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Section 4

Relevant Matters of National Environmental Significance

4 Relevant Matters of National Environmental Significance

4.1 Introduction

The Tailored EIS Guidelines for the Project require an assessment of the matters of NES that are likely or known to occur in the areas that would be or are likely to be impacted by the proposed action. The Tailored EIS Guidelines are structured into two parts that can be summarised as follows:

- Section 4.5 Part A relates to potential impacts associated with the mine, Port and associated infrastructure and outlines the assessment requirements for three of the six controlling provisions (listed threatened species and communities, listed migratory species and Commonwealth marine areas) associated with these activities.
- Section 4.5 Part B sets out the assessment requirements that are to be addressed in relation to the impacts of the Project that have not been addressed in Section 4.5 Part A. Specifically:
  - the assessment of the impacts of the mine, Port and associated infrastructure for the three controlling provisions not included in Part A (i.e. World Heritage properties, National Heritage places and the GBRMP); and,
  - the assessment of impacts relating to shipping activities for all six controlling provisions.

Assessment of the matters of NES that are likely or known to be impacted by the proposed action is required. The purpose of this section is to determine the level of assessment required for each matter of NES based on the likelihood of occurrence within the Project area and Project-related shipping routes, and the likelihood of potential impact from the Project.

This section is structured as follows:

- **Section 4.2** provides a general overview and regional context of the ecosystem features of the mine and Port area as well as along Project shipping routes.
- **Section 4.3** describes the overall process that has been used to identify the matters of NES that are present and/or are likely or known to be impacted by the Project and to determine the level of assessment that is required. This section also outlines the process that was followed if it was determined that the matter of NES was likely or known to be impacted.
- **Section 4.4** describes the results of the Protected Matters Search and identifies the relevant matters of NES for the Project area (mine, Port and associated infrastructure) and assesses the likelihood of impact and which matters of NES require subsequent detailed assessment.
- **Section 4.5** describes the results of the Protected Matters Search undertaken to identify the relevant matters of NES along the Project shipping routes and assesses the likelihood of impact and which matters of NES require subsequent detailed assessment.

4.2 Regional Ecological Context for Project Area and Shipping Routes

4.2.1 Mine, Port and Associated Infrastructure

The following sections provide a general overview of ecological features in the Project area encompassing the proposed mine, Port and associated infrastructure.

4.2.1.1 General Overview

The terrestrial part of the Project area (the portion of the mining lease south of the Embley River) is essentially an elevated bauxite plateau that is fringed on much of its coastal margins by low cliffs and lateritic outcrops.

The area sheds run off from a centrally located topographic high to the east via a series of creeks and tributaries. The main rivers and creeks in the proposed mine area are shown in **Figure 2-4**. Seasonal variation in the ephemeral reaches of rivers and creeks is pronounced, with wet season discharge typically commencing from mid to late December. The dry season retreat of stream flow over the ephemeral sections can occur from early April. The underlying shallow aquifer is able to sustain baseflows well into the dry season over the lower reaches of the major watercourses. Estuaries are present at the lower reaches of the Ward, Watson and Embley Rivers and of Norman Creek.

The proposed mine and infrastructure areas are located within the Weipa Plateau Subregion of the Cape York Peninsula Bioregion (Sattler and Williams 1999). This is the most extensive of the six provinces and covers a large area of the central and north-western portions of Cape York Peninsula. The area is relatively homogenous in vegetation and landform, and is characterised by large areas of Darwin Stringybark (*Eucalyptus tetrodonta*) open forests or woodlands, dissected by smaller areas of mesic riparian vegetation, vine thicket patches and paperbark swamps.

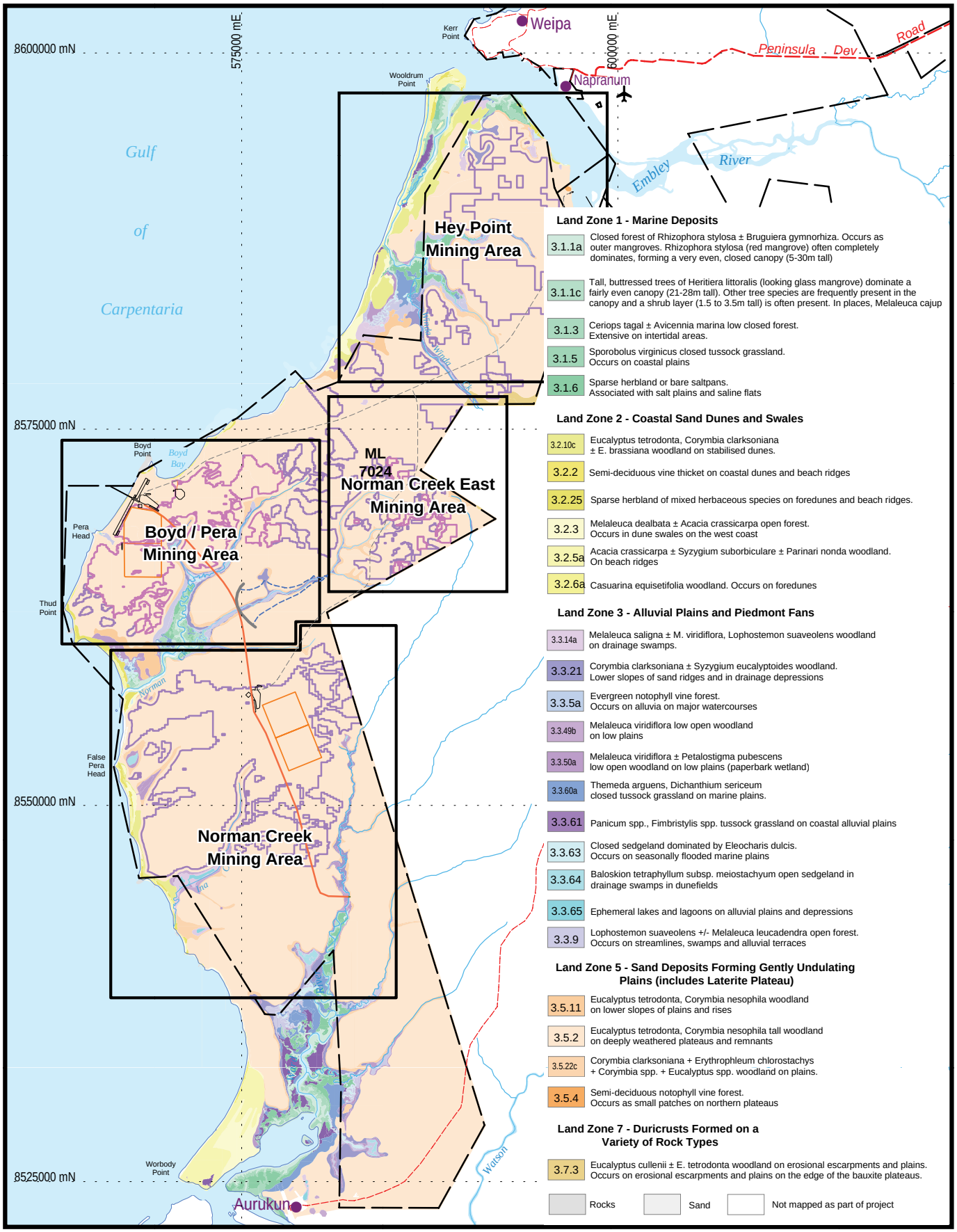
A large part of the areas within the mining lease south of the Embley River would not be disturbed as a result of the Project. Therefore, for the purposes of this assessment, the “disturbance area” refers to the infrastructure and mining areas shown on **Figure 2-4**, and dredging and dredge spoil disposal areas associated with the Project. The “Project area” incorporates the “disturbance area” in addition to the areas within the mining lease south of the Embley River which would not be disturbed (see **Figure 2-4**). Shipping routes associated with the Project are discussed in **Section 3.9.3**.

4.2.1.2 Regional Ecosystems

The REs occurring in the Project area are shown in **Figure 4-1**. Of the 27 REs occurring in the Project area, 24 are listed under the Queensland *Vegetation Management Regulation 2012* (Qld) as ‘Least concern’, and three are listed as ‘Of concern’. No ‘Endangered’ REs are known to occur within the area. Although RE's have been described to provide context on the potential habitat of terrestrial matters of NES, RE classifications are not relevant to the decision making by the Commonwealth Environment Minister under the EPBC Act.

Only 10 REs would be disturbed as a result of Project activities, including one “Of concern” RE (3.2.6a *Casuarina equisetifolia* woodland). The total disturbance of RE 3.2.6a would be approximately 0.4ha, which is 0.2% of the area of this RE mapped in the Project area and 0.1% of the area mapped in the Weipa Plateau Subregion.

Approximately 99% of the vegetation that would be disturbed as a result of Project activities is mapped as *E. tetrodonta*, *Corymbia nesophila* tall woodland on deeply weathered plateaus (RE 3.5.2 (‘Darwin Stringybark woodland’)). This ‘Least concern’ RE correlates with the bauxite-bearing Weipa Plateau.



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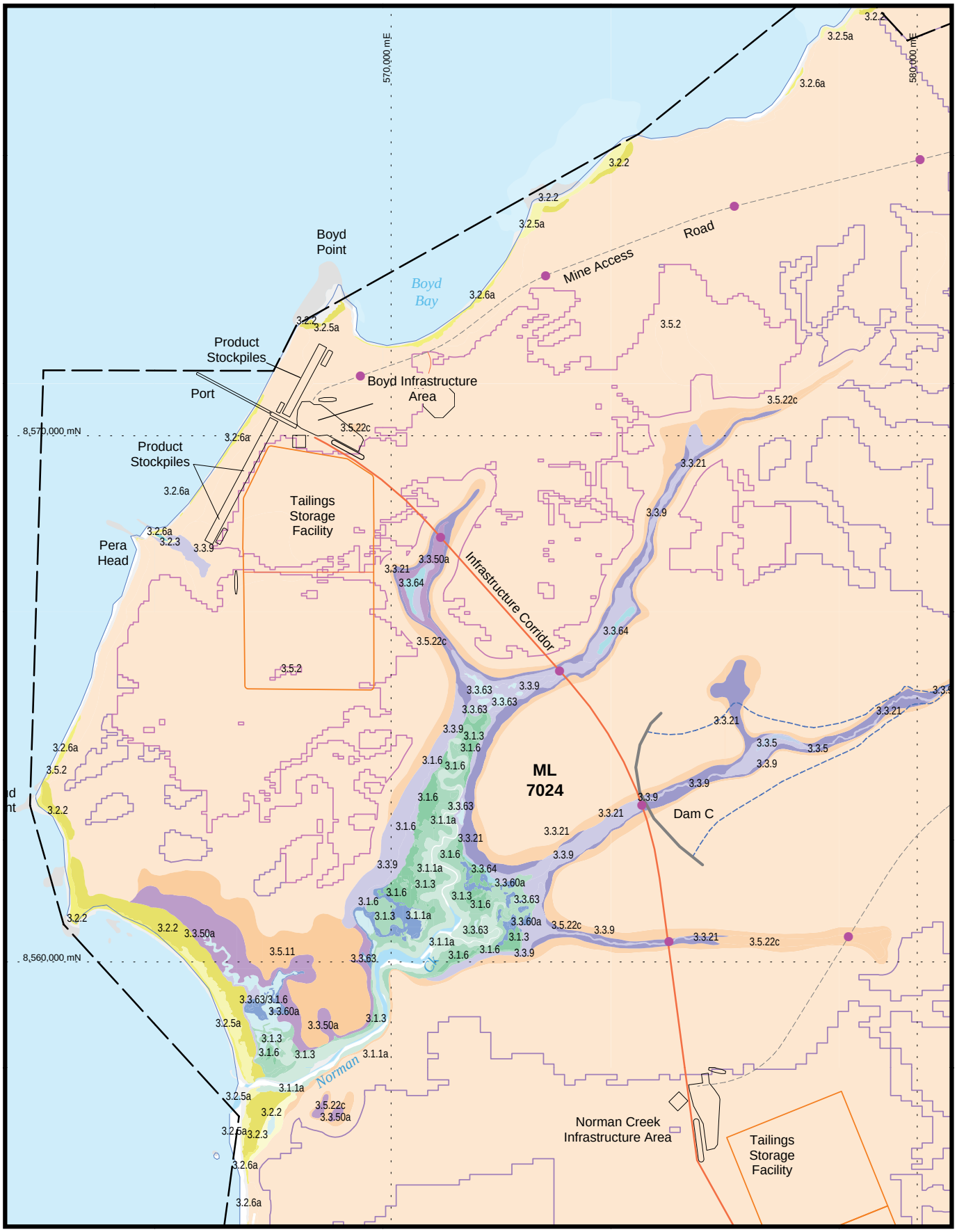
South of Embley Project

Fig. 4-1: Regional Ecosystems (Ground Surveyed)

Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012



RTA Mining Lease boundary
Freshwater dam
Tailings storage facility
Mining Years 1- 13
Mining Years 14- 40
Drainage line crossings

For RE Descriptions See Fig 4-1

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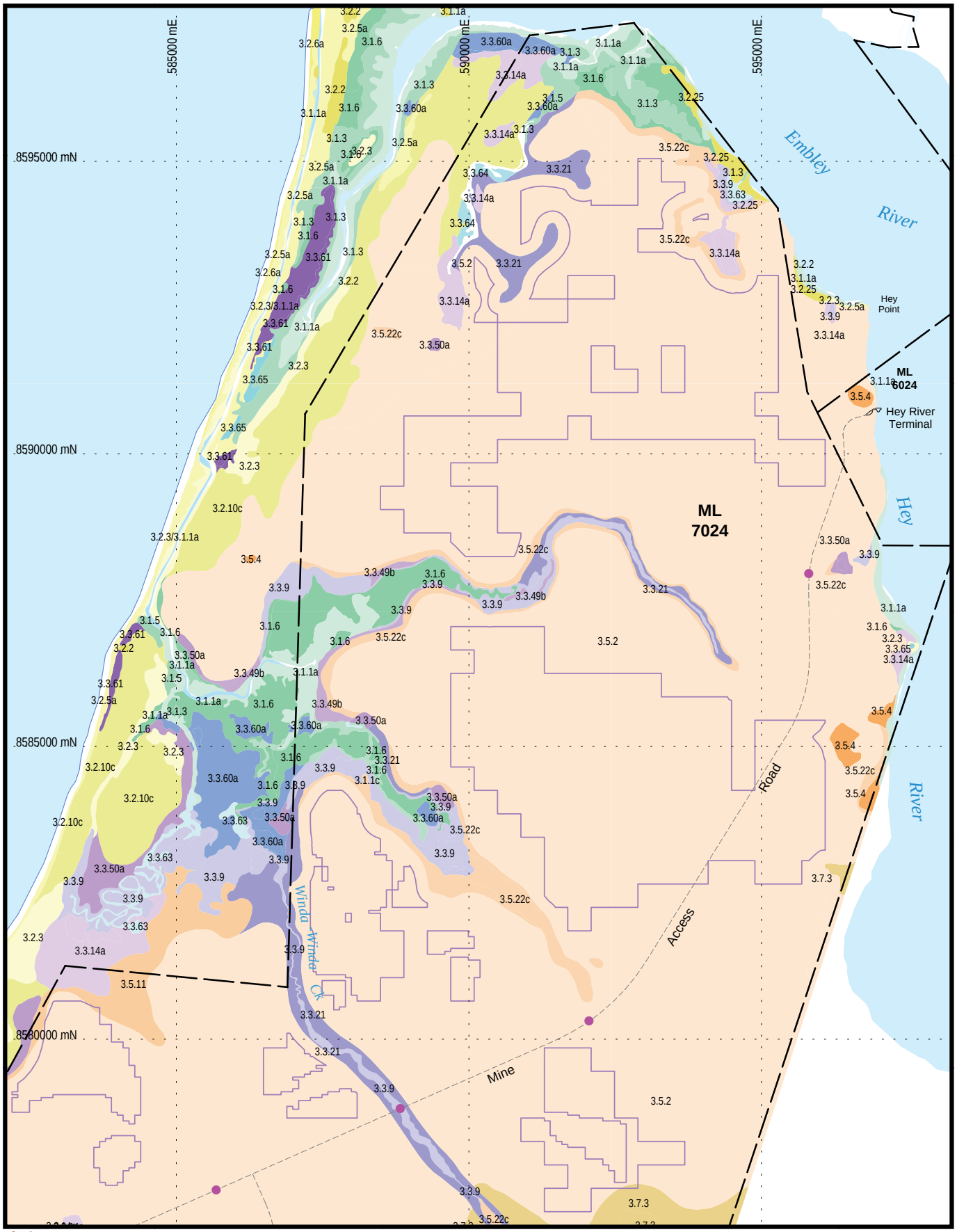
South of Embley Project

Fig. 4-1a: Regional Ecosystems (Boyd/Pera Mining Area)

N

1 0 1 2km

Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012



RTA Mining Lease boundary

Mining Years 14- 40

Drainage line crossings

For RE Descriptions See Fig. 4-1

South of Embley Project

Fig. 4-1b: Regional Ecosystems (Hey Point Mining Area)

N

1 0 1 2km

Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012

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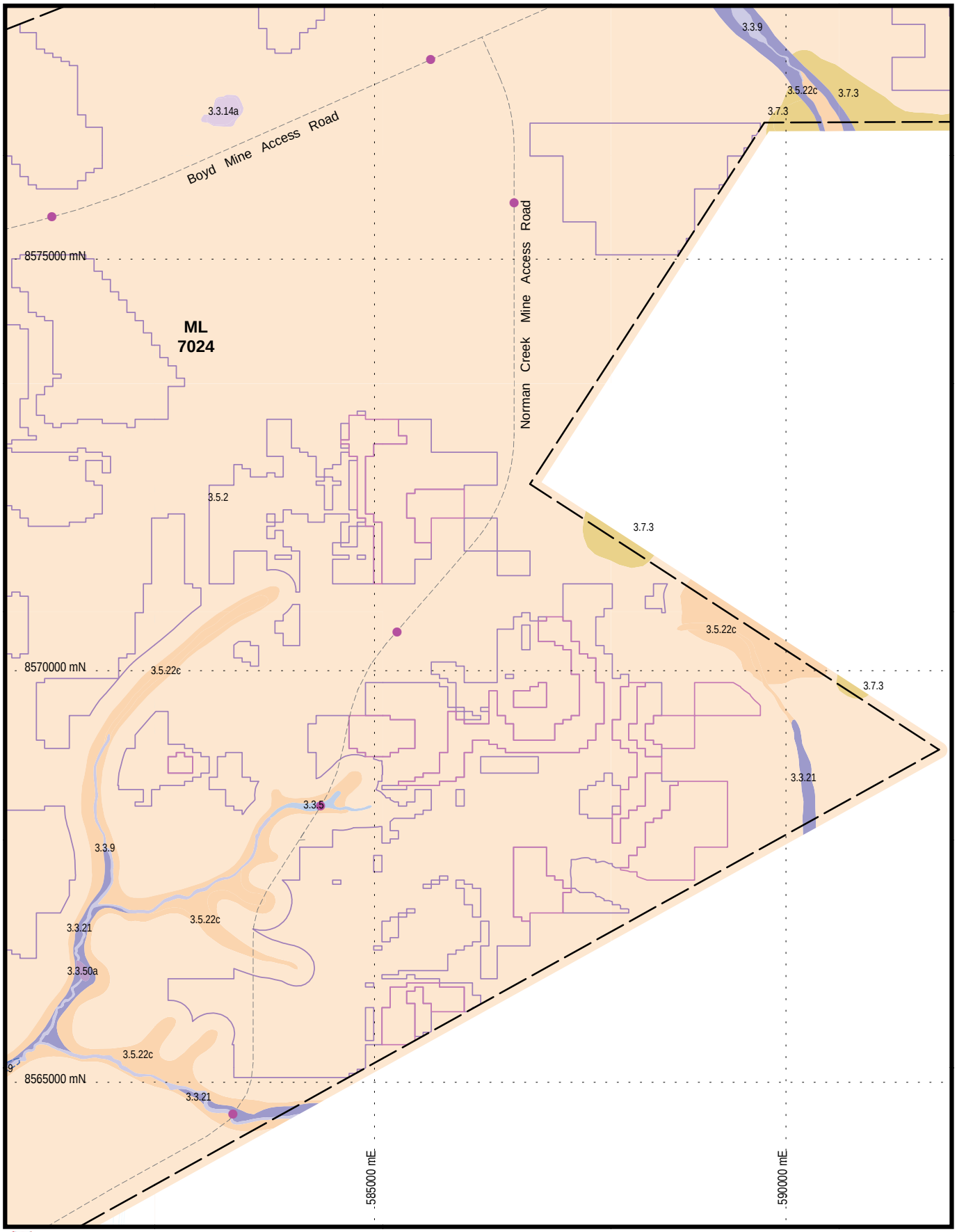

RTA Mining Lease boundary

Mining Years 1- 13

Mining Years 14- 40

Drainage line crossings

For RE Descriptions See Fig. 4-1

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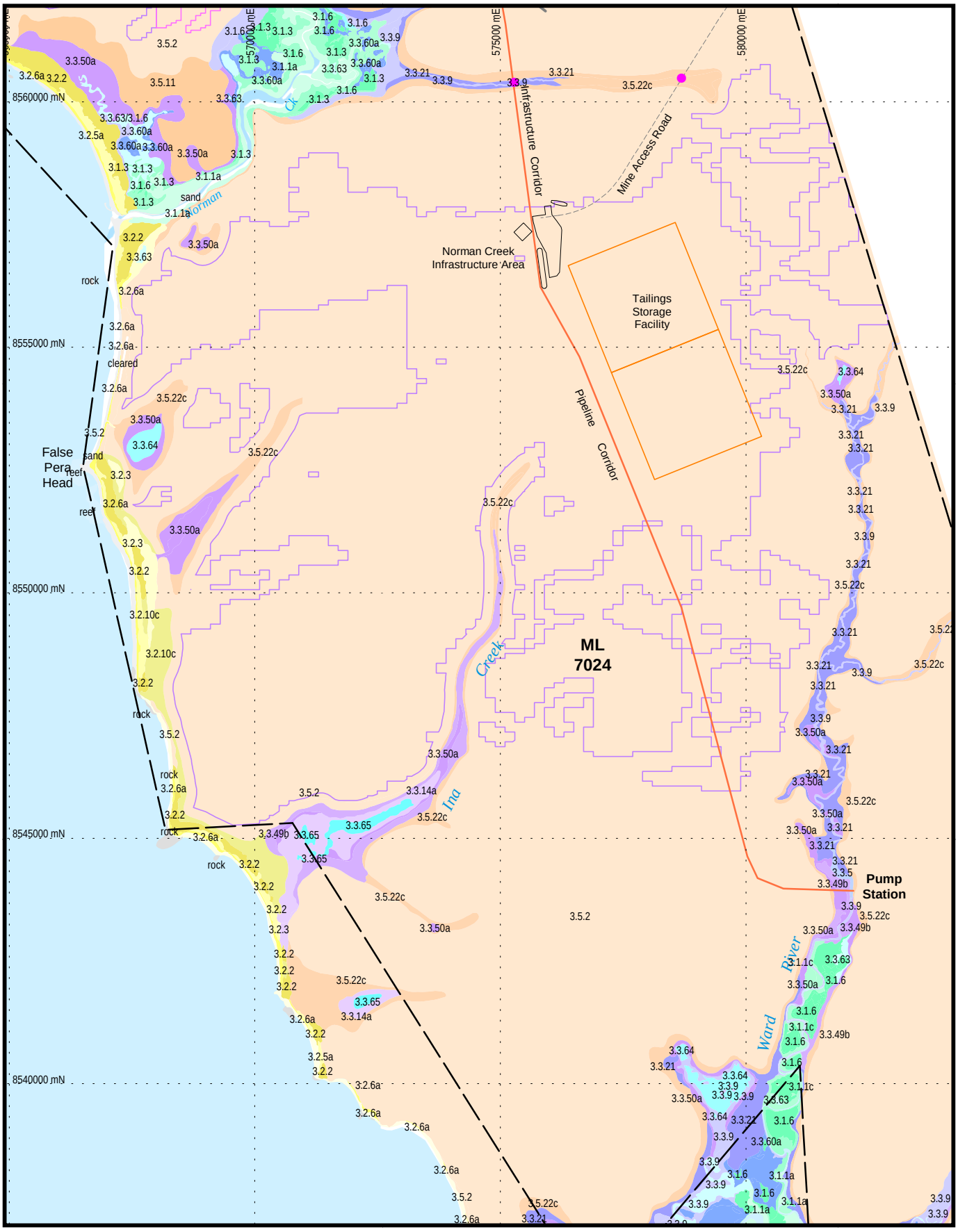
Fig. 4-1c: Regional Ecosystems (Norman Creek East Mining Area)

N

1 0 1km

Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012



RTA Mining Lease boundary

Mining Years 1- 13

Mining Years 14- 40

Drainage line crossings

For RE Descriptions See Fig. 4-1

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South of Embley Project

Fig. 4-1d: Regional Ecosystems (Norman Creek Mining Area)

N

1 0 1 2km

Datum/Projection: GDA94/MGA Zone 54 Date: 05/02/2013

Approximately 29,366ha of RE 3.5.2 is proposed to be disturbed over the 40 year mine life of the Project. This represents 33.6% of the area of this RE mapped in the Project area and 4.4% of the area of this RE mapped in the Weipa Plateau Subregion. The total area disturbed by the Project would be 29,658ha, of which 27,709ha would be for mining, 778ha for Dam C and 1,171ha for other infrastructure.

RE 3.3.5 (evergreen notophyll vine forest) is classified 'least concern' under the *Vegetation Management Regulation 2012* (Qld). There is 28ha of RE 3.3.5 within the Project area, of which 7.9ha would be disturbed within the footprint of Dam C. The other areas of RE 3.3.5 within the Project area occur in two patches; 8.6ha along Norman Creek, upstream of Dam C and 11.9ha along the Ward River) (refer **Figure 4-1**). There is 22,498ha and 54,065ha of RE 3.3.5 in the Weipa Plateau subregion and the Cape York Bioregion, respectively. The clearing of 7.9ha of RE 3.3.5 within Dam C represents less than 0.04% and 0.015% of the extent in this RE in the sub-region and bioregion respectively.

4.2.1.3 Terrestrial Fauna Community

The terrestrial fauna community within the Project area is not unique or of particular importance with similar fauna assemblages occurring elsewhere along the west coast of the Cape York Peninsula, particularly within Darwin Stringybark dominated habitats. There is considerable fauna diversity within the area reflecting the diversity of habitats present including closed forest, woodland, and a range of stream, wetland and coastal habitats. Fauna diversity is concentrated within the non-Darwin Stringybark woodland habitats which together comprise approximately 1% of the area that would be disturbed by Project activities.

4.2.1.4 Aquatic Ecosystems

The Project area sheds runoff from a centrally located topographic high to the west via Ina and Norman Creeks; to the north via Triluck–Winda Winda Creek, Roberts and Leithen Creeks (the latter two primarily estuarine); to the east via unnamed tributary drainages of the Hey River estuary; and to the south via the Ward River system. A number of smaller, less defined drainage depressions also flow independently to the Gulf of Carpentaria between these named drainage systems. Within the Project area there are also several swamps that occur in depressions within the bauxite plateau which are largely isolated from defined drainage networks.

Given the generally small size of these catchments and the highly seasonal rainfall of the region, many of the smaller streams and depressional swamps do not contain permanent aquatic habitats. However, shallow groundwater connectivity to surface water features is apparent in parts of the Project area and semi-permanent groundwater discharge maintains streamflows in the lower reaches of larger streams (e.g. Norman Creek, Ward River) beyond the wet season.

Surface water features are described in detail in **Section 16.1**. Aquatic ecosystems within the Project area include swamps, lagoons, freshwater channels, and estuaries. The Norman Creek system includes perennial stream reaches and aquatic refugia and supports a host of aquatic habitat types. The systems are a mix of perennial and seasonal systems, some of which are interconnected with the groundwater system.

The southern extremity of the Project area overlaps the Archer Bay Aggregation on the lower Ward River, which is a nationally significant wetland area listed in the Directory of Important Wetlands in Australia (Blackman *et al.* 1999).

No mining is proposed within the Archer Bay Aggregation. Archer Bay is fed by the Ward, Watson and Archer Rivers with mining occurring only within the Ward River catchment, which covers only 3.8% of the total contributing catchment of 17,358km^2. The Project would not affect the Watson or Archer Rivers. An assessment of impacts of mining on the Ward River catchment determined that the Project would reduce mean annual discharge to the Ward River estuary by 0.5% (refer **Section 16.2.4**). The Project impact on the Archer Bay Aggregation, and any threatened, migratory or marine species which use these systems, would be negligible.

