/07/2019	614.8	62.6
MB18WON0004	15/07/2019	614.9	62.6
MB18WON0004	14/07/2019	614.9	62.6
MB18WON0004	13/07/2019	614.9	62.6
MB18WON0004	12/07/2019	614.9	62.6
MB18WON0004	11/07/2019	614.9	62.6
MB18WON0004	10/07/2019	614.8	62.6
MB18WON0004	9/07/2019	614.8	62.6
MB18WON0004	8/07/2019	614.8	62.6
MB18WON0004	7/07/2019	614.8	62.6
MB18WON0004	6/07/2019	614.8	62.6
MB18WON0004	5/07/2019	614.8	62.6
MB18WON0004	4/07/2019	614.8	62.6
MB18WON0004	3/07/2019	614.8	62.6
MB18WON0004	2/07/2019	614.8	62.6
MB18WON0004	1/07/2019	614.8	62.6
MB18WON0004	30/06/2019	614.8	62.6
MB18WON0004	29/06/2019	614.8	62.6
MB18WON0004	28/06/2019	614.8	62.6
MB18WON0004	27/06/2019	614.8	62.6
MB18WON0004	26/06/2019	614.8	62.6
MB18WON0004	25/06/2019	614.8	62.6
MB18WON0004	24/06/2019	614.8	62.6
MB18WON0004	23/06/2019	614.8	62.6
MB18WON0004	22/06/2019	614.8	62.6
MB18WON0004	21/06/2019	614.8	62.6
MB18WON0004	20/06/2019	614.8	62.6
MB18WON0004	19/06/2019	614.8	62.6
MB18WON0004	18/06/2019	614.8	62.6
MB18WON0004	17/06/2019	614.8	62.6
MB18WON0004	16/06/2019	614.9	62.6

ID	Date	WL mAHD	WL mbgl
MB15HD20007	4/06/2019	626.0	86.8
MB15HD20007	5/06/2019	626.0	86.8
MB15HD20007	6/06/2019	626.0	86.8
MB15HD20007	7/06/2019	626.0	86.8
MB15HD20007	8/06/2019	626.0	86.8
MB15HD20007	9/06/2019	626.0	86.8
MB15HD20007	10/06/2019	626.0	86.8
MB15HD20007	11/06/2019	626.0	86.8
MB15HD20007	12/06/2019	626.0	86.8
MB15HD20007	13/06/2019	626.0	86.8
MB15HD20007	14/06/2019	626.0	86.8
MB15HD20007	15/06/2019	626.0	86.8
MB15HD20007	16/06/2019	626.0	86.8
MB15HD20007	17/06/2019	626.0	86.8
MB15HD20007	18/06/2019	626.0	86.8
MB15HD20007	19/06/2019	626.0	86.8
MB15HD20007	20/06/2019	626.0	86.8
MB15HD20007	21/06/2019	626.0	86.8
MB15HD20007	22/06/2019	626.0	86.8
MB15HD20007	23/06/2019	626.0	86.8
MB15HD20007	24/06/2019	626.0	86.8
MB15HD20007	25/06/2019	626.0	86.8
MB15HD20007	26/06/2019	626.0	86.8
MB15HD20007	27/06/2019	626.0	86.8
MB15HD20007	28/06/2019	626.0	86.8
MB15HD20007	29/06/2019	626.0	86.8
MB15HD20007	30/06/2019	626.0	86.8
MB15HD20007	1/07/2019	626.0	86.8
MB15HD20007	2/07/2019	626.0	86.8
MB15HD20007	3/07/2019	626.0	86.8
MB15HD20007	4/07/2019	626.0	86.8
MB15HD20007	5/07/2019	626.0	86.8
MB15HD20007	6/07/2019	626.0	86.8
MB15HD20007	7/07/2019	626.0	86.8
MB15HD20007	8/07/2019	626.0	86.8
MB15HD20007	9/07/2019	626.0	86.8
MB15HD20007	10/07/2019	626.0	86.8
MB15HD20007	11/07/2019	626.0	86.8
MB15HD20007	12/07/2019	626.0	86.8
MB15HD20007	13/07/2019	626.0	86.8
MB15HD20007	14/07/2019	626.0	86.8
MB15HD20007	15/07/2019	626.0	86.8
MB15HD20007	16/07/2019	626.0	86.8
MB15HD20007	17/07/2019	626.0	86.8
MB15HD20007	18/07/2019	626.0	86.8
MB15HD20007	19/07/2019	626.0	86.8
MB15HD20007	20/07/2019	626.0	86.8
MB15HD20007	21/07/2019	626.0	86.8
MB15HD20007	22/07/2019	626.0	86.8
MB15HD20007	23/07/2019	626.0	86.8
MB15HD20007	24/07/2019	626.0	86.8
MB15HD20007	25/07/2019	626.0	86.8
MB15HD20007	26/07/2019	626.0	86.8
MB15HD20007	27/07/2019	626.0	86.8
MB15HD20007	28/07/2019	626.0	86.8
MB15HD20007	29/07/2019	626.0	86.8
MB15HD20007	30/07/2019	626.0	86.8
MB15HD20007	31/07/2019	626.0	86.8
MB15HD20007	1/08/2019	626.0	86.8
MB15HD20007	2/08/2019	626.0	86.8
MB15HD20007	3/08/2019	626.0	86.8
MB15HD20007	4/08/2019	626.0	86.8
MB15HD20007	5/08/2019	626.0	86.8
MB15HD20007	6/08/2019	626.0	86.8
MB15HD20007	7/08/2019	626.0	86.8
MB15HD20007	8/08/2019	626.0	86.8
MB15HD20007	9/08/2019	626.0	86.8
MB15HD20007	10/08/2019	626.0	86.8
MB15HD20007	11/08/2019	626.0	86.8
MB15HD20007	12/08/2019	626.0	86.8
MB15HD20007	13/08/2019	626.0	86.8
MB15HD20007	14/08/2019	626.0	86.8
MB15HD20007	15/08/2019	626.0	86.8
MB15HD20007	16/08/2019	626.0	86.8
MB15HD20007	17/08/2019	626.0	86.8
MB15HD20007	18/08/2019	626.0	86.8
MB15HD20007	19/08/2019	626.0	86.8
MB15HD20007	20/08/2019	626.0	86.8
MB15HD20007	21/08/2019	626.0	86.8
MB15HD20007	22/08/2019	626.0	86.8
MB15HD20007	23/08/2019	626.0	86.8
MB15HD20007	24/08/2019	626.0	86.8
MB15HD20007	25/08/2019	626.0	86.8
MB15HD20007	26/08/2019	626.0	86.8
MB15HD20007	27/08/2019	626.0	86.8
MB15HD20007	28/08/2019	626.0	86.8
MB15HD20007	29/08/2019	626.0	86.8
MB15HD20007	30/08/2019	626.0	86.8
MB15HD20007	31/08/2019	626.0	86.8
MB15HD20007	1/09/2019	626.0	86.8
MB15HD20007	2/09/2019	626.0	86.8
MB15HD20007	3/09/2019	626.0	86.8
MB15HD20007	4/09/2019	626.0	86.8
MB15HD20007	5/09/2019	625.9	86.8
MB15HD20007	6/09/2019	625.9	86.8
MB15HD20007	7/09/2019	625.9	86.8
MB15HD20007	8/09/2019	626.0	86.8
MB15HD20007	9/09/2019	626.0	86.8
MB15HD20007	10/09/2019	626.0	86.8
MB15HD20007	11/09/2019	626.0	86.8
MB15HD20007	12/09/2019	626.0	86.8
MB15HD20007	13/09/2019	626.0	86.8
MB15HD20007	14/09/2019	626.0	86.8
MB15HD20007	15/09/2019	626.0	86.8
MB15HD20007	16/09/2019	626.0	86.8
MB15HD20007	17/09/2019	626.0	86.8
MB15HD20007	18/09/2019	626.0	86.8
MB15HD20007	19/09/2019	626.0	86.8
MB15HD20007	20/09/2019	626.0	86.8
MB15HD20007	21/09/2019	626.0	86.8
MB15HD20007	22/09/2019	626.0	86.8
MB15HD20007	23/09/2019	626.0	86.8
MB15HD20007	24/09/2019	626.0	86.8
MB15HD20007	25/09/2019	626.0	86.8
MB15HD20007	26/09/2019	626.0	86.8
MB15HD20007	27/09/2019	626.0	86.8
MB15HD20007	28/09/2019	626.0	86.8
MB15HD20007	29/09/2019	626.0	86.8
MB15HD20007	30/09/2019	625.9	86.8
MB15HD20007	1/10/2019	625.9	86.8
MB15HD20007	2/10/2019	625.9	86.8
MB15HD20007	3/10/2019	625.9	86.8
MB15HD20007	4/10/2019	626.0	86.8
MB15HD20007	5/10/2019	625.9	86.8
MB15HD20007	6/10/2019	625.9	86.8
MB15HD20007	7/10/2019	625.9	86.8
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MB15HD20007	13/10/2019	625.9	86.9
MB15HD20007	14/10/2019	625.9	86.9
MB15HD20007	15/10/2019	625.9	86.9
MB15HD20007	16/10/2019	625.9	86.9
MB15HD20007	17/10/2019	625.9	86.9

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MB18HD20012	21/09/2021	691.6	37.9
MB18HD20012	22/09/2021	691.6	37.9
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MB18HD20012	24/09/2021	691.6	38.0
MB18HD20012	25/09/2021	691.6	38.0
MB18HD20012	26/09/2021	691.6	38.0
MB18HD20012	27/09/2021	691.6	38.0
MB18HD20012	28/09/2021	691.6	38.0
MB18HD20012	29/09/2021	691.6	38.0
MB18HD20012	30/09/2021	691.6	38.0
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MB18HD20012	3/10/2021	691.6	38.0
MB18HD20012	4/10/2021	691.6	38.0
MB18HD20012	5/10/2021	691.6	38.0
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MB18HD20012	8/10/2021	691.6	38.0
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MB18HD20012	11/10/2021	691.6	38.0
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MB18HD20012	16/10/2021	691.5	38.0
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MB18HD20012	1/11/2021	691.6	38.0
MB18HD20012	2/11/2021	691.6	38.0
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MB18HD20012	5/11/2021	691.6	38.0
MB18HD20012	6/11/2021	691.6	38.0
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MB18HD20012	22/11/2021	691.6	38.0
MB18HD20012	23/11/2021	691.6	38.0
MB18HD20012	24/11/2021	691.6	38.0
MB18HD20012	25/11/2021	691.6	38.0
MB18HD20012	26/11/2021	691.6	38.0
MB18HD20012	27/11/2021	691.6	38.0
MB18HD20012	28/11/2021	691.6	38.0
MB18HD20012	29/11/2021	691.6	38.0
MB18HD20012	30/11/2021	691.5	38.0
MB18HD20012	1/12/2021	691.5	38.0
MB18HD20012	2/12/2021	691.6	38.0
MB18HD20012	3/12/2021	691.6	38.0
MB18HD20012	4/12/2021	691.6	38.0
MB18HD20012	5/12/2021	691.5	38.0
MB18HD20012	6/12/2021	691.5	38.0
MB18HD20012	7/12/2021	691.5	38.0
MB18HD20012	8/12/2021	691.6	38.0
MB18HD20012	9/12/2021	691.6	38.0
MB18HD20012	10/12/2021	691.5	38.0
MB18HD20012	11/12/2021	691.5	38.0
MB18HD20012	12/12/2021	691.5	38.0
MB18HD20012	13/12/2021	691.5	38.0
MB18HD20012	14/12/2021	691.5	38.0
MB18HD20012	15/12/2021	691.5	38.0
MB18HD20012	16/12/2021	691.5	38.0
MB18HD20012	17/12/2021	691.5	38.0
MB18HD20012	18/12/2021	691.6	38.0
MB18HD20012	19/12/2021	691.6	38.0
MB18HD20012	20/12/2021	691.6	38.0
MB18HD20012	21/12/2021	691.6	38.0
MB18HD20012	22/12/2021	691.5	38.0
MB18HD20012	23/12/2021	691.5	38.0
MB18HD20012	24/12/2021	691.5	38.0
MB18HD20012	25/12/2021	691

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	27/07/2012	158.6	528.0
HDVP2	26/07/2012	158.6	528.0
HDVP2	25/07/2012	158.6	528.0
HDVP2	24/07/2012	158.6	528.0
HDVP2	23/07/2012	158.6	528.0
HDVP2	22/07/2012	158.6	528.0
HDVP2	21/07/2012	158.6	528.0
HDVP2	20/07/2012	158.6	528.0
HDVP2	19/07/2012	158.6	528.0
HDVP2	18/07/2012	158.6	528.0
HDVP2	17/07/2012	158.6	528.0
HDVP2	16/07/2012	158.6	528.0
HDVP2	15/07/2012	158.6	528.0
HDVP2	14/07/2012	158.6	528.0
HDVP2	13/07/2012	158.6	528.0
HDVP2	12/07/2012	158.6	528.0
HDVP2	11/07/2012	158.6	528.0
HDVP2	10/07/2012	158.6	528.0
HDVP2	9/07/2012	158.6	528.0
HDVP2	8/07/2012	158.6	528.0
HDVP2	7/07/2012	158.6	528.0
HDVP2	6/07/2012	158.6	528.0
HDVP2	5/07/2012	158.6	528.0
HDVP2	4/07/2012	158.6	528.0
HDVP2	3/07/2012	158.6	528.0
HDVP2	2/07/2012	158.6	528.0
HDVP2	1/07/2012	153.6	533.0
HDVP2	30/06/2012	153.6	533.0
HDVP2	29/06/2012	153.6	533.0
HDVP2	28/06/2012	153.6	533.0
HDVP2	27/06/2012	153.6	533.0
HDVP2	26/06/2012	153.6	533.0
HDVP2	25/06/2012	153.6	533.0
HDVP2	24/06/2012	153.6	533.0
HDVP2	23/06/2012	153.6	533.0
HDVP2	22/06/2012	153.6	533.0
HDVP2	21/06/2012	153.6	533.0
HDVP2	20/06/2012	153.6	533.0
HDVP2	19/06/2012	153.6	533.0
HDVP2	18/06/2012	153.6	533.0
HDVP2	17/06/2012	153.6	533.0
HDVP2	16/06/2012	153.6	533.0
HDVP2	15/06/2012	153.6	533.0
HDVP2	14/06/2012	153.6	533.0
HDVP2	13/06/2012	153.6	533.0
HDVP2	12/06/2012	153.6	533.0
HDVP2	11/06/2012	153.6	533.0
HDVP2	10/06/2012	153.6	533.0
HDVP2	9/06/2012	153.6	533.0
HDVP2	8/06/2012	153.6	533.0
HDVP2	7/06/2012	153.6	533.0
HDVP2	6/06/2012	153.6	533.0
HDVP2	5/06/2012	153.6	533.0
HDVP2	4/06/2012	153.6	533.0
HDVP2	3/06/2012	153.6	533.0
HDVP2	2/06/2012	153.6	533.0
HDVP2	1/06/2012	153.6	533.0
HDVP2	31/05/2012	191.9	494.7
HDVP2	30/05/2012	191.9	494.7
HDVP2	29/05/2012	191.9	494.7
HDVP2	28/05/2012	191.9	494.7
HDVP2	27/05/2012	191.9	494.7
HDVP2	26/05/2012	191.9	494.7
HDVP2	25/05/2012	191.9	494.7
HDVP2	24/05/2012	191.9	494.7
HDVP2	23/05/2012	191.9	494.7
HDVP2	22/05/2012	191.9	494.7
HDVP2	21/05/2012	191.9	494.7
HDVP2	20/05/2012	191.9	494.7
HDVP2	19/05/2012	191.9	494.7
HDVP2	18/05/2012	191.9	494.7
HDVP2	17/05/2012	191.9	494.7
HDVP2	16/05/2012	191.9	494.7
HDVP2	15/05/2012	191.9	494.7
HDVP2	14/05/2012	191.9	494.7
HDVP2	13/05/2012	191.9	494.7
HDVP2	12/05/2012	191.9	494.7
HDVP2	11/05/2012	191.9	494.7
HDVP2	10/05/2012	191.9	494.7
HDVP2	9/05/2012	191.9	494.7
HDVP2	8/05/2012	191.9	494.7
HDVP2	7/05/2012	191.9	494.7
HDVP2	6/05/2012	191.9	494.7
HDVP2	5/05/2012	191.9	494.7
HDVP2	4/05/2012	191.9	494.7
HDVP2	3/05/2012	191.9	494.7
HDVP2	2/05/2012	191.9	494.7
HDVP2	1/05/2012	191.9	494.7
HDVP2	30/04/2012	213.8	472.7
HDVP2	29/04/2012	213.8	472.7
HDVP2	28/04/2012	213.8	472.7
HDVP2	27/04/2012	213.8	472.7
HDVP2	26/04/2012	213.8	472.7
HDVP2	25/04/2012	213.8	472.7
HDVP2	24/04/2012	213.8	472.7
HDVP2	23/04/2012	213.8	472.7
HDVP2	22/04/2012	213.8	472.7
HDVP2	21/04/2012	213.8	472.7
HDVP2	20/04/2012	213.8	472.7
HDVP2	19/04/2012	213.8	472.7
HDVP2	18/04/2012	213.8	472.7
HDVP2	17/04/2012	213.8	472.7
HDVP2	16/04/2012	213.8	472.7
HDVP2	15/04/2012	213.8	472.7
HDVP2	14/04/2012	213.8	472.7
HDVP2	13/04/2012	213.8	472.7
HDVP2	12/04/2012	213.8	472.7
HDVP2	11/04/2012	213.8	472.7
HDVP2	10/04/2012	213.8	472.7
HDVP2	9/04/2012	213.8	472.7
HDVP2	8/04/2012	213.8	472.7
HDVP2	7/04/2012	213.8	472.7
HDVP2	6/04/2012	213.8	472.7
HDVP2	5/04/2012	213.8	472.7
HDVP2	4/04/2012	213.8	472.7
HDVP2	3/04/2012	213.8	472.7
HDVP2	2/04/2012	213.8	472.7
HDVP2	1/04/2012	213.8	472.7
HDVP2	31/03/2012	252.6	433.9
HDVP2	30/03/2012	252.6	433.9
HDVP2	29/03/2012	252.6	433.9
HDVP2	28/03/2012	252.6	433.9
HDVP2	27/03/2012	252.6	433.9
HDVP2	26/03/2012	252.6	433.9
HDVP2	25/03/2012	252.6	433.9
HDVP2	24/03/2012	252.6	433.9
HDVP2	23/03/2012	252.6	433.9
HDVP2	22/03/2012	252.6	433.9
HDVP2	21/03/2012	252.6	433.9
HDVP2	20/03/2012	252.6	433.9
HDVP2	19/03/2012	252.6	433.9
HDVP2	18/03/2012	252.6	433.9
HDVP2	17/03/2012	252.6	433.9
HDVP2	16/03/2012	252.6	433.9
HDVP2	15/03/2012	252.6	433.9
HDVP2	14/03/2012	252.6	433.9

ID	Date	WL mAHD	WL mbgl
MB18WON0004	15/06/2019	614.8	62.6
MB18WON0004	14/06/2019	614.8	62.6
MB18WON0004	13/06/2019	614.8	62.6
MB18WON0004	12/06/2019	614.9	62.6
MB18WON0004	11/06/2019	614.8	62.6
MB18WON0004	10/06/2019	614.8	62.6
MB18WON0004	9/06/2019	614.8	62.6
MB18WON0004	8/06/2019	614.8	62.6
MB18WON0004	7/06/2019	614.8	62.6
MB18WON0004	6/06/2019	614.8	62.6
MB18WON0004	5/06/2019	614.9	62.6
MB18WON0004	4/06/2019	614.9	62.6
MB18WON0004	6/05/2019	614.8	62.6
MB18WON0004	5/05/2019	614.8	62.6
MB18WON0004	4/05/2019	614.9	62.6
MB18WON0004	3/05/2019	614.9	62.6
MB18WON0004	2/05/2019	614.8	62.6
MB18WON0004	1/05/2019	614.8	62.6
MB18WON0004	30/04/2019	614.8	62.6
MB18WON0004	29/04/2019	614.8	62.6
MB18WON0004	28/04/2019	614.9	62.6
MB18WON0004	27/04/2019	614.9	62.6
MB18WON0004	26/04/2019	614.9	62.6
MB18WON0004	25/04/2019	614.9	62.6
MB18WON0004	24/04/2019	614.9	62.6
MB18WON0004	23/04/2019	614.9	62.6
MB18WON0004	22/04/2019	614.9	62.6
MB18WON0004	21/04/2019	614.9	62.6
MB18WON0004	20/04/2019	614.8	62.6
MB18WON0004	19/04/2019	614.8	62.6
MB18WON0004	18/04/2019	614.8	62.6
MB18WON0004	17/04/2019	614.8	62.6
MB18WON0004	16/04/2019	614.8	62.6
MB18WON0004	15/04/2019	614.8	62.6
MB18WON0004	14/04/2019	614.8	62.6
MB18WON0004	13/04/2019	614.8	62.6
MB18WON0004	12/04/2019	614.8	62.6
MB18WON0004	11/04/2019	614.8	62.6
MB18WON0004	10/04/2019	614.8	62.6
MB18WON0004	9/04/2019	614.8	62.6
MB18WON0004	8/04/2019	614.8	62.6
MB18WON0004	7/04/2019	614.8	62.6
MB18WON0004	6/04/2019	614.8	62.6
MB18WON0004	5/04/2019	614.8	62.6
MB18WON0004	4/04/2019	614.8	62.6
MB18WON0004	3/04/2019	614.8	62.6
MB18WON0004	2/04/2019	614.8	62.6
MB18WON0004	1/04/2019	614.8	62.6
MB18WON0004	31/03/2019	614.8	62.6
MB18WON0004	30/03/2019	614.8	62.6
MB18WON0004	29/03/2019	614.8	62.6
MB18WON0004	28/03/2019	614.8	62.6
MB18WON0004	27/03/2019	614.8	62.6
MB18WON0004	26/03/2019	614.8	62.6
MB18WON0004	25/03/2019	614.8	62.6
MB18WON0004	24/03/2019	614.8	62.7
MB18WON0004	23/03/2019	614.8	62.7
MB18WON0004	22/03/2019	614.8	62.6
MB18WON0004	21/03/2019	614.8	62.7
MB18WON0004	20/03/2019	614.8	62.6
MB18WON0004	19/03/2019	614.8	62.6
MB18WON0004	18/03/2019	614.8	62.6
MB18WON0004	17/03/2019	614.8	62.6
MB18WON0004	16/03/2019	614.8	62.6
MB18WON0004	15/03/2019	614.8	62.6
MB18WON0004	14/03/2019	614.8	62.6
MB18WON0004	13/03/2019	614.8	62.6
MB18WON0004	12/03/2019	614.8	62.6
MB18WON0004	11/03/2019	614.8	62.6
MB18WON0004	10/03/2019	614.8	62.6
MB18WON0004	9/03/2019	614.8	62.6
MB18WON0004	8/03/2019	614.8	62.6
MB18WON0004	7/03/2019	614.8	62.6
MB18WON0004	6/03/2019	614.8	62.6
MB18WON0004	5/03/2019	614.8	62.6
MB18WON0004	4/03/2019	614.8	62.6
MB18WON0004	3/03/2019	614.8	62.6
MB18WON0004	2/03/2019	614.8	62.6
MB18WON0004	1/03/2019	614.8	62.6
MB18WON0004	28/02/2019	614.8	62.6
MB18WON0004	27/02/2019	614.8	62.6
MB18WON0004	26/02/2019	614.8	62.6
MB18WON0004	25/02/2019	614.8	62.6
MB18WON0004	24/02/2019	614.8	62.6
MB18WON0004	23/02/2019	614.8	62.6
MB18WON0004	22/02/2019	614.8	62.6
MB18WON0004	21/02/2019	614.8	62.6
MB18WON0004	20/02/2019	614.8	62.6
MB18WON0004	19/02/2019	614.8	62.6
MB18WON0004	18/02/2019	614.8	62.6
MB18WON0004	17/02/2019	614.8	62.6
MB18WON0004	16/02/2019	614.8	62.6
MB18WON0004	15/02/2019	614.8	62.6
MB18WON0004	14/02/2019	614.8	62.6
MB18WON0004	13/02/2019	614.8	62.6
MB18WON0004	12/02/2019	614.8	62.6
MB18WON0004	11/02/2019	614.8	62.6
MB18WON0004	10/02/2019	614.8	62.6
MB18WON0004	9/02/2019	614.8	62.6
MB18WON0004	8/02/2019	614.8	62.6
MB18WON0004	7/02/2019	614.8	62.6
MB18WON0004	6/02/2019	614.8	62.6
MB18WON0004	5/02/2019	614.8	62.6
MB18WON0004	4/02/2019	614.8	62.7
MB18WON0004	3/02/2019	614.8	62.6
MB18WON0004	2/02/2019	614.8	62.6
MB18WON0004	1/02/2019	614.8	62.6
MB18WON0004	31/01/2019	614.8	62.6
MB18WON0004	30/01/2019	614.8	62.6
MB18WON0004	29/01/2019	614.8	62.6
MB18WON0004	28/01/2019	614.8	62.6
MB18WON0004	27/01/2019	614.8	62.6
MB18WON0004	26/01/2019	614.8	62.6
MB18WON0004	25/01/2019	614.8	62.7
MB18WON0004	24/01/2019	614.8	62.7
MB18WON0004	23/01/2019	614.8	62.6
MB18WON0004	22/01/2019	614.8	62.7
MB18WON0004	21/01/2019	614.8	62.6
MB18WON0004	20/01/2019	614.8	62.6
MB18WON0004	19/01/2019	614.8	62.6
MB18WON0004	18/01/2019	614.8	62.6
MB18WON0004	17/01/2019	614.8	62.6
MB18WON0004	16/01/2019	614.8	62.6
MB18WON0004	15/01/2019	614.8	62.6
MB18WON0004	14/01/2019	614.8	62.6
MB18WON0004	13/01/2019	614.8	62.6
MB18WON0004	12/01/2019	614.8	62.6
MB18WON0004	11/01/2019	614.8	62.6
MB18WON0004	10/01/2019	614.8	62.6
MB18WON0004	9/01/2019	614.8	62.6
MB18WON0004	8/01/2019	614.8	62.6
MB18WON0004	7/01/2019	614.9	62.6
MB18WON0004	6/01/2019	614.9	62.6
MB18WON0004	5/01/2019	614.9	62.6
MB18WON0004	4/01/2019	614.8	62.6
MB18WON0004	3/01/2019	614.8	62.6

ID	Date	WL mAHD	WL mbgl
MB15HD20007	18/10/2019	625.9	86.9
MB15HD20007	19/10/2019	625.9	86.9
MB15HD20007	20/10/2019	625.9	86.9
MB15HD20007	21/10/2019	625.9	86.9
MB15HD20007	22/10/2019	625.9	86.9
MB15HD20007	23/10/2019	625.9	86.9
MB15HD20007	24/10/2019	625.9	86.9
MB15HD20007	25/10/2019	625.9	86.9
MB15HD20007	26/10/2019	625.9	86.9
MB15HD20007	27/10/2019	625.9	86.9
MB15HD20007	28/10/2019	625.9	86.9
MB15HD20007	29/10/2019	625.9	86.9
MB15HD20007	30/10/2019	625.9	86.9
MB15HD20007	31/10/2019	625.9	86.9
MB15HD20007	1/11/2019	625.9	86.9
MB15HD20007	2/11/2019	625.9	86.9
MB15HD20007	3/11/2019	625.9	86.9
MB15HD20007	4/11/2019	625.9	86.9
MB15HD20007	5/11/2019	625.9	86.9
MB15HD20007	6/11/2019	625.9	86.9
MB15HD20007	7/11/2019	625.9	86.9
MB15HD20007	8/11/2019	625.9	86.9
MB15HD20007	9/11/2019	625.9	86.9
MB15HD20007	10/11/2019	625.9	86.9
MB15HD20007	11/11/2019	625.9	86.9
MB15HD20007	12/11/2019	625.9	86.9
MB15HD20007	13/11/2019	625.9	86.9
MB15HD20007	14/11/2019	625.9	86.9
MB15HD20007	15/11/2019	625.9	86.9
MB15HD20007	16/11/2019	625.9	86.9
MB15HD20007	17/11/2019	625.9	86.9
MB15HD20007	18/11/2019	625.9	86.9
MB15HD20007	19/11/2019	625.9	86.9
MB15HD20007	20/11/2019	625.9	86.9
MB15HD20007	21/11/2019	625.9	86.9
MB15HD20007	22/11/2019	625.9	86.9
MB15HD20007	23/11/2019	625.9	86.9
MB15HD20007	24/11/2019	625.9	86.9
MB15HD20007	25/11/2019	625.9	86.9
MB15HD20007	26/11/2019	625.9	86.9
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MB15HD20007	29/11/2019	625.9	86.9
MB15HD20007	30/11/2019	625.9	86.9
MB15HD20007	1/12/2019	625.9	86.9
MB15HD20007	2/12/2019	625.9	86.9
MB15HD20007	3/12/2019	625.9	86.9
MB15HD20007	4/12/2019	625.9	86.9
MB15HD20007	5/12/2019	625.9	86.9
MB15HD20007	6/12/2019	625.9	86.9
MB15HD20007	7/12/2019	625.9	86.9
MB15HD20007	8/12/2019	625.9	86.9
MB15HD20007	9/12/2019	625.9	86.9
MB15HD20007	10/12/2019	625.9	86.9
MB15HD20007	11/12/2019	625.9	86.9
MB15HD20007	12/12/2019	625.9	86.9
MB15HD20007	13/12/2019	625.9	86.9
MB15HD20007	14/12/2019	625.9	86.9
MB15HD20007	15/12/2019	625.9	86.9
MB15HD20007	16/12/2019	625.9	86.9
MB15HD20007	17/12/2019	625.9	86.9
MB15HD20007	18/12/2019	625.9	86.9
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MB15HD20007	20/12/2019	625.9	86.9
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MB15HD20007	22/12/2019	625.9	86.9
MB15HD20007	23/12/2019	625.9	86.9
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MB15HD20007	25/12/2019	625.9	86.9
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MB15HD20007	27/12/2019	625.9	86.9
MB15HD20007	28/12/2019	625.9	86.9
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MB15HD20007	30/12/2019	625.9	86.9
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MB15HD20007	2/01/2020	625.9	86.9
MB15HD20007	3/01/2020	625.9	86.9
MB15HD20007	4/01/2020	625.9	86.9
MB15HD20007	5/01/2020	625.9	86.9
MB15HD20007	6/01/2020	625.9	86.9
MB15HD20007	7/01/2020	625.9	86.9
MB15HD20007	8/01/2020	625.8	86.9
MB15HD20007	9/01/2020	625.8	87.0
MB15HD20007	10/01/2020	625.8	87.0
MB15HD20007	11/01/2020	625.8	86.9
MB15HD20007	12/01/2020	625.9	86.9
MB15HD20007	13/01/2020	625.9	86.9
MB15HD20007	14/01/2020	625.9	86.9
MB15HD20007	15/01/2020	625.9	86.9
MB15HD20007	16/01/2020	625.9	86.9
MB15HD20007	17/01/2020	625.9	86.9
MB15HD20007	18/01/2020	625.9	86.9
MB15HD20007	19/01/2020	625.9	86.9
MB15HD20007	20/01/2020	625.9	86.9
MB15HD20007	21/01/2020	625.9	86.9
MB15HD20007	22/01/2020	625.9	86.9
MB15HD20007	23/01/2020	625.9	86.9
MB15HD20007	24/01/2020	625.9	86.9
MB15HD20007	25/01/2020	625.9	86.9
MB15HD20007	26/01/2020	625.9	86.9
MB15HD20007	27/01/2020	625.9	86.9
MB15HD20007	28/01/2020	625.9	86.9
MB15HD20007	29/01/2020	625.9	86.9
MB15HD20007	30/01/2020	625.9	86.9
MB15HD20007	31/01/2020	625.8	86.9
MB15HD20007	1/02/2020	625.8	86.9
MB15HD20007	2/02/2020	625.9	86.9
MB15HD20007	3/02/2020	625.9	86.9
MB15HD20007	4/02/2020	625.9	86.9
MB15HD20007	5/02/2020	625.9	86.9
MB15HD20007	6/02/2020	625.9	86.9
MB15HD20007	7/02/2020	625.9	86.9
MB15HD20007	8/02/2020	625.9	86.9
MB15HD20007	9/02/2020	625.9	86.9
MB15HD20007	10/02/2020	625.8	87.0
MB15HD20007	11/02/2020	625.8	86.9
MB15HD20007	12/02/2020	625.9	86.9
MB15HD20007	13/02/2020	625.9	86.9
MB15HD20007	14/02/2020	625.9	86.9
MB15HD20007	15/02/2020	625.9	86.9
MB15HD20007	16/02/2020	625.9	86.9
MB15HD20007	17/02/2020	625.9	86.9
MB15HD20007	18/02/2020	625.9	86.9
MB15HD20007	19/02/2020	625.9	86.9
MB15HD20007	20/02/2020	625.9	86.9
MB15HD20007	21/02/2020	625.9	86.9
MB15HD20007	22/02/2020	625.9	86.9
MB15HD20007	23/02/2020	625.9	86.9
MB15HD20007	24/02/2020	625.9	86.9
MB15HD20007	25/02/2020	625.9	86.9
MB15HD20007	26/02/2020	625.9	86.9
MB15HD20007	27/02/2020	625.9	86.9
MB15HD20007	28/02/2020	625.9	86.9
MB15HD20007	29/02/2020	625.8	86.9
MB15HD20007	1/03/2020	625.8	87.0

ID	Date	WL mAHD	WL mbgl
MB18HD20012	7/02/2022	691.6	38.0
MB18HD20012	8/02/2022	691.6	38.0
MB18HD20012	9/02/2022	691.6	38.0
MB18HD20012	10/02/2022	691.6	38.0
MB18HD20012	11/02/2022	691.6	38.0
MB18HD20012	12/02/2022	691.6	38.0
MB18HD20012	13/02/2022	691.6	37.9
MB18HD20012	14/02/2022	691.6	37.9
MB18HD20012	15/02/2022	691.6	37.9
MB18HD20012	16/02/2022	691.6	37.9
MB18HD20012	17/02/2022	691.6	37.9
MB18HD20012	18/02/2022	691.6	37.9
MB18HD20012	19/02/2022	691.6	37.9
MB18HD20012	20/02/2022	691.6	37.9
MB18HD20012	21/02/2022	691.6	38.0
MB18HD20012	22/02/2022	691.6	38.0
MB18HD20012	23/02/2022	691.6	38.0
MB18HD20012	24/02/2022	691.6	38.0
MB18HD20012	25/02/2022	691.6	38.0
MB18HD20012	26/02/2022	691.6	38.0
MB18HD20012	27/02/2022	691.6	38.0
MB18HD20012	28/02/2022	691.6	38.0
MB18HD20012	1/03/2022	691.6	38.0
MB18HD20012	2/03/2022	691.6	38.0
MB18HD20012	3/03/2022	691.6	38.0
MB18HD20012	4/03/2022	691.6	37.9
MB18HD20012	5/03/2022	691.6	37.9
MB18HD20012	6/03/2022	691.6	37.9
MB18HD20012	7/03/2022	691.6	37.9
MB18HD20012	8/03/2022	691.6	37.9
MB18HD20012	9/03/2022	691.6	37.9
MB18HD20012	10/03/2022	691.6	37.9
MB18HD20012	11/03/2022	691.6	37.9
MB18HD20012	12/03/2022	691.6	37.9
MB18HD20012	13/03/2022	691.6	38.0
MB18HD20012	14/03/2022	691.6	37.9
MB18HD20012	15/03/2022	691.6	38.0
MB18HD20012	16/03/2022	691.6	37.9
MB21HD20001	27/11/2021	626.6	73.5
MB21HD20002	28/11/2021	624.8	53.5
MB21HD20003	4/12/2021	624.6	63.9
MB21HD20004	20/01/2022	625.7	82.4
MB21HD20005	21/12/2021	627.3	88.7
WB16HD20001	26/02/2016	627.2	85.6
WB16HD20001	4/08/2016	627.1	85.7
WB16HD20001	4/09/2016	627.8	85.0
WB16HD20001	3/02/2019	626.9	85.9
WB16HD20001	12/11/2019	627.0	85.8
WB16HD20001	29/11/2020	627.0	85.8
WB16HD20001	3/09/2021	626.7	86.1
WB16HD20001	12/11/2021	626.7	86.1
WB16HD20001	2/02/2022	626.6	86.2
WB18HD20001	3/02/2019	625.9	82.0
WB18HD20002	3/02/2019	625.2	68.3
WB18HD20002	13/12/2019	625.1	68.4
WB18HD20002	28/11/2020	625.1	68.5
WB18HD20002	3/09/2021	625.0	68.6
WB18HD20002	12/11/2021	625.0	68.5
WB18HD20002	2/02/2022	625.0	68.6
WB18HD20003	3/02/2019	625.9	75.1
WB18HD20003	12/11/2019	626.0	75.0
WB18HD20003	28/11/2020	625.9	75.1
WB18HD20003	3/09/2021	625.8	75.2
WB18HD20003	12/11/2021	625.8	75.2
WB18HD20003	2/02/2022	625.8	75.3

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	13/03/2012	252.6	433.9
HDVP2	12/03/2012	252.6	433.9
HDVP2	11/03/2012	252.6	433.9
HDVP2	10/03/2012	252.6	433.9
HDVP2	9/03/2012	252.6	433.9
HDVP2	8/03/2012	252.6	433.9
HDVP2	7/03/2012	252.6	433.9
HDVP2	6/03/2012	252.6	433.9
HDVP2	5/03/2012	252.6	433.9
HDVP2	4/03/2012	255.8	430.7
HDVP2	3/03/2012	255.8	430.7
HDVP2	2/03/2012	255.8	430.7
HDVP2	1/03/2012	255.8	430.7
HDVP2	29/02/2012	255.8	430.7
HDVP2	28/02/2012	255.8	430.7
HDVP2	27/02/2012	255.8	430.7
HDVP2	26/02/2012	255.8	430.7
HDVP2	25/02/2012	255.8	430.7
HDVP2	24/02/2012	255.8	430.7
HDVP2	23/02/2012	255.8	430.7
HDVP2	22/02/2012	255.8	430.7
HDVP2	21/02/2012	255.8	430.7
HDVP2	20/02/2012	255.8	430.7
HDVP2	19/02/2012	255.8	430.7
HDVP2	18/02/2012	255.8	430.7
HDVP2	17/02/2012	255.8	430.7
HDVP2	16/02/2012	255.8	430.7
HDVP2	15/02/2012	255.8	430.7
HDVP2	14/02/2012	255.8	430.7
HDVP2	13/02/2012	255.8	430.7
HDVP2	12/02/2012	255.8	430.7
HDVP2	11/02/2012	255.8	430.7
HDVP2	10/02/2012	255.8	430.7
HDVP2	9/02/2012	255.8	430.7
HDVP2	8/02/2012	255.8	430.7
HDVP2	7/02/2012	255.8	430.7
HDVP2	6/02/2012	255.8	430.7
HDVP2	5/02/2012	255.8	430.7
HDVP2	4/02/2012	255.8	430.7
HDVP2	3/02/2012	255.8	430.7
HDVP2	2/02/2012	255.8	430.7
HDVP2	1/02/2012	255.8	430.7
HDVP2	31/01/2012	190.1	496.4
HDVP2	30/01/2012	190.1	496.4
HDVP2	29/01/2012	190.1	496.4
HDVP2	28/01/2012	190.1	496.4
HDVP2	27/01/2012	190.1	496.4
HDVP2	26/01/2012	190.1	496.4
HDVP2	25/01/2012	190.1	496.4
HDVP2	24/01/2012	190.1	496.4
HDVP2	23/01/2012	190.1	496.4
HDVP2	22/01/2012	190.1	496.4
HDVP2	21/01/2012	190.1	496.4
HDVP2	20/01/2012	190.1	496.4
HDVP2	19/01/2012	190.1	496.4
HDVP2	18/01/2012	190.1	496.4
HDVP2	17/01/2012	190.1	496.4
HDVP2	16/01/2012	190.1	496.4
HDVP2	15/01/2012	190.1	496.4
HDVP2	14/01/2012	190.1	496.4
HDVP2	13/01/2012	190.1	496.4
HDVP2	12/01/2012	190.1	496.4
HDVP2	11/01/2012	190.1	496.4
HDVP2	10/01/2012	190.1	496.4
HDVP2	9/01/2012	190.1	496.4
HDVP2	8/01/2012	190.1	496.4
HDVP2	7/01/2012	190.1	496.4
HDVP2	6/01/2012	190.1	496.4
HDVP2	5/01/2012	190.1	496.4
HDVP2	4/01/2012	190.1	496.4
HDVP2	3/01/2012	190.1	496.4
HDVP2	2/01/2012	190.1	496.4
HDVP2	1/01/2012	190.1	496.4
HDVP2	31/12/2011	245.5	441.0
HDVP2	30/12/2011	245.5	441.0
HDVP2	29/12/2011	245.5	441.0
HDVP2	28/12/2011	245.5	441.0
HDVP2	27/12/2011	245.5	441.0
HDVP2	26/12/2011	245.5	441.0
HDVP2	25/12/2011	245.5	441.0
HDVP2	24/12/2011	245.5	441.0
HDVP2	23/12/2011	245.5	441.0
HDVP2	22/12/2011	245.5	441.0
HDVP2	21/12/2011	245.5	441.0
HDVP2	20/12/2011	245.5	441.0
HDVP2	19/12/2011	245.5	441.0
HDVP2	18/12/2011	245.5	441.0
HDVP2	17/12/2011	245.5	441.0
HDVP2	16/12/2011	245.5	441.0
HDVP2	15/12/2011	245.5	441.0
HDVP2	14/12/2011	245.5	441.0
HDVP2	13/12/2011	245.5	441.0
HDVP2	12/12/2011	245.5	441.0
HDVP2	11/12/2011	245.5	441.0
HDVP2	10/12/2011	245.5	441.0
HDVP2	9/12/2011	245.5	441.0
HDVP2	8/12/2011	245.5	441.0
HDVP2	7/12/2011	245.5	441.0
HDVP2	6/12/2011	245.5	441.0
HDVP2	5/12/2011	245.5	441.0
HDVP2	4/12/2011	245.5	441.0
HDVP2	3/12/2011	245.5	441.0
HDVP2	2/12/2011	245.5	441.0
HDVP2	1/12/2011	245.5	441.0
HDVP2	30/11/2011	231.0	455.5
HDVP2	29/11/2011	231.0	455.5
HDVP2	28/11/2011	231.0	455.5
HDVP2	27/11/2011	231.0	455.5
HDVP2	26/11/2011	231.0	455.5
HDVP2	25/11/2011	231.0	455.5
HDVP2	24/11/2011	231.0	455.5
HDVP2	23/11/2011	231.0	455.5
HDVP2	22/11/2011	231.0	455.5
HDVP2	21/11/2011	231.0	455.5
HDVP2	20/11/2011	231.0	455.5
HDVP2	19/11/2011	231.0	455.5
HDVP2	18/11/2011	231.0	455.5
HDVP2	17/11/2011	231.0	455.5
HDVP2	16/11/2011	231.0	455.5
HDVP2	15/11/2011	231.0	455.5
HDVP2	14/11/2011	231.0	455.5
HDVP2	13/11/2011	231.0	455.5
HDVP2	12/11/2011	231.0	455.5
HDVP2	11/11/2011	231.0	455.5
HDVP2	10/11/2011	231.0	455.5
HDVP2	9/11/2011	231.0	455.5
HDVP2	8/11/2011	231.0	455.5
HDVP2	7/11/2011	231.0	455.5
HDVP2	6/11/2011	231.0	455.5
HDVP2	5/11/2011	231.0	455.5
HDVP2	4/11/2011	231.0	455.5
HDVP2	3/11/2011	231.0	455.5
HDVP2	2/11/2011	231.0	455.5
HDVP2	1/11/2011	231.0	455.5
HDVP2	31/10/2011	199.6	487.0
HDVP2	30/10/2011	199.6	487.0

ID	Date	WL mAHD	WL mbgl
MB18WON0004	2/01/2019	614.8	62.6
MB18WON0004	1/01/2019	614.8	62.6
MB18WON0004	31/12/2018	614.8	62.6
MB18WON0004	30/12/2018	614.8	62.6
MB18WON0004	29/12/2018	614.8	62.6
MB18WON0004	28/12/2018	614.8	62.6
MB18WON0004	27/12/2018	614.8	62.6
MB18WON0004	26/12/2018	614.8	62.6
MB18WON0004	25/12/2018	614.8	62.6
MB18WON0004	24/12/2018	614.8	62.6
MB18WON0004	23/12/2018	614.8	62.6
MB18WON0004	22/12/2018	614.9	62.6
MB18WON0004	21/12/2018	614.9	62.6
MB18WON0004	20/12/2018	614.8	62.6
MB18WON0004	19/12/2018	614.9	62.6
MB18WON0004	18/12/2018	614.9	62.6
MB18WON0004	17/12/2018	614.8	62.6
MB18WON0004	16/12/2018	614.8	62.6
MB18WON0004	15/12/2018	614.8	62.7
MB18WON0004	14/12/2018	614.8	62.6
MB18WON0004	13/12/2018	614.8	62.6
MB18WON0004	12/12/2018	614.8	62.6
MB18WON0005	2/03/2022	621.2	14.9
MB18WON0005	1/03/2022	621.2	14.9
MB18WON0005	28/02/2022	621.2	14.9
MB18WON0005	27/02/2022	621.2	14.9
MB18WON0005	26/02/2022	621.2	14.9
MB18WON0005	25/02/2022	621.2	14.8
MB18WON0005	24/02/2022	621.2	14.8
MB18WON0005	23/02/2022	621.2	14.9
MB18WON0005	22/02/2022	621.2	14.9
MB18WON0005	21/02/2022	621.2	14.9
MB18WON0005	20/02/2022	621.2	14.8
MB18WON0005	19/02/2022	621.3	14.8
MB18WON0005	18/02/2022	621.3	14.8
MB18WON0005	17/02/2022	621.3	14.8
MB18WON0005	16/02/2022	621.3	14.8
MB18WON0005	15/02/2022	621.3	14.8
MB18WON0005	14/02/2022	621.2	14.9
MB18WON0005	13/02/2022	621.2	14.9
MB18WON0005	12/02/2022	621.2	14.9
MB18WON0005	11/02/2022	621.2	14.9
MB18WON0005	10/02/2022	621.2	14.9
MB18WON0005	9/02/2022	621.1	14.9
MB18WON0005	8/02/2022	621.1	15.0
MB18WON0005	7/02/2022	621.1	15.0
MB18WON0005	6/02/2022	621.1	15.0
MB18WON0005	5/02/2022	621.1	15.0
MB18WON0005	4/02/2022	621.1	15.0
MB18WON0005	3/02/2022	621.1	15.0
MB18WON0005	2/02/2022	621.1	15.0
MB18WON0005	1/02/2022	621.1	15.0
MB18WON0005	31/01/2022	621.0	15.1
MB18WON0005	30/01/2022	621.1	15.0
MB18WON0005	29/01/2022	621.1	15.0
MB18WON0005	28/01/2022	621.1	15.0
MB18WON0005	27/01/2022	621.0	15.1
MB18WON0005	26/01/2022	621.0	15.1
MB18WON0005	25/01/2022	621.0	15.1
MB18WON0005	24/01/2022	621.0	15.0
MB18WON0005	23/01/2022	621.1	15.0
MB18WON0005	22/01/2022	621.1	15.0
MB18WON0005	21/01/2022	621.1	15.0
MB18WON0005	20/01/2022	621.1	15.0
MB18WON0005	19/01/2022	621.1	15.0
MB18WON0005	18/01/2022	621.1	15.0
MB18WON0005	17/01/2022	621.1	15.0
MB18WON0005	16/01/2022	621.0	15.1
MB18WON0005	15/01/2022	621.0	15.0
MB18WON0005	14/01/2022	621.1	15.0
MB18WON0005	13/01/2022	621.1	15.0
MB18WON0005	12/01/2022	621.1	15.0
MB18WON0005	11/01/2022	621.2	14.9
MB18WON0005	10/01/2022	621.1	15.0
MB18WON0005	9/01/2022	621.1	15.0
MB18WON0005	8/01/2022	621.1	15.0
MB18WON0005	7/01/2022	621.1	15.0
MB18WON0005	6/01/2022	621.1	15.0
MB18WON0005	5/01/2022	621.1	15.0
MB18WON0005	4/01/2022	621.1	15.0
MB18WON0005	3/01/2022	621.1	15.0
MB18WON0005	2/01/2022	621.1	15.0
MB18WON0005	1/01/2022	621.1	15.0
MB18WON0005	31/12/2021	621.1	15.0
MB18WON0005	30/12/2021	621.1	15.0
MB18WON0005	29/12/2021	621.1	15.0
MB18WON0005	28/12/2021	621.1	15.0
MB18WON0005	27/12/2021	621.1	14.9
MB18WON0005	26/12/2021	621.2	14.9
MB18WON0005	25/12/2021	621.1	14.9
MB18WON0005	24/12/2021	621.1	15.0
MB18WON0005	23/12/2021	621.1	15.0
MB18WON0005	22/12/2021	621.1	15.0
MB18WON0005	21/12/2021	621.2	14.9
MB18WON0005	20/12/2021	621.2	14.9
MB18WON0005	19/12/2021	621.2	14.9
MB18WON0005	18/12/2021	621.2	14.9
MB18WON0005	17/12/2021	621.2	14.9
MB18WON0005	16/12/2021	621.2	14.9
MB18WON0005	15/12/2021	621.2	14.9
MB18WON0005	14/12/2021	621.2	14.9
MB18WON0005	13/12/2021	621.1	15.0
MB18WON0005	12/12/2021	621.1	15.0
MB18WON0005	10/12/2021	621.1	15.0
MB18WON0005	26/02/2021	621.4	14.7
MB18WON0005	24/02/2021	621.4	14.7
MB18WON0005	23/02/2021	621.4	14.7
MB18WON0005	22/02/2021	621.4	14.7
MB18WON0005	21/02/2021	621.4	14.7
MB18WON0005	20/02/2021	621.4	14.7
MB18WON0005	19/02/2021	621.4	14.7
MB18WON0005	18/02/2021	621.3	14.8
MB18WON0005	17/02/2021	621.3	14.8
MB18WON0005	15/02/2021	621.3	14.8
MB18WON0005	14/02/2021	621.3	14.8
MB18WON0005	11/02/2021	621.1	15.0
MB18WON0005	10/02/2021	621.1	15.0
MB18WON0005	9/02/2021	621.1	15.0
MB18WON0005	8/02/2021	621.1	15.0
MB18WON0005	7/02/2021	621.1	15.0
MB18WON0005	4/02/2021	621.1	15.0
MB18WON0005	31/01/2021	621.1	15.0
MB18WON0005	30/01/2021	621.1	15.0
MB18WON0005	29/01/2021	621.1	15.0
MB18WON0005	28/01/2021	621.1	15.0
MB18WON0005	27/01/2021	621.1	15.0
MB18WON0005	26/01/2021	621.1	15.0
MB18WON0005	25/01/2021	621.1	15.0
MB18WON0005	24/01/2021	621.1	15.0
MB18WON0005	23/01/2021	621.1	15.0
MB18WON0005	22/01/2021	621.1	15.0
MB18WON0005	21/01/2021	621.1	15.0
MB18WON0005	20/01/2021	621.1	15.0
MB18WON0005	19/01/2021	621.1	15.0
MB18WON0005	18/01/2021	621.1	15.0
MB18WON0005	17/01/2021	621.1	15.0

ID	Date	WL mAHD	WL mbgl
MB15HD20007	2/03/2020	625.8	87.0
MB15HD20007	3/03/2020	625.9	86.9
MB15HD20007	4/03/2020	625.9	86.9
MB15HD20007	5/03/2020	625.9	86.9
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MB15HD20007	7/03/2020	625.9	86.9
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MB15HD20007	13/03/2020	625.9	86.9
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MB15HD20007	17/03/2020	625.9	86.9
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MB15HD20007	25/03/2020	625.9	86.9
MB15HD20007	26/03/2020	625.9	86.9
MB15HD20007	27/03/2020	625.9	86.9
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MB15HD20007	26/04/2020	625.9	86.9
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MB15HD20007	28/05/2020	625.9	86.9
MB15HD20007	29/05/2020	625.9	86.9
MB15HD20007	30/05/2020	625.9	86.9
MB15HD20007	31/05/2020	625.9	86.9
MB15HD20007	1/06/2020	625.9	86.9
MB15HD20007	2/06/2020	625.9	86.8
MB15HD20007	3/06/2020	625.9	86.8
MB15HD20007	4/06/2020	626.0	86.8
MB15HD20007	5/06/2020	625.9	86.8
MB15HD20007	6/06/2020	625.9	86.8
MB15HD20007	7/06/2020	625.9	86.9
MB15HD20007	8/06/2020	625.9	86.9
MB15HD20007	9/06/2020	625.9	86.9
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MB15HD20007	24/06/2020	625.9	86.9
MB15HD20007	25/06/2020	625.9	86.9
MB15HD20007	26/06/2020	625.9	86.9
MB15HD20007	27/06/2020	625.9	86.9
MB15HD20007	28/06/2020	625.9	86.9
MB15HD20007	29/06/2020	625.9	86.9
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MB15HD20007	9/07/2020	625.9	86.9
MB15HD20007	10/07/2020	625.9	86.9
MB15HD20007	11/07/2020	625.9	86.9
MB15HD20007	12/07/2020	625.9	86.9
MB15HD20007	13/07/2020	625.9	86.9
MB15HD20007	14/07/2020	625.9	86.9
MB15HD20007	15/07/2020	625.9	86.9

ID	Date	WL mAHD	WL mbgl

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	29/10/2011	199.6	487.0
HDVP2	28/10/2011	199.6	487.0
HDVP2	27/10/2011	199.6	487.0
HDVP2	26/10/2011	199.6	487.0
HDVP2	25/10/2011	199.6	487.0
HDVP2	24/10/2011	199.6	487.0
HDVP2	23/10/2011	199.6	487.0
HDVP2	22/10/2011	199.6	487.0
HDVP2	21/10/2011	199.6	487.0
HDVP2	20/10/2011	199.6	487.0
HDVP2	19/10/2011	199.6	487.0
HDVP2	18/10/2011	199.6	487.0
HDVP2	17/10/2011	199.6	487.0
HDVP2	16/10/2011	199.6	487.0
HDVP2	15/10/2011	199.6	487.0
HDVP2	14/10/2011	199.6	487.0
HDVP2	13/10/2011	199.6	487.0
HDVP2	12/10/2011	199.6	487.0
HDVP2	11/10/2011	199.6	487.0
HDVP2	10/10/2011	199.6	487.0
HDVP2	9/10/2011	199.6	487.0
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HDVP2	7/10/2011	199.6	487.0
HDVP2	6/10/2011	199.6	487.0
HDVP2	5/10/2011	199.6	487.0
HDVP2	4/10/2011	199.6	487.0
HDVP2	3/10/2011	199.6	487.0
HDVP2	2/10/2011	199.6	487.0
HDVP2	1/10/2011	199.6	487.0
HDVP2	30/09/2011	177.5	509.1
HDVP2	29/09/2011	177.5	509.1
HDVP2	28/09/2011	177.5	509.1
HDVP2	27/09/2011	177.5	509.1
HDVP2	26/09/2011	177.5	509.1
HDVP2	25/09/2011	177.5	509.1
HDVP2	24/09/2011	177.5	509.1
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HDVP2	9/09/2011	177.5	509.1
HDVP2	8/09/2011	177.5	509.1
HDVP2	7/09/2011	177.5	509.1
HDVP2	6/09/2011	177.5	509.1
HDVP2	5/09/2011	177.5	509.1
HDVP2	4/09/2011	177.5	509.1
HDVP2	3/09/2011	177.5	509.1
HDVP2	2/09/2011	177.5	509.1
HDVP2	1/09/2011	177.5	509.1
HDVP2	31/08/2011	174.2	512.3
HDVP2	30/08/2011	174.2	512.3
HDVP2	29/08/2011	174.2	512.3
HDVP2	28/08/2011	174.2	512.3
HDVP2	27/08/2011	174.2	512.3
HDVP2	26/08/2011	174.2	512.3
HDVP2	25/08/2011	174.2	512.3
HDVP2	24/08/2011	174.2	512.3
HDVP2	23/08/2011	174.2	512.3
HDVP2	22/08/2011	174.2	512.3
HDVP2	21/08/2011	174.2	512.3
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HDVP2	19/08/2011	174.2	512.3
HDVP2	18/08/2011	174.2	512.3
HDVP2	17/08/2011	174.2	512.3
HDVP2	16/08/2011	174.2	512.3
HDVP2	15/08/2011	174.2	512.3
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HDVP2	6/08/2011	174.2	512.3
HDVP2	5/08/2011	174.2	512.3
HDVP2	4/08/2011	174.2	512.3
HDVP2	3/08/2011	174.2	512.3
HDVP2	2/08/2011	174.2	512.3
HDVP2	1/08/2011	174.2	512.3
HDVP2	31/07/2011	165.1	521.4
HDVP2	30/07/2011	165.1	521.4
HDVP2	29/07/2011	165.1	521.4
HDVP2	28/07/2011	165.1	521.4
HDVP2	27/07/2011	165.1	521.4
HDVP2	26/07/2011	165.1	521.4
HDVP2	25/07/2011	165.1	521.4
HDVP2	24/07/2011	165.1	521.4
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HDVP2	21/07/2011	165.1	521.4
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HDVP2	17/07/2011	165.1	521.4
HDVP2	16/07/2011	165.1	521.4
HDVP2	15/07/2011	165.1	521.4
HDVP2	14/07/2011	165.1	521.4
HDVP2	13/07/2011	165.1	521.4
HDVP2	12/07/2011	165.1	521.4
HDVP2	11/07/2011	165.1	521.4
HDVP2	10/07/2011	165.1	521.4
HDVP2	9/07/2011	165.1	521.4
HDVP2	8/07/2011	165.1	521.4
HDVP2	7/07/2011	165.1	521.4
HDVP2	6/07/2011	165.1	521.4
HDVP2	5/07/2011	165.1	521.4
HDVP2	4/07/2011	165.1	521.4
HDVP2	3/07/2011	165.1	521.4
HDVP2	2/07/2011	165.1	521.4
HDVP2	1/07/2011	165.1	521.4
HDVP2	30/06/2011	192.1	494.4
HDVP2	29/06/2011	192.1	494.4
HDVP2	28/06/2011	192.1	494.4
HDVP2	27/06/2011	192.1	494.4
HDVP2	26/06/2011	192.1	494.4
HDVP2	25/06/2011	192.1	494.4
HDVP2	24/06/2011	192.1	494.4
HDVP2	23/06/2011	192.1	494.4
HDVP2	22/06/2011	192.1	494.4
HDVP2	21/06/2011	192.1	494.4
HDVP2	20/06/2011	192.1	494.4
HDVP2	19/06/2011	192.1	494.4
HDVP2	18/06/2011	192.1	494.4
HDVP2	17/06/2011	192.1	494.4
HDVP2	16/06/2011	192.1	494.4

ID	Date	WL mAHD	WL mbgl
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MB18WON0005	15/01/2021	621.1	15.0
MB18WON0005	14/01/2021	621.1	15.0
MB18WON0005	13/01/2021	621.1	15.0
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MB18WON0005	11/01/2021	621.1	15.0
MB18WON0005	10/01/2021	621.1	15.0
MB18WON0005	9/01/2021	621.1	15.0
MB18WON0005	8/01/2021	621.1	15.0
MB18WON0005	7/01/2021	621.1	15.0
MB18WON0005	6/01/2021	621.1	15.0
MB18WON0005	4/01/2021	621.0	15.1
MB18WON0005	3/01/2021	621.0	15.1
MB18WON0005	2/01/2021	621.0	15.1
MB18WON0005	1/01/2021	621.0	15.1
MB18WON0005	31/12/2020	621.0	15.1
MB18WON0005	30/12/2020	621.0	15.1
MB18WON0005	29/12/2020	621.0	15.1
MB18WON0005	28/12/2020	621.0	15.1
MB18WON0005	27/12/2020	621.0	15.1
MB18WON0005	26/12/2020	621.0	15.1
MB18WON0005	25/12/2020	621.0	15.1
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MB18WON0005	22/12/2020	621.0	15.1
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MB18WON0005	19/12/2020	621.0	15.1
MB18WON0005	18/12/2020	621.0	15.1
MB18WON0005	17/12/2020	621.0	15.1
MB18WON0005	16/12/2020	621.0	15.1
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MB18WON0005	10/12/2020	621.0	15.1
MB18WON0005	9/12/2020	621.0	15.1
MB18WON0005	8/12/2020	621.0	15.1
MB18WON0005	7/12/2020	621.0	15.1
MB18WON0005	6/12/2020	621.0	15.1
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MB18WON0005	18/09/2020	621.1	15.0
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MB18WON0005	9/09/2020	621.2	14.9
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MB18WON0005	29/04/2020	621.5	14.6
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MB18WON0005	27/04/2020	621.5	14.6
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MB18WON0005	17/04/2020	621.5	14.5
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MB18WON0005	15/04/2020	621.5	14.6
MB18WON0005	14/04/2020	621.5	14.6
MB18WON0005	13/04/2020	621.5	14.5
MB18WON0005	12/04/2020	621.5	14.5
MB18WON0005	11/04/2020	621.6	14.5
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MB18WON0005	9/04/2020	621.6	14.5
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MB18WON0005	6/04/2020	621.5	14.5
MB18WON0005	5/04/2020	621.6	14.5
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MB18WON0005	3/04/2020	621.5	14.5
MB18WON0005	2/04/2020	621.5	14.6
MB18WON0005	1/04/2020	621.5	14.6
MB18WON0005	31/03/2020	621.5	14.6
MB18WON0005	30/03/2020	621.5	14.5
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MB18WON0005	28/03/2020	621.6	14.5
MB18WON0005	27/03/2020	621.6	14.5
MB18WON0005	26/03/2020	621.6	14.5
MB18WON0005	25/03/2020	621.6	14.5
MB18WON0005	24/03/2020	621.6	14.5
MB18WON0005	23/03/2020	621.6	14.5
MB18WON0005	22/03/2020	621.6	14.5
MB18WON0005	21/03/2020	621.6	14.5
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MB18WON0005	12/03/2020	621.6	14.5
MB18WON0005	11/03/2020	621.6	14.5
MB18WON0005	10/03/2020	621.5	14.5
MB18WON0005	9/03/2020	621.5	14.5
MB18WON0005	8/03/2020	621.6	14.5
MB18WON0005	7/03/2020	621.6	14.5
MB18WON0005	6/03/2020	621.6	14.5
MB18WON0005	5/03/2020	621.5	14.6
MB18WON0005	4/03/2020	621.5	14.6
MB18WON0005	3/03/2020	621.5	14.6
MB18WON0005	2/03/2020	621.5	14.6
MB18WON0005	1/03/2020	621.5	14.6
MB18WON0005	29/02/2020	621.5	14.6
MB18WON0005	28/02/2020	621.5	14.6
MB18WON0005	27/02/2020	621.5	14.6
MB18WON0005	26/02/2020	621.5	14.6
MB18WON0005	25/02/2020	621.5	14.6
MB18WON0005	24/02/2020	621.5	14.6
MB18WON0005	23/02/2020	621.5	14.6

ID	Date	WL mAHD	WL mbgl
MB15HD20007	16/07/2020	625.9	86.9
MB15HD20007	17/07/2020	625.9	86.9
MB15HD20007	18/07/2020	625.9	86.9
MB15HD20007	19/07/2020	625.9	86.9
MB15HD20007	20/07/2020	625.9	86.9
MB15HD20007	21/07/2020	625.9	86.9
MB15HD20007	22/07/2020	625.9	86.9
MB15HD20007	23/07/2020	625.9	86.9
MB15HD20007	24/07/2020	625.9	86.9
MB15HD20007	25/07/2020	625.9	86.9
MB15HD20007	26/07/2020	625.9	86.9
MB15HD20007	27/07/2020	625.9	86.9
MB15HD20007	28/07/2020	625.9	86.9
MB15HD20007	29/07/2020	625.9	86.9
MB15HD20007	30/07/2020	625.9	86.9
MB15HD20007	31/07/2020	625.9	86.9
MB15HD20007	1/08/2020	625.9	86.9
MB15HD20007	2/08/2020	625.9	86.9
MB15HD20007	3/08/2020	625.9	86.9
MB15HD20007	4/08/2020	625.9	86.9
MB15HD20007	5/08/2020	625.9	86.9
MB15HD20007	6/08/2020	625.9	86.9
MB15HD20007	7/08/2020	625.9	86.9
MB15HD20007	8/08/2020	625.9	86.9
MB15HD20007	9/08/2020	625.9	86.9
MB15HD20007	10/08/2020	625.9	86.9
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MB15HD20007	15/09/2020	625.9	86.9
MB15HD20007	16/09/2020	625.9	86.9
MB15HD20007	17/09/2020	625.9	86.9
MB15HD20007	18/09/2020	625.9	86.9
MB15HD20007	19/09/2020	625.9	86.9
MB15HD20007	20/09/2020	625.9	86.9
MB15HD20007	21/09/2020	625.9	86.9
MB15HD20007	22/09/2020	625.9	86.9
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MB15HD20007	26/09/2020	625.9	86.9
MB15HD20007	27/09/2020	625.9	86.9
MB15HD20007	28/09/2020	625.9	86.9
MB15HD20007	29/09/2020	625.9	86.9
MB15HD20007	30/09/2020	625.9	86.9
MB15HD20007	1/10/2020	625.9	86.9
MB15HD20007	2/10/2020	625.9	86.9
MB15HD20007	3/10/2020	625.9	86.9
MB15HD20007	4/10/2020	625.9	86.9
MB15HD20007	5/10/2020	625.9	86.9
MB15HD20007	6/10/2020	625.9	86.9
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MB15HD20007	9/10/2020	625.9	86.9
MB15HD20007	10/10/2020	625.9	86.9
MB15HD20007	11/10/2020	625.9	86.9
MB15HD20007	12/10/2020	625.9	86.9
MB15HD20007	13/10/2020	625.9	86.9
MB15HD20007	14/10/2020	625.9	86.9
MB15HD20007	15/10/2020	625.9	86.9
MB15HD20007	16/10/2020	625.9	86.9
MB15HD20007	17/10/2020	625.8	87.0
MB15HD20007	18/10/2020	625.8	87.0
MB15HD20007	19/10/2020	625.8	87.0
MB15HD20007	20/10/2020	625.8	87.0
MB15HD20007	21/10/2020	625.8	87.0
MB15HD20007	22/10/2020	625.8	87.0
MB15HD20007	23/10/2020	625.8	87.0
MB15HD20007	24/10/2020	625.8	87.0
MB15HD20007	25/10/2020	625.8	87.0
MB15HD20007	26/10/2020	625.8	87.0
MB15HD20007	27/10/2020	625.8	87.0
MB15HD20007	28/10/2020	625.8	87.0
MB15HD20007	29/10/2020	625.8	86.9
MB15HD20007	30/10/2020	625.9	86.9
MB15HD20007	31/10/2020	625.9	86.9
MB15HD20007	1/11/2020	625.8	86.9
MB15HD20007	2/11/2020	625.8	87.0
MB15HD20007	3/11/2020	625.9	86.9
MB15HD20007	4/11/2020	625.9	86.9
MB15HD20007	5/11/2020	625.9	86.9
MB15HD20007	6/11/2020	625.9	86.9
MB15HD20007	7/11/2020	625.9	86.9
MB15HD20007	8/11/2020	625.8	86.9
MB15HD20007	9/11/2020	625.8	86.9
MB15HD20007	10/11/2020	625.8	86.9
MB15HD20007	11/11/2020	625.9	86.9
MB15HD20007	12/11/2020	625.9	86.9
MB15HD20007	13/11/2020	625.8	86.9
MB15HD20007	14/11/2020	625.8	87.0
MB15HD20007	15/11/2020	625.8	87.0
MB15HD20007	16/11/2020	625.8	86.9
MB15HD20007	17/11/2020	625.9	86.9
MB15HD20007	18/11/2020	625.8	86.9
MB15HD20007	19/11/2020	625.8	86.9
MB15HD20007	20/11/2020	625.8	86.9
MB15HD20007	21/11/2020	625.8	87.0
MB15HD20007	22/11/2020	625.8	87.0
MB15HD20007	23/11/2020	625.8	86.9
MB15HD20007	24/11/2020	625.8	86.9
MB15HD20007	25/11/2020	625.8	87.0
MB15HD20007	26/11/2020	625.8	87.0
MB15HD20007	27/11/2020	625.8	87.0
MB15HD20007	28/11/2020	625.8	87.0

ID	Date	WL mAHD	WL mbgl

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	15/06/2011	192.1	494.4
HDVP2	14/06/2011	192.1	494.4
HDVP2	13/06/2011	192.1	494.4
HDVP2	12/06/2011	192.1	494.4
HDVP2	11/06/2011	192.1	494.4
HDVP2	10/06/2011	192.1	494.4
HDVP2	9/06/2011	192.1	494.4
HDVP2	8/06/2011	192.1	494.4
HDVP2	7/06/2011	192.1	494.4
HDVP2	6/06/2011	192.1	494.4
HDVP2	5/06/2011	192.1	494.4
HDVP2	4/06/2011	192.1	494.4
HDVP2	3/06/2011	192.1	494.4
HDVP2	2/06/2011	192.1	494.4
HDVP2	1/06/2011	192.1	494.4
HDVP2	31/05/2011	182.2	504.4
HDVP2	30/05/2011	182.2	504.4
HDVP2	29/05/2011	182.2	504.4
HDVP2	28/05/2011	182.2	504.4
HDVP2	27/05/2011	182.2	504.4
HDVP2	26/05/2011	182.2	504.4
HDVP2	25/05/2011	182.2	504.4
HDVP2	24/05/2011	182.2	504.4
HDVP2	23/05/2011	182.2	504.4
HDVP2	22/05/2011	182.2	504.4
HDVP2	21/05/2011	182.2	504.4
HDVP2	20/05/2011	182.2	504.4
HDVP2	19/05/2011	182.2	504.4
HDVP2	18/05/2011	182.2	504.4
HDVP2	17/05/2011	182.2	504.4
HDVP2	16/05/2011	182.2	504.4
HDVP2	15/05/2011	182.2	504.4
HDVP2	14/05/2011	182.2	504.4
HDVP2	13/05/2011	182.2	504.4
HDVP2	12/05/2011	182.2	504.4
HDVP2	11/05/2011	182.2	504.4
HDVP2	10/05/2011	182.2	504.4
HDVP2	9/05/2011	182.2	504.4
HDVP2	8/05/2011	182.2	504.4
HDVP2	7/05/2011	182.2	504.4
HDVP2	6/05/2011	182.2	504.4
HDVP2	5/05/2011	182.2	504.4
HDVP2	4/05/2011	182.2	504.4
HDVP2	3/05/2011	182.2	504.4
HDVP2	2/05/2011	182.2	504.4
HDVP2	1/05/2011	182.2	504.4
HDVP2	30/04/2011	207.6	478.9
HDVP2	29/04/2011	207.6	478.9
HDVP2	28/04/2011	207.6	478.9
HDVP2	27/04/2011	207.6	478.9
HDVP2	26/04/2011	207.6	478.9
HDVP2	25/04/2011	207.6	478.9
HDVP2	24/04/2011	207.6	478.9
HDVP2	23/04/2011	207.6	478.9
HDVP2	22/04/2011	207.6	478.9
HDVP2	21/04/2011	207.6	478.9
HDVP2	20/04/2011	207.6	478.9
HDVP2	19/04/2011	207.6	478.9
HDVP2	18/04/2011	207.6	478.9
HDVP2	17/04/2011	207.6	478.9
HDVP2	16/04/2011	207.6	478.9
HDVP2	15/04/2011	207.6	478.9
HDVP2	14/04/2011	207.6	478.9
HDVP2	13/04/2011	207.6	478.9
HDVP2	12/04/2011	207.6	478.9
HDVP2	11/04/2011	207.6	478.9
HDVP2	10/04/2011	207.6	478.9
HDVP2	9/04/2011	207.6	478.9
HDVP2	8/04/2011	207.6	478.9
HDVP2	7/04/2011	207.6	478.9
HDVP2	6/04/2011	207.6	478.9
HDVP2	5/04/2011	207.6	478.9
HDVP2	4/04/2011	207.6	478.9
HDVP2	3/04/2011	207.6	478.9
HDVP2	2/04/2011	207.6	478.9
HDVP2	1/04/2011	207.6	478.9
HDVP2	31/03/2011	215.0	471.6
HDVP2	30/03/2011	215.0	471.6
HDVP2	29/03/2011	215.0	471.6
HDVP2	28/03/2011	215.0	471.6
HDVP2	27/03/2011	215.0	471.6
HDVP2	26/03/2011	215.0	471.6
HDVP2	25/03/2011	215.0	471.6
HDVP2	24/03/2011	215.0	471.6
HDVP2	23/03/2011	215.0	471.6
HDVP2	22/03/2011	215.0	471.6
HDVP2	21/03/2011	215.0	471.6
HDVP2	20/03/2011	215.0	471.6
HDVP2	19/03/2011	215.0	471.6
HDVP2	18/03/2011	215.0	471.6
HDVP2	17/03/2011	215.0	471.6
HDVP2	16/03/2011	215.0	471.6
HDVP2	15/03/2011	215.0	471.6
HDVP2	14/03/2011	215.0	471.6
HDVP2	13/03/2011	215.0	471.6
HDVP2	12/03/2011	215.0	471.6
HDVP2	11/03/2011	215.0	471.6
HDVP2	10/03/2011	215.0	471.6
HDVP2	9/03/2011	215.0	471.6
HDVP2	8/03/2011	215.0	471.6
HDVP2	7/03/2011	215.0	471.6
HDVP2	6/03/2011	215.0	471.6
HDVP2	5/03/2011	215.0	471.6
HDVP2	4/03/2011	215.0	471.6
HDVP2	3/03/2011	215.0	471.6
HDVP2	2/03/2011	215.0	471.6
HDVP2	1/03/2011	215.0	471.6
HDVP2	28/02/2011	208.1	478.5
HDVP2	27/02/2011	208.1	478.5
HDVP2	26/02/2011	208.1	478.5
HDVP2	25/02/2011	208.1	478.5
HDVP2	24/02/2011	208.1	478.5
HDVP2	23/02/2011	208.1	478.5
HDVP2	22/02/2011	208.1	478.5
HDVP2	21/02/2011	208.1	478.5
HDVP2	20/02/2011	208.1	478.5
HDVP2	19/02/2011	208.1	478.5
HDVP2	18/02/2011	208.1	478.5
HDVP2	17/02/2011	208.1	478.5
HDVP2	16/02/2011	208.1	478.5
HDVP2	15/02/2011	208.1	478.5
HDVP2	14/02/2011	208.1	478.5
HDVP2	13/02/2011	208.1	478.5
HDVP2	12/02/2011	208.1	478.5
HDVP2	11/02/2011	208.1	478.5
HDVP2	10/02/2011	208.1	478.5
HDVP2	9/02/2011	208.1	478.5
HDVP2	8/02/2011	208.1	478.5
HDVP2	7/02/2011	208.1	478.5
HDVP2	6/02/2011	208.1	478.5
HDVP2	5/02/2011	208.1	478.5
HDVP2	4/02/2011	208.1	478.5
HDVP2	3/02/2011	208.1	478.5
HDVP2	2/02/2011	208.1	478.5
HDVP2	1/02/2011	208.1	478.5
HDVP2	31/01/2011	208.1	478.5

ID	Date	WL mAHD	WL mbgl
MB18WON0005	22/02/2020	621.5	14.6
MB18WON0005	21/02/2020	621.5	14.6
MB18WON0005	20/02/2020	621.4	14.6
MB18WON0005	19/02/2020	621.4	14.7
MB18WON0005	18/02/2020	621.4	14.7
MB18WON0005	17/02/2020	621.4	14.6
MB18WON0005	16/02/2020	621.4	14.7
MB18WON0005	15/02/2020	621.4	14.7
MB18WON0005	14/02/2020	621.4	14.7
MB18WON0005	13/02/2020	621.4	14.7
MB18WON0005	12/02/2020	621.3	14.8
MB18WON0005	11/02/2020	621.3	14.8
MB18WON0005	10/02/2020	621.2	14.9
MB18WON0005	9/02/2020	621.1	15.0
MB18WON0005	8/02/2020	621.2	14.9
MB18WON0005	7/02/2020	621.2	14.9
MB18WON0005	6/02/2020	621.2	14.9
MB18WON0005	5/02/2020	621.2	14.9
MB18WON0005	4/02/2020	621.2	14.9
MB18WON0005	3/02/2020	621.2	14.9
MB18WON0005	2/02/2020	621.2	14.9
MB18WON0005	1/02/2020	621.2	14.9
MB18WON0005	31/01/2020	621.1	15.0
MB18WON0005	30/01/2020	621.1	15.0
MB18WON0005	29/01/2020	621.1	15.0
MB18WON0005	28/01/2020	621.1	15.0
MB18WON0005	27/01/2020	621.1	14.9
MB18WON0005	26/01/2020	621.1	15.0
MB18WON0005	25/01/2020	621.1	15.0
MB18WON0005	24/01/2020	621.1	15.0
MB18WON0005	23/01/2020	621.1	15.0
MB18WON0005	22/01/2020	621.0	15.0
MB18WON0005	21/01/2020	621.0	15.1
MB18WON0005	20/01/2020	621.0	15.1
MB18WON0005	19/01/2020	621.0	15.1
MB18WON0005	18/01/2020	620.9	15.1
MB18WON0005	17/01/2020	620.9	15.2
MB18WON0005	16/01/2020	620.9	15.1
MB18WON0005	15/01/2020	620.9	15.2
MB18WON0005	14/01/2020	620.9	15.2
MB18WON0005	13/01/2020	620.9	15.2
MB18WON0005	12/01/2020	620.9	15.2
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MB18WON0005	9/01/2020	620.8	15.3
MB18WON0005	8/01/2020	620.8	15.3
MB18WON0005	7/01/2020	620.8	15.3
MB18WON0005	6/01/2020	620.8	15.3
MB18WON0005	5/01/2020	620.8	15.3
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MB18WON0005	2/01/2020	620.8	15.3
MB18WON0005	1/01/2020	620.8	15.3
MB18WON0005	31/12/2019	620.8	15.3
MB18WON0005	30/12/2019	620.8	15.2
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MB18WON0005	15/12/2019	620.9	15.2
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MB18WON0005	10/12/2019	620.9	15.2
MB18WON0005	9/12/2019	620.9	15.2
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MB18WON0005	7/12/2019	620.9	15.2
MB18WON0005	6/12/2019	620.9	15.2
MB18WON0005	5/12/2019	620.9	15.2
MB18WON0005	4/12/2019	620.9	15.2
MB18WON0005	3/12/2019	620.9	15.2
MB18WON0005	2/12/2019	620.9	15.2
MB18WON0005	1/12/2019	621.0	15.1
MB18WON0005	30/11/2019	621.0	15.1
MB18WON0005	29/11/2019	620.9	15.2
MB18WON0005	28/11/2019	620.9	15.2
MB18WON0005	27/11/2019	620.9	15.2
MB18WON0005	26/11/2019	620.9	15.2
MB18WON0005	25/11/2019	620.9	15.2
MB18WON0005	24/11/2019	620.9	15.2
MB18WON0005	23/11/2019	620.9	15.2
MB18WON0005	22/11/2019	621.0	15.1
MB18WON0005	21/11/2019	620.9	15.2
MB18WON0005	20/11/2019	620.9	15.2
MB18WON0005	19/11/2019	620.9	15.2
MB18WON0005	18/11/2019	620.9	15.2
MB18WON0005	17/11/2019	621.0	15.1
MB18WON0005	16/11/2019	621.0	15.1
MB18WON0005	15/11/2019	621.0	15.1
MB18WON0005	14/11/2019	621.0	15.1
MB18WON0005	13/11/2019	621.0	15.1
MB18WON0005	12/11/2019	621.0	15.1
MB18WON0005	11/11/2019	620.9	15.2
MB18WON0005	10/11/2019	620.9	15.1
MB18WON0005	9/11/2019	621.0	15.1
MB18WON0005	8/11/2019	621.0	15.1
MB18WON0005	7/11/2019	621.0	15.1
MB18WON0005	6/11/2019	621.0	15.1
MB18WON0005	5/11/2019	621.0	15.1
MB18WON0005	4/11/2019	621.0	15.1
MB18WON0005	3/11/2019	621.0	15.1
MB18WON0005	2/11/2019	621.0	15.1
MB18WON0005	1/11/2019	621.0	15.1
MB18WON0005	31/10/2019	620.9	15.1
MB18WON0005	30/10/2019	621.0	15.1
MB18WON0005	29/10/2019	621.0	15.1
MB18WON0005	28/10/2019	621.0	15.1
MB18WON0005	27/10/2019	621.0	15.1
MB18WON0005	26/10/2019	621.0	15.1
MB18WON0005	25/10/2019	621.0	15.1
MB18WON0005	24/10/2019	621.0	15.1
MB18WON0005	23/10/2019	621.0	15.1
MB18WON0005	22/10/2019	621.0	15.1
MB18WON0005	21/10/2019	621.0	15.1
MB18WON0005	20/10/2019	621.0	15.0
MB18WON0005	19/10/2019	621.0	15.1
MB18WON0005	18/10/2019	621.0	15.1
MB18WON0005	17/10/2019	621.0	15.1
MB18WON0005	16/10/2019	621.0	15.1
MB18WON0005	15/10/2019	621.0	15.1
MB18WON0005	14/10/2019	621.0	15.1
MB18WON0005	13/10/2019	621.0	15.1
MB18WON0005	12/10/2019	621.0	15.1
MB18WON0005	11/10/2019	621.0	15.1
MB18WON0005	10/10/2019	621.0	15.0

ID	Date	WL mAHD	WL mbgl
MB15HD20007	29/11/2020	625.8	87.0
MB15HD20007	30/11/2020	625.8	87.0
MB15HD20007	1/12/2020	625.8	87.0
MB15HD20007	2/12/2020	625.8	87.0
MB15HD20007	3/12/2020	625.8	87.0
MB15HD20007	4/12/2020	625.8	86.9
MB15HD20007	5/12/2020	625.8	87.0
MB15HD20007	6/12/2020	625.8	87.0
MB15HD20007	7/12/2020	625.8	87.0
MB15HD20007	8/12/2020	625.8	87.0
MB15HD20007	9/12/2020	625.8	87.0
MB15HD20007	10/12/2020	625.8	87.0
MB15HD20007	11/12/2020	625.8	87.0
MB15HD20007	12/12/2020	625.8	87.0
MB15HD20007	13/12/2020	625.8	87.0
MB15HD20007	14/12/2020	625.8	87.0
MB15HD20007	15/12/2020	625.8	87.0
MB15HD20007	16/12/2020	625.8	87.0
MB15HD20007	17/12/2020	625.8	87.0
MB15HD20007	18/12/2020	625.8	87.0
MB15HD20007	19/12/2020	625.8	87.0
MB15HD20007	20/12/2020	625.8	87.0
MB15HD20007	21/12/2020	625.8	87.0
MB15HD20007	22/12/2020	625.8	87.0
MB15HD20007	23/12/2020	625.8	87.0
MB15HD20007	24/12/2020	625.8	87.0
MB15HD20007	25/12/2020	625.8	87.0
MB15HD20007	26/12/2020	625.8	87.0
MB15HD20007	27/12/2020	625.8	87.0
MB15HD20007	28/12/2020	625.8	87.0
MB15HD20007	29/12/2020	625.8	87.0
MB15HD20007	30/12/2020	625.8	87.0
MB15HD20007	31/12/2020	625.8	87.0
MB15HD20007	1/01/2021	625.8	87.0
MB15HD20007	2/01/2021	625.8	87.0
MB15HD20007	3/01/2021	625.8	87.0
MB15HD20007	4/01/2021	625.8	87.0
MB15HD20007	5/01/2021	625.8	87.0
MB15HD20007	6/01/2021	625.8	87.0
MB15HD20007	7/01/2021	625.8	87.0
MB15HD20007	8/01/2021	625.8	87.0
MB15HD20007	9/01/2021	625.8	86.9
MB15HD20007	10/01/2021	625.8	87.0
MB15HD20007	11/01/2021	625.8	87.0
MB15HD20007	12/01/2021	625.8	87.0
MB15HD20007	13/01/2021	625.8	87.0
MB15HD20007	14/01/2021	625.8	87.0
MB15HD20007	15/01/2021	625.8	87.0
MB15HD20007	16/01/2021	625.8	87.0
MB15HD20007	17/01/2021	625.8	87.0
MB15HD20007	18/01/2021	625.8	87.0
MB15HD20007	19/01/2021	625.8	87.0
MB15HD20007	20/01/2021	625.8	87.0
MB15HD20007	21/01/2021	625.8	87.0
MB15HD20007	22/01/2021	625.8	87.0
MB15HD20007	23/01/2021	625.8	87.0
MB15HD20007	24/01/2021	625.8	87.0
MB15HD20007	25/01/2021	625.8	87.0
MB15HD20007	26/01/2021	625.8	87.0
MB15HD20007	27/01/2021	625.8	87.0
MB15HD20007	28/01/2021	625.8	87.0
MB15HD20007	29/01/2021	625.8	87.0
MB15HD20007	30/01/2021	625.8	87.0
MB15HD20007	31/01/2021	625.8	87.0
MB15HD20007	1/02/2021	625.8	87.0
MB15HD20007	2/02/2021	625.8	87.0
MB15HD20007	3/02/2021	625.8	87.0
MB15HD20007	4/02/2021	625.8	87.0
MB15HD20007	5/02/2021	625.8	87.0
MB15HD20007	6/02/2021	625.8	87.0
MB15HD20007	7/02/2021	625.8	87.0
MB15HD20007	8/02/2021	625.8	87.0
MB15HD20007	9/02/2021	625.8	87.0
MB15HD20007	10/02/2021	625.8	87.0
MB15HD20007	11/02/2021	625.8	87.0
MB15HD20007	12/02/2021	625.8	87.0
MB15HD20007	13/02/2021	625.8	87.0
MB15HD20007	14/02/2021	625.8	87.0
MB15HD20007	15/02/2021	625.8	87.0
MB15HD20007	16/02/2021	625.8	87.0
MB15HD20007	17/02/2021	625.8	87.0
MB15HD20007	18/02/2021	625.8	87.0
MB15HD20007	19/02/2021	625.8	87.0
MB15HD20007	20/02/2021	625.8	87.0
MB15HD20007	21/02/2021	625.8	87.0
MB15HD20007	22/02/2021	625.8	87.0
MB15HD20007	23/02/2021	625.8	87.0
MB15HD20007	24/02/2021	625.8	87.0
MB15HD20007	25/02/2021	625.8	87.0
MB15HD20007	26/02/2021	625.8	87.0
MB15HD20007	27/02/2021	625.8	87.0
MB15HD20007	28/02/2021	625.8	87.0
MB15HD20007	1/03/2021	625.8	87.0
MB15HD20007	2/03/2021	625.8	87.0
MB15HD20007	3/03/2021	625.8	87.0
MB15HD20007	4/03/2021	625.8	87.0
MB15HD20007	5/03/2021	625.8	87.0
MB15HD20007	6/03/2021	625.8	87.0
MB15HD20007	7/03/2021	625.8	87.0
MB15HD20007	8/03/2021	625.8	87.0
MB15HD20007	9/03/2021	625.8	87.0
MB15HD20007	10/03/2021	625.8	87.0
MB15HD20007	11/03/2021	625.8	87.0
MB15HD20007	12/03/2021	625.8	87.0
MB15HD20007	13/03/2021	625.8	87.0
MB15HD20007	14/03/2021	625.8	86.9
MB15HD20007	15/03/2021	625.9	86.9
MB15HD20007	16/03/2021	625.9	86.9
MB15HD20007	17/03/2021	625.9	86.9
MB15HD20007	18/03/2021	625.8	86.9
MB15HD20007	19/03/2021	625.8	86.9
MB15HD20007	20/03/2021	625.8	86.9
MB15HD20007	21/03/2021	625.8	87.0
MB15HD20007	22/03/2021	625.8	87.0
MB15HD20007	23/03/2021	625.8	87.0
MB15HD20007	24/03/2021	625.8	87.0
MB15HD20007	25/03/2021	625.8	87.0
MB15HD20007	26/03/2021	625.8	87.0
MB15HD20007	27/03/2021	625.8	87.0
MB15HD20007	28/03/2021	625.8	87.0
MB15HD20007	29/03/2021	625.8	87.0
MB15HD20007	30/03/2021	625.8	86.9
MB15HD20007	31/03/2021	625.8	86.9
MB15HD20007	1/04/2021	625.8	86.9
MB15HD20007	2/04/2021	625.8	86.9
MB15HD20007	3/04/2021	625.8	86.9
MB15HD20007	4/04/2021	625.8	86.9
MB15HD20007	5/04/2021	625.8	87.0
MB15HD20007	6/04/2021	625.8	86.9
MB15HD20007	7/04/2021	625.8	87.0
MB15HD20007	8/04/2021	625.8	87.0
MB15HD20007	9/04/2021	625.8	87.0
MB15HD20007	10/04/2021	625.8	87.0
MB15HD20007	11/04/2021	625.8	87.0
MB15HD20007	12/04/2021	625.8	87.0
MB15HD20007	13/04/2021	625.8	87.0

ID	Date	WL mAHD	WL mbgl

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	30/01/2011	208.1	478.5
HDVP2	29/01/2011	208.1	478.5
HDVP2	28/01/2011	208.1	478.5
HDVP2	27/01/2011	208.1	478.5
HDVP2	26/01/2011	208.1	478.5
HDVP2	25/01/2011	208.1	478.5
HDVP2	24/01/2011	208.1	478.5
HDVP2	23/01/2011	208.1	478.5
HDVP2	22/01/2011	208.1	478.5
HDVP2	21/01/2011	208.1	478.5
HDVP2	20/01/2011	208.1	478.5
HDVP2	19/01/2011	208.1	478.5
HDVP2	18/01/2011	208.1	478.5
HDVP2	17/01/2011	208.1	478.5
HDVP2	16/01/2011	208.1	478.5
HDVP2	15/01/2011	208.1	478.5
HDVP2	14/01/2011	208.1	478.5
HDVP2	13/01/2011	208.1	478.5
HDVP2	12/01/2011	208.1	478.5
HDVP2	11/01/2011	208.1	478.5
HDVP2	10/01/2011	208.1	478.5
HDVP2	9/01/2011	208.1	478.5
HDVP2	8/01/2011	208.1	478.5
HDVP2	7/01/2011	208.1	478.5
HDVP2	6/01/2011	208.1	478.5
HDVP2	5/01/2011	208.1	478.5
HDVP2	4/01/2011	208.1	478.5
HDVP2	3/01/2011	208.1	478.5
HDVP2	2/01/2011	208.1	478.5
HDVP2	1/01/2011	208.1	478.5
HDVP2	31/12/2010	233.6	452.9
HDVP2	30/12/2010	233.6	452.9
HDVP2	29/12/2010	233.6	452.9
HDVP2	28/12/2010	233.6	452.9
HDVP2	27/12/2010	233.6	452.9
HDVP2	26/12/2010	233.6	452.9
HDVP2	25/12/2010	233.6	452.9
HDVP2	24/12/2010	233.6	452.9
HDVP2	23/12/2010	233.6	452.9
HDVP2	22/12/2010	233.6	452.9
HDVP2	21/12/2010	233.6	452.9
HDVP2	20/12/2010	233.6	452.9
HDVP2	19/12/2010	233.6	452.9
HDVP2	18/12/2010	233.6	452.9
HDVP2	17/12/2010	233.6	452.9
HDVP2	16/12/2010	233.6	452.9
HDVP2	15/12/2010	233.6	452.9
HDVP2	14/12/2010	233.6	452.9
HDVP2	13/12/2010	233.6	452.9
HDVP2	12/12/2010	233.6	452.9
HDVP2	11/12/2010	233.6	452.9
HDVP2	10/12/2010	233.6	452.9
HDVP2	9/12/2010	233.6	452.9
HDVP2	8/12/2010	233.6	452.9
HDVP2	7/12/2010	233.6	452.9
HDVP2	6/12/2010	233.6	452.9
HDVP2	5/12/2010	233.6	452.9
HDVP2	4/12/2010	233.6	452.9
HDVP2	3/12/2010	233.6	452.9
HDVP2	2/12/2010	233.6	452.9
HDVP2	1/12/2010	233.6	452.9
HDVP2	30/11/2010	109.2	577.3
HDVP2	29/11/2010	109.2	577.3
HDVP2	28/11/2010	109.2	577.3
HDVP2	27/11/2010	109.2	577.3
HDVP2	26/11/2010	109.2	577.3
HDVP2	25/11/2010	109.2	577.3
HDVP2	24/11/2010	109.2	577.3
HDVP2	23/11/2010	109.2	577.3
HDVP2	22/11/2010	109.2	577.3
HDVP2	21/11/2010	109.2	577.3
HDVP2	20/11/2010	109.2	577.3
HDVP2	19/11/2010	109.2	577.3
HDVP2	18/11/2010	109.2	577.3
HDVP2	17/11/2010	109.2	577.3
HDVP2	16/11/2010	109.2	577.3
HDVP2	15/11/2010	109.2	577.3
HDVP2	14/11/2010	109.2	577.3
HDVP2	13/11/2010	109.2	577.3
HDVP2	12/11/2010	109.2	577.3
HDVP2	11/11/2010	109.2	577.3
HDVP2	10/11/2010	109.2	577.3
HDVP2	9/11/2010	109.2	577.3
HDVP2	8/11/2010	109.2	577.3
HDVP2	7/11/2010	109.2	577.3
HDVP2	6/11/2010	109.2	577.3
HDVP2	5/11/2010	109.2	577.3
HDVP2	4/11/2010	109.2	577.3
HDVP2	3/11/2010	109.2	577.3
HDVP2	2/11/2010	109.2	577.3
HDVP2	1/11/2010	109.2	577.3
HDVP2	31/10/2010	161.7	524.8
HDVP2	30/10/2010	161.7	524.8
HDVP2	29/10/2010	161.7	524.8
HDVP2	28/10/2010	161.7	524.8
HDVP2	27/10/2010	161.7	524.8
HDVP2	26/10/2010	161.7	524.8
HDVP2	25/10/2010	161.7	524.8
HDVP2	24/10/2010	161.7	524.8
HDVP2	23/10/2010	161.7	524.8
HDVP2	22/10/2010	161.7	524.8
HDVP2	21/10/2010	161.7	524.8
HDVP2	20/10/2010	161.7	524.8
HDVP2	19/10/2010	161.7	524.8
HDVP2	18/10/2010	161.7	524.8
HDVP2	17/10/2010	161.7	524.8
HDVP2	16/10/2010	161.7	524.8
HDVP2	15/10/2010	161.7	524.8
HDVP2	14/10/2010	161.7	524.8
HDVP2	13/10/2010	161.7	524.8
HDVP2	12/10/2010	161.7	524.8
HDVP2	11/10/2010	161.7	524.8
HDVP2	10/10/2010	161.7	524.8
HDVP2	9/10/2010	161.7	524.8
HDVP2	8/10/2010	161.7	524.8
HDVP2	7/10/2010	161.7	524.8
HDVP2	6/10/2010	161.7	524.8
HDVP2	5/10/2010	161.7	524.8
HDVP2	4/10/2010	161.7	524.8
HDVP2	3/10/2010	161.7	524.8
HDVP2	2/10/2010	161.7	524.8
HDVP2	1/10/2010	161.7	524.8
HDVP2	30/09/2010	161.7	524.8
HDVP2	29/09/2010	143.5	543.1
HDVP2	28/09/2010	143.5	543.1
HDVP2	27/09/2010	143.5	543.1
HDVP2	26/09/2010	143.5	543.1
HDVP2	25/09/2010	143.5	543.1
HDVP2	24/09/2010	143.5	543.1
HDVP2	23/09/2010	143.5	543.1
HDVP2	22/09/2010	143.5	543.1
HDVP2	21/09/2010	143.5	543.1
HDVP2	20/09/2010	143.5	543.1
HDVP2	19/09/2010	143.5	543.1
HDVP2	18/09/2010	143.5	543.1
HDVP2	17/09/2010	143.5	543.1

ID	Date	WL mAHD	WL mbgl
MB18WON0005	9/10/2019	621.1	15.0
MB18WON0005	8/10/2019	621.0	15.0
MB18WON0005	7/10/2019	621.0	15.1
MB18WON0005	6/10/2019	621.0	15.0
MB18WON0005	5/10/2019	621.1	15.0
MB18WON0005	4/10/2019	621.1	15.0
MB18WON0005	3/10/2019	621.0	15.0
MB18WON0005	2/10/2019	621.1	15.0
MB18WON0005	1/10/2019	621.1	15.0
MB18WON0005	30/09/2019	621.1	15.0
MB18WON0005	29/09/2019	621.1	15.0
MB18WON0005	28/09/2019	621.1	15.0
MB18WON0005	27/09/2019	621.1	15.0
MB18WON0005	26/09/2019	621.1	15.0
MB18WON0005	25/09/2019	621.1	15.0
MB18WON0005	24/09/2019	621.1	15.0
MB18WON0005	23/09/2019	621.1	15.0
MB18WON0005	22/09/2019	621.1	15.0
MB18WON0005	21/09/2019	621.1	15.0
MB18WON0005	20/09/2019	621.1	15.0
MB18WON0005	19/09/2019	621.1	15.0
MB18WON0005	18/09/2019	621.1	15.0
MB18WON0005	17/09/2019	621.1	15.0
MB18WON0005	16/09/2019	621.1	15.0
MB18WON0005	15/09/2019	621.1	15.0
MB18WON0005	14/09/2019	621.1	15.0
MB18WON0005	13/09/2019	621.1	15.0
MB18WON0005	12/09/2019	621.2	14.9
MB18WON0005	11/09/2019	621.2	14.9
MB18WON0005	10/09/2019	621.1	15.0
MB18WON0005	9/09/2019	621.1	15.0
MB18WON0005	8/09/2019	621.1	15.0
MB18WON0005	7/09/2019	621.1	15.0
MB18WON0005	6/09/2019	621.1	15.0
MB18WON0005	5/09/2019	621.1	15.0
MB18WON0005	4/09/2019	621.1	15.0
MB18WON0005	3/09/2019	621.1	15.0
MB18WON0005	2/09/2019	621.1	15.0
MB18WON0005	1/09/2019	621.1	15.0
MB18WON0005	31/08/2019	621.1	15.0
MB18WON0005	30/08/2019	621.1	15.0
MB18WON0005	29/08/2019	621.1	15.0
MB18WON0005	28/08/2019	621.1	15.0
MB18WON0005	27/08/2019	621.1	15.0
MB18WON0005	26/08/2019	621.1	15.0
MB18WON0005	25/08/2019	621.1	15.0
MB18WON0005	24/08/2019	621.1	15.0
MB18WON0005	23/08/2019	621.1	14.9
MB18WON0005	22/08/2019	621.2	14.9
MB18WON0005	21/08/2019	621.2	14.9
MB18WON0005	20/08/2019	621.2	14.9
MB18WON0005	19/08/2019	621.2	14.9
MB18WON0005	18/08/2019	621.2	14.9
MB18WON0005	17/08/2019	621.2	14.9
MB18WON0005	16/08/2019	621.2	14.9
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MB18WON0005	13/08/2019	621.2	14.9
MB18WON0005	12/08/2019	621.2	14.9
MB18WON0005	11/08/2019	621.2	14.9
MB18WON0005	10/08/2019	621.2	14.9
MB18WON0005	9/08/2019	621.2	14.9
MB18WON0005	8/08/2019	621.2	14.9
MB18WON0005	7/08/2019	621.2	14.9
MB18WON0005	6/08/2019	621.1	14.9
MB18WON0005	5/08/2019	621.2	14.9
MB18WON0005	4/08/2019	621.2	14.9
MB18WON0005	3/08/2019	621.2	14.9
MB18WON0005	2/08/2019	621.2	14.9
MB18WON0005	1/08/2019	621.2	14.9
MB18WON0005	31/07/2019	621.2	14.9
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MB18WON0005	27/07/2019	621.2	14.9
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MB18WON0005	25/07/2019	621.2	14.9
MB18WON0005	24/07/2019	621.2	14.9
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MB18WON0005	22/07/2019	621.2	14.9
MB18WON0005	21/07/2019	621.2	14.9
MB18WON0005	20/07/2019	621.2	14.9
MB18WON0005	19/07/2019	621.2	14.9
MB18WON0005	18/07/2019	621.2	14.9
MB18WON0005	17/07/2019	621.2	14.9
MB18WON0005	16/07/2019	621.2	14.9
MB18WON0005	15/07/2019	621.2	14.9
MB18WON0005	14/07/2019	621.3	14.8
MB18WON0005	13/07/2019	621.3	14.8
MB18WON0005	12/07/2019	621.2	14.8
MB18WON0005	11/07/2019	621.3	14.8
MB18WON0005	10/07/2019	621.2	14.9
MB18WON0005	9/07/2019	621.2	14.9
MB18WON0005	8/07/2019	621.2	14.9
MB18WON0005	7/07/2019	621.2	14.9
MB18WON0005	6/07/2019	621.2	14.9
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MB18WON0005	3/07/2019	621.2	14.9
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MB18WON0005	28/06/2019	621.3	14.8
MB18WON0005	27/06/2019	621.2	14.9
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MB18WON0005	25/06/2019	621.2	14.8
MB18WON0005	24/06/2019	621.2	14.8
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MB18WON0005	22/06/2019	621.2	14.9
MB18WON0005	21/06/2019	621.2	14.8
MB18WON0005	20/06/2019	621.2	14.9
MB18WON0005	19/06/2019	621.2	14.9
MB18WON0005	18/06/2019	621.2	14.9
MB18WON0005	17/06/2019	621.3	14.8
MB18WON0005	16/06/2019	621.3	14.8
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MB18WON0005	11/06/2019	621.3	14.8
MB18WON0005	10/06/2019	621.2	14.9
MB18WON0005	9/06/2019	621.2	14.9
MB18WON0005	8/06/2019	621.2	14.9
MB18WON0005	7/06/2019	621.3	14.8
MB18WON0005	6/06/2019	621.3	14.8
MB18WON0005	5/06/2019	621.3	14.8
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MB18WON0005	2/06/2019	621.3	14.8
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MB18WON0005	31/05/2019	621.3	14.8
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MB18WON0005	29/05/2019	621.3	14.8
MB18WON0005	28/05/2019	621.3	14.8
MB18WON0005	27/05/2019	621.3	14.8

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MB15HD20007	16/04/2021	625.9	86.9
MB15HD20007	17/04/2021	625.9	86.9
MB15HD20007	18/04/2021	625.9	86.9
MB15HD20007	19/04/2021	625.9	86.9
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MB15HD20007	23/04/2021	625.9	86.9
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MB15HD20007	4/05/2021	625.9	86.9
MB15HD20007	5/05/2021	625.9	86.9
MB15HD20007	6/05/2021	625.8	86.9
MB15HD20007	7/05/2021	625.8	86.9
MB15HD20007	8/05/2021	625.9	86.9
MB15HD20007	9/05/2021	625.9	86.9
MB15HD20007	10/05/2021	625.9	86.9
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MB15HD20007	13/05/2021	625.9	86.9
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MB15HD20007	15/05/2021	625.9	86.9
MB15HD20007	16/05/2021	625.9	86.9
MB15HD20007	17/05/2021	625.9	86.9
MB15HD20007	18/05/2021	625.9	86.9
MB15HD20007	19/05/2021	625.9	86.9
MB15HD20007	20/05/2021	625.9	86.9
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MB15HD20007	29/06/2021	625.9	86.9
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MB15HD20007	4/07/2021	625.9	86.9
MB15HD20007	5/07/2021	625.9	86.9
MB15HD20007	6/07/2021	625.9	86.9
MB15HD20007	7/07/2021	625.9	86.9
MB15HD20007	8/07/2021	625.9	86.9
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MB15HD20007	10/07/2021	625.9	86.9
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MB15HD20007	14/07/2021	625.8	87.0
MB15HD20007	15/07/2021	625.8	86.9
MB15HD20007	16/07/2021	625.9	86.9
MB15HD20007	17/07/2021	625.9	86.9
MB15HD20007	18/07/2021	625.9	86.9
MB15HD20007	19/07/2021	625.9	86.9
MB15HD20007	20/07/2021	625.9	86.9
MB15HD20007	21/07/2021	625.9	86.9
MB15HD20007	22/07/2021	625.9	86.9
MB15HD20007	23/07/2021	625.9	86.9
MB15HD20007	24/07/2021	625.9	86.9
MB15HD20007	25/07/2021	625.9	86.9
MB15HD20007	26/07/2021	625.9	86.9
MB15HD20007	27/07/2021	625.8	86.9
MB15HD20007	28/07/2021	625.8	87.0
MB15HD20007	29/07/2021	625.8	87.0
MB15HD20007	30/07/2021	625.8	87.0
MB15HD20007	31/07/2021	625.8	87.0
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MB15HD20007	2/08/2021	625.9	86.9
MB15HD20007	3/08/2021	625.9	86.9
MB15HD20007	4/08/2021	625.9	86.9
MB15HD20007	5/08/2021	625.9	86.9
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MB15HD20007	7/08/2021	625.9	86.9
MB15HD20007	8/08/2021	625.9	86.9
MB15HD20007	9/08/2021	625.9	86.9
MB15HD20007	10/08/2021	625.9	86.9
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MB15HD20007	18/08/2021	625.9	86.9
MB15HD20007	19/08/2021	625.9	86.9
MB15HD20007	20/08/2021	625.9	86.9
MB15HD20007	21/08/2021	625.9	86.9
MB15HD20007	22/08/2021	625.9	86.9
MB15HD20007	23/08/2021	625.9	86.9
MB15HD20007	24/08/2021	625.9	86.9
MB15HD20007	25/08/2021	625.9	86.9
MB15HD20007	26/08/2021	625.9	86.9
MB15HD20007	27/08/2021	625.9	86.9

ID	Date	WL mAHD	WL mbgl

Appendix II - Water Level Data

ID	Date	WL mAHD	WL mbgl
HDVP2	16/09/2010	143.5	543.1
HDVP2	15/09/2010	143.5	543.1
HDVP2	14/09/2010	143.5	543.1
HDVP2	13/09/2010	143.5	543.1
HDVP2	12/09/2010	143.5	543.1
HDVP2	11/09/2010	143.5	543.1
HDVP2	10/09/2010	143.5	543.1
HDVP2	9/09/2010	143.5	543.1
HDVP2	8/09/2010	143.5	543.1
HDVP2	7/09/2010	143.5	543.1
HDVP2	6/09/2010	143.5	543.1
HDVP2	5/09/2010	143.5	543.1
HDVP2	4/09/2010	143.5	543.1
HDVP2	3/09/2010	143.5	543.1
HDVP2	2/09/2010	143.5	543.1
HDVP2	1/09/2010	143.5	543.1
HDVP2	31/08/2010	177.1	509.4
HDVP2	30/08/2010	177.1	509.4
HDVP2	29/08/2010	177.1	509.4
HDVP2	28/08/2010	177.1	509.4
HDVP2	27/08/2010	177.1	509.4
HDVP2	26/08/2010	177.1	509.4
HDVP2	25/08/2010	177.1	509.4
HDVP2	24/08/2010	177.1	509.4
HDVP2	23/08/2010	177.1	509.4
HDVP2	22/08/2010	177.1	509.4
HDVP2	21/08/2010	177.1	509.4
HDVP2	20/08/2010	177.1	509.4
HDVP2	19/08/2010	177.1	509.4
HDVP2	18/08/2010	177.1	509.4
HDVP2	17/08/2010	177.1	509.4
HDVP2	16/08/2010	177.1	509.4
HDVP2	15/08/2010	177.1	509.4
HDVP2	14/08/2010	177.1	509.4
HDVP2	13/08/2010	177.1	509.4
HDVP2	12/08/2010	177.1	509.4
HDVP2	11/08/2010	177.1	509.4
HDVP2	10/08/2010	177.1	509.4
HDVP2	9/08/2010	177.1	509.4
HDVP2	8/08/2010	177.1	509.4
HDVP2	7/08/2010	177.1	509.4
HDVP2	6/08/2010	177.1	509.4
HDVP2	5/08/2010	177.1	509.4
HDVP2	4/08/2010	177.1	509.4
HDVP2	3/08/2010	177.1	509.4
HDVP2	2/08/2010	177.1	509.4
HDVP2	1/08/2010	177.1	509.4
HDVP2	31/07/2010	182.4	504.1
HDVP2	30/07/2010	182.4	504.1
HDVP2	29/07/2010	182.4	504.1
HDVP2	28/07/2010	182.4	504.1
HDVP2	27/07/2010	182.4	504.1
HDVP2	26/07/2010	182.4	504.1
HDVP2	25/07/2010	182.4	504.1
HDVP2	24/07/2010	182.4	504.1
HDVP2	23/07/2010	182.4	504.1
HDVP2	22/07/2010	182.4	504.1
HDVP2	21/07/2010	182.4	504.1
HDVP2	20/07/2010	182.4	504.1
HDVP2	19/07/2010	182.4	504.1
HDVP2	18/07/2010	182.4	504.1
HDVP2	17/07/2010	182.4	504.1
HDVP2	16/07/2010	182.4	504.1
HDVP2	15/07/2010	182.4	504.1
HDVP2	14/07/2010	182.4	504.1
HDVP2	13/07/2010	182.4	504.1
HDVP2	12/07/2010	182.4	504.1
HDVP2	11/07/2010	182.4	504.1
HDVP2	10/07/2010	182.4	504.1
HDVP2	9/07/2010	182.4	504.1
HDVP2	8/07/2010	182.4	504.1
HDVP2	7/07/2010	182.4	504.1
HDVP2	6/07/2010	182.4	504.1
HDVP2	5/07/2010	182.4	504.1
HDVP2	4/07/2010	182.4	504.1
HDVP2	3/07/2010	182.4	504.1
HDVP2	2/07/2010	182.4	504.1
HDVP2	1/07/2010	182.4	504.1
HDVP2	30/06/2010	159.2	527.3
HDVP2	29/06/2010	159.2	527.3
HDVP2	28/06/2010	159.2	527.3
HDVP2	27/06/2010	159.2	527.3
HDVP2	26/06/2010	159.2	527.3
HDVP2	25/06/2010	159.2	527.3
HDVP2	24/06/2010	159.2	527.3
HDVP2	23/06/2010	159.2	527.3
HDVP2	22/06/2010	159.2	527.3
HDVP2	21/06/2010	159.2	527.3
HDVP2	20/06/2010	159.2	527.3
HDVP2	19/06/2010	159.2	527.3
HDVP2	18/06/2010	159.2	527.3
HDVP2	17/06/2010	159.2	527.3
HDVP2	16/06/2010	159.2	527.3
HDVP2	15/06/2010	159.2	527.3
HDVP2	14/06/2010	159.2	527.3
HDVP2	13/06/2010	159.2	527.3
HDVP2	12/06/2010	159.2	527.3
HDVP2	11/06/2010	159.2	527.3
HDVP2	10/06/2010	159.2	527.3
HDVP2	9/06/2010	159.2	527.3
HDVP2	8/06/2010	159.2	527.3
HDVP2	7/06/2010	159.2	527.3
HDVP2	6/06/2010	159.2	527.3
HDVP2	5/06/2010	159.2	527.3
HDVP2	4/06/2010	159.2	527.3
HDVP2	3/06/2010	159.2	527.3
HDVP2	2/06/2010	159.2	527.3
HDVP2	1/06/2010	159.2	527.3
HDVP2	31/05/2010	0.6	685.9
HDVP2	30/05/2010	0.6	685.9
HDVP2	29/05/2010	0.6	685.9
HDVP2	28/05/2010	0.6	685.9
HDVP2	27/05/2010	0.6	685.9
HDVP2	26/05/2010	0.6	685.9
HDVP2	25/05/2010	0.6	685.9
HDVP2	24/05/2010	0.6	685.9
HDVP2	23/05/2010	0.6	685.9
HDVP2	22/05/2010	0.6	685.9
HDVP2	21/05/2010	0.6	685.9
HDVP2	20/05/2010	0.6	685.9
HDVP2	19/05/2010	0.6	685.9
HDVP2	18/05/2010	0.6	685.9

ID	Date	WL mAHD	WL mbgl
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MB18WON0005	25/05/2019	621.3	14.8
MB18WON0005	24/05/2019	621.3	14.8
MB18WON0005	23/05/2019	621.3	14.8
MB18WON0005	22/05/2019	621.3	14.8
MB18WON0005	21/05/2019	621.3	14.8
MB18WON0005	20/05/2019	621.3	14.8
MB18WON0005	19/05/2019	621.3	14.8
MB18WON0005	18/05/2019	621.3	14.8
MB18WON0005	17/05/2019	621.3	14.8
MB18WON0005	16/05/2019	621.3	14.8
MB18WON0005	15/05/2019	621.3	14.8
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MB18WON0005	13/05/2019	621.3	14.8
MB18WON0005	12/05/2019	621.3	14.8
MB18WON0005	11/05/2019	621.3	14.7
MB18WON0005	10/05/2019	621.4	14.7
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MB18WON0005	8/05/2019	621.3	14.8
MB18WON0005	7/05/2019	621.3	14.8
MB18WON0005	6/05/2019	621.3	14.8
MB18WON0005	5/05/2019	621.3	14.8
MB18WON0005	4/05/2019	621.3	14.8
MB18WON0005	3/05/2019	621.3	14.8
MB18WON0005	2/05/2019	621.3	14.8
MB18WON0005	1/05/2019	621.3	14.8
MB18WON0005	30/04/2019	621.3	14.8
MB18WON0005	29/04/2019	621.3	14.8
MB18WON0005	28/04/2019	621.3	14.8
MB18WON0005	27/04/2019	621.3	14.8
MB18WON0005	26/04/2019	621.3	14.8
MB18WON0005	25/04/2019	621.3	14.8
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MB18WON0005	16/04/2019	621.2	14.8
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MB18WON0005	2/04/2019	621.2	14.9
MB18WON0005	1/04/2019	621.2	14.8
MB18WON0005	31/03/2019	621.2	14.8
MB18WON0005	30/03/2019	621.2	14.8
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MB18WON0005	11/03/2019	621.2	14.9
MB18WON0005	10/03/2019	621.2	14.9
MB18WON0005	9/03/2019	621.3	14.8
MB18WON0005	8/03/2019	621.2	14.8
MB18WON0005	7/03/2019	621.2	14.9
MB18WON0005	6/03/2019	621.2	14.9
MB18WON0005	5/03/2019	621.2	14.8
MB18WON0005	4/03/2019	621.3	14.8
MB18WON0005	3/03/2019	621.3	14.8
MB18WON0005	2/03/2019	621.3	14.8
MB18WON0005	1/03/2019	621.2	14.9
MB18WON0005	28/02/2019	621.2	14.8
MB18WON0005	27/02/2019	621.2	14.9
MB18WON0005	26/02/2019	621.3	14.8
MB18WON0005	25/02/2019	621.3	14.8
MB18WON0005	24/02/2019	621.3	14.8
MB18WON0005	23/02/2019	621.3	14.8
MB18WON0005	22/02/2019	621.3	14.8
MB18WON0005	21/02/2019	621.2	14.9
MB18WON0005	20/02/2019	621.2	14.9
MB18WON0005	19/02/2019	621.2	14.9
MB18WON0005	18/02/2019	621.2	14.9
MB18WON0005	17/02/2019	621.2	14.9
MB18WON0005	16/02/2019	621.2	14.9
MB18WON0005	15/02/2019	621.2	14.9
MB18WON0005	14/02/2019	621.2	14.9
MB18WON0005	13/02/2019	621.2	14.9
MB18WON0005	12/02/2019	621.2	14.9
MB18WON0005	11/02/2019	621.2	14.9
MB18WON0005	10/02/2019	621.2	14.9
MB18WON0005	9/02/2019	621.2	14.9
MB18WON0005	8/02/2019	621.2	14.9
MB18WON0005	7/02/2019	621.2	14.9
MB18WON0005	6/02/2019	621.2	14.9
MB18WON0005	5/02/2019	621.2	14.9
MB18WON0005	4/02/2019	621.2	14.9
MB18WON0005	3/02/2019	621.2	14.9
MB18WON0005	2/02/2019	621.2	14.9
MB18WON0005	1/02/2019	621.2	14.9
MB18WON0005	31/01/2019	621.3	14.8
MB18WON0005	30/01/2019	621.3	14.8
MB18WON0005	29/01/2019	621.3	14.8
MB18WON0005	28/01/2019	621.3	14.8
MB18WON0005	27/01/2019	621.3	14.8
MB18WON0005	26/01/2019	621.3	14.8
MB18WON0005	25/01/2019	621.3	14.8

ID	Date	WL mAHD	WL mbgl
MB15HD20007	28/08/2021	625.9	86.9
MB15HD20007	29/08/2021	625.9	86.9
MB15HD20007	30/08/2021	625.9	86.9
MB15HD20007	31/08/2021	625.9	86.9
MB15HD20007	1/09/2021	625.8	86.9
MB15HD20007	2/09/2021	625.8	87.0
MB15HD20007	3/09/2021	625.8	86.9
MB15HD20007	4/09/2021	625.9	86.9
MB15HD20007	5/09/2021	625.9	86.9
MB15HD20007	6/09/2021	625.9	86.9
MB15HD20007	7/09/2021	625.9	86.9
MB15HD20007	8/09/2021	625.9	86.9
MB15HD20007	9/09/2021	625.9	86.9
MB15HD20007	10/09/2021	625.9	86.9
MB15HD20007	11/09/2021	625.9	86.9
MB15HD20007	12/09/2021	625.9	86.9
MB15HD20007	13/09/2021	625.8	86.9
MB15HD20007	14/09/2021	625.8	87.0
MB15HD20007	15/09/2021	625.8	87.0
MB15HD20007	16/09/2021	625.8	87.0
MB15HD20007	17/09/2021	625.8	86.9
MB15HD20007	18/09/2021	625.9	86.9
MB15HD20007	19/09/2021	625.9	86.9
MB15HD20007	20/09/2021	625.9	86.9
MB15HD20007	21/09/2021	625.9	86.9
MB15HD20007	22/09/2021	625.9	86.9
MB15HD20007	23/09/2021	625.9	86.9
MB15HD20007	24/09/2021	625.9	86.9
MB15HD20007	25/09/2021	625.8	86.9
MB15HD20007	26/09/2021	625.8	87.0
MB15HD20007	27/09/2021	625.8	87.0
MB15HD20007	28/09/2021	625.8	87.0
MB15HD20007	29/09/2021	625.8	87.0
MB15HD20007	30/09/2021	625.8	87.0
MB15HD20007	1/10/2021	625.8	87.0
MB15HD20007	2/10/2021	625.8	87.0
MB15HD20007	3/10/2021	625.8	87.0
MB15HD20007	4/10/2021	625.8	87.0
MB15HD20007	5/10/2021	625.8	87.0
MB15HD20007	6/10/2021	625.8	87.0
MB15HD20007	7/10/2021	625.8	87.0
MB15HD20007	8/10/2021	625.8	87.0
MB15HD20007	9/10/2021	625.8	87.0
MB15HD20007	10/10/2021	625.8	87.0
MB15HD20007	12/11/2021	625.8	87.0
MB15HD20007	13/11/2021	625.8	87.0
MB15HD20007	14/11/2021	625.8	87.0
MB15HD20007	15/11/2021	625.8	87.0
MB15HD20007	16/11/2021	625.8	87.0
MB15HD20007	17/11/2021	625.8	87.0
MB15HD20007	18/11/2021	625.8	87.0
MB15HD20007	19/11/2021	625.8	87.0
MB15HD20007	20/11/2021	625.8	87.0
MB15HD20007	21/11/2021	625.8	87.0
MB15HD20007	22/11/2021	625.8	87.0
MB15HD20007	23/11/2021	625.8	87.0
MB15HD20007	24/11/2021	625.8	87.0
MB15HD20007	25/11/2021	625.8	87.0
MB15HD20007	26/11/2021	625.8	87.0
MB15HD20007	27/11/2021	625.8	87.0
MB15HD20007	28/11/2021	625.8	87.0
MB15HD20007	29/11/2021	625.8	87.0
MB15HD20007	30/11/2021	625.8	87.0
MB15HD20007	1/12/2021	625.8	87.0
MB15HD20007	2/12/2021	625.8	87.0
MB15HD20007	3/12/2021	625.8	87.0
MB15HD20007	4/12/2021	625.8	87.0
MB15HD20007	5/12/2021	625.8	87.0
MB15HD20007	6/12/2021	625.8	87.0
MB15HD20007	7/12/2021	625.8	87.0
MB15HD20007	8/12/2021	625.8	87.0
MB15HD20007	9/12/2021	625.8	87.0
MB15HD20007	10/12/2021	625.8	87.0
MB15HD20007	11/12/2021	625.8	87.0
MB15HD20007	12/12/2021	625.8	87.0
MB15HD20007	13/12/2021	625.8	87.0
MB15HD20007	14/12/2021	625.8	87.0
MB15HD20007	15/12/2021	625.8	87.0
MB15HD20007	16/12/2021	625.8	87.0
MB15HD20007	17/12/2021	625.8	87.0
MB15HD20007	18/12/2021	625.8	87.0
MB15HD20007	19/12/2021	625.8	87.0
MB15HD20007	20/12/2021	625.8	87.0
MB15HD20007	21/12/2021	625.8	87.0
MB15HD20007	22/12/2021	625.8	87.0
MB15HD20007	23/12/2021	625.8	87.0
MB15HD20007	24/12/2021	625.8	87.0
MB15HD20007	25/12/2021	625.8	87.0
MB15HD20007	26/12/2021	625.8	87.0
MB15HD20007	30/12/2021	625.8	87.0
MB15HD20007	31/12/2021	625.8	87.0
MB15HD20007	1/01/2022	625.8	87.0
MB15HD20007	2/01/2022	625.8	87.0
MB15HD20007	3/01/2022	625.8	87.0
MB15HD20007	4/01/2022	625.8	87.0
MB15HD20007	5/01/2022	625.8	87.0
MB15HD20007	6/01/2022	625.8	87.0
MB15HD20007	7/01/2022	625.8	87.0
MB15HD20007	8/01/2022	625.8	87.0
MB15HD20007	9/01/2022	625.8	87.0
MB15HD20007	10/01/2022	625.8	87.0
MB15HD20007	11/01/2022	625.8	87.0
MB15HD20007	12/01/2022	625.8	87.0
MB15HD20007	13/01/2022	625.8	87.0
MB15HD20007	14/01/2022	625.8	87.0
MB15HD20007	15/01/2022	625.8	87.0
MB15HD20007	16/01/2022	625.7	87.1
MB15HD20007	17/01/2022	625.7	87.1
MB15HD20007	18/01/2022	625.7	87.0
MB15HD20007	19/01/2022	625.8	87.0
MB15HD20007	20/01/2022	625.8	87.0
MB15HD20007	21/01/2022	625.8	87.0
MB15HD20007	22/01/2022	625.8	87.0
MB15HD20007	23/01/2022	625.8	87.0
MB15HD20007	24/01/2022	625.8	87.0
MB15HD20007	25/01/2022	625.7	87.1
MB15HD20007	26/01/2022	625.7	87.1
MB15HD20007	27/01/2022	625.7	87.1
MB15HD20007	28/01/2022	625.7	87.1
MB15HD20007	29/01/2022	625.7	87.1
MB15HD20007	30/01/2022	625.7	87.0
MB15HD20007	31/01/2022	625.7	87.1

ID	Date	WL mAHD	WL mbgl

Sample Point	MB21HD20005	MB21HD20004	MB18HD20009	WB16HD20001	WB18HD20003	WB18HD20002	WB18HD20001	MB18HD20012	WB18HD20003	WB18HD20002	MB18HD20012	WB16HD20001
Sample Date	14/12/2021	8/12/2021	3/08/2019	2/08/2019	2/08/2019	22/07/2019	22/07/2019	19/07/2019	3/02/2019	3/02/2019	3/02/2019	3/02/2019
(OTHER) OTHER JOB No. (text)	EP2115518	EP2115518	EP1907809	EP1907809	EP1907809	EP1907277	EP1907277	EP1907277	EP1900990	EP1900990	EP1900990	EP1900990
(OTHER) OTHER REFERENCE Lab (text)	EP2115518002	EP2115518001	EP1907809015	EP1907809027	EP1907809029	EP1907277014	EP1907277013	EP1907277011	EP1900990016	EP1900990015	EP1900990014	EP1900990013
(Calc) CALC ANZECC 95PCT HMTV ZN (mg/L)	0.07401206	0.0637798	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
(CHEM) CHEM ACIDITY CACO3 (mg/L)												
(CHEM) CHEM ALKALINITY CaCO3 (mg/L)	157	220	288	232	274	337	342	94	216	238	92	206
(CHEM) CHEM CO2 FREE (mg/L)			7	4	5	8	6	76	7	< 1	53	6
(CHEM) CHEM CO2 TOTAL (mg/L)			260	208	246	305	307	159	197	203	134	187
(CHEM) CHEM Cond EC LAB (uS/cm)	964	788	1,050	896	943	945	933	2,850	993	666	2,800	917
(CHEM) CHEM HARDNESS (CaCO3) (mg/L)	411	345										
(CHEM) CHEM HYDROX ALK. CaCO3 (mg/L)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
(CHEM) CHEM IONS ANION TTL mEq/L (mEq/L)	9.42	8.3	11.6	9.68	11.2	10.9	9.97	36				
(CHEM) CHEM ION CATION TTL mEq/L (mEq/L)	11.3	8.8	12.8	10.8	11	10.9	10	34.3				
(CHEM) CHEM IONIC BALANCE (%)	9.18	2.91	5.22	5.26	1.02	0.27	0.37	2.35				
(CHEM) CHEM pH (pH Units)	8.27	8.25	7.92	8.04	8.06	7.9	8.02	6.39	7.79	8.69	6.54	7.86
(CHEM) CHEM REDOX (ORP) (mV)												
(CHEM) CHEM REDOX pH (pH Units)												
(CHEM) CHEM TDS (mg/L)	616	496	659	558	561	542	504	2,200	614	326	2,280	514
(CHEM) CHEM TSS (mg/L)	30	82	< 5	10	14	165	7	< 5	14	24	< 5	5
(CHEM) CHEM TURBIDITY (NTU)												
(INORG) INORG ALUMINIUM (mg/L)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
(INORG) INORG ANTIMONY (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
(INORG) INORG ARSENIC (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
(INORG) INORG BARIUM (mg/L)	0.045	< 0.001	0.026	0.011	0.018	0.037	0.01	0.03	0.025	0.068	0.056	0.008
(INORG) INORG BERYLLIUM (mg/L)			< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
(INORG) INORG BICARBON. ALK CaCO3 (mg/L)	157	220	288	232	274	337	342	94	216	221	92	206
(INORG) INORG BORON (mg/L)	0.26	0.26	0.26	0.22	0.21	0.21	0.17	0.29	0.24	0.2	0.33	0.2
(INORG) INORG BROMIDE (mg/L)			< 0.05	0.446	0.024	0.032	0.047	0.672	0.498	0.446	0.987	0.519
(INORG) INORG CADMIUM (mg/L)	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0057	< 0.0001	< 0.0001	0.0449	< 0.0001
(INORG) INORG CALCIUM (mg/L)	64	64	87	56	61	77	58	241	75	11	249	62
(INORG) INORG CARBONATE ALK CaCO3 (mg/L)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	18	< 1	< 1
(INORG) INORG CHLORIDE (mg/L)	107	89	100	97	95	86	78	235	93	86	240	104
(INORG) INORG CHROMIUM (mg/L)	< 0.001	0.005	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
(INORG) INORG COBALT (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	< 0.001	0.041	< 0.001	< 0.001	0.058	< 0.001
(INORG) INORG COPPER (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	0.009	< 0.001
(INORG) INORG FLUORIDE (mg/L)	0.3	0.2	0.4	0.3	0.4	0.2	0.2	0.2	0.4	0.2	0.2	0.3
(INORG) INORG IRON (mg/L)	< 0.05	< 0.05	0.29	0.46	2.08	1.12	1.48	19.6	3.99	< 0.05	7.9	0.11
(INORG) INORG LEAD (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001
(INORG) INORG MAGNESIUM (mg/L)	61	45	69	63	62	59	44	160	63	46	172	47
(INORG) INORG MANGANESE (mg/L)	0.004	< 0.001	0.125	0.164	0.138	0.343	0.175	2.23	0.117	0.052	3.45	0.12
(INORG) INORG MERCURY (mg/L)	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
(INORG) INORG MOLYBDENUM (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
(INORG) INORG NICKEL (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.145	< 0.001	< 0.001	0.131	< 0.001
(INORG) INORG NITRATE (mg/L)	3.5	13.8							0.09	< 0.01	< 0.01	1.77
(INORG) INORG NITROGEN AMMONIA (mg/L)	< 0.01	< 0.01										
(INORG) INORG N AMMONIUM NH4-N (mg/L)	< 0.01	< 0.01										
(INORG) INORG N NITRATE N (mg/L)	0.79	3.11							0.02	< 0.01	< 0.01	0.4
(INORG) INORG N NITRITE N (mg/L)	< 0.01	0.01							< 0.01	< 0.01	< 0.01	< 0.01
(INORG) INORG N NOX NITROGEN (mg/L)	0.79	3.12							0.02	< 0.01	< 0.01	0.4
(INORG) INORG NITROGEN KJEL (mg/L)	< 0.1	0.7										
(INORG) INORG NITROGEN TOT (mg/L)	0.8	3.8										
(INORG) INORG OXYGEN DISSOLVED (% Sat)	92.7	98.2	64.5	71.3	59.9	82.3	72.1	76.3	49	53.9	66.5	59.6
(INORG) INORG Oxyg Dissolve (mg/L)												
(INORG) INORG Phosp Filt React (mg/L)									< 0.01	< 0.01	< 0.01	< 0.01
(INORG) INORG PHOSPH TOTAL (mg/L)	< 0.01	0.09	< 0.01	< 0.01	< 0.01	0.02	0.01	< 0.01	0.03	0.04	0.03	0.03
(INORG) INORG POTASSIUM (mg/L)	13	8	11	10	10	8	24	24	9	8	24	31
(INORG) INORG SELENIUM (mg/L)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
(INORG) INORG SILICON (mg/L)	7.07	11.6	7.69	5.6	6.02	13.2	16.1	7.8	6.65	0.95	8.42	5.11
(INORG) INORG SILICON DIOXIDE (mg/L)												
(INORG) INORG SILVER (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
(INORG) INORG SODIUM (mg/L)	64	39	58	58	59	47	67	196	58	68	197	79
(INORG) INORG STRONTIUM (mg/L)			0.16	0.095	0.122	0.124	0.12	0.186	0.156	0.033	0.204	0.119
(INORG) INORG SULPHATE (mg/L)	157	67	143	111	146	83	45	1,320	167	28	1,290	129
(INORG) INORG SULPHUR (S) (mg/L)												
(INORG) INORG TIN (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
(INORG) INORG URANIUM (mg/L)	< 0.001	< 0.001										
(INORG) INORG VANADIUM (mg/L)			< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
(INORG) INORG ZINC (mg/L)	< 0.005	< 0.005	0.069	0.043	0.017	0.009	0.006	4.25	0.012	< 0.005	1.95	< 0.005
(RAD) RAD TRITIUM RATIO (RATIO)												
(Calc) CALC ANZECC 95PCT HMTV CD (mg/L)	0.00205452	0.00175813	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
(Calc) CALC ANZECC 95PCT HMTV CU (mg/L)	0.01295211	0.01116146	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014
(Calc) CALC ANZECC 95PCT HMTV NI (mg/L)	0.10176658	0.08769722	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
(Calc) CALC ANZECC 95PCT HMTV PB (mg/L)	0.09443088	0.07560755	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034