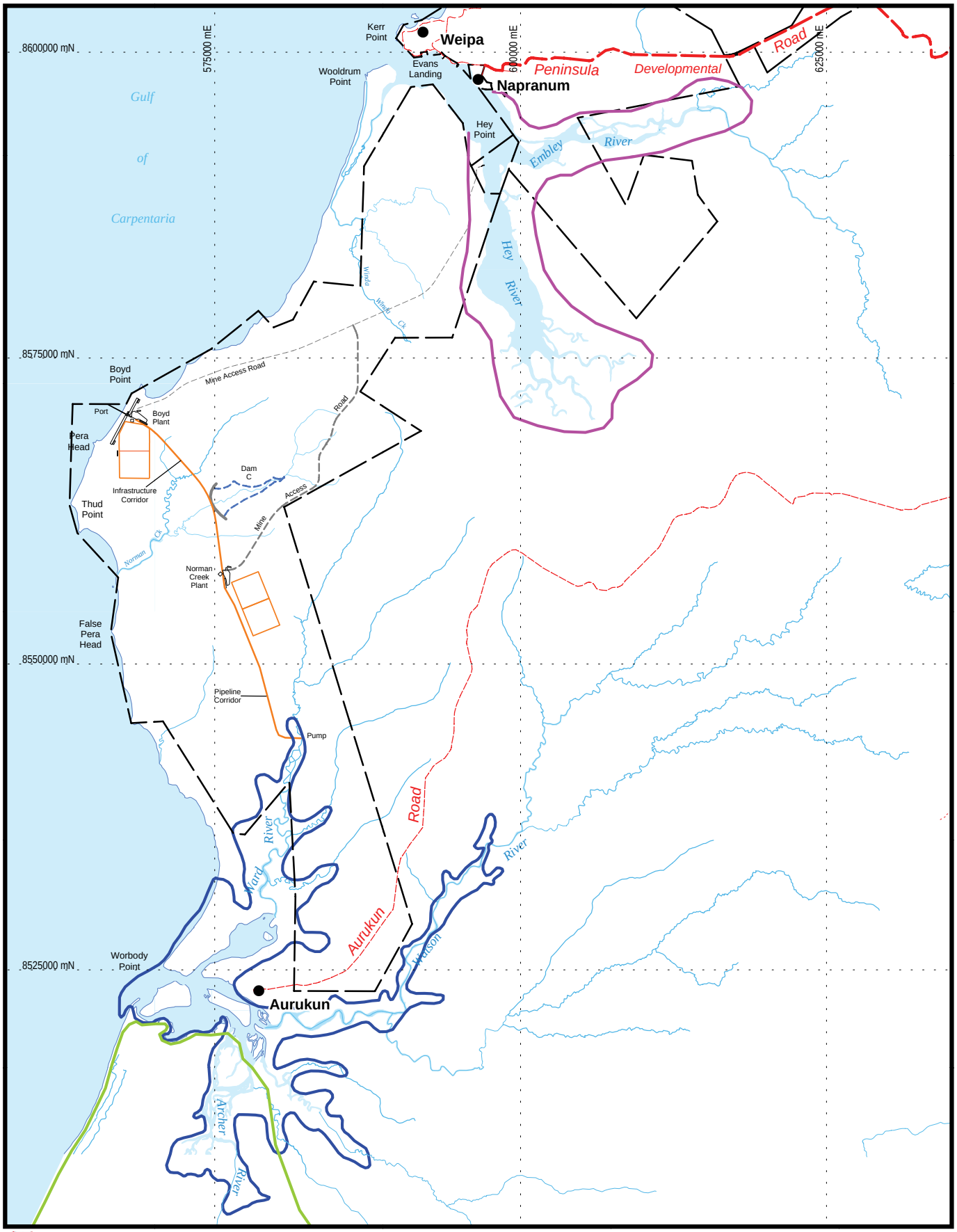
The Cape York Peninsula Land Use Strategy (CYPLUS) (Abrahams *et al.* 1995) identifies two areas of conservation significance adjacent to the Project area (**Figure 4-2**): the estuary of the Embley River to the north and the Aurukun Wetlands to the south. There are two other relatively large wetland aggregations partly or wholly contained within the Project area; lower Winda Winda–Triluck Creeks and lower Norman Creek. These systems provide wetland habitat, productivity (carbon biomass), fish nursery, fisheries, nesting/feeding areas for migratory birds, aquatic refugia, habitat for threatened species and areas of cultural significance. There are no Ramsar wetlands within or near the area affected by the Project.

Aquatic ecosystems in the Project area were surveyed and sampled in May 2008 and May 2009, with additional observations made during site visits in August–September 2007, November 2007, February 2008, December 2008, and February–March 2009. Further targeted sampling for sawfish and the Speartooth Shark was conducted in August 2012.

Sampling of aquatic biota comprised two post wet season sampling periods in May 2008 and May 2009 as this presented the optimal site conditions for sampling. During the wet season, stream reaches could not be sampled due to the inaccessibility of sites due to wet season inundation of the landscape and the presence of debris laden high flows that prevented the safe and effective deployment of sampling equipment. While field observations were made at other times, the limited biological sampling cannot fully quantify seasonal and inter-annual variation in the Project area. However, when combined with information from surveys conducted by the same biologists elsewhere on the Weipa Plateau, the general composition of the aquatic biota can be suitably characterised for the purpose of this assessment. It also provides an initial baseline snapshot prior to commencement of mining. A detailed survey methodology is provided in Section 8.3 of the Queensland EIS (RTA 2011).

A total of 45 species of freshwater, estuarine and marine fish were recorded. The number of species recorded indicates that the fish communities present have lower species diversity than adjoining catchments and estuaries in the region. The freshwater fish community comprises species occurring elsewhere in the western Cape York drainage systems (Section 8.7.4 of RTA 2011).

An unidentified species of freshwater crab *Austrothelphusa sp.* was first recorded in 2008 from Winda Winda Creek. The crab was found during surveys undertaken for the EIS and sent to the Queensland Museum for identification. Assessment by the Queensland Museum identified that this possibly represents a new undescribed species (P. Davie pers. comm.). Further survey work in 2009 extended the species recorded range beyond the original record in Winda Winda Creek but not beyond the Winda Winda Creek catchment within the Project area.



RTA Mining Lease boundary
Locality
Road/track
Tailings storage facility
Archer Bay Aggregation (Directory of Important Wetlands in Australia)
Aurukun Wetlands approximate boundary (CYPLUS)
Hey - Embley River approximate boundary (CYPLUS)

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South of Embley Project

Fig. 4-2: Areas of Conservation Significance

N

5 0 5 10km

Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012

A Mysid (shrimp) Crustacean from a littoral grab sample in the upper Ward estuary was tentatively identified by macroinvertebrate taxonomists, including the senior curator of Crustacea at the Queensland Museum, as belonging to the family Lepidomysidae. This Family is also generally known to be stygofauna (groundwater/cave dwelling organisms), although they can occur in brackish water away from caves. Its appearance in a grab sample may suggest the upper estuary sample site was in a groundwater upwelling location, as upwellings are common in the upper estuary, and such an upwelling would be a likely habitat for a stygobiont able to survive in open water.

RTA, in consultation with Queensland Museum and EHP, undertook additional surveys for the unidentified crab and Mysid shrimp species in May 2012. The survey involved revisiting the original locations and surveying additional locations in the Western Cape with similar features. Taxonomic assessment by the Queensland Museum confirmed that additional specimens of the undescribed species of freshwater crab were collected north of the Embley River in Luang Tree Swamp (Luthing Creek) and south of the Embley River in freshwater tributaries of the Hey River. Both Luthing Creek and the freshwater tributaries of the Hey River are outside the Project area. The Queensland Museum is currently undertaking classification of the crab species. Records of the undescribed species of freshwater crab from surveys conducted for the Project and for the existing Weipa operations are shown in **Appendix 4-A**, **Figure 1**. Additionally, taxonomic assessment by the Queensland Museum confirmed that additional specimens of the undescribed Mysid shrimp species were collected within the upper estuary of Andoom Creek, north of the Embley River, outside the Project area. The specimens were again collected from a littoral grab sample. The Queensland Museum is currently undertaking further description and classification of the Mysid shrimp species. Records for the undescribed Mysid shrimp species from Project surveys are shown in **Appendix 4-A**, **Figure 2**.

4.2.1.5 Marine and Estuarine Habitats

The following provides an overview of marine and estuarine habitats. Additional details are provided in **Section 7.2**.

Benthic (sea floor) habitat surveys were completed within the Project area during October 2007, June 2008, November 2008, June 2009, July 2009, June 2010, and February 2012. A combination of towed video sled and drop camera video techniques and grab samples were adopted for these studies, allowing the survey of multiple sites in a short period, providing key information to describe the distribution and structure of benthic habitats.

Near shore fringing reef communities in the vicinity of the proposed Port occur approximately 2km to the north-east at Boyd Point and approximately 2.8km to the south-west at Pera Head. Fringing reef communities also occur between Pera Head and Thud Point in Queensland coastal waters. These communities comprise both hard corals and low profile reefs containing soft coral/sponge assemblages. Satellite imagery also indicates there may be numerous small reef outcrops present between Thud Point and Aurukun. Hard corals over the reef areas include species from the following genera: *Porites*, branching *Acropora*, *Turbinaria*, *Monitipora*, *Lobophyllia*, *Platygyra*, *Pavona* and *Favia*.

The development footprints for all marine infrastructure components of the Project (the Port, barge/ferry terminals, proposed new spoil ground, and temporary seaborne access areas) have been confirmed by field inspection. Most benthic habitats consist primarily of soft sediment habitats. The habitat closest to the Port contains extensive sub-tidal soft sediment habitats and small areas of soft coral-sponge habitat with <2% live cover. Some coral reef was observed at the Boyd Point temporary passenger jetty option with coral bombies up to 2m in diameter observed. Some coral reef was also observed to the south of the temporary barge landing area near Pera Head.

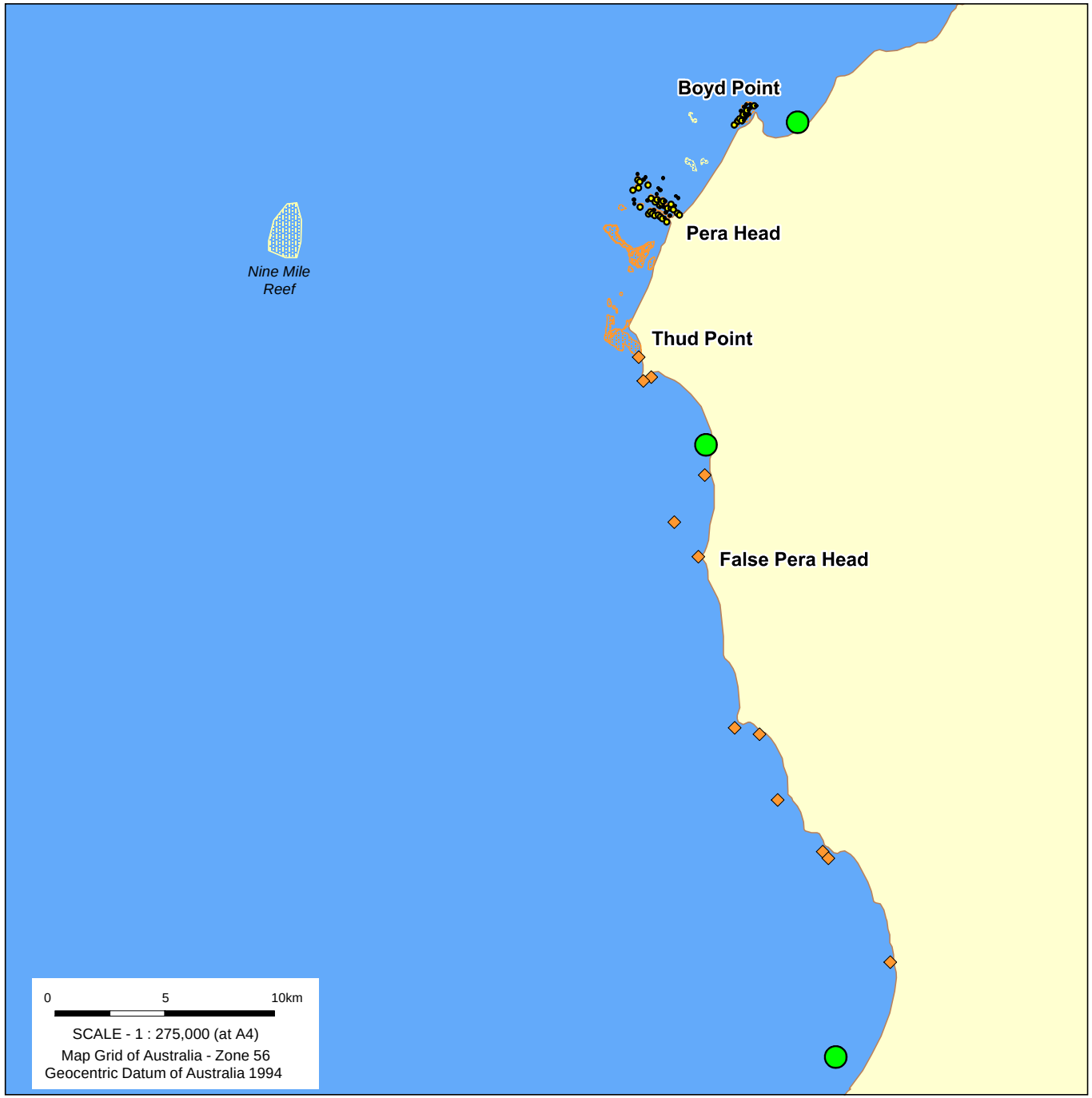
The proposed new spoil ground consists primarily of soft sediment habitats that contain sparse epifauna typical of soft sediments, such as seapens and tube dwelling anemones, soft corals or sponges (see **Section 7.2.9**). Nine Mile Reef is located approximately 6km south south-west of the proposed new spoil ground in the CMA and is an important fishing location for local recreational fishermen and commercial line fishing. The importance of these reef systems (Boyd Point to Thud Point and Nine Mile Reef) in a regional context is considered to be high as they support resources which are of conservation, cultural, commercial and recreational importance. The near shore sponge and soft coral reefs provide a food resource for a range of marine turtle species.

The existing spoil ground at Albatross Bay is located in Queensland coastal waters and currently receives capital and maintenance dredging material from the Port of Weipa. Dredging for the Port of Weipa is currently undertaken by NQBP. This spoil ground receives an average of 1,000,000m^3 annually of spoil from the inner harbour and entrance channel (NQBP 2009). Sediment characterisation of material that is placed in the Albatross Bay spoil ground must be suitable for disposal at sea according to the assessment framework described in the *National Assessment Guidelines for Dredging* (NAGD) (2009). The Albatross Bay spoil ground has been confirmed by field inspection as consisting primarily of soft sediment habitats that contain sparse epifauna typical of soft sediments, such as seapens and tube dwelling anemones, soft corals or sponges. The Albatross Bay spoil ground does not contain, and is not close to any, reef communities, contains no seagrass beds, and is not shallow in nature (refer **Section 7.2.9**).

Seagrass beds are typically present in the more sheltered areas of the Embley and Hey River estuaries and Boyd Bay. No seagrass was detected within the proposed Hornibrook terminal dredging footprint. Samples collected within 100m of the footprint recorded seagrass (*Enhalus acoroides*) leaves (no attached rhizomes) and additional samples collected to the east in an area previously known to have seagrass recorded seagrass (*E. acoroides*) leaves (no attached rhizomes) and seagrass with attached rhizomes (*E. acoroides*). No seagrass was detected within the proposed Humbug terminal dredging footprint area during the drop camera surveys in July 2009 and February 2012; however isolated patches of *E. acoroides* were observed within and adjacent to the dredge footprint during visual inspection in May 2010. Seagrass with attached rhizomes (*Halophila ovalis*) was detected approximately 100m north-northwest of the footprint. No seagrass was detected within, or adjacent to, the proposed Hey River terminal dredging footprint. Samples collected in the bay to the north of the terminal, in an area previously known to have seagrass, recorded seagrass (*E. acoroides*) leaves (no attached rhizomes). No seagrass was observed in the survey of the temporary barge landing area near Pera Head. Seagrass was observed at the Boyd Bay temporary passenger jetty option (refer **Section 7.2.4**).

Figure 4-3 to **Figure 4-7** outline reef and seagrass beds in the vicinity of the Port and river facilities.

Pine River Bay, in the northern part of Albatross Bay, was declared a fish habitat area (FHA) on 25 November 2011. FHAs are declared under the Queensland *Fisheries Regulation 2008* as part of the identification, management and protection of critical fish habitats in Queensland (Baker and Sheppard 2006). The Pine River Bay FHA encompasses 25,573ha and has both cultural and fisheries significance (DEEDI 2011a). The FHA includes fisheries for banana prawns, tiger prawns, Spanish mackerel, mud crab, barramundi, and threadfin salmon (DEEDI 2011a). The Pine Rivers FHA is recognised for its habitat values including seagrass meadows, open waters, inshore reefs, sandy shores, rocky shores, mangrove forests, marine swamps, estuarine waters, intertidal banks, and saltpans (DEEDI 2011a).



LEGEND

- Indicative seagrass locations

Reefal Habitat

- Unconfirmed reef locations
- Live coral cover (hard coral and/or soft coral/sponges)
- Reef substrate - no coral cover
- Reef substrate available for hard coral and/or soft coral/sponges
- Reef substrate available for soft coral/sponges

Note: Video transects conducted in February 2012 identified low density isolated patches of seagrass in Boyd Bay (overall density 8.7 +/- 1.3 shoots/sqm of *H. uninervis*) and reef supporting hard coral near Boyd Point.

2006 Aerial Photography
Supplied by client December 2008
Bathymetery
Extracted from bathy.dwg supplied by client December 2008
Indicative Seagrass Locations
Queensland Seagrass Meadows 1984-1988
Department of Primary Industries and Fisheries 2002
Coastal Habitat Resources Information System
http://chrisweb.dpi.qld.gov.au/CHRIS/
Pers. Comm. Michael Rasheed, 2010
Video Transects
Video transects captured 14/02/2012

Rev	Date	Revision Description	DRN	CHK	ENG	APPD
1	06/11/2012	Issued for use	MM	KK		

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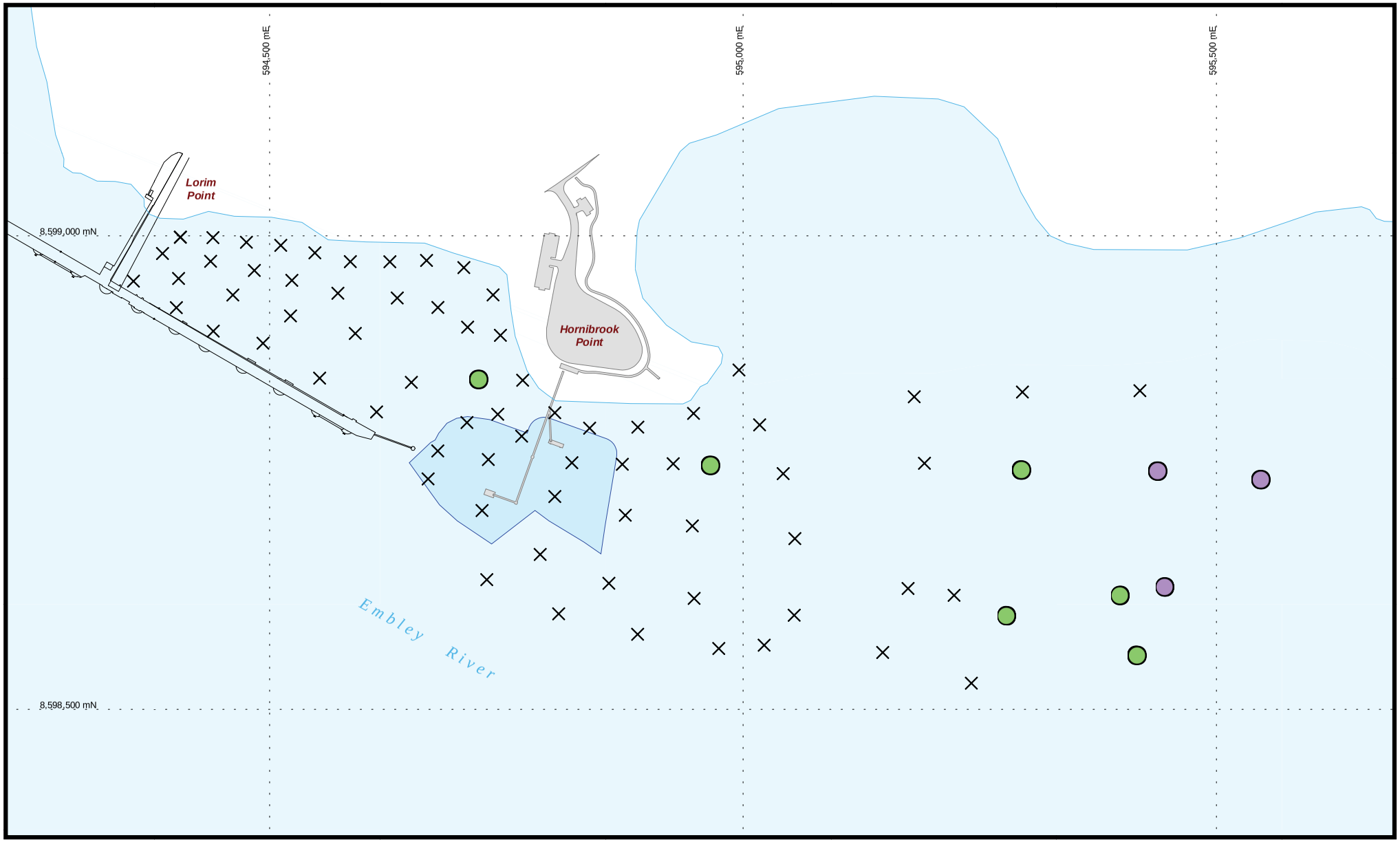
SOUTH OF THE EMBLEY PROJECT

Figure 4-3 Habitat Distribution

Project No: 301001-01069	Figure: 01069-00-GM-DAL-0058	Rev: 1

Compiled by BRISBANE GEOMATICS

K:\RTA\301001-01069\GM\DAL\01069-00-GM-EN-0058-1(Reef_Habitat_Distn_Classn).wor



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Dredged area

Grab sample location

Seagrass *(Enhalus acoroides)*

Seagrass leaves *(Enhalus acoroides)*, no rhizomes

Survey conducted February 2012

N

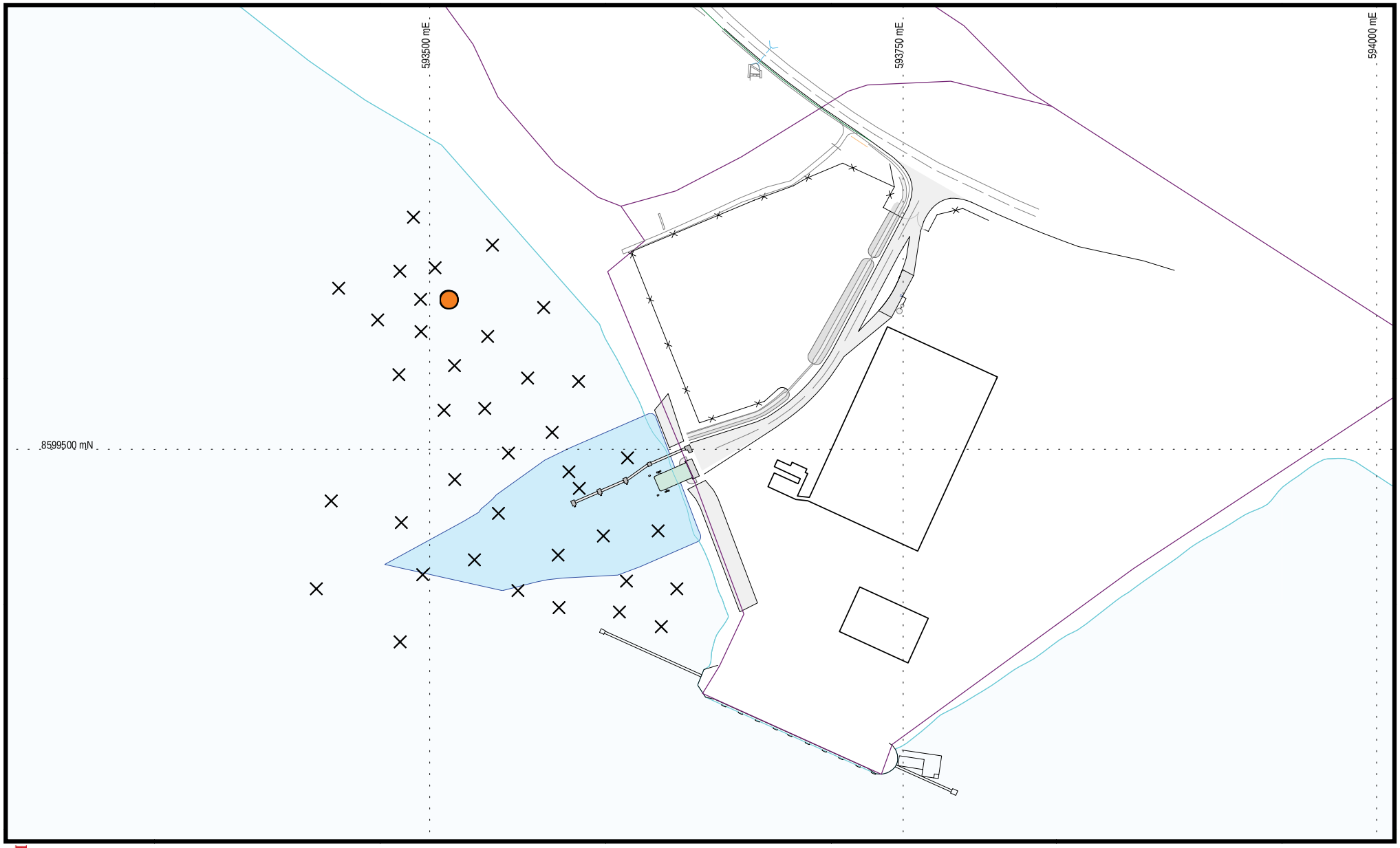
0 100m

South of Embley Project

Fig. 4-4: Seagrass Survey (Hornibrook Ferry Terminal and Tug Berths)

Datum/Projection: GDA94/MGA Zone 54

Date: 15/08/2012



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Reclaimed area
Dredged area
Grab sample location
Seagrass *(Halophila ovalis)*

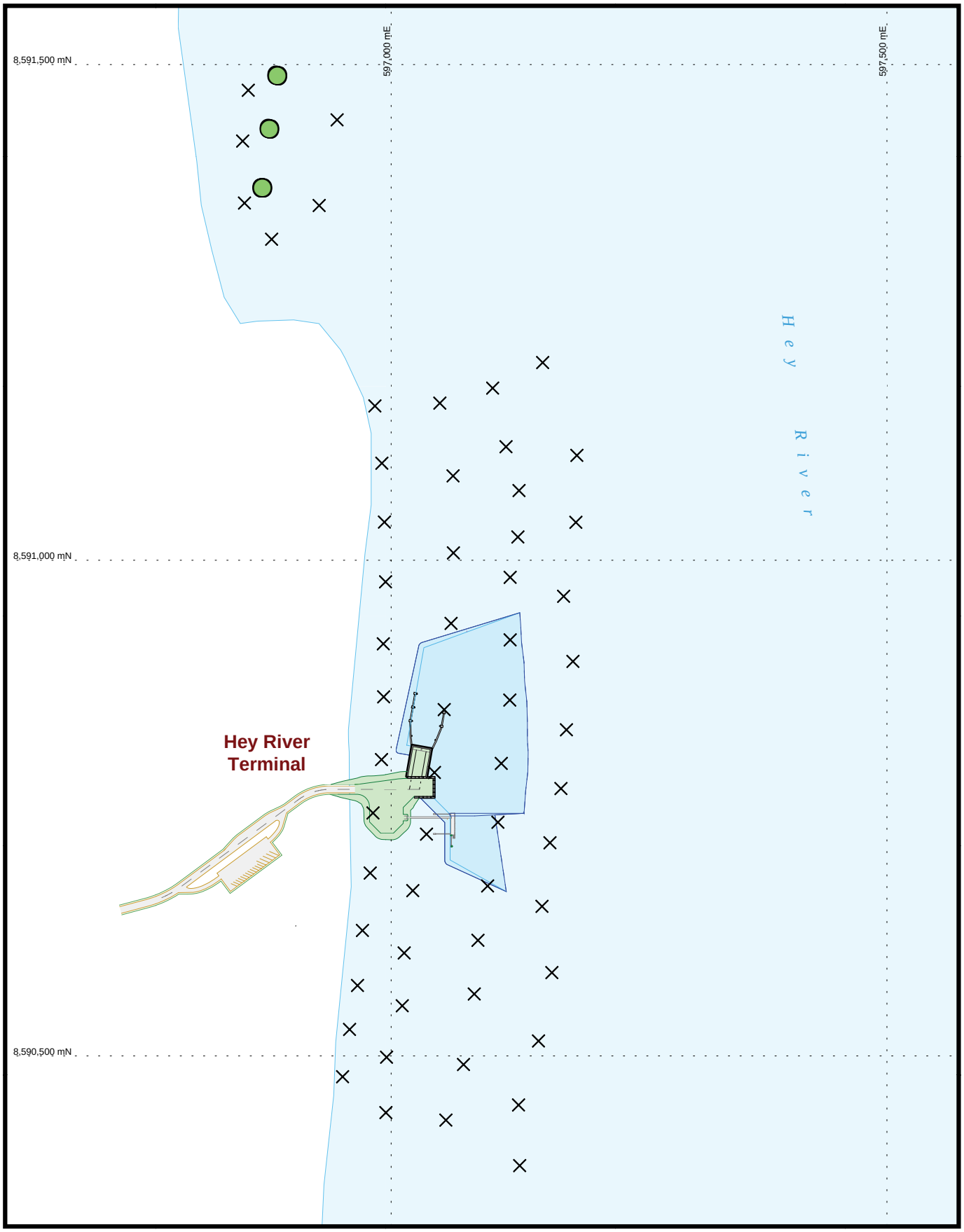
Survey conducted February 2012

N
0 50m

South of Embley Project

Fig. 4-5: Seagrass Survey (Humbug Barge Terminal)