Sample Point	WB18HD20001	MB18HD20009	MB18HD20012	WB18HD20003	WB16HD20001	MB15HD20002	MB15HD20003	MB15HD20004	MB15HD20006	MB15HD20002	MB15HD20003	MB15HD20004
Sample Date	3/02/2019	3/02/2019	18/11/2018	11/11/2018	2/11/2018	14/05/2017	14/05/2017	14/05/2017	14/05/2017	2/05/2016	2/05/2016	2/05/2016
(OTHER) OTHER JOB No. (text)	EP1900990	EP1900990	EP1813484	EP1813208	EP1812918	EP1705040	EP1705040	EP1705040	EP1705040	EP1603916	EP1603916	EP1603916
(OTHER) OTHER REFERENCE Lab (text)	EP1900990012	EP1900990011	EP1813484001	EP1813208003	EP1812918001	EP1705040001	EP1705040002	EP1705040003	EP1705040004	EP1603916001	EP1603916002	EP1603916003
(Calc) CALC ANZECC 95PCT HMTV ZN (mg/L)	0.008	0.008	0.18921055	0.07721437	0.07721437	0.008	0.008	0.008	0.008	0.008	0.008	0.008
(CHEM) CHEM ACIDITY CACO3 (mg/L)			18	24	7							
(CHEM) CHEM ALKALINITY CaCO3 (mg/L)	312	265	90	222	218	188	244	111	189	234	265	155
(CHEM) CHEM CO2 FREE (mg/L)	7	8				5	5	4	4	9	10	7
(CHEM) CHEM CO2 TOTAL (mg/L)	282	241				170	220	102	170	215	243	144
(CHEM) CHEM Cond EC LAB (uS/cm)	977	1,060	2,960	983	937	914	940	879	786	1,040	1,070	1,010
(CHEM) CHEM HARDNESS (CaCO3) (mg/L)			1,240	432	432							
(CHEM) CHEM HYDROX ALK. CaCO3 (mg/L)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
(CHEM) CHEM IONS ANION TTL mEq/L (mEq/L)			35.6	10.7	10.1							
(CHEM) CHEM ION CATION TTL mEq/L (mEq/L)			34.8	11.3	11.2							
(CHEM) CHEM IONIC BALANCE (%)			1.13	2.43	5.42							
(CHEM) CHEM pH (pH Units)	7.93	7.83				7.89	7.95	7.73	7.97	7.7	7.74	7.62
(CHEM) CHEM REDOX (ORP) (mV)			163	181	164							
(CHEM) CHEM REDOX pH (pH Units)			7.05	7.21	7.99							
(CHEM) CHEM TDS (mg/L)	577	648	2,300	653	613	644	710	676	576	623	658	621
(CHEM) CHEM TSS (mg/L)	< 5	< 5	280	< 5	< 5	90	9	14	188	316	236	132
(CHEM) CHEM TURBIDITY (NTU)			317	16.9	0.7							
(INORG) INORG ALUMINIUM (mg/L)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.01
(INORG) INORG ANTIMONY (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
(INORG) INORG ARSENIC (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
(INORG) INORG BARIUM (mg/L)	0.013	0.025				0.015	0.002	0.02	0.027	0.026	0.008	0.03
(INORG) INORG BERYLLIUM (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
(INORG) INORG BICARBON. ALK CaCO3 (mg/L)	312	265	90	222	218	188	244	111	189	234	265	155
(INORG) INORG BORON (mg/L)	0.23	0.25	0.31	0.2	0.22	0.21	0.22	0.24	0.27	0.28	0.28	0.28
(INORG) INORG BROMIDE (mg/L)	0.396	0.536	1.01	0.461	0.512	0.534	0.633	0.861	0.494	0.519	0.56	0.762
(INORG) INORG CADMIUM (mg/L)	< 0.0001	< 0.0001	0.0224	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
(INORG) INORG CALCIUM (mg/L)	53	83	225	74	74	72	72	57	70	77	85	68
(INORG) INORG CARBONATE ALK CaCO3 (mg/L)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
(INORG) INORG CHLORIDE (mg/L)	88	100	240	93	104	95	110	156	105	100	117	156
(INORG) INORG CHROMIUM (mg/L)	< 0.001	< 0.001	< 0.001	0.001	< 0.001	0.002	0.003	0.008	0.006	< 0.001	0.003	0.007
(INORG) INORG COBALT (mg/L)	< 0.001	< 0.001	0.029	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
(INORG) INORG COPPER (mg/L)	< 0.001	< 0.001	0.021	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.004	< 0.001	0.001	0.001
(INORG) INORG FLUORIDE (mg/L)	0.3	0.3	0.2	0.4	0.4	0.4	0.3	0.4	0.3	0.4	0.3	0.4
(INORG) INORG IRON (mg/L)	0.6	0.52	3.11	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
(INORG) INORG LEAD (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
(INORG) INORG MAGNESIUM (mg/L)	62	69	164	60	60	55	53	42	48	57	58	46
(INORG) INORG MANGANESE (mg/L)	0.112	0.107	0.937	0.001	0.001	0.001	0.001	0.002	0.01	0.007	0.082	0.041
(INORG) INORG MERCURY (mg/L)	< 0.0001	< 0.0001	< 0.00004	< 0.00004	< 0.00004	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
(INORG) INORG MOLYBDENUM (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
(INORG) INORG NICKEL (mg/L)	< 0.001	< 0.001	0.11	< 0.001	< 0.001	0.001	0.001	0.002	0.003	< 0.001	< 0.001	< 0.001
(INORG) INORG NITRATE (mg/L)	1.37	0.09	< 0.01	3.1	3.32	3.01	7.79	22.1	7.13			
(INORG) INORG NITROGEN AMMONIA (mg/L)			0.05	< 0.01	0.05							
(INORG) INORG N AMMONIUM NH4-N (mg/L)												
(INORG) INORG N NITRATE N (mg/L)	0.31	0.02	< 0.01	0.7	0.75	0.68	1.76	4.99	1.61	0.95	1.9	5.22
(INORG) INORG N NITRITE N (mg/L)	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
(INORG) INORG N NOX NITROGEN (mg/L)	0.32	0.02	< 0.01	0.7	0.75	0.68	1.76	4.99	1.61	0.95	1.9	5.22
(INORG) INORG NITROGEN KJEL (mg/L)			0.3	0.1	0.1							
(INORG) INORG NITROGEN TOT (mg/L)			0.3	0.8	0.8							
(INORG) INORG OXYGEN DISSOLVED (% Sat)	56.1	54.9	82.4	83.5	80.7							
(INORG) INORG Oxyg Dissolve (mg/L)						6.6	6.8	6.3	6.2	8.6	8.7	8.1
(INORG) INORG Phosp Filt React (mg/L)	< 0.01	< 0.01				< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
(INORG) INORG PHOSPH TOTAL (mg/L)	0.02	0.03	0.04	0.02	0.03	0.06	0.01	< 0.01	0.06	0.16	0.27	0.09
(INORG) INORG POTASSIUM (mg/L)	9	10	28	10	10	12	10	9	13	10	9	9
(INORG) INORG SELENIUM (mg/L)	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
(INORG) INORG SILICON (mg/L)	16.7	7.59				7.42	9.88	13	11	7.15	9.03	11.7
(INORG) INORG SILICON DIOXIDE (mg/L)			15.6	17	16.1							
(INORG) INORG SILVER (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
(INORG) INORG SODIUM (mg/L)	54	56	216	55	54	54	53	60	74	51	53	58
(INORG) INORG STRONTIUM (mg/L)	0.103	0.155				0.124	0.093	0.144	0.133	0.153	0.108	0.169
(INORG) INORG SULPHATE (mg/L)	60	159	1,300	177	134	156	139	114	85	155	142	114
(INORG) INORG SULPHUR (S) (mg/L)			417	62	50							
(INORG) INORG TIN (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
(INORG) INORG URANIUM (mg/L)												
(INORG) INORG VANADIUM (mg/L)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
(INORG) INORG ZINC (mg/L)	< 0.005	< 0.005	2.05	0.017	< 0.005	0.01	0.01	0.022	0.039	< 0.005	0.011	0.022
(RAD) RAD TRITIUM RATIO (RATIO)												
(Calc) CALC ANZECC 95PCT HMTV CD (mg/L)	0.0002	0.0002	0.00548956	0.0021477	0.0021477	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
(Calc) CALC ANZECC 95PCT HMTV CU (mg/L)	0.0014	0.0014	0.03311185	0.01351251	0.01351251	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014
(Calc) CALC ANZECC 95PCT HMTV NI (mg/L)	0.011	0.011	0.26016451	0.10616975	0.10616975	0.011	0.011	0.011	0.011	0.011	0.011	0.011
(Calc) CALC ANZECC 95PCT HMTV PB (mg/L)	0.0034	0.0034	0.38386672	0.1006003	0.1006003	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034

Sample Point	MB15HD20006	WB16HD20001
Sample Date	2/05/2016	17/02/2016
(OTHER) OTHER JOB No. (text)	EP1603916	EP1601403
(OTHER) OTHER REFERENCE Lab (text)	EP1603916004	EP1601403001
(Calc) CALC ANZECC 95PCT HMTV ZN (mg/L)	0.008	0.008
(CHEM) CHEM ACIDITY CACO3 (mg/L)		
(CHEM) CHEM ALKALINITY CaCO3 (mg/L)	229	224
(CHEM) CHEM CO2 FREE (mg/L)	7	
(CHEM) CHEM CO2 TOTAL (mg/L)	208	
(CHEM) CHEM Cond EC LAB (uS/cm)	879	959
(CHEM) CHEM HARDNESS (CaCO3) (mg/L)		
(CHEM) CHEM HYDROX ALK. CaCO3 (mg/L)	< 1	< 1
(CHEM) CHEM IONS ANION TTL mEq/L (mEq/L)		
(CHEM) CHEM ION CATION TTL mEq/L (mEq/L)		
(CHEM) CHEM IONIC BALANCE (%)		
(CHEM) CHEM pH (pH Units)	7.84	8.12
(CHEM) CHEM REDOX (ORP) (mV)		
(CHEM) CHEM REDOX pH (pH Units)		
(CHEM) CHEM TDS (mg/L)	541	586
(CHEM) CHEM TSS (mg/L)	552	24
(CHEM) CHEM TURBIDITY (NTU)		
(INORG) INORG ALUMINIUM (mg/L)	< 0.01	< 0.01
(INORG) INORG ANTIMONY (mg/L)	< 0.001	< 0.001
(INORG) INORG ARSENIC (mg/L)	< 0.001	< 0.001
(INORG) INORG BARIUM (mg/L)	0.041	0.007
(INORG) INORG BERYLLIUM (mg/L)	< 0.001	
(INORG) INORG BICARBON. ALK CaCO3 (mg/L)	229	224
(INORG) INORG BORON (mg/L)	0.3	0.22
(INORG) INORG BROMIDE (mg/L)	0.475	
(INORG) INORG CADMIUM (mg/L)	< 0.0001	< 0.0001
(INORG) INORG CALCIUM (mg/L)	69	59
(INORG) INORG CARBONATE ALK CaCO3 (mg/L)	< 1	< 1
(INORG) INORG CHLORIDE (mg/L)	105	106
(INORG) INORG CHROMIUM (mg/L)	0.001	< 0.001
(INORG) INORG COBALT (mg/L)	< 0.001	< 0.001
(INORG) INORG COPPER (mg/L)	< 0.001	< 0.001
(INORG) INORG FLUORIDE (mg/L)	0.3	0.4
(INORG) INORG IRON (mg/L)	< 0.05	0.23
(INORG) INORG LEAD (mg/L)	< 0.001	< 0.001
(INORG) INORG MAGNESIUM (mg/L)	44	55
(INORG) INORG MANGANESE (mg/L)	0.028	0.313
(INORG) INORG MERCURY (mg/L)	< 0.0001	< 0.0001
(INORG) INORG MOLYBDENUM (mg/L)	< 0.001	< 0.001
(INORG) INORG NICKEL (mg/L)	< 0.001	< 0.001
(INORG) INORG NITRATE (mg/L)		
(INORG) INORG NITROGEN AMMONIA (mg/L)		0.05
(INORG) INORG N AMMONIUM NH4-N (mg/L)		0.05
(INORG) INORG N NITRATE N (mg/L)	1.13	0.69
(INORG) INORG N NITRITE N (mg/L)	0.01	0.01
(INORG) INORG N NOX NITROGEN (mg/L)	1.14	0.7
(INORG) INORG NITROGEN KJEL (mg/L)		0.2
(INORG) INORG NITROGEN TOT (mg/L)		0.9
(INORG) INORG OXYGEN DISSOLVED (% Sat)		
(INORG) INORG Oxyg Dissolve (mg/L)	7.4	
(INORG) INORG Phosp Filt React (mg/L)	< 0.01	
(INORG) INORG PHOSPH TOTAL (mg/L)	0.08	0.07
(INORG) INORG POTASSIUM (mg/L)	9	11
(INORG) INORG SELENIUM (mg/L)	< 0.01	< 0.01
(INORG) INORG SILICON (mg/L)	10.4	4.62
(INORG) INORG SILICON DIOXIDE (mg/L)		
(INORG) INORG SILVER (mg/L)	< 0.001	< 0.001
(INORG) INORG SODIUM (mg/L)	48	65
(INORG) INORG STRONTIUM (mg/L)	0.158	
(INORG) INORG SULPHATE (mg/L)	84	165
(INORG) INORG SULPHUR (S) (mg/L)		
(INORG) INORG TIN (mg/L)	< 0.001	< 0.001
(INORG) INORG URANIUM (mg/L)		< 0.001
(INORG) INORG VANADIUM (mg/L)	< 0.01	
(INORG) INORG ZINC (mg/L)	< 0.005	< 0.005
(RAD) RAD TRITIUM RATIO (RATIO)		
(Calc) CALC ANZECC 95PCT HMTV CD (mg/L)	0.0002	0.0002
(Calc) CALC ANZECC 95PCT HMTV CU (mg/L)	0.0014	0.0014
(Calc) CALC ANZECC 95PCT HMTV NI (mg/L)	0.011	0.011
(Calc) CALC ANZECC 95PCT HMTV PB (mg/L)	0.0034	0.0034

Sample Point	WB17BHT0001	MB18BHT0003	WB17BHT0001	MB18BHT0003	WB16BHT0001	WB17BHT0001	WB17BHT0001	WB16BHT0001	WB16BHT0001
Sample Date	3/08/2019	21/07/2019	2/02/2019	15/11/2018	23/10/2018	14/08/2018	13/07/2017	3/06/2016	28/02/2016
(OTHER) OTHER JOB No. (text)	EP1907809	EP1907277	EP1900990	EP1813413	EP1812477	EP1809433	EP1707689	EP1605373	EP1601792
(OTHER) OTHER REFERENCE Lab (text)	EP1907809028	EP1907277010	EP1900990006	EP1813413001	EP1812477001	EP1809433001	EP1707689001	EP1605373013	EP1601792001
(Calc) CALC ANZECC 95PCT HMTV ZN (mg/L)	0.008	0.008	0.008	0.06861935	0.06550424	0.06768749	0.07553995		0.0631507
(CHEM) CHEM ACIDITY CACO3 (mg/L)				< 1	27	5	3		
(CHEM) CHEM ALKALINITY CaCO3 (mg/L)	203	378	226	204	181	171	160	230	229
(CHEM) CHEM CO2 FREE (mg/L)	4	14	5						
(CHEM) CHEM CO2 TOTAL (mg/L)	183	346	204						
(CHEM) CHEM Cond EC LAB (uS/cm)	891	1,450	893	928	876	1,220	1,090	724	836
(CHEM) CHEM HARDNESS (CaCO3) (mg/L)				376	356	370	421		341
(CHEM) CHEM HYDROX ALK. CaCO3 (mg/L)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
(CHEM) CHEM IONS ANION TTL mEq/L (mEq/L)	9.68	16	10.1	10.8	8.08	11.5	11.9		
(CHEM) CHEM ION CATION TTL mEq/L (mEq/L)	9.92	15.8	9.3	11.3	9.15	12.3	12.4		
(CHEM) CHEM IONIC BALANCE (%)	1.25	0.41	4.36	2.48	6.2	3.14	1.86		
(CHEM) CHEM pH (pH Units)	7.97	7.74	7.93					7.41	8.15
(CHEM) CHEM REDOX (ORP) (mV)				-12.7	112	1.7	63		-22.7
(CHEM) CHEM REDOX pH (pH Units)				8.39	7.81	7.29	8.27		
(CHEM) CHEM TDS (mg/L)	474	856	530	623	503	692	706	526	524
(CHEM) CHEM TSS (mg/L)	< 5	872	< 5	6,190	< 5	< 5	< 5		398
(CHEM) CHEM TURBIDITY (NTU)				8,770	20.5	3.8	6.7		
(INORG) INORG ALUMINIUM (mg/L)	< 0.01	< 0.01	< 0.01	0.02	< 0.01	0.02	< 0.01		< 0.01
(INORG) INORG ANTIMONY (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		< 0.001
(INORG) INORG ARSENIC (mg/L)	0.001	0.002	< 0.001	0.001	0.017	0.005	0.003		0.011
(INORG) INORG BARIUM (mg/L)	0.294	0.426	0.218						
(INORG) INORG BERYLLIUM (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		< 0.001
(INORG) INORG BICARBON. ALK CaCO3 (mg/L)	203	378	226	196	181	171	160	230	229
(INORG) INORG BORON (mg/L)	0.19	0.32	0.2	0.33	0.22	0.19	0.22		0.23
(INORG) INORG BROMIDE (mg/L)	0.769	0.658	0.921	0.652	0.375	1.08		0.356	
(INORG) INORG CADMIUM (mg/L)	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001		< 0.0001
(INORG) INORG CALCIUM (mg/L)	48	93	41	50	60	61	73		59
(INORG) INORG Ca TOTAL (mg/L)								59	
(INORG) INORG CARBONATE ALK CaCO3 (mg/L)	< 1	< 1	< 1	8	< 1	< 1	< 1	< 1	< 1
(INORG) INORG CHLORIDE (mg/L)	197	232	199	154	80	214	230	80	78
(INORG) INORG CHROMIUM (mg/L)	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001		< 0.001
(INORG) INORG COBALT (mg/L)	< 0.001	0.003	< 0.001	< 0.001	0.001	< 0.001	< 0.001		0.001
(INORG) INORG COPPER (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		< 0.001
(INORG) INORG FLUORIDE (mg/L)	0.7	0.3	0.6	0.4	0.4	0.4	0.4		0.4
(INORG) INORG IRON (mg/L)	1.93	< 0.05	4.19	< 0.05	2.82	0.42	< 0.05		< 0.05
(INORG) INORG Fe TOTAL (mg/L)								5.95	
(INORG) INORG LEAD (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		< 0.001
(INORG) INORG MAGNESIUM (mg/L)	47	81	47	61	50	53	58		47
(INORG) INORG Mg TOTAL (mg/L)								48	
(INORG) INORG MANGANESE (mg/L)	0.372	0.508	0.219	0.006	0.219	0.663	0.703		0.23
(INORG) INORG MERCURY (mg/L)	< 0.0001	< 0.0001	< 0.0001	< 0.00004	< 0.00004	< 0.00004	< 0.00004		< 0.00004
(INORG) INORG MOLYBDENUM (mg/L)	< 0.001	0.002	< 0.001	0.003	< 0.001	< 0.001	< 0.001		< 0.001
(INORG) INORG NICKEL (mg/L)	< 0.001	0.004	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		0.002
(INORG) INORG NITRATE (mg/L)				0.22	< 0.01	0.31	0.31		
(INORG) INORG NITROGEN AMMONIA (mg/L)				0.03	0.06	0.03	0.04		
(INORG) INORG N AMMONIUM NH4-N (mg/L)									
(INORG) INORG N NITRATE N (mg/L)				0.05	< 0.01	0.07	0.07		0.04
(INORG) INORG N NITRITE N (mg/L)				< 0.01	< 0.01	< 0.01	< 0.01		< 0.01
(INORG) INORG N NOX NITROGEN (mg/L)				0.05	< 0.01	0.07	0.07		0.04
(INORG) INORG NITROGEN KJEL (mg/L)				0.2	< 0.1	< 0.1	0.3		
(INORG) INORG NITROGEN TOT (mg/L)				0.2	< 0.1	< 0.1	0.4		
(INORG) INORG OXYGEN DISSOLVED (% Sat)	57.9	76.8	44.9	33.5	75.8	57.5	92.5		
(INORG) INORG PHOSPH TOTAL (mg/L)	< 0.01	0.18	0.05	0.19	0.01	< 0.01	< 0.01		
(INORG) INORG POTASSIUM (mg/L)	12	14	10	17	10	13	14		11
(INORG) INORG K TOTAL (mg/L)								12	
(INORG) INORG SELENIUM (mg/L)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		< 0.01
(INORG) INORG SILICON (mg/L)	3.8	33.9	2.42					5.51	
(INORG) INORG SILICON DIOXIDE (mg/L)				24.8	11.9	15.5	14.6		10.4
(INORG) INORG SILVER (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		< 0.001
(INORG) INORG SODIUM (mg/L)	77	96	72	77	41	104	83		41
(INORG) INORG Na TOTAL (mg/L)								42	
(INORG) INORG STRONTIUM (mg/L)	0.105	0.306	0.088						
(INORG) INORG Sr TOTAL (mg/L)								0.096	
(INORG) INORG SULPHATE (mg/L)	3	90	1	112	106	99	108	115	110
(INORG) INORG SULPHUR (S) (mg/L)				34	38	40	36		
(INORG) INORG TIN (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		< 0.001
(INORG) INORG URANIUM (mg/L)									
(INORG) INORG VANADIUM (mg/L)	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		< 0.01
(INORG) INORG ZINC (mg/L)	0.034	0.131	< 0.005	< 0.005	< 0.005	0.023	0.027		0.015
(ISO) ISOTOPE C13 (PDB)									
(ISO) ISOTOPE C14 (PMC)									
(ISO) ISOTOPE Deuterium (per ml VSMOW)									
(ISO) ISOTOPE O18 (per ml VSMOW)									
(Calc) CALC ANZECC 95PCT HMTV CD (mg/L)	0.0002	0.0002	0.0002	0.00189806	0.00180793	0.00187108	0.00209896		0.00173998
(Calc) CALC ANZECC 95PCT HMTV CU (mg/L)	0.0014	0.0014	0.0014	0.01200839	0.01146324	0.01184531	0.01321949		0.01105137
(Calc) CALC ANZECC 95PCT HMTV NI (mg/L)	0.011	0.011	0.011	0.0943516	0.09006833	0.09307029	0.10386743		0.08683221

Bore	Date	Deuterium (per ml VSMOW)	O18 (per ml VSMOW)	RAD TRITIUM RATIO (RATIO)
MB15HD20002	14-May-17	-55.60	-7.63	
MB15HD20003	14-May-17	-54.90	-7.72	
MB15HD20004	14-May-17	-53.30	-7.92	
MB15HD20006	14-May-17	-53.70	-7.76	
MB18BHT0003	14-Dec-19	-57.90	-8.63	
MB18BHT0003	21-Jul-19	-58.60	-8.67	0.118
MB18HD20009	12-Dec-19	-56.30	-7.64	
MB18HD20009	03-Aug-19	-55.95	-7.42	-0.019
MB18HD20009	03-Feb-19	-56.04	-7.47	
MB18HD20012	12-Dec-19	-49.80	-6.90	
MB18HD20012	19-Jul-19	-50.07	-6.87	0.002
MB18HD20012	03-Feb-19	-50.20	-6.90	
WB16BHT0001	11-Dec-19	-55.80	-7.96	
WB16BHT0001	03-Jun-16	-56.40	-8.04	
WB16HD20001	11-Dec-19	-55.10	-7.53	
WB16HD20001	02-Aug-19	-55.41	-7.56	-0.004
WB16HD20001	03-Feb-19	-55.30	-7.51	
WB17BHT0001	11-Dec-19	-56.00	-8.06	
WB17BHT0001	03-Aug-19	-55.63	-7.95	-0.008
WB17BHT0001	01-Feb-19	-56.00	-7.98	
WB18HD20001	22-Jul-19	-56.23	-8.00	0.017
WB18HD20001	03-Feb-19	-56.30	-7.96	
WB18HD20002	13-Dec-19	-54.90	-7.66	
WB18HD20002	22-Jul-19	-54.79	-7.64	0.0000
WB18HD20002	03-Feb-19	-55.10	-7.62	
WB18HD20003	11-Dec-19	-53.90	-7.57	
WB18HD20003	02-Aug-19	-53.40	-7.46	
WB18HD20003	03-Feb-19	-54.20	-7.49	

E.3: Baby Hope Hydrology & Hydraulic Assessment

Water Resource Evaluation / Projects & Development

Baby Hope Hydrology & Hydraulic Assessment

28 February 2014

Executive summary

This report presents the results of a flood study to determine the expected annual exceedance probability (AEP) design flood quantiles for Pebble Mouse Creek at the Baby Hope ore deposit and the Hope Downs 1 South East pit. Additionally, the results of 2D hydraulic modelling have been used to determine the 1% AEP flood depths and extent under existing and post pit development conditions for the Baby Hope deposit.

A RORB rainfall-runoff routing model was calibrated to the Tarina gauging station on Weeli Wolli Creek (708014) and used to estimate design flood quantiles at Baby Hope and the HD1 SE pit. The expected 1% AEP design flows for Pebble Mouse Creek at the Baby Hope deposit and HD1 SE pit are 970 m^3/s and 890 m^3/s respectively.

The spatial variability of rainfall and streamflow exhibited in the region introduces a large degree of uncertainty in design flood estimates, as there are no streamflow gauges or rainfall gauges within the Pebble Mouse Creek catchment. To reduce uncertainty in estimates it is recommended that pressure transducers are installed in Pebble Mouse Creek to record the surface water response to rainfall events. This data can then be used to validate the design flood estimates for Baby Hope.



Figure 1-1: Looking south over the Baby Hope deposit from the northern range; one of many deeply incised creeks that drain south over the deposit and are intercepted by the pit

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1. Introduction

1.1 Terminology

Probability concepts are fundamental to design flood estimation. The terminology used in the communication of these concepts is paramount if it is to be effective for all stakeholders. The term 'average recurrence interval' or 'ARI' has generally been used within Rio Tinto and by industry professionals to describe the probability of a particular magnitude of flood occurring ie. '100 yr ARI' or '1 in 100 year flood'.

Average Recurrence Interval (ARI) - the average period between occurrences equalling or exceeding a given value.

This description of flood events has often been misinterpreted by professionals, community members impacted by floods and other stakeholders as the probability of the chosen event is not explicitly defined. To ensure effective communication of event probabilities alternative terminology has been adopted by the Bureau of Meteorology (BoM) and other industry bodies. Australian Rainfall and Runoff (ARR) has outlined the proposed terminology to be adopted (Ball, 2013), and this follows;

Annual Exceedance Probability (AEP) - the probability of an event occurring or being exceeded within a year. For example a 1% AEP event has a 1% probability of being equalled or exceeded in any year.

The annual exceedance probability (AEP) expressed as a percentage, will be used to describe flood event probabilities for this study. Additionally, where appropriate, peak flows described as Q_y for the year ARI, will now be described as $Q_{n\%}$ AEP (including the percentage sign). Table 1-1 gives the AEP equivalent for ARI's commonly in used in flood studies.

Table 1-1: ARI and equivalent AEP

ARI	AEP (1 in x)	AEP %
1.44	2	50
4.48	5	20
9.49	10	10
20	20	5.0
50	50	2.0
100	100	1.0
200	200	0.50
500	500	0.20
1000	1000	0.10

1.2 Previous reports

Surface water investigations of the local catchment area have been previously undertaken for the development of Hope Downs 1. Regional catchment hydrology has been investigated for the development of Yandicoogina. Studies relevant to the Baby Hope deposit hydrology include:

- "Hope Downs Iron Ore Project: Preliminary Investigation into Surface Water Hydrology" – unpublished technical report prepared for Hope Downs Management Services, Halpern Glick Maunsell 1999.

- "Hope Downs Project Stage 1: Report for review of hydrology" – technical report prepared for Rio Tinto Iron Ore Expansion Projects, KBR March 2006.

- "Hope Downs Project Stage 1: Surface water management plan" – technical report prepared for Rio Tinto Iron Ore Expansion Projects, KBR March 2007.

- "Weeli Wolli hydrology and hydraulics" – unpublished internal technical report 2013 RTIO-PDE-0117748.

Other relevant regional studies include:

- "Surface Hydrology of the Pilbara Region" – technical report by the Water and Rivers Commission (Ruprecht, J. & Ivanescu, S., 2000).

- "Pilbara Surface Water Management Strategy" unpublished internal report RTIO-PDE-0053914.

2. Catchment characteristics

The Baby Hope study area is located in the Pebble Mouse Creek catchment within the Weeli Wolli Creek catchment that forms part of the Fortescue River Region (BoM, 2012a). Pebble Mouse Creek has a total catchment area of approximately 340 km² to the confluence with Weeli Wolli Creek, 258 km² of which is upstream of the study area, Figure 2-1. The targeted ore deposit lies on the lower northern slopes of a 2 km wide valley, approximately 10 km south west of Hope Downs 1 mine site and 78 km north west of the Newman township. A railway line and road, both containing culverts, are located south of the deposit on the opposite side of the Pebble Mouse Creek valley.

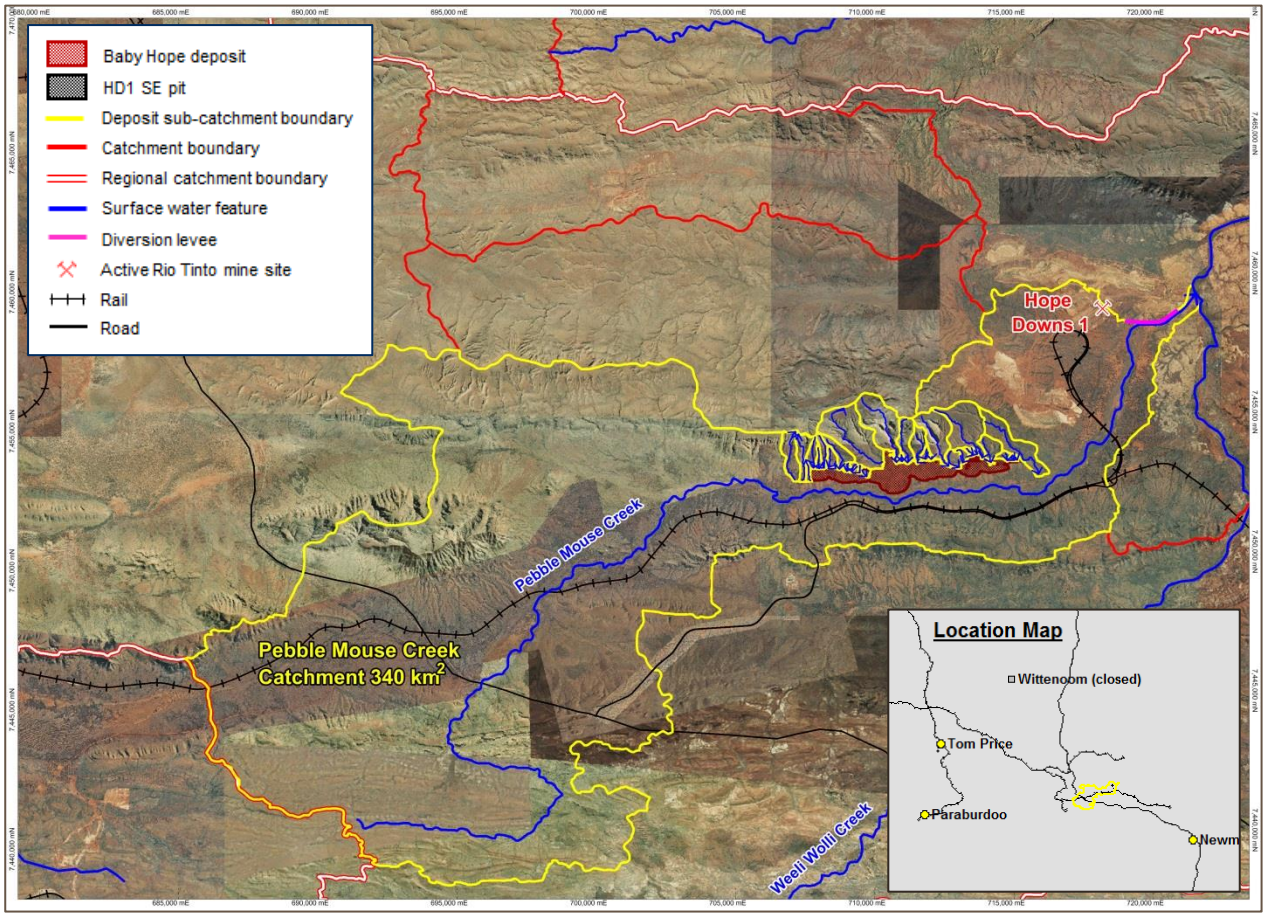

Figure 2-1: Catchments reporting to the Baby Hope ore deposit

The upper reaches of Pebble Mouse Creek tributaries are dominated by the Newman land system and lower reaches by the Boolgeeda and Platform land systems (van Vreeswyk et al. 2004). The Newman land system is characterised by rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands. The Boolgeeda and Platform land systems are characterised by stony slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrub lands.

Pebble Mouse Creek is generally well defined with little braiding and has an equal area slope of 3.4 m/km. The lower section of the catchment, approaching the deposit becomes confined in a 2 km wide valley that runs west to east with average low flow channel width of 10 m and depth of 1.5 m. A diversion levee was constructed to divert a section of the Pebble Mouse Creek low flow channel around Hope Downs 1 mine site as shown in Figure 2-1.

Runoff from the upper catchment produces the bulk of the flood water during large flood events with smaller sub-catchments on the north and south side slopes of the lower catchment contributing a minor proportion of run-off volume during flood events. A relatively steep range of hills directly north of the deposit area consists of many small but significant sub-catchments that have deeply incised creeks flowing south over the deposit. The deep incisions created by the creeks suggest that the range has been subjected to high water velocities and erosion.

Currently there are no stream flow or rainfall gauges within the Pebble Mouse Creek catchment. However the Tarina stream flow and rainfall gauge on Weeli Wolli Creek is located approximately 13 km downstream from the Pebble Mouse/Weeli Wolli confluence. The Wonmunna rainfall gauge is located approximately 8 km from the Pebble Mouse catchment centroid.

3. Regional and local climate

3.1 Regional climate characteristics

The Pilbara region spans across three Köppen climate zones: hot (persistently dry) grassland in the west, hot (winter drought) desert in the east and areas of hot (persistently dry) desert in the north and south (BoM, 2005a). It is typically classified as an arid to semi-arid climate, but annual rainfall totals are highly variable. Rainfall occurs predominantly in summer, with major falls caused by tropical cyclones, monsoon lows and convective thunderstorms. Rainfall is typically greatest around the Hamersley Ranges and decreases with distance from the coast. Tropical cyclones are a feature of the region and typically occur between January and March, with none expected between May and November. Extended periods of low rainfall can be common occurrences.

The spatial variability of rainfall across the Pilbara is high as a result of convective/cyclonic rainfall mechanisms. Average evaporation rates greatly exceed average rainfall rates and temperature variations can be extremely large (Ruprecht & Ivanescu, 2000). Mean annual evaporation rates range from 3000 to 4000 mm across the region, approximately an order of magnitude greater than the mean annual rainfall range of 200 to 500 mm.

3.2 Local climate

Based on the Köppen classification system the Baby Hope site is described as a grassland: hot (persistently dry)(BoM, 2005a). The Newman Bureau of Meteorology weather station (78 km southeast of Baby Hope) shows an average annual maximum temperature of 33° Celsius and summer maximum averages of 40° Celsius.

3.2.1 Rainfall

Long term daily gridded rainfall data has recently become available for Australia from the Bureau of Meteorology (Bo M, 2012b). The gridded data has been derived from recorded daily rainfalls and is provided for areas with sides approximately 5 km by 5 km.

A comparison between the recorded rainfall at Wonmunna (507012) and the gridded data at Wonmunna (700,633 mE/7,442,611 mN) indicated a strong correlation in larger rainfall days with a tendency to overestimate lower rainfall days, Table 3-1. The average number of rainfall days at Wonmunna (507012) is 57 as opposed to 74 days from BoM gridded data, with the majority of the difference coming from days with rainfall below 3 mm.

Table 3-1: Comparison of daily rainfall at Wonmunna (507012) and BoM gridded data (700,633 mE/7,442,611 mN)

Rainfall > (mm)	Average days per year 507012	Average days per year BoM gridded
1	35	43
2	29	33
3	25	27
5	18	19
10	11	10
20	5	4
25	4	3
35	2	1
50	1	1

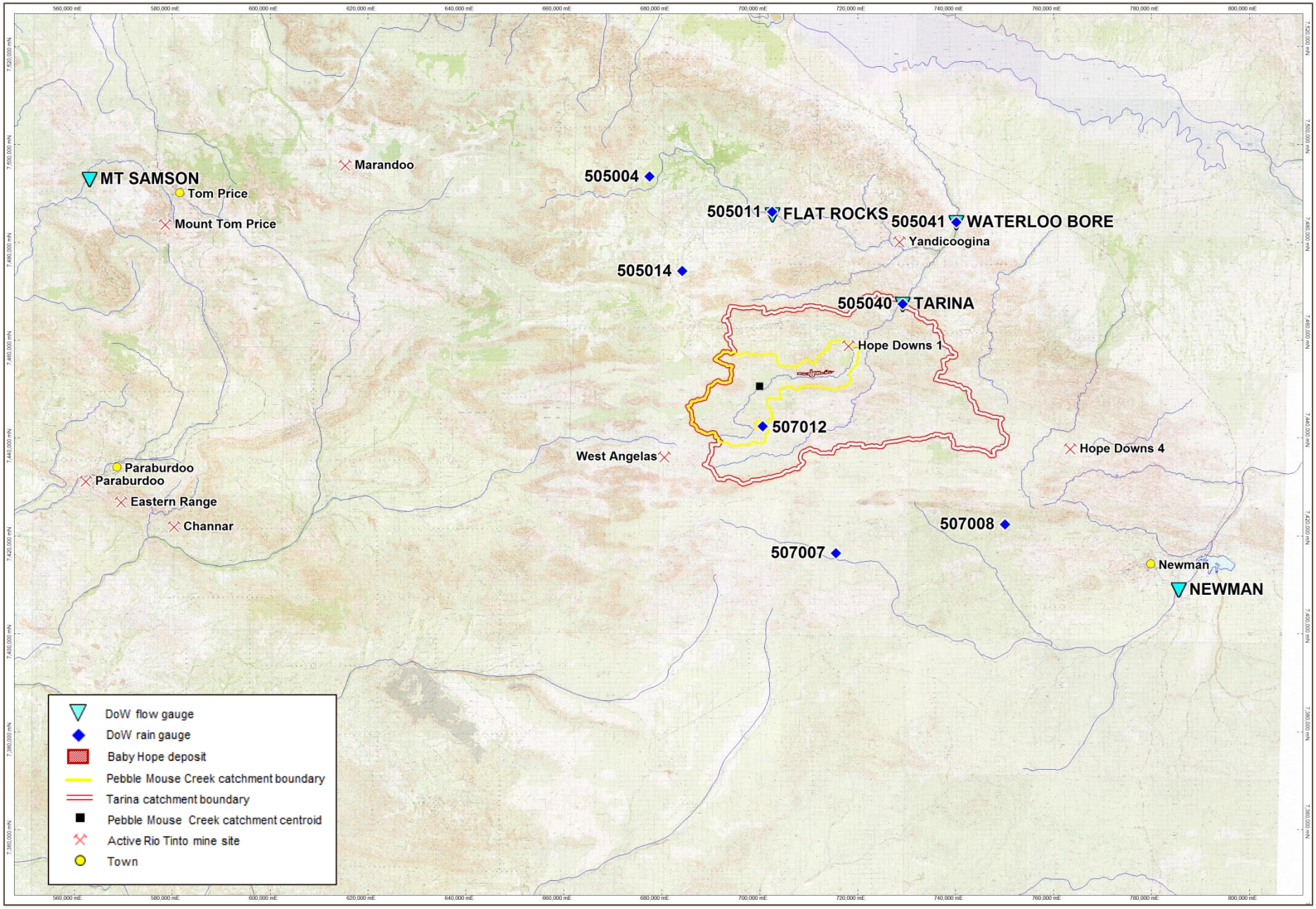

Figure 3-1: Pebble Mouse Creek catchment within the Tarina catchment

A comparison of monthly totals from the two data sets, Figure 3-2, revealed a strong correlation with a tendency to underestimate the larger rainfall months. Analysis of the differences in monthly recorded and gridded rainfalls showed that 90% of the gridded monthly totals were within +27 mm and -26 mm of the recorded totals.

In the absence of long term recorded rainfall data from within the catchment of interest the BoM gridded data was considered to be suitable for use as an estimate of Pebble Mouse Creek catchment rainfall. Baby Hope daily rainfall from 1906 to 2012 was obtained for the centroid of the Pebble Mouse Creek catchment, shown in Figure 3-1 (700,016 mE/7,450,612 mN), and used for analysis.

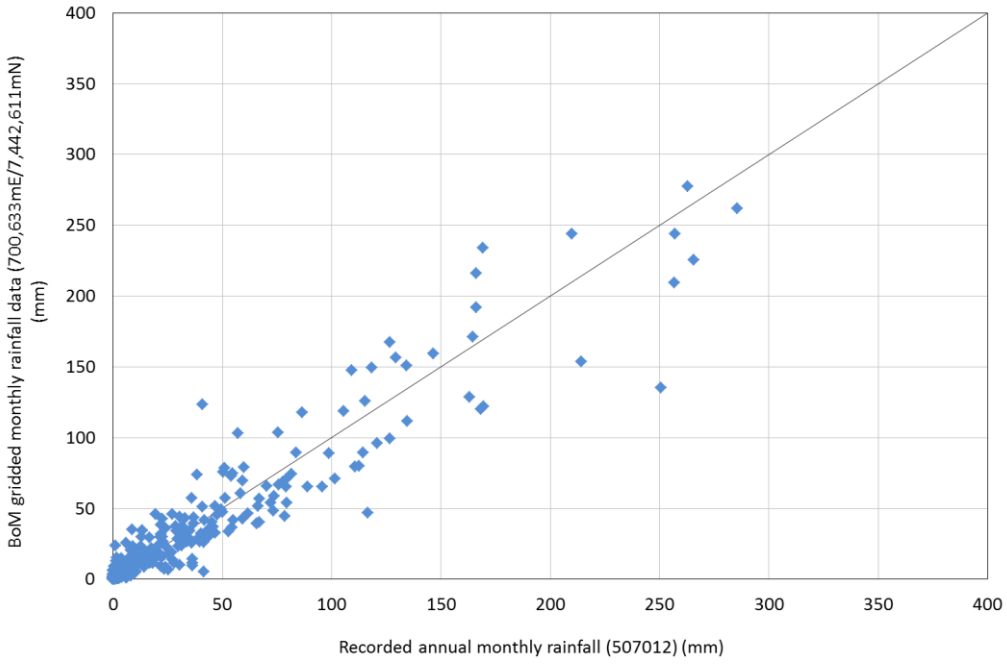

Figure 3-2: Relationship between recorded and gridded rainfall data at Wonmunna (Station 507012)

The monthly rainfall statistics for Baby Hope are provided in Figure 3-3. The rainfall is highly seasonal with 73% of the annual total occurring between December and April. Rainfall is typically associated with tropical low pressure systems and thunderstorm activity from the monsoonal trough that develops over northern Australia during summer. Winters are typically dry and mild though winter rain events can occur in June and July as a result of tropical cloud bands that intermittently affect the area. The high seasonality of rainfall has resulted in the adoption of a “water year” for the purpose s of hydrological analysis. The water year in the Pilbara Region is typically defined from 1 October to 30 September with the reported year stated as the year in which the water year commences. For example, the 1950 water year refers to 1 October 1950 through 30 September 1951.

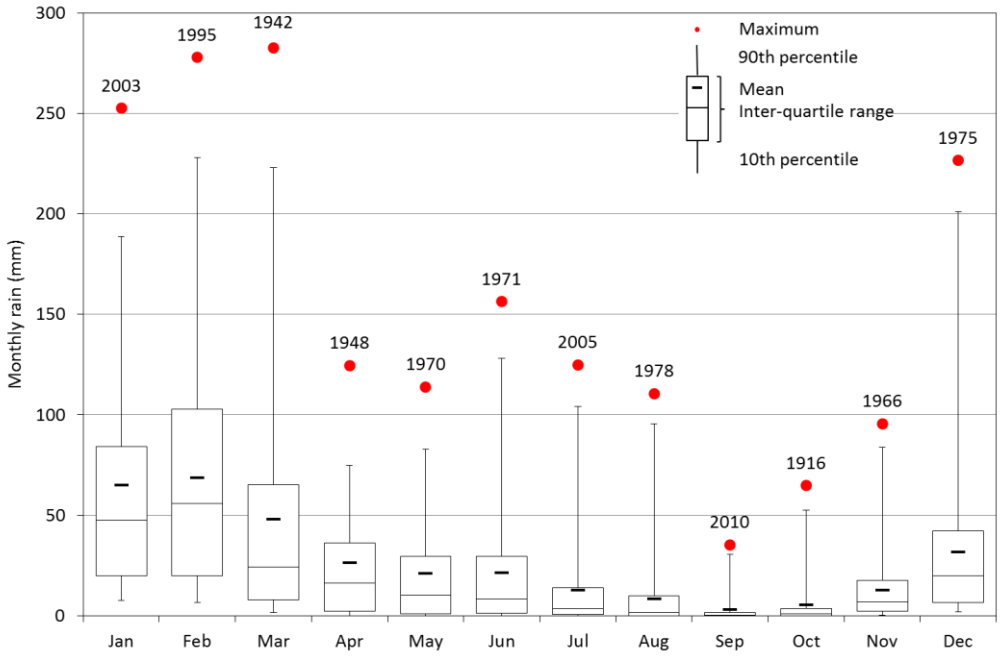

Figure 3-3: Monthly gridded rainfall distribution for Baby Hope (700,016 mE/7,450,612 mN)

The Coefficient of Variation (CV) of annual rainfall, used as a measure of inter-annual variability, is calculated as the ratio of the standard deviation to the mean annual rainfall. The CV of annual rainfall for the Baby Hope study area was calculated as 0.51, which is within the range of 0.4 to 0.7 reported for the Pilbara by Ruprecht and Ivanescu (2000).

An alternative methodology for characterising rainfall variability used by the Bureau of Meteorology calculates the rainfall *Index of Variability* (BoM, 2003) as:

$$index\ of\ variability = \frac{(90p - 10p)}{50p}$$

Where:

- $90p$ is the 90th annual rainfall percentile;

- $50p$ is the 50th annual rainfall percentile, or median annual rainfall; and

- $10p$ is the 10th annual rainfall percentile.

Under this classification scheme, the Baby Hope study area was calculated to have an Index of Variability of 1.28, which falls within the BoM's "high" variability range of 1.25 -1.50.

The long term mean annual rainfall for the study area is 317 mm with a range of 65 mm to 945 mm illustrating the high inter-annual variability. A trend analysis of annual rainfall indicates a long term increasing trend of 1.4 mm/year, Figure 3-4. The trend increases substantially to 7.1 mm/year when considering only the last 20 years. A similar rising trend has been observed at multiple locations in the Pilbara region.

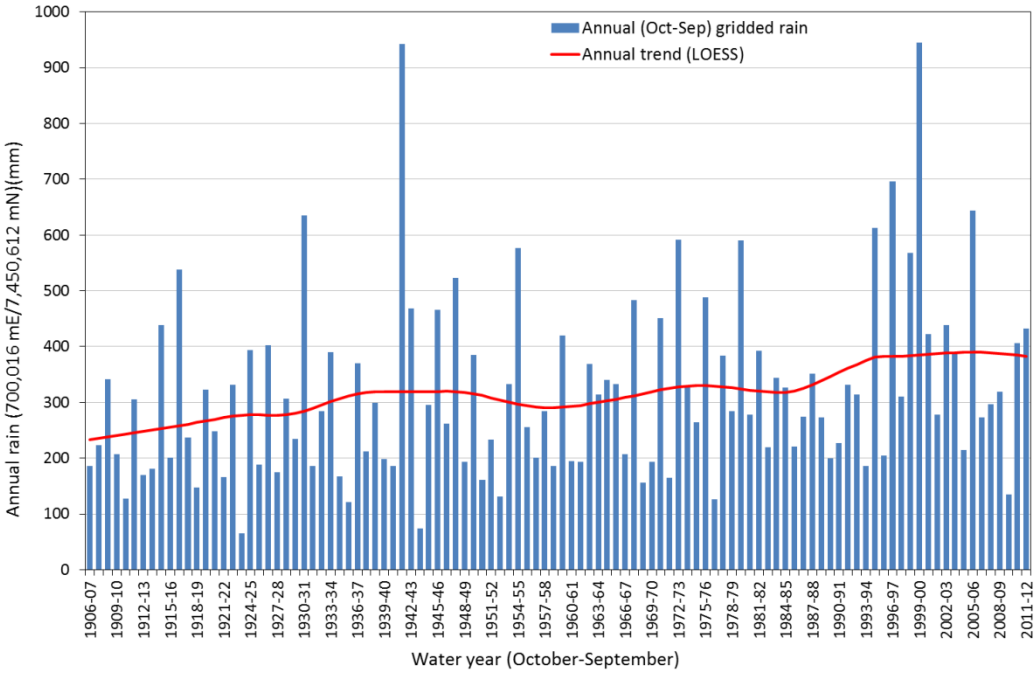

Figure 3-4: Trend for annual (October-September) rainfall, BoM gridded data Baby Hope (700,016 mE/7,450,612 mN)

Analysis of the daily gridded rainfall data indicates that rain events are infrequent and typically have low rainfall totals. Historically there are on average 39 rain days per year (rain greater than or equal to 1 mm) with majority of these days occurring from December to March. The daily rainfall statistics for the 107 year of record revealed; 76.4% of the daily rainfall totals are less than 5 mm; 96.4% are less than 25 mm; 98.2% are less than 35 mm; and 0.8% of daily rainfall totals are greater than 50 mm, an average of three days per year. Table 3-2 presents a summary of the gridded daily rainfall statistics for Baby Hope.

Table 3-2: 24 hour rainfall statistics BoM gridded data Baby Hope (700,016 mE / 7,450,612 mN)

	Statistics for days when rain occurred			**Statistics for all days**		
Month	Maximum (mm)	Mean (mm)	Standard deviation (mm)	Mean days of rain per year >=1 mm	Mean (mm) <10 mm only	Standard deviation (mm) <10 mm only
January	152	5.1	11.4	7	2.1	2.4
February	116	5.8	11.3	7	2.3	2.5
March	133	5.4	11.0	5	1.9	2.3
April	96	4.6	8.4	3	2.0	2.4
May	70	4.7	7.8	3	2.3	2.5
June	110	5.1	10.0	3	2.0	2.4
July	91	4.0	8.5	2	2.0	2.4
August	46	3.7	6.4	1	2.0	2.1
September	27	2.4	4.3	1	1.6	2.0
October	35	2.6	5.0	1	1.4	1.8
November	78	2.8	5.3	2	1.8	2.2
December	156	3.7	8.6	4	1.9	2.3

3.2.2 Evaporation and Evapotranspiration

Evaporation and evapotranspiration (ET) measures available for the Baby Hope study area are shown in Table 3-2. The mean annual Class A pan evaporation estimated for the study area is 3,333 mm (BoM, 2006), which greatly exceeds the average annual rainfall in the area, 317 mm/year, keeping it typically dry. Sheltered monthly evaporation was estimated using a pan evaporation conversion factor of 0.63, taken from a study by Luke et. al. (2003).

The annual mean point potential ET rate estimated for the study area is 3,030 mm/year (BoM, 2005b). Point potential ET is the ET that would take place, under the conditions of unlimited water supply, from an area so small that the local ET effects do not alter local air mass properties. The BoM advises that point potential ET may be taken as an estimate of evaporation from small water bodies such as shallow water storages, which may include surface water pools within a creek system.

The annual mean areal actual ET rate for the study area is estimated to be 361 mm/year (BoM, 2005b). This is the ET rate that actually takes place, under the condition of existing water supply, from an area so large that the effects of any upwind boundary transitions are negligible and local variations are integrated to an areal average. For example, this represents the evapotranspiration which would occur over a large area of land under existing (mean) rainfall conditions.

The annual mean areal potential ET for the study area is 1,518 mm/year (BoM, 2005b). This is the ET rate that would occur under the condition of unlimited water supply, from an area so large that the effects of any upwind boundary transitions are negligible and local variations are integrated to an areal average. For example, this represents the evapotranspiration which would occur over a very large wetland or large irrigated area, with a never-ending water inflow. A "large" area is defined as an area greater than one square kilometre.

Table 3-2: Evaporation rates estimated for the Baby Hope study area; evaporation estimates based on at least 10 years of data1975-2005, ET data based on 30 years of data 1961-1990.

Month	Mean Class A pan evaporation (mm)	Mean sheltered evaporation (mm)	Mean point potential ET (mm)	Mean areal actual ET (mm)	Mean areal potential ET (mm)
January	394	248	392	61	202
February	304	192	311	77	164
March	310	195	289	53	146
April	244	154	205	25	102
May	175	110	132	26	67
June	129	81	91	29	48
July	144	91	110	15	57
August	188	118	155	12	77
September	260	164	229	12	111
October	357	225	334	7	160
November	393	248	377	13	181
December	435	274	405	31	203
Annual	3333	2100	3030	361	1518

4. Hydrology

4.1 Regional flow

Ruprecht and Ivanescu (2000) describe the hydrology of the Pilbara as being one of extremes, ranging from severe droughts to major floods. Pilbara streamflow is predominantly short-lived, ephemeral and in direct response to rainfall, therefore it has a similar seasonality and variability to rainfall. Surface water runoff generation in the Pilbara region typically results from infiltration excess as opposed to saturation excess. Infiltration excess occurs when the rate of rainfall exceeds the infiltration capacity of the soil and is commonly associated with high intensity rainfall and impervious catchments. Conditions satisfying saturation excess runoff generation occur during prolonged rainfall influenced by cyclones and tropical depressions. With the low rainfall in the region and general lack of groundwater contribution to surface water flow, extended periods of no flow are common.

The Pilbara region is sparsely populated and areas of interest from a streamflow perspective are often long distances from townships, making it problematic to get to many creeks while they are flowing, especially small creeks. Large flow events are difficult to measure due to safety concerns and high velocities, and invariably result in changes to the geomorphology of creeks. As a result stage-discharge relationships in the Pilbara are particularly challenging to accurately define and frequently need to be updated following large flow events. It follows that there is a distinct lack of quality streamflow data in the region, on both a temporal and spatial scale.

4.2 Local flow

There are no local streamflow gauges within the Pebble Mouse Creek catchment. The Tarina gauging station is located on Weeli Wolli Creek, approximately 13 km downstream from the Pebble Mouse/Weeli Wolli Creek confluence and is the closest stream flow gauge to the Baby Hope deposit. Streamflow gauges in catchments surrounding the Baby Hope study area are shown in Figure 3-1 and Table 4-1. Characteristics of the Pebble Mouse Creek catchment to the Baby Hope deposit and HD1 SE pit are given in Table 4-2.

Table 4-1: Local stream gauges within 150 km of Baby Hope and with greater than 20 years of data

Station number	Gauge name	Catchment area (km^2)	Slope m/km	Distance from study area (km)	Period of record	Years of data	% record complete
706207	Mt Samson	250	8	140	1/1/1967 - 21/5/2001	33	96
708001	Flat Rocks	1,370	2.9	37	15/08/1967 - present	44	98
708011	Newman	2,824	1.67	95	09/01/1980 - present	32	100
708013	Waterloo Bore	3,991	2.65	53	30/11/1984 - present	28	100
708014	Tarina	1,512	3.65	34	10/05/1985 - present	27	100

The Depart of Water (DoW) has developed stage-discharge relationships for the gauges listed in Table 4-1. The strength of the relationship is dependent on the quality, number, range and date of measurements. Geometry of the cross section where flow measurements have been taken may change over time resulting in an altered relationship for the location and consequently it needs to be updated or redefined depending on the level of change. The latest stage-discharge relationships available have been used in this study and are shown in Appendix B.

Table 4-2: Characteristics of the Pebble Mouse Creek catchment

Catchment	Catchment area (km^2)	Slope (m/km)
Pebble Mouse Creek at Baby Hope	258	3.5
Pebble Mouse Creek at HD1 SE pit	297	3.5

4.3 Annual flow

It is reasonable to surmise that the streamflow regime at the Baby Hope study area is similar to the downstream flows at Tarina as the Pebble Mouse Creek catchment contributes to flow at the station. A total of 47 separate flow events have been recorded at the Tarina gauge over a 27 year period of operation, which represents an average of approximately 2 flow events per year. Analysis of the Baby Hope gridded rainfall data indicates that there were on average two rainfall events 35 mm or greater over the same period, suggesting that the minimum amount rainfall required to produce flow in the catchment is 35 mm. This is supported by Charles et. al. (2013) in their study on the Pilbara which included analysis of the Tarina catchment and found the minimum rainfall required to produce flow in the catchment is 36 mm.

The annual maximum flow time series (AMS) for the Tarina stream gauge is given in Figure 4-1. Based on the AMS large flow events are expected to occur on average once every five years. The CV of annual streamflow for Tarina is 2.08, indicating the stream flow is approximately 4 times more variable than rainfall. The AMS time series is dominated by the flow event as a result of Tropical Cyclone (TC) John in 1999 which is approximately 4 times greater than the next largest event. Analysis of large flows events within a catchment can provide an insight into the mechanisms that drive them.

Rainfall totals available for TC John and other large flow events at the Tarina gauge are shown in Table 4-3. The rainfall totals show that the Unnamed Tropical Low (UTL) in January 2003 produced a much higher rainfall than TC John particularly around the Tarina rain gauge (505040), yet resulted in much lower flows. Analysis of rainfall from the two events at the Wonmunna rainfall gauge (Appendix A) in the upper catchment reveals that rainfall from TC John at the gauge was equivalent to a 2% AEP rainfall event and rainfall from the January 2003 UTL at the gauge was equivalent to a 5% AEP rainfall event. The difference in intensity between the two rainfall events provides an explanation for the difference in flow as a result of them and highlights the spatial variability of rainfall and streamflow within the Tarina catchment.

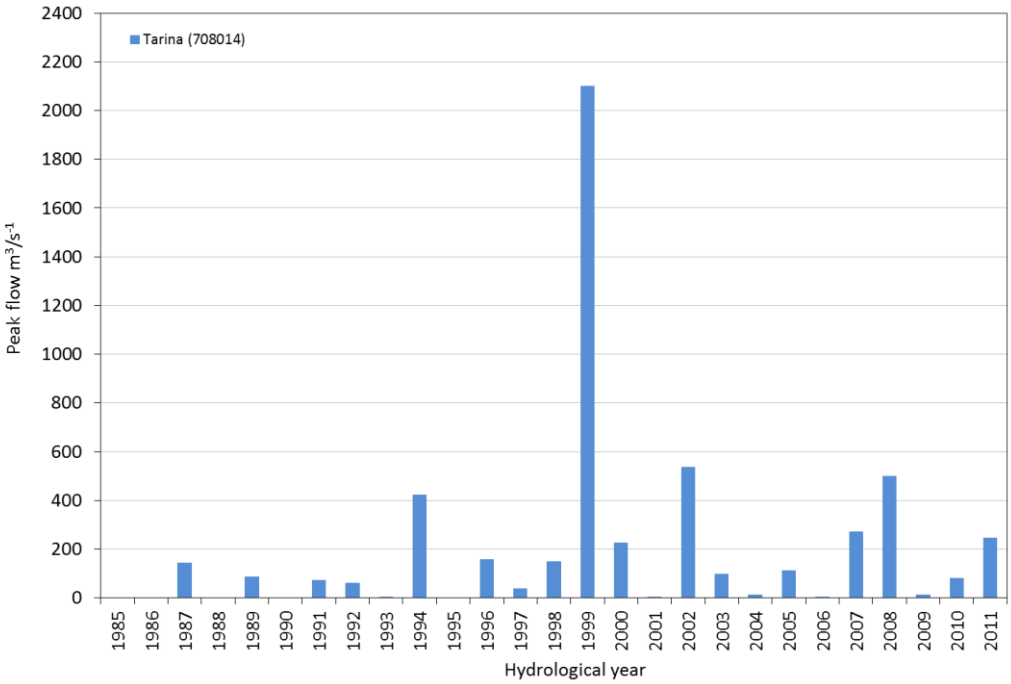

Figure 4-1: Annual maximum stream flow record for hydrological year (September to October)

Large streamflows in the Pilbara are almost always the result of tropical cyclones or tropical lows and large peak flows at Tarina correlate well with tropical cyclones or tropical lows that resulted in rainfall in the region as shown in Table 4-3.

Table 4-3: Significant rainfall events producing flows at Tarina; as a result of tropical lows and tropical cyclones

Event name	Date	Hydrological year (Sep-Oct)	Rainfall 505040 (mm)	Rainfall 507012 (mm)	BoM gridded rainfall* (mm)
TC Bobby	26/02/1995	1994	135	109	126
TC John	16/12/1999	1999	160	199	155
TC Wylva	22/02/2001	2000	140	79	72
Unnamed Tropical Low	25/01/2003	2002	317	203	246
Unnamed Tropical Low	01/03/2009	2008	116	130	93

** from centroid of Pebble Mouse catchment*

Monthly streamflow analysis and flow duration curves for Tarina are shown in Figure 4-2 and Figure 4-3. The mean monthly flow at Tarina indicates the creek flows year round; this is not typical in the Pilbara and is a result of the release of surplus mine dewatering water into Weeli Wolli Creek which began in 2007. The release of the surplus water has altered the flow regime of the creek system from an ephemeral to a perennial system. The flow duration curves also indicate a change in flow regime, however there is no indication that this has significantly impacted on the AMS, with the exception of low flows.

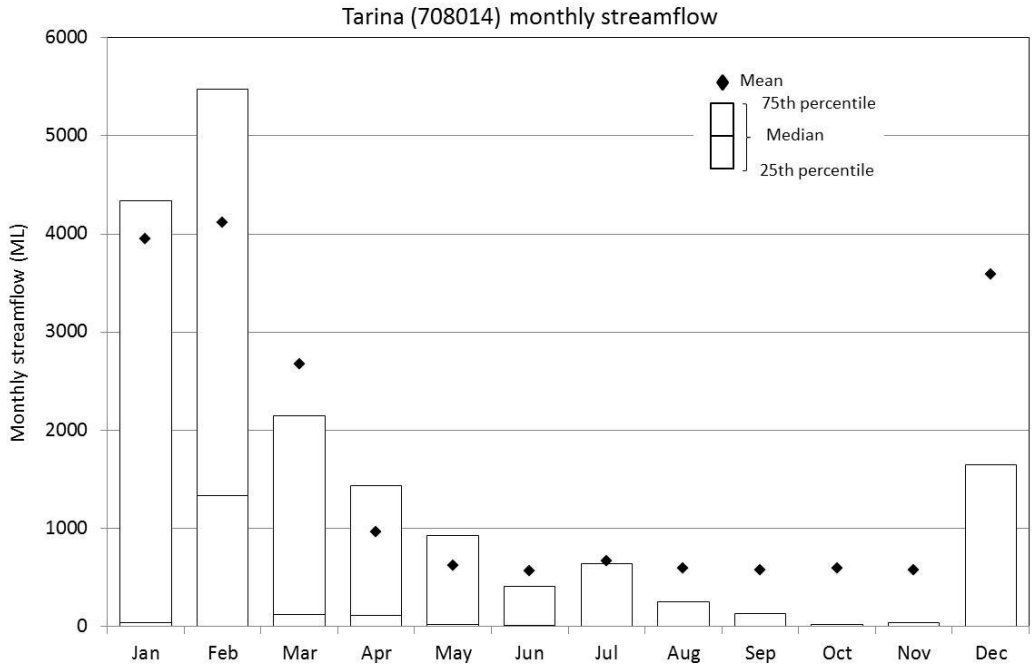

Figure 4-2: Monthly streamflow for Tarina 1985-2012

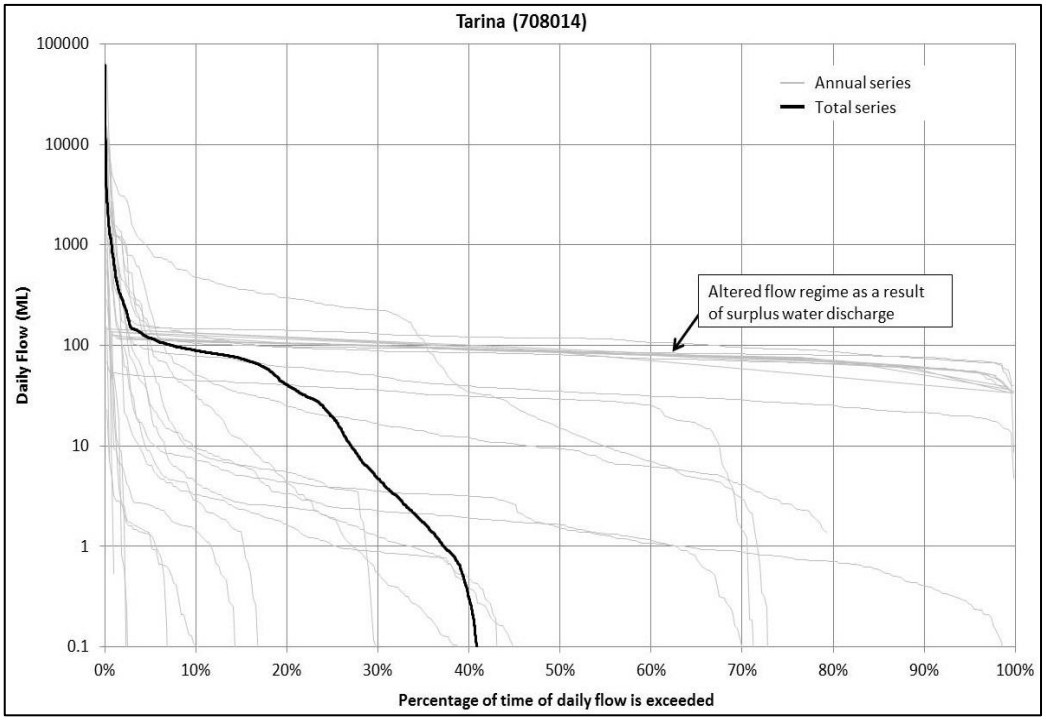

Figure 4-3: Flow duration curves at Tarina gauging station (708014) on Weeli Wolli Creek

4.4 Regional flood frequency analysis

Regional flood frequency analysis (RFFA) is the most commonly adopted technique to derive design flood estimates on ungauged catchments (Rahman et.al. 2012). A RFFA method attempts to transfer flood characteristic information from a group of gauged catchments to an ungauged catchment of interest. FFAs can be undertaken on flood volumes and/or peak discharges and may be carried out graphically or analytically

(Pilgrim, 1998). A FFA was performed on the annual maximum series (AMS) of peak discharges recorded at local regional streamflow gauges with more than 20 years of data, Table 4-1. The years in which data were missing were investigated further to determine if significant rainfalls occurred during the periods for which streamflow information was lacking. For years where it was determined that the missing data would not impact on the recorded peak discharge for that year, the peak was included in the analysis.

An analytical FFA using the HEC-SSP flood frequency analysis program (USACE, 2010) was undertaken. In accordance with Australian Rainfall and Runoff (AR&R) (Pilgrim, 1998) the 3-parameter Log Pearson III distribution was adopted for this study. A conditional probability adjustment was performed in HEC-SSP to account for zero values, missing data and low outliers. Additional low outliers were excluded where the fit of the distribution was considered poor for the rarer AEP events. The observed AMS is only one representation of the AMS from the total population of annual floods. To obtain an unbiased estimate of the true AEP the average of a large number of annual series, or the expected annual exceedance probability, is required. The expected annual exceedance probability was adopted for estimates of FFA quantiles this study.

During the FFA process it was noted that the fitted distribution at Waterloo Bore was a poor fit to the observed data. Comments made by the Department of Water (DOW), who developed the stage-discharge relationship, suggest that there is a great deal of uncertainty in its quality. Subsequently this gauging station was removed from any analysis. The FFA distribution, rating curve and comments for Waterloo Bore can be found in Appendix A.

Table 4-4: Results of FFA for gauges surrounding the Baby Hope study area

			AEP (%) (LPIII Expected design peak m^3/s)					
Station number	**Gauge name**	**Area (km^2)**	**50**	**20**	**10**	**5**	**2**	**1**
706207	Mt Samson	250	20	90	190	310	500	640
708001	Flat Rocks	1,370	80	230	420	710	1,340	2,110
708011	Newman	2,820	230	590	1,030	1,700	3,140	4,890
708014	Tarina	1,510	80	250	500	920	1,950	3,350

Results of the FFA on gauges surrounding the Baby Hope area are given in Table 4-4 and fitted distributions are shown in Appendix A. Tarina is the closest gauge downstream of the Baby Hope study area that could be used to calibrate a rainfall-runoff routing model. The FFA for Tarina is shown in Figure 4-4. The altered flow regime at the gauge as discussed in section 4.3 was not taken into account in the FFA due to the small period of record of altered flow (5 years) and no distinct affects observed on large flow events of the AMS.

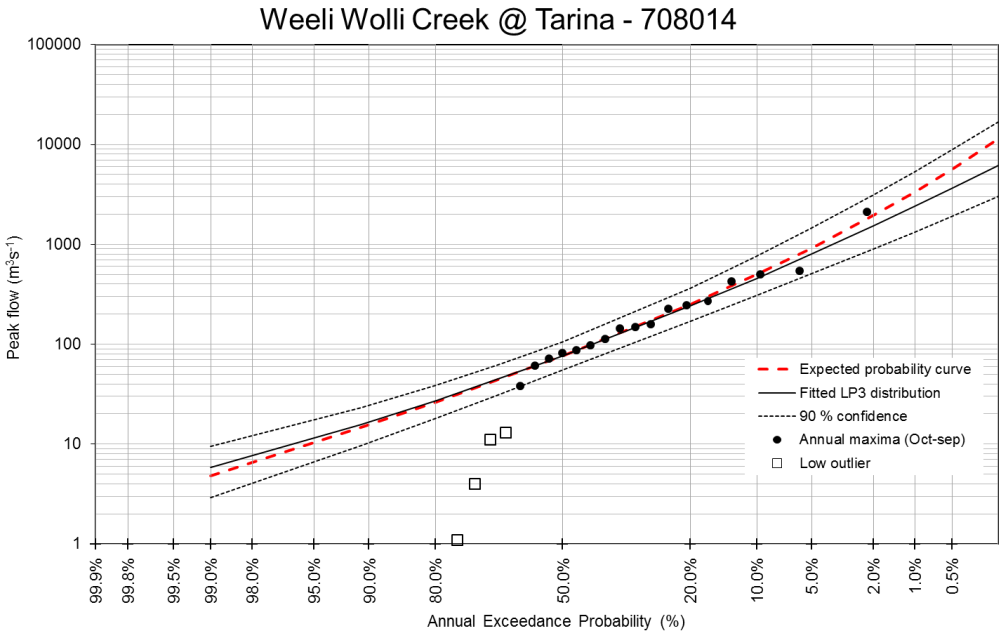

Figure 4-4: Tarina annual maximum stream flow flood frequency analysis

For FFA it is important to have a record which is representative of the total population, it follows that the period of record available for analysis influences the reliability of a FFA, this is highlighted by Table 4-5. The table was developed from data generated synthetically from a probability distribution, and outlines the number of years of record needed to estimate three AEP's with 95% confidence and the expected margin of error. From the table it can be seen that estimates of the 1% AEP from the 27 year record of data available for Tarina are subject to an expected error of greater than 25%. Although 27 years of data is a considerable period for a Pilbara streamflow gauge, it is important to understand the limitations of estimates made using it.

Table 4-5: Length of record (years) required to estimates floods of various AEP with 95% confidence (Gordon et. al.2004)

	Error	
Annual exceedance probability (AEP %)	10%	25%
10	90	18
2	110	39
1	115	48

4.5 Regional design flood estimates

Regional design flood estimates are typically based on equations developed from a RFFA. The probabilistic rational method (PRM) and the index flood method (IFM), published in ARR (Pilgrim, 1987), were design peak flow estimation techniques recommended for the Pilbara region. These methods were based on the limited data available at the time and in hindsight are considered to be conservative design flood estimation techniques.

Recently there have been a number of new methods developed for the Pilbara namely; a Regional Flood Frequency Procedure (RFFP) by Flavell, 2000 and updated in 2006 (Flavell 2012); an updated Pilbara Index Flood method (JDA) (Davies and Yip, 2014) and a Quantile Regression Technique (QRT) (Rahman et. al., 2012). The more recent methods

are based on a longer record of data and for this reason are considered to give a more reliable estimation of design flows. Estimates using the RFFP, JDA and QRT methods mentioned above were calculated for this study.

4.5.1 Regional flood frequency procedure for the Pilbara (RFFP)

A regional flood frequency procedure for the Pilbara was developed by Flavell in 2000 and updated in 2006 (Flavell 2012). The 2000 RFFP method was developed using 15 Pilbara catchments and is recommended for design events for 20 year ARI or larger, as it gives larger peak flow estimates. There are two equations for the 2000 method and again the recommended approach is to adopt the larger estimate. The two equations are as follows:

$$Q_{20} = 1.98 \times 10^{-23} (AS_e{}^{0.5})^{0.79} LAT^{-15.08} LONG^{20.91}$$

or

$$Q_{20} = Q_{10}(13.21A^{0.61})/(8.74A^{0.60})$$

Where:

Q_{20} = 20yr ARI (5% AEP) peak discharge (m^3/s);

A = catchment area (km^2)

S_e = equal area slope (m/km)

Q_{10} = $2.36 \times 10^{-34} \left(AS_e{}^{0.5}\right)^{0.81} LAT^{-15.24} LONG^{26.28} \left(\frac{L^2}{A}\right)^{-0.39}$

Table 4-6: RFFP 2006 frequency factors

Frequency factor	Catchment area (km^2)						
	0.1	1.0	10	100	1,000	10,000	100,000
Q_{50}/Q_{20}	1.66	1.72	1.78	1.83	1.88	1.93	2.00
Q_{100}/Q_{20}	2.44	2.61	2.75	2.87	3.03	3.20	3.42

The Q_{20} is subsequently adjusted to the Q_{50} and the Q_{100} design flood estimate by applying flood frequency factors shown in Table 4-6. Equations for estimating smaller design flow events are given in the Flavell (2012) paper shown in the references. Estimates of Q_{100} ($Q_{1\%}$) using the 2000 RFFP method are given in section 4.5.5.

4.5.2 Updated Pilbara index flood method (JDA)

An updated Pilbara index flood method based on data from 57 catchments from the Pilbara, Gascoyne and Mid-west regions was developed by Davies and Yip in 2012 and updated in 2014. The method separates catchments by size with individual equations developed for; catchments less than 1,000 km^2; catchments between 1,000 km^2 and 10,000 km^2; and catchments greater than 10,000 km^2. The design equation for Baby Hope (258 km^2) using this method is as follows:

$$Q_5 = 7.32 \times 10^{-8} A^{0.651} I_{1h,2yr}{}^{5.251}$$

Where:

Q_5 = 5yr ARI (20% AEP) peak discharge (m^3/s);

A = catchment area (km^2)

$I_{1h,2yr}$ = the design intensity frequency duration (IFD) (ARR 1987) value for a 1 hour 2 year rainfall (mm/hour) at the study area centroid.

Table 4-7: JDA frequency factors

ARI (yrs)	2	5	10	20	50	100
Frequency factor	0.31	1.00	1.70	2.58	126	5.82

Q_5 is subsequently adjusted to the design discharge by applying a flood frequency factor as shown in Table 4-7. Estimates of Q_{100} ($Q_{1\%}$) using the JDA method are given in section 4.5.5.

4.5.3 Quantile regression technique (QRT)

The recently completed ARR Project 5 Stage 2 study (2012) into design flood estimation has found that regression-based RFFA methods such as the QRT are preferable to PRM (Rahman et. al., 2012). The study was conducted on 12 Pilbara catchments and resulted in the following design equation:

$$\ln(Q_{100}) = 5.87 + 0.39[\ln(area) - 4.71] + 5.34[\ln(I_{12,2}) - 1.47]$$

Where $area$ is the catchment area (km²) and $I_{12,2yr}$ is the design intensity frequency duration (IFD) (ARR 1987) value for a 12 hour 2 year rainfall (mm/hour) at the study area centroid. Estimates of Q_{100} ($Q_{1\%}$) using the QRT are given in section 4.5.5.

4.5.4 Scaling of flood frequency analysis

A simple form of design flood estimation for ungauged catchments is performed using area to adjust peak flow estimates from gauged catchments close to the study area of interest. The strength of this method comes from the locality of catchments used, as proximity is frequently a strong indicator of hydrologic similarity (Lowe and Nathan, 2005). Estimates of $Q_{1\%}$ from the FFA on gauges in section 4.2 were scaled using the following equation from Grayson et. al., 1996:

$$Q_u = Q_g\left(\frac{A_u}{A_g}\right)^{0.7}$$

Where Q_u and Q_g are flow (m³/s) of ungauged and gauged catchments; A_u and A_g are area (km²) of ungauged and gauged catchments. The coefficient 0.7 accounts for the non-linear effects of catchment area on runoff. Results of the area adjusted local region FFA are shown in Table 4-8. The local area adjusted mean was calculated as the mean value of 4 scaled estimates from catchments surrounding the Baby Hope deposit. The local area adjusted mean estimate of 1% AEP peak flow for Pebble Mouse Creek to the Baby Hope deposit and to HD1 SE Pit was calculated to be 790 m³/s and 870 m³/s respectively.

Table 4-8: Area adjusted estimates of 1% AEP Pebble Mouse Creek at Baby Hope deposit

Station number	Catchment name	Catchment area (km²)	FFA Log Pearson III $Q_{(1\%)}$ (m³/s)	Pebble Mouse at Baby Hope $Q_{(1\%)}$ (m³/s)	Pebble Mouse at HD1 SE Pit $Q_{(1\%)}$ (m³/s)
706207	Mt Samson	250	640	650	720
708001	Flat Rocks	1,370	2,110	660	720
708011	Newman	2,820	4,890	920	1,010
708014	Tarina	1,510	3,350	910	1,010
		Local area adjusted mean		790	870

4.5.5 Regional flood frequency results

Estimates of 1% AEP for Pebble Mouse creek up to the Baby Hope deposit and HD1 SE pit, and surrounding local catchments using the preceding regional flood frequency methods are presented in Table 4-9. The results show a significant variation in estimates from the different methods for Pebble Mouse Creek ranging from 300 m^3/s to 790 m^3/s to Baby Hope deposit and from 320 m^3/s to 870 m^3/s to HD1 SE pit. Estimates of the 1% AEP using RFFP from surrounding catchments are within 20% of the FFA, with the exception of the Newman.

Table 4-9: Estimates of 1% AEP design flood using regional flood frequency analysis

Catchment	JDA (m^3/s)	RFFP (m^3/s)	QRT (m^3/s)	FFA (m^3/s)	Local area adjusted average (m^3/s)
Mt Samson	740#	760#	610*#	670	-
Flat rocks	1,560	2,400*#	1,440	2,110	-
Tarina	1,310	2,980*#	670	3,180	-
Newman	1,390	2,370*	450	4,890	-
Pebble Mouse to Baby Hope deposit	320	550	300	-	790
Pebble Mouse to HD1 SE Pit	360	610	320	-	870

**Estimation closest to the catchment FFA of methods examined*
#Estimation within 20% of the catchment FFA

4.6 Hydrologic modelling

A hydrologic model of the Weeli Wolli Creek catchment was developed using the RORB (Laurenson et al., 2007) model in order to estimate design peak flows for Pebble Mouse Creek at the Baby Hope deposit and at HD1 SE pit. RORB is a rainfall runoff and streamflow routing model that calculates flood hydrographs from rainfall and other channel inputs. Rainfall excess, calculated by subtracting losses from rainfall, is routed through catchment storages to produce runoff hydrographs at any location; losses are processes that occur on the catchment surface before the water enters the channel network. In addition to catchment storage, RORB allows for storage reservoirs and channel inflow and outflow processes, such as baseflow, to be modelled. Channel inflows and outflows can be modelled using a hydrograph, constant value or discharge relationship. The project catchment has been divided into sub-catchments bounded by drainage divides. The sub-catchments making up the model are depicted in

Figure 4-5. A rainfall excess for each sub-catchment is assumed to enter the channel network at a point near the centroid of the sub-catchment, added to any existing flow in the channel and routed through a routing procedure based on continuity and a storage-discharge relationship:

$$S = 3600kQ^m$$

where S is the storage (m^3), Q is the outflow discharge (m^3/s), m is a dimensionless exponent that is a measure of the catchment's non-linearity and k is a dimensionless empirical coefficient. The coefficient k is calculated as:

$$k = k_c k_r$$

where k_c is an empirical coefficient applicable to the catchment and stream network and k_r is a dimensionless ratio called the relative delay time applicable to an individual reach storage. Channel storages are proportional to the reach length and hydrographs are combined at channel junctions (Laurenson et al., 2007).

4.6.1 Tarina RORB calibration

The Tarina RORB model was calibrated using the initial/continuing loss model, where loss processes are modelled by an initial loss followed by a continuing (constant) loss rate. A value of 0.8 was adopted for the exponent m, following recommendation by RORB developers (Laurenson et.al, 2007) for ungauged catchments in the absence of more relevant information. Design values of k_c, initial loss and continuing loss for the study catchment were determined through calibration. Calibration was achieved by fitting flows produced by RORB, from the developed catchment and observed rainfall, to observed flows from Tarina gauging station. Five events were used to calibrate the RORB model to Tarina and are detailed in Table 4-10.

Table 4-10: Events used to calibrate the RORB model

Flow event peak date	Hydrological year (Oct-Sep)	Peak flows (m^3/s)	AEP (%) (from FFA)	Rainfall gauge used in calibration
28/03/1988	1992	57	50	505040
25/02/1995	1994	224	20	505040
8/01/1997	1996	108	50-20	505040
15/12/1999	1999	2,100	2	505040
25/01/2003	2002	535	10	505040

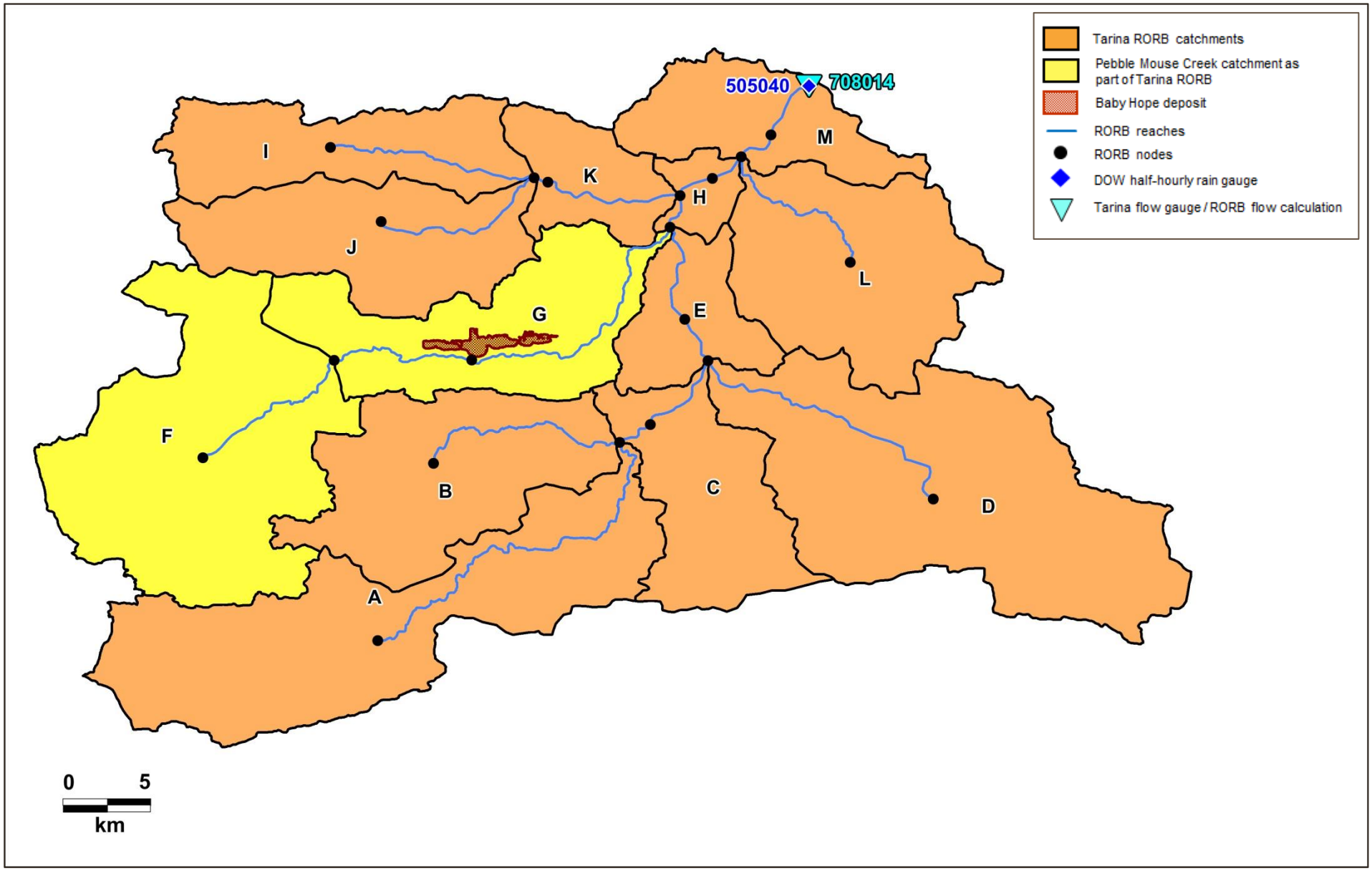

Figure 4-5: Tarina RORB model inputs; catchment sizes are listed in Appendix C

Considering the large catchment size and the use of only one rainfall gauge, the model was found to calibrate very well to observed hydrographs, as shown in Figure 4-6. The k_c parameter is the focus of calibration attempts as initial loss and continuing loss vary with antecedent conditions. The calibrated model parameters presented in Table 4-11 show some variation in the k_c value. Given the number of and range of calibration events an average value for the k_c parameter from the five events was adopted.

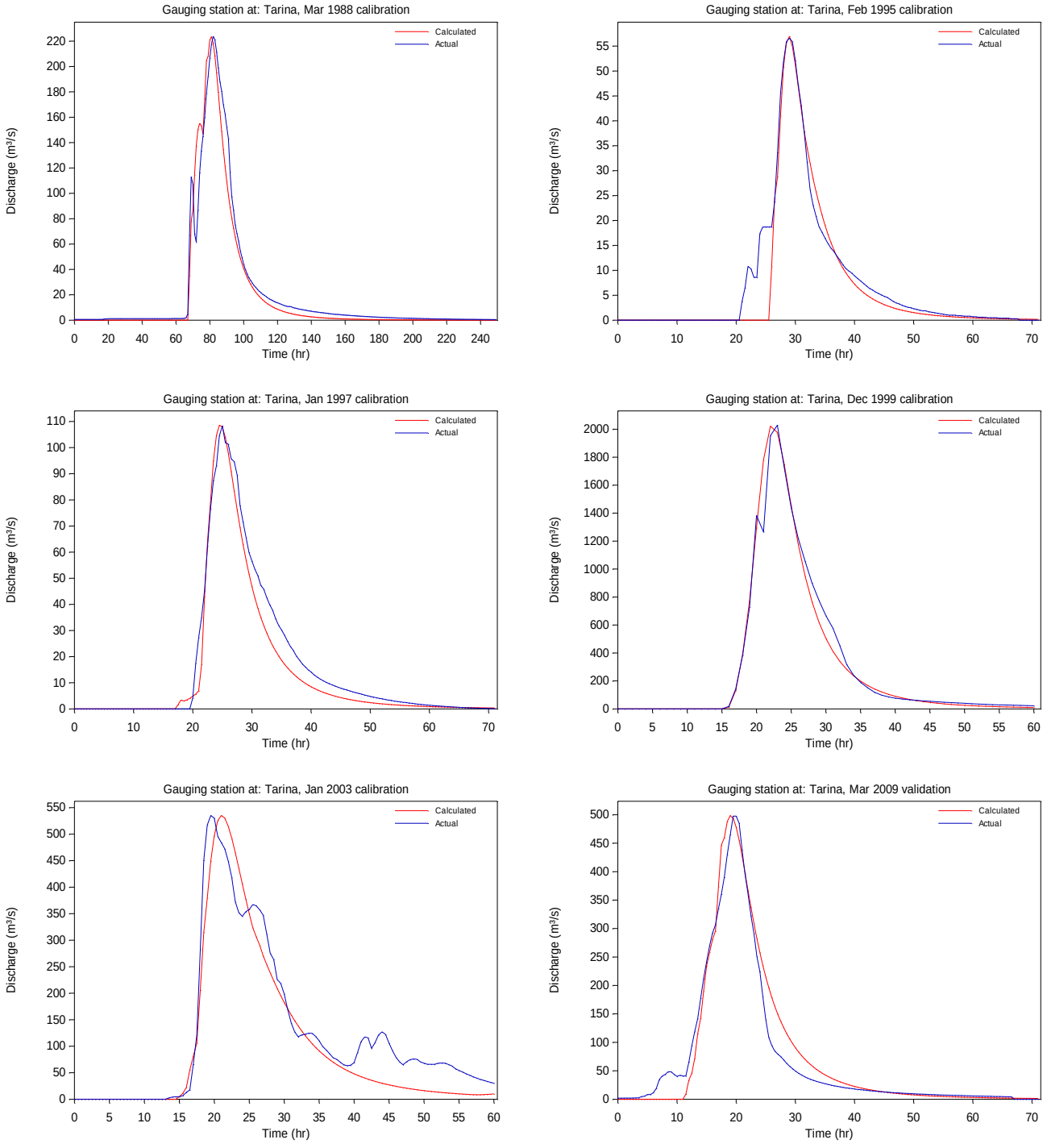

Figure 4-6: Five calibration and one validation event at Tarina stream flow gauge

To establish a level of confidence in the adopted k_c value a sixth event was used to validate the parameter. Validation was performed by assigning the adopted k_c value to the event and varying the losses to fit the peaks of the modelled hydrograph to observed hydrograph. Results of the validation are shown in Figure 4-6 and Table 4-11, and support the adopted k_c value.

Table 4-11: RORB parameters from calibration and validation

Flow event peak date	Peak flows(m^3/s)	Event use	k_c	d_{av}	$C_{0.8}$ value	Initial loss (mm)	Continuing loss (mm/hr)
28/03/1988	57	Calibration	9.7	30.5	0.32	80.3	1.4
25/02/1995	224	Calibration	27.8	30.5	0.91	70.0	8.7
08/01/1997	108	Calibration	12.9	30.5	0.42	57.0	8.9
15/12/1999	2,100	Calibration	21.0	30.5	0.69	45.0	11.1
25/01/2003	535	Calibration	21.4	30.5	0.70	62.2	11.0
01/03/2009	505	Validation	18.6	30.5	0.61*	46.0	10.0

*adopted K_c value, taken as the average of the five calibration events

The adopted k_c value of the Tarina catchment was transferred to the combined Pebble Mouse/Tarina catchment using a regional relationship developed for Pilbara catchments by Pearcey (2014). McMahon and Muller (1983) showed that k_c is directly proportional to d_{av} by the relationship:

$$C_{0.8} = \frac{k_c}{d_{av}}$$

Where d_{av} is the weighted average flow distance from all the nodes within the catchment to the catchment outlet; and where $C_{0.8}$ is characteristic (when m=0.8) of the catchment that is now independent of the scale or the size of the catchment. The calculation of an average regional $C_{0.8}$ value allows it to be used in ungauged catchments and gives confidence to values calculated in gauged catchments. The relationship between $C_{0.8}$ and catchment area for the Pilbara is given in Figure 4-7.

The $C_{0.8}$ calculated for the Tarina catchment using the adopted k_c value of 18.6 and a d_{av} of 30.50 taken from the RORB model, equates to 0.61 marginally higher than the expected $C_{0.8}$ of 0.59 for the Pilbara. This provides confidence in the adopted value of $C_{0.8}$ for the catchment.

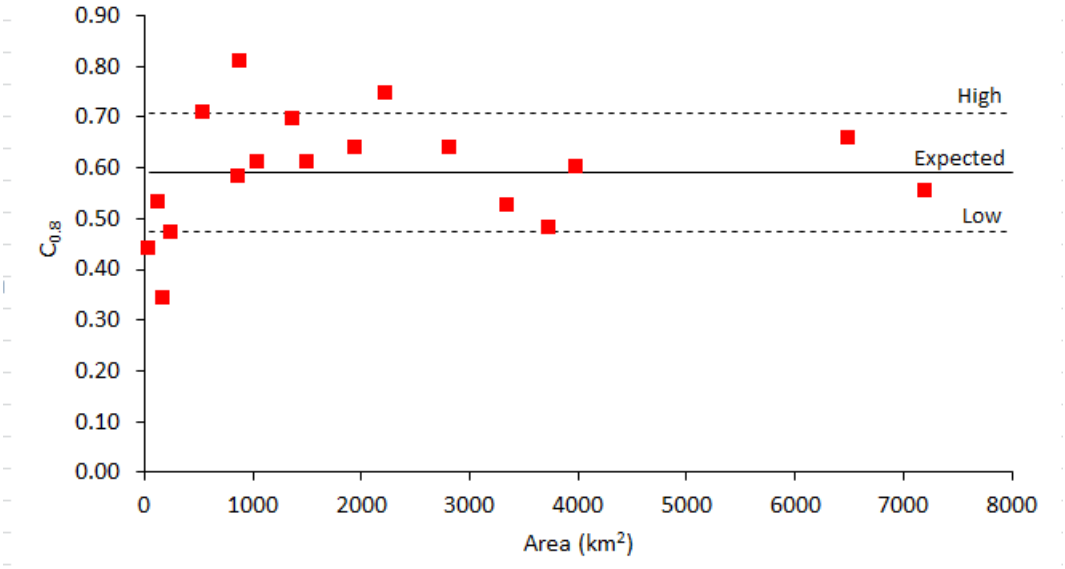

Figure 4-7: $C_{0.8}$ relationship for the Pilbara based on 18 catchments (Pearcey et al, 2014)

4.6.2 Combined Pebble Mouse/Tarina RORB

The existing RORB model was refined to include a number of sub-catchments upstream from the area of interest (Pebble Mouse Creek) as recommend by Laurenson (2007), Figure 4-8. This allowed the calibration of peak flows from design storm events at Tarina to the FFA at the gauge, whilst providing estimates of design peak flows at the Baby Hope deposit. Estimates of design peak flows approximately 9 km downstream of Baby Hope at Hope Downs 1 SE pit were also made using the same model. The calibrated $C_{0.8}$ value of 0.61 for the Tarina catchment was adopted for all events in the combined Pebble Mouse Creek/Tarina RORB model.

4.6.3 Design Event Critical Duration

The critical duration at a particular location refers to the duration of a design storm event that produces the maximum flood peak for a given annual exceedance probability. The combined RORB model was run for a range of AEP and design storm durations to determine the critical durations for Tarina. Design rainfall from the Tarina catchment centroid for events from 1% AEP to 20% AEP were applied to the model, with the $C_{0.8}$ value held constant, losses were adjusted to match peak flow estimates from the model to estimates from the Tarina FFA. Once it was established that the continuing loss value for the 1% AEP event calibration was 9 mm/hr, it was held constant throughout calibration of the rest of the AEP events, with initial loss being the only parameter adjusted. The continuing loss value of 9 mm/hr was the same as the average continuing loss value obtained from the calibration of actual rainfall events over the Tarina catchment, giving added weight to the adopted continuing loss value. Design rainfall for the 1% and 2% AEP events was taken from the CRC-Forge data for Western Australia (Durrant and Bowman, 2004). Design rainfall for 5% to 20% AEP events was taken from Intensity Frequency Duration (IFD) data provided by AR&R (Pilgrim, 1987). RORB applies the standard temporal patterns from AR&R (Pilgrim, 1987) to the design rainfall depths. Results of the Tarina calibrations are shown in Table 4-12.

Table 4-12: Parameter values for calibration of the Tarina RORB to design rainfalls

AEP (%)	Peak flows at 708014 from FFA (m^3/s)	Calibrated peak flow at 708014 from design rainfall (m^3/s)	Critical duration (hrs)	$C_{0.8}$	K_c	D_{av}	IL (mm)	CL (mm/h)
1*	3,180	3,180	9	0.61	22.1	36.2	0.0	9.0
2*	1,840	1,840	12	0.61	22.1	36.2	49.8	9.0
5#	880	880	24	0.61	22.1	36.2	44.1	9.0
10#	490	490	24	0.61	22.1	36.2	64.4	9.0
20#	260	260	12	0.61	22.1	36.2	49.2	9.0

*using CRC-Forge design rainfall

#using IFD design rainfall

To obtain design peak flow estimates of peak flow for Pebble Mouse Creek at the Baby Hope deposit and at HD1 SE pit the RORB model was run with the same parameters from the Tarina calibration of design rainfall to FFA. The design rainfall location was changed to the centroid of the Pebble Mouse Creek catchment and the areal reduction factors reduced to account for the smaller catchments upstream of the Baby Hope deposit and HD1 SE pit. Estimates of design peak flows at the Baby Hope deposit and the HD1 SE pit can be found in Table 4-13 and critical durations with areal reduction factors found in Table 4-14.

Table 4-13: Peak flow and critical duration estimates of AEP events for Pebble Mouse Creek at the Baby Hope deposit and HD1 SE Pits

AEP (%)	Peak flow at Baby Hope deposit (m^3/s)	Critical duration (hrs)	Peak flow HD1 SE pit (m^3/s)	Critical duration (hrs)	$C_{0.8}$	K_c	D_{av}	IL (mm)	CL (mm/h)
1*	970	6	890	6	0.61	22.1	36.2	0.0	9.0
2*	510	9	480	12	0.61	22.1	36.2	49.8	9.0
5#	280	24	240	24	0.61	22.1	36.2	65.0	9.0
10#	160	24	140	24	0.61	22.1	36.2	64.4	9.0
20#	80	24	70	24	0.61	22.1	36.2	49.2	9.0

*using CRC-Forge design rainfall

#using IFD design rainfall

Table 4-14: Critical durations and areal reduction factors for the three flow calculation locations

	Tarina (1529 km^2)		Pebble Mouse at Baby Hope (258 km^2)		Pebble Mouse at HD1 SE pit (297 km2)	
AEP (%)	Critical duration (hrs)	ARF	Critical duration (hrs)	ARF	Critical duration (hrs)	ARF
1*	9	0.80	6	0.84	6	0.83
2*	12	0.83	9	0.87	12	0.89
5#	24	0.92	24	0.95	24	0.95
10#	24	0.92	24	0.95	24	0.95
20#	12	0.89	24	0.95	24	0.95

*using CRC-Forge design rainfall

#using IFD design rainfall

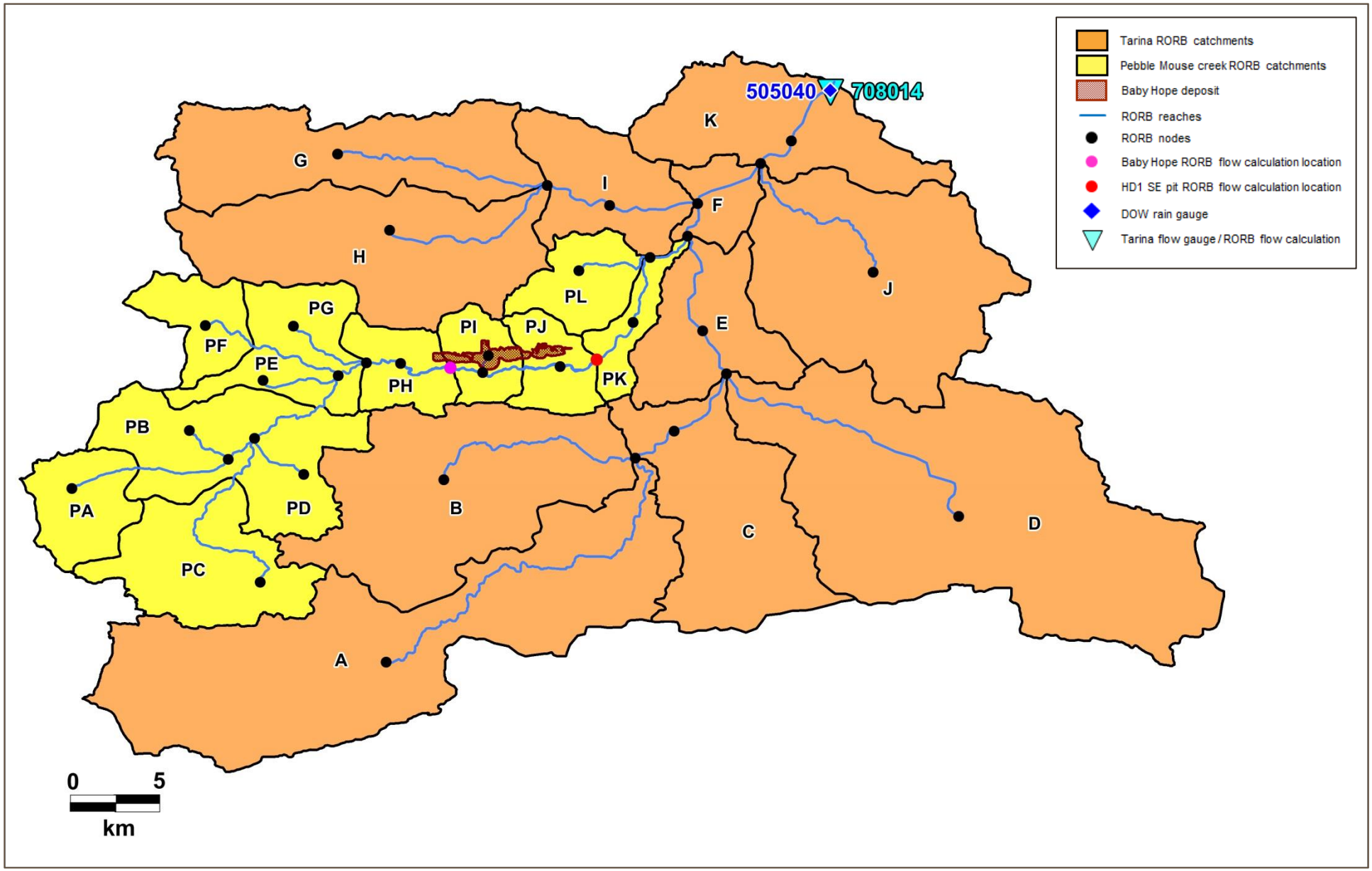

Figure 4-8: Pebble Mouse/Tarina RORB model inputs; catchment sizes are listed in Appendix C

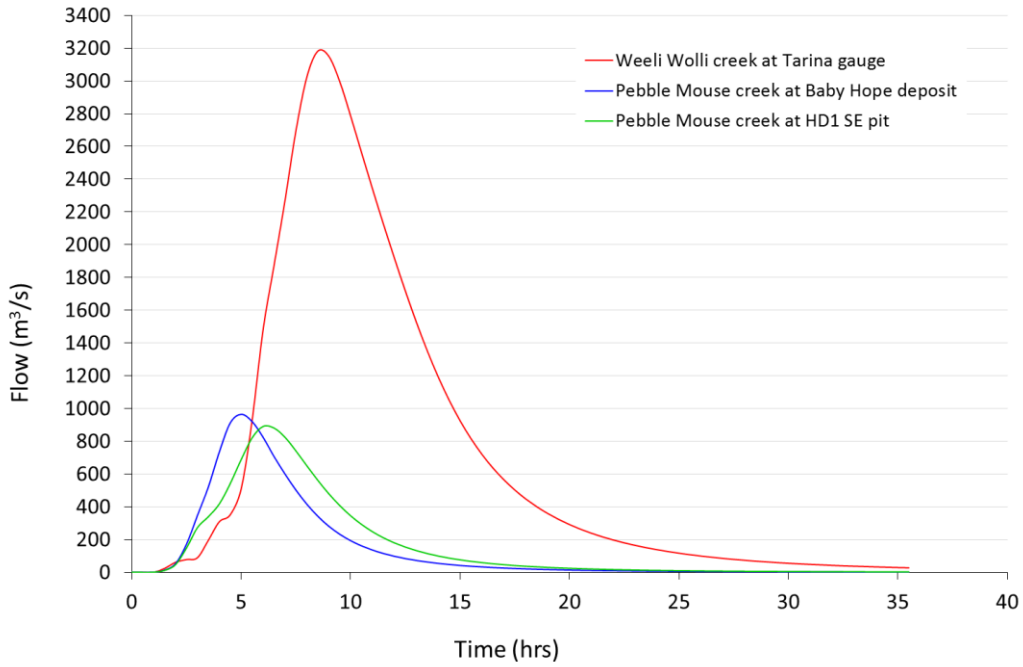

Figure 4-9: Hydrographs of estimated 1% AEP peak flows for Tarina gauging station and two locations on Pebble Mouse Creek

4.7 Recommended design flood estimation

Due to the lack of streamflow data within the Pebble Mouse Creek catchment results from the RORB model calibrated to Tarina were taken as the best estimate of design peak flows for Pebble Mouse Creek. Estimates of 1% AEP peak flows for Pebble Mouse Creek using this method were 970 m³/s at the Baby Hope deposit and 890 m³/s at HD1 SE pit.

5. Hydraulic modelling

5.1 2D hydraulic modelling

The TUFLOW/SMS two dimensional (2D) hydraulic software package was used to model existing flood conditions at the Baby Hope deposit. A 2D hydraulic model was considered to be the most effective way to model the Pebble Mouse Creek system, due to the ability to efficiently delineated detailed flood plains using high resolution topographic data.

5.2 Model Inputs

5.2.1 Digital terrain model

LiDAR topographic data is available for the Baby Hope area. The reported accuracy of the dataset is 0.3 m in the vertical direction and 0.4 m in the horizontal direction. A digital terrain model (DTM) of the LiDAR point cloud was built using the Global Energy Mapper software and a 5 m x 5 m grid of elevations was derived from the DTM to filter the large number of data points. The 5 m x 5 m elevation grid was used to build the DTM for the TUFLOW model. The extent of the DTM can be seen in Figure 5-1.

5.2.2 Boundary conditions

The location of boundary inputs is shown in Figure 5-1. The hydrograph calculated at the Baby Hope deposit from the combined Pebble Mouse and Tarina RORB model was used for Pebble Mouse Creek.

Table 5-1: Estimated 1% AEP flows.

Location	Critical duration	Estimated peak flow 1% AEP (m^3/s)
Pebble mouse creek at Baby Hope deposit	12 hour	970

Pebble Mouse Creek

The hydrograph was calculated at the edge of Baby Hope orebody, with boundary input location approximately 2 km upstream (SMS boundary description – Flow vs Time (QT)).

Downstream slope boundary

The downstream boundary was input as a slope (SMS boundary description - WSE vs Flow (HQ)) and calculated to be 0.0035 m/m.

Pebble Mouse Creek Tributaries

Design peak flows for the tributaries of Pebble Mouse Creek at Baby Hope were calculated using the regional flood frequency method developed by Flavell (2012) given in section 4.5.1. The time of concentration for these peak flows was calculated using the Bransby-Williams formula for ungauged catchments as recommended by ARR (1987):

$$t_c = \frac{58\,L}{A^{0.1} S_e^{0.2}}$$

Where:

t_c = time of concentration (mins)

L = mainstream length measured to the catchment divide (km)

A = catchment area (km^2)

S_e = equal area slope of the mainstream projected to the catchment divide.

Hydrographs were derived using a simple triangular relationship that has been calibrated against runoff volumes from RORB models in the Pilbara region. The hydrographs were added to the boundary locations along the northern and southern sides of the Pebble Mouse Creek valley, as shown in Figure 5-1. The hydrograph, peak flows and times of concentration for all tributary creeks are given in Appendix C.

All northern catchments were delineated into sub-catchments up to the pit outline in an effort to provide an estimate of pre-development flow velocities at all locations where surface water may enter the pit. The boundary locations of the northern catchments were placed before the edge of the proposed pit.

The southern catchments were not divided into smaller sub-catchments as it was determined that this was not a primary area of interest for the purposes of this study. Southern catchment areas were delineated to Pebble Mouse Creek and flows input upstream of this location.

Road

The road on the southern side of Pebble Mouse Creek valley was input as an added Z point line boundary, as it was built after the LiDAR data had been gathered and was not included in the DTM. The line coverage added 2.5 m to all elevation points along its alignment. It is understood that this does accurately reflect the actual elevation of the road; however it was determined to give sufficient representation in line with the level of interest in the area.

Culverts

One dimensional (1D) culverts where placed in the rail and road on the southern side of Pebble Mouse Creek valley for larger creeks of the southern valley catchments. The location and size of rail culverts was determined according to Pilbara Region Imagery photograph and through visual inspection during a site visit on 12/11/2013. The location and size of road culverts was determined by inspection of Pilbara Regional Imagery photograph. The low level of detail was considered acceptable given the magnitude of flows generated from the southern catchments and the expected low influence of flood flows from this area on the area of interest.

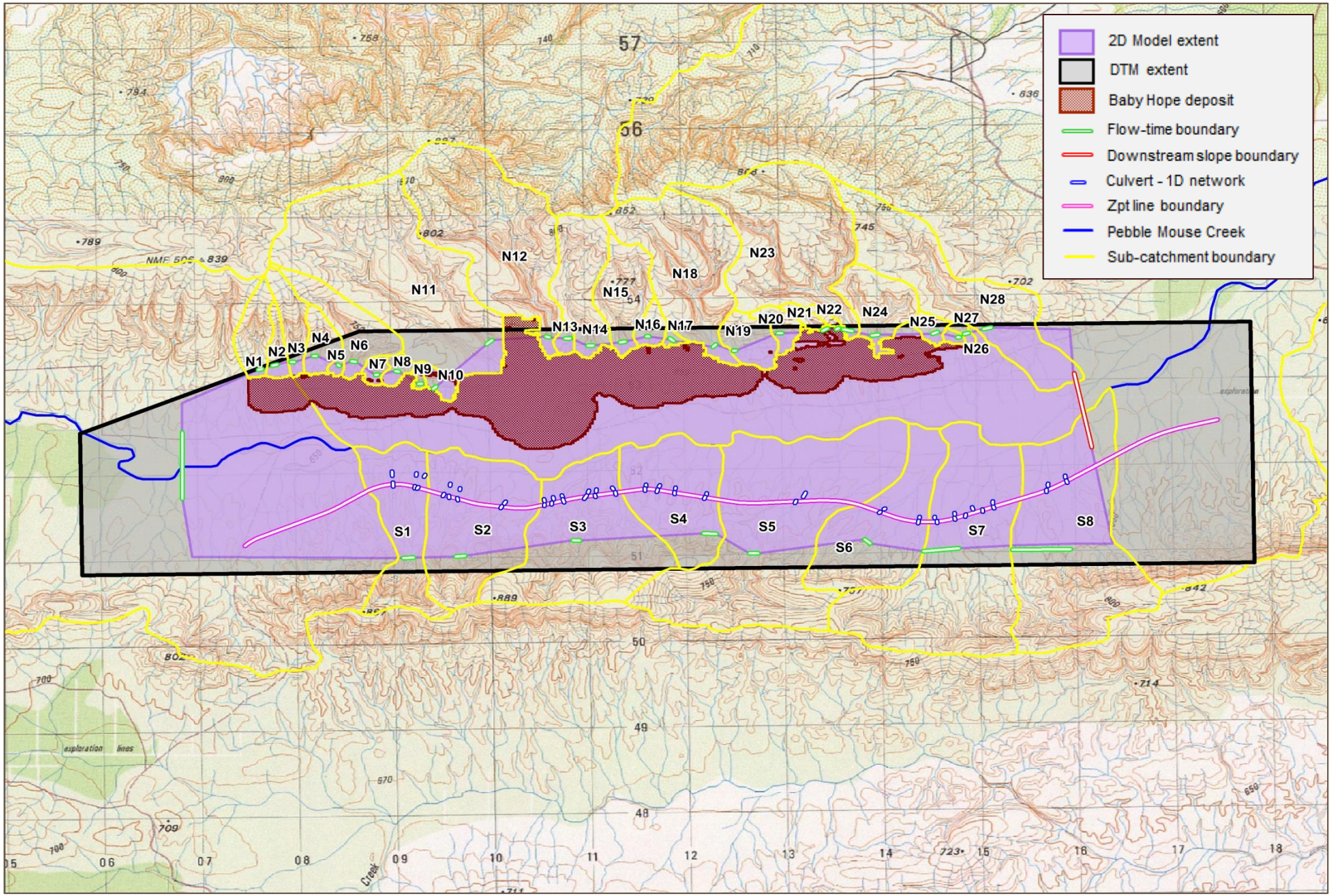

Figure 5-1: Baby Hope hydraulic model DTM extent and boundary locations

5.2.3 Bed resistance

Each cell in the 2D model was assigned a bed resistance value. The Land Unit Classification dataset (Van Vreeswyk etal, 2004) was used as a basis for bed resistance classification. Alterations to land unit areas were delineated through detailed examination of aerial photographs and raster maps. Areas were assigned a Manning's n value ranging from 0.035 (representing the road) to 0.055 (representing vegetated creek flood plain) to describe its bed resistance as shown in Figure 5-2.

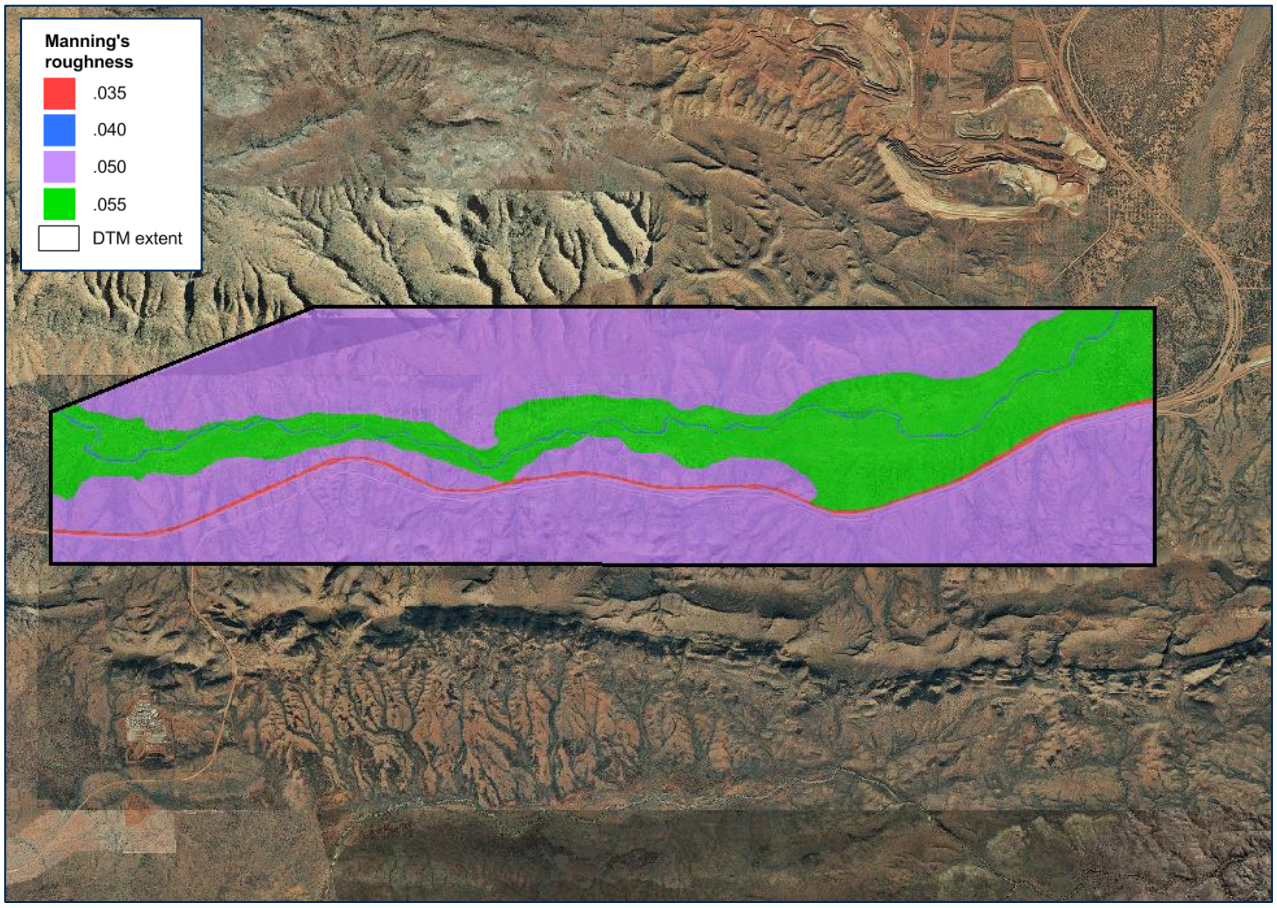

Figure 5-2: Bed resistance values used in the Baby Hope 2D model.

5.2.4 Cell size and time step

A cell size of 5 m by 5 m was used for all design events. A time step of 1.5 and 2 seconds was used for the 2D domain and 1D domain (culverts) respectively.

5.3 Modelled scenarios

The 1% AEP event was modelled for existing conditions and post pit development. There was no hydrology infrastructure development options considered in this study as the deposit is proposed to be developed without any major hydrology infrastructure. All pits are to remain outside of the 1% AEP flood plain. Maximum flood depths for existing conditions and post pit development are shown in Figure 5-3 and Figure 5-4 respectively. Maximum velocities for existing conditions are given in Figure 5-5. Throughout the modelling process it was observed that the northern and southern catchments had little to no effect on the flood extent of main flood plain of Pebble Mouse Creek.

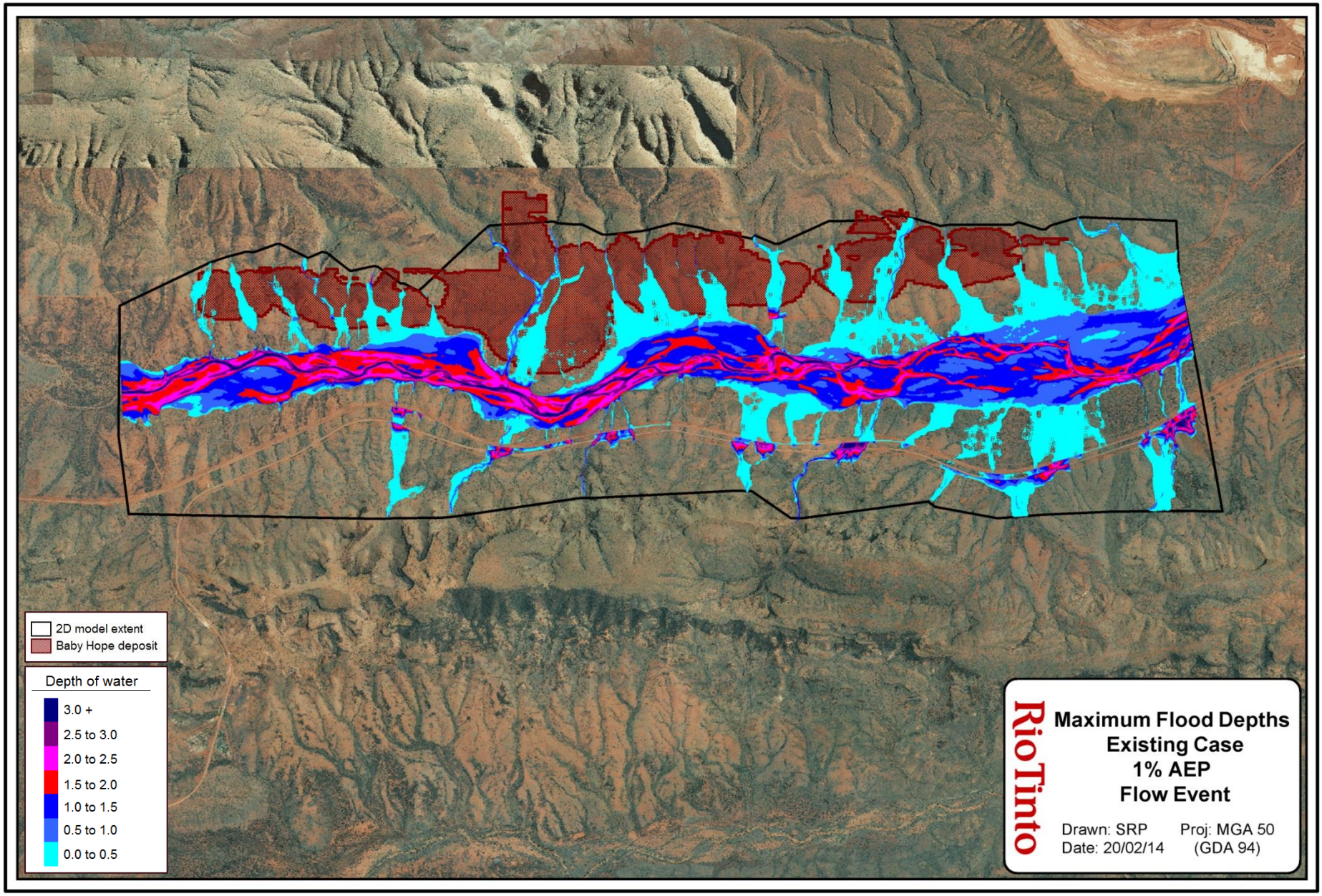

Figure 5-3: Estimated flood extent and depths for a 1% AEP event for existing conditions at the Baby Hope deposit

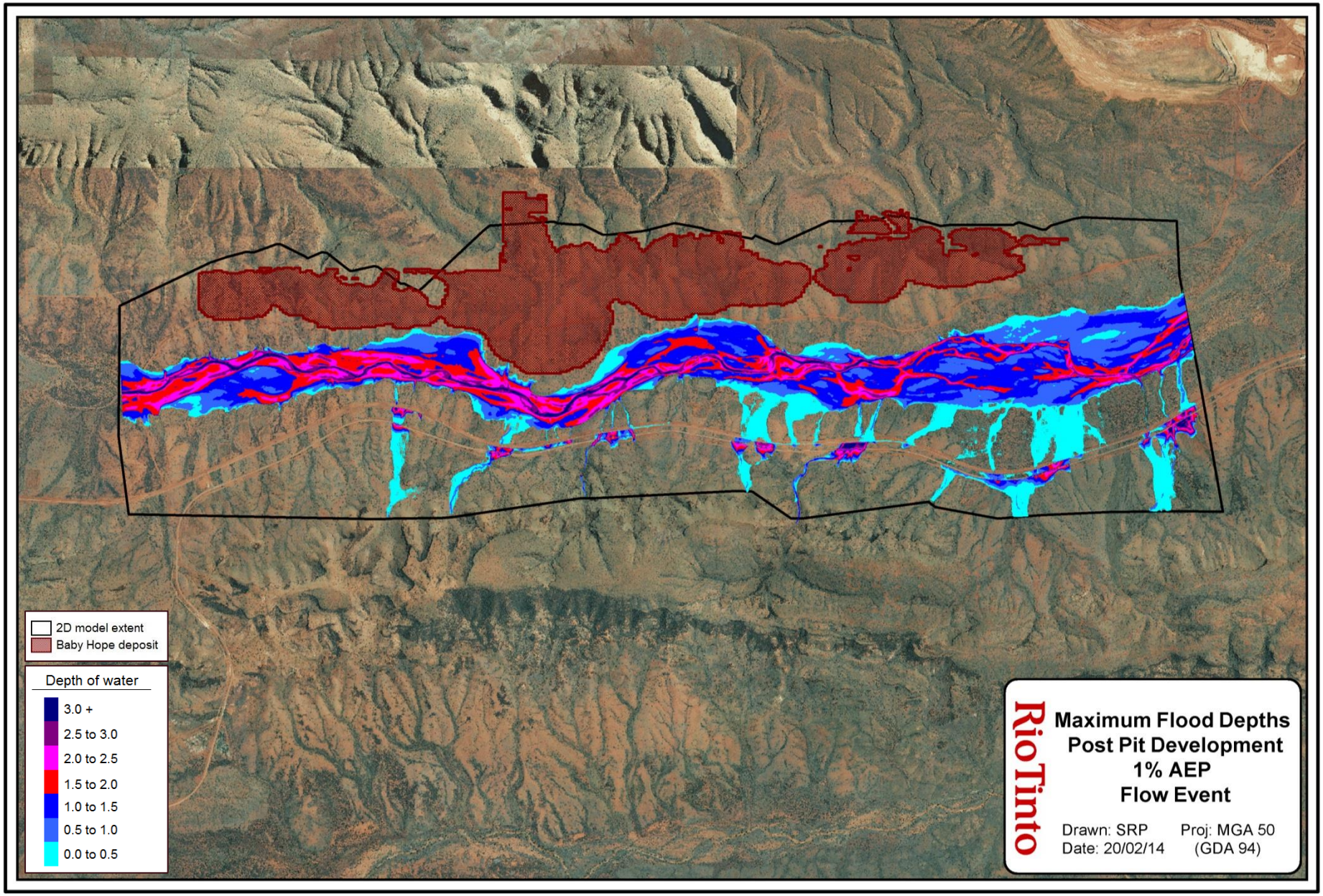

Figure 5-4: Estimated flood extent and depths for 1% AEP event at Baby Hope post pit development

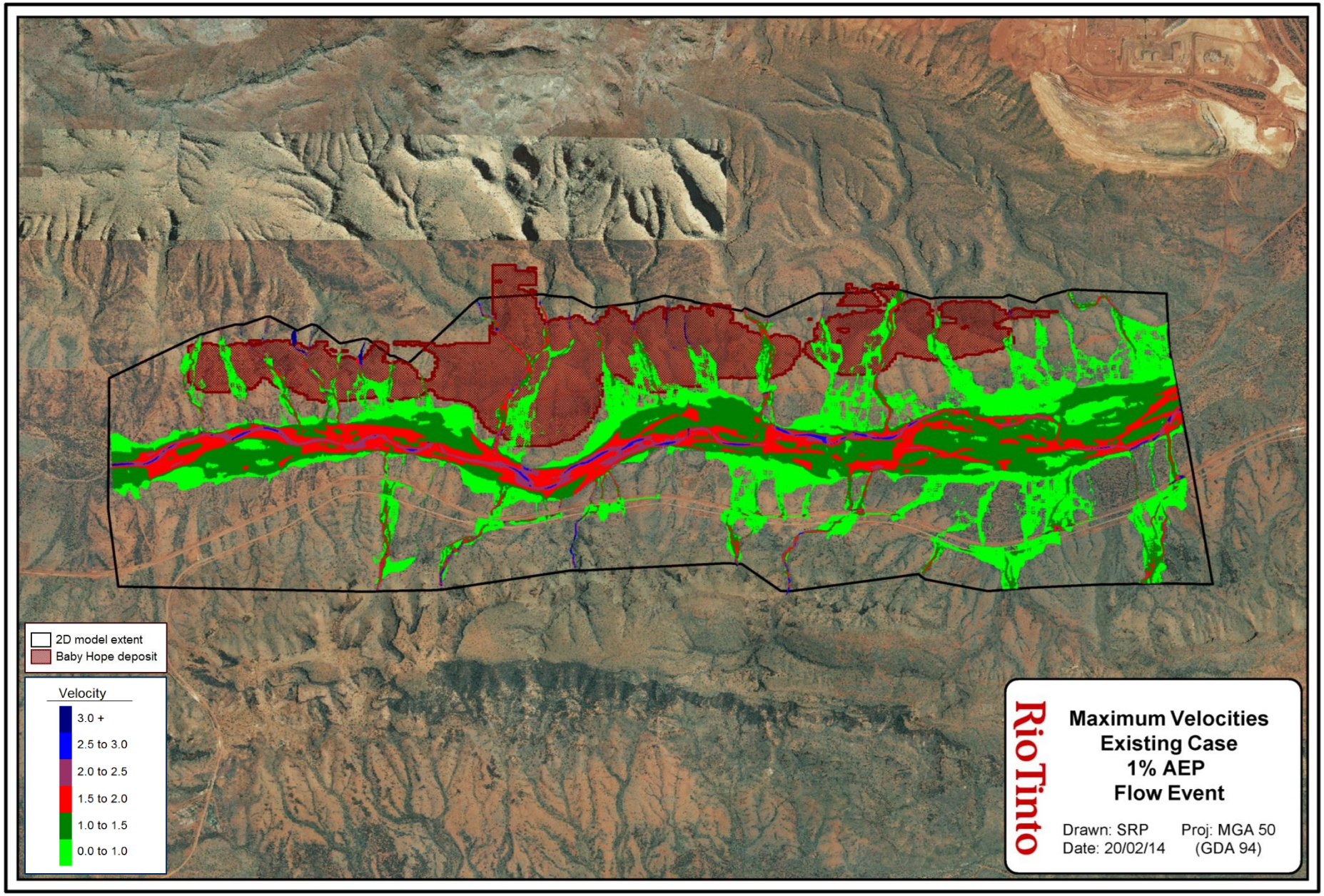

Figure 5-5: Estimated velocities for a 1% AEP event for existing conditions at the Baby Hope deposit

5.4 Model uncertainties

Peak flow estimates

Estimates of 1% AEP peak flow are calibrated to Tarina flow gauge FFA, 23 km downstream of the Baby Hope deposit. The Tarina FFA is based on 27 years of annual maxima and the 90% confidence interval of the distribution for the 1% AEP event is 1160 m^3/s to 7170 m^3/s. The lack of at-site streamflow and rainfall data also introduces a large degree of uncertainty in the estimates due to the high degree of spatial variability in rainfall exhibited in the Pilbara.

Sensitivity

A full sensitivity analysis was not performed on bed resistance values or flow inputs adopted in the model. However the 2D model was run with a 1% AEP design flow approximately 20% lower than the adopted value giving an insight to the sensitivity of the flood extent to peak flows. From this sensitivity assessment the area of the flood extent decreased by 2%, suggesting that it is relatively insensitive to changes in flow input.

6. Conclusion

An assessment of the baseline surface water hydrology of Pebble Mouse Creek up to the Baby Hope deposit, 23 km upstream of the Tarina streamflow gauging station on Weeli Wolli Creek (708014) has been undertaken through the application of annual, monthly and daily analysis of rainfall and annual analysis of streamflow at Tarina. Furthermore, a regional flood frequency analysis has been carried out on four local streamflow gauges within a 150 km radius of the catchment centroid.

The Pilbara Surface Water Management Strategy recommends flood protection to a minimum 1% AEP if construction is to take place in the 1% AEP floodplain. Development of the Baby Hope deposit is proposed to be undertaken without major flood protection infrastructure and therefore the pit outline is to be developed outside of the 1% AEP flood plain.

The 1% AEP peak flow event for the Pebble Mouse Creek at the Baby Hope deposit was estimated using the combined RORB model of Pebble Mouse and Weeli Wolli Creeks that was calibrated to the Tarina flow gauge. The hydrograph of the estimated 1% AEP event produced by the RORB model was used as a boundary condition in the Tuflow 2D hydraulic model and this enabled the 1% AEP event floodplain to be delineated. From this study it can be concluded that:

- The expected 1% AEP event peak flows for Pebble Mouse Creek at the Baby Hope deposit from the combined Pebble Mouse/ Weeli Wolli RORB model calibrated to Tarina is 970 m^3/s.

- Annual rainfall at the Baby Hope study area has 'high' temporal variability. Annual streamflow at Tarina (downstream from the Baby Hope study area) is 4 to 5 times more variable than Baby Hope rainfall.

- Large flow events that are integral to the estimation of large to extreme design flood events are predominately estimated using theoretical stage-discharge relationships.

- The Tarina FFA is based on 27 years of annual maxima and the 90% confidence interval of the distribution for the 1% AEP event is 1160 m^3/s to 7170 m^3/s

- Spatial variability exhibited in the area introduces a large degree of uncertainty in design flow estimates, as there are no at-site streamflow or rain gauges.

- Based on flow data from Tarina gauging station, flow events in Pebble Mouse Creek are expected to occur once every three years on average. Recent history suggests that large flow events are to be expected once every five years on average.

- There are many small but not insignificant creeks that flow from the northern range in a southerly direction over the deposit. The majority of the creeks will be intercepted by the pit and have deeply incised channels, indicating these areas are subject to high velocities and erosion.

- The tributaries of Pebble Mouse Creek in the area of the Baby Hope deposit have little or no influence on the flood extent of Pebble Mouse Creek. Additionally the floodplain of Pebble Mouse Creek is not highly sensitive to changes in flow input.

7. Recommendations

The following recommendations can be made as a result of this study:

- Due to the lack of data from within the Pebble Mouse Creek catchment, the RORB model calibrated to Tarina should be adopted for the estimation of design flood quantiles for the catchment.

- Pressure transducers should be installed within Pebble Mouse Creek, upstream and downstream from the Baby Hope deposit to estimate flows for calibration/validation of the RORB model and the 2D hydraulic model.

- The Bureau of Meteorology is currently undertaking work to revise the design rainfall temporal patterns. These design rainfall patterns have a large impact on design flows. It is expected that when published the revised temporal patterns will closer resemble those used in estimating the probable maximum precipitation (PMP). The impact of using the PMP temporal patterns on design flood estimates should be investigated.