Datum/Projection: GDA94/MGA Zone 54 Date: 15/08/2012



Reclaimed area

Dredged area

Grab sample location

Seagrass leaves *(Enhalus acoroides)*, no rhizomes

Survey conducted February 2012

Rio Tinto Alcan

South of Embley Project

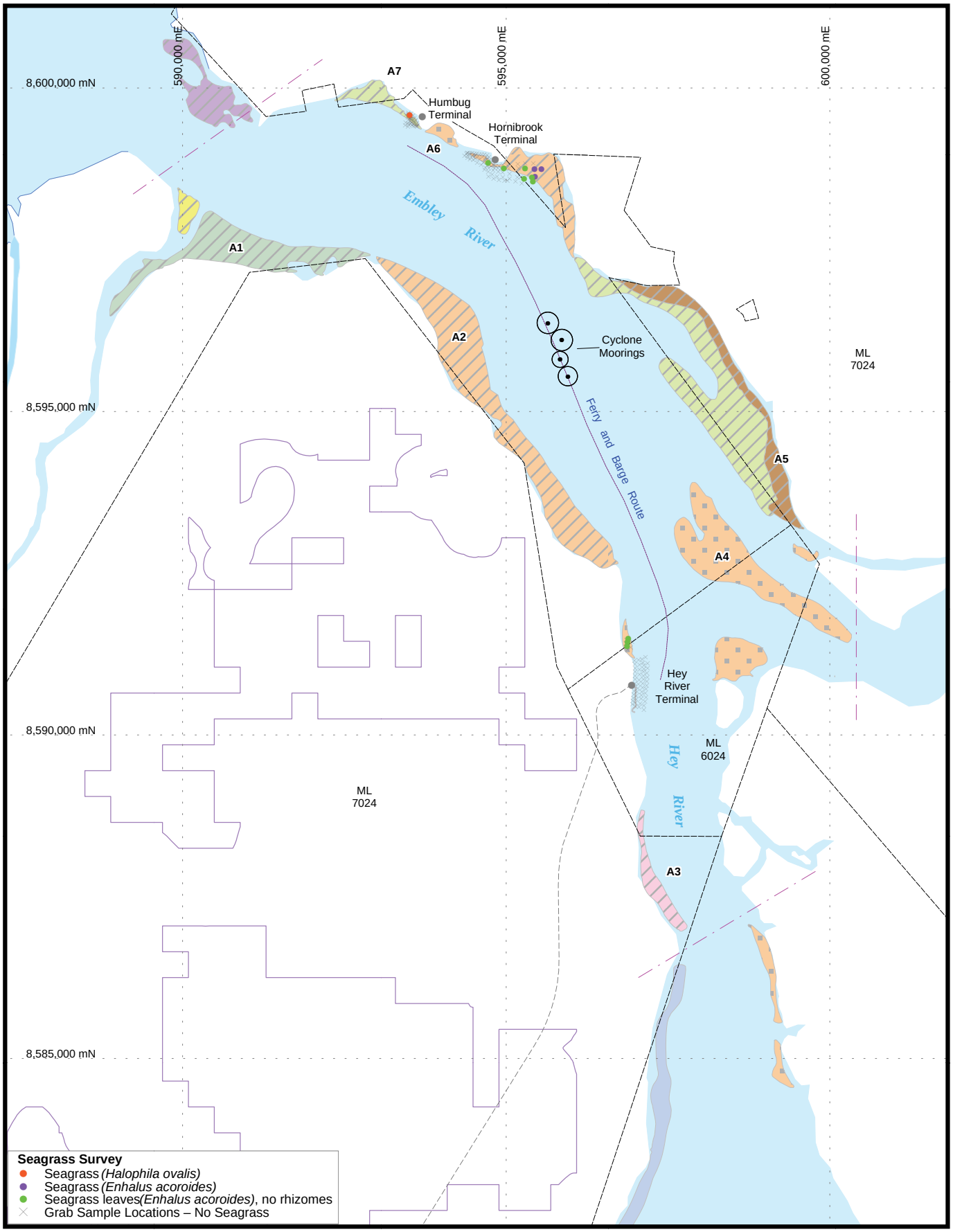
Fig. 4-6: Seagrass Survey (Hey River Ferry/Barge Terminal)

N

0 50 100 150m

Datum/Projection: GDA94/MGA Zone 54

Date: 17/09/2012



PlansSoE\2013\EIS Figure 4\Fig 4-07 Seagrass in Embley and Hey River Estuaries

RTA Mining Lease boundary

Mining Years 14- 40

Intensive monitoring area boundary

Seagrass Cover

- Aggregated patches
- Continuous cover
- Isolated patches

Community Type

- *Enhalus acoroides*
- *Enhalus acoroides* with mixed species
- *Halodule uninervis* (narrow)
- *Halodule uninervis* (narrow) with *Enhalus acoroides*
- *Halodule uninervis* (narrow) with mixed species
- *Thalassia hemprichii*
- *Thalassia hemprichii* with mixed species
- *Halophila ovalis* with mixed species

Source: North Qld Bulk ports and State of Qld through the Department of Agriculture, Fisheries and Forestry (2011)

South of Embley Project

Fig. 4-7: Seagrass in Embley and Hey River Estuaries

N

0 2km

Datum/Projection: GDA94/MGA Zone 54 Date: 26/02/2013

In the regional context, the North Marine Region comprises the Commonwealth marine area of the Gulf of Carpentaria, Arafura Sea and the Timor Sea as far west as the Northern Territory-Western Australian border. The North Marine Region is home to a diverse array of species that depend on the warm waters and the wide range of habitats. The North Commonwealth Marine Reserves Network was declared on the 16 November 2012 and came into effect on 17 November 2012, although potential 'on water' changes for users will not occur until July 2014 once management plans are finalised and take effect. DSEWPaC has provided general advice on zoning and allowed activities that would take effect once a management plan for the North Commonwealth Marine Reserves has been developed, and includes the continued authorisation of shipping through the area (DSEWPaC 2012j) The North Commonwealth Marine Reserves Network comprises eight reserves, including the West Cape York Commonwealth Marine Reserve. The West Cape York Reserve covers an area of 16,012km^2 near Mapoon to the north of Weipa (DSEWPaC 2012c). The reserve is an important resting area for marine turtles (Flatback, Hawksbill and Olive Ridley) between egg laying, and an important foraging habitat for aggregations of the migratory Lesser Frigatebird. The Reserve provides examples of the ecosystems of two provincial bioregions: the Northern Shelf Province and the Northeast Shelf Transition Province (DSEWPaC 2012c).

4.2.1.6 Existing Use of the Project Area

The Project area is not used for agriculture and is relatively undisturbed by development. Tracks to various parts of the Project area are used by recreational vehicle users, Traditional Owners and for access for exploration. Recreational uses include camping, fishing, pig hunting and recreational quad bike use. It is also used by the Traditional Owners for fishing and hunting. Exploration activities, including drilling and associated road development have taken place throughout the Project area; on-going activities, including investigations for the SoE Project, are continuing. There are no existing surface water dams or weirs within the Project area.

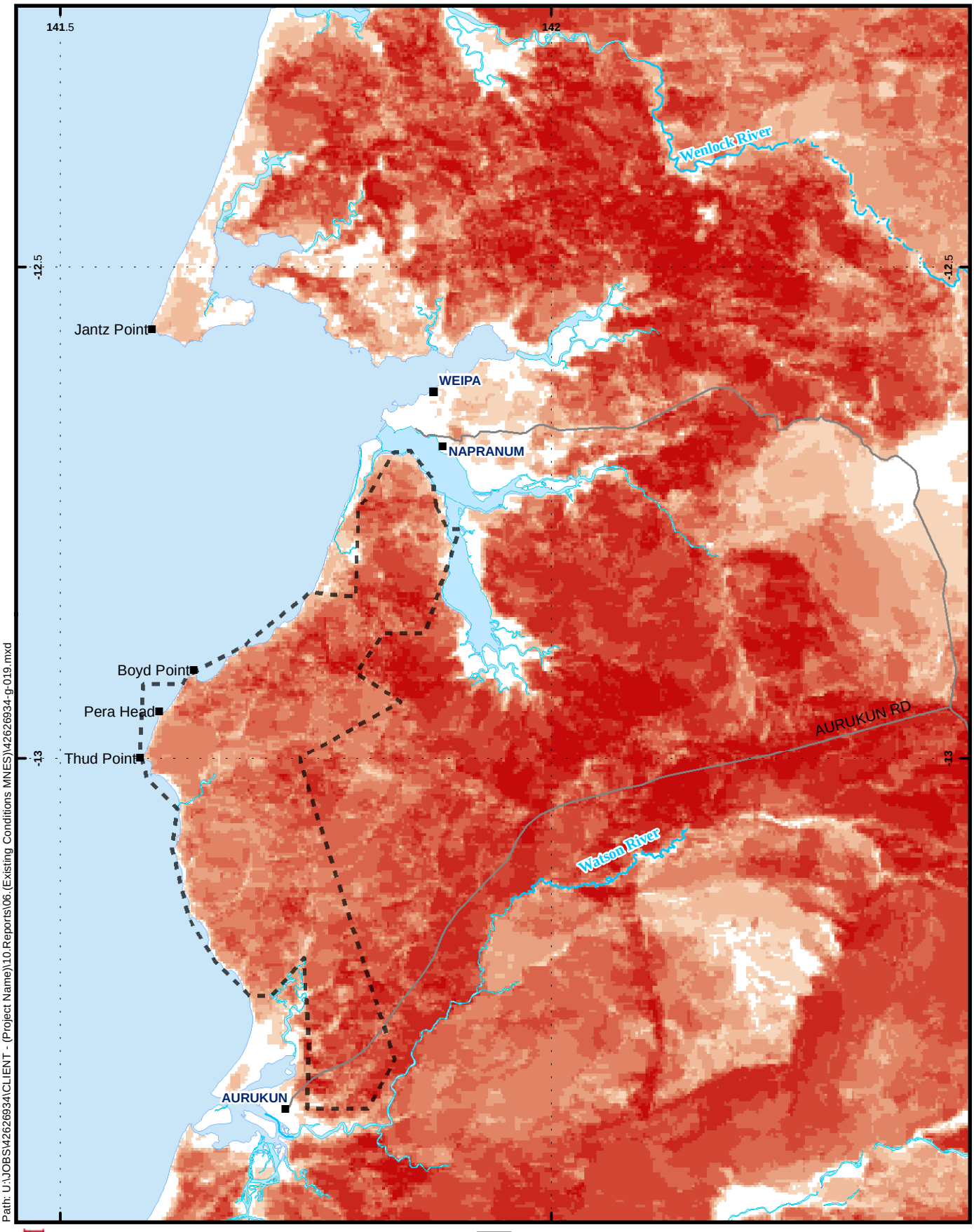
While overall there has been very little direct disturbance and the environment is generally in good condition, some areas of the Project area have been impacted by camping and rubbish dumping.

The proposed Port site, Hey River terminal and Hornibrook terminal have no existing infrastructure and no specific existing land use. The Hornibrook terminal is adjacent to the existing Lorim Point wharf. The proposed Humbug terminal is adjacent to NQBP's Humbug Wharf which is used by incoming barges carrying general cargo and fuel for Weipa and RTA's existing operations. Apart from activities associated with the existing Port of Weipa, the marine ecosystem in the area is effectively unmodified. Prawn trawling, commercial fishing and recreational fishing are carried out in the CMA and coastal waters surrounding the Project area.

4.2.1.7 Fire Regime

Fire regime is a critical determinant of vegetation condition and overall vegetation community composition, with the intensity, frequency and timing of fire important for both fire-adapted and fire-sensitive vegetation types. The current fire regime within the Project area is one of extensive, high intensity, late dry season fires with areas close to access tracks and high recreational visitation areas being intentionally burned on an annual basis.

Between 2004 and 2011, the entire Project area was burnt, with fires generally occurring three or four years out of the eight-year period and some areas being burnt every year (NAFI 2012) (**Figure 4-8**).



Path: U:\JOBS\42626934\CLIENT - (Project Name)\10.Reports\06.(Existing Conditions MNES)\42626934-g-019.mxd

Locality
South of Embley Mine and Port Area
Roads/Tracks
Drainage

Number of Years Burnt

0
1
2
3
4
5
6
7
8

South of Embley Project

Fig. 4-8: Fire History 2004 - 2011

N

0 3.75 7.5 15 km

Datum/Projection: GDA94/MGA Zone 54

Date: 06/11/2012

Rio Tinto Alcan

Fires in the Cape York region start through:

- maintenance of fire regimes by Traditional Owners;
- fire management for the purposes of biodiversity conservation;
- controlled burning by the Department of National Parks, Recreation, Sport and Racing in National Parks;
- maintenance of native pastures by the pastoral industry;
- storms; and,
- accidental or deliberate means.

The current fire regime within the Project area is inappropriate for both fire-adapted vegetation such as Darwin Stringybark woodland and fire-sensitive vegetation such as vine forest and riparian gallery forest (refer Section 7.10.1 in RTA 2011). Observations of vegetation patterns and fire damage within the Project area (and consideration of faunal communities) indicate that the current fire regime is promoting a simplified woodland vegetation community with premature loss of woodland canopy trees and suppression and retreat of fire sensitive flora and vegetation types.

4.2.1.8 Feral Animals

Six species of introduced fauna (pig, cat, dog, Cane Toad, horse and cattle) were detected during surveys of the Project area (refer **Figures 5-2** and **6-2**). All these species are commonly encountered throughout the Weipa–Aurukun area.

The feral pig is by far the most abundant introduced large fauna species, occurring within all habitat types. The damage from feral pigs on the terrestrial environment comprises rooting and wallows predominantly within *Melaleuca* wetlands, saltpan and coastal grasslands, riparian gallery forest and groundwater seepage areas. Feral pig damage in Darwin Stringybark woodland is usually minimal and does not have a significant impact on flora and fauna in this habitat. Predation by feral pigs is also the primary factor currently impacting marine turtle nesting success in the vicinity of the proposed Port site. Doherty (2005) and Limpus and Chatto (2004) identify one of the greatest threats to marine turtle populations on the west coast of Cape York is the loss of eggs from predation by feral pigs. Doherty (2005) reported 70% of nests surveyed in 2003-2004, between Pennefather River and Duyfken Point, were destroyed by feral pig predation, with a 100% predation rate early in the nesting season.

Relatively high densities of feral cats were recorded during the July 2007 survey period, with numerous individuals recorded in a single night's spotlighting effort. High numbers of feral cats were not subsequently recorded in later surveys. Given the low densities of small mammals within the Project area, key prey items for feral cats are likely to be ground reptiles, amphibians and birds.

Feral dogs/dingoes were observed during survey events with signs of the species also observed. The species was most frequently observed at campsites utilised during surveys that were located close to the coast and wetland areas. It is anticipated that, although the species would be encountered in all habitat types, it is most prevalent close to the coast where scavenging opportunities exist along beaches and close to human campsites.

The Cane Toad was not observed in the high densities that can be encountered on the east coast of Queensland, but was observed in and around wetland and riparian areas. Similarly, high densities of Cane Toad tadpoles were not observed in any of the wetland waterbodies, although minimal observations were possible during the commencement and middle of the wet season when peak reproduction would be expected. Cane Toads were not observed within the Darwin Stringybark

woodland habitat but may utilise these habitats during the wet season, although extensive use of this habitat away from wetland and riparian areas is not anticipated.

Feral horses and cattle were observed infrequently during all surveys but most often encountered in the Hey Point area close to the coast. It is likely that both species make use of grassy areas associated with seasonal wetlands and marine plains but neither is anticipated to be widespread in the Project area.

4.2.1.9 Weeds

Certain weeds currently present in the Weipa region would pose a significant threat to vegetation within the proposed mine and infrastructure areas were they to become established. Weeds such as Gamba Grass (*Andropogon gayanus*), Guinea Grass (*Panicum maximum*), Grader Grass (*Themeda quadriva /vis*), Rubber Vine (*Cryptostegia granditlora*), Leucaena (*Leucaena leucocephala*), Stinky Passionfruit (*Passiflora foetida*), Thatch Grass (*Hyparrehnia rufa*) and Hyptis (*Hyptis suaveolens*) can exclude native ground cover vegetation, significantly reduce ground cover floristic and structural diversity and affect recruitment of upper strata. Rubber Vine and Stinky Passionfruit can kill off midstorey and canopy trees with Rubber Vine most active in riparian and floodplain situations. Vegetation types most at risk from weed invasion include riparian, wetland, estuarine and coastal communities. Neem (*Azadirachta indica*) is an invasive plant that is also present in the Weipa area.

Weed invasion typically follows disturbance and it is anticipated that in the proposed mine and infrastructure areas, any potential weeds would most likely occur in rehabilitation areas and the edges of roads and mined areas. Based on observations of undisturbed habitat immediately adjacent to mining blocks at the existing East Weipa and Andoom mining areas, it is not anticipated that weed invasion of undisturbed vegetation would occur as a result of the Project provided that appropriate weed control measures are implemented.

4.2.2 Shipping Activities

DSEWPaC's *Significant Impact Guidelines* (DEWHA 2009c) notes that, where appropriate precautions have been taken against translocating potential pest species, routine ship transits would not normally be expected to have a significant impact on a matter of NES. However, an assessment of Project-related shipping activities has been made in accordance with the Tailored EIS Guidelines.

Bauxite shipping leaving the proposed Port would travel north through the Gulf of Carpentaria, past the existing Port of Weipa. Vessels supplying international export markets (e.g. China) would then typically pass through the Gulf of Carpentaria and the Arafura Sea to the west of West Papua, and then east of the Philippines (**Figure 2-3**). Vessels supplying the domestic bauxite market would travel from the proposed Port to the Port of Gladstone via the Torres Strait shipping route and the inner GBR Designated Shipping Area (**Figure 2-3**). A description of bauxite shipping activities is provided in **Section 3.9.2**.

Cargo shipping for both construction and operations from the Port of Cairns or other east coast domestic ports would travel a similar route to domestic bauxite shipping with deliveries being predominantly made to the existing Port of Weipa. Some cargo shipping during construction would originate from international ports, most likely in the Asia Pacific region, and would travel similar routes to export bauxite shipping without transiting the GBR navigational area. Other construction cargo shipping from other domestic ports would also travel established shipping routes. Fuel shipments for both construction and operations would originate from Darwin and travel to the Port of Weipa, unless alternate arrangements are made by the third party supplier.

4.2.3 International Shipping Route

The international shipping route from the Port would pass through the Gulf of Carpentaria (refer **Figure 2-3**). The Gulf forms a large part of the Australian North Marine Region and is the largest tropical epicontinental sea in the world. The North Marine Region is recognised as an area of global conservation significance for marine species and migratory birds, providing important breeding, feeding and nursery grounds for marine turtles and Dugong (DSEWPaC 2012f).

The *Marine Bioregional Plan for the North Marine Region* (DSEWPaC 2012f) identifies the Gulf of Carpentaria's coastal zone as one of the North Marine Region's key ecological features as the area supports high levels of biological productivity, aggregations of marine life, high biodiversity and endemism driven by nutrient inflow from rivers and the Gulf of Carpentaria Gyre (rotating ocean currents).

The majority of the Gulf of Carpentaria consists of flat, unvegetated, soft sediment habitats. These are populated by infauna and mobile epifauna invertebrate communities of polychaetes, crustaceans, molluscs and echinoderms.

Shipping would continue to occur through the West Cape York Commonwealth Marine Reserve near Mapoon to the north of Weipa (DSEWPaC 2012c). Under the proposed zoning scheme, shipping would still be permitted through the reserve.

Fisheries-oriented research has been carried out in the Arafura Sea, but ecological research has been limited.

4.2.4 Domestic Shipping Routes

4.2.4.1 Torres Strait Route

Domestic bauxite and cargo shipping would pass through the Gulf of Carpentaria before entering Torres Strait. The Torres Strait region covers an area of more than 35,000km^2, of which 2.6% is terrestrial land, 6.2% tidally inundated reef flats, and 91.2% open seas. The Torres Strait is a major shipping route for transit between the Indian and Pacific Oceans. The numerous reefs and shoals in Torres Strait limit safe navigation by large vessels with much of the navigable route through Torres Strait confined in both width and depth.

The Torres Strait contains a variety of biogeographical qualities ranging from mangrove islands of terrigenous origin in the north, sand cays in the central region, highly fertile volcanic islands in the east, and the granitic terrestrial islands in the west. The tidal influences of two ocean systems, the Indian and Pacific, as well as the input of freshwater and sediment from coastal rivers have a great effect on the area's biodiversity.

The Torres Strait provides important habitat for many vulnerable and endangered species, including marine turtles, and migratory species including Dugong. The Torres Strait also supports commercial fisheries including prawns, mackerel and tropical rock lobster.

In recognition of the environmental sensitivity of the area and the difficulties associated with safe navigation, the IMO has designated the Torres Strait as an extension of the GBR and classified it as a 'Particularly Sensitive Sea Area'. This designation allows Australian regulators to apply additional protective measures such as a ship reporting system, coastal vessel tracking services, compulsory pilotage, navigational aids, marine pollution response plans, and Designated Shipping Areas.

4.2.4.2 Great Barrier Reef Routes

The GBR is internationally recognised for its outstanding biodiversity. The World Heritage status of the GBR recognises its great diversity of species and habitats. The GBR is the world's largest coral reef ecosystem, extending over 14 degrees of latitudinal range, and includes:

- over 2,900 separate coral reefs;
- 70 bioregions, comprising 30 reef bioregions and 40 non-reef bioregions;
- over 2,000km² of mangroves, with species representing 54% of the world's mangrove diversity;
- about 6,000km² of seagrass beds;
- about 900 islands ranging from small coral cays to large continental islands; and,
- one of the world's most important Dugong populations and six of the world's seven species of marine turtle.

Domestic bauxite and cargo shipping would pass through the Gulf of Carpentaria, the Torres Strait and the GBR. Major shipping routes within the GBR are divided into an outer and inner route (Designated Shipping Area), with a number of additional channels connecting these (**Figure 2-3**). Approximately 65-75% of all shipping in the GBR uses the inner GBR Designated Shipping Area (GBRMPA 2009b). The inner GBR Designated Shipping Area is currently utilised by bulk carriers to transport bauxite from the Port of Weipa to the Port of Gladstone and would continue to be used to transport bauxite from the proposed Port (via the Torres Strait shipping route) to the Port of Gladstone. This route is described by Trainor and Hugget (2002) as follows:

> *"The inner route extends north-south between the GBR and the Queensland coast from Torres Strait to Gladstone in the south. The northern section from Torres Strait to Cairns is most restricted and passage through these waters involves navigation within confined waters for a long period, normally 40 hours. The inner route is well charted and marked with navigational aids."*

Under the *Great Barrier Reef Zoning Plan* (Zoning Plan), commercial ships do not require a permit to transit through General Use Zones and Designated Shipping Areas. By establishing Designated Shipping Areas the Zoning Plan also provides for certainty of access for shipping in the GBR and has facilitated the implementation of regulations governing safety, pollution prevention response, and search and rescue.

All Project-related bauxite and cargo shipping between the Project area and the Port of Gladstone or other Australian east coast ports would remain within the inner GBR Designated Shipping Areas. In this regard, the effect of section 43 of the EPBC Act is that approval is not required under Part 9 of the EPBC Act to authorise the proposed shipping activities within the Designated Shipping Areas in the GBR.

4.2.5 Port of Gladstone

The Port of Gladstone is within the GBRWHA, although it is not part of the GBRMP.

If on arrival at the Port of Gladstone bauxite bulk carriers are required to wait before entering, they are required to anchor at a designated location outside the port entrance as shown on **Figure 3-10**.

Upon entering the port, bauxite bulk carriers would travel along existing shipping channels from the outer harbour to the Targinie Channel. Passing of vessels is permitted using accepted by-pass channels to facilitate port efficiency and safety.

Vessel progress within the port boundaries would be monitored by radar at all times. All vessels would have a minimum of one local pilot on board through the Port of Gladstone, with pilotage commencing at the Fairway Buoy.

As is currently the case with bauxite shipped from the Port of Weipa, shipments would be delivered to the two existing alumina refineries; Queensland Alumina Limited (QAL) and Yarwun refineries. Bulk carriers for the QAL refinery would continue to be unloaded at South Trees Island on the southeast outskirts of the city of Gladstone. Bulk carriers for the Yarwun refinery would continue to be unloaded at Fisherman's Landing, north-west of Gladstone. The locations of these wharves are shown on **Figure 3-10**.

4.3 Assessment Process

The Tailored EIS Guidelines acknowledge that it is appropriate for the level of data collection and impact assessment undertaken to be commensurate to the potential or likelihood of impact that the Project could have on matters of NES.

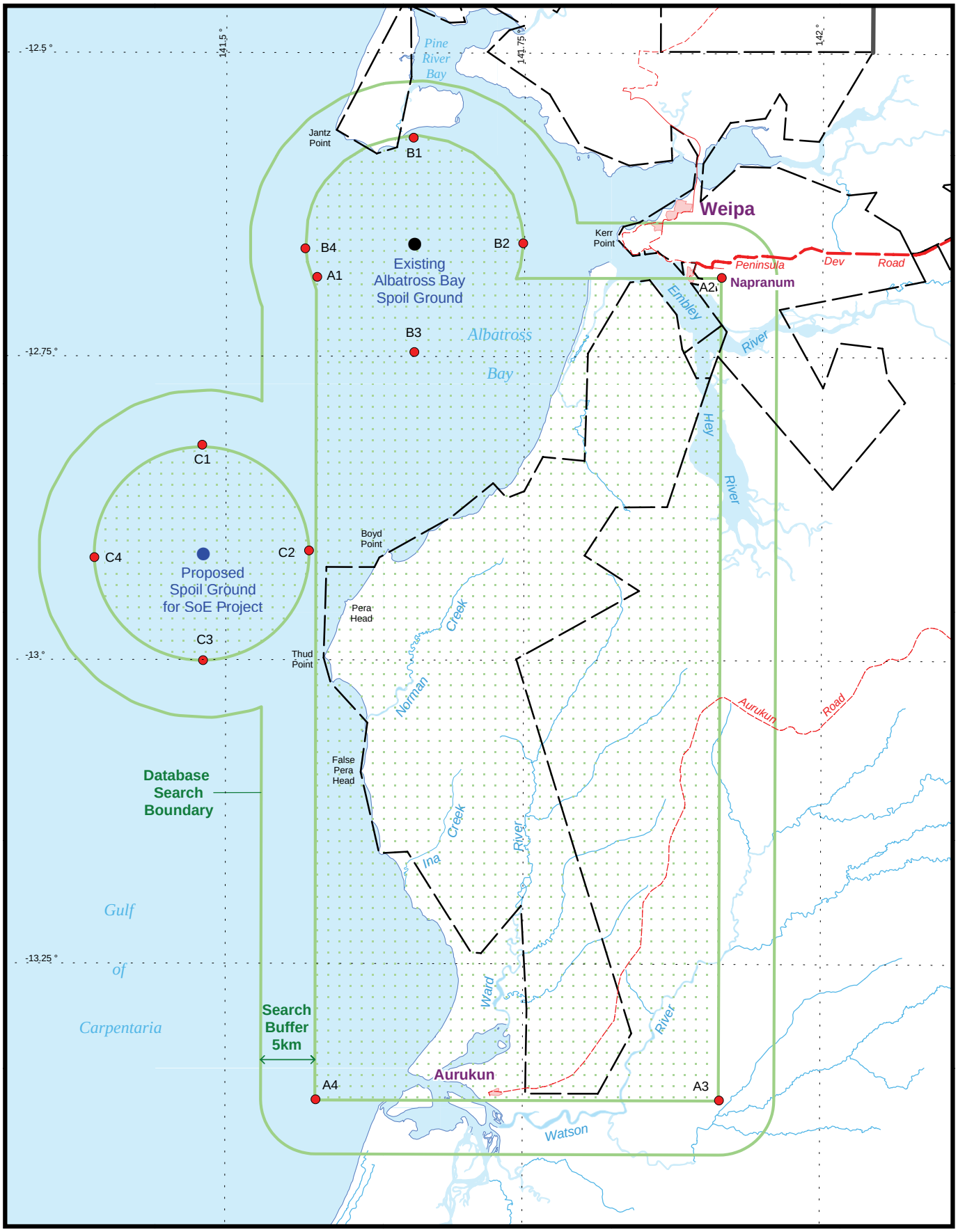
In accordance with Section 4.5 A1 and B1 of the Tailored EIS Guidelines, this section describes the process used to identify the matters of NES that are likely or known to occur in the Project area and Project-related shipping routes or are likely or known to be impacted by the Project (including Project-related shipping) in order to determine the appropriate level of impact assessment required.