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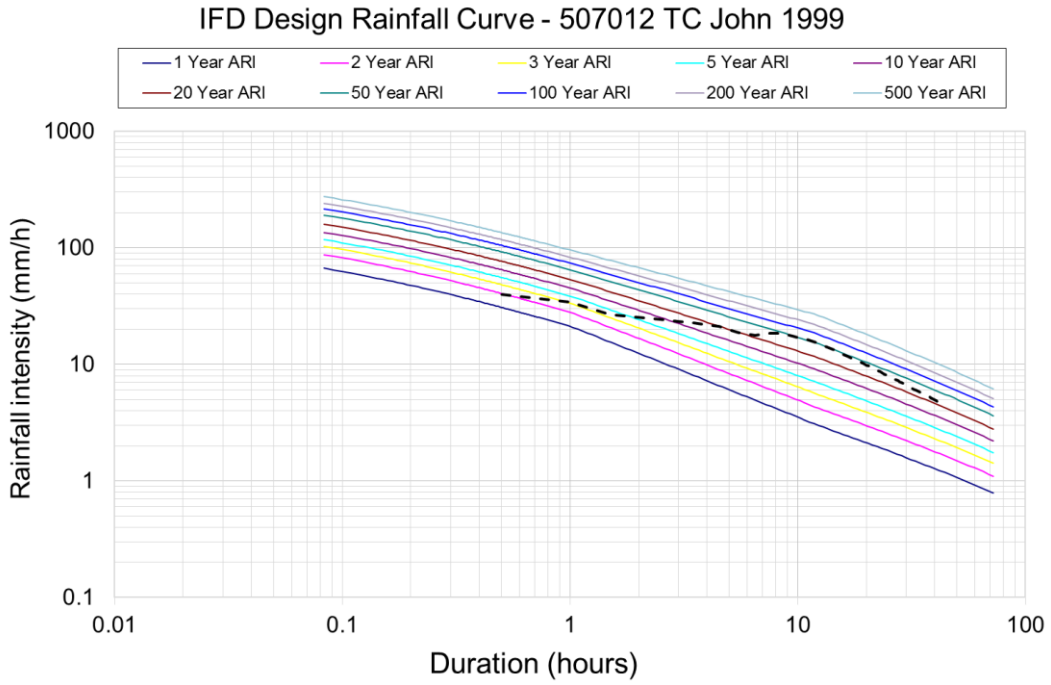
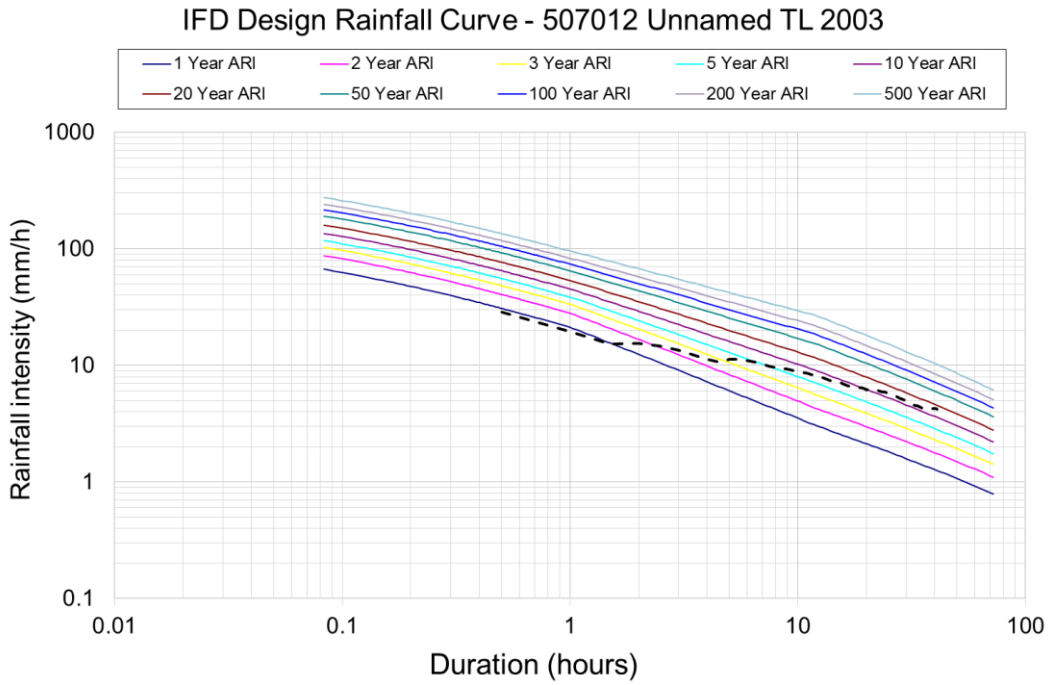
9. Appendix

9.1 Appendix A - AEP Event design rainfall curves





9.2 Appendix B - Flood frequency analysis and associated stage-discharge rating curves

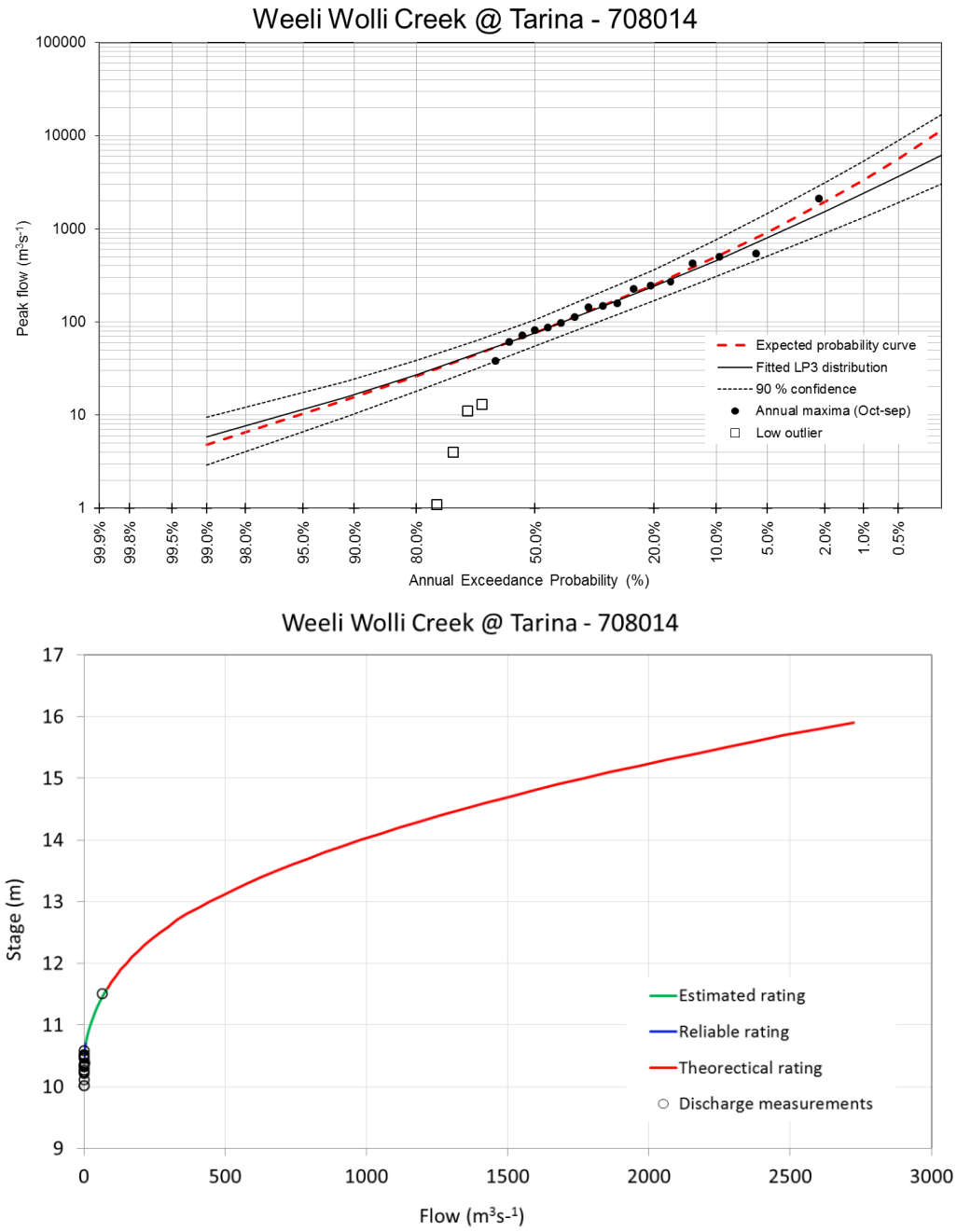


Figure 9-1: Tarina (708014) FFA and stage-discharge rating curve

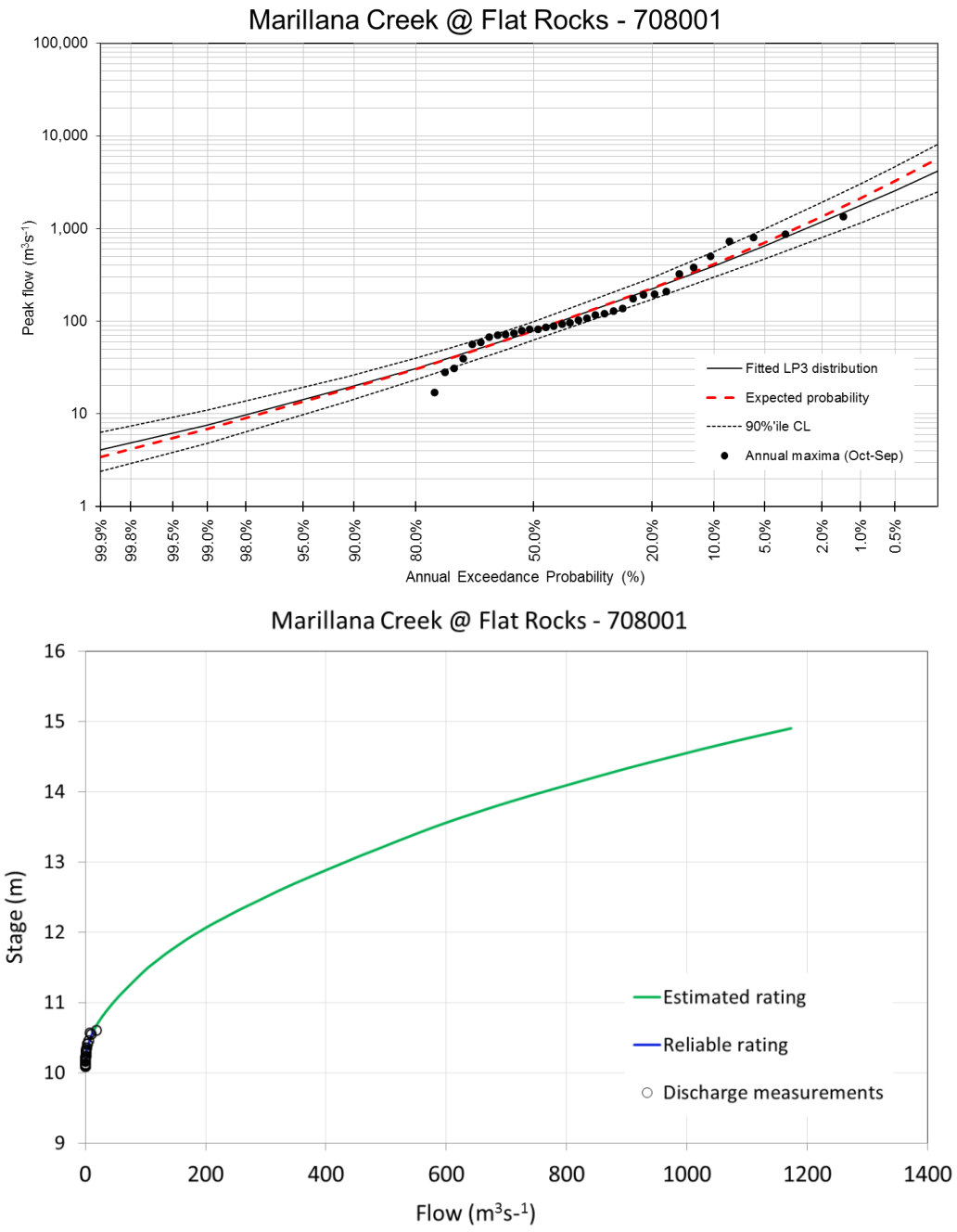


Figure 9-2: Flat Rocks (708001) FFA and stage-discharge rating curve

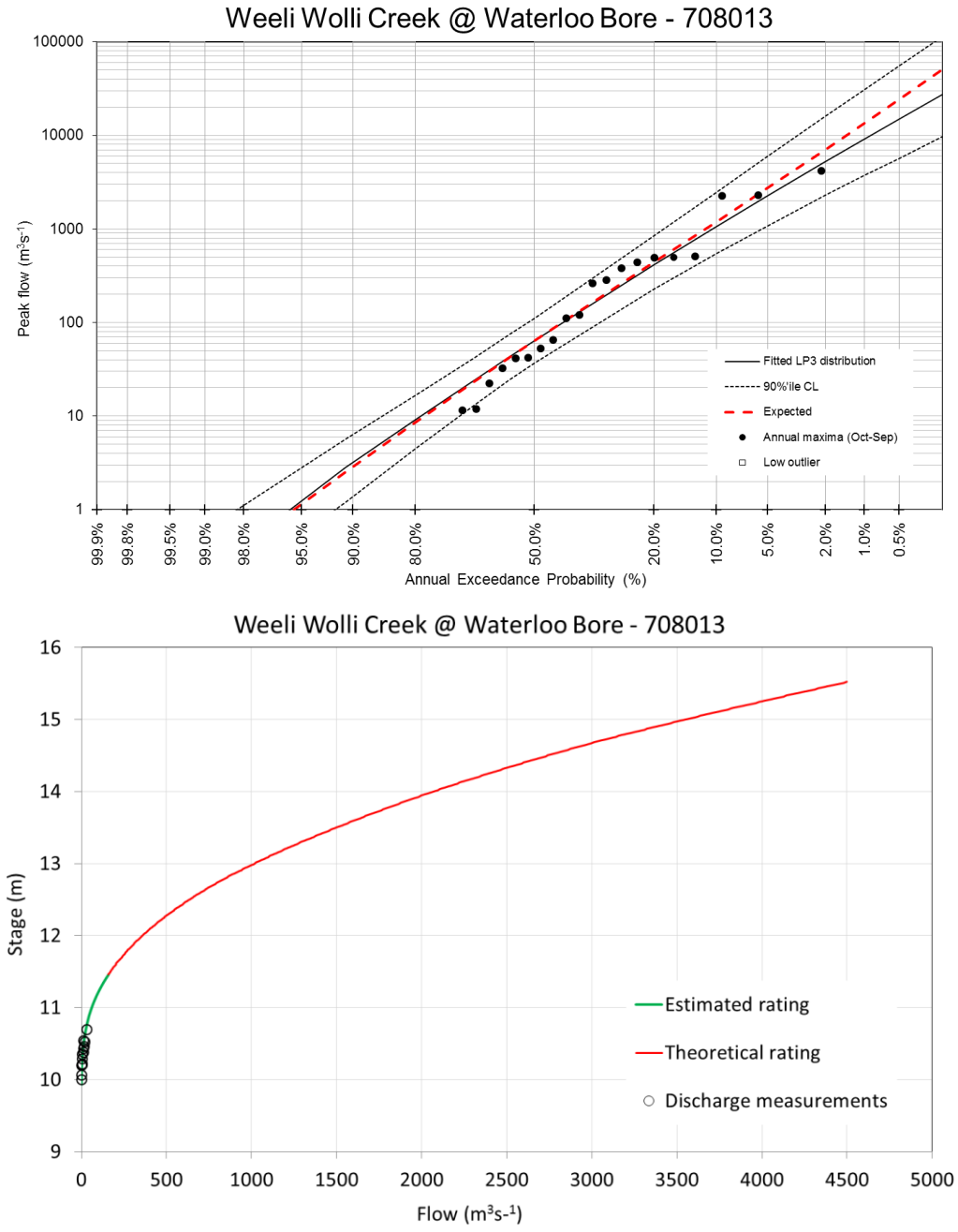


Figure 9-3: Waterloo Bore (708013) FFA and rating curve

Waterloo Bore rating curve comments provided by Mr Ross Doherty from DOW -

> 'Poor gauging station site – braided channel, unstable bed, in-channel vegetation etc. Has been modelled with HEC-RAS but unconfirmed by gauging. Estimated uncertainty – greater than +/-25%'

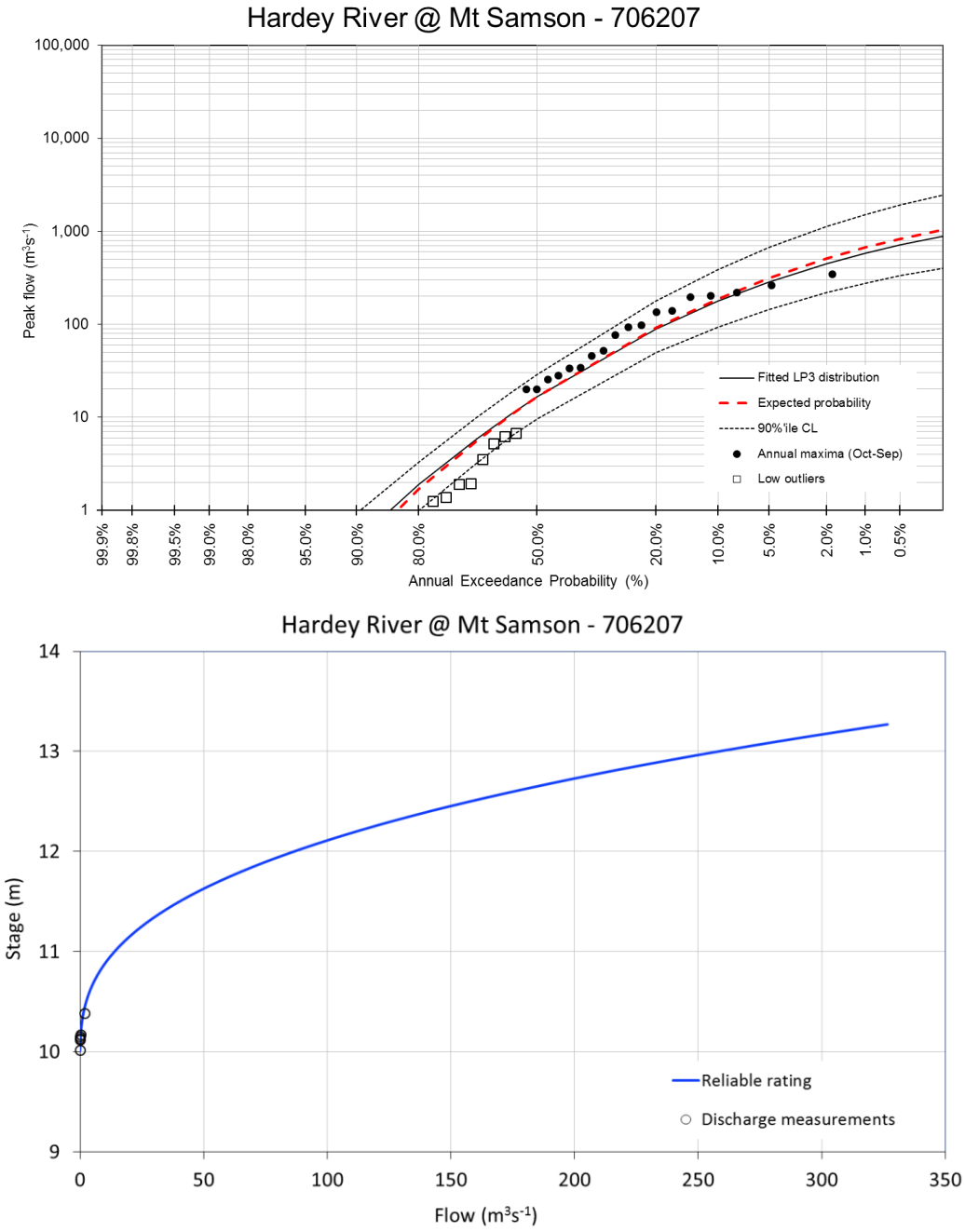


Figure 9-4: Mt Samson (706207) FFA and rating curve

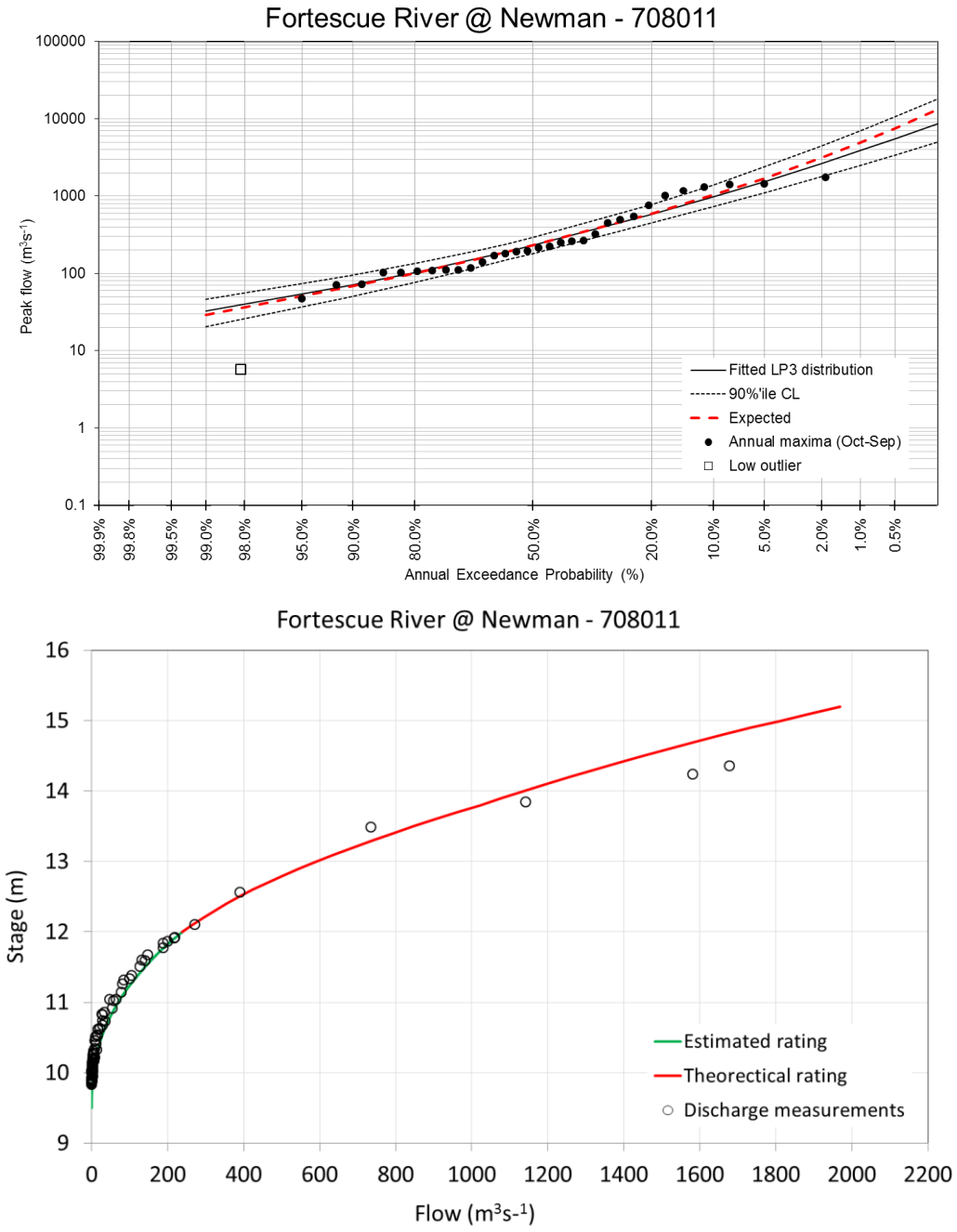


Figure 9-5: Newman (708011) FFA and rating curve

9.3 Appendix C - RORB model catchment sizes

Table 9-1: Tarina RORB catchment sizes

Catchment	Area (km^2)
A	212
B	129
C	91
D	243
E	51
F	216
G	124
H	18
I	87
J	110
K	47
L	131
M	71
Total	**1526**

Table 9-2: Pebble Mouse/Tarina RORB catchment sizes

Catchment	Area (km^2)
PA	61
PB	30
PC	45
PD	33
PE	19
PF	24
PG	23
PH	23
PI	18
PJ	20
PK	15
PL	25
A	212
B	129
C	91
D	243
E	51
F	18
G	87
H	110

I	47
J	131
K	71
Total	**1526**

9.4 Appendix D - Side catchment boundary conditions

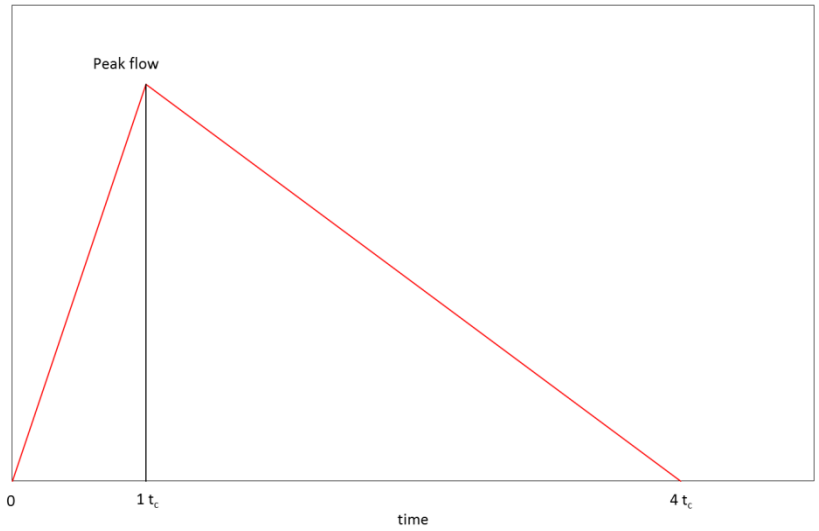


Figure 9-6: Relationship used to produce hydrographs for southern catchments; based on volumes from RORB models of Pilbara catchments

Table 9-3: Parameters of side boundary catchment estimated peak inflows; boundary locations given in Figure 5-1

Catchment	Area (km^2)	L (km)	S_e (m/km)	1% AEP Peak Q (m^3/s) (RFFP)	Tc hours
S1	1	2.2	51.1	17	1.0
S2	2	2.2	46.1	33	0.9
S3	2	2.4	73.7	37	0.9
S4	1	1.5	44.2	19	0.7
S5	4	3.6	27.1	43	1.6
S6	1	2.0	28.8	14	1.0
S7	3	3.2	24.2	31	1.4
S8	3	3.4	46.6	41	1.4
N1	0.31	1.1	101.6	8	0.5
N2	0.13	0.8	101.7	4	0.4
N3	0.28	1.3	86.5	8	0.6
N4	0.22	0.7	103.4	7	0.3
N5	0.03	0.2	211.3	2	0.1
N6	0.54	1.4	79.3	12	0.6
N7	0.07	0.4	184.4	3	0.2
N8	0.08	0.4	198.0	4	0.2
N9	0.04	0.2	287.9	4	0.1
N10	0.09	0.3	67.4	4	0.2
N11	2.93	3.5	42.7	38	1.5
N12	2.21	3.2	29.7	26	1.4

N13	0.06	0.3	127.6	3	0.1
N14	0.72	1.9	58.3	14	0.8
N15	0.56	1.3	60.7	12	0.6
N16	0.12	0.4	105.7	5	0.2
N17	0.03	0.2	101.6	2	0.1
N18	1.54	2.3	51.6	24	0.9
N19	0.29	0.9	51.8	6	0.4
N20	0.14	0.7	113.5	5	0.3
N21	0.07	0.4	74.8	2	0.2
N22	0.04	0.2	115.0	2	0.1
N23	2.08	3.0	42.6	29	1.3
N24	0.51	1.0	43.3	11	0.5
N25	0.09	0.3	124.3	5	0.1
N26	0.03	0.2	115.0	2	0.1
N27	0.04	0.3	67.3	1	0.2
N28	1.76	3.4	20.0	19	1.7

Table 9-4: Total runoff volumes potentially reporting to the deposits, using basic runoff coefficients as described in the Pilbara Surface Water Management Strategy

		Likelihood	**Almost Certain (1 yr ARI)**	**Likely (2 yr ARI)**	**Possible (10 yr ARI)**	**Unlikely (50 yr ARI)**	**Rare (500 yr ARI)**	**100 yr ARI 24 hours**
		Rainfall (mm)	**60**	**80**	**150**	**230**	**375**	**261**
Catchment	Area (km^2)		Vol Captured (m^3)	Vol Captured (m^3)	Vol Captured (m^3)	Vol Captured (m^3)	Vol Captured (m^3)	Vol Captured (m^3)
N1	0.31		7,000	11,000	25,000	45,000	74,000	55,000
N2	0.13		3,000	5,000	11,000	19,000	32,000	23,000
N3	0.28		7,000	10,000	23,000	41,000	67,000	49,000
N4	0.22		5,000	8,000	18,000	32,000	53,000	39,000
N5	0.03		1,000	1,000	2,000	4,000	6,000	5,000
N6	0.54		13,000	19,000	44,000	79,000	129,000	96,000
N7	0.07		2,000	2,000	6,000	10,000	16,000	12,000
N8	0.08		2,000	3,000	7,000	12,000	19,000	14,000
N9	0.04		1,000	1,000	3,000	6,000	10,000	7,000
N10	0.09		2,000	3,000	8,000	14,000	22,000	16,000
N11	2.93		35,000	57,000	149,000	293,000	477,000	332,000
N12	2.21		27,000	43,000	112,000	221,000	361,000	251,000
N13	0.06		1,000	2,000	5,000	8,000	13,000	10,000
N14	0.72		17,000	25,000	58,000	105,000	171,000	126,000
N15	0.56		13,000	20,000	45,000	82,000	133,000	98,000
N16	0.12		3,000	4,000	10,000	18,000	29,000	22,000

		Likelihood	Almost Certain (1 yr ARI)	Likely (2 yr ARI)	Possible (10 yr ARI)	Unlikely (50 yr ARI)	Rare (500 yr ARI)	100 yr ARI 24 hours
		Rainfall (mm)	**60**	**80**	**150**	**230**	**375**	**261**
Catchment	Area (km^2)		Vol Captured (m^3)	Vol Captured (m^3)	Vol Captured (m^3)	Vol Captured (m^3)	Vol Captured (m^3)	Vol Captured (m^3)
N17	0.03		1,000	1,000	3,000	5,000	8,000	6,000
N18	1.54		19,000	30,000	78,000	154,000	251,000	175,000
N19	0.29		7,000	10,000	24,000	43,000	70,000	52,000
N20	0.14		3,000	5,000	12,000	21,000	34,000	26,000
N21	0.07		2,000	2,000	6,000	10,000	17,000	12,000
N22	0.04		1,000	1,000	3,000	5,000	9,000	6,000
N23	2.08		25,000	40,000	105,000	208,000	339,000	236,000
N24	0.51		12,000	18,000	41,000	74,000	121,000	90,000
N26	0.03		2,000	3,000	7,000	14,000	22,000	16,000
N27	0.04		1,000	1,000	2,000	4,000	7,000	5,000
N28	1.76		1,000	1,000	3,000	5,000	8,000	6,000

9.5 Appendix E - Photos of the Baby Hope study area



Figure 9-7: Pebble Mouse Creek main channel approximately 707,160 mE/7,452,260 mN.



Figure 9-9: The northern range looking south over the Baby Hope deposit and across the range highlighting the slope.

APPENDIX G OFFSETS

G.1: Progressive Rehabilitation Summary

Rio Tinto Iron Ore Rehabilitation and Closure

Hope Downs 2 Proposal

Progressive Rehabilitation Performance Summary – Regional Overview

July 2022

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RTIO-0971880

RioTinto

Disclaimer and Limitation

This report has been prepared by Rio Tinto's Iron Ore Group (Rio Tinto), on behalf of Hamersley HMS Pty Limited (the Proponent), specifically for the Hope Downs 2 Proposal. Neither the report nor its contents may be referred to without the express approval of Rio Tinto, unless the report has been released for referral and assessment of proposals.

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TABLE OF ABBREVIATIONS

AGM	Alternative growth media
ANFO	Ammonium Nitrate Fuel Oil
BIF	Banded iron formation
BST	Batter Selector Tool
BWT	Below water table
DAWE	Commonwealth Department of Agriculture, Water and the Environment
JTSI	Department of Jobs, Tourism, Science and Innovation
DMIRS	Department of Mines, Industry Regulation and Safety
EPA	Environmental Protection Authority
EPBC	Environment Protection and Biodiversity Conservation
ESD	Environmental Scoping Document
GIL	Global Innovation Linkages
HD1	Hope Downs 1
HD2	Hope Downs 2
HD4	Hope Downs 4
IPCC	Intergovernmental Panel on Climate Change
LOM	Life of Mine
MCP	Mine closure plan
PAF	Potentially acid forming
PDCA	Plan, Do, Check and Act
PRG	Pilbara Rehabilitation Group
RQA	Rehabilitation Quality Assessment
Rio Tinto	Rio Tinto Iron Ore
SERA	Standards Reference Group Australia
SMART	Specific, Measurable, Achievable, Relevant and Time-Bound
UAV	Unmanned Aerial Vehicle
UWA	University of Western Australia
WABSI	Western Australian Biodiversity Science Institute
WFSF	Waste Fines Storage Facility

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1. SCOPE AND PURPOSE

This Progressive Rehabilitation Performance Summary (Summary) has been prepared primarily to support the Hope Downs 2 (HD2) Iron Ore Hub Proposal referred to the Environmental Protection Authority (EPA) for assessment under Part IV s38 of the Environmental Protection Act 1986 (EP Act) in August 2019.

This Summary has been developed in alignment with the Department of Mines, Industry Regulation and Safety (DMIRS) statutory requirements for MCP content and structure (DMIRS 2020a & b). It may also be used to support the submission of:

- Native Vegetation Clearing Permits; and
- Annual Environment Reports requirements for:
    - Iron Ore (Hamersley Range) State Agreement Act 1963 and Annual Compliance assessment reporting for Ministerial Statements to the Department of Jobs, Tourism, Science and Innovation (JTSI); or
    - Mining Act tenure to DMIRS; or
    - Native Vegetation Clearing Permits (to DMIRS).

As the HD2 Proposal is still under assessment and not yet operational, no progressive rehabilitation has been undertaken to date. This rehabilitation summary discusses the rehabilitation success, to date, at nearby Rio Tinto mine sites, Hope Downs 1 (HD1) and Hope Downs 4 (HD4), Yandicoogina and West Angelas, to provide evidence that current and future rehabilitation activities will be successful in establishing a self-sustaining functional native ecosystem (Table 2). Any relevant trials installed at other sites are also discussed.

2. GENERAL OVERVIEW OF PILBARA REHABILITATION

2.1. Progressive rehabilitation planning

Rio Tinto has a dedicated Rehabilitation and Closure team responsible for closure planning, progressive rehabilitation, ongoing development of closure knowledge, and closure cost estimation. This team is supported by a robust internal governance framework and embedded partnerships with multi-disciplinary technical experts.

Rio Tinto undertakes progressive rehabilitation across its network of Pilbara iron ore operations to actively reduce closure liability. A key driver for completion of progressive rehabilitation is growth in confidence in the ability to deliver quality rehabilitation and reduce associated closure liabilities. However, as the Rio Tinto Pilbara operations are typically large scale and long lived with multiple pits being mined simultaneously to meet grade and product requirements, the disturbance areas are usually active for long periods. Consequently, the pace of progressive rehabilitation is not always commensurate with the associated pace of clearing, and long periods of time may elapse between the construction and mining and the commencement of rehabilitation.

Lessons learnt, and information gathered, from progressive rehabilitation will be used to indicate the likely success of future rehabilitation and inform the development of final closure criteria. Local undisturbed vegetation is used as a reference to guide rehabilitation activities such as seed list development and rehabilitation quality assessment. Due to the nature of the mining activity undertaken, it must be recognised that rehabilitation will not reflect the pre-mining environment (i.e., as compared to ‘restoration’, as defined in SERA 2021).

To date, the success of the Rio Tinto rehabilitation in the Pilbara has been variable, with poor to moderately successful rehabilitation outcomes observed across historical and recent rehabilitation

areas. Significant improvements have been made recently in mineral waste characterisation and landform design and earthwork conformance to design practices, leading to closure designs with reduced erosion rates and related impacts and improved outcomes for rehabilitated areas. Generally, vegetation parameters in rehabilitation are good but are highly dependent on the rainfall volume received in the months and years following the completion of rehabilitation works coupled with the soil or growth media material utilised.

The Hope Downs operation is located in the Eastern Pilbara. Examples of successfully completed rehabilitation, particularly for high impact disturbance areas (such as waste rock dumps), are not as common in the Eastern Pilbara. This is due to most of Rio Tinto's operations in this area operating under Ministerial Statement approval conditions that require mine voids to be backfilled to above water table or greater, meaning waste rock dumps (as the source backfill material) are not rehabilitated progressively during operations unless it is clearly articulated in the Life of Mine plan that they can be.

Despite this limitation in the Eastern Pilbara, Rio Tinto has demonstrated in the greater Pilbara region their ability to undertake successful rehabilitation of a number of high impact disturbance areas at other operations. Rio Tinto anticipates that future rehabilitation activities will achieve more consistent outcomes, with a continually growing confidence in design selections driven by key learnings from progressive rehabilitation (Table 2) within the Pilbara.

2.2. Definition of land disturbance types

The following categories are applied to disturbance features at Rio Tinto operations.

2.2.1. Low impact disturbance

Low impact disturbance areas are defined as areas where vegetation has been cleared and there has been minimal disturbance to the soil profile. Examples include laydowns; above surface linear infrastructure corridors (pipelines, tracks etc.); topsoil stockpile footprints; and exploration disturbance. Rehabilitation of such areas includes backfilling sumps, contour ripping and spreading of topsoil (if available). Seed may also be spread, if required.

2.2.2. Moderate impact disturbance

Moderate impact disturbance areas are defined as areas requiring minor earthworks to either return the area to natural relief or create a compatible landform consistent with the surrounding natural relief and landforms. Examples include airstrips; buildings; infrastructure; mine access roads; and borrow pits. Typically, rehabilitation of such areas involves removal of infrastructure, services and road surfaces, deep ripping of compacted areas, re-contouring, spreading of topsoil, contour ripping and seeding.

2.2.3. High impact disturbance

High impact disturbance areas are defined as those areas that require extensive earthworks to either approximate surrounding natural relief or create a compatible landform consistent with the surrounding natural relief and landforms. Typically, such areas contain concrete footings that require cracking and covering with fill, voids that need to be filled with waste rock, and/or significant reshaping and contouring to create the required relief. All concrete and buried services are required to be removed to one metre below final surface. Examples of high disturbance areas include accommodation camps; fuel farm facilities; haul roads; bridges; dams; power stations; and processing plants. Constructed landforms (such as waste dumps and waste fines storage facilities) are also highly disturbed areas that require significant earthworks to achieve stable rehabilitation designs.

2.3. Rehabilitation methodology

Key learnings from the progressive rehabilitation undertaken to date across a range of Rio Tinto operational locations facilitate continual improvement within rehabilitation methodology. Examples relevant to the HD2 Proposal are provided in Table 1.

Table 1 Key learnings from progressive rehabilitation relevant to HD2 Proposal

Learning	Operational Control	Further Discussion Within the Summary
Rainfall is integral to the success of rehabilitation. Good results in plant density and spinifex cover are achieved if rainfall is received soon after seeding i.e., soil moisture assists in germination and establishment of seedlings. However, if the quantity of rainfall after seeding is too high, detrimental impacts upon rehabilitation success may occur.	Schedule seeding before the onset of wet season, rather than when the earthworks are completed, regardless of time of year. Planned trials to determine effect of timing of seeding.	2.3.2 Seed management 5 Summary of rehabilitation outcomes 6.1 Eco-engineering solutions to improve mine site rehabilitation outcomes
Ongoing intermittent rainfall is required through time to ensure that revegetation continues to develop on the desired trajectory to achieve closure criteria. In alignment, weed density generally decreases over periods of low rainfall.	Monitoring of reference sites to determine the effect of rainfall on natural systems Weed monitoring and management.	2.3.2 Seed management 5 Summary of rehabilitation outcomes 6.1 Eco-engineering solutions to improve mine site rehabilitation outcomes
The presence of weeds significantly impedes overall rehabilitation outcomes particularly within parameters native perennial species richness / density and native perennial cover.	Regular monitoring of weeds and prompt implementation of weed management actions when required.	5 Summary of rehabilitation outcomes
Generally, the addition of topsoil as a growth medium provides better revegetation results than those achieved at sites where no topsoil was available. However, there has been some successful revegetation at sites where no topsoil was utilised.	Ongoing review of topsoil management and monitoring of trials	2.3.1 Growth mediums 5 Summary of rehabilitation outcomes 6.5 Growth media trials
Current results indicate that waste materials with soil-like properties, collectively termed 'Alternate Growth Media' (AGM) can act as effective germination beds and be used as longer-term growth mediums.	Ongoing characterisation of potential AGM and monitoring of trials.	2.3.1 Growth mediums 6.5 Growth media trials
With the limited trials to date, application of fertiliser did not improve revegetation results.	Ongoing investigation of soil ameliorants to improve success of AGM, and of germination and survivability results for native species	2.3.1 Growth mediums 6.5 Growth media trials
Spinifex cover is closely associated with total plant cover and density values.	Ongoing monitoring to determine if association continues through time and with differing seed mixes.	5 Summary of rehabilitation outcomes

2.3.1. Growth mediums

There may also be a shortfall of topsoil and subsoil available for rehabilitation due to topsoil being naturally thin or absent on topography such as hillslopes and ridge lines, or steep underlying topography presenting safety risks preventing the collection of topsoil. Where a topsoil deficit exists at a site, consideration is given to the use of subsoil and alternative growth media in rehabilitation.

Throughout the Pilbara, there is an ongoing opportunity to utilise mineral waste as topsoil substitutes or supplements for rehabilitation activities. The waste materials with soil-like properties are referred to as 'alternative growth media' (AGM). It is anticipated that AGM will provide a suitable growth medium in rehabilitation areas where topsoil is unavailable or limited in quantity. Research trials are underway to determine if the revegetation success in areas rehabilitated with alternative growth media will be acceptable, and early indications are promising (Section 6.5). Waste types which are identified as potentially suitable are laboratory tested for key soil chemical and physical parameters. If the characterisation results are favourable, the material is stockpiled with location recorded on mine site survey records.

Alternative growth media material was identified and tested from several Rio Tinto sites in the Pilbara including: Marandoo; Tom Price; Western Turner Syncline; and Channar (Outback Ecology 2010, Stantec 2017, and Landloch 2018). Stockpiling of suitable material commenced, with additional investigations to incorporate materials into the mine plans for future recovery underway.

Results from ongoing monitoring of these trials will be used to inform future closure strategies. If required, seeding rates may be increased in areas receiving alternative growth media or subsoil material to compensate for the lack of a topsoil seedbank. The application of fertiliser, or other ameliorants, will also be considered for materials that have low nutrient status, although recent evidence suggests the addition of fertiliser is not always beneficial and can promote weed establishment (Stantec 2020).

2.3.2. Seed management

Locally collected seed assists in the revegetation and creation of a self-sustaining ecosystem. Over time, the viability of the seed within stockpiled topsoil may decrease, particularly if stored for long periods or if the stockpile does not become vegetated, and thus the quality of the seed bank in the topsoil may deteriorate. In addition, as topsoil is not always used in rehabilitation of areas it was salvaged from, the salvaged topsoil may not contain seeds of all the target species of its new location/habitat.

Seed mixes used during rehabilitation are of local provenance. Specific seed mixes are selected to provide a range of species appropriate to the landscape position and slope. Local colonising species are included in the mix aid to aid in quick vegetation establishment, and to thus compete with weed species that may establish from wind-blown seed. Rio Tinto is working towards ensuring culturally significant species are also considered in the selection of species and determination of proportion of seed numbers for each species in the mix.

Rio Tinto purchases seeds from commercial seed suppliers, with emphasis on ensuring that there are adequate seed of appropriate quantity and local provenance species available for planned rehabilitation at each of the mine sites or other assets. Stringent controls on seed quality, provenance and seed storage are in place and seed pre-treatments are used for a proportion of the seed of some species to maximise the potential of applied seed to germinate under field conditions. Seeds are stored in purpose-built, climate-controlled storage facilities to maximise long-term viability. Viability testing and species-specific pre-treatment occurs before seed are utilised in seed mix preparation and application onto rehabilitated sites. Increasing revegetation success through ongoing improvement projects and research partnerships in seed biology and seeding technologies is a key factor in the ability to successfully rehabilitate across all Pilbara mining operations.

As the opportunity to utilise rare and threatened species in rehabilitation programs is limited by various factors such as availability, the focus of rehabilitation programs is to restore vegetation complexes that include the more common species present in the habitat type, and to achieve a suitable range of strata considering the desired post-mining land use. Seed mixes may include species of conservation significance if available, but presence of these species in rehabilitation areas is more likely to result from natural recruitment from surrounding areas.

Legislative requirements regarding seed provenance are often included as conditions within Native Vegetation Clearing Permits obtained under the EP Act. A review of all legislative requirements for seed

provenance is conducted as part of the planning process for rehabilitation programs to ensure seed provenance conditions are met. All legal obligations related to rehabilitation and seed provenance for the HD2 area are summarised in the Legal Obligations Register appended to the MCP.

3. PROGRESSIVE REHABILITATION ANTICIPATED FOR HD2

Within the proposed HD2 closure boundary, all disturbed areas that can be accessed safely, with the exception of pit floors (unless backfilled to within 10m of the final surface), will be rehabilitated, either progressively through operations, or at closure.

This Summary references progressive rehabilitation undertaken at HD1, HD4, West Angelas and Yandicoogina disturbance areas but does not intend to capture an overview of all progressive rehabilitation conducted at these sites. Progressive rehabilitation conducted at these sites will be captured in specific Summaries and appended to each relevant MCP.

4. MONITORING PROGRAMME

Rio Tinto monitors rehabilitated areas across its Pilbara operations with the objective of obtaining data that will be used to evaluate the success of rehabilitation against biological completion criteria, as well as supporting adaptive management and continuous improvement of rehabilitation techniques as described in the Rio Tinto Rehabilitation Monitoring Procedure (Rio Tinto 2019b).

Analysis of monitoring results provides information to inform the development of realistic and achievable completion criteria, by examining changes in key parameters over time and comparing results from the rehabilitation with those from corresponding reference sites in undisturbed areas. Such analysis of monitoring results will also be used to indicate the likely success of progressive rehabilitation in achieving completion criteria and whether any areas of rehabilitation require rework due to poor performance.

4.1. Monitoring schedule and design factors

Rehabilitation monitoring is scheduled using a risk-based approach to determine the appropriate monitoring technique and frequency. Where possible, monitoring is completed annually for the first three years following rehabilitation, then in years 5, 7, 9, 12 and 15, and then every third year thereafter. Frequency of monitoring may be altered depending on the condition of the rehabilitated site and the availability of resources.

Rehabilitation monitoring is completed in the cooler months (June to September) of each year, noting that COVID restrictions modified the program in 2020 and 2021. The monitoring program design (i.e., monitoring technique and frequency) for each rehabilitated site considers the following factors:

- the level of complexity of the rehabilitation and subsequent risk to rehabilitation quality outcomes (e.g., generally waste dumps are a high risk due to their complexity whilst a lower risk for achieving desired rehabilitation outcomes exists for low disturbance areas).
- the regulatory requirements for rehabilitation monitoring.
- the age of the rehabilitation.
- the overall area of the rehabilitation (i.e., the larger the size, the higher the number of monitoring locations required).
- if there is a trial implemented on some of the rehabilitation (e.g., the ability to detect germination of seeded species requires early monitoring in the first year is especially important in analysis of trial results).
- natural disturbance such as fire or cyclonic rainfall (may reset the timing of monitoring to year 1).

- safe access for monitoring personnel.

Monitoring schedules for the rehabilitation sites are provided in Appendix A. In general, apart from the Yandicoogina Central Waste Dump rehabilitation (due to its completion being over 20 years ago), the rehabilitation monitoring schedules comply with the requirements of the Rio Tinto Rehabilitation Monitoring Procedure.

4.2. Rehabilitation monitoring methods

Monitoring methods utilised by Rio Tinto include:

- **Rehabilitation Quality Assessments (RQAs) and photo point monitoring**: These observational assessments are used on low to moderate disturbance areas, historical rehabilitation with no monitoring history, or on areas too small for transects. They can also be used in combination with the above transect methods on large rehabilitation areas to manage monitoring resources efficiently. The purpose is to gain an overview of the rehabilitation quality including erosion, growth medium, vegetation cover, species richness, vegetation structure, plant density, weed presence and general condition. Each characteristic is compared between the rehabilitation and local undisturbed native vegetation and given a score according to the RQA field book guidelines. A representative photograph is taken of both the rehabilitation and reference areas.
- **Vegetation, fauna habitat and erosion monitoring**: Vegetation monitoring involves establishing quadrats (2 m x 2 m) at 5 m intervals along a 50 m or 100 m transect. Within each quadrat, numbers of all native perennial plant species and weeds are counted, and individual percent cover estimated. The number of bare areas is assessed by dividing the edge of each quadrat on the transect baseline into eight x 25 cm sections and recording the number that has no perennial plant species cover. A subjective assessment of total native perennial plant cover (%) is also recorded for each quadrat. Notes are taken of the general condition of the rehabilitation, including new disturbance and fire damage. The term 'spinifex' in this report refers to *Triodia* species.

  Fauna and habitat monitoring comprises estimating litter cover, noting rocks and logs in each quadrat, and a whole-of-transect assessment of grazing extent, native animal scats, ant numbers, and other indicators of animal activity.

  Erosion monitoring entails an examination of a permanent vegetation transect to identify the presence and number of gullies that are greater than 30 cm in depth. Gully locations and associated measurements of total width and depth at the deepest point are recorded. Comparisons of data collected over time can determine if a landform has stabilised or if it is exhibiting rates of erosion which require intervention. Eroded areas that may require intervention are then investigated for potential rework opportunities.

4.2.1. Rehabilitation monitoring reference sites

To obtain meaningful information on rehabilitation outcomes, suitable reference sites are required for comparative purposes. The location, topography and vegetative structure of the rehabilitated area are the key considerations when selecting a reference site, which will ideally represent the natural landscape surrounding the operational area. Additional factors and potential limitations that are also considered during reference site selection include approval boundaries, exclusion areas, final landform designs, mine planning, accessibility and safety factors. Consequently, the distance between rehabilitation and reference sites can vary.

Reference sites are positioned within undisturbed native vegetation representative of the local area where the rehabilitation is to be conducted. Appropriately positioned monitoring reference sites will encompass the target vegetation community to provide the baseline vegetation criteria used for

assessing rehabilitation progress and outcomes and, where possible, enable a comparison to similar undisturbed areas. Reference sites are located on different topography types (upper slopes / hilltops, mid-slopes and lower slopes and flats) to account for spatial variations of mined landforms and their influencing factors.

The monitoring of reference sites provides a temporal record of natural variations in established vegetation through time which can offer valuable insights into the influence of non-mining related variables such as climate or fire events. Monitoring data obtained from reference sites also assists in the planning of rehabilitation by informing methodology, for example seed list selections. Using a range of reference sites is endorsed to better facilitate a comprehensive assessment of rehabilitation progress.

Reference sites will be established in the early development stage of HD2, after project approval. Details and vegetation parameter trends regarding the HD1, HD4, West Angelas and Yandicoogina monitoring reference sites cited in this Summary are provided in Appendix B of this Summary, with photos presented in Appendix C.

4.2.2. Revegetation completion criteria

Vegetation on rehabilitated land has been identified as a key outcome in evaluating the site condition at closure and compatibility with the post-mining land use. All progressive rehabilitation undertaken during operations is required to meet the associated closure outcomes / completion criteria described within the associated Mine Closure Plan (MCP). Broadly, the desired closure outcomes help align the rehabilitation methodology with the objectives of establishing a safe, stable, and non-polluting landscape vegetated with native species of local provenance, and ensuring the site is compatible with proposed post-mining land use.

Based on recent work undertaken by Rio Tinto and Stantec (Stantec 2020) on potential biological completion criteria for the Channar mine site, the following key parameters were selected to develop quantitative targets which are applicable across all rehabilitation areas and reference sites:

- **Native perennial species richness and species density**: Species richness is simply the total number of species in a defined area (i.e., the sum of quadrat species counts within entire transect). This differs from the more comprehensive measurement of species diversity which incorporates relative abundances.

  Species density was calculated as the mean number of species per quadrat and is a valuable measure for monitoring vegetation changes over the long-term. Although not significantly different to species richness, species density can better detect plant responses to a given management action, and unlike species richness, comparative analyses can still be made when transect lengths differ.

- **Native perennial plant density**: Plant density refers to the mean number of plants per transect. Total counts of native plants were documented for each quadrat and averaged for entire transect values.

- **Native perennial plant cover**: Values for this parameter were obtained with visual assessments for each quadrat of the percentage of surface area with vegetation (i.e., percentage that is not bare). Final values were calculated for each transect as the mean percentage of cover across all quadrats. Due to the subjectivity involved in visually assessing percentage cover, final values are considered estimates only.

The analysis of these parameters is standardised across all Rio Tinto operational sites and is considered appropriate in the development of a consistent approach to determining success of rehabilitation over time. Rio Tinto is undertaking further work on this approach and will also incorporate feedback when received from stakeholders on the preliminary Channar monitoring strategy present in the MCP (2020). Further refinements of completion criteria will be presented in future updates to closure plans and progressive rehabilitation performance summaries

The preliminary completion criteria for HD2 are presented in Table 2 below along with the associated monitoring methods and means of verification (vegetation parameters). These will be refined further as mining progresses to ensure they are Specific, Measurable, Achievable, Relevant and Time-Bound (S.M.A.R.T) (as defined by Young *et al* (2019)). Application of the S.M.A.R.T acronym facilitates a systematic and comprehensive framework for goal formation.

Table 2 HD2 Proposal preliminary completion criteria

CLOSURE OUTCOME	PRELIMINARY COMPLETION CRITERIA	UNIT(S) AND METHOD(S) OF VERIFICATION
Vegetation on rehabilitated land is self-sustaining and compatible with the post-mining land use.	Seed used in rehabilitation works is of local[1] provenance.	Seed management plan
	Native plants within rehabilitated areas are observed to flower and/or fruit.	Rehabilitation monitoring and site inspections Reproductive activity Species flowering/fruiting
	Recruitment of native perennial plants is observed	Rehabilitation monitoring and site inspections Number of native perennial plants per m^2
	Species richness of native perennial plants within rehabilitated areas is not less than reference sites.	Rehabilitation monitoring and site inspections Number of native perennial species per m^2
	Any weed species recorded within rehabilitation areas are present within the local area.	Analysis of weed species richness, estimated cover (%) within revegetation against baseline data. Proportion of weed cover to total perennial cover
The final landform is stable, and its design considers hydrological factors.	No erosion features that compromise landform integrity are present and if present, erosion features are stable	Rehabilitation monitoring program including quantitative evaluation of behavior of rills and gullies (if required) over time. Depth, width, and length of rills/gullies.
	The final landform has been designed and constructed with consideration given to its stability during intense rainfall and large flood events.	Analysis of aerial imagery to provide qualitative analysis of landform stability. Post-closure landform review to confirm that risks have been appropriately managed.
	Final landforms are outside predicted potentially unstable pit edge zones.	

[1] Local is defined as Pilbara IBRA and/or as defined in NVCPs

4.2.3. Climate data

Rainfall and temperature

Rainfall and temperature data is sourced, either directly or via the Bureau of Meteorology (BOM), from weather stations located at or in the vicinity of the relevant mine site. Generally, Rio weather stations are used to provide monthly localised data, with long-term averages sourced from BOM weather stations.

Yearly rainfall trends characteristic to the Pilbara region are generally that of extreme cyclone-associated rainfall throughout the summer months, with significantly less rainfall received during the winter months. Rainfall data referenced in this Summary was obtained from HD1 / HD4, Yandi and West Angelas weather stations, with long term averages sourced from the Marillana WS (005009) (BOM, 2020), located just under 50 km from HD2, and Turee Creek Station (007083) (BOM, 2020), approximately 85 km from HD2.

Annual temperature trends observed in the Pilbara region show the most range between maximum and minimum values during winter months, with the highest summer maximum usually recorded in November. Summer temperatures regularly exceed 35°C, with maximums above 40°C not uncommon. Temperature data within this Summary was sourced from the Newman Aero WS (007176) (BOM, 2020), despite it being 100 km from HD2, as monthly values were inconsistently recorded at closer stations. As such, the temperature data in this Summary is used to provide a general indication of trends over time rather than as source of specific values for comparisons with monitoring results.

Climate change

Climate change is a complex issue, with inherent uncertainty about the timing, pace, and severity of possible impacts. Risks from climate change to the stability of landforms, mobilisation of contaminants and revegetation are some of the identified vulnerabilities that have been considered in closure planning.

Based on climate change projections rainfall reduction will be relatively small in the Pilbara. However, the sensitivity of hydrological processes to small changes in rainfall coupled with the expected rise in temperatures (particularly during winter months, which may impact monitoring schedule and design) and potential evaporation will have a large impact on the hydrology of the Pilbara region (Charles *et al.*, 2015). The materialisation of these climate projections is likely to make successful rehabilitation in the Pilbara more challenging.

5. SUMMARY OF REHABILITATION PERFORMANCE

Examples of monitoring outcomes of key rehabilitation areas at adjacent Rio Tinto mine sites provide contemporary scientific evidence of the success of rehabilitation undertaken to date in the region.

Interpretations and analyses of rehabilitation monitoring results were limited to a moderate extent by deficiencies in pre-2010 records of rehabilitation methodology. For example, the use of ameliorant was rarely documented so any potential correlation with successful rehabilitation outcomes will not be evident. Data and document management is currently undergoing a significant upgrade to alleviate the issue. Detailed close-out reports will be completed for all future rehabilitation works, following a standardised approach which utilises up-to-date databases and document control methods.

5.1. Rainfall

Hope Downs

A sustained period of above average rainfall was received in the 2013/2014 summer, theoretically promoting seed germination and establishment at sites rehabilitated in 2013 (HD4 Powerline, Railway and Mine Access Road, Mine and Camp). Plant growth may have been limited in subsequent years due

to periods of below average rainfall recorded during the summer of 2015/2016, between December 2018 and April 2019, and in the six months leading up to the 2020 assessment.

A substantial summer rainfall event was recorded in January 2021, with rainfall being 102 mm above the long-term average. These trends are evident within Figure 1 which plots the monthly rainfall recorded at HD1 and HD4 against long-term averages.

Yandicoogina

In the time since the Central Waste Dump rehabilitation works were completed in 1999, rainfall has been mostly consistent with the long-term average, with above average rainfall recorded from 2003 to 2006 and 2011 to 2017 (Figure 2 and Figure 3). There were no severe and/or prolonged drought periods and while conditions during the periods of below average rainfall were sub-optimal for seed germination and plant recruitment, the Yandicoogina Central WD rehabilitation was old enough to tolerate the dry conditions.

Rainfall following completion of the Rubber Dump rehabilitation in 2013 was generally consistent with the long-term average, although minor periods of low rainfall were recorded from February to May 2016 and several months prior to the 2018 monitoring assessment, which may have adversely influenced vegetation parameters including plant cover and presence of annuals.

West Angelas

The monthly rainfall (mm) for West Angelas is presented in Figure 4, with observed trends being generally consistent with those expected for the Pilbara region. Yearly rainfall totals recorded since the completion of the East and South Waste Dump rehabilitation in 2012, were consistently above the long-term average of 253 mm, potentially aiding seed germination and plant establishment. An exception to this trend was observed during the twelve months prior to the 2019 assessment, with both annual and summer rainfall being well below the long-term average.

5.2. Temperature

Temperature data sourced from Newman Aero WS, approximately 100 km away from the Hope Downs mine site, is provided in Figure 5 as an indicator of yearly temperature variations and trends in the general area of HD2.

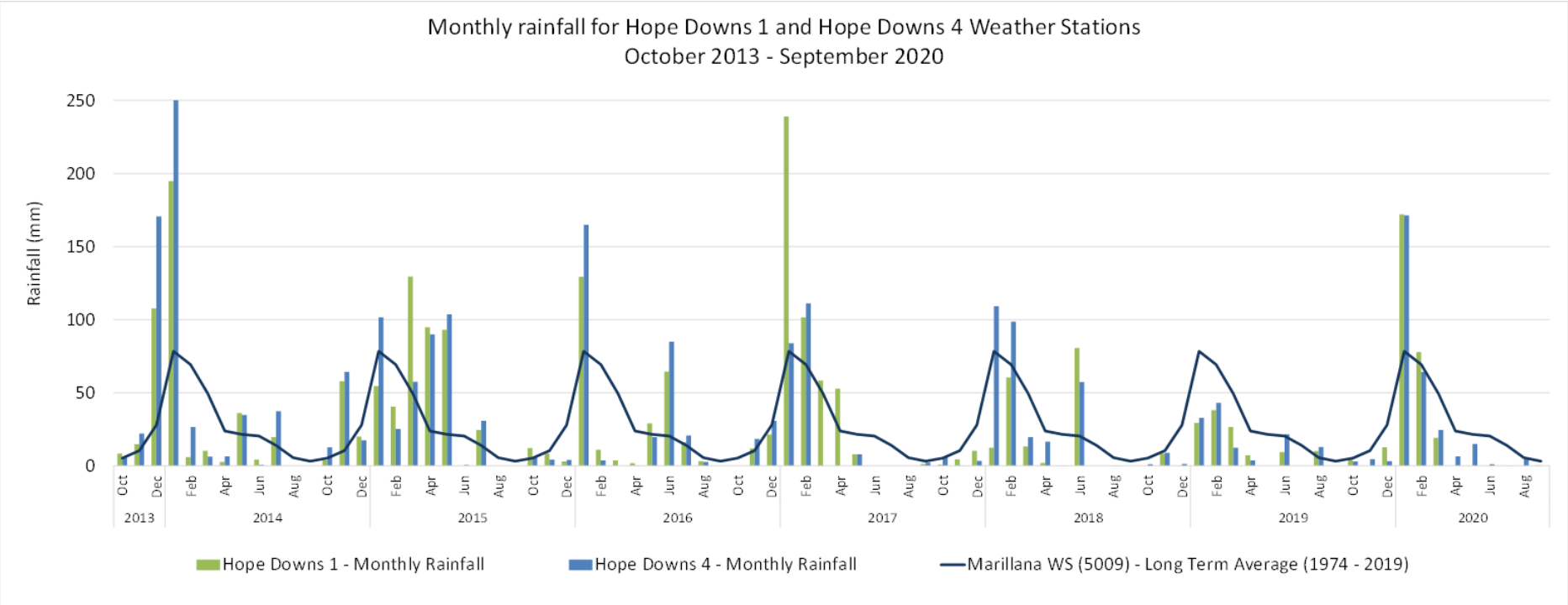

Figure 1: HD1 and HD4 monthly rainfall from January 2013 to September 2020, with long-term monthly average from Marillana WS (1974-2019).

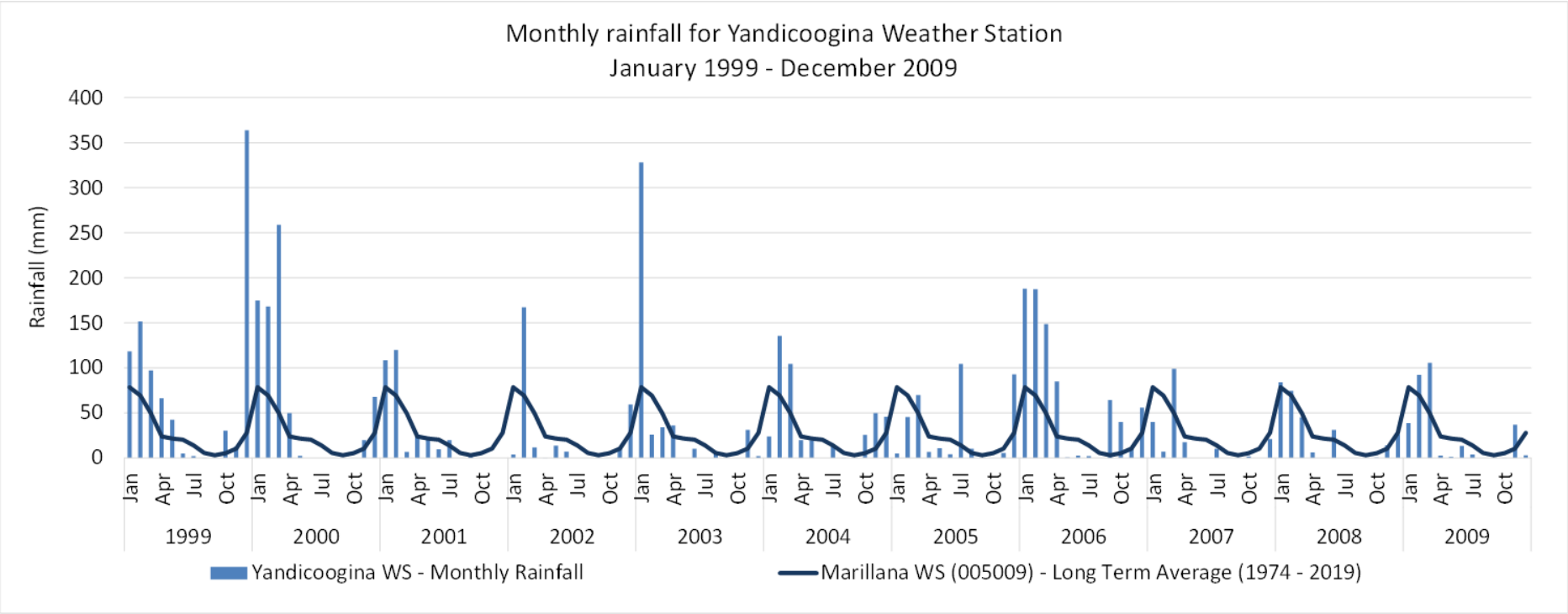

Figure 2: Yandicoogina monthly rainfall from January 1999 to December 2009, with long term monthly average from Marillana weather station (WS) (005009) (1974-2019).

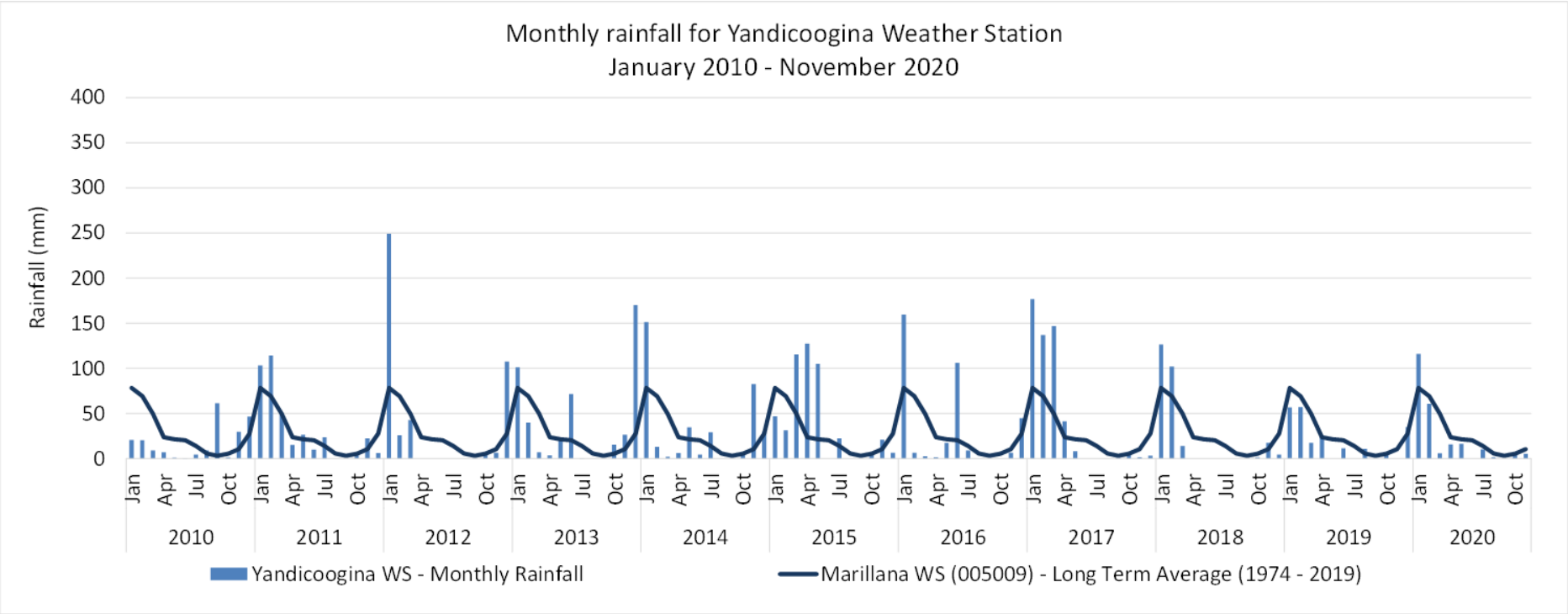

Figure 3: Yandicoogina monthly rainfall from January 2010 to December 2020, with long term monthly average from Marillana weather station (WS) (005009) (1974-2019).