The process for determining which matters of NES require assessment was as follows:

- *Listed threatened species and communities and listed migratory species* - For these two controlling provisions, the Tailored EIS Guidelines require detailed impact assessment for the mine, Port and associated infrastructure was based on whether the species were known or likely to occur in the Project area. For Project-related shipping activities, the need for detailed impact assessment was based on the likelihood that the species could be impacted.
- *World Heritage properties, National Heritage places, Commonwealth marine area and the Great Barrier Reef Marine Park* - given that the presence and boundaries are well-defined for these four controlling provisions, the need for detailed assessment was based on the presence of these matters of NES.

The methodology used to determine the level of assessment required for each matter of NES is based on a risk based approach, consistent with the Tailored EIS Guidelines, as follows:

- Listed Threatened Species and Ecological Communities/Listed Migratory Species;
  - *Mine, Port and Associated Infrastructure*. A Protected Matters Search of the Project area was undertaken to identify the relevant listed species (refer **Figure 4-9**). As all of the species identified in the search may not be present, an assessment of whether each species is known, likely, possible or unlikely to occur in the Project area was then undertaken based on records, survey or presence of habitat. Species that are known or likely to occur were deemed to warrant a detailed impact assessment as impacts could occur because development in the Project area would require construction and operational activities that could temporarily or permanently displace species or impact habitats. A conservative approach was taken and species that could possibly occur were also selected for more detailed assessment.
  - *Project-related Shipping Activities*. A Protected Matters Search was undertaken along the Project-related shipping routes to identify the relevant listed species. As the nature of Project-related shipping activities is significantly different to that of the activities proposed for the Project area (i.e. no direct displacement of habitat) the likelihood of impact on each species identified in the Protected Matters Search was used to determine the level of impact assessment required. If it was determined that the impact on matters of NES from Project-related shipping activities was likely, a more detailed impact assessment of the species was undertaken. If not, detailed impact assessment was not required.
  - World Heritage properties, National Heritage places, Commonwealth marine areas, and Great Barrier Reef Marine Park;
  - *Mine, Port and Associated Infrastructure*. A Protected Matters Search was undertaken of the Project area to identify if any of these matters of NES were present. For those present a detailed assessment was undertaken.



RTA Mining Lease boundary
Locality
Drainage
Road/track
EPBC Search Coordinates
Project Area
Area of Database Search

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South of Embley Project

Fig. 4-9: Area of Database Search (Mine and Port)

N

0 5 10 15km

Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012

— *Project-related Shipping Activities*. A Protected Matters Search was undertaken to identify if any of these matters of NES were present along Project-related shipping routes. For those present an impact assessment was undertaken.

The following sections outline the results of the Protected Matters Searches and the process used to identify the matters of NES that are likely or known to occur in the Project area or are likely or known to be impacted by the Project in order to determine which require detailed impact assessment.

The methodology used for the detailed impact assessment began with an assessment of the unmitigated direct and indirect impacts for each of the relevant matters of NES. Avoidance and mitigation measures were then developed and the mitigated direct and indirect impacts were determined. The magnitude of the mitigated relevant impacts (i.e. impacts that would or are likely to occur on a matter of NES) was then categorised as high, moderate, minor or none/negligible based on criteria relevant to the matter of NES being assessed. High or moderate mitigated relevant impacts were determined to be significant residual impacts. Minor or none/negligible mitigated relevant impacts were determined to be non-significant residual impacts.

4.4 Assessment of the Project Area

4.4.1 Protected Matters Search

4.4.1.1 Controlling Provisions

The Project area includes the mine, Port and associated infrastructure areas. Assessment relating to Project-related shipping activities is provided in **Section 4.5**. The controlling provisions relevant to the Project, as determined by the Minister for Sustainability, Environment, Water, Population and Communities in March 2012, are as follows:

- World Heritage properties (Sections 12 and 15A);
- National Heritage places (Sections 15B and 15C);
- Listed threatened species and communities (Sections 18 and 18A);
- Listed migratory species (Sections 20 and 20A);
- Commonwealth marine areas (Sections 23 and 24A); and,
- GBRMP (Sections 24B and 24C).

4.4.1.2 Search Area and Results Summary

A desktop analysis was conducted using the online Protected Matters Search Tool to identify any matters of NES that may be potentially present in the Project area and hence may be affected by Project activities.

It is important to note that the Protected Matters database has inherent limitations based on the accuracy of geographic data. In particular, data presented may relate to potential occurrences of species within a general area, rather than for known occurrences or actual observations at a specific site.

For threatened ecological communities where the distribution is well known, data have been derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are not as well known, existing vegetation maps and point location data were used to produce indicative distribution maps. For threatened species where the distributions are well known, data have been digitised from sources such as recovery plans and detailed habitat studies. For species whose distributions are not as well known, point locations are collated from government wildlife authorities, museums, and non-government organisations. Bioclimatic distribution models are then generated and these validated by experts. In some cases, the map data are based solely on expert knowledge (DSEWPaC 2012q).

The Protected Matters Search for the Project area covering the mine, Port and associated infrastructure was conducted on 19 July 2012 over an area bound by the coordinates listed in **Table 4-1** and included a 5km buffer. The extent of the search area is shown in **Figure 4-9**. The results of the Protected Matters Search for the Project area are summarised in **Table 4-2**.

Note that a Protected Matters Search of the shipping routes was also undertaken and is detailed in **Section 4.5.2.2**.

As shown in **Table 4-2**, there are no World Heritage properties or National Heritage places in or near the Project area for the mine, Port and associated infrastructure areas. The Project area does not overlap the GBRMP.

Table 4-1 Protected Matters Search Coordinates for the Project area

Location Point	Latitude	Longitude
A1	-12.68458	141.5761
A2	-12.68458	141.9152
A3	-13.36194	141.9152
A4	-13.36194	141.5761
B1	-12.56847	141.6611
B2	-12.66036	141.7493
B3	-12.74694	141.6551
B4	-12.66119	141.5661
C1	-12.8225	141.4855
C2	-12.91358	141.5732
C3	-13.0038	141.4767
C4	-12.91358	141.3891

Table 4-2 Results of Protected Matters Search for the Project Area

	Search Results
World Heritage Properties	There are no declared World Heritage properties within or near the Project area. The Australian Government is currently conducting consultation on the proposed nomination of a Cape York Peninsula World Heritage area. The Minister for Sustainability, Environment, Water, Population and Communities has stated that the nomination would not proceed without Traditional Owner consent. A nomination for Cape York has yet to be made.
National Heritage Places	There are no declared National Heritage places within or near the Project area.
Commonwealth Marine Areas	The proposed new spoil ground, approximately 17km west of Boyd Point, is in the Commonwealth marine area.
Great Barrier Reef Marine Park	The Project area does not overlap the Great Barrier Reef Marine Park.
Threatened Ecological Communities (TECs)	No TECs were returned by the database search or identified in field surveys of the Project area. The TEC '*The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin'* does not occur within or near the Project area.
Threatened Species	7 flora species 6 fauna species 13 estuarine/marine species
Migratory Species	45 avian migratory species 10 non-avian migratory species

4.4.1.3 Commonwealth Marine Areas

The Commonwealth marine area extends from three to 200 nautical miles from the territorial sea baseline. Dredged spoil from the proposed Port would be disposed of at the proposed new spoil ground within the Commonwealth marine area, approximately 17km west of Boyd Point. A detailed description of the Commonwealth marine area and an assessment of the Project's impacts on its values are provided in **Section 10**.

4.4.1.4 Listed Threatened Ecological Communities

A Protected Matters Search of the pre-defined Cape York Natural Resource Management (NRM) region (accessed on the 19/07/2012), identified the potential occurrence of the threatened ecological community '*The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin*'. Discharge springs, which are defined as spring's supplied by underground water from the Great Artesian Basin, are not found in the Project area or in Cape York. Therefore this threatened ecological community would not occur in or near the Project area (see **Section 16.3.4**).

4.4.1.5 Listed Threatened Species

The Protected Matters Search identified seven threatened terrestrial flora species, six threatened terrestrial fauna species and thirteen threatened estuarine and marine species. The potential likelihood of occurrence of these three groups of species is discussed in **Sections 4.4.2.1**, **4.4.2.2** and **4.4.2.3** respectively.

4.4.1.6 Listed Migratory Species

Avian Migratory Species

The Protected Matters Search identified 45 avian migratory species of which one species is listed as Vulnerable (Painted Snipe). The potential likelihood of occurrence of avian migratory species in the Project area is provided in **Section 4.4.2.4**.

Non-Avian Migratory Species

The Protected Matters Search identified ten non-avian migratory species of which one species is listed as Endangered (Blue Whale) and two species are listed as Vulnerable (Whale Shark and Humpback Whale). The potential likelihood of occurrence of non-avian migratory species in the Project area is provided in **Section 4.4.2.5**.

4.4.2 Matters of NES for the Project Area Requiring Further Assessment

This section assesses the likelihood of occurrence of each species identified in the Protected Matters Search areas at the following locations:

- mining area (mining footprint);
- infrastructure footprint, including Dam C on a tributary of Norman Creek;
- proposed Port site (including temporary seaborne access);
- proposed new spoil ground;
- Albatross Bay spoil ground;
- Ferry, barge and tug terminals – Hey and Embley Rivers;
- balance of Project area that would not be disturbed; and,
- Project-related shipping routes.

The following sections document the assessment for flora, terrestrial fauna, marine and estuarine fauna, migratory avian and migratory non-avian species to determine which species require more detailed assessment.

4.4.2.1 Threatened Flora

The seven threatened flora species identified by the Protected Matters Search and their likelihood of occurrence within the Project area are summarised in **Table 4-3**. Although the Tailored EIS Guidelines only require the assessment of species that are known or likely to occur, to be conservative, species that have been determined as possibly occurring within the Project area have also been included in the assessment. The following six species (all Vulnerable) were determined as being either possible, likely or known to be occur within the Project area:

- *Calophyllum bicolor*;
- Cooktown Orchid (*Dendrobium bigibbum)*;
- Chocolate Tea Tree Orchid (*Dendrobium johannis)*;
- Ant Plant (*Myrmecodia beccarii)*;
- Beach Nightshade (*Solanum dunalianum);* and,
- *Spathoglottis plicata.*

These species were therefore subjected to detailed impact assessments in accordance with the methodology described in **Section 4.3**. These assessments are presented in **Sections 5.3** to **5.8**.

Table 4-3 Likelihood of Threatened Flora Species Occurring in the Project Area

Species Name	EPBC Act Status	Likelihood of Occurrence within Project Area
Calophyllum bicolor [Clusiaceae]	*Vulnerable*	**Mining Area** **Unlikely:** no suitable habitat exists in Darwin Stringybark woodland. **Infrastructure footprint** **Unlikely:** targeted surveys of the dam area and infrastructure crossings of riparian areas indicated with a high reliability that this species is not present in these locations. **Balance of Project Area not disturbed** **Possible**: only limited areas of potentially suitable fire retardant habitat occur within the Project area. The species was not detected during field surveys of five semi-permanent groundwater seepage rainforest patches that are close to proposed mining areas and provide suitable habitat for the species, but may occur in the Project area in groundwater-fed riparian gallery forest or seepage zones nearer the coast. Six other semi-permanent seepage areas that were surveyed (located outside the disturbance footprint) did not have suitable habitat present.
Cooktown Orchid *Dendrobium bigibbum* (also known as *Vappodes bigibba)* [Orchidaceae]	*Vulnerable*	**Mining Area** **Unlikely:** no suitable habitat exists in Darwin Stringybark woodland. **Infrastructure footprint** **Known to Occur**: identified in pockets of riparian rainforest within the footprint of Dam C, in the vicinity of the infrastructure corridor crossings on Norman Creek, and in the vicinity of road crossings of Norman Creek and Winda Winda Creek. **Balance of Project Area not disturbed** **Known to Occur:** located in coastal and non-coastal vine forest, and mangrove edges at several locations within the Project area that would not be affected by mining or infrastructure.
Chocolate Tea Tree Orchid *Dendrobium johannis* (also known as *Cepobaculum johannis)* [Orchidaceae]	*Vulnerable*	**Mining Area** **Unlikely:** no suitable habitat exists in Darwin Stringybark woodland. **Infrastructure footprint** **Known to Occur**: occurs within the infrastructure corridor where it crosses Norman Creek. Not found in the footprint of Dam C. **Balance of Project Area not disturbed** **Known to Occur:** located in riparian gallery forest and *Melaleuca* dominated swamps particularly along major drainage lines and associated tributaries throughout the Project area, in areas not to be disturbed.
Ant Plant *Myrmecodia beccarii* [Rubiaceae]	*Vulnerable*	**Mining Area** **Unlikely:** no suitable habitat exists in Darwin Stringybark woodland. **Infrastructure footprint** **Unlikely:** targeted surveys of the dam area and infrastructure crossings of riparian areas indicated with a high reliability that this species is not present in these locations**.** **Balance of Project Area not disturbed** **Possible**: this species is of restricted distribution in the Weipa area. If a permanent groundwater seepage zone was identified within the Project area, this

Species Name	EPBC Act Status	Likelihood of Occurrence within Project Area
		species may occur within this zone. At present only semi-permanent groundwater seepage zones have been identified within the Project area. The species may also occur within or on the landward margin of mangroves within the Project area.
Beach Nightshade *Solanum dunalianum* [Solanaceae]	*Vulnerable*	**Mining Area** **Unlikely:** no suitable habitat exists in Darwin Stringybark woodland. **Infrastructure footprint** **Unlikely:** within the Project area the species is expected to be restricted to coastal vine forest and vine forest on bauxite. **Balance of Project Area not disturbed** **Likely**: not detected during field surveys but suitable coastal vine forest and vine forest on bauxite habitat occurs in the Project area in areas not to be disturbed.
Spathoglottis plicata [Orchidaceae]	*Vulnerable*	**Mining Area** **Unlikely:** no suitable habitat exists in Darwin Stringybark woodland. **Infrastructure footprint** **Possible:** potential habitat for the species occurs within the proposed footprint of Dam C and the infrastructure corridor crossing of Norman Creek, although targeted surveys did not locate the species within these areas. **Balance of Project area not disturbed** **Possible**: not detected during field surveys anywhere within the Project area but suitable stream, wetland and seepage habitat occurs extensively in the Project area in areas that would not be directly disturbed by the Project.
Cajanus mareebensis	*Endangered*	**Unlikely:** No suitable soil type or habitat is present within the Project area. *Cajanus mareebensis* occurs in grassy woodlands of *Melaleuca-Acacia*, *Eucalyptus-Callitris* and *Eucalyptus-Corymbia* woodlands on sandy soils derived from granite with a lower horizon of impeded drainage. This species was not found during field surveys of the Project area.

4.4.2.2 Threatened Fauna

The six threatened terrestrial fauna species identified by the Protected Matters Searches and their likelihood of occurrence within the Project area are summarised in **Table 4-4**. Although the Tailored EIS Guidelines only require the assessment of species that are known or likely to occur, to be conservative, species that have been determined as possibly occurring within the Project area have also been included in the assessment.

The Bare-rumped Sheathtail Bat (*Saccolaimus saccolaimus nudicluniatus)* was not identified in the Protected Matters database; however the distribution of this species on the SPRAT database (DSEWPaC 2012q) covers large areas of Cape York, although not specifically the Project area. This species has also been considered in the assessment (refer **Table 4-4** and **Section 6.6**).

The Masked Owl (*Tyto novaehollandiae kimberli*) and Australian Painted Snipe (*Rostratula australis*) were not identified in the current Protected Matters database search; however, have been included in the initial assessment as they were identified in a previous search of the Protected Matters database conducted for the Queensland EIS (Section 7.3 of RTA 2011).

Of the six species, the following three could possibly occur within the Project area:

- Red Goshawk (*Erythrotriorchis radiates)*;
- Masked Owl (*Tyto novaehollandiae kimberli)*; and,
- Northern Quoll (*Dasyurus hallucatus)*.

These species were subjected to a detailed impact assessment in accordance with the methodology described in **Section 4.3**. This assessment is presented in **Sections 6.3** to **6.5**.

It should be noted that the Protected Matters database search included the endangered Gouldian Finch (*Erythrura gouldiae*). Although not found during the field surveys, RTA engaged Professor Stephen Garnett of Charles Darwin University to undertake an independent review of the potential presence of this endangered species in the mine, Port and associated infrastructure areas (Garnett and Crowley 2000). Professor Garnett has been an author and contributor to the *Action Plan for Australian Birds* since 1990 and has been involved in the preparation of numerous recovery plans for various bird species, including the *National Recovery Plan for the Gouldian Finch* (O'Malley 2006). The review noted the following.

- Gouldian Finches were recorded in Western Cape York (on the Archer River outside the Project area) in 1914/15 but have not been recorded since;
- the bird is a savannah woodland granivorous bird that does not prefer the wetter taller forests characteristic of the mine, Port or associated infrastructure areas; and,
- a review of all the REs located in the Project area concluded that they did not contain suitable habitat for this species.

It was concluded that it is highly unlikely that the Gouldian Finch is present in the mine, Port or associated infrastructure areas. Professor Garnett's review is included in **Appendix 4-B**.

Table 4-4 Likelihood of Threatened Fauna Species Occurring in the Project Area

Species Name	EPBC Act Status	Likelihood of Occurrence within Project Area
Red Goshawk *Erythrotriorchis radiatus*	*Vulnerable*	**Mining Area** **Possible:** the open forests of the mining area and adjacent habitats constitute potential foraging habitat for the Red Goshawk. Although no sightings of the Red Goshawk were made during surveys. Darwin Stringybark woodlands within 1km of permanent water could be used for nesting. It is possible that nests of the species could occur within proposed mining areas. **Infrastructure footprint** **Possible**: no nests were located within the proposed dam site. However, the Dam C site contains potential foraging and nesting habitat. **Balance of Project Area not disturbed** **Possible**: the open forest, woodland, riparian, and wetland habitats that occur throughout the Project area, present suitable nesting and feeding opportunities for the species.
Gouldian Finch *Erythrura gouldiae*	*Endangered*	**Unlikely**: There is one record of Gouldian Finches in Western Cape York outside the Project area (Archer River) in 1914/15 but it has not been recorded since. The bird is a savannah woodland granivorous bird that does not prefer the wetter taller forests characteristic of the Project area. A review of all the REs located on the Project area concluded that the Project area did not contain preferred habitat for this species. Refer to **Appendix 4-B** for additional details.
Australian Painted Snipe *Rostratula australis*	*Vulnerable*	**Unlikely:** Project area is well beyond the known range of the species, which is not known to occur on Cape York Peninsula (Garnett and Crowley 2000).
Masked Owl *Tyto novaehollandiae kimberli*	*Vulnerable*	**Mining Area** **Unlikely:** suitable habitat areas (riparian, wetland and vine forest habitats) and peripheral habitat (Darwin Stringybark open forest habitat adjacent to the moderate suitability habitat areas), are not located within the proposed mining area. **Infrastructure footprint** **Possible**: sections of tall closed forest on major drainages along Norman Creek and the Ward River provide potentially suitable habitat. The Dam C footprint contains some suitable habitat; however, this area is not regarded as especially significant for foraging or breeding. The prevalence of the species may be significantly limited by the apparent paucity of small mammal populations within the Project area. **Balance of Project Area not disturbed** **Possible**: the majority of key habitat resources for the species within the Project area are located in areas not to be disturbed; however, the prevalence of the species may be significantly limited by the apparent paucity of small mammal populations.
Northern Quoll *Dasyurus hallucatus*	*Endangered*	**Mining Area** **Unlikely:** this species has declined on Cape York following the spread of Cane Toads to the area. A paucity of favoured rocky habitat and continued exposure to modification and suppression by fire may see limited persistence of the species in suitable habitat within the Project area. Whilst the species may once have utilised Darwin Stringybark woodland it is most likely that patches of vine forest and riparian forest habitat currently provide the most likely habitat for the species within the Project area (**Sections 6.5.2.1** and **6.5.2.2**).

Species Name	EPBC Act Status	Likelihood of Occurrence within Project Area
		Infrastructure footprint **Possible**: minor areas of suitable riparian habitats are located within the footprint of the water supply dam, although targeted searches did not locate the species in these areas. The habitat areas within the proposed dam footprint are not regarded as especially significant for foraging or breeding. **Balance of Project Area not disturbed** **Possible**: although the optimal habitat for the species, rocky outcrops and other rocky habitat, is not available within the Project area, the Northern Quoll may occur in vine forest and riparian gallery forest. Suitable habitat for the species includes the riparian communities of Norman Creek, and the vine forest patches in the Hey Point area, which are not within proposed mining areas. All vine forest areas, and most riparian habitats within the Project area, are located in areas not to be disturbed.
Northern Hopping Mouse *Notomys aquilo*	*Vulnerable*	**Unlikely:** The type specimen (i.e. the original specimen from which the description of a new species is made) of this species was recorded from Cape York Peninsula in 1867 but has since not been recorded in Queensland. Very little potential habitat within the Project area associated with isolated dunal systems.
Water Mouse *Xeromys myoides*	*Vulnerable*	**Unlikely:** DSEWPaC habitat mapping indicates the western Cape York area as potential habitat for the species but there are no known populations within approximately 750km of the Project area. Extensive traverses of wetland and mangrove habitat areas were undertaken within the Project area and no signs of the species, particularly nesting mounds, were located. It is not anticipated that the species occurs within or adjacent to the Project area.
Yakka skink *Egernia rugosa*	*Vulnerable*	**Unlikely:** The closest record of this species comes from the western section of Mungkan Kandju NP approximately 50km south east of the Project area, from 1933. The vegetation in this area includes a vegetation mosaic which is similar to that occurring within the Project area; however, the soils comprised sandy plains and not a gravelly bauxite substrate as found in the Project area. The current fire regime within the Project area of frequent extensive burns produces unfavourable conditions for the persistence of *Egernia rugosa* given its low tolerance of sustained disturbance and its low capacity to re-colonise suitable habitat. Given the age of the last confirmed records of the species on Cape York (1933) and the lack of recent records of the species within and immediately adjacent to the Project area and in the wider Weipa region, it is not anticipated that the Yakka Skink currently occurs in the Project area.
Bare-rumped Sheathtail Bat *Saccolaimus saccolaimus nudicluniatus*	*Critically Endangered*	**Data deficient:** The actual presence or distribution of this species is not known. There is an absence of records and data on habitat utilisation on western Cape York. Although the Project area provides structural habitat features similar to those known to be utilised by the species on the east coast, there are significant geographic differences between the known habitat on the east coast of Cape York and the habitat present in the Project area.

4.4.2.3 Estuarine and Marine

There were thirteen threatened estuarine and marine fauna species identified by the Protected Matters Search. Three of these species (Blue Whale, Humpback Whale and Whale Shark) are also listed migratory species and are assessed separately (refer **Table 4-7**). All three are unlikely to occur in the Project area.

The 10 remaining threatened estuarine and marine species and their likelihood of occurrence within the Project area (including Project-related shipping routes) are summarised in **Table 4-5**. Although the Tailored EIS Guidelines only require the assessment of species that are known or likely to occur, to be conservative, species that have been determined as possibly occurring within the Project area have also been included in the assessment. All 10 species are possible, likely or known to occur within the Project area:

- Hawksbill Turtle (*Eretmochelys imbricata*);
- Flatback Turtle (*Natator depressus)*;
- Olive Ridley Turtle (*Lepidochelys olivacea)*;
- Leatherback Turtle *(Dermochelys coriacea)*;
- Loggerhead Turtle (*Caretta caretta)*;
- Green Turtle (*Chelonia mydas)*;
- Dwarf or Queensland Sawfish (*Pristis clavata)*;
- Green Sawfish (*Pristis zijsron)*;
- Freshwater Sawfish (*Pristis microdon);* and,
- Speartooth Shark (*Glyphis sp. A*).

These species were subjected to a detailed impact assessment in accordance with the methodology described in **Section 4.3**. This assessment is presented in **Sections 7.3** and **7.4**.

4.4.2.4 Avian Migratory

Forty five avian migratory species were identified in the Protected Matters Searches and are listed in **Table 4-6**. Although the Tailored EIS Guidelines only require the assessment of species that are known or likely to occur, to be conservative, species that have been determined as possibly occurring within the Project area have also been included in the assessment.

The assessment determined that the following five species were unlikely to be present in the Project area and hence were not subject to detailed impact assessment:

- Cattle Egret (*Ardea ibis)*;
- Melville Cicadabird (*Coracina tenuirostris melvillensis*);
- Streaked Shearwater (*Calonectris leucomelas);*
- Painted Snipe (*Rostratula benghalensis s. lat.);* and,
- Oriental Pratincole (*Glareola maldivarum).*

The remaining 40 species were subjected to detailed impact assessment in accordance with the methodology described in **Section 4.3**. This assessment is presented in **Section 8.4** and **8.5**.

Table 4-5 Likelihood of Threatened Estuarine and Marine Species Occurring in the Project Area

Species Name	EPBC Act Status	Likelihood of Occurrence
Green Sawfish *Pristis zijsron*	*Vulnerable*	**Proposed Port Site** **Likely:** Not found during surveys. The species has been recorded from Albatross Bay and the proposed Port footprint contains suitable habitat for the species. **Proposed New Spoil Ground** **Possible:** While smaller specimens are more common in coastal waters, estuaries and river mouths, larger animals have been found in deeper offshore waters. **Albatross Bay Spoil Ground** **Possible:** While smaller specimens are more common in coastal waters, estuaries and river mouths, larger animals have been found in deeper offshore waters. **Proposed Dam C – Norman Creek** **Unlikely**: Not found during surveys. This species is not found and does not enter freshwater environments. Dam C would be located in a freshwater reach of Norman Creek. Therefore this species is unlikely to occur within the proposed footprint of Dam C or upstream of the dam. **Ferry/Barge Terminals – Hey and Embley Rivers** **Likely**: Not found during surveys. Records from Albatross Bay adjoining the mouth of the Embley River make occurrence of this species within the estuarine sections of the Hey and Embley Rivers likely. The extent of Project related disturbance of these areas would be minimal in relation to the total estuarine environment available within these rivers. Disturbance would consist of the clearance of 400m^2 of mangroves (0.008% of the associated vegetation community within the Project area) and 2.5ha of riverbed. The dredging in these areas would only be to a depth of -7.2m LAT. **Balance of Project Area not disturbed** **Likely:** The species has been recorded from Albatross Bay and the Project area contains suitable habitat for the species. **Shipping Routes** **Possible**: While smaller specimens are more common in coastal waters, estuaries and river mouths, larger animals have been found in deeper offshore waters.
Dwarf or Queensland Sawfish *Pristis clavata*	*Vulnerable*	**Proposed Port Site** **Likely**: The species has been recorded from Albatross Bay and the proposed Port footprint contains suitable habitat for the species. Not found during surveys. **Proposed New Spoil Ground** **Unlikely**: This species prefers shallower waters. The proposed new spoil ground is in waters that are deeper than what this species would usually prefer. **Albatross Bay Spoil Ground** **Unlikely**: For the same reasons as the proposed new spoil ground, it is unlikely that this species would occur at the Albatross Bay spoil ground. **Proposed Dam C – Norman Creek** **Unlikely**: Not found during surveys. This species is not found and does not enter freshwater environments. Dam C would be located in a freshwater

Species Name	EPBC Act Status	Likelihood of Occurrence
		reach of Norman Creek. Therefore this species is unlikely to occur within the proposed footprint of Dam C or upstream of the dam. **Ferry/Barge Terminals – Hey and Embley Rivers** **Likely:** Not found during targeted survey. Suitable habitat for this species is present in near coastal areas and the estuary of the Embley River. Disturbance in the Embley River associated with the Project would be limited to a small amount of dredging activities related to the construction and maintenance of the Hornibrook terminal. This species may also utilise as a resting place either side of high tide, the 400m^2 of mangrove forest that would be cleared for the construction of the Hey River ferry/barge terminal. The area of mangroves that would be cleared only represents 0.008% of this mangrove community within the Project area. Therefore there would be sufficient remaining mangrove habitat in the surrounding area which the species would be able to utilise for resting. **Balance of Project Area not disturbed** **Likely:** The species is likely to occur within Albatross Bay and the Project area contains suitable habitat for the species. **Shipping Routes** **Unlikely**: This species prefers shallower waters. The shipping route is in waters that are deeper than what this species would usually inhabit.
Freshwater Sawfish *Pristis microdon*	*Vulnerable*	**Proposed Port Site** **Possible**: Subadults are commonly associated with estuarine waters and migrate to sea as they near maturity so may occur in the area. Not found during surveys. **Proposed New Spoil Ground** **Possible**: Subadults are commonly associated with estuarine waters and migrate to sea as they near maturity so may enter the area although are generally associated with inshore waters. **Albatross Bay Spoil Ground** **Possible**: Subadults are commonly associated with estuarine waters and migrate to sea as they near maturity so may traverse the area although are generally associated with inshore waters. **Proposed Dam C – Norman Creek** **Unlikely**: Not found during targeted surveys. Anecdotal records only of sawfish (unknown species) have been recorded in the lower estuarine reaches of Norman Creek, downstream of Dam C. The freshwater reaches of the Norman Creek tributary above and below the proposed Dam C location are generally narrow and depths rarely exceed 0.5m during periods of reduced flow. No suitable habitat for *P. microdon* appears to exist and no suitable prey species were identified as occurring in freshwater above or below the proposed Dam C location, which suggests the tributary is unlikely to be extensively utilised by the species or represent significant habitat of the species. In addition, it is suggested that the extremely low conductivities of Norman Creek's freshwater tributaries would present an osmoregulation constraint on the Freshwater Sawfish as it possesses a more primitive osmoregulation capacity than modern ray finned fishes. **Ferry/Barge Terminals – Hey and Embley Rivers** **Possible:** Although this species has not been recorded in either of these rivers, the footprints of the ferry/barge terminals would be within the estuarine reaches of these rivers that this species may traverse. The extent of disturbance within these areas would be minimal in relation to the total estuarine environment available within these rivers. Disturbance would consist of the clearance of 400m^2 of mangroves (0.008% of the associated vegetation community within the Project area) and 2.5ha of riverbed. The dredging in these areas would only be to a depth of -7.2m LAT.

Species Name	EPBC Act Status	Likelihood of Occurrence
		Balance of Project Area not disturbed **Likely**: This species may occur in estuarine and the lowermost freshwater reaches within the Project area. Suitable habitat present in the brackish reaches of Norman Creek and the Ward River, though generally low abundance of all elasmobranch species has been observed in these systems. Anecdotal records of sawfish within lower Ward River estuary (which would not be disturbed by Project related activities) and Norman Creek estuary (downstream of Dam C) reported by Traditional Owners may include this species. **Shipping Routes** **Possible**: Subadults are commonly associated with estuarine waters and migrate to sea as they near maturity so may enter the area although are generally associated with inshore waters.
Speartooth Shark *Glyphis sp.* A	*Critically Endangered*	**Proposed Port Site** **Unlikely:** Not found during surveys. The species has only been captured in tidal rivers and estuaries. Although the species can tolerate higher salinities, it is considered that the proposed Port site is too far away (~35km) from the river entrances that provide potential suitable habitat. **Proposed New Spoil Ground** **Unlikely:** This species prefers shallower waters and has only been captured in tidal rivers and estuaries. Although the species can tolerate higher salinities, the proposed new spoil ground is remote from usual suitable habitat. **Albatross Bay Spoil Ground** **Unlikely:** This species prefers shallower waters and has only been captured in tidal rivers and estuaries. Although the species can tolerate higher salinities, the Albatross Bay spoil ground is remote from usual suitable habitat. **Proposed Dam C – Norman Creek** **Unlikely**: Not found during surveys. The potential area of occupancy of the Speartooth Shark in creek and river systems is restricted from the mouth of a river to the point where the river ceases to be perennial (Stevens *et al.* 2005). Regional records for the species come from large perennial river systems i.e. the Wenlock River. The species is not known to utilise small seasonal creek reaches. The proposed Dam C would be on a highly seasonal freshwater tributary of Norman Creek which, although perennial, dries to small, shallow pools which are isolated except for connecting trickling flows in the dry season. Therefore, it is unlikely that the Speartooth Shark, if present in Norman Creek would require passage past the proposed site of Dam C. In addition, it is suggested that the extremely low conductivities of Norman Creek's freshwater tributaries would present an osmoregulation constraint on the Speartooth Shark as it possesses a more primitive osmoregulation capacity than modern ray finned fishes. While the estuarine and possibly lower tidally influenced freshwater reaches of the Norman Creek system do provide potentially suitable habitat for this species, the seasonal freshwater tributaries of Norman Creek, including the middle tributary both upstream and downstream of the proposed Dam C, do not. **Ferry/Barge Terminals – Hey and Embley Rivers** **Possible**: This species was identified as occurring in the Embley and Hey Rivers during surveys conducted between 1978 and 1986 (Peverell *et al.* 2006, Last and Stevens 2009), however was not recorded in surveys by CSIRO conducted between 1986 and 2004, nor during the August 2012 targeted survey. While *G. glyphis* has not been confirmed as present in the Embley or Hey systems, it has been assumed the species may persist in those systems. If this species was to occur within these rivers, the extent of disturbance associated with the ferry/barge terminals would be minimal in relation to the total environment available within these rivers. **Balance of Project Area not disturbed** **Possible**: This species may occur in estuarine and the lowermost freshwater reaches within the Project area below the perennial extent of the creeks

Species Name	EPBC Act Status	Likelihood of Occurrence
		and rivers. Records exist for the Wenlock River and similar habitat is present within the Project area, though generally low abundances of all elasmobranchs species have been observed (Peverell *et al.* 2006). **Shipping Routes** **Unlikely**: This species prefers shallower waters and has only been captured in tidal rivers and estuaries. Although the species can tolerate higher salinities, the majority of the shipping route is remote from usual suitable habitat.
Green Turtle *Chelonia mydas*	*Vulnerable* *Migratory*	**Proposed Port Site** **Likely**: This species is known to forage in shallow coastal areas, which would include the proposed Port site footprint. Surveys have found no nests within the footprint of the proposed Port site. **Proposed New Spoil Ground** **Possible**: This species prefers to forage in shallow coastal areas or within seagrass beds. The proposed new spoil ground would be too deep (-25m LAT) to provide preferred foraging habitat for this species and it contains no seagrass beds. While the proposed new spoil ground does not represent preferred habitat, it is possible they are transient in the area. **Albatross Bay Spoil Ground** **Possible**: For the same reasons as the proposed new spoil ground, it is unlikely that this species would frequently occur at the Albatross Bay spoil ground; however, it is possible that they transit the area. **Ferry/Barge Terminals – Hey and Embley Rivers** **Likely**: This species is known to forage within shallow coastal areas and seagrass beds. Foraging habitat for this species is present in the estuaries. **Balance of Project Area not disturbed** **Likely**: The species is likely to forage in the Project area. Surveys have found no nests in the Project area. No large rookeries are present in the region. **Shipping Routes** **Likely**: This species is common, both feeding and nesting throughout the GBR and in tropical Australian waters including Torres Strait and the Arafura Sea.
Hawksbill Turtle *Eretmochelys imbricata*	*Vulnerable* *Migratory*	**Proposed Port Site** **Likely**: Near shore fringing reef communities occur within the vicinity of the proposed Port area at Boyd Point, Pera Head and between Pera Head and Thud Point. This species may therefore traverse across the proposed Port site to access preferred feeding habitat. This species is also known to nest on the beaches in the vicinity of the Project area. Therefore it may be assumed that the footprint of the proposed Port site may also contain suitable nesting habitat for this species. **Proposed New Spoil Ground** **Possible**: No seagrass beds or seabed features e.g. patch reefs were identified within the footprint of the proposed new spoil ground. Drop camera surveys indicate that this area is largely unvegetated; however, Hawksbill Turtles may feed on sea cucumbers or jellyfish in this area. As Nine Mile Reef, which includes suitable foraging habitat for this species, is located approximately 6km south-south-west of the proposed new spoil ground, this species may traverse the proposed new spoil ground to access Nine Mine Reef for foraging. **Albatross Bay Spoil Ground** **Possible**: The Albatross Bay spoil ground does not contain or is not close to any reef communities. It is currently actively used for disposal of spoil

Species Name	EPBC Act Status	Likelihood of Occurrence
		dredged annually by North Queensland Bulk Ports. It is therefore unlikely this species would frequently occur in this area; however they may transit the site. **Ferry/Barge Terminals – Hey and Embley Rivers** **Possible**: The Hey and Embley Rivers contain seagrass and mangrove habitats which may be utilised by this species. **Balance of Project Area not disturbed** **Known to Occur**: Although difficulties in identifying nest activity of this species exist, low density nesting is recorded from a number of locations from False Pera Head to Boyd Bay. Reef habitat in the area is also likely to provide significant foraging habitat for the species and they are also likely to inhabit seagrass flats and mangrove habitats. **Shipping Routes** **Likely**: This species is common, both feeding and nesting throughout the GBR and in tropical Australian waters including Torres Strait and the Arafura Sea.
Flatback Turtle *Natator depressus*	*Vulnerable* *Migratory*	**Proposed Port Site** **Known to Occur**: Nesting has been regularly recorded within and surrounding the proposed Port site footprint and is best described as low density nesting. The area is not a major location for breeding aggregations of the species. This species forages in shallow coastal habitats. The proposed footprint of the Port would be considered foraging habitat for this species. **Proposed New Spoil Ground** **Possible**: No seagrass beds or seabed features e.g. patch reefs were identified within the footprint of the proposed new spoil ground. Drop camera surveys indicate that this area is largely unvegetated; however, Flatback Turtles may feed on sea cucumbers or jellyfish in this area. **Albatross Bay Spoil Ground** **Possible:** The Albatross Bay spoil ground does not contain or is not close to any reef communities. It is currently actively used for disposal of spoil dredged annually by North Queensland Bulk Ports. It is therefore unlikely this species would frequently occur in this area; however, they may transit the site. **Ferry/Barge Terminals – Hey and Embley Rivers** **Likely**: The proposed footprints of the ferry/barge terminals are within an estuarine environment which may be considered foraging habitat for this species. **Balance of Project Area not disturbed** **Known to Occur**: The Flatback Turtle is likely to forage in the Project area and nesting has been regularly recorded and is best described as low density nesting. The area is not a major location for breeding aggregations of the species. **Shipping Routes** **Likely**: Nesting for this species is centred in the southern GBR and in western Torres Strait. The species is found foraging around Australia including through Torres Strait.
Olive Ridley Turtle *Lepidochelys olivacea* (also known as the Pacific Ridley Turtle	*Endangered* *Migratory*	**Proposed Port Site** **Known to Occur**: Sporadic nesting has been recorded surrounding the proposed Port site footprint. This species forages in shallow unvegetated coastal habitats. The proposed footprint of the Port would therefore be considered foraging habitat for this species.

Species Name	EPBC Act Status	Likelihood of Occurrence
under the NC Act)		**Proposed New Spoil Ground** **Possible**: Unvegetated sediments may provide foraging habitat for Olive Ridley Turtles, as this species has been known to forage within these depths. This species may also transit the site. **Albatross Bay Spoil Ground** **Possible**: Unvegetated sediments may provide foraging habitat for Olive Ridley Turtles, as this species has been known to forage within these depths. This species may also transit the site. **Ferry/Barge Terminals – Hey and Embley Rivers** **Likely**: This species forages in shallow unvegetated coastal habitats. The parts of the proposed footprints of the ferry/barge terminals that are not vegetated may therefore provide foraging habitat for this species. **Balance of Project Area not disturbed** **Known to Occur**: Low density nesting has previously been recorded from a number of locations from False Pera Head to Boyd Bay, and nesting has also been recorded further north between Weipa and Bamaga. **Shipping Routes** **Likely**: This species nests in the Northern Territory and the Gulf of Carpentaria. Although uncommon in the GBR, Olive Ridley Turtles are found around northern Australia.
Leatherback Turtle *Dermochelys coriacea*	*Endangered* *Migratory*	**Proposed Port Site** **Likely**: The species is likely to occur sporadically in the vicinity of the proposed Port site, using it for foraging. **Proposed New Spoil Ground** **Likely**: The species is likely to occur sporadically in the vicinity of the proposed new spoil ground, using it for foraging. **Albatross Bay Spoil Ground** **Likely**: The species is likely to occur sporadically in the vicinity of the Albatross Bay spoil ground, using it for foraging. **Ferry/Barge Terminals – Hey and Embley Rivers** **Unlikely**: This species prefers oceanic environments to estuarine environments, so it is unlikely to utilise the estuaries that contain the proposed footprints of the ferry/barge terminals as habitat. **Balance of Project Area not disturbed** **Likely**: The species is likely to occur in the Project area, using it for foraging. Leatherback Turtles are rarely found in Queensland; however they have been reported on the Western Cape York peninsula coast (EHP pers. comm.). **Shipping Routes** **Likely**: Although seen only in low densities in Australia, the species is known to occur in the GBR and nests in the Northern Territory and to the north of Australia, including in Papua.
Loggerhead Turtle *Caretta caretta*	*Endangered* *Migratory*	**Proposed Port Site** **Likely:** The species is likely to be transient in the vicinity of the proposed Port and use it for foraging or resting.

Species Name	EPBC Act Status	Likelihood of Occurrence
		Proposed New Spoil Ground **Likely:** This species is likely to occur within the proposed new spoil ground for the same reasons that it is likely to occur in the vicinity of the proposed Port. **Albatross Bay Spoil Ground** **Likely:** This species is likely to occur within the Albatross Bay spoil ground for the same reasons that it is likely to occur in the vicinity of the proposed Port. **Ferry/Barge Terminals – Hey and Embley Rivers** **Likely:** This species is likely to occur in the vicinity of the ferry/barge terminals for the same reasons that it is likely to occur within the proposed Port footprint. **Balance of Project Area not disturbed** **Likely:** The species is likely to be transient in the Project area and use it for foraging or resting. No rookeries are present in the Project area. **Shipping Routes** **Likely**: This species is commonly observed within the GBR and is known to migrate through the Gulf of Carpentaria, Torres Strait, Arnhem Land and Papua New Guinea. Nesting occurs in the southern GBR.

Table 4-6 Likelihood of Avian Migratory Species Occurring in the Project Area

Species	Likelihood of Occurrence Within Project Area	Species	Likelihood of Occurrence within Project Area
Clamorous Reed-Warbler *Acrocephalus stentoreus*	Known to Occur	Marsh Sandpiper *Tringa stagnatilis*	Known to Occur (during EIS surveys)
Common Sandpiper *Actitis hypoleucos*	Likely	Black-faced Monarch *Monarcha melanopsis*	Possible
Fork-tailed Swift *Apus pacificus*	Known to Occur (during EIS surveys)	Streaked Shearwater *Calonectris leucomelas*	Unlikely; prefers open ocean habitat
Great Egret, White Egret *Ardea alba*	Known to Occur (during EIS surveys)	Greater Sand Plover *Charadrius eschenaultii*	Possible
Cattle Egret *Ardea ibis*	Unlikely; prefers agricultural habitat	Lesser Sand Plover *Charadrius mongolus*	Known to Occur (during EIS surveys)
Sharp-tailed Sandpiper *Calidris acuminate*	Possible	Lesser Frigatebird *Fregata ariel*	Known to Occur (during EIS surveys)
Red Knot *Calidris canutus*	Possible	Great Frigatebird *Fregata minor*	Known to Occur (during EIS surveys)
Curlew Sandpiper *Calidris ferruginea*	Possible	Latham's Snipe, Japanese Snipe *Gallinago hardwickii*	Likely
Red-necked Stint *Calidris ruficollis*	Possible	Asian Dowitcher *Limnodromus semipalmatus*	Possible
Great Knot *Calidris tenuirostris*	Likely	Black-tailed Godwit *Limosa limosa*	Possible
Melville Cicadabird *Coracina tenuirostris melvillensis*	Unlikely; out of its known range	Eastern Curlew *Numenius madagascariensis*	Known to Occur (during EIS surveys)
Oriental Cuckoo *Cuculus saturates*	Likely	Little Curlew, Little Whimbrel *Numenius minutus*	Possible

Species	Likelihood of Occurrence Within Project Area	Species	Likelihood of Occurrence within Project Area
Oriental Plover *Charadrius veredus*	Possible	Whimbrel *Numenius phaeopus*	Known to Occur (during EIS surveys)
Eastern Reef Egret *Egretta sacra*	Known to Occur	Eastern Osprey *Pandion cristatus*	Known to Occur (during EIS surveys)
Oriental Pratincole *Glareola maldivarum*	Unlikely, out of its known range and no preferred habitat in the Project area	Glossy Ibis *Plegadis falcinellus*	Known to Occur (during EIS surveys)
Sarus Crane *Grus antigone*	Likely	Pacific Golden Plover *Pluvialis fulva*	Possible
White-bellied Sea-eagle *Haliaeetus leucogaster*	Known to Occur (during EIS surveys)	Grey Plover *Pluvialis squatarola*	Possible
Grey-tailed Tattler *Heteroscelus brevipes*	Possible	Rufous Fantail *Rhipidura rufifrons*	Known to Occur (during EIS surveys)
White-throated Needletail *Hirundapus caudacutus*	Known to Occur (during EIS surveys)	Painted Snipe *Rostratula benghalensis s. lat.* (also listed as Endangered under EPBC Act)	Unlikely, out of range
Barn Swallow *Hirundo rustica*	Possible	Little Tern *Sterna albifrons*	Known to Occur(during EIS surveys)
Bar-tailed Godwit *Limosa lapponica*	Possible	Common Greenshank *Tringa nebularia*	Known to Occur (during EIS surveys)
Rainbow Bee-eater *Merops ornatus*	Known to Occur (during EIS surveys)	Terek Sandpiper *Xenus cinereus*	Possible
Satin Flycatcher *Myiagra cyanoleuca*	Known to Occur (during EIS surveys)		

Note: Shipping Impact Assessment Summary for Avian Migratory Species is provided in Table 4A-5 of **Appendix 4-C**

4.4.2.5 Non-Avian Migratory

Ten non-avian migratory species were identified in the Protected Matters Searches and are listed in **Table 4-7**. Although the Tailored EIS Guidelines only require the assessment of species that are known or likely to occur, to be conservative, species that have been determined as possibly occurring within the Project area have also been included in the assessment.

The following five species were determined as being either possible, likely, or known to occur within the Project area:

- Estuarine Crocodile (*Crocodylus porosus)*;
- Dugong (*Dugong dugon)*;
- Australian Snubfin Dolphin (*Orcaella heinsohni)*;
- Indo-Pacific Humpback Dolphin (*Sousa chinensis)*; and,
- Bryde's Whale (*Balaenoptera edeni)*.

These species were subjected to a detailed impact assessment in accordance with the methodology described in **Section 4.3**. This assessment is presented in **Sections 9.3.4**, **9.3.5**, **9.4.4**, **9.4.5**, **9.5.4** and **9.5.5**.

Table 4-7 Likelihood of Non-Avian Migratory Species Occurring in the Project Area

Species Name	EPBC Act Status	Likelihood of Occurrence
Estuarine Crocodile *Crocodylus porosus*	*Migratory*	**Proposed Port Site** **Known to Occur**: Recorded in marine environments within the Project area with individuals sighted along the beach between Pera Head and Boyd Bay. **Proposed New Spoil Ground** **Possible**: Recorded within marine environments within the Project area, although not as far out to sea as the proposed new spoil ground. However, this species is known to occasionally traverse some distance into the marine environment, so it is possible that this species may occur in this area on occasion. **Albatross Bay Spoil Ground** **Possible**: Recorded within marine environments within the Project area, although not as far out to sea as the Albatross Bay spoil ground. However, this species is known to occasionally traverse some distance into the marine environment, so it is possible that this species may occur in this area on occasion. **Ferry/Barge Terminals – Hey and Embley Rivers** **Known to Occur**: Recorded in estuarine environments within the Project area with individuals observed in close proximity to the proposed Hey Point and Hornibrook terminals. The ferry/barge terminal sites are within estuarine and sometimes mangrove environments that represent the main habitat for this species. The species is likely to use the habitat within the ferry/barge terminal areas for foraging and shelter. **Proposed Dam C - Norman Creek** **Known to Occur**: Foraging and nesting habitats for Estuarine Crocodiles have been recorded within the footprint of Dam C and upstream of Dam C. **Balance of Project Area not disturbed** **Known to Occur**: Field surveys recorded 55 individual sightings and numerous sightings of tracks and slides. **Shipping Routes** **Possible**: Estuarine Crocodiles may swim considerable distances offshore and so may potentially transit areas along the shipping routes. The likelihood of presence decreases further south towards Gladstone as this species is less common in these areas.
Indo-Pacific Humpback Dolphin *Sousa chinensis*	*Migratory*	**Proposed Port Site** **Known to Occur**: Incidental sightings of this species were recorded in the vicinity of the proposed Port footprint during field studies. Targeted cetacean surveys in 2012 confirmed the presence of Indo-Pacific Humpback Dolphins at Boyd Point. **Proposed New Spoil Ground** **Possible**: No incidental sightings were recorded. The proposed new spoil ground is primarily characterised as flat, unvegetated soft sediment habitat, and is therefore unlikely to support sufficient densities of prey species to be considered preferred habitat for this species. However, it is possible that this species may migrate through or opportunistically feed in the area. **Albatross Bay Spoil Ground** **Possible**: No incidental sightings were recorded. The Albatross Bay spoil ground is primarily characterised as flat, unvegetated soft sediment habitat, and is therefore unlikely to support sufficient densities of prey species to be considered preferred habitat for this species. However, it is possible that this species may migrate through or opportunistically feed in the area.

Species Name	EPBC Act Status	Likelihood of Occurrence
		Ferry/Barge Terminals – Hey and Embley Rivers **Known to Occur**: Targeted cetacean surveys in 2012 confirmed the presence of Indo-Pacific Humpback Dolphins within the Hey and Embley River estuaries. **Balance of Project Area not disturbed** **Known to Occur**: Incidental sightings of this species were recorded in coastal waters during field studies. **Shipping Routes** **Known to Occur**: Although the species has been recorded from the Gladstone area and throughout coastal waters along the north Queensland coast, the Indo-Pacific Dolphin would generally occur inshore and in shallower waters rather than the majority of the shipping route.
Australian Snubfin Dolphin *Orcaella heinsohni* (Note: Previously the Australian Snubfin Dolphin was identified as the widely distributed Irrawaddy Dolphin (*Orcaella brevirostris*) (Beasley *et al*. 2005))	*Migratory*	**Proposed Port Site** **Known to Occur**: Incidental sightings of this species were recorded in the vicinity of the proposed Port footprint during field studies. **Proposed New Spoil Ground** **Possible**: No incidental sightings were recorded. This species usually inhabits shallow coastal waters less than 20m deep and are often associated with coastal and estuarine waters, enclosed bays and coastal lagoons (Corkeron *et al.* 1997, Hale *et al.* 1998, Jefferson 2000, Parra *et al.* 2006). The proposed new spoil ground is in deeper water than this and therefore it is unlikely to represent preferred habitat for this species. However, it is possible they may migrate through the area. **Albatross Bay Spoil Ground** **Possible**: No incidental sightings were recorded. The Albatross Bay spoil ground is primarily characterised as flat, unvegetated soft sediment habitat, and is therefore unlikely to support sufficient densities of prey species to be considered preferred habitat for this species. However, it is possible that this species may migrate through or opportunistically feed in the area. **Ferry/Barge Terminals – Hey and Embley Rivers** **Likely**: No incidental sightings were recorded in the Hey and Embley Rivers or during targeted August 2012 survey. However, this species are known to occur in estuarine and coastal habitats. As such, it is likely that this species may occur in the ferry/barge terminals. **Balance of Project Area not disturbed** **Known to Occur**: Incidental sightings of this species were recorded in coastal waters during field studies. **Shipping Routes** **Known to Occur**: Although the Australian Snubfin Dolphin has been recorded from the Gladstone area and throughout coastal waters along the north Queensland coast, the species would generally occur inshore and in shallower waters rather than the majority of the shipping route.
Bryde's Whale *Balaenoptera edeni*	*Migratory*	**Proposed Port Site** **Possible**: While the proposed Port site does not contain preferred habitat, the recording of the species from tropical inshore waters suggests it is possible that the species may occur sporadically in the vicinity of the proposed Port footprint. **Proposed New Spoil Ground** **Possible**: This species may possibly occur within the proposed new spoil ground footprint for the same reasons that it possibly occurs in the vicinity of the proposed Port site.

Species Name	EPBC Act Status	Likelihood of Occurrence
		Albatross Bay Spoil Ground **Possible**: This species may occur within the Albatross Bay spoil ground footprint for the same reasons that it possibly occurs in the vicinity of the proposed Port site. **Ferry/Barge Terminals – Hey and Embley Rivers** **Unlikely**: Although this species occurs in shallow water, it generally is found in coastal areas rather than estuaries. It is therefore unlikely to occur within the barge/ferry terminal footprints in the Embley and Hey Rivers. **Balance of Project Area not disturbed** **Possible**: While the Project area does not contain preferred habitat, it is possible that the species may occur sporadically in the Project area. **Shipping Routes** **Possible**: Although there have been very limited confirmed sightings of the Bryde's Whale in Australia, the majority of the shipping route is within suitable pelagic habitat and the known geographic range for this species.
#Humpback Whale *Megaptera novaeangliae*	*Vulnerable* *Migratory*	**Unlikely:** no feeding areas are located in the Project area and it is not along the migratory path of the species.
#Killer Whale *Orcinus orca*	*Migratory*	**Unlikely:** the species prefers offshore waters and as such is unlikely to occur in the Project area.
#Blue Whale *Balaenoptera musculus*	*Endangered* *Migratory*	**Unlikely:** the species principally occurs near the edge of the continental shelf in cooler waters and not in inshore areas of the Project area.
Dugong *Dugong dugon*	*Migratory*	**Proposed Port Site** **Known to Occur**: Traditional Owners report that the species migrates through Boyd Bay which also indicates migration past the proposed Port site. **Proposed New Spoil Ground** **Possible**: May migrate through this area between foraging grounds, although this site does not contain suitable foraging habitat. **Albatross Bay Spoil Ground** **Possible**: May possibly migrate through the area of the Albatross Bay spoil ground, although this site does not contain suitable foraging habitat. **Ferry/Barge Terminals – Hey and Embley Rivers** **Known to Occur**: Known to occur in the area, associated with seagrass beds. The seagrass beds in the Embley and Hey Rivers may potentially constitute foraging habitat for Dugong. **Balance of Project Area not disturbed** **Known to Occur**: Known to occur in the Project area. Traditional owners report that the species migrates through Boyd Bay. The species is highly mobile and would traverse coastal waters between seagrass beds. **Shipping Routes** **Likely**: Dugong may swim considerable distances offshore and so may potentially transit areas along the shipping routes. The likelihood of presence along the shipping route is greatest in Gladstone Harbour, which contains suitable habitat, and in shallower areas of the shipping route in Torres Strait.

Species Name	EPBC Act Status	Likelihood of Occurrence
#Whale Shark *Rhincodon typus*	*Vulnerable* *Migratory*	**Unlikely:** this species is unlikely to occur in the study area. The species prefers oceanic environments. The Project area does not provide the preferred habitat.
#Longfin mako *Isurus paucus*	*Marine*	**Unlikely:** the species is a deep-dwelling shark that is principally found in offshore waters and as such is unlikely to occur in the Project area.

The likelihood of occurrence of this species in shipping routes and the potential magnitude of impacts associated with shipping activities on this species is assessed in **Section 4.5.2**.

4.5 Assessment of Shipping Activities

4.5.1 Background Assessments of the Great Barrier Reef

4.5.1.1 Great Barrier Reef Marine Park Authority Risk Assessment

Section 54 of the *Great Barrier Reef Marine Park Act 1975* (GBRMP Act) requires the Great Barrier Reef Marine Park Authority (GBRMPA) to prepare a report referred to as the Great Barrier Reef Outlook Report (Outlook Report) every five years.

The first Outlook Report was given to the Minister for Environment, Heritage and the Arts by the Chairman and Chief Executive of the GBRMPA on 30 June 2009.