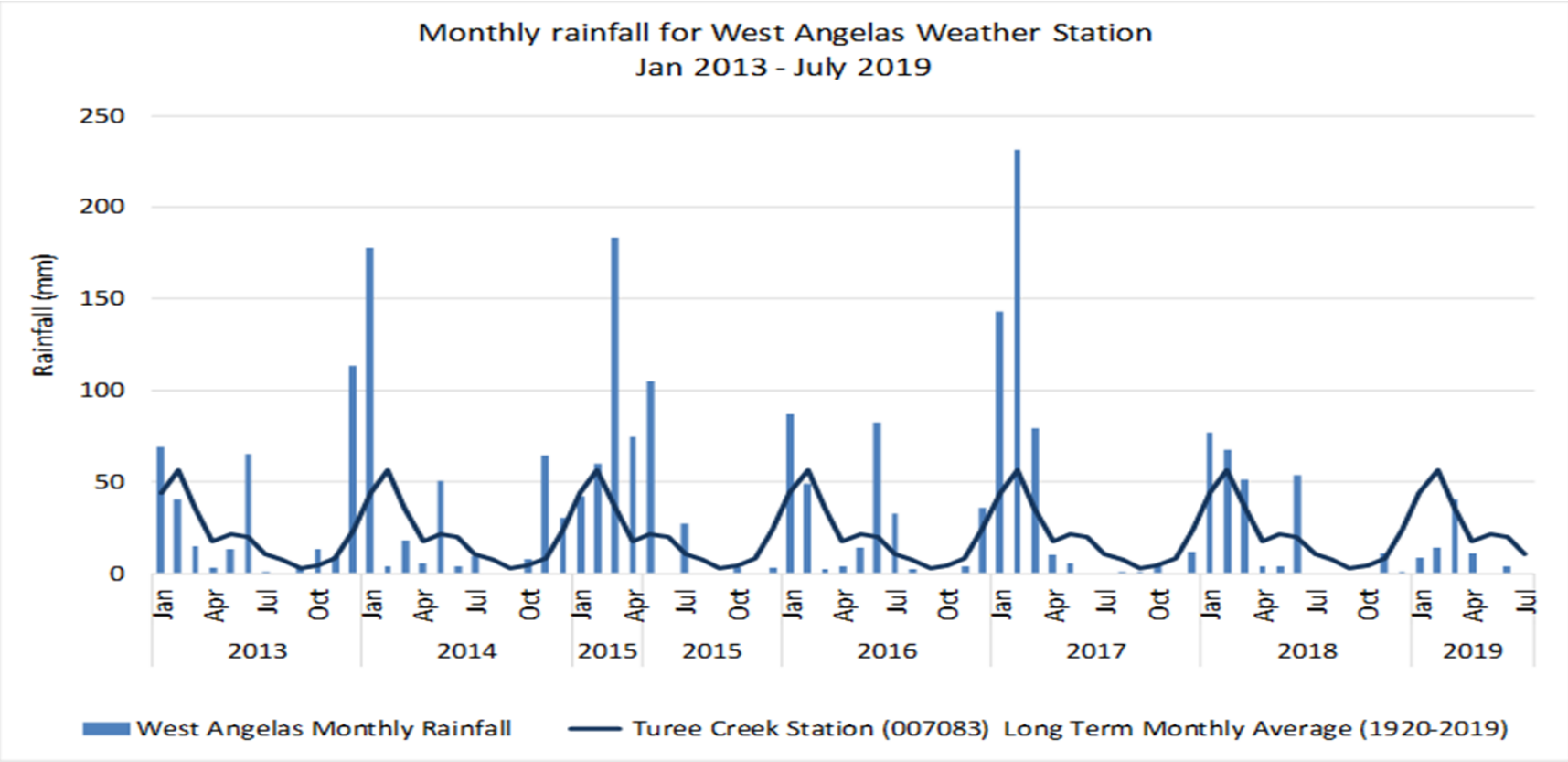

Figure 4: West Angelas monthly rainfall from January 2013 to July 2019, with long-term monthly average from Turee Creek Station (007083) (1920-2019).

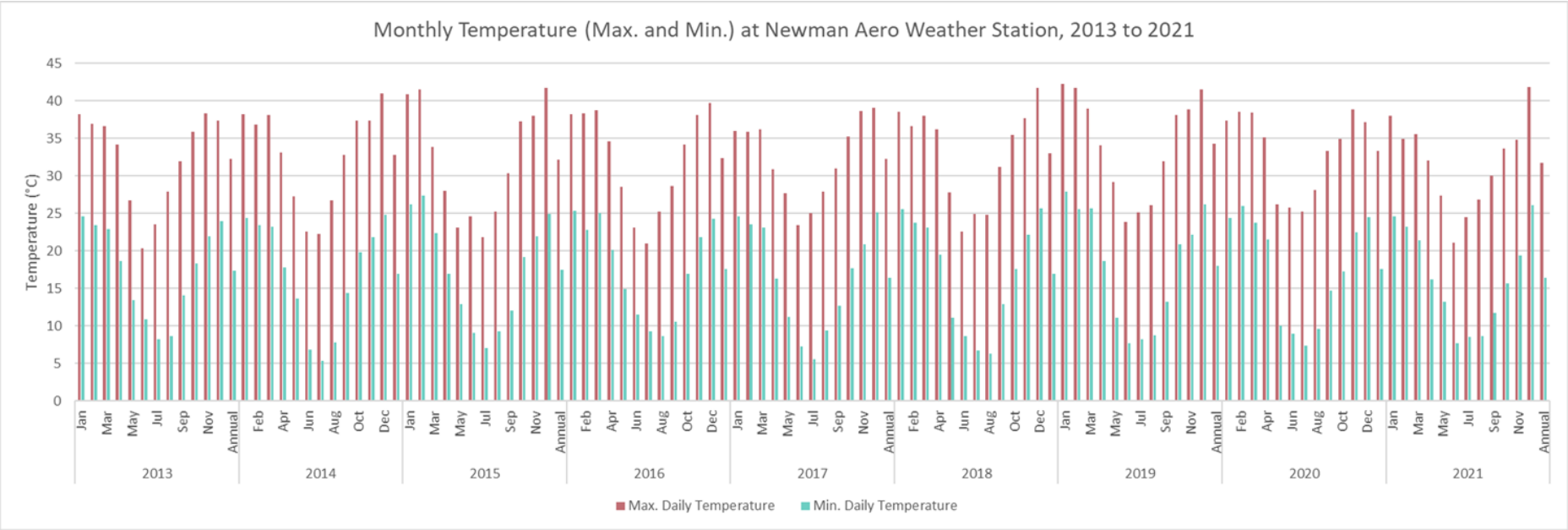

Figure 5: Monthly maximum and minimum temperature from 2013 to 2021 recorded at Newman Aero WS (007176).

5.3. Fire

Obtaining a comprehensive understanding of vegetation parameter dynamics in post-fire communities is highly valuable for rehabilitation in Western Australia due to the climate-induced, increasing prevalence of fire. The parallels observed between vegetation parameter trends at early rehabilitation sites and at burnt sites are also cause for furthering the current knowledge base on fire-affected communities, and to facilitate this, exploring the potential for undertaking additional monitoring at burnt sites.

Burnt reference sites do not provide appropriate targets for rehabilitation due to post-fire impacts on vegetation parameters, which were evident at nine reference sites (see Table 3 for details, Appendix B for trend analyses, with photos provided in Appendix C.

As fire is a natural and common occurrence in Pilbara ecosystems, and considering most sites were burnt in different years (Yandicoogina reference sites being the exception), vegetation quadrat data obtained from burnt reference sites can still facilitate meaningful comparisons on the premise that the trends observed reflect a vegetation community in post-fire recovery, and do not represent the target community for rehabilitation.

Photos of the only burnt rehabilitation transect are provided in Appendix C and resulting impacts to vegetation parameter trends are discussed within Section 5.4.2.

Table 3 Overview of burnt reference sites

REFERENCE SITE	MONITORING YEARS BETWEEN WHICH BURNING OCCURRED	PERCENTAGE OF QUADRATS BURNT
WAN_C3	2015 and 2017	100%
WAN_C4	2015 and 2017	100%
WAN_C7	2016 and 2018	95%
WAN_C8	2010 and 2012	45%
WAN_C9	2016 and 2017	90%
HD4_Flat_C12	2016 and 2018	85%
HD4_Flat_C6	2014 and 2015	60-80%
YAN_C6	2016 and 2017	100%
YAN_C9	2016 and 2017	100%

5.4. Monitoring results

5.4.1. Low impact disturbance sites

Anticipated disturbance areas for the HD2 Proposal will largely fall under moderate or high impact categories. There will be some low impact disturbance areas designated for rehabilitation, which will be monitored with the RQA method. This Summary focuses on vegetation quadrat monitoring data (typically used for moderate and high disturbance) as it provides greater analytic value for informing HD2 rehabilitation methodology. For this reason, no low impact disturbance areas have been included in this Summary.

5.4.2. Moderate impact disturbance areas – borrow pits

Prospective moderate impact disturbance areas within the HD2 Proposal boundary are likely to consist of borrow pits. A summary of rehabilitation methodology implemented at two HD4 borrow pit sites is provided in Table 4 provide an overview of general borrow pit rehabilitation undertaken in the region.

Ultimately, this will help inform methodology for future rehabilitation efforts, facilitate an increasing assurance in successful outcomes for rehabilitation, for example, through an enhanced risk management process resulting in less requirements for rework. Strategies and design parameters can be refined through the continual input of new data, facilitating a continually growing confidence in the chosen methodology for borrow pit rehabilitation.

Table 4 Rehabilitation overview for borrow pit sites

REHABILITATION PARAMETER	SITE	
	HD4 Railway	**HD4 Mine Access Road, Mine and Camp**
Initial no. transects monitored	15	10
Current no. transects monitored	5	9
Area (ha)	Unknown	Unknown
Closure domain	Borrow pit	Borrow pit
Year of rehab	2013	2013
Growth medium	Topsoil	Topsoil. Note: Camp_T4 had very little topsoil applied, substituted with coarse rocky substrate
Depth of growth medium application (mm)	200 mm	200 mm
Seeding mix	Not applicable	Not applicable
Seeding rate (kg/ha)	0	0
Soil ameliorant (type)	Unknown	Unknown
Contour ripping (depth)	200 mm	200 mm

Hope Downs 4 railway borrow pits

Rehabilitation of the HD4 Railway borrow pits, which included contouring, topsoil application and ripping, was completed in 2013 with 15 Railway transects (all 50 m in length and located on flat terrain) first monitored in 2014. The last monitoring assessment was conducted for five Railway transects only. LHRX_T5 was the only transect affected by fire, with burning occurring prior to the 2018 assessment (photos showing the transect pre- and post- burn are provided in Appendix III).

A visual assessment of rehabilitation outcomes at HD4 Railway borrow pit monitoring indicates variable results, with a notable increase in total cover observed at LHRX_T1 (Figure 6 and Figure 7). Species density and plant density at most rehabilitation transects follow mostly declining trajectories showing some stabilisation in later years The initial declines observed for species and plant density appear to be loosely correlated with considerably high initial densities. The impacts of fire at rehabilitation site LHRX_T5 are most evident within the plant cover parameter, with trends in species density and plant

density not notably different to the unburnt transects. Rehabilitation outcomes are further discussed below, with inferences based on comparative analyses of rehabilitation and reference site vegetation quadrat data. For clarity of results, only the transects monitored in all years were assessed.



Figure 6: HD4_LHRX_T1 (start) 2014 (one year after rehabilitation)



Figure 7: HD4_LHRX_T1 (start) 2018 (5 years after rehabilitation)

Native perennial species density and species richness

Species density values recorded at all rehabilitation transects from 2014 to 2018 were considerably higher than species density values recorded from 2015 to 2018 at reference sites Flat_C11 and Flat_C2 (Figure 8). Inclining trends in species density were observed at 4 rehabilitated transects between the first two monitoring assessments (steepest inclines occurred at the two sites with the lowest density in the first year of monitoring recorded at LHRX_T4, whilst the other 2 showed declines. Burnt reference sites Flat_C6 and Flat_C12 showed the most variability to the rehabilitation species density trajectories.

Decreases in species density occurred at all sites between 2015 and 2016, with LHRX_T1 best reflecting the reference site's gradual rate of decline. Based on the 2020 monitoring assessment all rehabilitation transects show significant similarity to the 1.6 species per quadrat recorded at the reference site. However, species density increased at the reference site between 2018 and 2020 yet decreased at all rehabilitation transects (except LHRX_T2 which remained constant). This may be attributed to the below average rainfall recorded in 2017 and 2019 as well as losses of early coloniser species, which is consistent with the age of the rehabilitation. All species density values recorded in 2020 at the rehabilitation transects were within the range of values recorded in 2021 for the reference sites (noting reference sites weren't monitored in 2020).

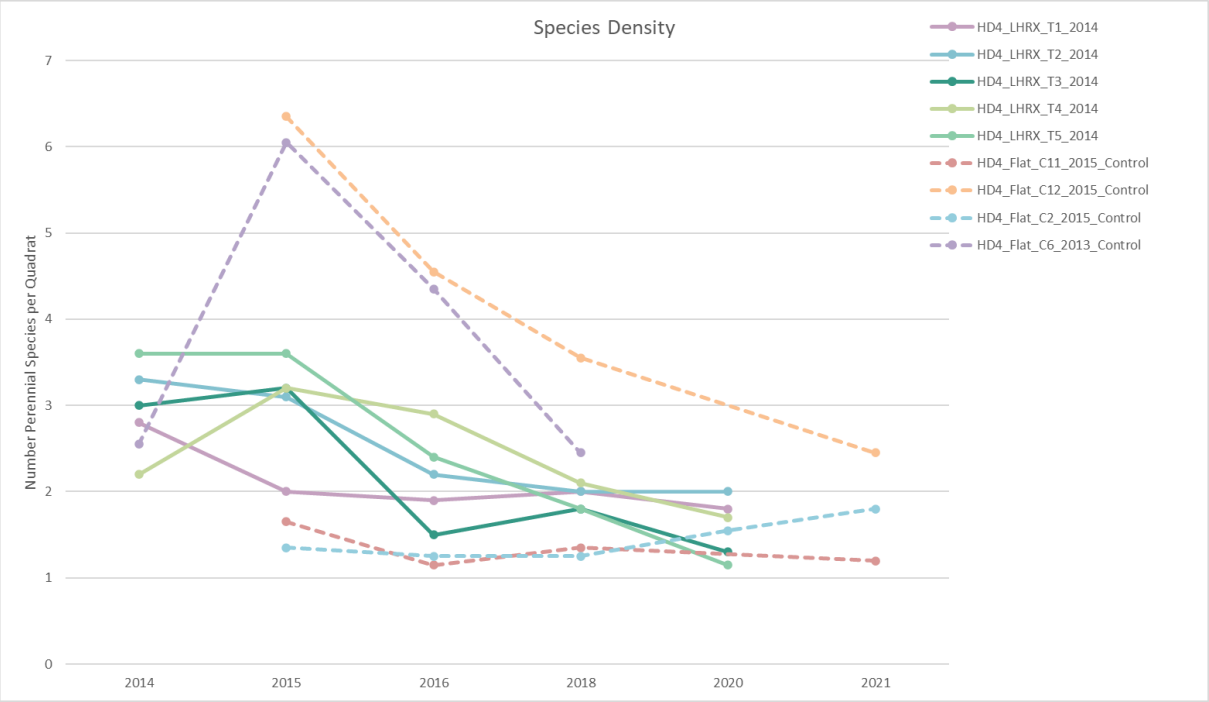

Figure 8: Native perennial species density (species/ quadrat) for the Railway borrow pits rehabilitation and reference sites over time.

Species richness decreased at all rehabilitation transects over the duration of monitoring, with the largest decline of seven species recorded at LHRX_T3. At the time of the last assessment, total numbers of species ranged from four at LHRX_T3 to 10 at LHRX_T5, with the latter a reflection of impacts from fire. The majority of native perennial species recorded across the rehabilitation can be plausibly assumed to have returned through applied topsoil, or wind born seed, as no seeding was carried out. Common species between the rehabilitation sites included spinifex and shrub species such as *Acacia pruinocarpa*, *Triodia basedowii*, *Triodia wiseana*, and *Acacia bivenosa* which was the only species present at all sites (rehabilitation and reference).

Native perennial plant density

The rehabilitated transects show a general declining trend in plant density over five years, with steep declines observed from 2015 to 2016, and, excluding LHRX_T2, from 2018 to 2020 (Figure 9. Note: y-axis has been adjusted for clarity of rehabilitation trajectories).

Two notable increases in plant density were observed, one at LHRX_T5 (which can be attributed to fire) between 2016 and 2018, and another at LHRX_T1 between 2018 and 2020. Differences between plant density values recorded in 2020 for the rehabilitated sites and the reference sites were only statistically significant when Flat_C12 and Flat_C6 were included in the analysis.

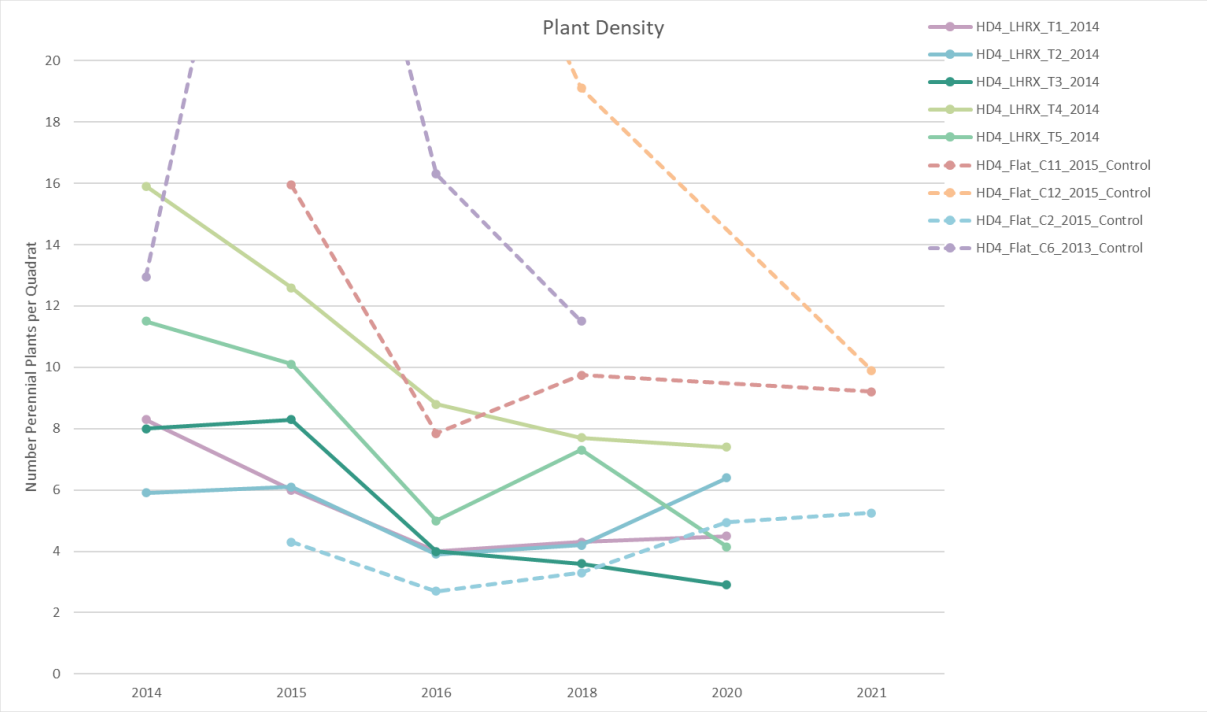

Figure 9: Native perennial plant density (plants/quadrat) for the Railway borrow pits rehabilitation and reference sites over time[1]

Native perennial plant cover

Similar native perennial plant cover trends are observed between 2014 to 2018 for all rehabilitation sites except LHRX_T5 where a steep decline is observed between 2016 and 2018 (Figure 5 10) due to fire disturbance. The site had begun to recover as of the last monitoring assessment in 2020, with plant cover increasing by approximately 5%. Perennial weeds were included in plant cover estimates in 2018, although their contribution to total cover across the rehabilitation was absent or minimal.

All rehabilitated transects saw an increase in plant cover from 2018 to 2020, in contrast to an 11% decline observed at the reference site. The greatest increase during this time occurred at Powerline_T1, where cover increased from 21% to 36%. In 2020 all rehabilitation transects except LHRX_T2 had less than the range of values (42% to 65%) recorded at reference sites Flat_C2, Flat_C11 and Flat_C12 (no data collected for Flat_C6). Similarly, reference values recorded in 2018 were above those recorded for all rehabilitation transects except LHRX_T2. Significant variations to reference site values were found for LHRX_T5, which can be attributed to fire disturbance.

[1] Reference sites not fully graphed on x-axis due to scale limitations. Refer to **Error! Reference source not found.** for full results.

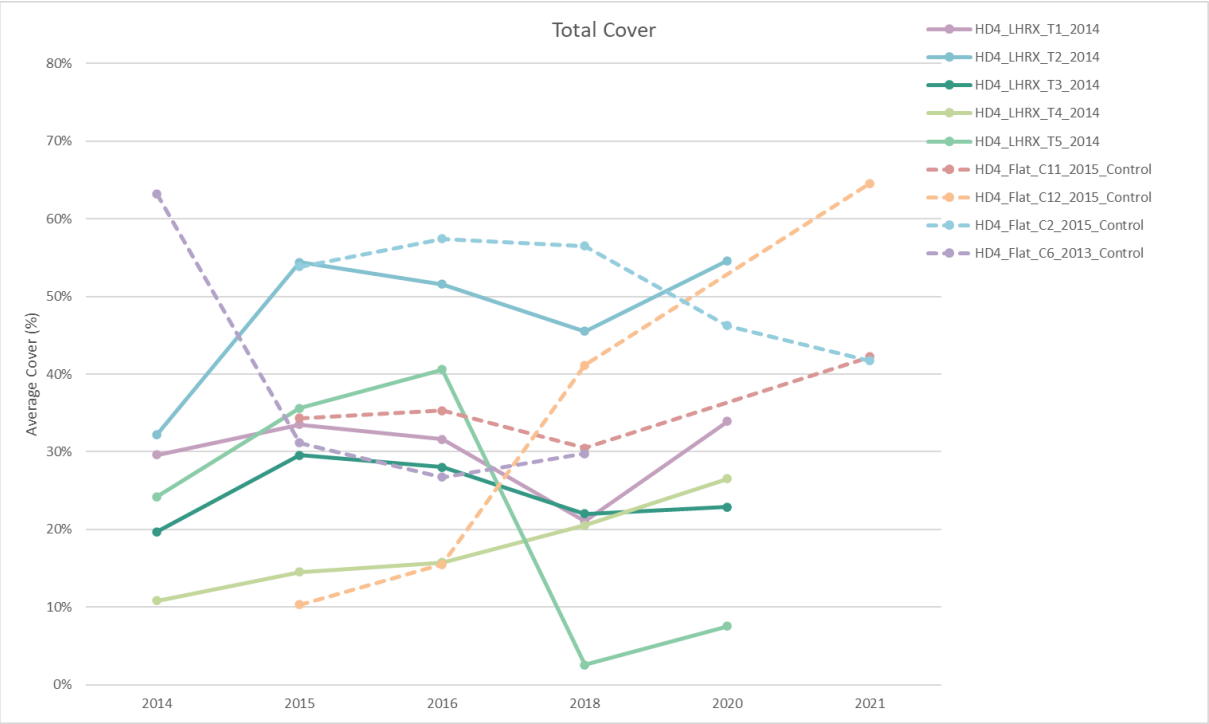

Figure 10: Native perennial plant total cover (%) for the Railway borrow pits rehabilitation and reference sites over time.

Hope Downs 4 Mine Access Road, Camp and Mine borrow pits

Rehabilitation at the Hope Downs 4 Mine Access Road, camp and mine borrow pits was completed in 2013, with an initial monitoring assessment the following year. Rehabilitation transects are located on flat topography and rehabilitation works (summarised in Table 4) included contouring, spreading of topsoil (excluding Mine_T4) and deep ripping, followed by contour ripping.

Variable rehabilitation outcomes were observed at the Mine Access Road, Camp and Mine borrow pits (Figure 11 to Figure 14), with low values in all three vegetation parameters recorded at Mine_T2 and Mine_T1. Rehabilitation trajectories for species and plant density were generally of a declining nature which can predominately be attributed to the natural senescence of native colonising species and low rainfall. The modified growth medium applied at Camp_T4 resulted in less satisfactory results compared to the three other Camp borrow pit transects, indicating that better rehabilitation outcomes are derived from sites with sufficient topsoil applied.

The impact of fire at reference sites Flat_C6 and Flat_C12 appeared to mimic the observed early rehabilitation trends, with both sites showing declines in vegetation density parameters. As expected, the most variation between the rehabilitation and the reference sites was observed for total plant cover, as reference values are not usually obtained until rehabilitation is sufficiently mature. Emergent trends based on analyses of vegetation quadrat data for the Mine Access Road, camp and mine rehabilitation and reference sites are further discussed below.



Figure 11: HD4_Camp_T3 (start) 2014 (1 year since rehabilitation)



Figure 12: HD4_Camp_T3 (start) 2018 (5 years after rehabilitation)



Figure 13: HD4_Mine_T2 (end) 2014 (one year after rehabilitation)



Figure 14: HD4_Mine_T2 (end) 2018 (5 years after rehabilitation)

Native perennial species density and species richness

A high variation in initial species density values was observed across the rehabilitation, ranging from 0.2 at Camp_T4 and Mine_T2 to 4.8 at MAR_T1 (Figure 15). Excluding Camp_T2, all rehabilitated sites

saw notable increases in species density between 2014 and 2015, signifying satisfactory primary establishment and germination rates. Transects with high initial species densities (MAR_T1, Camp_T1, Camp_T3 and Mine_T3) generally experienced greater rates of decline over the entire monitoring period, particularly between 2015 and 2016 when low rainfall likely exacerbated the losses. In contrast, the rehabilitated sites with the lowest starting densities (Mine_T1, Mine_T2, Camp_T4) showed steady increases of species density up until 2018.

Between 2018 and 2020, species density declined across all rehabilitation transects except for Camp_T1 which increased marginally by 0.1 species per quadrant. The below average rainfall received throughout 2019 may have played a role in the diminishing species densities but was unlikely the main contributing factor as Flat_C2 saw an increase in species per quadrat over this time. The greatest loss for this period was recorded at Camp_T3 which had declined from 3.5 (the highest species density value recorded in 2018) to 1.7 species per quadrat. The loss corroborates the potential correlation between high rates of species density decline and high pre-decline values (previously inferred based on the 2015 and 2016 monitoring assessments). Despite these declines, all but two rehabilitation transects (Camp_T4 and Mine_T1) had final density values above 1.6 recorded at reference site Flat_C2 and were not significantly different to the range of reference values recorded in 2021.

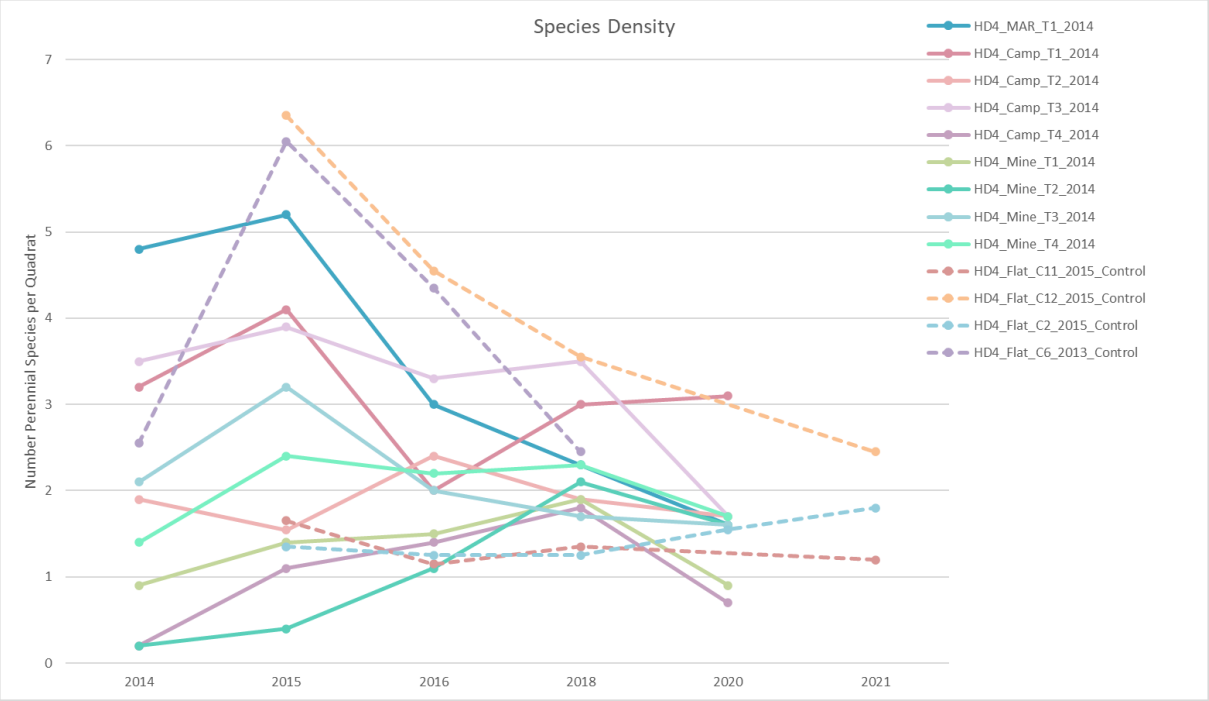

Figure 15: Native perennial species density (species/ quadrat) for Mine Access Road, Camp and Mine borrow pits rehabilitation and reference site over time.

Most rehabilitation transects showed declining species richness from 2014 to 2020, although an increase of 6 and 3 species were recorded at Mine_T2 and Camp_T4 respectively. Common native perennial species recorded in 2020 included *Acacia ancistrocarpa*, *Acacia bivenosa*, *Triodia basedowii* and *Triodia pungens*. Seven rehabilitation sites also identified *Eucalyptus leucophloia* and *Acacia bivenosa*, both also present at the reference site. No seed was applied to any of the rehabilitation sites, so the presence of these species is predominately attributed to the application of topsoil or windblown seed.

Native perennial plant density

The relatively stable plant density trajectories observed at Camp_T2 and Mine_T4, and to a lesser extent Camp_T4, Mine_T1 and T2, reflect reference site trends seen at Flat_C2 and at Flat_C11 from 2016 onward (Figure 16 – y-axis has been adjusted for clarity of rehabilitation trajectories). Congruent with

species density (Figure 15), a large range of initial plant densities were recorded at the rehabilitation, with transects exhibiting high initial densities (MAR_T1, Camp_T1, Camp_T3 and Mine_T3) but showing steeper declines in the subsequent year. The lowest numbers of plants per quadrat in the first monitoring year were recorded at Mine_T2, and at Camp_T4 where plant density remained low until 2018, likely due to the poor quality of the growth medium applied (a substrate of very coarse rocky material and minimal topsoil).

Inclining trends in plant density were observed at most rehabilitated transects between 2014 and 2015, and again between 2016 and 2018. Between 2015 and 2016 plant density increased for half of the rehabilitation sites and decreased for the other half. Considering corresponding declines occurred at all reference sites, plant losses may be attributed to the below average rainfall received during these years.

Plant density trajectories between 2018 and 2020 vary, with three rehabilitation sites increasing, and six decreasing. The steepest decline occurred at Camp_T3 which was mostly attributed to losses of Aristida and Acacia species. Losses of shrub and grass species were observed across the rehabilitation in 2020, accounting for a significant proportion of plant density declines.

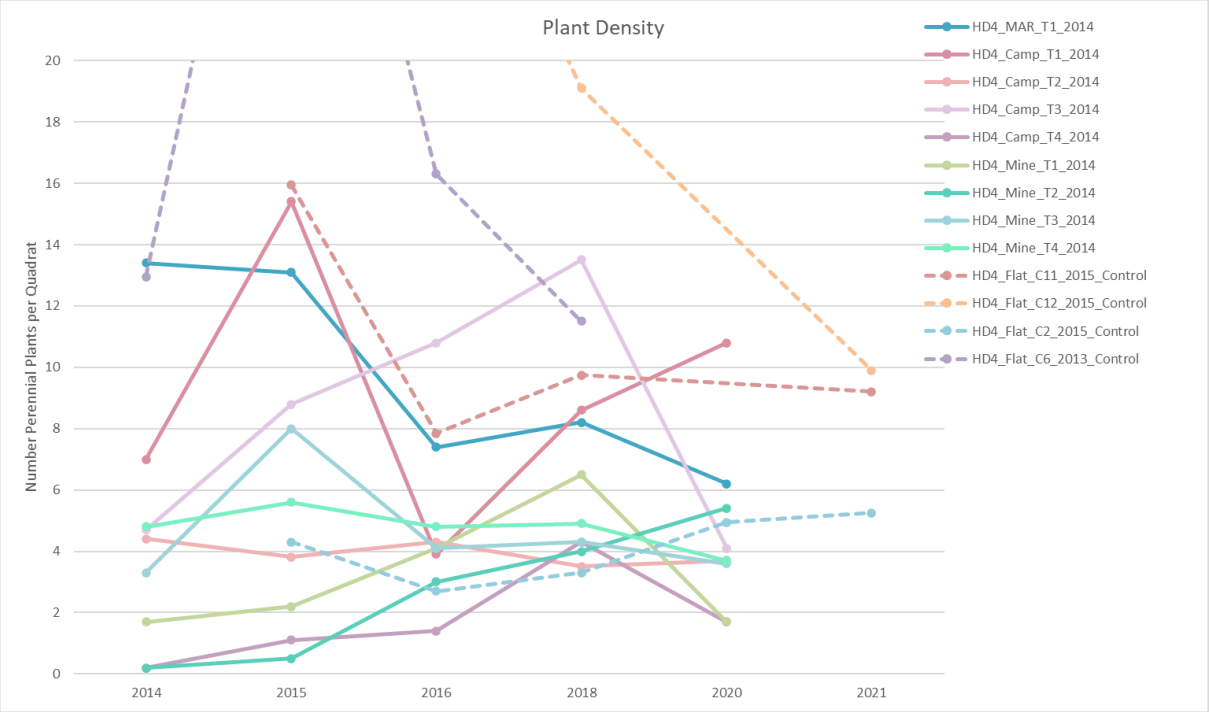

Figure 16: Native perennial plant density (plants/ quadrat) for the Mine Access Road, Camp and Mine borrow pits rehabilitation and reference sites over time.

Native perennial plant cover

Rehabilitated transects show general inclining trends in native perennial plant cover over the monitoring period (2014 to 2020), whilst the reference site remains relatively constant from 2015 to 2018 before gradually declining (Figure 17). The three transects showing most variability along their trajectory (MAR_T1, Camp_T1 and Camp_T3) also had high initial plant cover

Notable decreases between 2018 and 2020 were observed at Camp_T1 and Camp_T3, with the later remaining within the range of reference site values. Conversely, a significant increase in cover between 2018 and 2020 was recorded in MAR_T1 which was the only rehabilitation transect where perennial plant cover was above all reference site values at the time of the last monitoring assessment. This may be attributed to the development and maturing of Triodia hummocks at the site. Consistent with species density and plant density, the lowest cover values documented during the 2020 assessment occurred in Mine_T2 and Mine_T1.

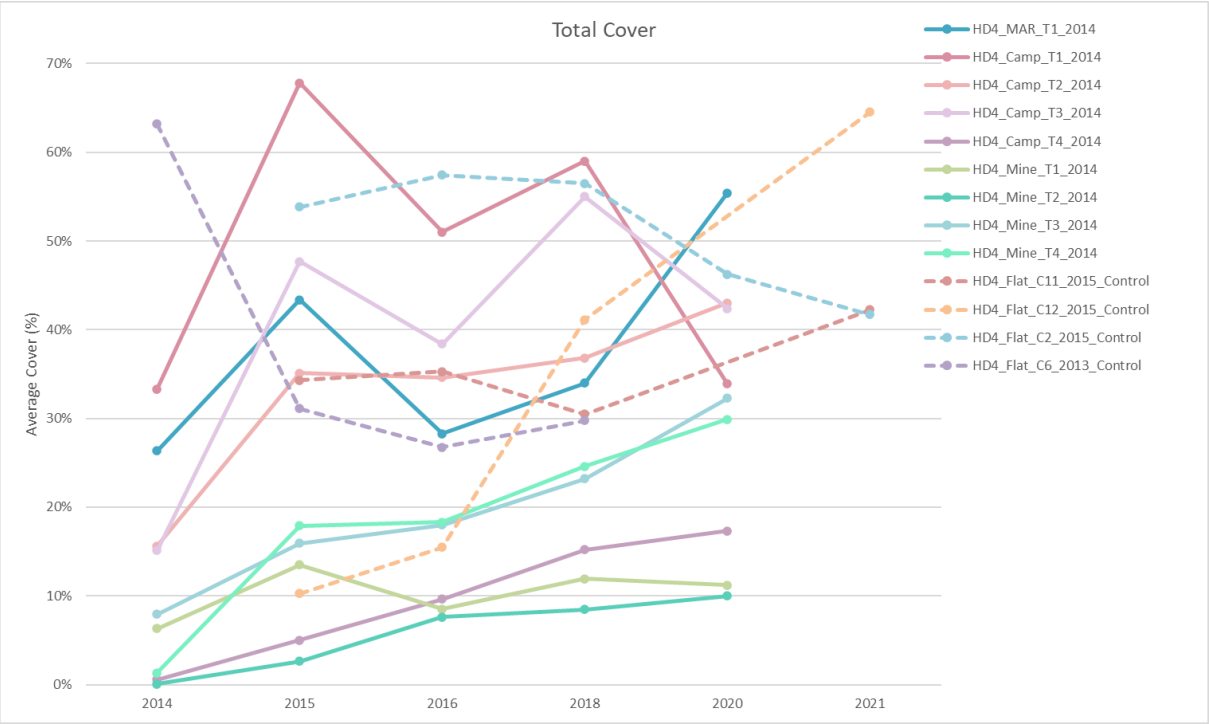

Figure 17: Native perennial plant density (plants/ quadrat) for the Mine Access Road, Camp and Mine borrow pits rehabilitation and reference sites over time.

5.4.3. Moderate impact disturbance areas – infrastructure

Additional moderate impact disturbance areas within the HD2 Proposal boundary are likely to consist of infrastructure corridors. Table 5 outlines the rehabilitation undertaken at two HD4 infrastructure sites – the Dewatering Pipeline and Powerline, with works completed in 2014 and 2013 respectively.

Table 5 Rehabilitation overview for infrastructure sites

REHABILITATION PARAMETER	SITE	
	HD4 Dewatering Pipeline	HD4 Powerline
Initial no. transects monitored	2	4
Current no. transects monitored	2	2
Area (ha)	Unknown	Unknown
Closure domain	Infrastructure	Infrastructure
Year of rehab	2014	2013
Growth medium	Topsoil	Topsoil
Depth of growth medium application (mm)	200 mm	200 mm
Time of storage of growth medium (yr)	Unknown	Unknown
Seeding mix	Not applicable	Not applicable
Seeding rate (kg/ha)	0	0
Contour ripping (depth)	200 mm	200 mm

Hope Downs 4 Dewatering Pipeline and Powerline

Transect monitoring commenced in the year following rehabilitation completion. The rehabilitated area is relatively narrow and located on a flat to gently sloping terrain. Works included contouring, topsoil application and ripping, with neither site receiving seed.

Noticeable increases in plant cover at both Dewatering Pipeline rehabilitated transects are evident in Figure 20 and Figure 22 and confirmed by vegetation quadrat data (Figure 25). Similar trends were observed at Powerline_T1, juxtaposed with subpar outcomes at Powerline_T2, which had unsatisfactory results across all three parameters due to a weed infestation one to two years post-rehabilitation. The lack of progress is apparent in Figure 18 and Figure 19, although a moderate increase in cover is observed. Further analyses of vegetation parameter trends at Hope Downs 4 Dewatering Pipeline and Powerline rehabilitation are discussed below.



Figure 18: HD4_Powerline_T2B (start) 2014 (one year after rehabilitation)



Figure 19: HD4_Powerline_T2B (start) 2018 (5 years after rehabilitation)



Figure 20: HD4_DewateringPL_T1 (end) 2016 (2 years after rehabilitation)



Figure 21: HD4_DewateringPL_T1 (end) 2018 (4 years after rehabilitation)



Figure 22: HD4_DewateringPL_T2 (start) 2016 (2 years after rehabilitation)



Figure 23: HD4_DewateringPL_T2 (start) 2018 (4 years after rehabilitation)

Native perennial species density and species richness

Species density over the full (2015 to 2018) monitoring period declined marginally for each rehabilitation transect, with an initial increase (between 2015 and 2016) observed at T1 (Figure 24). A similar rate of

decline was observed between 2016 and 2018, with species per quadrat decreasing by one at T1 and by 0.7 at T2. This can be attributed to a combination of the low summer rainfall received in 2017/18 and the natural plant senescence of coloniser species and short-lived perennials. Initial species density values at the rehabilitation transects were higher than the reference site Flat_C11, indicating successful early establishment and germination rates, likely due to the use of topsoil and the above average rainfall received over the 2014/15 summer period. Reference site Flat_C12 follows a steep declining species density trajectory, reflecting the short-term influence of fire on species density.

Between 2018 and 2020 the steepest decline in species density occurred at Powerline_T2, leaving the transect with a lower number of species per quadrant than when first monitored one year after rehabilitation. The presence of weeds may, in part, explain the transects trajectory as it is the only one where weeds were observed at high densities. Although no weeds were recorded for Powerline_T2 in 2020, prior assessments document an infestation of Spiked Malvastrum (*Malvastrum americanum*) (Table 6). Values for species density recorded during the 2020 assessment ranged from 0.3 at Powerline_T2 to just over 2 species per quadrat at Powerline_T1.

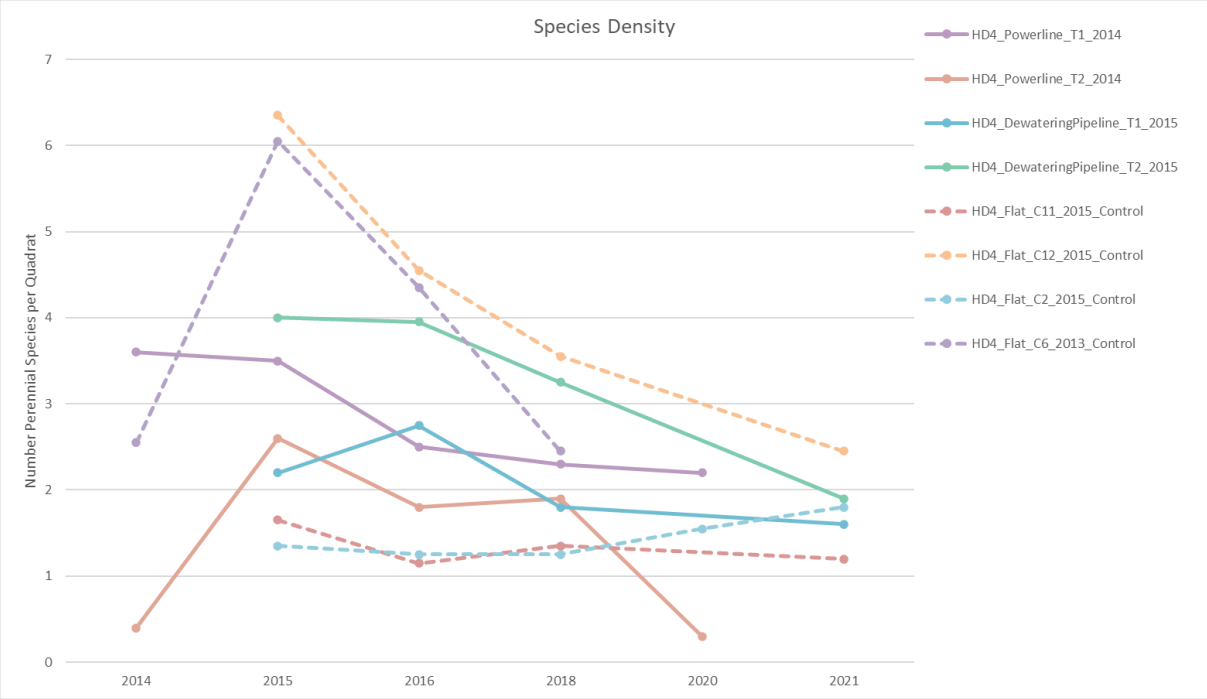

Figure 24: Native perennial species density (species/ quadrat) for the Dewatering Pipeline and Powerline rehabilitation and reference sites over time.

Table 6 Powerline T2 weed overview (*Malvastrum americanum*)

Species/Parameter	Year	Powerline_T2
Malvastrum americanum		
Density (plants/quadrat)	2020	0
	2018	4.8
	2016	14.4
	2015	41.8
	2014	26
Cover (%)	2020	0
	2018	0.2
	2016	0.7
	2015	16.7
	2014	Unknown

Native perennial plant density

Plant density trajectories at the rehabilitated transects remained relatively constant over the monitoring period, with T1 fluctuating between 7.2 and 8.2 plants per quadrant and T2 between 9.2 and 11 (Figure 25). Plant density at the rehabilitated areas remained higher than Flat_C11 over the entire duration of monitoring, but less than Flat_C12 where post-fire germination and regrowth resulted in an increased number of plants per quadrant. Although plant density did not increase at either Pipeline transect between 2016 and 2018, it is of value to note that spinifex density did increase, indicating a growing dominance of spinifex in the vegetation community.

A notable decline was observed at Powerline_T2 from 2015 to 2016, with weeds considered a likely a factor in the loss of three plants per quadrat. Increases in plant density were observed at Powerline_T2 from 2014 to 2015 and from 2016 to 2018. Differences between plant density values recorded in 2020 for the rehabilitated sites and the reference sites were only statistically significant when Flat_C12 and Flat_C6 were included in the analysis.

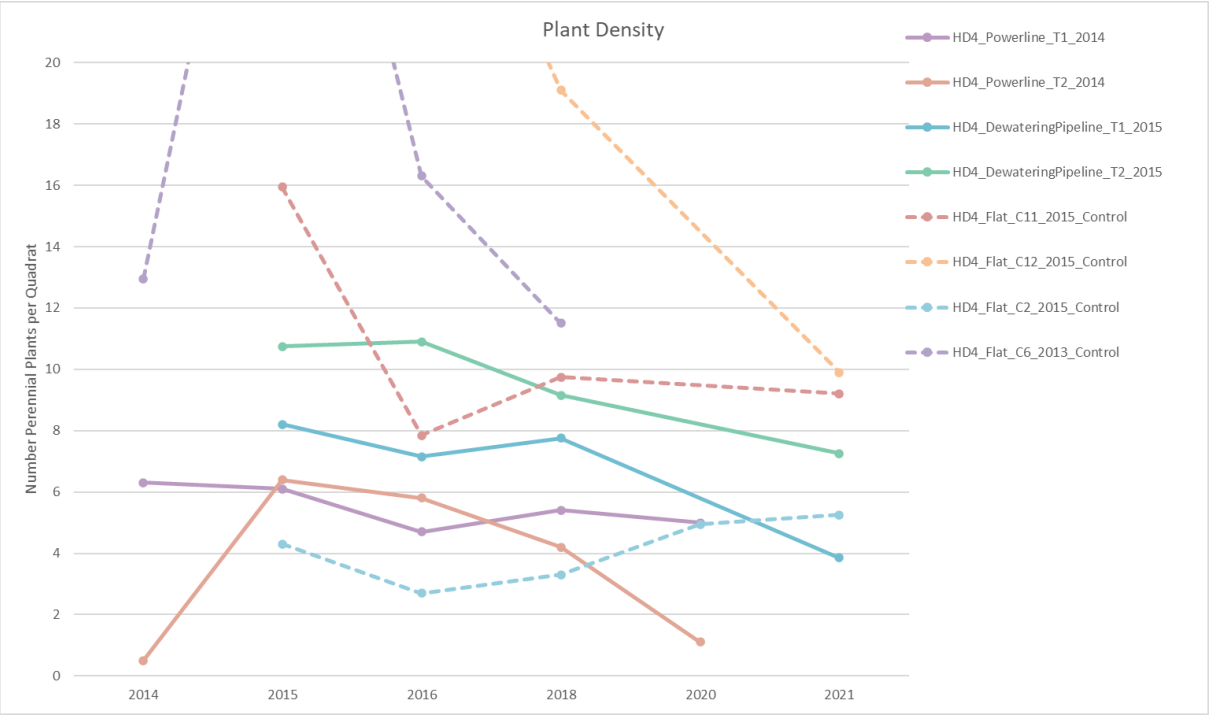

Figure 25: Native perennial plant density (plants/ quadrat) for the Dewatering Pipeline and Powerline rehabilitation and reference sites over time.

Native perennial plant cover

Inclining trajectories of perennial native plant cover (exclusive of weeds) are observed at both rehabilitated transects (Figure 26). A doubling in cover occurred across the rehabilitation between 2016 to 2018 and a substantial increase was recorded for the reference site Flat_C12. As per species density, the increase at Flat_C12 is a result of enhanced shrub regrowth following fire and as such, does not provide meaningful comparison for the unburnt rehabilitation (but may be useful as an example of post-fire successional states). Cover at the rehabilitation transects in 2018 was statistically similar to the unburnt reference site Flat_C11 and if current trajectories are maintained, cover across Dewatering Pipeline rehabilitation will soon be representative (for this parameter) of the reference vegetation community. Native plant cover at Powerline_T2 remained under 10% for the entire trajectory, potentially due to the presence of weeds (as described for species density).

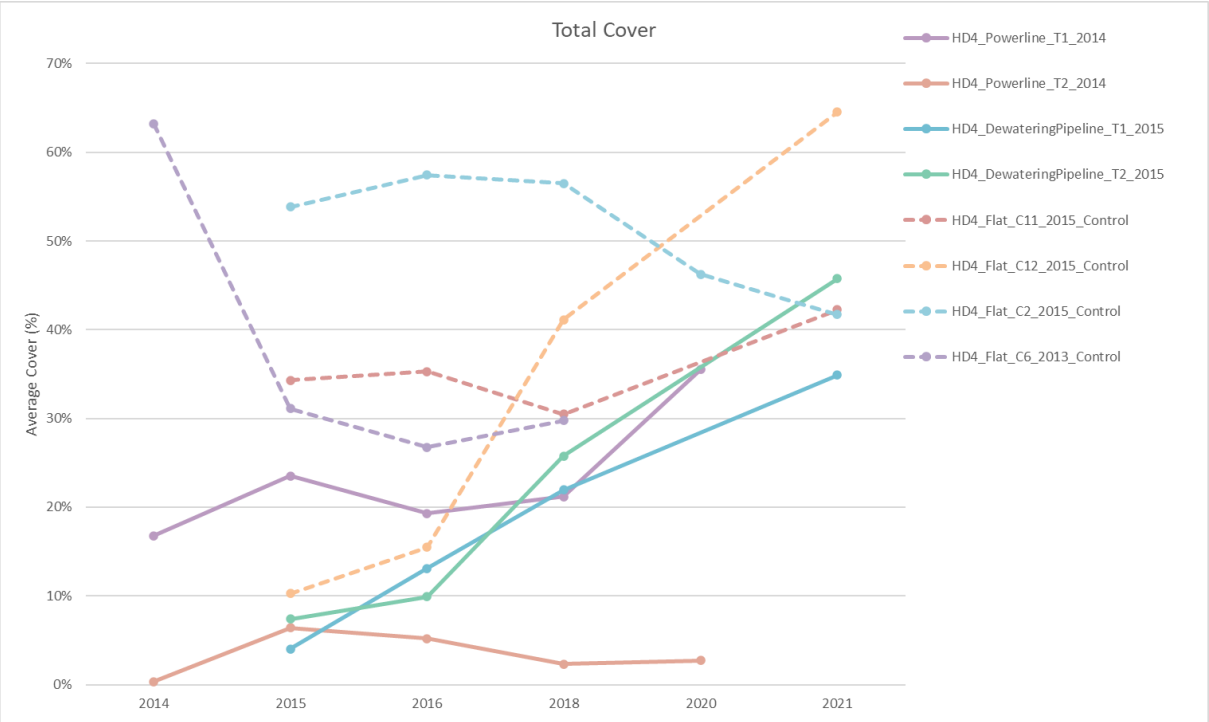

Figure 26: Native perennial plant total cover (%) for the Dewatering Pipeline and Powerline rehabilitation and reference sites over time.

5.4.4. Moderate impact disturbance areas – landfill

The HD2 Proposal will also include the construction of a site landfill, which is also considered to be a moderate impact disturbance area. Examples of regional landfill rehabilitation are provided below from HD1 and Yandicoogina which will help inform rehabilitation techniques that may be successful at HD2. Available information on the landfill rehabilitation methodology is outlined in Table 7 below.

Table 7 Rehabilitation overview for landfill sites

REHABILITATION PARAMETER	SITE	
	HD1 Old Landfill	**Yandicoogina Landfill**
Initial no. transects monitored	1	4
Current no. transects monitored	1	2
Area (ha)	3.4 hectares	1.9 hectares
Closure domain	Landfill	Landfill
Year of rehab	2013	2018 (YL3 and YL4) 2009 (T1 and T2)
Growth medium	Topsoil and subsoil	Topsoil
Depth of growth medium application (mm)	Unknown	100 mm
Time of storage of growth medium (yr)	Unknown	Unknown
Seeding mix	Six native species, East Pilbara provenance, 8.4kg total weight. Seed numbers and quality documented	Fourteen native species of local provenance. Seed numbers and quality documented
Seeding rate (kg/ha)	Spread by hand at 4.95 kg/ha over half of area	7kg/ha, with a total of 41.12 kg applied.

Contour ripping (depth)	Unknown	100-200 mm

Hope Downs 1 Old Landfill

Rehabilitation of Hope Downs 1 Old Landfill site was completed in October 2013, with the above average rainfall received in the 2013-2014 summer facilitating successful initial plant establishment and germination. Monitoring of the only established transect (100 m in length) commenced in 2014 and was last monitored in 2020. The site was surface ripped and contoured to align with the surrounding natural environment. Native seed was spread over half of the site, with the intention of comparing the outcomes for areas where seed is applied versus areas without. This resulted in double the recommended seeding rate being applied to the seeded area, which may have impeded early establishment and germination outcomes.

Observational comparison of Figure 27 and Figure 28 reveals minor improvements in vegetation cover at the Hope Downs 1 Old Landfill rehabilitation, although plant health appears to be poor and there is little to no vegetation structure. Initial plant establishment at the Old Landfill rehabilitation was less than satisfactory, evident by the significant differences to the corresponding reference values observed in Figure 29 and Figure 30.

The Old Landfill rehabilitation was most comparable to reference sites Flat_C2 and Flat_C11, particularly for species density with no significant differences detected until the 2020 monitoring assessment. The most variation between rehabilitation and reference quadrat values occurred within the plant cover parameter (Figure 31). This is not unusual for rehabilitation less than 10 years old, however the stabilising trajectory post 2017 indicates deteriorating conditions, suggesting plant cover is not improving. Rehabilitation outcomes within the selected vegetation parameters observed at Hope Downs 1 Old Landfill rehabilitation are further discussed below.



Figure 27: HD1_OldLandfill_T1 (start) 2014.



Figure 28: HD1_OldLandfill_T1 (start) 2017.

Native perennial species density and species richness

There was minimal change in the number of species per quadrat recorded at the Old Landfill site between the first two monitoring assessments, with a decline of just over 50% recorded between 2017 and 2020 (Figure 29). It should be noted that the trajectory observed between 2014 and 2017 at the Old Landfill site may not be a true reflection of the species density trajectory for this period due to the three-year gap between assessments. The rehabilitation was most comparable to reference sites Flat_C11 and Flat_C2, with the latter being the only transect where an increase in species density was observed between the two most recent assessments, indicating that the declines observed at the other transects were influenced by factors other than rainfall or temperature.

Species richness at the Old Landfill site decreased from nine species in 2014 to 5 species in 2020. Three of the six seeded species were recorded in 2020. An additional four, non-seeded native species were also present (*Acacia aneura*, *Acacia aptaneura*, *Solanum lasiophyllum* and *T. pungens*).

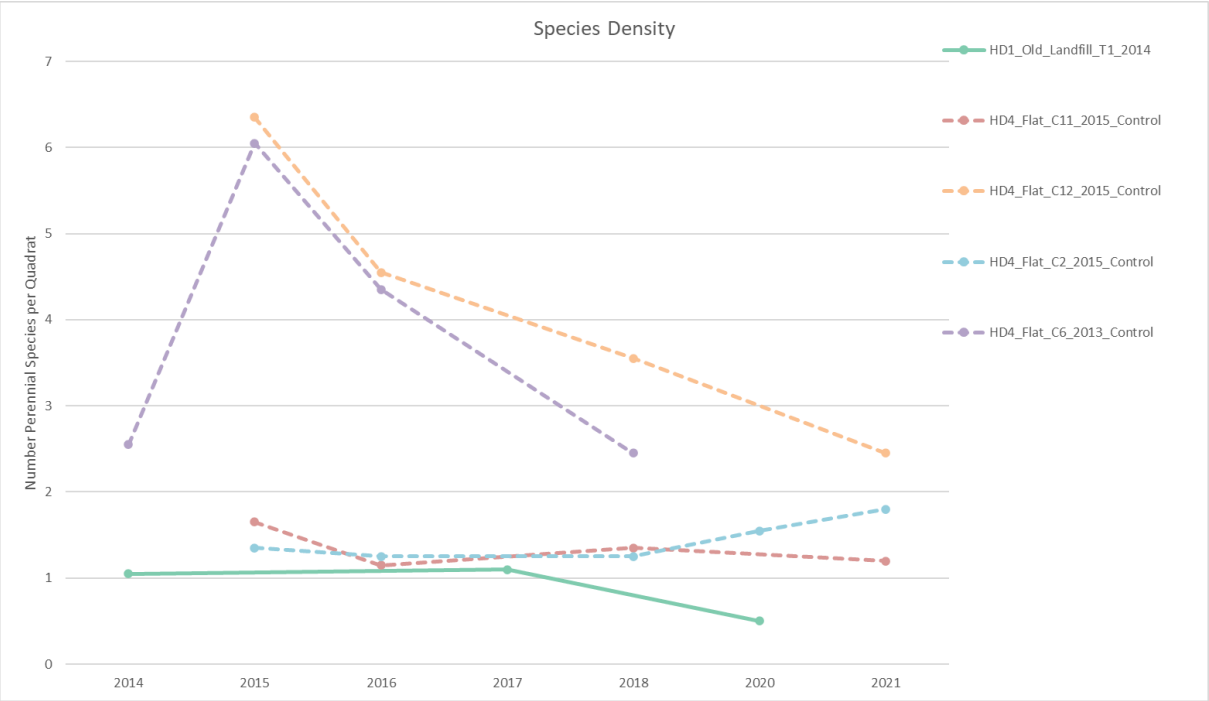

Figure 29: Native perennial species density (species/ quadrat) for the Hope Downs 1 Old Landfill rehabilitation and reference site over time.

Native perennial plant density

Plant density remained low in Landfill_T1 over the entire monitoring period, whilst reference sites Flat_C2 and Flat_C11 follow mostly inclining trajectories after initially decreasing between 2015 and 2016 (Figure 30). A slight decrease in plant density at the rehabilitation occurred between the 2017 and 2020 monitoring assessments, which, although the decline corresponds with a period of below average rainfall, is most likely a reflection of the natural loss of short-lived coloniser species. Low rainfall may have exacerbated plant loss but considering one reference site (Flat_C2) experienced increasing plant density during this time, it is improbable that it entirely accounts for the declines observed at the other transects.

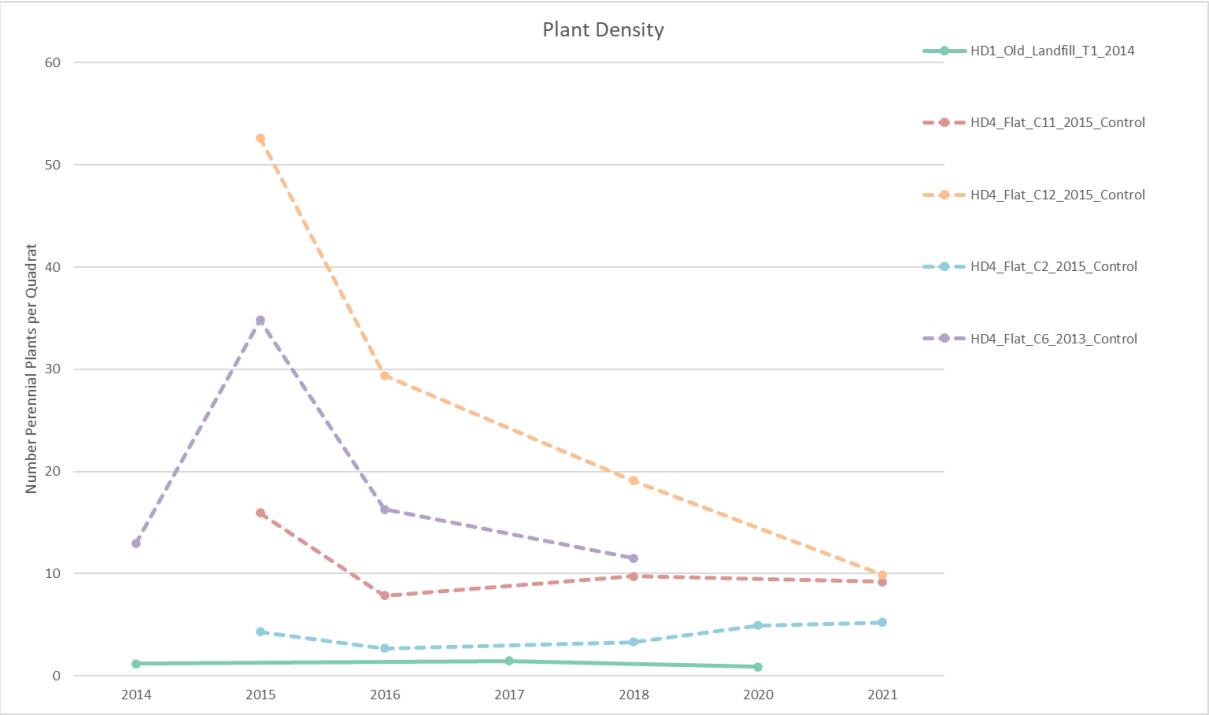

Figure 30: Native perennial plant density (plants/ quadrat) for the Hope Downs 1 Old Landfill rehabilitation and reference site over time.

Native perennial plant cover

Native perennial plant cover (%) at the Old Landfill rehabilitation increased from just over 0% in 2014 to 9% in 2020, showing some early similarity to burnt reference site Flat_C12 (Figure 31). However, cover at the rehabilitation plateaus in 2017 whilst continues to increase at a high rate in Flat_C12 indicating that environmental conditions are not a significantly limiting factor and other issues prevented further plant establishment at the rehabilitation. Statistically significant differences were found between the rehabilitation and reference sites for all monitoring years, although the 2014 value was comparable to Flat_C12 in 2015 when first monitored.

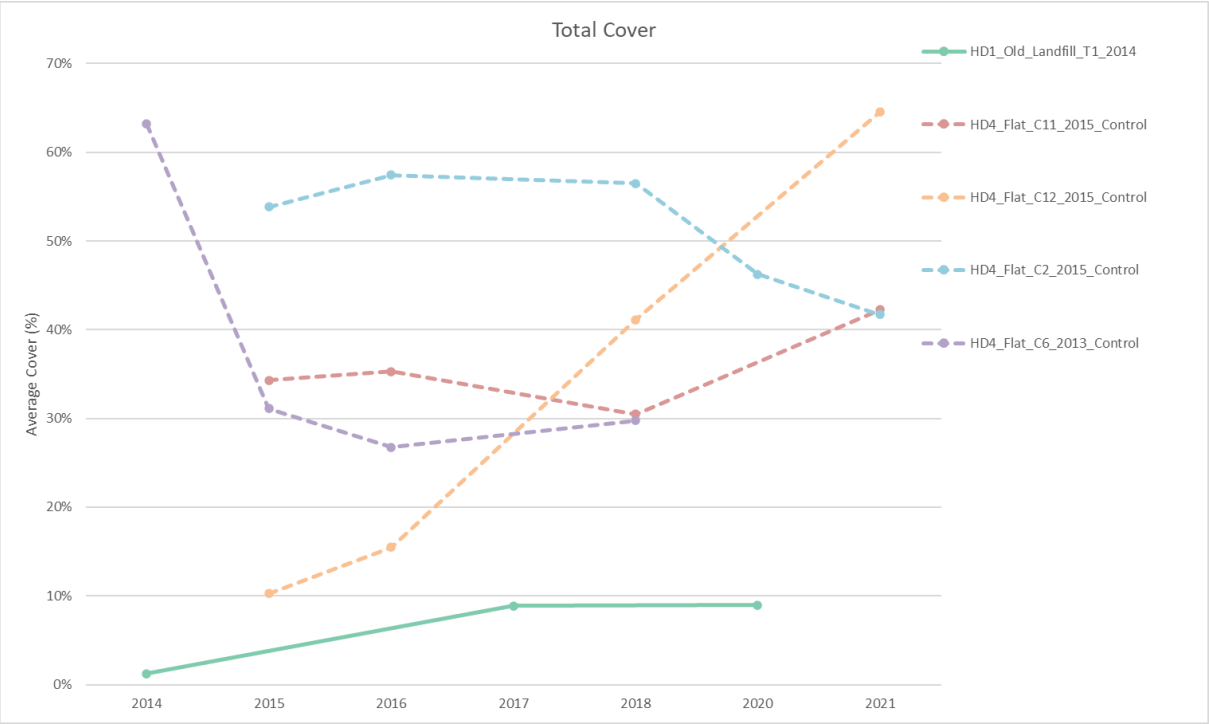

Figure 31: Native perennial plant total cover (%) for the Hope Downs 1 Old Landfill rehabilitation and reference site over time.

Yandicoogina Landfill

The first Yandicoogina Landfill rehabilitation event, which involved ripping and seeding, was completed in 2009, with monitoring of the two parallel 50m transects (YAN_Landfill_T1 and T2) commencing in 2013. Rehabilitation works at Landfill_YL3 and Landfill_YL4 were completed in 2018 and documented works include ripping (at a shallow depth to reduce water infiltration), seeding and topsoil/subsoil application. These sites were first monitored in 2019 and have not been burnt since monitoring began. Table 7 provides an overview of key rehabilitation parameter values for the Yandicoogina Landfill transects.