Section 54(3)(d) requires the report to include an assessment of the risks to the ecosystem within the GBR Region. An assessment of risks to the GBR was undertaken by GBRMPA and included in the Section 8 of the Outlook Report.

The risk assessment (GBRMPA 2009b) sought input from a wide range of stakeholders including reef scientists, industry partners, regulators and communities. The GBRMPA's 11 regionally based Local Marine Advisory Committees and four issues-based Reef Advisory Committees participated in a detailed process to identify and rank threats to the GBR ecosystem. Broader community views were sought though an attitudinal survey. The risk assessment followed the procedures outlined in the Australian Standard for risk assessment (AS/NZS 4360:2004).

The GBRMPA (2009b) assessment identified 41 threats to the GBR (refer **Figure 4-10**) including a number of shipping-related threats such as the grounding of large vessels, large oil spills and the introduction of exotic species from ballast water discharge or hull fouling. None of these shipping-related threats were concluded to have high or very high risks to the GBR ecosystem. The high or very high risks were determined to relate to the following:

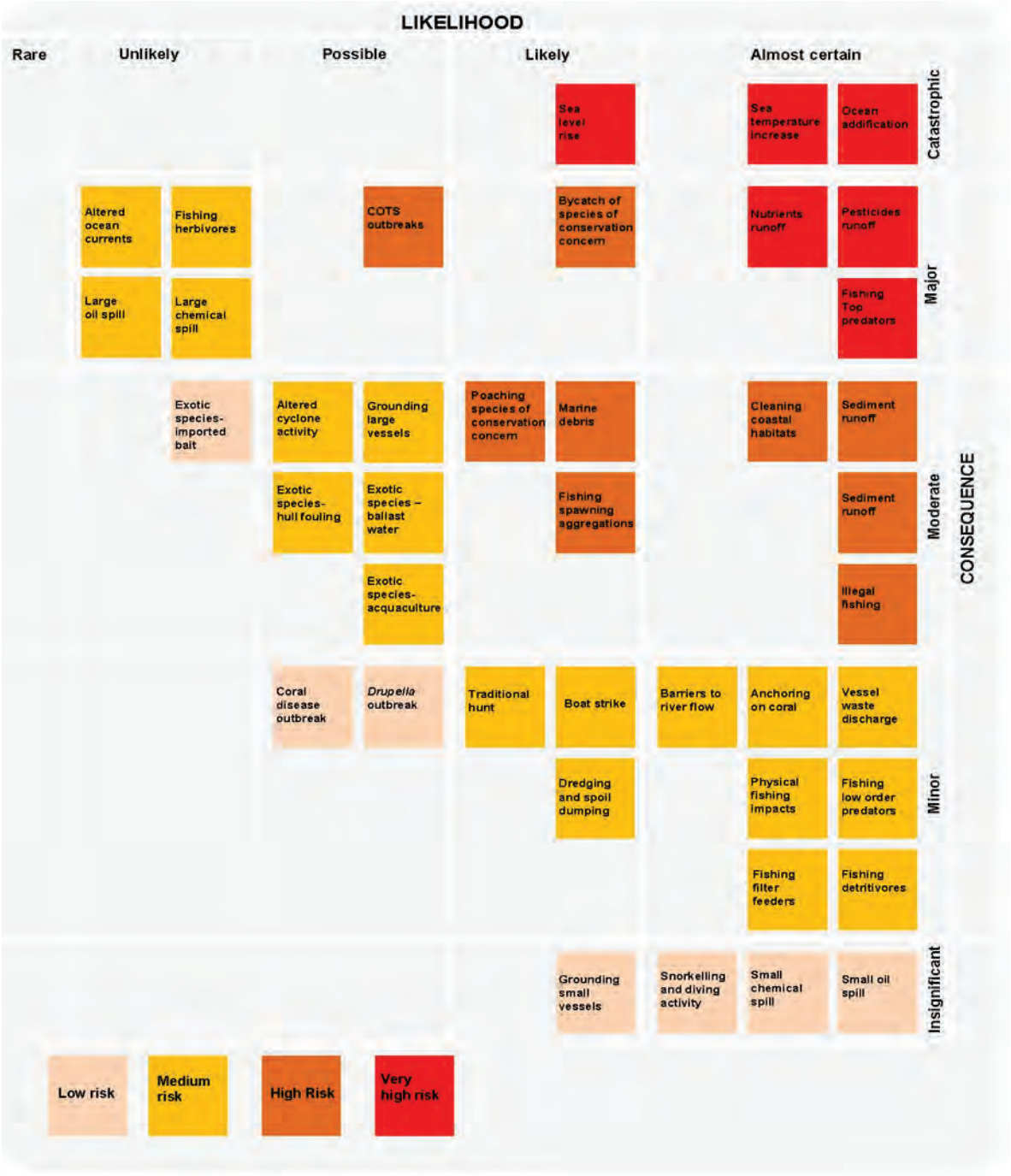
- climate change;
- catchment runoff;
- coastal development; and,
- fishing.

GBRMPA (2009b) concluded that the greatest threats facing the GBR ecosystem are from climate change. The individual threats of increasing sea temperatures, ocean acidification and rising sea levels are assessed as very high risk to the ecosystem and they could occur across the entire region. Their impacts were considered to be compounded by each other and by other existing regional and local threats. The most serious regional-scale risks to the GBR are catchment runoff and coastal development (GBRMPA 2009b).

The threats related to commercial shipping were determined by the risk assessment to be of medium risk. These threats included the following.

- large oil spills;
- grounding of large vessels;
- introduction of exotic species; and,
- vessel waste discharge.

Figure 4-10 Risks to Great Barrier Reef Ecosystem



Source: GBRMPA (2009b)

For these medium risks the assessment concluded:

> "*Given current management arrangements, few of the threats considered likely or certain to occur are predicted to have moderate consequences for the Region's ecosystem and none will have catastrophic consequences. Some unlikely threats (large chemical or oils spills) may have major consequences for the Region's ecosystem*" (GBRMPA 2009b).

The risk of threats associated with commercial shipping activities occurring were assessed as unlikely, which reflects the low level of historical shipping incidents in the GBR as outlined in Section 4.5.3 of the Outlook Report as follows:

> *"Almost all ships travel safely along the designated shipping routes of the Great Barrier Reef with little if any impact. In the last 10 years there have been three or fewer major shipping incidents each year and, despite the increase in shipping traffic, the number of major incidents has been stable over that period…"*

A discussion of the existing controls and impact mitigation measures that are in place to manage RTA's shipping activities in the GBRMP is provided in **Section 4.5.3**.

A summary of the results of the GBRMPA (2009b) risk assessment showing the likelihood and consequences as well as the risk for all of the 41 threats considered is provided in **Figure 4-10**.

4.5.1.2 UNESCO Reactive Monitoring Mission

In response to the approval of an LNG processing plant on Curtis Island, the WHC and IUCN requested that the GBR be considered at the 35th session of the WHC. The WHC sought, and obtained, further information on the LNG project from Australia (WHC 2011). The WHC urged Australia to undertake a strategic assessment, requested that Australia invite a reactive monitoring mission and requested a report by 1 February 2012.

On 19 January 2012, Australia submitted the State Party report, and on 14 March 2012, a list of all proposed developments was also submitted.

The monitoring mission visited Australia from the 6 to 14 of March 2012. The United Nations Educational, Scientific and Cultural Organization (UNESCO) released a report in June 2012 (UNESCO 2012) on the reactive monitoring mission. The objective of the mission was to assess the state of conservation of the GBRWHA and contribute to the strategic assessment process, as requested by the World Heritage Committee. The mission included an inspection of the GBRMP and discussions with many relevant government, industry and community stakeholders.

The mission's report concluded that the GBRMP continues to demonstrate its Outstanding Universal Values (OUVs) which were part of the basis of its listing as a World Heritage property. The report describes the property as iconic as it is the world's largest coral reef ecosystem of which the size, beauty, composition and biodiversity rate remain exceptional. The property is one of the largest multiple use marine areas included on the World Heritage List. UNESCO (2012) notes that the efforts to conserve the area as a whole over the 31 years it has been inscribed on the World Heritage List as "remarkable". Threats that are reported as having been dealt with effectively include oil and gas development inside the property, recreation, fishing, tourism, and water quality from catchment run-off. The planning framework for surveillance, and the monitoring and evaluation of the property are noted as being highly sophisticated.

UNESCO (2012) noted that the rapid increase in new port development, expansion of port export capacities, associated dredging and dumping of dredged material as well increased shipping, is of high concern to the conservation of the property.

A consensus amongst stakeholders was noted in the report that any new port developments within the GBRWHA should be located within existing major ports along the Queensland coast, such as the Port of Gladstone, but excluding Port Alma / north of Curtis Island. The report concluded that fewer, well managed 'mega' ports, would pose less risk to the OUV of the property.

The predicted growth in port activity was identified as leading to increased shipping within the property which has the potential to create a range of issues. These include dredging, dredge disposal and the regulation of shipping traffic including 'the very noticeable "boat parks" where large vessels sit at anchorage waiting for cargo near ports'. However, the report noted that the mission received strong evidence of competent and effective systems and regulations for managing shipping activities, including:

- the Reef VTS and related systems for reporting and compulsory pilotage of shipping that is transiting or taking on cargo in the ports within the property; and,
- the Australian Government's active role in pursuing international regulation of shipping activities, and the possibilities to manage vessel traffic, including through the use of international instruments such as the IMO Particularly Sensitive Sea Area scheme.

The report noted that the specific impacts of shipping on the GBRWHA require increased attention within the planning and assessment process and that the Commonwealth's Strategic Assessment would consider this. However, it noted that the revised and adaptive strategy to the management of shipping within the GBR minimises the risks originating from shipping to the property. Consolidating infrastructure was also noted to limit the marine footprint within the property (including in relation to shipping routes, boat parks, dredging and reclamation).

Based on these findings, the mission provided the following recommendation for shipping:

> *Develop a fully integrated approach to the planning, regulation and management of ports and shipping activity affecting the property, including via Shipping Policy for the property, the proposed Ports Strategy of Queensland, and individual Port Plans, that will ensure that ports and shipping activity does not negatively impact the OUV, including the integrity, of the property, and meets the highest international standards in its planning, regulation, assessment and operation.*

Following the report, the WHC decided (among other things) to request that Australia submit a report by 1 February 2013 on the state of conservation of the property, which would be considered a 37th session in 2013.

The Commonwealth Government provided a report to the WHC in February 2013 outlining the state of conservation of the GBRWHA as well as the implementation of the recommendations made by the WHC (Australian Government 2013). With regards to shipping in the GBRWHA, this report commits to the following measures.

- Development of a North-East Shipping Management Plan (NESMP) to assess the effectiveness of the existing safety control measures that apply to shipping activities in the GBR, Coral Sea and Torres Strait regions. The NESMP will assess the effectiveness of existing management arrangements and identify additional or enhanced measures that may be required in the future in light of expected increased shipping movements and vessel sizes.
- Development of best practice guidance for shipping management in the GBR region.
- Conducting an independent review of Gladstone Harbour and Curtis Island that considers the governance arrangements and environmental performance of consented development. The review will then provide advice on improved practices based on expert scientific advice. This will help ensure that future planning and development in the Port of Gladstone is based on cutting-edge performance standards for protecting the GBRWHA. The findings of the review will also help inform the government's consideration of future port developments and operations within the GBR region. The terms of reference for this independent review have been finalised with the review panel scheduled to report back to the Australian government by 30 June 2013.

- Implementation of the National Ports Strategy which aims to encourage best practice in long term integrated master planning for ports precincts and to guide future planning for, and development of, freight and port infrastructure.
- Development of the Queensland Government's Great Barrier Reef Ports Strategy which will restrict significant port development, within and adjoining the GBRWHA, to within existing port limits for the next 10 years. Public consultation on the Great Barrier Reef Ports Strategy closed on 14 December 2012 following a six week consultation period.
- Preparation of a Ports Position Statement by GBRMPA which aims to establish ecologically sustainable management frameworks and incorporate best practice management techniques to minimise environmental impacts from ports.
- Development a "whole-of-GBR receiving waters model", to place the local models used for assessing the impacts of ports and other developments into a whole-of-GBR context. The model will also make it possible to begin assessing the cumulative impacts of a range of port developments occurring at or around the same time.
- Continuation of publishing the Ports and Shipping Information Sheet to inform stakeholders and the general public about the role of ports and shipping in the GBR region and how GBRMPA is meeting the challenges of managing an ecologically sustainable multiple-use Marine Park.
- Implementation by AMSA of the recommendations outlined in the Australian Transport Safety Bureau's report into *Queensland Coastal Pilotage* by 2013 including assigning overall responsibility of risk management of pilotage to pilotage providers.

4.5.2 Protected Matters Search

4.5.2.1 Controlling Provisions

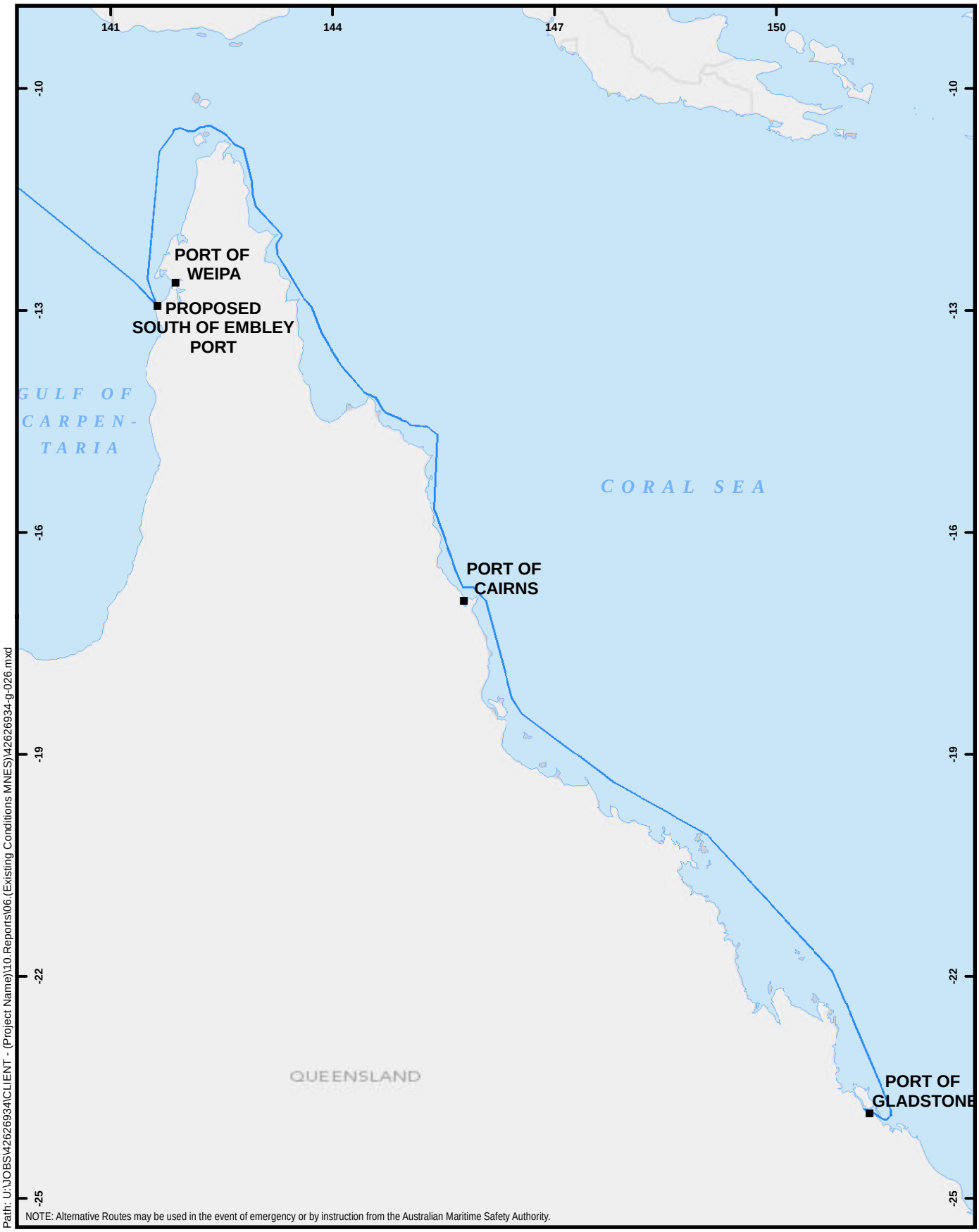
The controlling provisions relevant to Project-related shipping activities as determined by the Minister for DSEWPaC in March 2012, are as follows:

- World Heritage properties (Sections 12 and 15A);
- National Heritage places (Sections 15B and 15C);
- Listed threatened species and communities (Sections 18 and 18A);
- Listed migratory species (Sections 20 and 20A);
- Commonwealth marine areas (Sections 23 and 24A); and,
- Great Barrier Reef Marine Park (Sections 24B and 24C).

4.5.2.2 Search Area and Results Summary

A desktop analysis was conducted using the online Protected Matters Search Tool to identify any matters of NES that may be potentially present along Project-related shipping routes and hence may be affected by Project-related shipping activities.

The search areas were determined from Global Positioning System (GPS) point coordinates relating to the proposed domestic and international shipping routes that would be used by Project-related shipping sailing to and from the Project area. The search area includes the international shipping route from Weipa to the Exclusive Economic Zone and the domestic route from Weipa to the Port of Gladstone (**Figure 4-11**). Due to the large distances covered by Project-related shipping travelling within Australian waters (coastal waters and Commonwealth marine area), and to minimise the number of terrestrial-based records returned in the Protected Matters Search, a 1km buffer was applied.



Path: U:\JOBS\42626934\CLIENT - (Project Name)\10.Reports\06.(Existing Conditions MNES)\42626934-g-026.mxd

Rio Tinto Alcan

Locality

Area of Database Search (1km Buffer)

South of Embley Project

Fig. 4-11: Area of Database Search (Shipping Activities)

N

0 50 100 200 km

Datum/Projection: GDA94/MGA Zone 54 Date: 06/11/2012

It is important to note that the Protected Matters database has inherent limitations based on the accuracy of geographic data for some matters. These limitations are described in **Section 4.2.1.2**.

The results of the Protected Matters Search for the Project-related shipping routes, dated 19 July 2012, are listed in **Appendix 4-C** and are summarised in **Table 4-8**.

Table 4-8 Matters of NES along the Shipping Route

Matters of National Environmental Significance	Search Results
Great Barrier Reef Marine Park	Up to a predicted average of 300 shipments (600 return movements) per year of bulk carriers carrying bauxite from the proposed Port to the Port of Gladstone would pass through the Great Barrier Reef Marine Park. This would be a net average increase of 30 shipments (60 movements) per annum over 2015 levels. Cargo shipments from east coast ports (predominantly Cairns) to the Project area would also pass through the GBRMP.
World Heritage Properties	Up to a predicted average of 300 shipments (600 return movements) per year of bulk carriers carrying bauxite from the proposed Port to the Port of Gladstone would pass through the GBRWHA. This would be a net average increase of 30 shipments (60 movements) per annum over 2015 levels. Cargo shipments from east coast ports (predominantly Cairns) to the Project area would also pass through the GBRWHA.
National Heritage Places	The Great Barrier Reef, through which Project-related domestic bauxite and cargo shipping would transit, is listed as a National Heritage place.
Commonwealth Marine Area	Up to a predicted average of 300 shipments (600 return movements) per year of bulk carriers carrying bauxite from the proposed Port to Port of Gladstone would pass through the Commonwealth marine area. In addition, up to a predicted average of 400 shipments (800 movements) of bauxite per annum would pass through the Commonwealth marine area in the Gulf of Carpentaria bound for international ports. Cargo and fuel shipments would pass through the Commonwealth marine area.
Threatened Ecological Communities (TECs)	Two TECs
Threatened Species	11 Flora species 21 Terrestrial Fauna species 11 Estuarine/Marine species
Migratory Species	40 Avian Migratory species 19 Non-Avian Migratory species

4.5.2.3 Great Barrier Reef Marine Park

The shipping route between the Project area and Gladstone (or other east coast ports for cargo shipping) passes through GBRMP.

The Zoning Plan divides the park into numerous use zones such as General Use, Designated Shipping Area, Conservation Park, Habitat Protection and Marine National Park. The shipping routes relative to the locations of the GBRMP boundary are shown on **Figure 2-3**. All Project-related bauxite and cargo

shipping activities would be confined to the inner GBR Designated Shipping Area which traverses these zones such that permission is not required under the GBRMP Act. The inner GBR Designated Shipping Area has been located to avoid areas of high environmental and heritage values.

Under the Zoning Plan, commercial ships do not require a permit to transit through General Use Zones and Designated Shipping Areas. By establishing Designated Shipping Areas, the Zoning Plan also provides for certainty of access in the GBR and has facilitated the implementation of regulations governing safety, pollution prevention response and search and rescue.

All Project-related bauxite and cargo shipping between the Project area and Gladstone or other east coast ports would remain within the GBR Designated Shipping Areas. In this regard, the effect of section 43 of the EPBC Act is that approval is not required under Part 9 of the EPBC Act to authorise the proposed shipping activities within the Designated Shipping Areas of the GBRMP.

A detailed description of the GBRMP and an assessment of Project-related shipping impacts on its values are provided in **Section 11**.

4.5.2.4 World Heritage Area

The shipping route between the Project area and the Port of Gladstone and other east coast ports passes through GBRWHA. The shipping route and its location relative to the boundary of the GBRWHA are shown on **Figure 2-3**. A detailed description of the GBRWHA and an assessment of Project-related shipping impacts on its values are provided in **Section 12**.

4.5.2.5 National Heritage Places

The shipping route between the Project area and the Port of Gladstone and other east coast ports passes through the GBR. The GBR was included on the National Heritage List on 21 May 2007. A detailed description of the GBRNHP and an assessment of Project-related shipping impacts on its values are provided in **Section 13**.

4.5.2.6 Commonwealth Marine Areas

The shipping route between the Project area and the Port of Gladstone and domestic and international ports passes through the CMA which extends from three to 200 nautical miles from the territorial sea baseline. The location of the CMA along the shipping route is shown on **Figure 2-3**. Ships delivering fuel for the Project from Darwin (or other locations as determined by the third party provider) would also pass through the CMA. A detailed description of the CMA and an assessment of Project-related shipping impacts on its values are provided in **Section 10**.

4.5.2.7 Listed Threatened Communities

The Protected Matters Search identified the following two TECs within the search area that would be transited by Project-related shipping:

- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia (critically endangered); and,
- Weeping Myall Woodlands (endangered).

The Protected Matters Search area contained a 1km buffer and hence encompassed some land above the intertidal zone. The Protected Matters Search results are listed in **Table 4A-1** of **Appendix 4-C**. It is unlikely that Project-related shipping activities would affect these TEC's and therefore no further assessment is required.

4.5.2.8 Listed Threatened Species

Flora

The Protected Matters Search identified 11 terrestrial plant species within search the area conducted for Project-related shipping. Of the 11 species identified, two are listed as Endangered and nine as Vulnerable. The Protected Matters Search results are listed in **Table 4C-2** of **Appendix 4-C**. It is unlikely that Project-related shipping activities would affect these 11 species and therefore no further assessment is required.

Fauna

The Protected Matters Search identified 21 terrestrial fauna species within the search area conducted for Project-related shipping. The Protected Matters Search results are listed in **Table 4C-3** of **Appendix 4-C**.

Birds

The Protected Matters Search identified 12 bird species within the search area conducted for Project-related shipping, including one species listed as Critically Endangered (Herald Petrel), three species listed as Endangered (Black-Throated Finch, Australian Bittern, Royal Albatross) and eight species listed as Vulnerable (Red Goshawk, White-Bellied Storm-Petrel, Squatter Pigeon, Kermadec Petrel, Australian Painted Snipe, Black-Breasted Button-Quail, Fairy Tern, Masked Owl).

Mammals

The Protected Matters Search identified five terrestrial mammal species within the search area conducted for Project-related shipping, including one species listed as Critically Endangered (Bare-rumped Sheathtail Bat), one species listed as Endangered (Northern Quoll) and three species listed as Vulnerable (Large-eared Pied Bat, Spectacled Flying-fox, and Water Mouse).

Reptiles

The Protected Matters Search identified four terrestrial reptile species within the search area that conducted for Project-related shipping. All are listed as Vulnerable (Collared Delma, Yakka Skink, Dunmall's Snake and Brigalow Scaly-Foot).

Estuarine and Marine Fauna

The Protected Matters Search identified 14 estuarine and marine fauna species within the area that would be transited by Project-related shipping. The Protected Matters Search results are listed in **Table 4C-4** of **Appendix 4-C**. The likelihood of occurrence along the shipping route for estuarine and marine fauna identified in the shipping activities Protected Matters Search and the mine, Port and associated infrastructure areas Protected Matters Search are provided in **Table 4-5** to facilitate assessment of the whole Project on these species.

Fish

The Protected Matters Search identified five fish species within the area that would be transited by Project-related shipping, including one species listed as Critically Endangered (Speartooth Shark) and four species listed as Vulnerable (Freshwater Sawfish, Dwarf Sawfish, Green Sawfish and Whale Shark). The Whale Shark is addressed in this assessment as a non-avian migratory species.

Mammals

The Protected Matters Search identified two listed marine mammal species within the area that would be transited by Project-related shipping. The Blue Whale is listed as Endangered, and the Humpback

Whale is listed as Vulnerable. These species are addressed in this assessment as non-avian migratory species.

Reptiles

The Protected Matters Search identified seven reptile species within the area that would be transited by Project-related shipping. Of these seven species identified, six species are marine turtles. Three species are listed as Endangered (Loggerhead Turtle, Leatherback Turtle and Olive Ridley Turtle) and three species are listed as Vulnerable (Green Turtle, Hawksbill Turtle and Flatback Turtle). Green, Loggerhead, Hawksbill and Flatback Turtles have internationally significant populations in the GBRMP (Dobbs and Pierce 2005). Marine turtles are present in both coastal and pelagic marine waters of the GBRMP depending on their life history phase. The Freshwater Crocodile was also identified as a listed marine species in the Protected Matters Search.

4.5.2.9 Listed Migratory Species

Avian Migratory Species

The Protected Matters Search identified 40 listed avian migratory species within the area that would be transited by Project-related shipping, of which two species are also listed as Endangered (Southern-Giant Petrel and Grey-Headed Albatross) and four species are also listed as Vulnerable (Painted Snipe, Wandering Albatross, Northern Giant Petrel and Sooty Albatross). The Protected Matters Search results are listed in **Table 4C-5** of **Appendix 4-C**.

Non-Avian Migratory Species

The Protected Matters Search identified 19 listed non-avian migratory species within the area that would be transited by Project-related shipping, of which four species are also listed as Endangered (Blue Whale, Loggerhead Turtle, Leatherback Turtle and Olive Ridley Turtle) and five species are listed as Vulnerable (Whale Shark, Humpback Whale, Green Turtle, Hawksbill Turtle and Flatback Turtle). The six marine turtles are addressed in this assessment as threatened estuarine and marine fauna. The Protected Matters Search results are listed in **Table 4C-6** of **Appendix 4-C**, including the likelihood of occurrence along the shipping route for identified non-avian migratory species.

4.5.3 Threats, Mitigation Measures and Likelihood of Impacts on Matters of NES from Project-related Shipping

4.5.3.1 Objective

The objective of this section is to identify the key threats and mitigation measures associated with Project-related shipping activities that may cause environmental harm and to assess the likelihood of impacts on the threatened species and communities and on the migratory species identified from the Protected Matters Search (**Section 4.5.2**) to determine the level of impact assessment required.

4.5.3.2 General Approach to Shipping Impact Assessment

This section discusses the potential impacts from the Project-related shipping threats and the relevant mitigation measures proposed. The Project-related shipping threats that have been assessed are as follows:

- collisions and groundings;
- marine oil spills from bauxite shipping;

- marine oil spills from barges or service vessels;
- bauxite spills;
- operational discharges – oily mixtures of bilges;
- operational discharges – sewage;
- operational discharges – garbage (including quarantine waste);
- operation discharges – air emissions;
- vessel noise;
- vessel lighting;
- vessel strikes on marine fauna; and,
- marine species introductions (including ballast water management).

An assessment was made of the likelihood of impact from each of the above threats on each of the identified listed threatened and migratory species on the basis of the following likelihood categories:

- nil: impact not physically possible;
- rare: impact that is very unlikely to occur during the lifetime of the Project;
- unlikely: impact that is unlikely to occur during the lifetime of a Project;
- possible: impact that may occur during the lifetime of the Project;
- likely: impact that may occur frequently during the lifetime of the Project; and,
- almost certain: recurring impact during the lifetime of the Project.