Rehabilitation transect Landfill_YL4 performed better than YL3 across all three vegetation parameters, recording higher total cover and species density in 2021 than the reference sites. The presence of two weed species at YL3 in 2019 may account for the lower values recorded. The rehabilitation varied most significantly to the reference sites in terms of plant density due to the post-fire germination observed at both reference sites in 2017. Declining trends in plant density were observed across the rehabilitation, although YL4 shows a promising incline as recorded during the last monitoring assessment.

Total plant cover increased across all four transects, with T1 achieving almost 70 % cover 10 years after rehabilitation. For all parameters, values recorded for T2 were marginally lower than those for T1, however they did not differ significantly from either reference site. Trends derived from the Yandicoogina Landfill rehabilitated and reference sites vegetation quadrat data are discussed further below.



Figure 32: YAN_Landfill_YL4 (start) 2019 (one year after rehabilitation).



Figure 33: YAN_Landfill_YL4 (end) 2019 (one year after rehabilitation).

Native perennial species density and species richness

Three out of the four rehabilitated transects show inclining trends between the first two monitoring assessments, with declines recorded in all ensuing assessments (Figure 34). The rate of decline

between 2020 and 2021 at Landfill_YL3 and YL4 was similar, decreasing by 0.7 and 0.3 species per quadrat respectively. The rates of incline (between 2019 and 2020) show more variation, with a steep increase (1.2 species per quadrat) occurring at Landfill_YL4 compared to a marginal increase of 0.2 at Landfill_YL3. There was no significant difference between rehabilitation and reference species densities in either 2020 or 2021, with all sites recording between 2.5 and 3.2 species per quadrat in 2020 and between 2.1 and 2.9 in 2021. However, the declining trends observed at the reference sites indicates they had not yet recovered to pre-fire values and do not currently reflect species density for the target vegetation community.

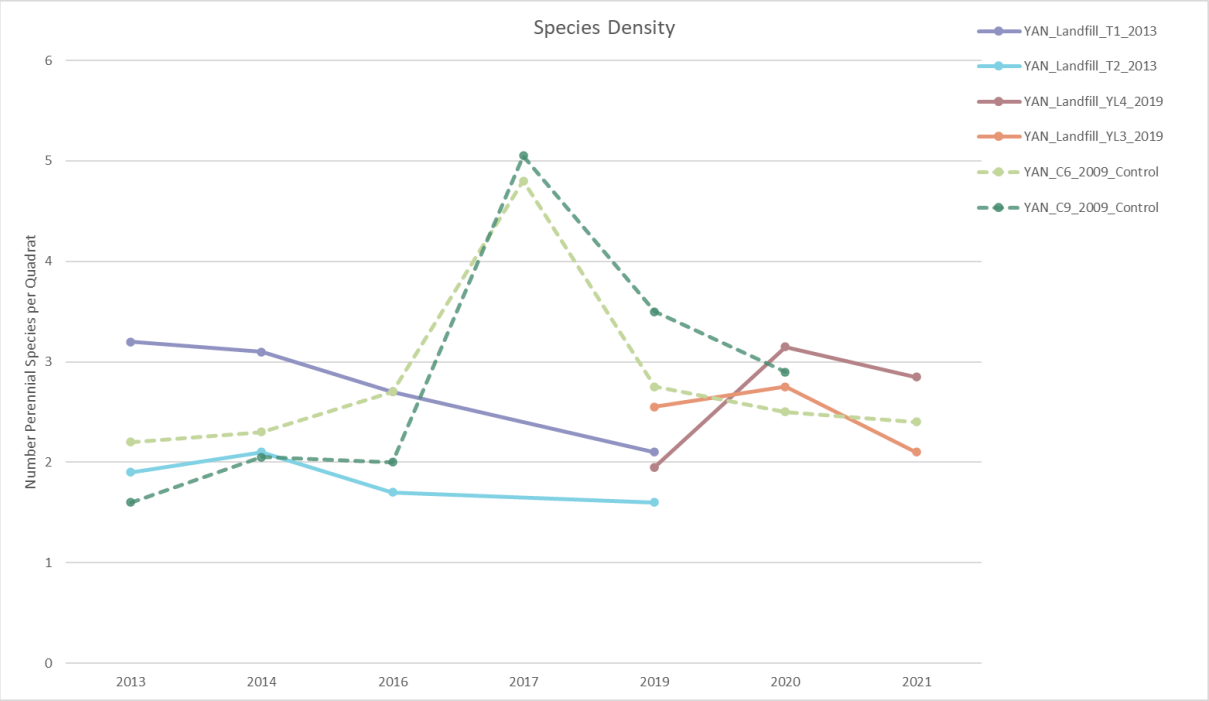

Figure 34: Native perennial species density (species/ quadrat) for Yandicoogina Landfill rehabilitation and reference sites over time.

Three of the 14 seeded species were recorded on the rehabilitated sites in 2020 (*Acacia bivenosa*, *Ptilotus calostachyus* and *Solanum lasiophyllum*) and total species count (based on transects and walk around assessment) had increased to 35 (from 22 species in 2019). Considering so few of the species recorded in 2020 were seeded, it is likely that most of the plants recorded were recruited from the growth medium applied and/or natural seed recruitment from the surrounding undisturbed landscape. Species present at all the rehabilitation and reference sites were *Acacia adoxa*, *A.bivenosa*, *Corchorus lasiocarpus* and *Triodia pungens*.

Native perennial plant density

Rehabilitation transects Landfill_T1 and T2 both decline over the monitoring period, with neither site being within the range of reference values recorded in 2019. However, this is attributable to the post-fire condition of the reference sites, where plant density was still declining towards pre-fire values as post-fire germination resulted in uncharacteristically high plant densities recorded in 2017.

Plant density trends observed between 2019 and 2021 differ between the two monitored transects, with Landfill_YL3 declining by 35 % and Landfill_YL4 increasing by 56 % (Figure 35). The rates of incline / decline were correspondingly higher between 2020 and 2021.

A decrease in plant density was observed at both reference sites between 2019 and 2020, with YAN_C6 showing a moderate increase the following year. Plant density at the rehabilitation remained below the

reference densities throughout the monitoring period, however this is attributable to the high rates of post-fire germination observed at both reference sites.

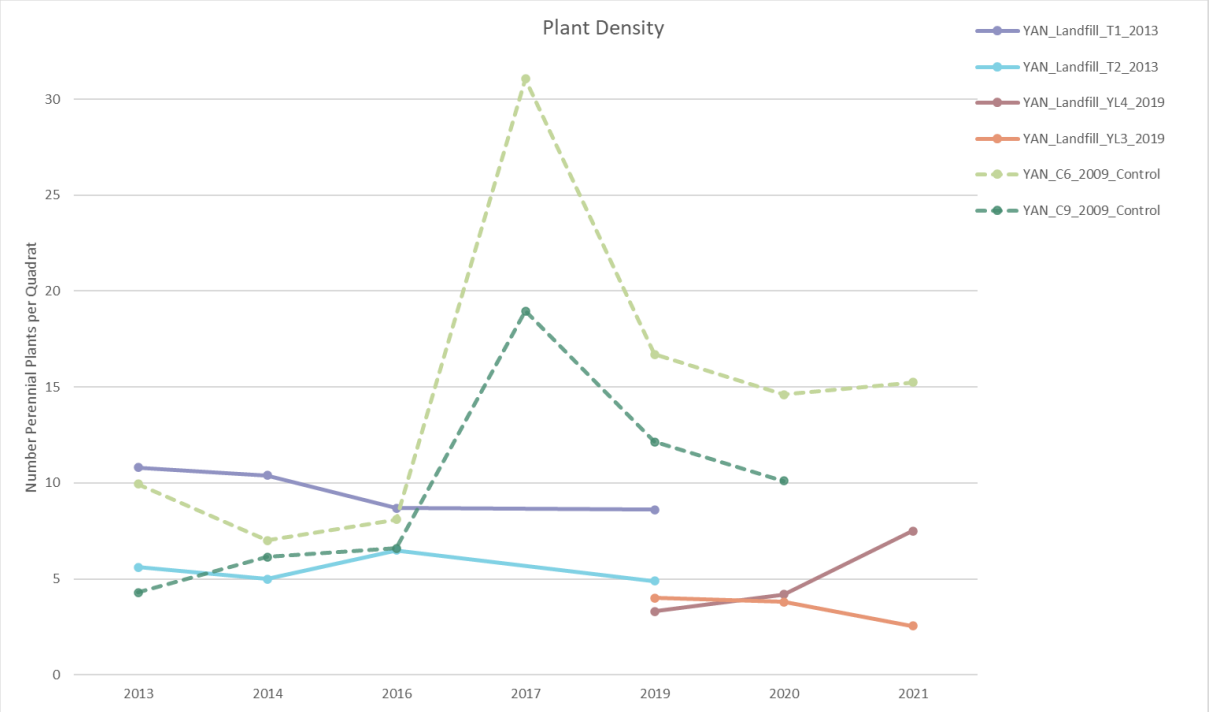

Figure 35: Native perennial species density (species/ quadrat) for Yandicoogina Landfill rehabilitation and reference sites over time.

Native perennial plant cover

Total plant cover increased over the duration of monitoring at all Yandi Landfill rehabilitation transects, with three out of four recording higher values as of their last monitoring assessment compared to the corresponding reference values (Figure 36). Conversely, less plant cover was observed at three out of the four rehabilitation transects during the first monitoring assessment compared to each reference site. Cover at Landfill_T2 had begun to stabilise when the transect was last monitored, whilst the inclining trends continued at Landfill_T1, resulting in almost two thirds of the transect being covered.

Landfill_YL4 saw a substantial expansion of cover between 2019 and 2020, increasing from 15% to 40%, whereas Landfill_YL3 increased from 10% to 20% making it equivalent to reference site YAN_C9. There was no significant difference in plant cover between the rehabilitation and reference sites in 2020. Cover at the rehabilitation and reference site YAN_C6 remained relatively constant between 2020 and 2021.

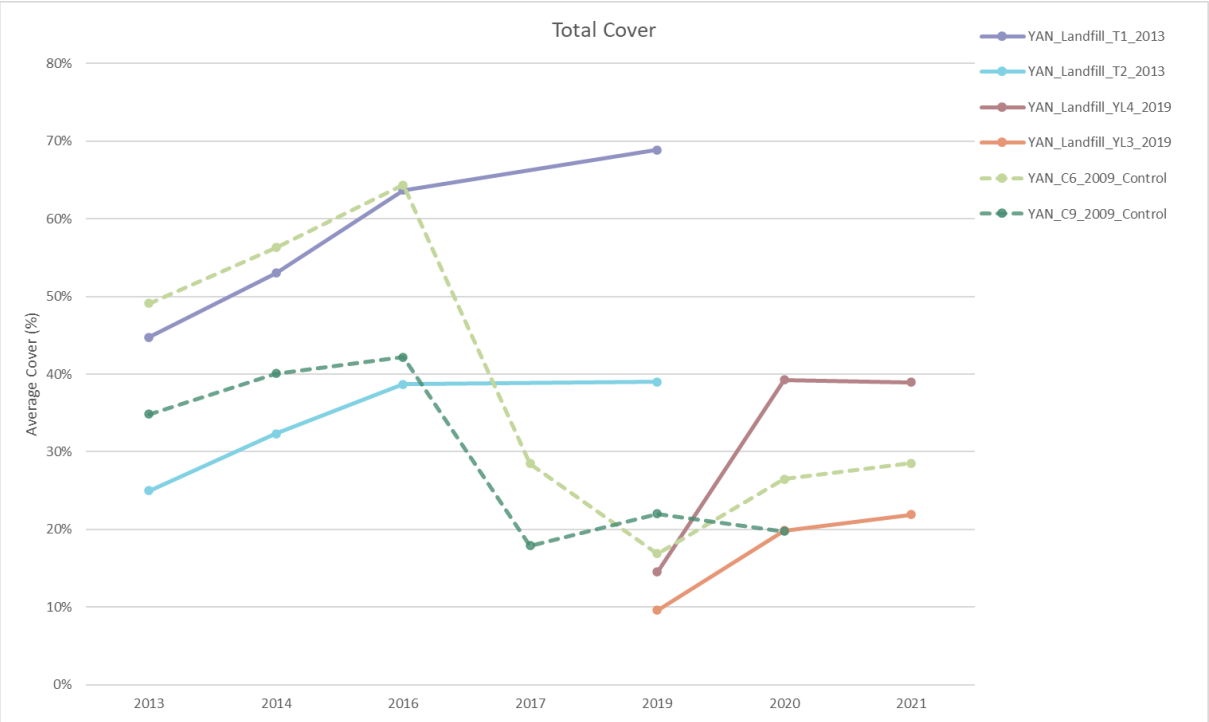

Figure 36: Native perennial species density (species/ quadrat) for Yandicoogina Landfill rehabilitation and reference sites over time.

5.4.5. High impact disturbance areas

As discussed in Section 2, there are a limited number of regional examples of rehabilitated high impact disturbance areas. Examples of completed rehabilitation of regional waste dumps have been discussed below, noting that learnings from these, as well as examples from the wider Pilbara region, will be used to guide rehabilitation techniques for high impact disturbance at the HD2 Proposal. Known rehabilitation methods for waste dumps included in this Summary are presented in Table 8 below.

Table 8 Rehabilitation overview for waste dump sites

REHABILITATION PARAMETER	SITE		
	YAN Central WD	YAN Rubber Dump	West Ang East and South WDs
Initial no. transects monitored	2	1	4
Current no. transects monitored	2	1	4
Area (ha)	3.31 ha	Unknown	7.5 hectares – 1.5 ha for East WD and 6 ha for South WD
Closure domain	Waste dump	Waste dump	Waste dump
Year of rehab	1999	2013	2012
Growth medium	Topsoil	None	Topsoil
Depth of growth medium application (mm)	Unknown	Unknown	200 mm

Time of storage of growth medium (yr)	Unknown	Unknown	Unknown
Seeding mix	Not applicable	Seven (7) native species of local provenance	Twenty-two native species (two annuals and twenty perennials) mixed with sandpit sand at 1:2 ratio.
Seeding rate (kg/ha)	0	7 kg/ha	Hand seeded at approximately 13 kg / ha.
Contour ripping (depth)	Unknown	Unknown	Maximum depth of 0.5 m

Yandicoogina Central Waste Dump and Rubber Dump

Rehabilitation works on the Central Waste Dump were completed in 1999 and two 100 m transects, CentralWD_T1 and CentralWD_T2, were installed and monitored for the first time in 2016. No methodology details are available due to rehabilitation occurring prior to 2010. As previously mentioned, recording of rehabilitation methodology has been improved since this time.

Rehabilitation activities on the Rubber Dump, which included ripping and seeding, were completed in 2013 and one 100 m transect, RubberDump_T1, was first monitored in 2014. An overview of the rehabilitation for Yandicoogina Central Waste Dump and Rubber Dump is presented in Table 8. These sites have been assessed in parallel for comparative value and to indicate general waste dump trends.

Photographic evidence shows a loss of cover and plant density at the Central WD rehabilitation between 2017 (Figure 39) and 2018 (Figure 40). Conversely, Rubber Dump photos (Figure 37and Figure 38) show some improvements in cover and density, with vegetation quadrat data for species density and total cover loosely confirming this but indicating poorer outcomes for plant density. Although lower values were observed at the Rubber Dump than the Central WD for all three vegetation parameters, the relatively stable trajectories and absence of significant declines indicate satisfactory outcomes regarding overall quality of vegetation and progression toward the target community.

Declining trends observed at the Central Waste Dump rehabilitation can be mostly attributed to low rainfall as the reference sites show corresponding declines. Plant density and species density trends were characteristic of early rehabilitation communities, with the increases reflecting high establishment rates, and the ensuing declines depicting the senescence of short-lived colonising species. Vegetation parameter trends at Yandicoogina's rehabilitated waste dump sites are further discussed below with comparative analyses to reference sites.



Figure 37: Rubber Dump T1 (lower slope) (end) 2014 (one year after rehabilitation).



Figure 38: Rubber Dump T1 (lower slope) (end) 2014 (five years after rehabilitation).



Figure 39: CentralWD_T1 (start) 2017 (eight years after rehabilitation).



Figure 40: CentralWD_T1 (start) 2017 (nine years after rehabilitation).

Native perennial species density and species richness

Declining species density trends are observed from 2017 / 2018 onwards at the rehabilitation and reference sites, corresponding with records of low rainfall (Figure 41). Statistically, CentralWD_T2

shows the highest similarity to the reference sites, however the overall trajectory observed for CentralWD_T1 is most reminiscent of the reference trajectories which illustrate post-fire vegetation dynamics. Species density in 2020 was significantly lower at CentralWD_T1 and RubberDump_T1 than reference site YAN_C9 but they were not significantly different by pairwise comparison to YAN_C6.

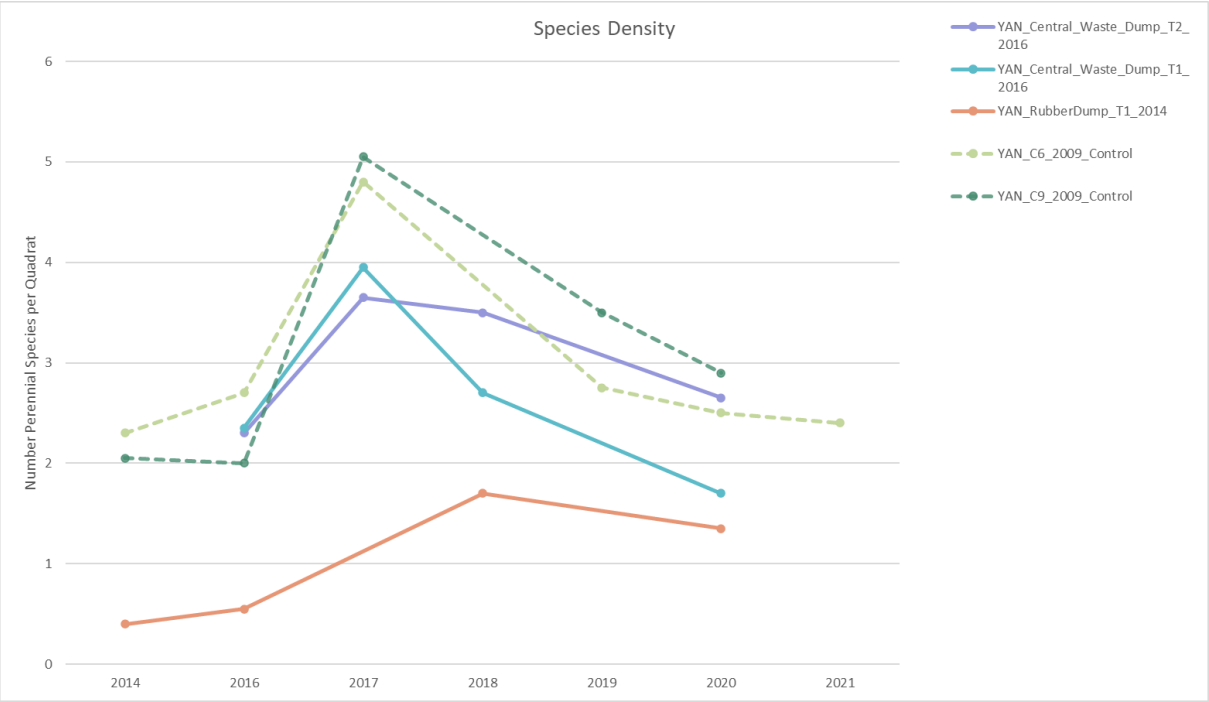

Figure 41: Native perennial species density (species/ quadrat) for Central Waste Dump and Rubber Dump rehabilitation and reference sites over time.

Species richness at the rehabilitated sites ranged from 12 to 15 in 2020, with only CentralWD_T1 showing a notable decrease from previous assessments. Six of the seven species seeded at the Rubber Dump rehabilitation were observed in 2020, indicating a relatively good degree of germination success from seeding. Additional species, *Eucalyptus gamophylla* and *Acacia pruinocarpa*, were recorded at the Rubber Dump in 2020 indicating upper strata development.

Native perennial plant density

Native perennial plant density at the rehabilitation sites decreased slightly between 2018 and 2020 assessments (Figure 42), with below average rainfall likely to be a contributing factor. Excluding CentralWD_T1, rehabilitation plant density values remained below those of the reference sites in 2020, with the lowest number of plants per quadrat (two) recorded at the Rubber Dump site and highest (15) at reference site YAN_C6. Both reference sites recorded plant densities in 2020 that were above their pre-fire values.

All rehabilitation sites shared similarity with YAN_C9, and any differences detected between sites were not significant by pairwise comparison.

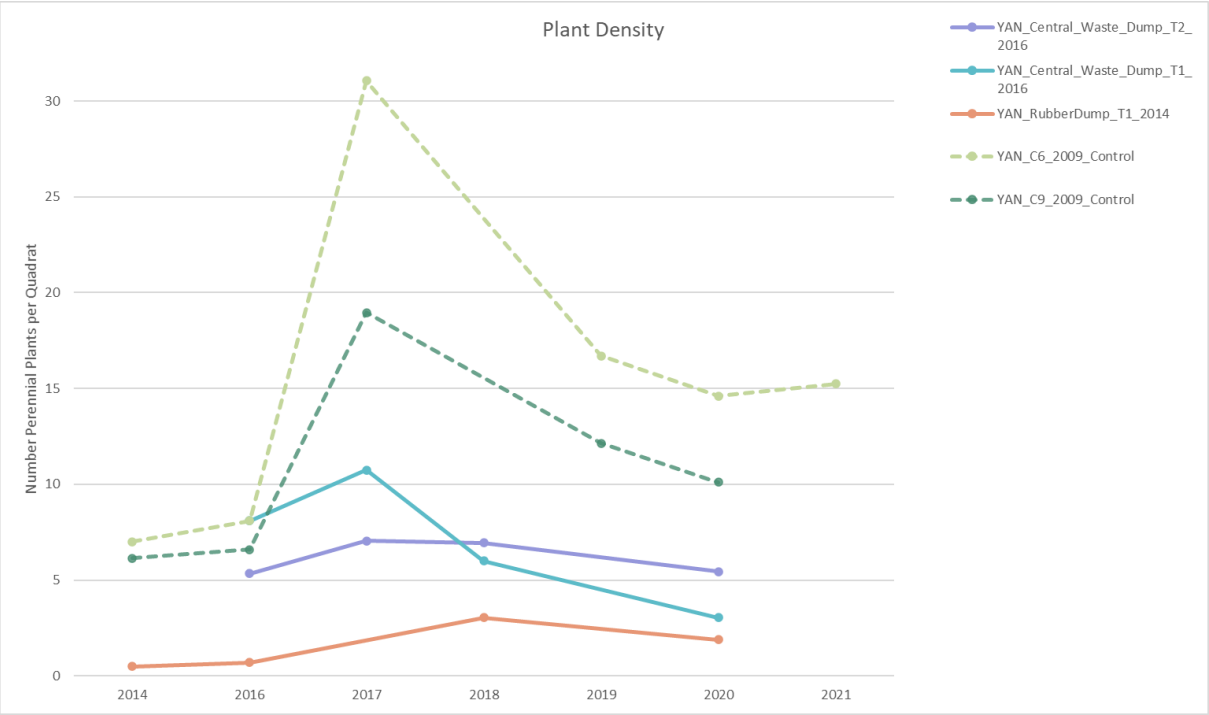

Figure 42: Native perennial plant density (plants/ quadrat) for the Central Waste Dump and Rubber Dump rehabilitation and reference sites over time (reference sites burnt post 2016 monitoring).

Native perennial plant cover

Native perennial plant cover decreased at the Central Waste Dump rehabilitation between 2018 and 2020, whilst remaining relatively constant at the Rubber Dump rehabilitation from 2016 onwards (Figure 43). Although declining trends from 2017 onwards occurred at the Central Waste Dump rehabilitation, the 49% cover recorded at CentralWD_T2 in 2020 is significantly higher than both reference sites. In contrast, 13% and 24% plant cover values were recorded in 2020 for CentralWD_T1 and RubberDump_T1 respectively, neither being significantly different to the reference site range.

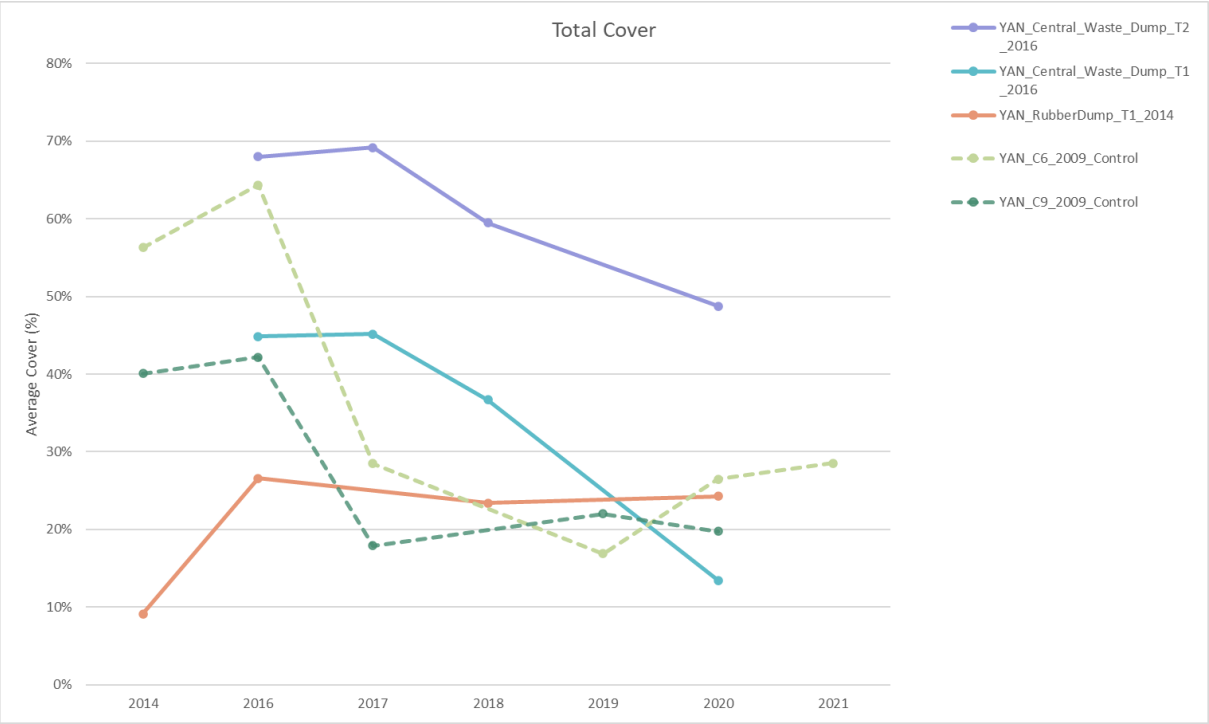

Figure 43: Native perennial total plant cover (%) for the Central Waste Dump and Rubber Dump rehabilitation and reference sites over time

West Angelas East and South waste dumps

Four transects were delineated at West Angelas' East and South Waste Dumps: EastWD_T1 on a flat area (categorised as "lower slope"), and EastWD_T2, SouthWD_T1 and SouthWD_T2 on mid-slopes. Rehabilitation works, which included reprofiling / dozing of waste dump slopes, seeding, contour ripping and topsoil application, were completed in 2012 with transects first monitored in 2013. Further information on the rehabilitation methodology for the East and South Waste Dumps is provided in Table 8.

Photographic evidence (Figure 44 to Figure 47) of the East and South Waste Dump rehabilitation indicates some successful outcomes, particularly regarding total plant cover. The highest quadrat values and trajectories most aligned with the relevant reference sites were observed at rehabilitation transect EastWD_T1 for all parameters.

The species density trajectories observed over the entire monitoring period are characteristic to the age of the rehabilitation, with early inclines reflecting successful establishment of colonising species, and the gradual declines occurring due to natural senescence of the short-lived colonisers. Corresponding steep declines in species density and plant density occurred between 2013 and 2014 at rehabilitation site SouthWD_T1, attributed to unusually high numbers of *Ptilotus nobilis* recorded in 2013.

Based on the 2019 monitoring quadrat values, the rehabilitation exhibited greatest success within total plant cover, an unusual outcome, as a high variation between rehabilitation and reference values is usually observed for this parameter. Upon further analysis, high variation was evident in the early monitoring years, and when the post-fire condition of the reference sites is accounted for, success in this parameter is mostly confined to EastWD_T1.



Figure 44: WA_EastWD_T1 (lower slope) (start) 2013 (one year after rehabilitation).



Figure 45: WA_EastWD_T1 (lower slope) (start) 2017 (five years after rehabilitation).



Figure 46: WA_SouthWD_T2 (end) 2013 (one year after rehabilitation



Figure 47: WA_SouthWD_T2 (end) 2013 (five years after rehabilitation

Native perennial species density and species richness

The East and South Waste Dump rehabilitation sites show mostly inclining trends in species density over the first three years of monitoring (2013 to 2015), with the only decline observed at SouthWD_T1

(Figure 48). There was no statistically significant variation between rehabilitation and reference species density values in 2015, indicating good establishment and early survival of native plant species. Establishment from seed was considered relatively effective, with thirteen of the twenty-two seeded species recorded in 2015 at one or more of the rehabilitated sites. Two transects, EastWD_T1 and SouthWD_T2 recorded higher numbers of species per quadrat than all five reference sites, with EastWD_T1 maintaining a trajectory above all references for the entire duration of monitoring.

Post 2015, the rehabilitation transects exhibit gradual declining trends in species density, with three of the four transects remaining within the relevant reference site range (C9 excluded for due to being heavily impacted by fire). However, rehabilitation transects EastWD_T2 and SouthWD_T1 fall outside the range if reference site C8 is also excluded. The observed species density trajectory at C8 suggests the site has not yet fully recovered (in this parameter) from the pre-2013 burn. Rather than informing vegetation parameter targets for rehabilitated sites, C8 data is more appropriate for establishing values that could be obtained in early rehabilitation.

From 2015 to 2019, the number of species per quadrat decreased at almost identical rates for EastWD_T1, SouthWD_T1 and SouthWD_T2, whilst EastWD_T2 remained relatively constant. Statistically, there were significant differences in species density between all eight sites in the last two monitoring years. However, the rehabilitated transects were comparable to at least one reference site. The greatest number of species per quadrat across all sites in 2019 was 4.4, observed at EastWD_T1 which also recorded the highest number of seeded species. Recording 0.9 species per quadrat, SouthWD_T1 had the lowest species density in 2019, decreasing by over half from 2017. Although species density at SouthWD_T1 was not significantly different to reference site C9, the low species density at the reference site was due to post-fire conditions, thus not reflective of the target vegetation community.

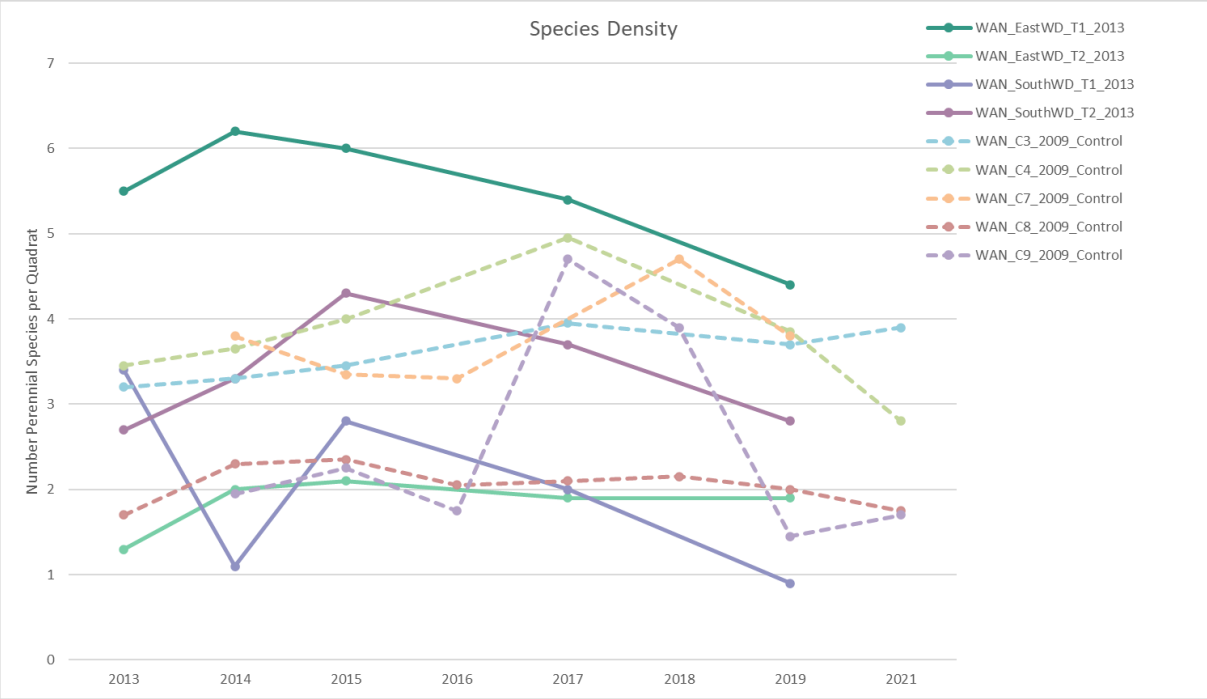

Figure 48: Native perennial total species density (species/quadrant) for the East and South Waste Dump transects and reference sites over time (EastWD_T1 represents a flat transect).

Native perennial plant density

Native perennial plant density at the rehabilitated transects remained relatively constant from 2013 to 2019, with the greatest fluctuations observed at SouthWD_T1 (Figure 49). The number of plants per quadrat recorded at SouthWD_T1 decreased substantially between the first two monitoring years, with

a gradual incline observed in the subsequent year. The high number of plants per quadrat recorded in 2013 at SouthWD_T1 was attributed to atypically high numbers of *Ptilotus nobilis*.

Significant variations between reference and rehabilitation plant density values exist for post-2016/17 data, mostly due to the considerably high post-fire values recorded at C3, C4 and C9. The greatest change in plant density in rehabilitated areas was observed at EastWD_T2, which increased from seven plants per quadrat in 2017 to 9.4 in 2019. Slightly higher plant densities were recorded at the East Waste Dump rehabilitation compared with the South Waste Dump rehabilitation, with SouthWD_T1 recording the lowest density of 1.2 plants per quadrat.

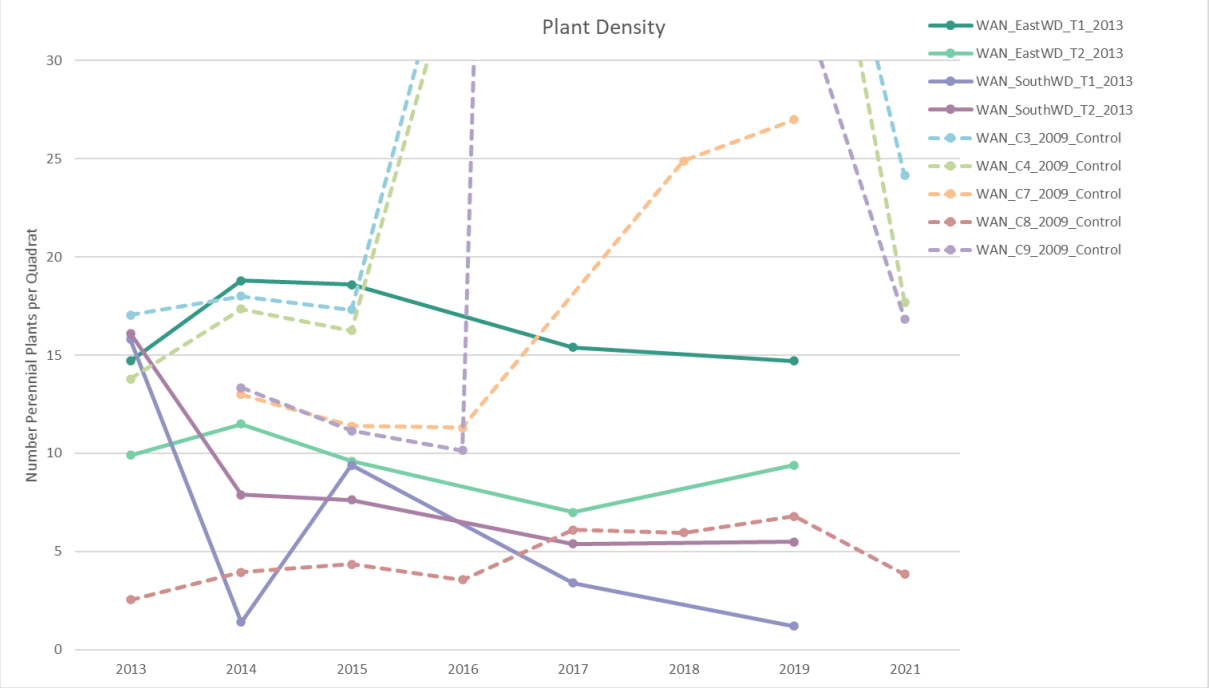

Figure 49: Native perennial plant density (plants/quadrant) for the East and South Waste Dump transects and reference sites over time[2]

Native perennial plant cover

Overall plant cover trajectories observed at the rehabilitation are roughly inverse to those observed at the post-fire reference transects – C3, C4 and C9 (Figure 50). Increasing trends were observed at all four rehabilitation transects between 2013 and 2014, with plant cover continuing to increase until 2015 at all transects except SouthWD_T2 which saw a steep decline in cover between 2014 and 2015. Rehabilitation cover begins to plateau post-2015 at both East Waste Dump transects, whilst cover at the South Waste Dump transects shows similar stabilising trends post-2017. This was least evident at SouthWD_T1 where a significant loss of cover occurred between 2015 and 2017, with the declining trend continuing but lessening in severity between 2017 and 2019. Despite this, cover at SouthWD_T1 at the time of the 2019 monitoring was notably higher than initial cover recorded in 2013. Although the 2019 monitoring report found some significant differences, plant cover at all rehabilitation transects was either within the reference site range (16% to 35% cover), or (at EastWD_T1) higher than the reference site range. The highest native perennial plant cover overall (57%) was recorded at rehabilitation transect EastWD_T1, where over 55% cover had been maintained since 2015, indicating an excellent rehabilitation outcome in this parameter.

[2] Full reference site data not presented on x-axis due to scale limitations. Full results available in Appendix 1.

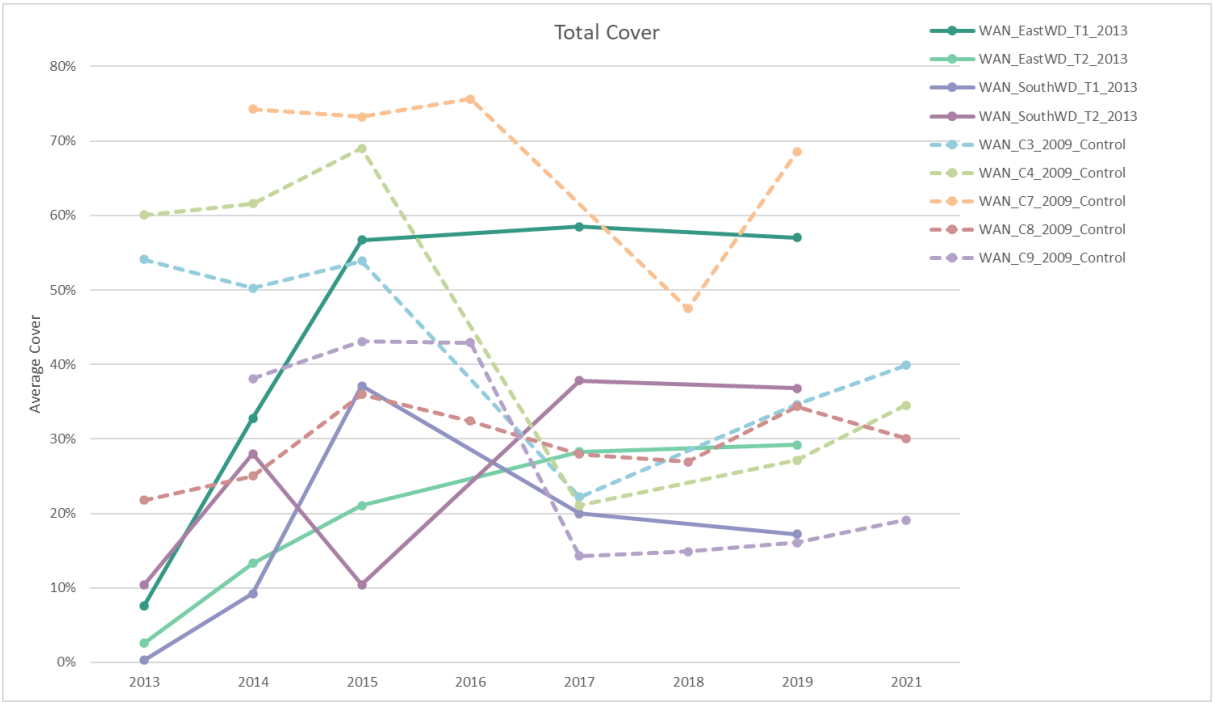

Figure 50: Native perennial total plant cover (%) for the East and South Waste Dump transects and reference sites over time.

5.4.6. Discussion

A comparative overview of the range of vegetation parameter values recorded during recent monitoring assessments for each closure domain is presented in Table 9. Higher species richness values were observed at the seeded sites, suggesting a potential correlation, especially if the low values recorded at HD1 Old Landfill are excluded on the basis that only half the area received seed. Similarly, higher numbers of flowering / fruiting species appear to be associated with the application of seed.

A wide range of total cover values were recorded for all closure domains, and no weeds were present at any site as of the last monitoring event. As expected, erosion gullies were only recorded at waste dump sites, which was the only closure domain where all transects had annuals present. Overall, the most satisfactory results in spinifex density and spinifex cover occurred at the borrow pit sites, although the highest value in spinifex cover was recorded at a waste dump site. Borrow pits scored the lowest in terms of annuals present and species richness, but exhibited good results in plant density, whilst seeded sites (waste dumps and landfill) performed poorly in this parameter.

Implications for rehabilitation methodology utilised within the HD2 Proposal area include the:

- Consideration of application of both topsoil and seed. Where available sites should be rehabilitated with both topsoil and seed applied.
- Additional erosion monitoring may be valuable to ensure successful outcomes at waste dump sites.
- Increasing the frequency of monitoring upon confirmation of a site being burnt may also be valuable, as compiling post-fire vegetation quadrat data will enable a more comprehensive understanding of post-fire recovery rates for Pilbara ecosystems. Considering the parallels observed between early rehabilitation and post-fire reference sites, this information could be utilised to predict the trajectory from rehabilitation to climax community, and thus the formulation of appropriate and achievable completion criteria.

Table 9 Rehabilitation monitoring overview for all sites

MONITORING	REHABILTATION SITE			
	HD4 Railway BPs and HD4 MAR, Camp and Mine BPS	**HD4 Dewatering Pipeline and HD4 Powerline**	**HD1 Old Landfill and YAN Landfill**	**YAN Central WD and Rubber Dump and WAN East and South WDs**
Closure domain	Borrow pits	Infrastructure	Landfill	Waste dumps
Year last monitored*	2020	2018 / 2020	2020	2020
Rehab methodology	Topsoil Not seeded	Topsoil Not seeded	Topsoil Seeded	Topsoil Seeded except for YAN Central WD
Range of species richness values	4 to 10	2 to 13	5 to 20	12 to 15
Range of species density values	1.2 to 2.0	0.3 to 3.3	0.5 to 3.2	1.4 to 2.7
Range of plant density values	2.9 to 7.4	1.1 to 9.2	0.9 to 4.2	1.9 to 5.5
Range of spinifex density values	2.7 to 7.0	0 to 7.1	0 to 0.5	0.9 to 2.8
Range of total cover values (%)	8 to 55 %	3 to 36 %	9 to 39 %	13 to 49 %
Range of spinifex cover values (%)	13 to 36 %	1.4 to 21 %	0 to 3.4 %	5.9 to 43.0 %
Range of weed cover values (%)	0	0	0	0
Range of weed cover as a percentage of total cover values (%)	0	0	0	0
Range of weed density values	0	0	0	0
Range of percentages of quadrats with weeds present	0	0	0	0
Range of percentages of quadrats with annuals present	0 to 10	0 to 30	0 to 60	10 to 25
Range of # of species flowering / fruiting (inc. walkaround assessment)	0 to 3	1 to 4	3 to 7	3 to 8
Erosion (qualitative)	None	None	None	Four erosion gullies, two potentially unstable

6. RESEARCH AND DEVELOPMENT

Rio Tinto undertakes research and development in order to increase its understanding of the local natural ecosystems, optimise its rehabilitation techniques and improve confidence in the ability to achieve closure outcomes. Research and development projects range from opportunistic on-ground trials to large-scale multi-partner funded research programmes. Trial monitoring data is reviewed regularly to identify opportunities to refine rehabilitation techniques, such as the germination rates of sown seed, for continual improvement.

Although some research and trial projects described below were not conducted specifically on the tenements covered by this report, the learnings can be applied to works conducted on these sites and indicate the scientific approach applied to strive for continual improvement. A selection of recent research and development projects are summarised below.

6.1. Eco-engineering solutions to improve mine site rehabilitation outcomes

Rio Tinto Iron Ore and BHP Western Australia Iron Ore are partners in a federally funded research program investigating the rapidly developing field of Restoration Engineering, with a particular focus on the mining-intensive Pilbara region of Western Australia. This 4-year Global Innovation Linkages (GIL) project is led by the Kings Park Science research team and has additional partners from The University of Western Australia (UWA), Greening Australia, University of California, Brigham Young University, the University of Nevada, and Natural Resource Conservation LLC (a private US-based consultancy). The Restoration Engineering approach partners ecological research, focused on best practice use of seeds from a recruitment biology point of view, with innovative ecologically guided engineering solutions focussed on the invention and modification of seeding equipment needed to deliver native seeds at scale.

This project has continued to test a range of custom-built precision seeding machines for use in sloped and rocky soils of the Pilbara. Firstly, a critical evaluation of the field limitations of current mechanised seeding techniques has been undertaken. Broadcasting seeds onto the soil surface is now known to be problematic and un-desirable. With this, new precision seed delivery machines have been designed, constructed, and field tested over the past three Pilbara summers in sites operated by both mining partners. Preliminary findings of this work have demonstrated that seeds are being incorporated in the upper soil layer more efficiently than previously achieved. Monitoring of these sites after significant rain events is suggesting seedling recruitment and rehabilitation performance of targeted genera such as Triodia is improving.

By experimentally comparing seed sowing depth (standard practice versus precision placement with the newly designed machinery) and manipulating the recruitment dynamics of seeds (standard ‘off-the-shelf’ seed treatments versus seeds treated to maximise recruitment potential – using treatment such as flash flaming or smoke-priming of seeds), the research group have shown that perennial grasses establishment of focal *Triodia* species can be increased to 35 seedlings per square metre (6-fold higher that standard, common seeding practices). These findings were observed after this trial site received suitable cyclonic rainfall (Figure 51). In the summer season of 2020/2021, replicated, multi-hectare trials have been installed across both mining partner sites (Rio Tinto Iron Ore and BHP) in over 30 hectares that are made up of different landforms and soil types. These repeat trials are critical to assess the performance of the precision seed delivery machinery and seed treatments across years and under varying conditions of rainfall.



Figure 51: Germination of grass seed following trial of precision seeding equipment.

6.2. Acceptable rates of erosion for rehabilitated mineral waste landforms

A major consideration for rehabilitation and closure of waste landforms on mine sites is long-term erosion stability. In Western Australia, regulators require that landforms will remain 'stable' for hundreds of years or in the 'long-term'. Therefore, assessment of a landform's potential long-term erosion stability requires the use of erosion and/or landform evolution models and defensible erosion thresholds below which rehabilitation landform designs are considered acceptably erosion resistant or 'stable'.

To date, definitions of acceptable long-term erosion rates used in mining settings have been based on limiting the initiation of key erosion processes for steeply sloping land (i.e., rill and gully erosion). These approaches have been observed to achieve suitable results but may be somewhat conservative. Importantly, the rates currently applied as acceptable in landform design were based on measurements of erosion during rehabilitation monitoring and on landform evolution modelling for a limited range of materials and climates. To address this, Rio Tinto, with three other member companies of the Pilbara Rehabilitation Group (PRG), BHP, Fortescue Metals Group and Roy Hill, initiated a project aimed at defining acceptable rates of erosion for rehabilitation landform design for the Pilbara region of Western Australia. Landloch Pty Ltd was selected to undertake the work for this project using information derived from PRG member sites, with the Western Australian Biodiversity Science Institute (WABSI) acting as the project facilitator.

As part of the project, a review of information relating to erosion rates on natural and man-made landforms was conducted. This review showed that a wide range of approaches has been used to define acceptable erosion rates, including a linking to rates of soil formation; maintenance of soil quality (which may include considerations of plant/crop productivity, effective soil depth and soil organic matter and nutrient stores); rates of natural erosion in adjoining areas; potential for gully formation; and water quality impacts. Based on this review, a guideline was developed to define acceptable erosion rates for use in the design of stable mine waste landforms in the Pilbara region. The guideline uses a risk-based approach, with erosion thresholds being linked to the physical properties of the waste material and the adverse environmental impacts that may result from landform failure. The first phase of this project was completed in 2018 and stakeholder engagement occurred to communicate key project findings. Further work is underway to define how to incorporate this guideline into Rio Tinto's landform design processes and to understand implications for the business.

6.3. Additional waste samples for batter selector

Rio Tinto is looking to build a more robust test work programme to determine erodibility data for waste types across Rio Tinto mine sites in the Pilbara. The key driver for the work is to ensure that key waste types across the various mine sites and lithologies are well understood and that detail is provided on the thresholds used to derive the Rio Tinto erodibility classifications of low, moderate, and high.

Rio Tinto utilise a Batter Selector Tool (BST), that is based on laboratory testing of individual waste types to optimise the final landform design by determining appropriate lift heights, slope angles, berm widths and berm back slope angles on an individual landform basis. The BST is based on the ongoing testing of waste material samples over a number of years; however, sampling has historically been biased towards some sites and some waste types more than others. This project seeks to address identified gaps and build greater certainty into the application of the BST.

Landloch undertook a gap analysis of the BST in 2018 and provided input on key wastes to consider in future revisions of the tool. Rio Tinto have developed a list of sampling priorities based on the gap analysis. The list provides detail on the site, geology, consolidated rock type and priority rating based on existing waste characterisation data completed by Landloch and presented within the BST. Test work will continue, facilitating advancements within waste type classification methodology, and the BST and landform design will continue evolve.

6.4. Channar scree slope trial

In 2014, as part of a preliminary closure study for the Channar mine, it was proposed to use rock armouring for a number of constructed legacy landforms, including land bridges and waste dumps, where access for standard rehabilitation earthworks purposes is constrained and/or too steep to safely bench and push down the slopes. Specific design criteria were developed based on modelling to meet acceptable erosion rate and long-term stability, including maximum batter heights, gradient, and rock size. The Department of Mines and Petroleum (now DMIRS) were consulted regarding this approach in May 2015 and indicated the requirement of further information and certainty before such an approach could be endorsed. In August 2019, DMIRS were advised that planning for a trial of the concept was underway. This project aimed to implement a scree slope (rock armouring) trial at the Channar mine on the CHE WD1 NE waste dump.

From October to late December 2020, contractors constructed a ~1m thick, rock armour on the CHE WD1 NE. This was achieved by screening various stockpiled or blasted material in Channar NE, to test for rocky material yield. This rocky material was then hauled to the tip head, where it was tipped short and pushed over. This process usually took 2 or 3 days for material to be built up enough to push over the tip head (Figure 52 and Figure 53). The trial demonstrated that sufficient rocky material to build the rock armour, is achievable through screening stockpiled/dumped (or blasted) material. However, productivity of the screening plant can be variable. Achieved Yield was lower in stockpiles. The trial indicated that, based on yield, the most suitable rock armour material would be a mix of banded iron

formation (BIF) and hard cap. The trial was able to demonstrate that the scree slope design could be achieved from a constructability perspective achieving a consistent 1m rock armour cap along the slope, with minor variation attributed to the pre-trial landform profile.

The scree slope trial will be monitored using high resolution UAV survey for a minimum of 5 years, to monitor the long-term stability of the scree slope rehabilitation strategy.



Figure 52: Pre-project slope.



Figure 53: Post-project slope.

6.5. Growth media trials

Throughout the Pilbara, there is an ongoing opportunity to utilise mineral waste as soil substitutes or supplements for rehabilitation activities. It is anticipated that alternative growth media (AGM) will provide a suitable growth medium in rehabilitation areas where topsoil and subsoil are unavailable or limited. Research is underway to determine if utilising various types of AGM in various situation will provide acceptable rehabilitation outcomes.

When a waste type is identified as potentially suitable as an AGM, testing for standard parameters occurs, and then stockpiling will occur with relevant location information recorded on mine site survey records. Alternative growth media material has been previously identified and tested at Marandoo, Tom Price, Western Turner Syncline and Channar. Stockpiling of suitable material has commenced, with

additional investigations to incorporate materials into the mine plans for future recovery also underway. During 2017 the MMW4 rehabilitation project at Tom Price utilised S652 Gravels with monitoring of the rehabilitation showing positive trends and vegetation establishment. Monitoring progress of this area continued into 2020, and the materials are proposed for use at a future rehabilitation project at the MMS waste dump, tentatively planned for 2022 completion.

During 2019 a rehabilitation project, at the Brockman DP4 waste dump, had different ages of topsoil, subsoil and no soil incorporated into the design (Figure 54). The aim of the trial was to evaluate the performance of the soil materials, and to consider modifying the seed mix to better reflect the growth media. The rehabilitation of this area was completed in early 2020 and monitoring of its performance will be undertaken to provide a comparison of revegetation performance using fresh topsoil, stockpiled topsoil or subsoil.



Figure 54: Soil and alternative growth media trial design at the Brockman 4 DP1 and DP4 projects.

6.6. Mycorrhizal fungi trials at Middle Robe legacy rehabilitation sites

In 2020, a rehabilitation project targeting legacy areas was undertaken, which provided an opportunity to investigate the use of mycorrhizal fungi on rehabilitation performance. Most native Australian flora have a relationship with mycorrhizal fungi, which are often eradicated during heavy disturbance events. There is evidence that inoculating soil with a variety of mycorrhizae fungi will improve plant survivability and germination (Koziol et al., 2018). There is also evidence that mycorrhizae fungi may assist some native species to establish that otherwise wouldn't through traditional rehabilitation methods (Jeffries et al., 2003).

In the Middle Robe project, seed was coated in powder form mycorrhizae fungi for several trial areas (Figure 55). The expectation is that when moisture is encountered, the mycorrhizae will propagate and expand into the surrounding soil, inhabiting the new plants roots and assisting with plant nutrient uptake. The trial areas were incorporated into the 2021 monitoring program and will therefore enable control and trial data to be collection and analysed through time.



Figure 55: Mycorrhizal fungi trial areas.

7. PLANNED STRATEGIC PROJECTS

The Rehabilitation and Closure team facilitates a quarterly regulator forum. It is intended that this forum is utilised for ongoing updates on the:

- Annual progressive rehabilitation program.
- Research and development.
- Strategic improvement projects.

7.1. Rehabilitation performance and completion criteria development

A Rehabilitation performance and improvement framework incorporating a plan, do, check and act (PDCA) cycle to centralise and improve the management and communication of rehabilitation performance status, learnings, remediation requirements, risks, knowledge gaps and associated actions is a planned initiative for 2022.

In association with this initiative, a strategic project to review both the current monitoring programme methodology and available rehabilitation monitoring data to develop a standardised method to develop suitable SMART completion criteria for all operations is also scheduled for development in 2022. The development of quantitative completion criteria will then follow with a prioritisation for those assets approaching closure.

This has already occurred at Eastern Range and Channar and the completion criteria have been submitted with the MCP to regulators. Pending regulator feedback will be utilised for the alignment of the development process.

An associated outcome of this strategic work will be a defined procedure for the determination of when and where remedial works are required for rehabilitated sites where performance is not tracking towards acceptable performance criteria.

7.2. Seed strategic plan

If seed is not of a sufficient quantity, type and/or quality, the rehabilitation performance of implemented works will not meet agreed completion criteria to the satisfaction of stakeholders. Therefore, a strategic project will be undertaken to ensure suitable seed species and volumes are available to meet increasing rehabilitation outputs through to 2027 and beyond. The integration of Traditional Owner businesses into the seed supply chain will also be investigated.

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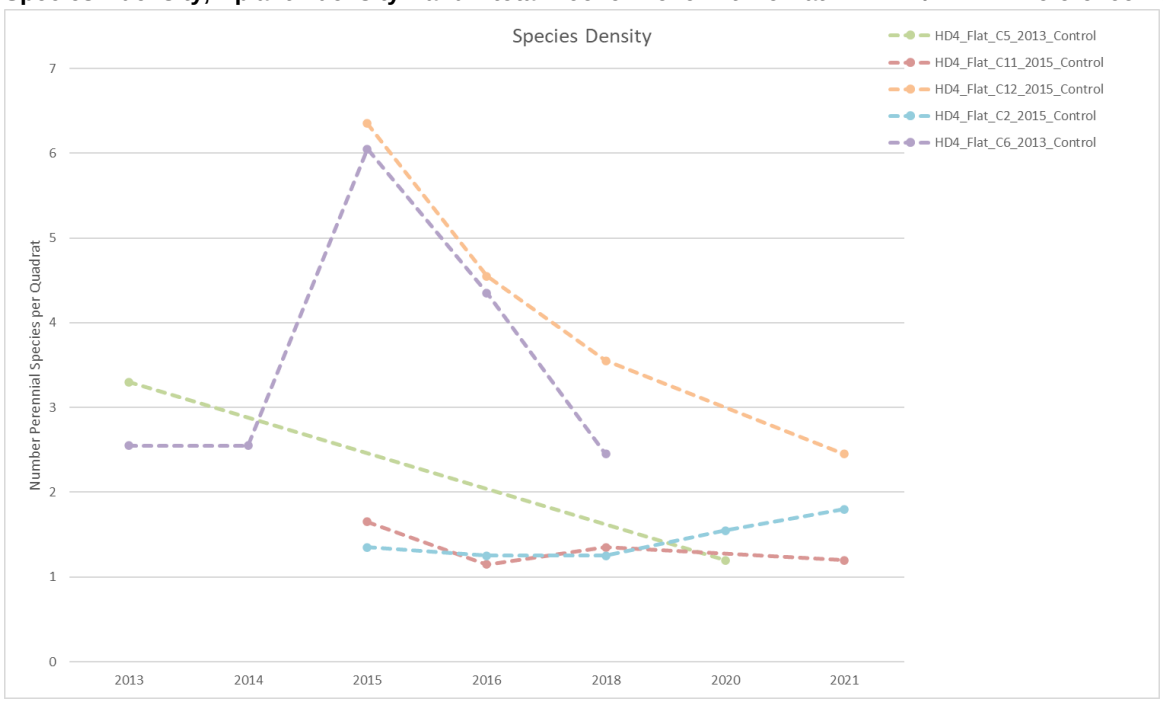
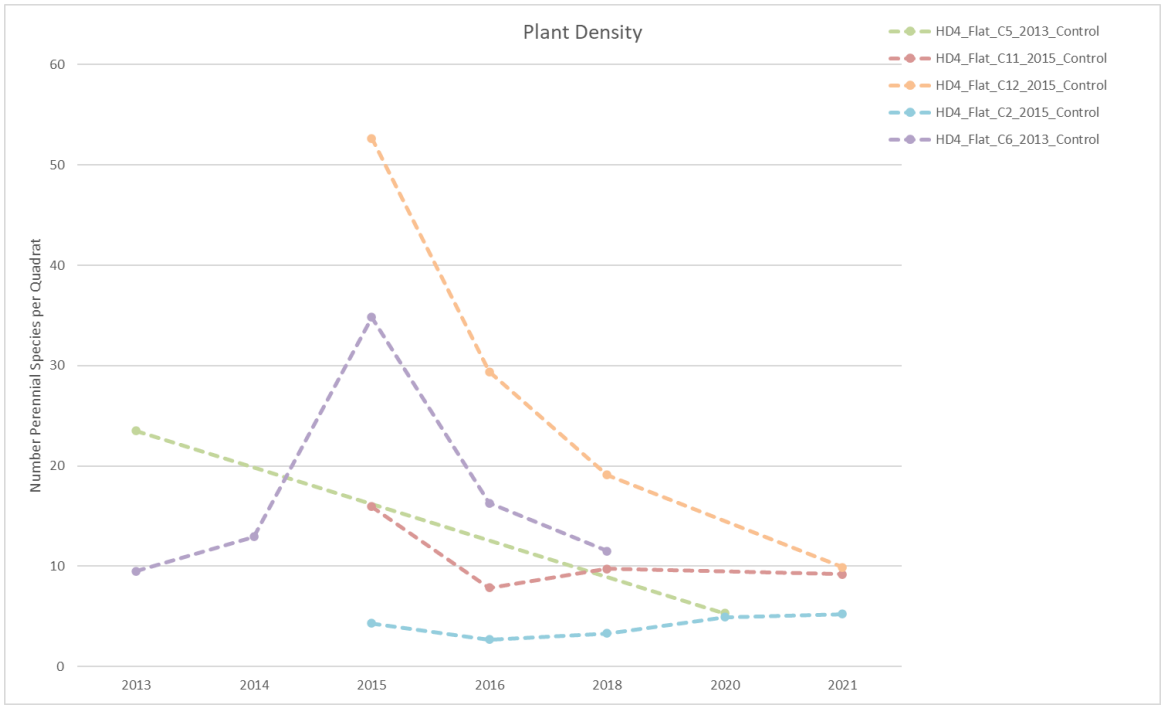
APPENDIX A: REHABILITATION MONITORING SCHEDULES

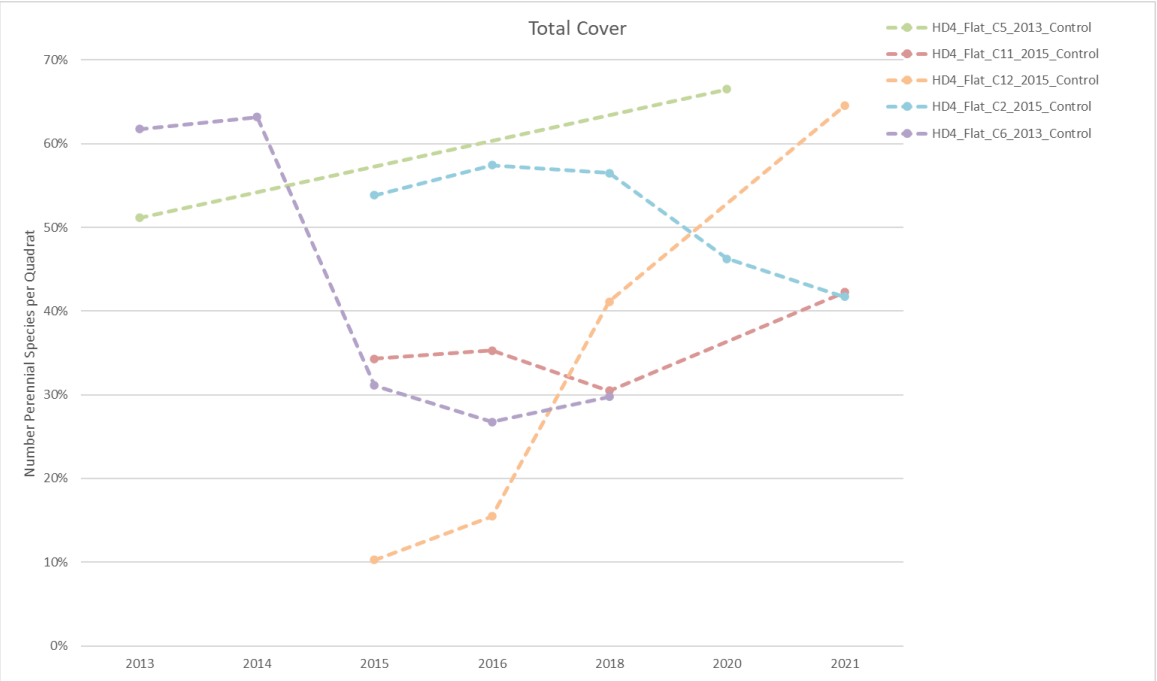
REHABILITATION SITE	MONITORING EVENTS CONDUCTED					
	1st	**2nd**	**3rd**	**4th**	**5th**	**Next Scheduled**
HD4 Railway	2014 *(All transects)*	2015 *(All transects)*	2016 *(Excluding LHRX_T13 and T14)*	2018 *(Excluding LHRX_T13 and T14)*	2020 *(Only LHRX_T1-T5)*	2023
HD4 Mine Access Road, Camp and Mine	2014	2015	2016	2018	2020	2023
HD4 Dewatering Pipeline	2015	2016	2018	2021	-	2024
HD4 Powerline	2014	2015	2016	2018	2020	2023
HD1 Old Landfill	2015	2016	2017	-	-	*None as site was destroyed*
YAN Landfill (YL3 and YL4)	2019	2020	2021	-	-	2023
YAN Central WD	2016	2017	2018	2020	-	2022
YAN Rubber Dump	2014	2016	2020	-	-	2023
WAN East and South WD	2013	2014	2015	2017	2019	2022

APPENDIX B: SUPPLEMENTARY REFERENCE SITE DATA

Species density, plant density and total cover over time at HD4 / HD1 reference sites







Discussion

Flat_C12 trajectories do not seem to align with the period of supposed burning (between 2016 and 2018 monitoring assessments). High densities are usually recorded in the year following fire, yet Flat_C12's highest plant and density values were recorded in 2015. Additionally, no loss of cover was recorded during the entire monitoring period, with the steepest rate of increase recorded between the 2016 and 2018 monitoring events (when transect was documented as burnt). A 2017 monitoring assessment may have provided further insights into the atypical trends observed post-fire in Flat_C12, for example, the occurrence of an immediate and short-term post-fire decrease in cover that was not evident in 2018 due to quick regrowth at the transect.

The trends observed in Flat_C6 better align with expected post-fire trajectories, evident by initial increases in density values succeeded by relatively inversely proportional declines, and a sharp decline preceding stabilisation of total cover 1-2 years post-burn. Notably, if only 2014 and 2016 Flat_C6 data is considered (likening it to Flat_C12's monitoring schedule) the resulting trajectories circumvent the originally observed density increases and successive decreases which are characteristic of post-fire vegetation communities.

The high cover but low plant and species density values recorded over the duration of monitoring in Flat_C2 suggests a dominance of one or a few species, which is not a good target for rehabilitation due to less diversity and subsequently, less resilience. Although, consistently low values were recorded at the transect, the stable trajectory provides, to some extent, a base reference of minimal values for rehabilitation.

The linear trajectories observed for Flat_C5 are a result of only two monitoring events taking place at the transect and do not reflect how density and cover parameters behave over time (evident through comparison with consistently monitored transects).