A summary of the assessment of the likelihood of impact on each identified listed threatened and migratory species is provided in **Appendix 4-C**. The assessment results summarised in **Appendix 4-C** show that after the application of the relevant controls and mitigation measures discussed in the following sections, the likelihood of impacts on each identified listed threatened and migratory species from Project-related shipping would be either nil, rare or unlikely. There are no impacts that are either almost certain, likely or possible. Hence, based on the methodology described in **Section 4.3**, detailed impact assessment is not required for impacts on listed threatened and migratory species associated with Project-related shipping activities.

As discussed in **Sections 4.5.2.3** to **4.5.2.6**, all of the other controlling provisions (GBRMP, GBRWHA, GBRNHP, and CMA) are present along parts of the route that would be utilised by Project-related shipping. Consequently, based on the process described in **Section 4.3**, these controlling provisions are subject to further assessment commensurate with the level of impact. These further assessments are provided in **Sections 10** to **13**.

4.5.3.3 Collision and Grounding

Threats

Collisions with other vessels or stationary objects such as port structures, have the potential to cause oil or cargo releases into the environment. Grounding of a vessel may directly damage benthic substrates such as coral reefs. The specific impacts of oil and cargo spills are discussed separately in **Sections 4.5.3.4**, **4.5.3.5** and **4.5.3.6**.

Grounding impacts are likely to be highly localised, however the severity of impacts would depend on the nature of the grounding. More damage is likely if a vessel remains aground and is moved by waves and tidal action over an extended period.

Further damage to the substrate may result from activities required to free the vessel. Vessels may have to be dragged over benthic substrates, or blasting of the substrate may be required to clear a

path for the vessel. Decisions on vessel recovery are made by the delegated regulatory authorities in conjunction with the appointed salvage experts. The priorities of any salvage action are protecting life and the environment, and minimising the risk of a marine oil spill.

During a vessel grounding there is also a possibility that antifouling paint would be scraped from the vessel's hull and cause localised contamination of the substrate. Antifouling paint historically contained the biocide tributyltin (TBT), although this product is now banned in Australia and most parts of the world. However, even modern antifouling paints, by their nature, have a biocidal action and it is also possible that residual TBT paints may remain on the hull even where it has been recoated. Depending on local current regimes, antifouling paints can have localised toxic effects that radiate from the impact location. For instance, the grounding in December 2000 of the *Bunga Teratai Satu* on Sudbury Reef, 40km to south east of Cairns, caused injuries to hard and soft corals up to 250m from the grounding site (Marshall *et al*. 2002).

Although there have been a number of shipping incidents in the GBRWHA (which includes the GBRMP and the GBRNHP) and Torres Strait, there have been no major pollution events affecting the region since the *Oceanic Grandeur* grounded in Torres Strait in 1970 (AMSA 2012c). A 2002 review of shipping safety in the GBRMP and Torres Strait found that there were 40 major shipping incidents that had the potential for environmental harm in the GBRMP and Torres Strait region, comprising 26 groundings and 14 collisions between 1985 and 2000. This equates to fewer than 2.5 incidents per annum for the study period. Much of this period was prior to the implementation of navigation initiatives such as the ReefVTS. Since the introduction of ReefVTS in 1996, groundings in the GBRMP have reduced from an average rate of one per year to 0.16 per year.

Project-related bauxite shipping may also require anchoring while waiting to enter the port at either SoE or Gladstone. Anchors may drag along the seabed causing a small area of local disturbance. No anchoring would be expected while the ships are en route.

Existing Controls and Impact Mitigation

The management of shipping within the GBR has been significantly improved since the area was included on the World Heritage list over 30 years ago and since the IMO has designated it and the Torres Strait as a Particularly Sensitive Sea Area. Management initiatives that have been implemented include compulsory and recommended pilotage regimes, a ship reporting system (REEFREP) which was subsequently updated to a vessel traffic system (ReefVTS), establishment of Designated Shipping Areas and defined traffic routes, increased navigation aids and a differential GPS service, and the requirement for vessels to carry Automatic Identification Systems (AIS).

Currently, all vessels over 70m in length (or those transporting bulk oil, chemicals and liquefied gas cargoes) are required to carry a pilot when transiting through Torres Strait, the inner route of the GBR to the north of Cairns, Hydrographers Passage (off Mackay), and the waters around the Whitsunday Islands. Compulsory pilotage is estimated to reduce the risk of a shipping incident by a factor of 30.3 (DNV 2011).

ReefVTS was implemented in 1996 to increase navigational safety within the area north of Gladstone to the Torres Strait. Under this system, all vessels over 50m in length, special product carriers, and certain vessels under tow, have systems requiring mandatory position reporting at specific points along the inner GBR Designated Shipping Area and automated position reporting via satellite. The reporting system is integrated with a system of navigation aids including VHF radio, radar monitoring and a network of differential global positioning systems and AIS stations situated throughout the GBR.

Automated Position Reporting via Inmarsat C is now the primary means for ships to provide position reports.

With the advent of these mandatory reporting systems and the extension of radar and satellite monitoring of shipping movements by AMSA, groundings in the GBR have reduced from an average rate of 1.0 per year to 0.16 per year since 1996.

New offences under the *Navigation Act 1912* (Cth) for operating a vessel in a manner that causes pollution or damage have also been introduced, including increased penalties for failure to report an incident in the GBR. Increased penalties of up to $11 million have also been introduced under the *Protection of the Sea (Prevention of Pollution from Ship) Act 1983* (Cth) for the discharge of oil or oil residues by ships in Australian waters.

Existing RTA controls to minimise the risk of a collision or grounding would apply to all Project-related RTA owned bauxite shipping travelling through the GBR and include the following:

- all vessels navigate within designated shipping areas and channels;
- all vessels travelling via the inner GBR Designated Shipping Area and through the compulsory pilotage areas within the Torres Strait have on board an AMSA pilot. These pilots have a very high degree of familiarity with the routes and the requirements for safe transit of the vessel;
- all vessels have a Bridge Resource Management system, which helps to maximise cooperation and use of resources during critical passages and to minimise fatigue;
- the Vessel Operations Manual and the International Standards of Training, Certification and Watchkeeping including guidelines for fatigue management for vessel crew are complied with;
- all vessels are monitored using the AIS, which is integrated with the ReefVTS. ReefVTS compiles timely and accurate traffic imaging of shipping throughout the region and generates ship encounter predictions, which are disseminated to ships;
- relevant deck officers hold certificates above the minimum qualifications required by the International Standards of Training, Certification and Watchkeeping Convention;
- vessels operate in accordance with a berth-to-berth passage plan, which is audited in line with safety management systems;
- vessels navigate using up-to-date electronic charts with paper chart backups;
- the RTA fleet consists of young ships in a good state of repair and subject to regular inspections, minimising the risk of a vessel being disabled;
- an AMSA Emergency Towage Vessel (ETV), the *Pacific Responder*, is stationed at Cairns and works principally within the northern part of the GBR and Eastern Torres Strait. The *Pacific Responder* has sufficient bollard pull capacity and resources to assist a disabled vessel that has lost power or steerage (a common cause of vessel grounding);
- in the restricted waters (RW) of the Port of Gladstone vessels are under pilotage and further controls and navigational requirements are implemented by the Gladstone Ports Corporation to minimise the risk of collision, including the use of a MSQ pilot and vessel separation protocols;
- the Port of Weipa and Port of Gladstone both have tug facilities;
- vessels are attended at all times by two tugs during berthing operations;
- vessels operate in strict accordance with the marine legislation and regulations at all times; and,
- while awaiting port entry, all vessels would anchor only at the anchorage locations designated by the Regional Harbour Master at both SoE and Gladstone.

Vessels transporting cargo to Weipa through the GBR would be owned and operated by a third party and therefore some of the mitigation measures for cargo shipping would be predominantly under the control of the owners and operators of those vessels. However, as a minimum, the following mitigation measures would be implemented under existing regulatory and other requirements for vessels transporting cargo through the GBR to Weipa:

- all vessels navigate within Designated Shipping Areas and channels;
- all vessels travelling via the inner GBR Designated Shipping Area and through the compulsory pilotage areas within the Torres Strait have on board an AMSA pilot. These pilots have a very high degree of familiarity with the routes and the requirements for safe transit of the vessel;
- vessels are attended at all times by two tugs during berthing operations at the Port of Weipa (this would also be the case for vessels transporting fuel from Darwin); and,
- the ETV Pacific Responder is stationed at Cairns and works principally within the northern part of the GBR and Eastern Torres Strait. The Pacific Responder has sufficient bollard pull capacity and resources to assist a disabled vessel that has lost power or steerage (a common cause of vessel grounding).

Likelihood of Impacts

As shown in **Appendix 4-C,** the likelihood of impacts occurring to listed threatened and migratory species from collision or grounding of Project-related bauxite and cargo ships would be rare (or nil for terrestrial species). This assessment has been based on the following:

- the significant reduction in the number of groundings and collisions in the GBR since the introduction of mandatory reporting systems and the extension of radar and satellite monitoring of shipping movements by AMSA despite the increase number of ships;
- the application of existing RTA shipping controls noted above (for RTA owned bauxite ships);
- the application of mitigation measures under existing regulatory requirements for vessels transporting cargo through the GBR that are not owned by RTA as outlined above; and,
- the small potential increase in overall Project-related bauxite and cargo shipping movements through the CMA and the GBR.

Therefore no further assessment of the impact from this threat is required for listed threatened and migratory species. The assessments for the GBRMP, GBRWHA, GBRNHP and CMA associated with Project-related shipping are provided in **Sections 10** to **13**.

4.5.3.4 Marine Oil Spills from Project-related Bauxite Shipping

Oil Spill Risk Assessment

An assessment of the risk of pollution by oil spills from ships in domestic ports and waters was undertaken by Det Norske Veritas (DNV 2011) on behalf of AMSA as part of its national oil spill response planning to estimate Australia's oil spill risk profile. This assessment considered the oil spill risks for a range of sources, ship types and accident types. Risks have been expressed in terms of spill frequencies and an environmental risk index (ERI) which is expressed in units of millions of dollars per year. An ERI should give a better prediction of risk as it takes account of both the environmental and financial implications of a spill (DNV 2011).

Table 4-9 presents the overall national spill risks expressed as the expected annual quantities of oil spilled into the marine environment (DNV 2011). The table shows that the spill risk in terms of volume is dominated by offshore oil production (33%) followed by offshore drilling (22%), trading

ships at sea (22%) and trading ships at port (18%). When using an ERI to assess the risks from the same sources a different profile emerges with a dominance of trading ships in port (50%). This is because the ERI also considers the sensitivity of the marine environment and the cost of the spill. The overall national spill risk by source expressed as ERI is also provided in **Table 4-9**.

Table 4-9 Overall National Oil Spill Risk

Source	Overall National Oils Spill Risk		Overall National Environmental Spill Risk	
	Spill Risk (t/year)	Percentage (%)	ERI ($M/year)	Percentage (%)
Trading ships at sea	212	22	2.6	29
Trading ships in port	174	18	4.5	50
Small commercial vessels	2	0.2	0.1	1
Offshore oil production	310	33	0.6	6
Offshore drilling	209	22	0.2	2
Shore based	42	5	1.1	12
Total		100		100

Source: DNV (2011)

The ERIs for the GBRMP (particularly along the inner GBR Designated Shipping Area) are rated as high or very high primarily because of the high shipping activity and high environmental sensitivity.

The DNV (2011) risk assessment also considered the risk profiles of various ship types at various locations. **Table 4-10** presents the results for spill frequency, spill risk and ERI.

Table 4-10 Risk Metrics for Ship Types and Locations

	Spill Frequency		Spill Risk		ERI	
	Spills per year	Per cent (%)	Tonnes per year	Per cent (%)	$M per year	Per cent (%)
Ship Type						
Oil tanker	0.229	12	276	71	1.5	21
Chemical tanker	0.021	1	2	1	0.1	1
Bulk carrier	0.296	15	59	15	3.3	45
General cargo ship	0.074	4	9	2	0.6	8
Container ship	0.118	6	28	7	1.2	17
Other ships	0.088	5	10	3	0.5	7
Small commercial	1.105	57	2	1	0.1	1
Total	1.931	100	387	100	7.3	100

Source: DNV (2011)

Table 4-10 shows that bulk carriers have the second highest significant spill frequency (15%) and spill risk (15%). However they have the highest ERI given their proximity to sensitive areas.

Consideration was also given to the risk of different accident types on each ship type as various ships are susceptible to different spill risks depending on the nature of the accident causing the spill. **Table 4-11** summarises the results for a range of typical accident types.

Table 4-11 Annual Spill Frequencies for Ship Types and Accident Types

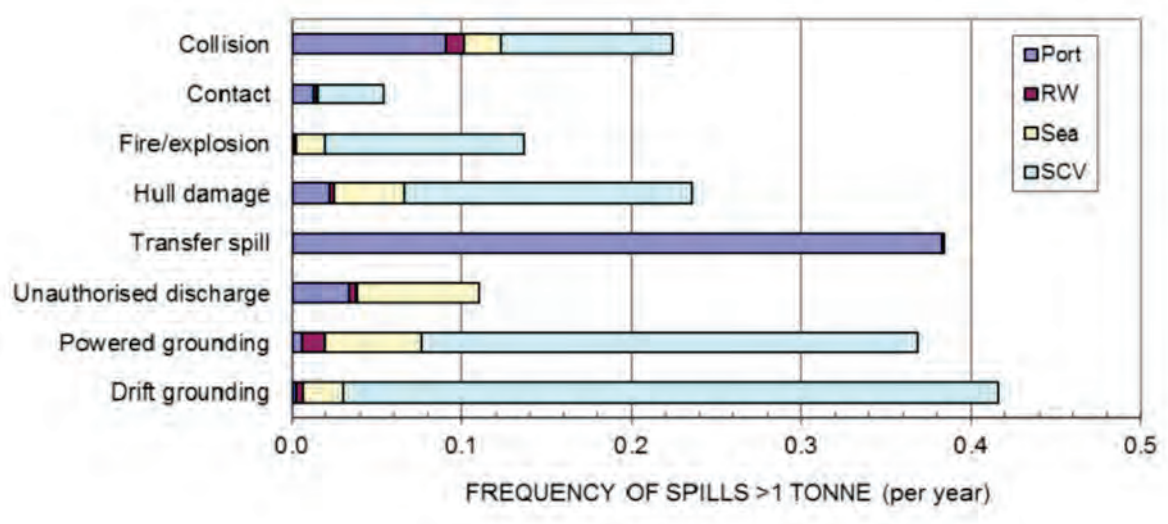
Ship Type	Ship collision	Contact with external object	Fire or explosion	Structural hull damage	Bunkering	Unauthorised discharge	Powered grounding	Drift grounding	Total
Oil tanker	0.01	0.001	0.00	0.01	0.18	0.01	0.01	0.00	0.23
Chemical tanker	0.00	0.001	0.00	0.00	0.01	0.00	0.00	0.00	0.02
Bulk carrier	0.06	0.006	0.01	0.03	0.09	0.05	0.04	0.01	0.30
General cargo ship	0.01	0.002	0.00	0.01	0.02	0.01	0.01	0.01	0.07
Container ship	0.03	0.004	0.00	0.01	0.04	0.02	0.01	0.00	0.12
Other ships	0.11	0.040	0.12	0.18	0.05	0.01	0.30	0.39	1.19
Total	0.22	0.054	0.14	0.24	0.38	0.11	0.37	0.42	1.93

Source: DNV (2011)

Table 4-11 shows that bulk carriers have the second highest spill frequencies for all of the accident types apart from "unauthorised discharge" for which they have the largest spill frequency.

The risk assessment also assessed the spill frequency by accident type, ship type and location. The results, which are shown in **Figure 4-12**, considered trading ships in port (Port), in transit in RW, and at sea (Sea). It also included an assessment of small commercial vessels (SCV).

Figure 4-12 Frequency of Spills Exceeding 1 Tonne for Ships



Source: DNV (2011)

Figure 4-12 shows that the highest accident types for ships in ports are transfer spills (bunkering). The *Oil Spill Risk Assessment for the Coastal Waters of Queensland and the Great Barrier Reef Marine Park* (Queensland Government 2000) indicates that 95% of oil spills during bunkering involve quantities of less than seven tonnes.

The (DNV 2011) assessment identifies the highest risk geographic area in the vicinity of Project-related shipping activities as the Port of Gladstone. The report states that (DNV 2011):

> *For the purpose of emergency planning, it is desirable to understand which regions of the Australian coast experience the highest oil spill risks.*

With respect to Queensland, the report identifies the following geographic areas as relatively high risks:

> *Queensland coast centred on QLD4 but also including QLD3, QLD5 and QLD6. This arises mainly from trading ships in ports such as Hay Point (QLD4), Gladstone (QLD5) and Brisbane (QLD6).*

With respect to the type of incidents, the report states that:

> *The main accident types are spills from bunkering of bulk carriers and cargo transfer on oil tankers. There are also significant contributions to smaller spills from small commercial vessels and shore-based activities.*

The *Port of Gladstone First-Strike Oil Spill Response Plan* (TMR 2011) identifies a spill of five tonnes of petroleum products during vessel bunkering operations as one of the spill scenarios used in spill planning and preparedness for the port.

Threats

In Australia, the greatest risk of oil spills, in terms of both frequency and costs, relates to incidents occurring in ports via fuel and oil transfer spills (for spills exceeding one tonne in volume) (DNV 2011). Oil spills within ports have the potential to impact on shorelines and vegetation such as mangroves and saltmarsh plants, intertidal fauna and shorebirds. Oil spills may also have significant economic impacts by interrupting port and vessel operations during clean-up activities.

The impact of oil spills on coastal and marine environments can be both short and long term and depend primarily upon the quantity of oil spilt, the chemistry and properties (type) of the oil, and the sensitivity of the biological resources impacted (AMSA 2012c). The persistence of the oil is a significant factor on its fate in the environment. Impacts of spills on foreshores also depend heavily upon the form and wave exposure characteristics of the coastline. For example oil will persist for longer and have a greater impact in mangroves and salt marshes, while exposed rocky coastlines naturally self-clean and are less sensitive to oil spills.

The extent and magnitude of impact from oil and fuel spills depends on many factors including the following:

- the type and volume of oil spilled;
- the location and trajectory of the resulting oil spill;
- seasonal factors that will affect water temperature and movement, which will affect the natural oil weathering processes;
- the presence and reproductive stage of different organisms in the impact zone; and,
- options for, and effectiveness of, spill response actions.

Oil spills can impact matters of NES in a number of ways, including the following:

- mortality or long term indirect impacts to marine flora and fauna as a result of the toxicity of the oil or direct smothering by heavy oils; and,
- damage to foreshore and marine habitats on which marine fauna depend.

Oil spills will rapidly spread to form a thin surface slick, which is a key threat to any seabird species that spend significant amounts of time swimming on the sea surface. Oiling may reduce the insulation and waterproofing properties of feathers, reducing the buoyancy of seabirds causing them to drown or resulting in hypothermia. Oil that is spread across the sea surface may also be ingested by marine fauna and cause internal bleeding and ulceration (AMSA 2012c). Marine fauna that surface to breathe may ingest oil or inhale hydrocarbon vapours leading to internal organ damage.

Generally an untreated oil slick will remain on the surface of the water until it weathers through processes such as evaporation, photo-degradation and natural bioremediation. Studies of oil concentrations below slicks of heavy oils in open water have found that hydrocarbon concentrations are at very low concentrations (<5 parts per million (ppm) and often below detection within approximately 3m of the surface) as the majority of the oil will remain on the surface unless kept in suspension by high energy wave action (Ballou *et al.* 1987).

Impacts of oil spills on coral reefs are difficult to predict because each spill presents a unique set of physical, chemical, and biological conditions. The way in which corals are exposed to oil and the composition of the oil at the time of impact determines how serious the impact will be (NOAA 2012). Direct contact of oil may result when surface oil is deposited on intertidal corals. Generally, oil will float off from the reef with the rising tide except in the event of oiling by extremely heavy oil products such as bitumen, where the density of the oil is greater than the surrounding seawater.

Research indicates sub-lethal impacts and short term recovery of corals where temporary smothering has occurred. Sub-lethal impacts include reduction or expulsion of zooxanthellae (bleaching), impaired feeding, impaired sediment cleaning ability, increased mucus production, and partial tissue death (Loya and Rinkevitch 1980). Of greater threat to corals and resident fauna species is the spill of light oil products such as diesel, in circumstances where high concentrations of the toxic lighter hydrocarbon compounds may persist long enough to cause long term impacts.

The scale of impacts to intertidal mangroves that may provide habitat to some maters of NES is highly dependent on prevailing wind and current conditions. Heavy oiling of roots, pneumatophores, tree trunks and sediments can cause mortality of mangroves via mechanical suffocation and prevention of gas exchange processes and/or decomposition of underground root mass (Proffitt 1996). Where oil reaches intertidal environments, mangrove mortality is highest among propagules, seedlings and juvenile trees due to their closer proximity to oil spill surfaces and the potential for heavy and repeated oiling on ingoing and outgoing tides (Proffitt 1996). In other cases, such as during the *Global Peace* spill in Gladstone Harbour in 2006, the primary impact observed is the temporary loss of foliage. Nonetheless, mangrove impacts may continue for years following an oil spill due to oil persistence in sediments and sublethal stress to the plants.

The Tailored EIS Guidelines requires RTA to undertake an assessment of the “the most likely scenarios (e.g. geographic areas, pollutant types and relative amounts) for a shipping incident and include stochastic modelling for those areas including likely worst case scenario for each high risk geographic area”. The “likely worst case scenario” would most reasonably equate to the “maximum credible spill volume” definition of a spill volume as defined in AMSA (2012b). The definition for this spill volume is:

> *"The largest spill that is considered possible given the spill prevention, control and other mitigation methods in place. Generally, the worst case spill assumes a failure of one or two levels of spill prevention or control."*

Importantly, an indicator provided for a spill size of this volume is the "largest spill volume known to have occurred based on recent (50 year) data." Historical spill records for the GBR show that the largest spill volume recorded in the GBR for the last 50 years, associated with a bulk carrier, was 25t spilt in Gladstone Harbour from the *Global Peace* in 2006.

In 2010, the probability of a spill greater than 10t for all Australian shipping (both trading ships at sea and trading ships in port) was 0.511, or almost once every two years (DNV 2011). This probability is based on 26,235 trading vessel arrivals in Australia and does not include ship movements where vessels leave an Australian port for a non-Australian port destination and therefore under represents the total number of ship movements. At maximum production, predicted annual Project-related shipping movements through the GBR would be 900 movements (600 bauxite vessel movements and 300 cargo movements), which equates to 3.4% of the 2010 shipping traffic used to calculate the spill probability.

On this basis, the probability of an oil spill greater than 10t (approximately $10m^3$) from Project-related shipping traversing the GBR would be 0.0174, which equates to a probability of a spill greater than 10t once every 57 years. The Project has a mine life of approximately 40 years. Modelling for a spill of 25t ($25.25m^3$) therefore constitutes an appropriate "likely worst case scenario". A fuel oil spill of this size was agreed with DSEWPAC and GBRMPA as an appropriate scenario for modelling. For modelling purposes, $25.25m^3$ fuel oil spills were assumed to occur in the high risk geographic area of Gladstone Harbour at both wharves used by Project-related bauxite shipping (Fisherman's Landing and South Trees Wharf). Spills were assumed to occur during the dry season and during the wet season. In addition, smaller $5m^3$ spills of diesel and fuel oil were also modelled as these represent likely spill scenarios during bunkering operations. In scenarios with the potential to result in $25.25m^3$ spills, such as collisions during berthing operations, the location of the diesel tanks on the bulk carriers means that such tanks are much less likely to be affected.

The threshold of oil thickness used for modelling the probability distribution of surface oil was 0.01mm (10 microns) (equivalent to 1L of oil covering an area of $100m^2$ if surface cover is continuous). Below this threshold the likelihood of any environmental harm resulting from the surface oil is considered to be very low. The use of the 0.01mm threshold for modelling surface oil is recommended in the *Interim Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities* (AMSA 2012b). There is no equivalent recommended threshold for oil thickness when modelling oil on the shoreline. A more conservative threshold of 0.001mm (1 micron) was used for the oil on shoreline modelling and this is consistent with the thickness used for oil on shoreline modelling in other published Environmental Impact Assessments (Asia Pacific Applied Science 2005, DHI Water and Environment 2010, URS 2011).

In summary, the following 12 spill scenarios have been stochastically modelled to investigate the probability distributions of both oil on surface and of oil occurring on the shoreline:

- a $5m^3$ release of fuel oil at both Fisherman's Landing and South Trees Wharf, each for two seasons (four scenarios);
- a $5m^3$ release of diesel at both Fisherman's Landing and South Trees Wharf, each for two seasons (four scenarios); and,
- a $25.25m^3$ release of fuel oil at both Fisherman's Landing and South Trees Wharf, each for two seasons (four scenarios).

The detailed results of the stochastic modelling are presented in **Appendix 4-D**.The spill modelling outlined in **Appendix 4-D** reflects a situation where a spill is assumed to have occurred and the model estimates the probability of a spill reaching a particular location. The model does not estimate the probability of a spill occurring. The probability of a spill occurring is related to the number of vessels utilising the Port of Gladstone (refer **Appendix 4-D**). The modelled results in **Appendix 4-D** of a 25.25m^3 spill suggested that there would be up to 2% and up to 6% possibility of 0.01mm or thicker water-surface slicks entering the GBRMP from a spill at Fisherman's Landing and South Trees Wharf respectively if such a spill occurred. For the modelled cells within the GBPMP that have a possibility for oil on water, there is a maximum probability of 2% and 6% for a slick to occur from a spill at Fisherman's Landing and South Trees Wharf respectively. The model results for a 5m^3 spill at both Fisherman's Landing and South Trees Wharf would not result in any water-surface oil slicks of 0.01mm or thicker being transported into the GBRMP. As described above the DNV (2011) estimate of the annual probability of a spill (>10t) in the GBRMP being 0.0511 and the probability of an oil spill greater than 10t from a Project-related vessel (bauxite or cargo) traversing the GBR is 0.0174 (1.74%), and therefore the increase in the annual probability of a spill due to the predicted increase in Project-related shipping is estimated to be 0.0058 (or 0.58%). Given a similar increase in spill probability in the Port of Gladstone, the small potential increase in Project-related shipping at maximum production would only increase the risk of an oil or fuel spill entering the GBRMP to a negligible extent.

The modelled results in **Appendix 4-D** suggest that there would be a range of probabilities of 0.001mm or thicker oiling on shores within Gladstone Harbour (including Curtis and Facing Island) which are within the GBRWHA and GBRNHP resulting from the modelled spill scenarios at Fisherman's Landing and South Trees Wharf. **Appendix 4-D** also notes that the probability of shore oiling decreases with distance from the spill location.

It should be noted that the modelling is based on a spill without any control measures. As discussed below, bunkering and mooring would occur at existing facilities that maintain spill containment and response equipment. These would continue to be used for Project-related shipping. Implementation of these spill management measures would minimise oil distribution and transport patterns within the study area for any oil spill associated with Project-related bauxite shipping and reduce any associated potential impacts.

Existing Controls and Impact Mitigation

Measures introduced by the IMO have helped to ensure that vessels are safely constructed and operated to reduce the amount of oil spilled in the event of an accident either from ship's bunkers or product tanks. The key regulations for preventing pollution by oil from ships are contained in *Annex I – Oil of International Convention for the Prevention of Pollution from Ships 1973/1978* (commonly abbreviated as MARPOL). The SOLAS Convention also includes special requirements for tankers (IMO 2012a).

AMSA manages the *National Plan to Combat the Pollution of the Sea by Oil and Other Noxious and Hazardous Substances* (AMSA 2007) and provides an organisational framework for ship-sourced oil and chemical spill response throughout Australia. The National Plan (AMSA 2007) outlines combined stakeholder arrangements designed to allow a rapid and cooperative response to marine oil spills and is complemented by Government and industry contingency plans prepared at State/Northern Territory, regional, port and facility levels. The National Plan (AMSA 2007) also coordinates the provision of national and international support. Special oil spill contingency plans called REEFPLAN and TORRESPLAN have been developed for the waters of the GBR and Torres Strait.

As part of the National Plan (AMSA 2007), equipment stockpiles are maintained at strategic locations, with a comprehensive equipment stockpile located at the Port of Gladstone in response to the high numbers of vessels using the port and the presence of bunkering facilities. A smaller stockpile of equipment, including over 500m of oil spill boom, is held at the Port of Weipa. Under the tiered response arrangements of the National Plan (AMSA 2007), the port authority is responsible for the Tier 1, or first strike, response to a spill. Both the Port of Gladstone and the Port of Weipa have First-Strike Oil Spill Response Plans, which are supplementary to the *Queensland Coastal Contingency Action Plan* (MSQ 2011). These plans detail the roles and responsibilities of agencies and individual positions within the incident command structure, an assessment of the threats and possible spill scenarios, response options and arrangements, procedures, equipment and contact lists.