Selected HD1 and HD4 reference sites for this Summary

The most recent rehabilitation monitoring reports for Hope Downs 1 Old Landfill, Hope Downs 4 Railway and Powerline, Mine Access Road, Camp and Mine borrow pits, and the WFSF borrow pits use topographically flat reference sites Flat_C2 and Flat_C5 for comparative analyses. Flat_C5 was first monitored in 2013 and again in 2020 with significant differences observed for each vegetation parameter, resulting in linear trends that do not accurately reflect how vegetation parameters fluctuate or develop over time (see above for graphs which demonstrate this). Meaningful comparisons to the

rehabilitated sites cannot be made without intermediate data for Flat_C5. For this reason and the fact that it is categorised as 'inactive' within Rio's monitoring schedule, it has been excluded from comparative analyses. The initial Flat_C2 site (HD4_Flat_C2_2013_Control) was destroyed after the 2014 assessment, with a replacement site (HD4_Flat_C2_2015_Control) established in 2015 but not used until 2018. For the purposes of this Summary the abbreviated site name 'Flat_C2' refers only to the 2015 site.

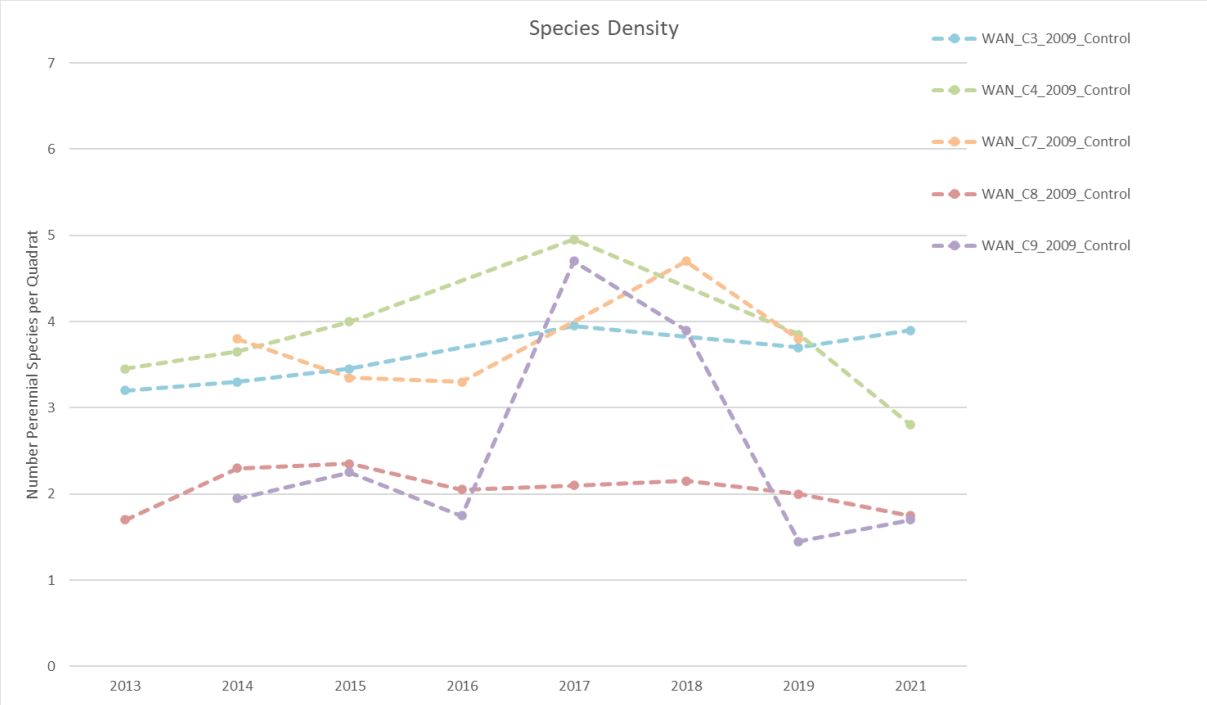
Rehabilitation at the Dewatering Pipeline was compared to two reference sites on flat terrain, Flat_C11 and Flat_12, which were also used in 2015 and 2016 for the HD4 Railway and Powerline, and HD4 Mine Access Road Mine and Camp borrow pits (see table below for an overview of reference site selection at HD4 and HD1 for each monitoring year).

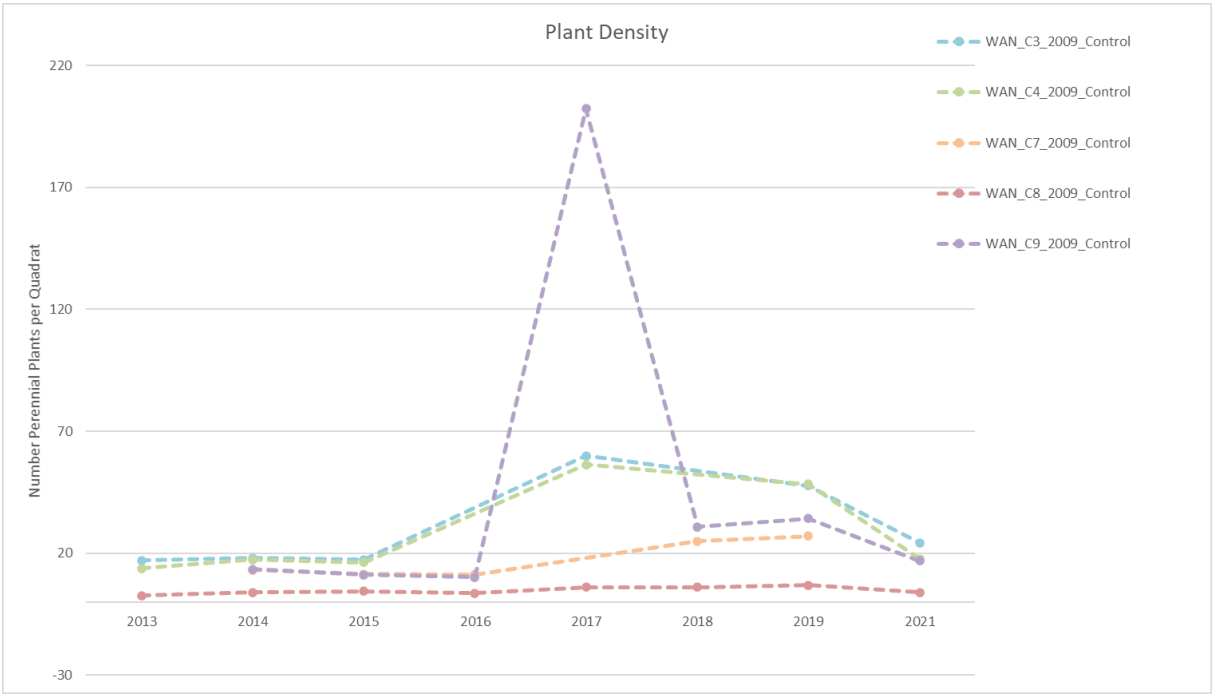
Given the poor suitability of Flat_C2 as a reference site, Flat_C11 and 12 have been included for comparative analyses of HD4 moderate impact disturbance sites. For rehabilitation preceding 2016 Flat_C6 is also used, as some comparative value is retained despite the site being burnt between the 2014 and 2015 assessments. Variations in vegetation parameters resulting from the impacts of fire were taken into consideration for all burnt reference sites. Further justification for inclusion of burnt reference sites is provided in the West Angelas reference sites discussion.

Rehabilitation site	Reference sites used in monitoring reports					Reference sites used in this Summary
HD4 Railway and Powerline	**2014**: Unknown (report unavailable at time of writing)	**2015:** 2013_HD4_Flat_C2 2013_HD4_Flat_C6 2015_HD4_Flat_C11 2015_HD4_Flat_C12 C8 (HD1) C9 (HD1)	**2016:** 2013_HD4_Flat_C2 2013_HD4_Flat_C6 2015_HD4_Flat_C11 2015_HD4_Flat_C12 C8 (HD1) C9 (HD1)	**2018** HD4_Flat_C2_2015_Control HD4_Flat_C6_2013_Control	**2020:** HD4_Flat_C2_2015_Control HD4_Flat_C5_2013_Control	2013_HD4_Flat_C2 2013_HD4_Flat_C6 2015_HD4_Flat_C11 2015_HD4_Flat_C12
HD4 Mine Access Road, Camp and Mine borrow pits	**2014:** Unknown (report unavailable at time of writing)	**2015:** 2013_HD4_Flat_C2 2013_HD4_Flat_C6 2015_HD4_Flat_C11 2015_HD4_Flat_C12 C8 (HD1) C9 (HD1)	**2016:** 2013_HD4_Flat_C2 2013_HD4_Flat_C6 2015_HD4_Flat_C11 2015_HD4_Flat_C12 C8 (HD1) C9 (HD1)	**2018:** HD4_Flat_C2_2015_Control HD4_Flat_C6_2013_Control	**2020** HD4_Flat_C2_2015_Control HD4_Flat_C5_2013_Control	2013_HD4_Flat_C2 2013_HD4_Flat_C6 2015_HD4_Flat_C11 2015_HD4_Flat_C12
HD4 WFSF Borrow Pit	**2020:** HD4_Flat_C2_2015_Control HD4_Flat_C5_2013_Control		**2021:** Unknown (report unavailable at time of writing)			HD4_Flat_C2_2015_Control 2015_HD4_Flat_C11 2015_HD4_Flat_C12
HD4 Dewatering Pipeline	**2015:** 2013_HD4_Flat_C2 2013_HD4_Flat_C6	**2016:** 2013_HD4_Flat_C2 2013_HD4_Flat_C6	**2018:** HD4_Flat_C11_2015_Control	**2021:** Unknown (report unavailable at time of writing)		HD4_Flat_C11_2015_Control HD4_Flat_C12_2015_Control

Rehabilitation site	Reference sites used in monitoring reports				Reference sites used in this Summary
	2015_HD4_Flat_C11 2015_HD4_Flat_C12 C8 (HD1) C9 (HD1)	2015_HD4_Flat_C11 2015_HD4_Flat_C12 C8 (HD1) C9 (HD1)	HD4_Flat_C12_2015_Control		
HD1 Old Landfill	**2014:** Unknown (report unavailable at time of writing)	**2017:** Unknown (report unavailable at time of writing)	**2020:** HD4_Flat_C2_2015_Control HD4_Flat_C5_2013_Control		HD4_Flat_C2_2015_Control

Species density, plant density and total cover over time at West Angelas reference sites







Discussion

The 2017 and 2019 monitoring reports compare rehabilitation on the East and South Waste Dumps to four reference sites: C3, C4, C8 and C9, with an additional reference site C7 used for the 2015 and 2014 assessments. Reference sites C3 and C4 were entirely burnt between the 2015 and 2017 monitoring surveys, while C9 was largely burnt (90% of quadrats) between the 2016 and 2017 monitoring surveys. Fire also impacted reference site C7 (between 2017 and 2018) and C8 had not been burnt since monitoring began in 2013 but was affected by fire in 2011/12. Photos depicting the effects of fire on the vegetation at each site are provided in Appendix C.

Monitoring reports refer to C8 as the “unburnt reference site”, using the observed trends (when significant variations between other reference sites exist) to confirm rehabilitation quadrat data is within the reference range. The use of C8 as an ‘unburnt reference’ lacks viability due to early reports recording

considerably low plant density and total cover, consistent with the site being burnt in 2011/12. Sites with low counts for native species and low total cover (relative to other reference sites) do not provide appropriate data for quantitative targets and may distort the accompanying analyses. This was recognized within the 2013 and 2014 monitoring reports, where the low plant density and low total cover recorded at C8 skewed the results of the significance of variance analysis. The site still holds comparative value, but not as an unburnt reference, and any parallel trends observed at the rehabilitation transects should be assessed in consideration of potential long-term post-fire alterations of vegetation parameters.

Yandicoogina reference sites overview

Yandicoogina Landfill rehabilitation was compared to two reference sites, YAN_C6 and YAN_C9, classified as mid slope and flat lower slope, respectively. YAN_C6 comprises hummock grassland of *Triodia basedowii* and *Triodia wiseana*, with *Eucalyptus gamophylla* and *Acacia* spp., present on mid slopes. The flat terrain of YAN_C9 also exhibits hummock grassland but comprises *Triodia pungens* with *Eucalyptus gamophylla*, *Eucalyptus xerothermica*, and *Acacia* spp.

Both sites were impacted by fire prior to the 2017 assessment and the subsequent alterations in vegetation structure and composition were taken into consideration for this Summary. Appendix C provides a visual example of post-fire secondary succession states at the Yandicoogina reference sites.

APPENDIX C: SUPPLEMENTARY PHOTOS

Yandicoogina reference sites pre and post-fire



YAN_C6 – End of transect 2014 *(pre-fire)*



YAN_C6 – End of transect 2017 *(<1-year post-fire)*



YAN_C6 – End of transect 2020 *(Approx. 3 years post-fire)*



YAN_C9 – End of transect 2014 *(pre-fire)*



YAN_C9 – End of transect 2017 *(<1-year post-fire)*



YAN_C9 – End of transect 2020 *Approx. 3 years post-fire)*

West Angelas reference sites



WA_C7 – Start of transect 2014



WA_C7 – Start of transect 2018



WA_C8 – Start of transect 2013



WA_C8 – Start of transect 2018



WA_C9 – End of transect 2014



WA_C9 – End of transect 2018



WA_C3 – End of transect 2013



WA_C3 – End of transect 2017



WA_C4 – End of transect 2013



WA_C4 – End of transect 2017

Hope Downs 1 and 4



HD4_Flat_C2 – Start of transect 2014



HD4_Flat_C2 – Start of transect 2018



HD4_Flat_C2 – End of transect 2014



HD4_Flat_C2 – End of transect 2018

Burnt rehabilitation transect HD2_LHRX_T5



HD2_LHRX_T5 – End of transect 2014 *(pre-fire)*



HD2_LHRX_T5 – End of transect 2016 *(0-1-year pre-fire)*



HD2_LHRX_T5 – End of transect 2018 *(2-3-years post-fire)*

G.2: Draft Hope Downs 2 Impact Reconciliation Procedure

Impact Reconciliation Procedure (Offsets)

Hamersley HMS Pty Ltd

Hope Downs 2

DRAFT

November 2023

RTIO-0957953

Hamersley HMS Pty Ltd
152-158 St Georges Terrace, Perth
GPO Box A42, Perth, WA 6837

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Appendix 6: Proposal MS Offset Areas

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Appendix 7-2: Proposal EPBC Offset Areas – Ghost Bat

Appendix 7-3: Proposal EPBC Offset Areas – Pilbara Leaf-nosed Bat

Appendix 7-4: Proposal EPBC Offset Areas – Total

Appendix 8: Vegetation Condition Mapping References

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1 THE PROPOSAL AND CONDITION REQUIREMENTS

1.1 The Proposal

This Hope Downs 2 Impact Reconciliation Procedure (IRP) has been prepared in accordance with the Western Australian Department of Water and Environmental Regulation's (DWER) requirements relating to offset reconciliation for the Hope Downs 2 Proposal (the Proposal). The Proposal is currently subject to assessment under Part IV of the *Environmental Protection Act 1986* (EP Act) Assessment Number 2316, and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Assessment 2021/9035, as an accredited assessment.

This IRP addresses both State and Commonwealth offset requirements. Rio Tinto on behalf of Hamersley HMS Pty Ltd (the Proponent) intends to seek the Department of Climate Change, Energy, the Environment and Water's (DCCEEW) approval to utilise the WA Pilbara Environmental Offset Fund (PEOF), as the nominated 'Conservation Offset Fund', to meet EPBC Act Decision Notice offset requirements.

1.2 Ministerial Statement and Commonwealth approval condition requirements

Conditions from Ministerial Statement XXXX (State) and Decision Notice 2021/9035 (Commonwealth) relevant to offsets for the Proposal are included in Table A 1 and Table A 2 respectively of Appendix 1.

2 PROCEDURE

The methodology for determining the baseline and offset contributions to deliver an outcome that aligns with DWER's IRPs and Impact Reconciliation Reports (IRRs) is detailed below. Content of both IRPs and IRRs is outlined in Section 3.2.

2.1 Identification of environmental values requiring offsets

Ministerial Statement XXXX and Decision Notice 2021/9035 include conditions that require the Proponent to offset the residual significant impact of the Proposal including clearing of 'good to excellent' condition native vegetation and high local significance vegetation, moderate significance critical supporting (foraging and dispersal) habitat and high significance critical (roosting and breeding) habitat in the Hamersley Interim Biogeographic Regionalisation for Australia (IBRA) subregion.

Ministerial Statement XXXX and Decision Notice 2021/9035 specify the biodiversity values listed in Table 1 below and associated offset rates.

Table 1: Environmental Values Requiring Offsets for the Proposal

Biodiversity Value		Offset rate ($/ha)[1] (excl. GST)
State (WA) Ministerial Statement XXXX (Placeholder values subject to offset conditions		
[Cond #]	[condition]	$TBC
EPBC Decision Notice 2021/9035 (Placeholder values subject to offset conditions		
TBC	[TBC]	$TBC

2.1.1 Vegetation Condition

To support approval processes for the Proposal, baseline flora and vegetation surveys were conducted, identifying native vegetation types and condition in the proposed Development Envelope. Details of the surveys, including the time they were undertaken, are provided in Appendix 8. The 'CondDate' attribute in the

[1] Base rate provided in Ministerial Statement XXXX and Decision Notice 2021/9035, to be adjusted annually in accordance with the average percentage change in the Perth Consumer Price Index (CPI) applicable for the calendar year that disturbance occurred.

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data standard reflects the date that the vegetation survey occurred. Where vegetation surveys occurred over a period of time, the most recent date has been used.

At the time of the surveys botanists recorded the condition of the vegetation based on Trudgen's (1991) Vegetation Condition Index[2]. This data was then digitised and logged in the Rio Tinto (the Company) central GIS system. Note that all clearing conducted (at the time of the IRP submission) prior to the Proposal's approval has been assigned a vegetation condition of 'Cleared' in the offset exempt footprints, completely degraded in vegetation condition data and has been removed from environmentally significant values area data. A reconciliation of offset exempt clearing conducted between submission of the IRP and commencement of the Proposal will be documented in the first IRR, as per Section 4.

Where fire has occurred, the vegetation condition was extrapolated from surrounding unburnt vegetation assuming that the area will regenerate over time.

2.1.2 Footprint Attribution

Aerial ortho or satellite imagery encompassing the proposed Development Envelope is taken as close to the Proposal's approval time as practicable and aligning with the Proponent's existing flyover schedules. Where required, ground survey and truthing practices may also be used to supplement the imagery.

Cleared areas are identified and digitised according to an internal data standard using the Company's GIS package. The 'CondDate' attribute in the data standard reflects the end of the reporting period as the vegetation was cleared, up to the date of commencement of action under the current Ministerial Statement (MS) or, if a prior MS was superseded during the report period, the date the prior MS was superseded.

Whilst IRRs are required to be submitted biennially (refer to Table 4 for timing), footprints for each environmental value and EPBC protected matters will be created annually.

2.2 Method to determine impacts

2.2.1 Footprint attribution

Aerial ortho or satellite imagery encompassing the proposed Development Envelope is taken as close to the end of the reporting period as practicable and aligning with the Company's existing flyover schedules. Where available, ground survey and truthing practices may also be used to supplement the imagery.

Although IRR's are submitted biennially (refer to Table 4 for timing), footprints for each environmental value and EPBC protected matters will be created annually.

The previous annual footprint, or baseline footprint if first reporting year, is overlaid on the report period image to identify new clearing and rehabilitation activities and/or changes in ground condition and land use. These areas are then digitised and attributed in a similar process to that outlined in Section 2.1.2 above, in the Company's GIS package, to the Company's relevant data standards.

2.2.2 Offset contribution determination

Once the cleared footprint has been updated and finalised, data from the Company's internal data standard is consolidated and translated into the required DWER data standards.

For MS: Footprints attributed to the current MS are overlaid against baseline layers for vegetation condition, type and areas of significant environment value that have been identified as requiring offset. The offset contribution is determined where the footprint and offset applicable areas intersect.

For EPBC Act Decision Notice: Footprints attributed to the EPBC Act approval, after impacts commenced, will incur offset requirements (footprints prior to impacts commencing under the EPBC Act approval will be attributed to a MS or other clearing mechanism).

For areas that are offset applicable under both the State and Commonwealth approvals, the offset will be paid once only, at the highest applicable rate (i.e., no overlap between MS and EPBC Act approval offset payable layers) (Refer to Table 2 and Table 3).

Data and supporting spatial files will be submitted biennially in the IRRs, refer to Section 3.2.2 and Table 4 for details of IRR content and reporting period and frequency of the IRRs.

[2] Trudgen, M.E. (1991) *Vegetation Condition Scale. In: National Trust (WA) 1993 Urban Bushland Policy*. National Trust of Australia (WA). Wildflower Society of Western Australia (Inc.) and the Tree Society (Inc.), Perth, Western Australia.

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Where a previous and current MS (for the same Proposal) both have offset conditions over a common overlapping area, offset applicable clearing under both MS's will be subject to the requirements and rates of the newest MS, unless otherwise specified[3].

The increase in the amount to be paid per hectare cleared in respect of the year in which clearing occurred will be calculated by application of the Perth Consumer Price Index (CPI) and paid as specified in the approval conditions.

Following the determination of offset liability, the Company will source the appropriate funds annually, aligning with internal accounting processes. Following submission and approval of IRRs (biennial), DWER will issue an invoice, which the Company will pay by transferring the required funds into the prescribed fund. The Company will submit evidence of each payment made to the prescribed fund to DCCEEW within 10 business days of the date of making the payment.

To meet the requirements of the EPBC Act Offsets Policy, an initial contribution of 10% of the total calculated offset contribution for matters of national environmental significance (MNES) values is required to be paid into the PEOF prior to the commencement of the Action (see Table 3 for estimated contribution calculations). Since the initial payment is made prior to impacts commencing, this amount will be subtracted from the subsequent offsets payable prior to CPI adjustments being applied until the full 10% has been accounted for, with CPI then applied only to any remaining amount owing for that period.

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[3] Noting, the Proposal is not subject to a previously approved Ministerial Statement so this requirement is not applicable in this instance however, due to overlap other Ministerial Statements (MSs), relevant offset rates will apply in line with the scope approved under each Proposal's MS.

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Table 2: EP Act Offset - estimated contribution calculation into the PEOF

EP Act Environmental Value to be Offset	Amount of Area to be offset in ha(s)	Protected Matter Value Rating Category	Environmental Value Justification	IBRA Subregion	Estimated Offset Rate Documented ($/ha) [4]	Total to be Offset
Good – Excellent condition native vegetation	1,471	Good – Excellent condition native vegetation	Clearing of good to excellent condition native vegetation (which does not overlap significant EPBC fauna habitat)	Hamersley	$890	$1,309,524
High local significance vegetation	31	High significance vegetation	Clearing of high local significance vegetation (D4 and H2)	Hamersley	$1,653	$51,243
Total amount for the Proposal into the PEOF (State requirement)						**$1,360,767**

[4] Estimated offset rates calculated on the 2021/22 financial year (excluding GST). Real value of contributions will be maintained through indexation to the Perth Consumer Price Index (CPI), with the first adjustment to be applied to the first contribution

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Table 3: EPBC Act Offset - estimated contribution calculation into the PEOF

EPBC Act Protected Matter to be Offset	Amount of Area to be offset in ha(s)	Protected Matter Value Rating Category	Environmental Value Justification	IBRA Subregion	Estimated Offset Rate Documented ($/ha) [5]	Total to be Offset
Critical habitat (denning, roosting, shelter and breeding)	105	*Critical* habitat (denning, roosting, shelter and breeding) for MNES species: Northern Quoll, Ghost Bat and Pilbara Olive Python[6]	Clearing of critical habitat (breeding, denning, shelter and roosting (high significance) habitat) comprising: • Breakaway; and • Gorge/Gully	Hamersley	$3,306	$347,130
Supporting habitat (foraging and dispersal)	2,659	*Supporting* habitat (foraging and dispersal) for: • Northern Quoll – Minor Drainage and Rocky Hills (within 1 km of Northern Quoll records), • Ghost Bat – all habitat within 12 km of Category 1 and 2 roosts (other than Critical habitat) • Pilbara Leaf-nosed Bat – all habitat within 20 m of Category 4 roosts (other than Critical habitat)	Clearing of supporting habitat (foraging and dispersal habitat) comprising: • Minor Drainage • Rocky Hill • Alluvial Plain • Low Hills and Slopes • Mulga Woodland; and • Stony Plain	Hamersley	$1,653	$4,395,684
Total amount for the Proposal into the PEOF (EPBC Act Requirement)						**$4,742,814**
Initial estimated contribution into the PEOF (Commonwealth requirement, 10% of the overall EPBC Act offset contribution)						**$474,281**

[5] Estimated offset rates calculated on the 2021/22 financial year (excluding GST). Real value of contributions will be maintained through indexation to the Perth Consumer Price Index (CPI), with the first adjustment to be applied to the first contribution

[6] No known records of Pilbara Olive Python have been identified within the Development Envelope. The Proponent has applied a conservative approach in limiting clearing of potential Critical habitat (i.e. Gorge/Gully and Breakaway habitat)

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3 REPORTING

3.1 Frequency and timing

The reporting schedule for IRP and IRR submission for the first three periods is outlined below in Table 4. It will be extrapolated and implemented until the end of the period of effect of the approval or as otherwise agreed to by DWER and the Australian Government Minister for the Environment.

Table 4: Proposed reporting period and frequency of the Impact Reconciliation Reports

Biennial period	Action	Timing
	Ministerial Statement issued	DD Month Year
	Decision Notice issued	DD Month Year
	Proposal implementation commenced	[Year 1]
	Initial EPBC Act payment	Prior to or upon commencement of the Action
	Submit evidence of initial payment to the DCCEEW	Within 10 business days of receipt of payment
Period 1	First biennial reporting period	From the commencement of the action to 31 December [Year 2]
	Aerial survey/ground-truthing	As close to 31 December as practicable
	IRR submission	30 April [Year 3]
	Submit evidence of payment into PEOF account to the DCCEEW	Within 10 business days of receipt of payment
Period 2	Second biennial reporting period	1 January [Year 3] – 31 December [Year 4]
	IRR submission	30 April [Year 5]
	Submit evidence of payment into PEOF account to the DCCEEW	Within 10 business days of receipt of payment
Period 3	Third biennial reporting period	1 January [Year 5] – 31 December [Year 6]
	IRR submission	30 April [Year 7]
	Submit evidence of payment into PEOF account to the DCCEEW	Within 10 business days of receipt of payment
Final Period	Final reporting period	1 January [Year X] – 31 December [Year X]
	Final IRR submission	30 April of Year after final reporting period
	Submit evidence of payment into PEOF account to the DCCEEW	Within 10 business days of receipt of payment

3.2 Content

Commercially sensitive information within spatial data and aerial imagery in both Baseline and IRRs will be considered when completing required metadata and licensing statements (provided separately).

3.2.1 Baseline

The Baseline package will contain three components:

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1. IRP – this document.
2. Aerial imagery clipped to the proposed Development Envelope boundary and taken as close to the commencement of the approval as practicable, with an index providing date of capture for each image compiling the full composite.
3. Spatial data to support the above procedure. At a minimum, spatial data will meet the following:

    - be topographically accurate and georeferenced;
    - use GDA2020 (datum) co-ordinate system and projected into the appropriate Map Grid of Australia zone (i.e., 50);
    - include closed polygons and clipped to the relevant approval boundaries (any topology errors rectified);
    - be supplied in ESRI geodatabase format or shapefile;
    - be aligned with and attributed according to DWER's GIS Data Standards;
    - polygons of similar 'purpose' shall not overlap (i.e., clearing polygons shall not overlap, vegetation type and condition polygons shall not overlap, and exemption polygons shall not overlap);
    - all clearing data will be supplied to two decimal places in attributable tables.

    Spatial data and layers shall include:

    - Spatial boundaries including:
        - Development Envelopes *(Current and overlapping Proponent MSs only, previous MSs not to be included)*;
        - Areas of Significance *(Environment Matters specified in MS and EPBC Act Decision Notice, prescribed in offset conditions) with areas already cleared at the time of IRP submission removed;*
    - Vegetation condition and type (1 consolidated polygon per condition and type), by IBRA region;
    - Offset exempt areas. Exemptions may include clearing associated with:
        - previous MS (1 consolidated polygon per MS) *(where areas are not subject to offsets);*[7]
        - overlapping MS where the proponent is a Rio Tinto Company (1 consolidated polygon per MS), by IBRA region;
        - MS-prescribed NVCPs (1 consolidated polygon) *(where MS prescribes NVCPs which contribute to the total Proposal clearing allocation),* by IBRA region;
        - other NVCP (1 consolidated polygon), all clearing attributed to NVCPs within the Proposal's Development Envelope, not prescribed by the MS, by IBRA region;
        - other clearing mechanism (1 consolidated polygon, by IBRA region) – may include:
            - Clearing authorised under an alternative approval mechanism (e.g., *Bush Fires Act 1954*, *Land Administration Act 1997*, Prescribed clearing under Regulation 5 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*). Note NVCP has been separated;
            - Clearing conduction prior to clearing legislation commencement;
            - Clearing not completed by the Proponent (where possible, information will be added within the notes section of the attribution table detailing the suspected cause of the impact).
        - Note: Exemptions related to clearing mechanisms applied at the Western Australian level do not apply to the EPBC Act approval, except for clearing not conducted by the Proponent.
    - Maps to support the above-mentioned spatial data.

[7] Noting, the Proposal is not subject to a previously approved Ministerial Statement, so this requirement is not applicable in this instance. However, due to overlap other Ministerial Statements (MSs), relevant offset rates will apply in line with the scope approved under each Proposal's MS.

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3.2.2 Impact Reconciliation Reports

IRR's will contain three components:

1. A biennial report specifying the annual area cleared (in hectares), and base and CPI adjusted rates for each offset applicable requirement outlined in the MS and EPBC Act approval as well as estimates of projected clearing for subsequent biennial periods. The report structure and content will be in accordance with an internal template which will be reviewed biennially to ensure alignment and consistency with DWER issued templates and guidance material. A final IRR will be submitted in the year after the final reporting period that includes the offset attributable clearing footprint that has occurred over the life of the approval.
2. Aerial imagery clipped to the relevant approval boundaries and taken as close to the end of the annual reporting periods as practicable, with an index providing date of capture of each image compiling the full composite.
3. Spatial data to support the above report. Both IRR and Baseline spatial data shall be used to inform the overall requirement for offsets for the action. At a minimum, spatial data will meet the following:
    - be topographically accurate and georeferenced;
    - use GDA2020 (datum) co-ordinate system and projected into the appropriate Map Grid of Australia zone (i.e., 50);
    - include closed polygons and clipped to the relevant approval boundaries (any topology errors rectified);
    - be supplied in ESRI geodatabase format or shapefile;
    - be aligned with and attributed according to DWER's GIS Data Standards;
    - polygons of similar 'purpose' shall not overlap (i.e., clearing polygons shall not overlap, vegetation type and condition polygons shall not overlap, and exemption polygons shall not overlap);
    - all clearing data will be supplied to two decimal places in the attribute tables.

    Spatial data and layers for both the MS and EPBC Act approval shall include:

    - Clearing activity:
        - all clearing undertaken for each calendar year of each biennial reporting period (1 polygon per year, per mechanism, per IBRA region);
        - offset payable clearing undertaken for each calendar year of each biennial reporting period (1 polygon per year, per rate, per mechanism);
        - updates to offset exempt areas (1 polygon for each previously submitted layer indicating changes).
    - Maps to support the above-mentioned spatial data.
    - Updated spatial layers if a change is required (refer to Section 4).

4 MANAGEMENT OF CHANGE

The Proponent recognises that due to the timing of new submissions, approval complexity and continued process and technology improvements, changes to submitted data may be required. For the below listed known changes, the Proponent will supply any updated data and support spatial files in the next IRR submission. Note that only the changed information will be provided, rather than the re-supply of the entire layer:

- offset exempt areas acknowledging that clearing will continue to occur between submission of baseline as part of pre-approval conditions (where required) and Proposal approval; and
- updated exempt areas as a result of continued clearing or until the previously approved offset-exempt clearing allocation has been exhausted.

For unforeseen changes, the Proponent will conduct an assessment of materiality and will initiate discussions with DWER and DCCEEW to determine an appropriate resolution strategy.

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5 APPENDICES

Appendix 1: PLACEHOLDER Proposed offset conditions that may apply to the Proposal

Table A 1 – EP Act Ministerial Statement XXX offset conditions that apply to the Proposal

PLACEHOLDER [placeholder until conditions are drafted. The values and associated rates are proposed to be offset in line with Table 1]

Condition Number	Condition Requirement
TBC	

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Table A 2 - EPBC Decision Notice 2021/9035 offset conditions that apply to the Proposed Action

PLACEHOLDER [placeholder until conditions are drafted. The values and associated rates are proposed to be offset in line with Table 1]

Condition Number	Condition Requirement
TBC	

DRAFT

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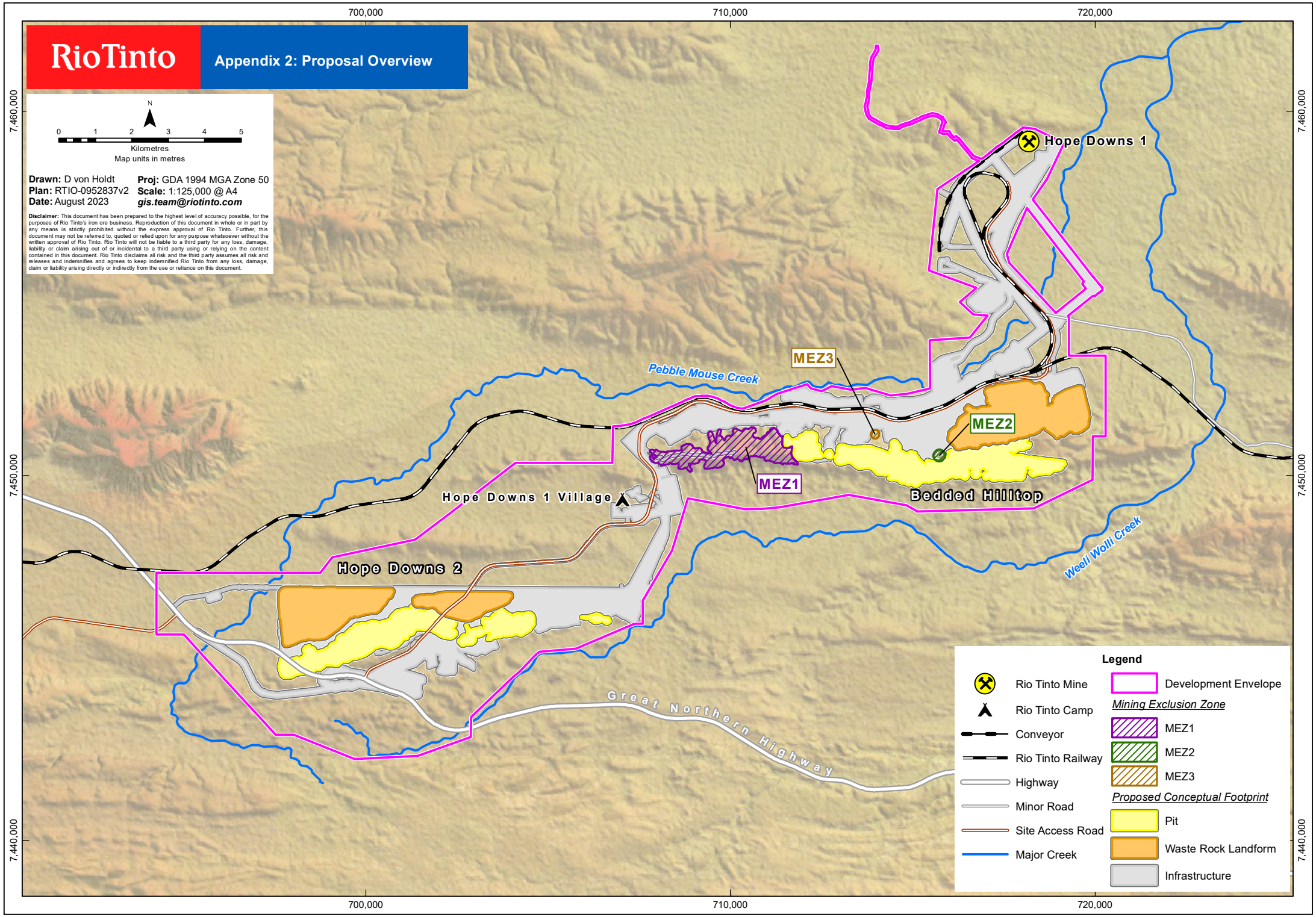
RioTinto
Appendix 2: Proposal Overview
N
0 1 2 3 4 5
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: RTIO-0952837v2
Date: August 2023
Proj: GDA 1994 MGA Zone 50
Scale: 1:125,000 @ A4
gis.team@riotinto.com
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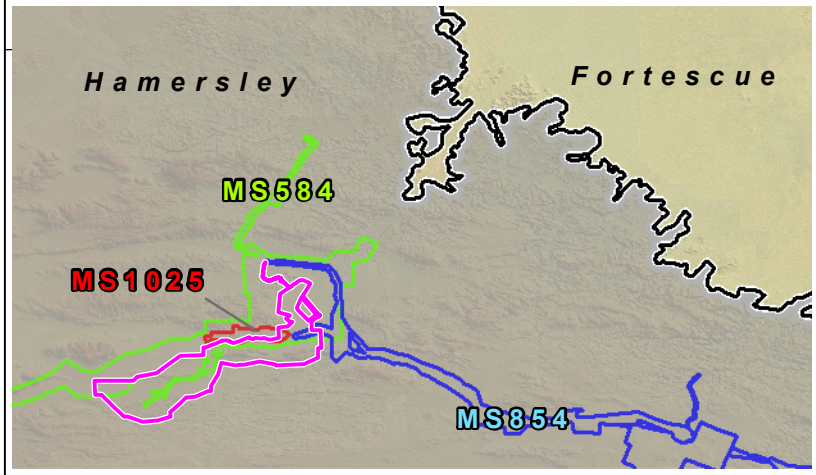
700,000
710,000
720,000
7,460,000
7,450,000
7,440,000
Hope Downs 1
MEZ3
MEZ2
MEZ1
Pebble Mouse Creek
Hope Downs 1 Village
Bedded Hilltop
Hope Downs 2
Weeli Wolli Creek
Great Northern Highway
Legend
Rio Tinto Mine
Rio Tinto Camp
Conveyor
Rio Tinto Railway
Highway
Minor Road
Site Access Road
Major Creek
Development Envelope
Mining Exclusion Zone
MEZ1
MEZ2
MEZ3
Proposed Conceptual Footprint
Pit
Waste Rock Landform
Infrastructure

Appendix 3: Proposal Overview and Current MS Approvals



700,000 710,000 720,000

7,460,000 7,450,000 7,440,000

Hope Downs 1

MS584

MS1025

MS854

Bedded Hilltop

Hope Downs 1 Village

Hamersley

Hope Downs 2

Great Northern Highway

N

0 1 2 3 4 5

Kilometres

Map units in metres

Drawn: D von Holdt
Plan: RTIO-0952838v2
Date: August 2023

Proj: GDA 1994 MGA Zone 50
Scale: 1:125,000 @ A4
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Legend

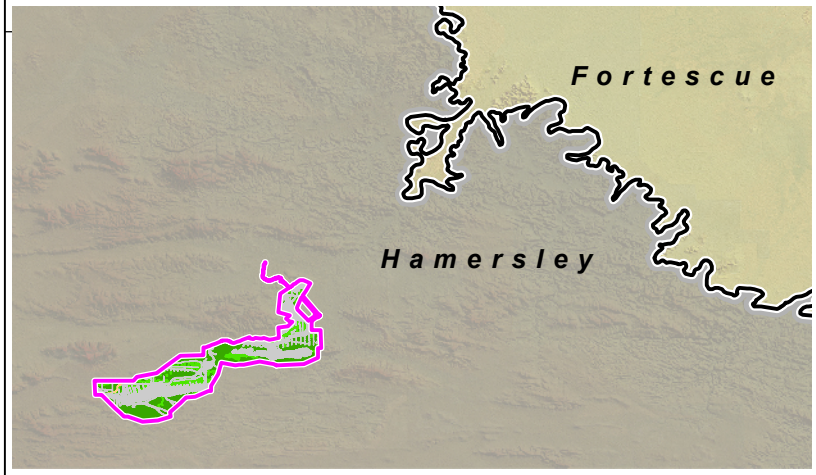
- Rio Tinto Mine
- Rio Tinto Camp
- Conveyor
- Rio Tinto Railway
- Highway
- Minor Road
- Site Access Road
- Development Envelope
- IBRA Subregion

Ministerial Statement

- MS1025
- MS854
- MS584

RioTinto

Appendix 4: Proposal Baseline Vegetation



N

0 1 2 3 4 5

Kilometres
Map units in metres

Drawn: D von Holdt
Plan: RTIO-0952839v3
Date: August 2023

Proj: GDA 1994 MGA Zone 50
Scale: 1:105,000 @ A4
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700,000 710,000 720,000

7,460,000

7,450,000

Hope Downs 1

Hamersley

Hope Downs 1 Village

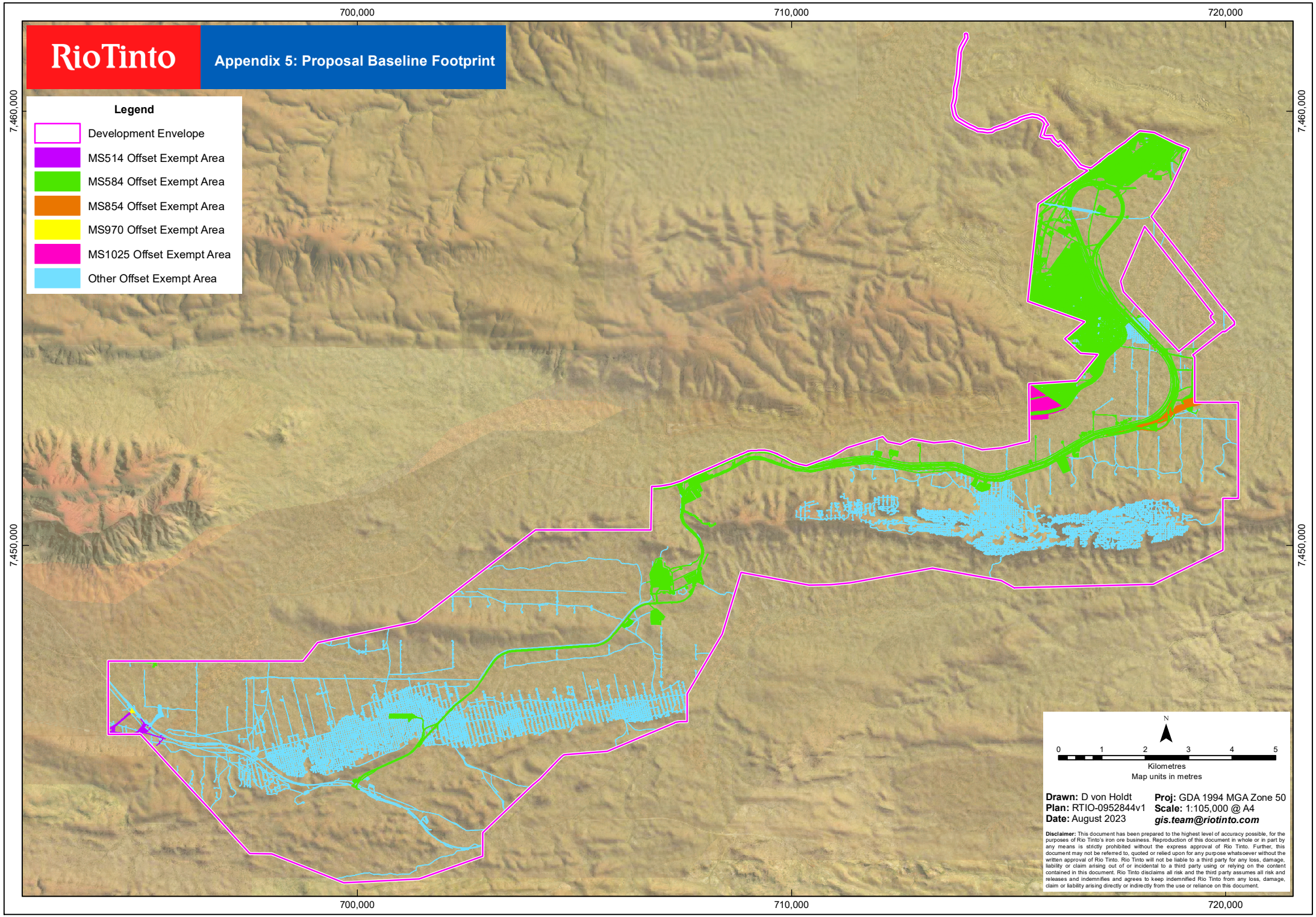
Great Northern Highway

Legend

- Rio Tinto Mine
- Rio Tinto Camp
- Conveyor
- Rio Tinto Railway
- Highway
- Minor Road
- Site Access Road
- Development Envelope
- IBRA Subregion

Vegetation Condition

- Excellent
- Very Good
- Good
- Completely Degraded


RioTinto
Appendix 5: Proposal Baseline Footprint
Legend
Development Envelope
MS514 Offset Exempt Area
MS584 Offset Exempt Area
MS854 Offset Exempt Area
MS970 Offset Exempt Area
MS1025 Offset Exempt Area
Other Offset Exempt Area
700,000
710,000
720,000
7,460,000
7,450,000
N
0 1 2 3 4 5
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: RTIO-0952844v1
Date: August 2023
Proj: GDA 1994 MGA Zone 50
Scale: 1:105,000 @ A4
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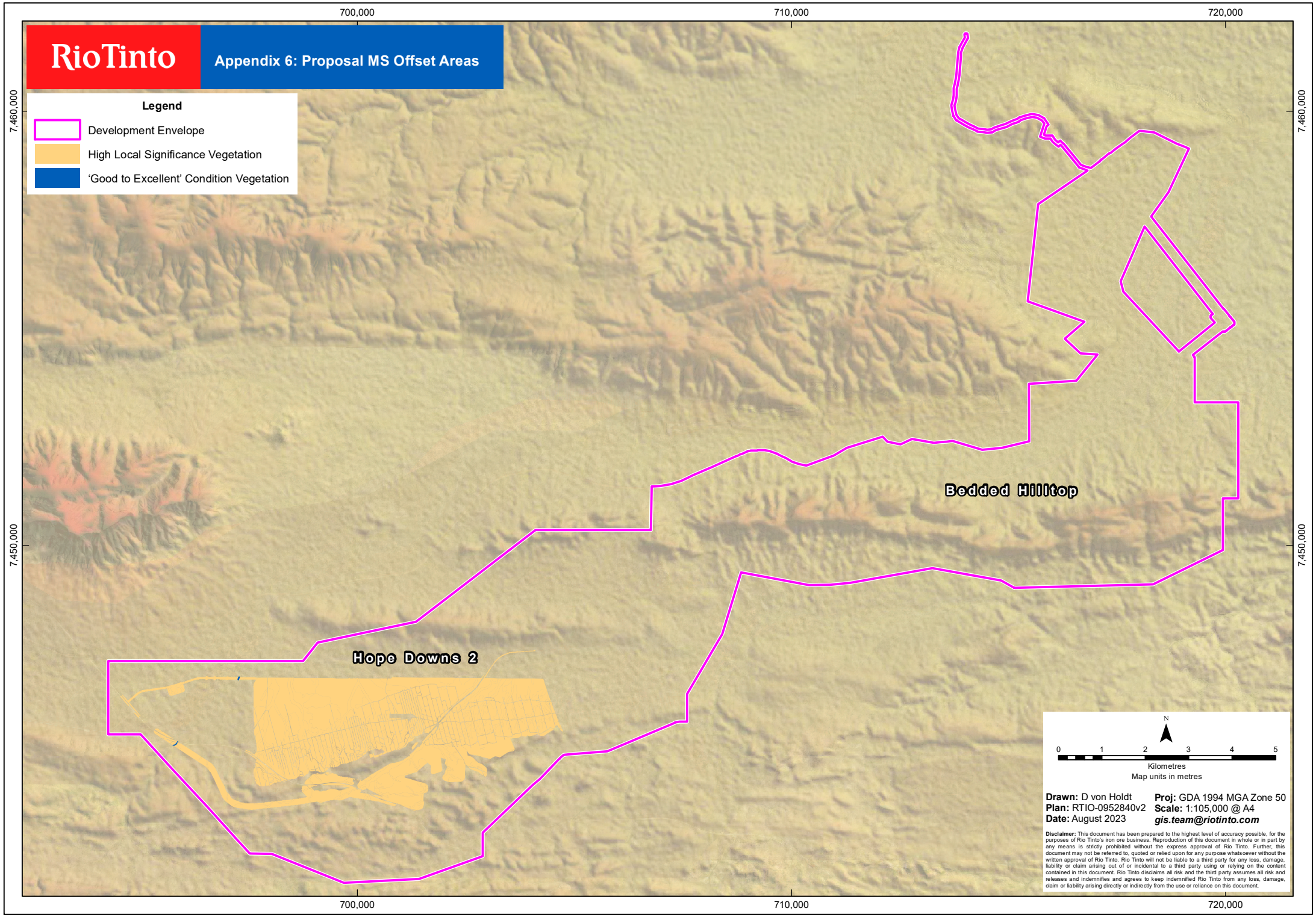
RioTinto
Appendix 6: Proposal MS Offset Areas
Legend
Development Envelope
High Local Significance Vegetation
'Good to Excellent' Condition Vegetation
700,000
710,000
720,000
7,460,000
7,450,000
Bedded Hilltop
Hope Downs 2
N
0 1 2 3 4 5
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: RTIO-0952840v2
Date: August 2023
Proj: GDA 1994 MGA Zone 50
Scale: 1:105,000 @ A4
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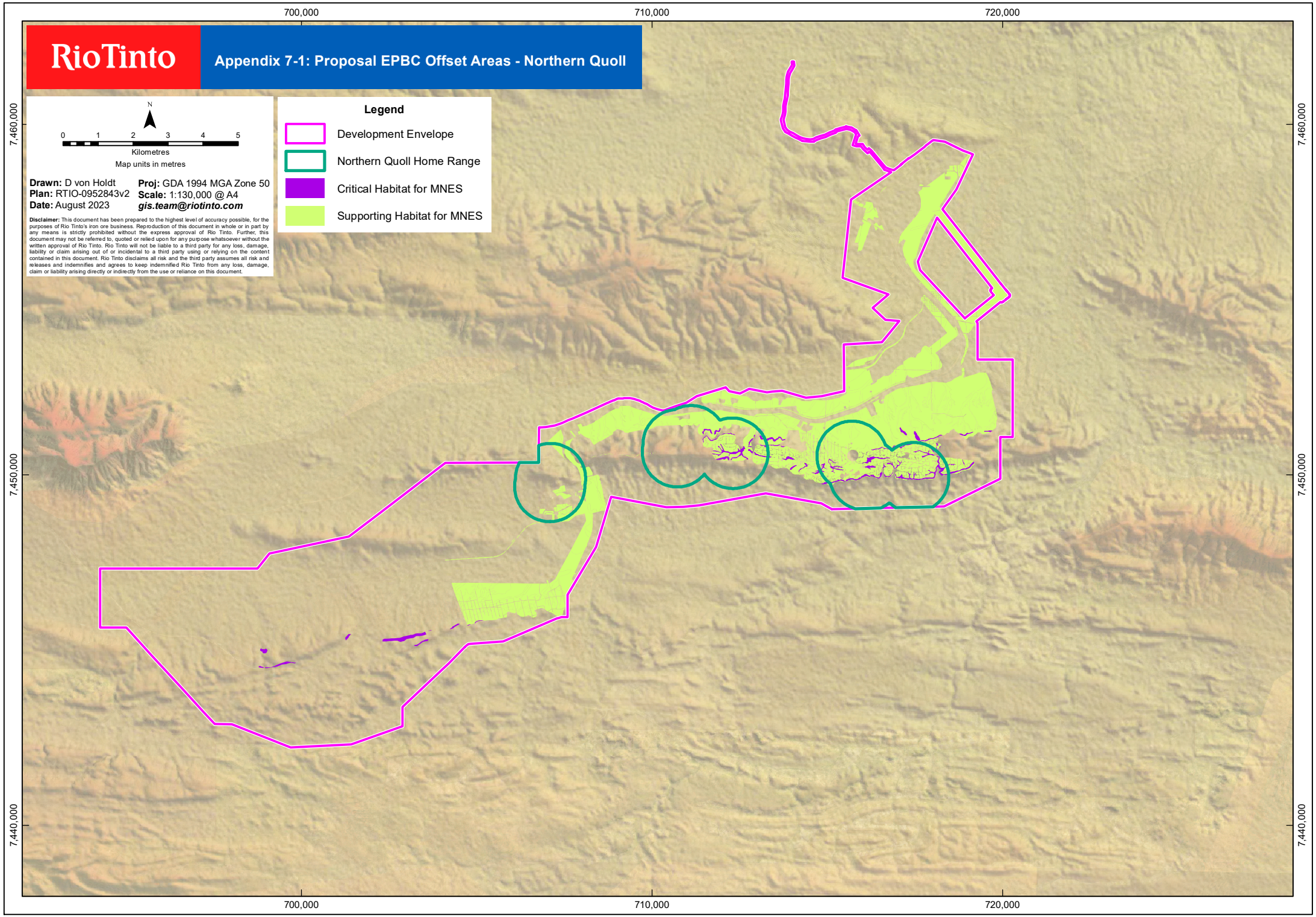
RioTinto
Appendix 7-1: Proposal EPBC Offset Areas - Northern Quoll
N
0 1 2 3 4 5
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: RTIO-0952843v2
Date: August 2023
Proj: GDA 1994 MGA Zone 50
Scale: 1:130,000 @ A4
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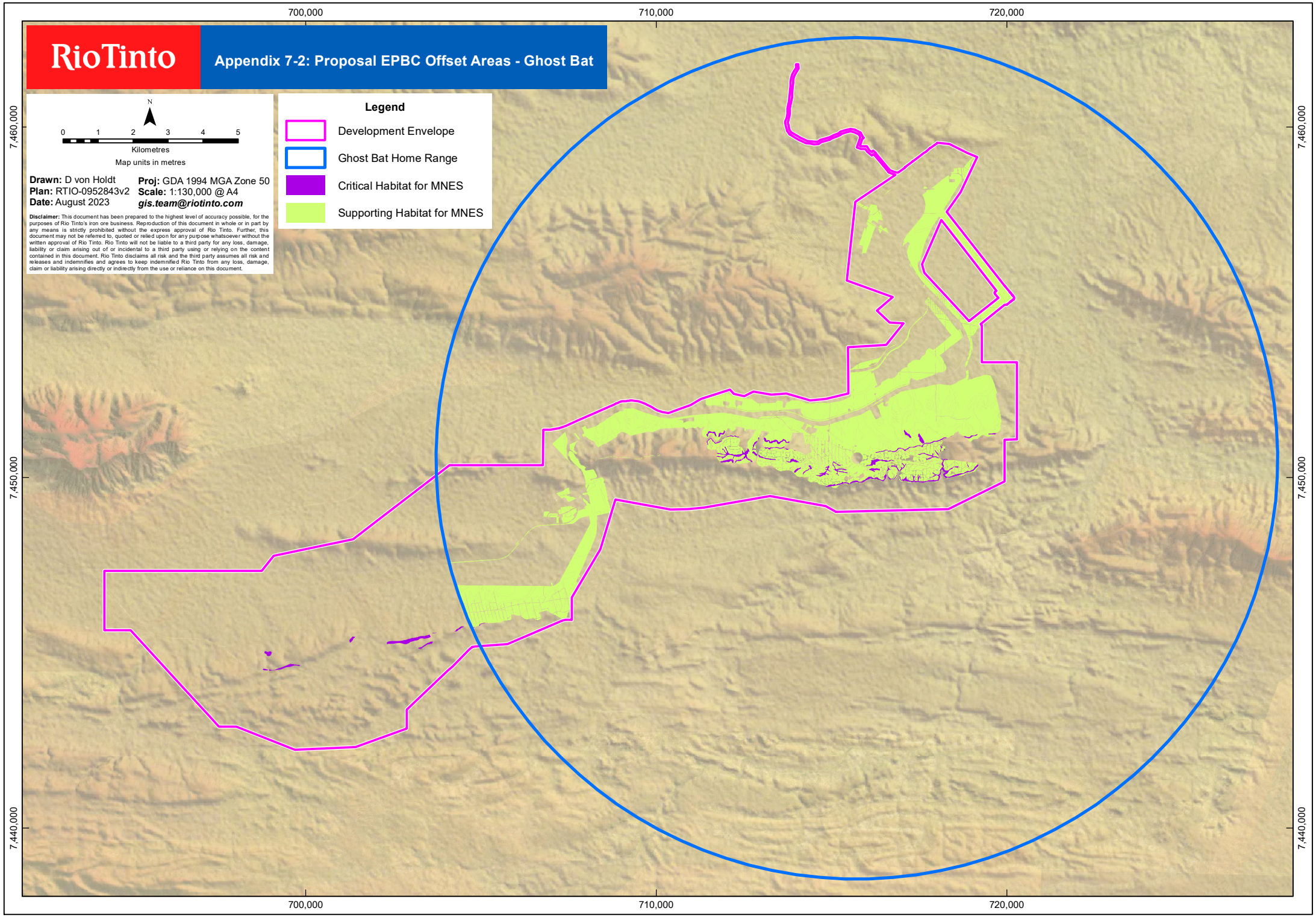
Legend
Development Envelope
Northern Quoll Home Range
Critical Habitat for MNES
Supporting Habitat for MNES
700,000
710,000
720,000
7,460,000
7,450,000
7,440,000


RioTinto
Appendix 7-2: Proposal EPBC Offset Areas - Ghost Bat
N
0 1 2 3 4 5
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: RTIO-0952843v2
Date: August 2023
Proj: GDA 1994 MGA Zone 50
Scale: 1:130,000 @ A4
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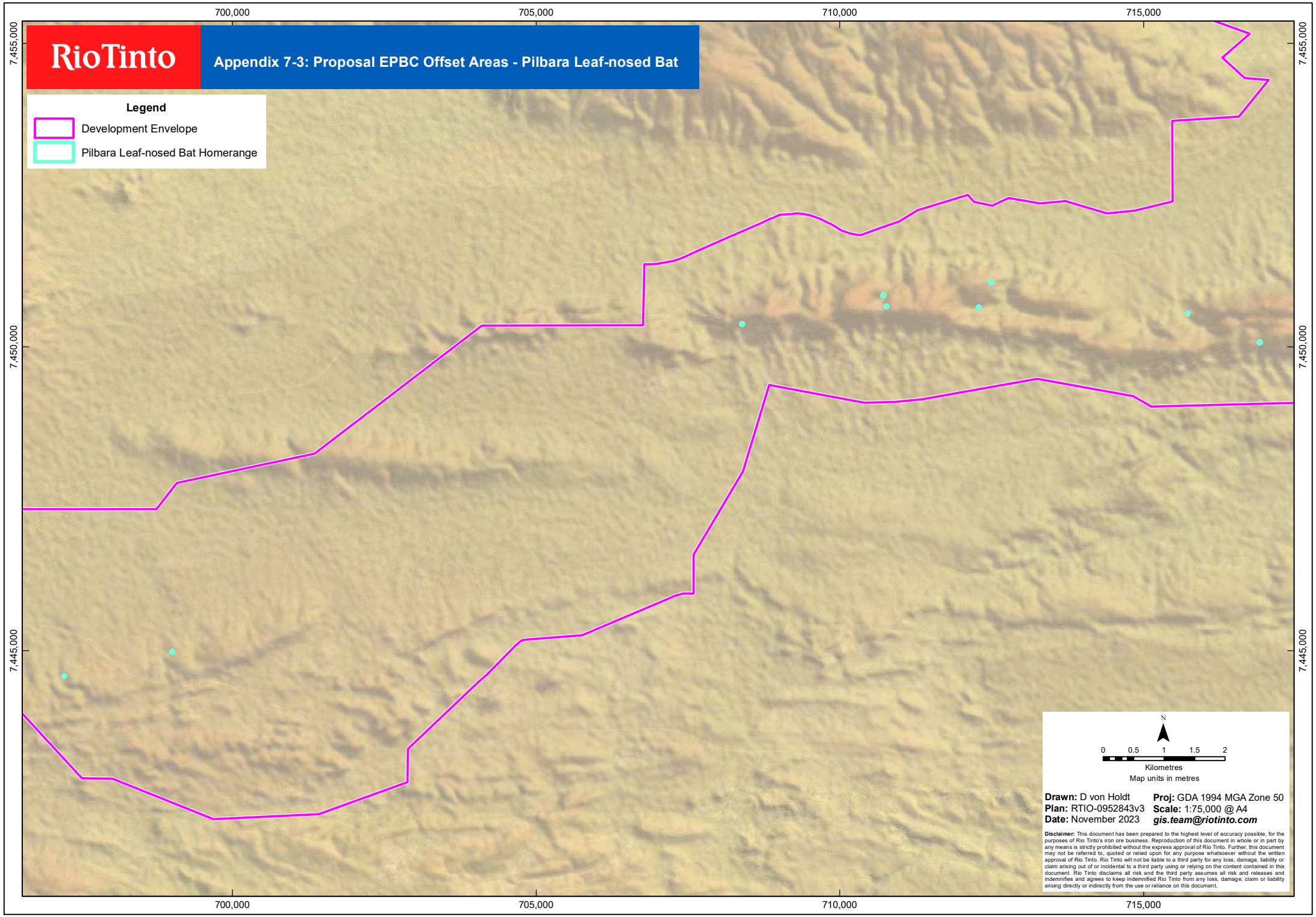
Legend
Development Envelope
Ghost Bat Home Range
Critical Habitat for MNES
Supporting Habitat for MNES
700,000
710,000
720,000
7,460,000
7,450,000
7,440,000


RioTinto
Appendix 7-3: Proposal EPBC Offset Areas - Pilbara Leaf-nosed Bat
Legend
Development Envelope
Pilbara Leaf-nosed Bat Homerange
700,000
705,000
710,000
715,000
7,455,000
7,450,000
7,445,000
N
0
0.5
1
1.5
2
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: RTIO-0952843v3
Date: November 2023
Proj: GDA 1994 MGA Zone 50
Scale: 1:75,000 @ A4
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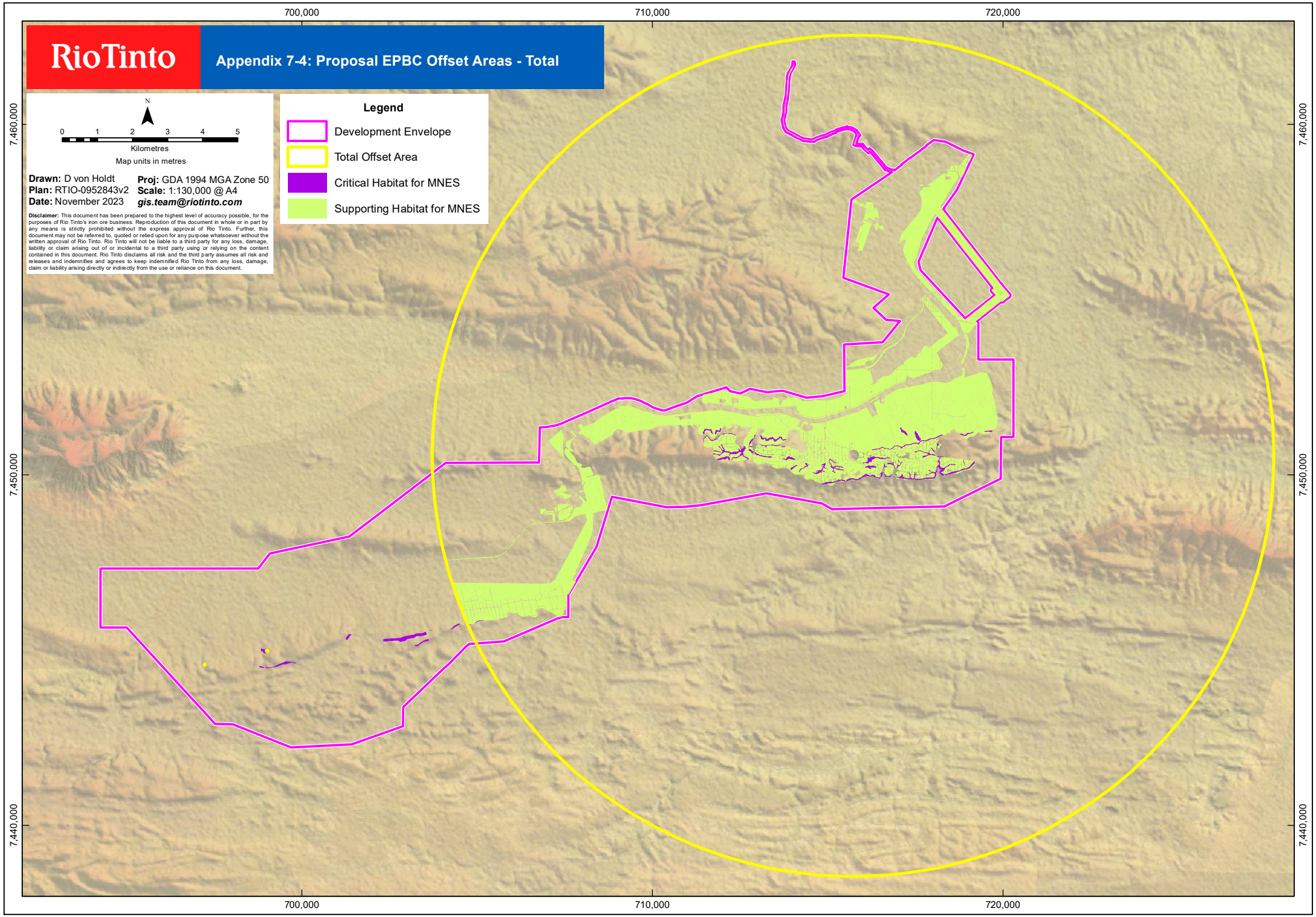
RioTinto
Appendix 7-4: Proposal EPBC Offset Areas - Total
N
0 1 2 3 4 5
Kilometres
Map units in metres
Drawn: D von Holdt
Plan: RTIO-0952843v2
Date: November 2023
Proj: GDA 1994 MGA Zone 50
Scale: 1:130,000 @ A4
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Legend
Development Envelope
Total Offset Area
Critical Habitat for MNES
Supporting Habitat for MNES
700,000
710,000
720,000
7,460,000
7,450,000
7,440,000

Appendix 8: Vegetation Condition Mapping References

Report References
• Astron, 2019a. Hope Downs 2 Proposal Flora and Vegetation Survey • Astron, 2020a. Hope Downs Development Envelope – Vegetation Mapping • Astron, 2020d. Hope Downs Development Envelope – Fauna Habitat Mapping • Rio Tinto, 2022. Metadata Statement Vegetation Condition Mapping for Hope Downs 2

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