In the event that the spill is beyond the immediate capacity of the port authority, assistance will be sought from MSQ (Tier II) or AMSA (Tier III). A Tier II or III response will likely be assisted by the Australian Marine Oil Spill Centre, which is an industry funded organisation that holds additional equipment stockpiles and employs specialist spill-response professionals. Any spill associated with Project-related shipping in the GBR would also be supported by environmental expertise from GBRMPA and EHP.

When operating in Australia, Project-related bauxite ships would only take on bunker fuel at the Port of Gladstone, working under the existing controls and procedures of the Gladstone Ports Corporation. There would be no bunkering of bulk carriers at the Boyd Port facilities.

The bunkering facility at the Port of Gladstone is a barge operated by BP. It has an oil pollution emergency plan and operating protocols in place to minimise the risk of a spill incident occurring during bunkering operations. First-strike spill response equipment is held on board the bunker barge. In addition, the Port of Gladstone has a first-strike oil spill response plan, which designates the oil company as the combat agency for first-strike to oil spills from their facilities but allows for mobilisation of Port of Gladstone resources and equipment, and National Plan (AMSA 2007) equipment to assist in containment of any oil spill. The response plan identifies the potential risk from bunkering operations as being approximately 5t of petroleum products.

Standard protocols on board ships receiving bunker oils include pre-sounding of fuel tanks to determine the volume of fuel required, continuous watch of operations and communications with the bunkering provider, blocking scuppers on the deck of the vessel, and having spill response equipment on hand during the operations.

The potential impacts of oil and fuel spills are affected by the actions of response taken. Spill response options may include the following:

- monitoring the slick as the oil breaks down and disperses naturally;
- mechanical containment and recovery of the spilled oil at sea; and,
- chemical dispersion and removal of the oil from shorelines following stranding.

Any decisions regarding response options are made by the appointed on-scene commander, who will be a representative of the Gladstone Ports Corporation or MSQ. Oil spill response management will be made with input from specialist environmental advisors using a process of net environmental benefit analysis.

Where the oil has been treated with chemical dispersants it will be broken into very small droplets, allowing it to be kept in suspension in the water column with minimal water energy and preventing the reformation of a surface slick. As a consequence, dispersed oil is subject to a high degree of horizontal and vertical dilution. Vertical dilution alone for a thick oil slick (typically 0.1 mm) will reduce

the hydrocarbon concentration in 5m of water to 20ppm and to 10ppm in 10m of water. Experience from experimental field trials and dispersant operations at actual spills has shown that dispersed oil will be rapidly diluted into the sea, with oil concentrations dropping rapidly from a maximum of 30 - 50ppm just below the surface shortly after treatment to concentrations of <1ppm in the top 10 to 15m after a few hours (Lewis 2001). The resulting hydrocarbon concentrations in the water column are therefore unlikely to significantly impact on seagrasses, corals or other benthic fauna or fish below this depth. In shallow water where oil has been chemically dispersed, there is some potential for toxic impacts from the oil on subtidal fauna and flora. This high degree of dilution resulting from dispersion also enhances natural rates of biodegradation and minimises the formation of surface slicks that pose a threat to birds or marine mammals.

The decision to use oil spill dispersants is based on the sensitivity of reef and intertidal communities in the area. Chemical dispersants are not generally effective on heavy fuel oils such as those used currently by some RTA vessels, although intermediate grade fuel oils are amenable to dispersant use. Chemical dispersants are also not recommended for use on marine diesel spills, as these lighter oils break down quickly under normal conditions, and it is generally preferable to leave them to weather naturally rather than disperse the lighter oil fractions into the water column.

The application of chemical dispersants within the GBRMP must be approved by an officer prescribed within the *Great Barrier Reef Marine Park Regulations* 1983 (Cth) and would be made in consultation with environmental advisors from the GBRMPA as well as EHP and MSQ. Any use of dispersants will be subject to conditions imposed by these authorities (e.g. dispersants would not normally be used over coral reefs or seagrasses except where the oil is likely to impact upon mangroves or where water depths exceed 10m).

In Australian waters, response actions and decisions are the responsibility of the AMSA, who will source environmental advice from DSEWPaC in addition to the agencies noted above. Under the existing response arrangements for Australia, RTA would not be involved in decision making regarding the preferred response option for a marine oil spill and any dispersant operations would be undertaken by the nominated response authorities.

Controls to minimise the risk of collision and grounding are discussed in **Section 4.5.3.3**. Measures to minimise the loss of oil from Project-related RTA owned bauxite ships in the event of a collision or grounding or during bunkering include the following:

- bunker fuels are divided into a number of tanks located throughout the RTA vessels. In all vessels the bunker tanks are in protected locations with a void space of at least 0.76m between the outer hull and at least 1.0m between the outer side hull of the ship and the bunker tank. This measure is designed to significantly reduce the risk of bunker tanks being breached in the event that the hull is damaged during a collision or grounding and is a requirement prescribed under amendments to MARPOL Annex I for new ships delivered after 1 August 2010. It is estimated that the effect of double hull protection fuel tanks will reduce the spill frequency from collision, contact and grounding by 75% (DNV 2011);
- all Project-related shipping and bunkering facilities have emergency marine spill response plans and carry spill response equipment;
- spill response equipment is deployed ready for use and scuppers are plugged during all bunkering operations;
- the ability of the vessel master to internally transfer fuel between bunker tanks to reduce the volume in any damaged tanks;

- the ability of the vessel master to move ballast water between ballast tanks to elevate the damaged portion of the hull and minimise oil release;
- systems allowing for immediate reporting of the incident to MSQ to initiate spill containment and response operations; and,
- access to the AMSA ETV, the *Pacific Responder*, which is stationed at Cairns and works principally within the GBR and eastern Torres Strait. The ETV *Pacific Responder* is equipped to assist large vessels in distress and has first strike capacity for oil spill response (this mitigation measure would also be relevant to third party cargo vessels through the GBR to Weipa).

Likelihood of Impact

As shown in **Appendix 4-C**, the likelihood of impacts occurring on listed threatened and migratory species from marine oil spills associated with Project-related bauxite shipping would be either rare or unlikely (nil for terrestrial species). This assessment has been based on the following:

- the significant reduction in the number of groundings and collisions in the GBR since the introduction of mandatory reporting systems and the extension of radar and satellite monitoring of shipping movements by AMSA despite the increase number of ships;
- the application of existing RTA shipping controls to the Project's bauxite ships;
- the existence of oil spill response plans and equipment at the higher risk areas i.e. the ports at Gladstone and Weipa;
- bunkering of domestic bauxite ships only at the Port of Gladstone, using an experienced bunker operator with spill response equipment on hand; and,
- the small potential increase in overall Project-related bauxite and cargo shipping movements.

Therefore no further assessment of the impact from this threat is required for listed threatened and migratory species. The assessments for the GBRMP, GBRWHA, GBRNHP and CMA associated with Project-related shipping are provided in **Sections 10** to **13**.

4.5.3.5 Marine Oil Spills from Barges and Service Vessels

Threats

A service vessel would be used to refuel the dredges during the construction period. Barges would be used to transfer fuel carried in road tankers from the Humbug Wharf to the Hey Point barge/ferry terminal during both the construction and operational phases of the Project.

The threats from an oil spill from a service vessel or barge would be similar to those described in **Section 4.5.3.4** for bulk carriers.

Existing Controls and Impact Mitigation

Existing RTA controls to minimise the risk of oil spills from the barges would apply to all Project-related barges and include the following:

- storage, handling and use would be in accordance with MARPOL, relevant Australian Standards, and the AMSA guidelines;
- the transfer of dangerous goods and hazardous substances by barge would be carried out in accordance with the relevant regulatory requirements;
- procedures would be developed for the storage, handling, transfer and disposal of hazardous substances to minimise the risk of spills;

- relevant employees and contractors involved in the storage, handling, use and disposal of hazardous substances and materials would be trained to ensure that they are aware of their responsibilities in relation to hazardous substances, including further detailed risk assessments around the systems, processes and procedures to ensure adequate controls are in place;
- procedures would be developed for spill cleanup and appropriate emergency response equipment provided at key locations to reduce the risk of harm resulting a spill; and,
- RTA would prepare an oil spill response plan for the barges carrying fuel tanks, including further detailed risk assessments around the processes and procedures for response.

Likelihood of Impacts

As shown in **Appendix 4-C**, the likelihood of impacts occurring on listed threatened and migratory species from oil spills from Project service vessels or barges would be either rare or unlikely (or nil for terrestrial species). This assessment has been based on the implementation of the existing RTA controls listed above.

Therefore no further assessment of the impact from this threat is required for listed threatened and migratory species.

4.5.3.6 Bauxite Spills

Threats

Bauxite ships carry only bauxite as cargo. Bauxite generally consists of granular nodules ranging in size from 0.3 to 25.0mm. Bauxite has negligible solubility in water and a specific gravity (individual particles) of 2.65. Bauxite is a benign material that does not leach contaminants in either seawater or freshwater (refer **Section 3.5.4**). Bauxite is not classified as a dangerous good or marine pollutant, and is a Class C substance under the International Maritime Solid Bulk Cargo code. Due to its large particle size (gravel), its density and its lack of solubility, any bauxite spilled into the sea would be expected to settle to the sea floor. Any bauxite spilled during ship loading or unloading, or as a result of hull damage caused by collision or grounding would not change water quality. It should be noted that bauxite naturally occurs in the sediment of the proposed Port, having been derived from the adjacent cliff areas through natural erosion processes (RTA 2011, Section 6.9.2.9). These naturally deposited bauxite materials do not appear to have had any impact on the marine environment.

Adverse environmental impacts could result from a bauxite spill if benthic organisms including coral, seagrasses or marine invertebrates are smothered. Impacts from smothering would persist until any spilled material was physically recovered, dispersed by ocean currents, or until the spill area was recolonised by benthic species. In the event of a shipping collision, the likelihood of bauxite spills impacting coral or seagrass communities is considered unlikely as these communities occur in shallow waters outside of deeper shipping channels. Physical recovery of any spilled material may be possible to limit the potential of any long term and widespread impacts occurring. Bauxite, having negligible solubility in water and low toxicity, would not be anticipated to cause either acute or chronic toxic effects in marine biota.

Existing Controls and Impact Mitigation

Bulk carriers would be loaded with bauxite at the proposed Port via a conveyor from the stockpile located on the shore. The conveyor and ship loader would be designed and operated to minimise dust generation and spillage to the surrounding environment, particularly in the vicinity of transfer points. These measures would include the following:

- a catch tray would be positioned under the ship loader tripper to catch spillage from the inclined section of belt. The material collected from the tripper catch tray would be directed to the head end sump and then pumped onshore to a sediment holding pond;
- three stage belt scraping with water sprays would be positioned at the conveyor head pulley to clean the belt. The scrapings and the water used for belt cleaning would be directed into the head end sump for pumping onshore into sedimentation dams;
- the wharf conveyor would be designed with variable speed drives to provide controlled belt starting, thereby minimising the potential for bauxite spillage;
- belt drift switches would be installed on the wharf and ship loading conveyor that shuts down the conveyor drives if a belt moves from the designed position. Training idlers that track the belts would also be installed;
- when loading ships the ship-loading boom conveyor would be stopped prior to the movement of the ship loader to prevent bauxite spillage onto the deck of the ship; and,
- a sealed maintenance area would be provided at the end of the wharf so the ship loading boom can be serviced and cleaned within a bunded area. Runoff from this sealed maintenance area would report to the head end sump for pumping back to shore.

Bauxite would be loaded into bulk carriers with an approximate moisture content of 13% (on a wet weight basis). Any cargo spillage during loading would be cleared from the decks before sailing and all holds sealed during the voyage to prevent the ingress of seawater into the hold. The RTA fleet consists of relatively new ships, and hold covers are regularly inspected and kept in a good state of repair. With these controls it is considered that the potential for any dust discharges during the voyage is very low.

At the Gladstone alumina refineries, the bauxite would be unloaded using a clam shell style bucket capable of picking up approximately 14t of cargo with each grab. The bucket would transport the bauxite to a hopper which would link via a conveyor to a stockpile on shore. Bauxite unloading procedures would be subject to strict controls relating to the processes for vessel berthing, machinery management and maintenance, managing the process to minimise structural strain on the ship, and the risk of unloading equipment damaging cargo holds. Following unloading, any cargo residues on deck would be recovered as far as possible, after which the decks would be swept of any remaining minimal residue prior to the vessel sailing from port. The ship loading and unloading controls are backed up by training, work instructions and procedures.

Vessel holds would not be washed between consecutive voyages, thereby avoiding the risk of discharge of cargo residues in hold washwater.

Likelihood of Impact

As shown in **Appendix 4-C**, the likelihood of impacts occurring on listed threatened and migratory species from bauxite spills would be rare (or nil for terrestrial species). This assessment has been based on the following:

- the significant reduction in the number of groundings and collisions in the GBR that could result in a cargo spill since the introduction of mandatory reporting systems and the extension of radar and satellite monitoring of shipping movements by AMSA despite the increase number of ships;
- the application of significant spill controls during ship loading and unloading operations;
- the chemical nature of the bauxite, being insoluble and non-toxic, means that there is limited potential for either acute or chronic toxic effects on water quality or marine species as a result of a spill;
- while there is a higher probability of cargo being spilled overboard during loading or unloading, this would occur in sheltered waters where recovery of the spilled cargo is possible;
- spills during loading or unloading would occur into areas that are routinely dredged and highly modified, limiting the likelihood of any significant impacts to marine benthic fauna or flora in these areas; and,
- the small potential increase in overall Project-related bauxite shipping movements through the GBR.

Therefore no further assessment of the impact from this threat is required for listed threatened and migratory species. The assessments for the GBRMP, GBRWHA, GBRNHP and CMA associated with bauxite spills from Project-related shipping are provided in **Sections 10** to **13**.

4.5.3.7 Operational Discharges – Oily Mixtures from Bilges

Threats

Bilge water, which accumulates during regular ship operations must be removed from machinery spaces for the safety and protection of the vessel and on-board machinery, but often contains oil residue that may pose a risk to the marine environment.

The discharge of oily water at a concentration of not more than 15ppm is permitted within all Australian waters (excluding within port limits) including the GBR providing the vessel is en route at the time of discharge. The discharge of any oily water is not permitted within port limits.

Oil within the legal discharge concentrations does not form a surface slick and is not considered a risk to birds or marine megafauna. Given the rapid horizontal and vertical dilution that immediately takes place, oil concentrations from oily water discharges drop below detection limits almost immediately. It is therefore highly unlikely that any acute or chronic toxicity impacts on marine species, including corals or seagrasses, would occur.

Existing Controls and Impact Mitigation

MARPOL Annex I and the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) set requirements for the management of oily wastes. This includes the requirement for vessels over 400 gross tonnes to have an IMO-approved oily water separator that is designed to reduce the oil content in water to less than 15ppm (which equates to approximately 1.5mL of oil in one cubic metre of water). This reduction results in no visible oily residue in the discharge water. The oily-water separator must include monitoring system alerts and systems for stopping the discharge if the 15ppm limit is exceeded at any time.

MARPOL Annex I also requires that ships have holding tanks for the storage of oily waste, connections for discharge of oily waste to shore facilities, and to maintain detailed record books pertaining to management of oil and oily wastes on board the vessel. Compliance with these provisions is included in ship surveys and all large vessels must hold a Class approved International Oil Pollution Prevention (IOPP) Certificate. The oily water separator and its connections, and the oil record book are often a key focus of routine Port State Control inspections.

All Project vessels would be fully compliant with the provisions of MARPOL Annex I, and would have the following;

- current IOPP Certificates;
- on-board IMO approved oily water separators;
- holding tanks;
- discharge connections; and,
- oil record books.

Oily wastes from the separator that cannot be discharged at sea (sludge or water containing 15ppm oil or greater) would be discharged to licensed shore facilities at Gladstone or at an international port.

All Project-related bauxite vessels would have a comprehensive oily water separator maintenance system, including management and maintenance of seals for the bilge system. The amount of oily machinery waste produced on board would be minimised by frequent routine maintenance. Although water with oil concentrations up to 15ppm may legally be discharged, no oily water would be discharged by Project-related bauxite vessels on passage through Australian waters and any discharges by export vessels would be in fully accordance with MARPOL Annex I.

Likelihood of Impacts

As shown in **Appendix 4-C**, the likelihood of impacts occurring on listed threatened and migratory species from the discharge of oily mixtures from Project-related shipping would be rare (or nil for terrestrial species). This assessment is based on Project-related bauxite vessels transiting Australian waters adhering to the provisions and controls for oily waste discharges listed above.

Therefore no further assessment of the impact from this threat is required for listed threatened and migratory species. The assessments for the GBRMP, GBRWHA, GBRNHP and CMA associated with oily water discharges from Project-related shipping are provided in **Sections 10** to **13**.

4.5.3.8 Operational Discharges – Sewage

Threats

Ships' sewage typically comes from sources including toilet and bathroom facilities, laundries, the medical bay and the galley. It contains much the same wastes and contaminants as would typically be found in domestic sewage waste on land.

Raw sewage discharged to the marine environment has the potential to deplete oxygen in the surrounding water when decomposing, thereby reducing the amount of oxygen available to fish and other aquatic animals. Sewage can also contain disease-causing bacteria and viruses which pose a risk to public health for swimmers and those eating contaminated shellfish. Sewage discharges often contain high levels of nutrients which may increase algal and plant growth, and potentially contribute to the formation of algal blooms that reduce light penetration through the water column, produce toxins and deplete oxygen.

Existing Controls and Impact Mitigation

All Project-related bauxite vessels would have an on-board sewage treatment plant that is IMO approved (see Marine Environment Protection Committee Resolution 159(55)) and holding tanks and discharge connections. Crews would maintain a sewage log book in accordance with the provisions of MARPOL Annex IV – Sewage, and the *Transport Operations (Marine Pollution) Act 1995* (Qld). The discharge of sewage in the GBRMP is also regulated under the GBRMP Act (Cth), which enacts the provisions of Annex IV. On-board sewage treatment systems would be included in the vessels' maintenance system, and compliance with sewage treatment and discharge regulations is included in Port State Control inspections.

Sewage discharge from Project-related bauxite vessels would only take place in accordance with the provisions of MARPOL Annex IV, including no discharges within three nautical miles from land, and all sewage would be comminuted (ground) and fully treated through an on-board IMO-approved sewage treatment plant. Where sewage has been stored in holding tanks it would only be discharged outside 12 nautical miles from land and whilst the ship is en route to facilitate rapid dilution. There would be no discharge of any sewage into the waters of the GBRMP or GBRWHA and ships would dispose of sewage at a shore-based facility in Gladstone.

The number of crew on bauxite bulk carriers servicing the Project would be approximately 18 to 25, thereby limiting the volume of sewage effluent produced on board from all sources.

Likelihood of Impact

As shown in **Appendix 4-C**, the likelihood of impacts occurring on listed threatened and migratory species from the discharge of sewage from Project-related shipping would be rare (or nil for terrestrial species). This assessment is based on Project vessels transiting Australian waters adhering to the provisions and controls for sewage discharges listed above.

Therefore no further assessment of the impact from this threat is required for listed threatened and migratory species. The assessments for the GBRMP, GBRWHA, GBRNHP and CMA associated with sewage discharges from Project-related shipping are provided in **Sections 10** to **13**.

4.5.3.9 Operational Discharges - Garbage

Threats

Harmful marine debris is listed as a key threatening process under the EPBC Act (DSEWPaC 2012e). Ships' garbage is defined according to MARPOL Annex V - Garbage, and includes all kinds of food, domestic and operational wastes generated during normal operation of the ship. Garbage from ships may also include waste that is subject to quarantine restrictions and is regulated by the Australian Quarantine and Inspections Service (AQIS), such as food or galley waste from overseas origins. The definition of garbage does not include oily waste from machinery spaces and bilges, which is addressed under Annex I.

Garbage from shipping, including recreational, fishing and large commercial carriers, is estimated to contribute between 10% and 20% of the world's marine debris (Sheavly 1995, Faris and Hart 1994). A survey conducted by the Marine Conservation Society in 1997 indicated that 14% of the litter items found in areas along the UK coast were likely to be attributable to shipping.

Floating garbage items may persist in the marine environment for decades, and can also provide a means of transport for harmful aquatic organisms. Larger pieces of debris, such as sheets of plastic,

may cause smothering of benthic animals and plants in intertidal and subtidal habitats. Abrasion of hard debris against benthic substrates may cause damage to benthic fauna such as corals. Plastic debris discharged from ships, such as plastic bags and strapping bands, can be ingested by marine animals or result in their entanglement causing death. Marine turtles, seabirds and marine mammals are particularly vulnerable to marine debris. Marine turtles frequently ingest plastic bags, confusing them with jellyfish prey. Autopsies of 15 dead Leatherback Turtles found on Long Island in the Whitsundays showed that 11 individuals had ingested plastic bags that had consequently blocked their stomach openings (Laws 2000).

Existing Controls and Impact Mitigation

Garbage disposal from ships is regulated internationally by MARPOL Annex V. Annex V currently prohibits the discharge of any plastics, but allows the discharge of many other garbage types including food, metal and glass items taking into account minimum distances from land and treatment standards. In response to international calls for improved management of garbage waste from ships, amendments to Annex V were adopted by the IMO in July 2011. Under the new provisions of Annex V that will be in force by the commencement of the Project, the only garbage that may be discharged at sea will include food wastes (at least three nautical miles from nearest land after the food waste has been ground to less than 25mm or at least 12 nautical miles for untreated food wastes); cargo residues that cannot be recovered using commonly available methods for unloading and cargo hold cleaning; and wash water from the deck or holds providing that the cleaning additives used are not harmful to the marine environment.

Project-related bauxite vessels operating domestically would not discharge any garbage, including food wastes, while at sea within the GBR or parts of Torres Strait (defined as “nearest land” under MARPOL) in accordance with regulations. Garbage from Project-related bauxite vessels, including any waste that may be subject to quarantine restrictions, may also be incinerated at sea or discharged ashore in Gladstone to a licensed shore waste reception facility. The only exception to this would be where the discharge is necessary for the safety of the ship and its crew or as a result of damage to the ship during an incident.

The definition of quarantine waste from the *Quarantine Regulations 2000* (Cth) includes material of overseas origin including:

- material used to pack or stabilise cargo (dunnage);
- galley and food waste;
- human, animal, or plant waste; and,
- refuse or sweepings from holds or decks of vessels or installation.

While in port, all vessel waste on deck must be secured so that it is inaccessible to birds or animals i.e. bagged and in lidded deck bins. No plant or animal material is to be taken off the vessel without prior permission from AQIS (DAFF 2011b).

In the context of Project-related shipping, the only likely item of quarantine waste will be food waste that arrives on vessels from overseas. Some dunnage may be present on vessels transporting equipment or materials to the Project area.

Garbage on export vessels travelling via international routes would be disposed of in accordance with the revised provisions of MARPOL Annex V and local regulations while at sea outside Australian waters. The small number of crew on board Project vessels (typically 18 to 25) would minimise the amount of food waste likely to be generated and requiring disposal at sea.

Likelihood of Impacts

As shown in **Appendix 4-C**, the likelihood of impacts occurring on listed threatened and migratory species from the discharge of garbage from Project-related shipping would be rare or unlikely (or nil for terrestrial species). This assessment is based on Project vessels transiting Australian waters adhering to the provisions and controls for garbage discharges listed above.

Therefore no further assessment of the impact from this threat is required for listed threatened and migratory species. The assessments for the GBRMP, GBRWHA, GBRNHP and CMA associated with garbage disposal from Project-related shipping are provided in **Sections 10** to **13**.

4.5.3.10 Operational Discharges – Air Emissions

Threats

An air discharge of environmental significance for bulk carriers is exhaust, which includes particulates and oxides of sulphur (SO_x) and nitrogen (NO_x) generated by the ships' engines. Heavy grade fuel oils contain many residual oil products remaining from the refining process and have a higher concentration of SO_x than lighter fuels. Some particulates may also be generated by onboard incinerators. Particulates and NO_x are primarily of concern from a human health perspective.

Existing Controls and Impact Mitigation

NO_x emissions are controlled by engine design that maximises combustion efficiency, with low speed engines such as those used on Project vessels generally having lower NO_x emissions. New build ships are required to meet the limits imposed by the IMO based on the year they were constructed. The sulphur content of ships' exhaust varies considerably based on the fuel type used. Currently Project vessels use heavy fuel oil with a sulphur content not exceeding 3.5%.

MARPOL Annex VI – Air was amended over recent years to include provisions for progressive reduction in the allowable concentration of sulphur in ships' bunker fuels. From 1 January 2012, the sulphur content of fuel oil is not to exceed 3.5%, and from 1 January 2020 the allowable sulphur content will be further decreased to 0.5%. Evidence of the sulphur content of fuel is provided in the form of a bunker supply note. In practice, refining practices and limited availability of low sulphur crude oils make it unlikely that heavy fuel oils will be able to meet the 0.5% sulphur standard and the new regulations will have the effect of excluding the use of heavy grade bunker fuels by shipping. As a consequence vessels will have to change the fuel products they use, most likely switching to marine diesel oil unless cost effective and adequate sulphur scrubbing technologies are able to be developed in the near future.

The vessel operation plans for Project-related bauxite vessels would include the requirement for notification of the engine room if any excessive funnel smoke is observed so that immediate action may be taken to rectify the situation.

The deliberate emission of ozone depleting substances, such as certain refrigerant gases, is prohibited under MARPOL Annex VI. As RTA ships do not have refrigerated cargo spaces, there would be no potential for accidental discharge of ozone depleting substances from Project-related shipping activities.

Project-related bauxite vessels would have on-board incinerators for the disposal of garbage wastes as required when garbage wastes are not disposed at sea. These incinerators would be subject to

regular maintenance to ensure effective and efficient operation and minimise air discharges. Due to the small numbers of crew, the requirement for incineration of waste would be minimal.

Likelihood of Impact

As shown in **Appendix 4-C**, the likelihood of impacts occurring on listed threatened and migratory species from the air emissions discharged from Project-related shipping would be rare (or nil for terrestrial species). This is because air emissions from Project vessels would be minor and controlled via modern engine and emission control engineering design.

Therefore no further assessment of the impact from this threat is required for listed threatened and migratory species. The assessments for the GBRMP, GBRWHA, GBRNHP and CMA associated with air emissions from Project-related shipping are provided in **Sections 10** to **13**.

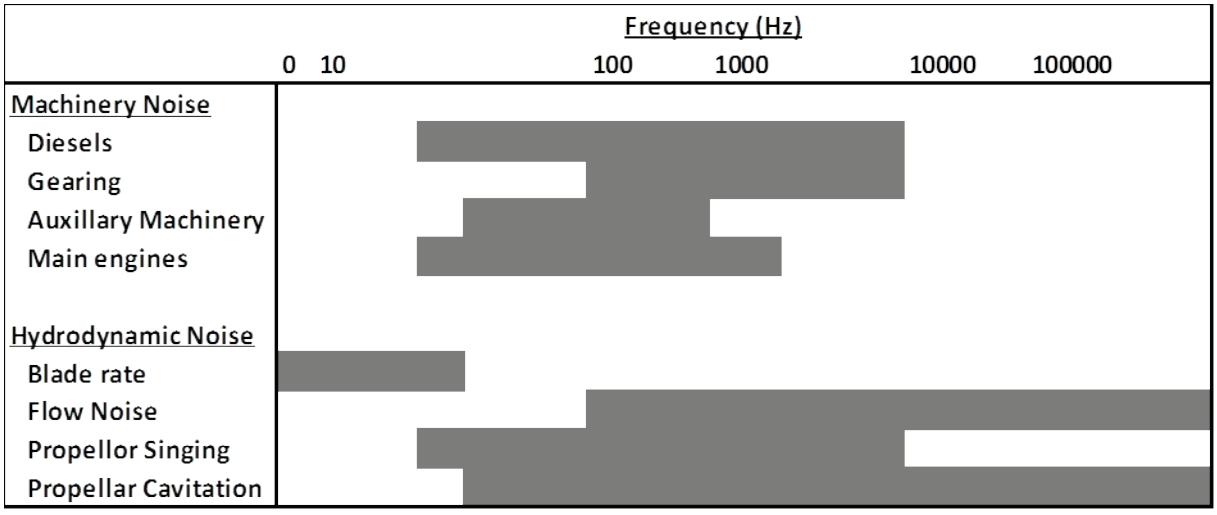
4.5.3.11 Vessel Noise

Threats

Commercial shipping is the major contributor of low frequency noise (5 to 500 hertz (Hz)) in the world's oceans. Underwater noise from shipping principally originates from propeller action and cavitation, movement of the water across the hull, and the transmission of on-board machinery noise as vibration through the hull of the vessel (IMO 2009, Southall 2005).

The frequency of noise generated by various shipping operations is illustrated in **Figure 4-13**. Propeller cavitation is the predominant noise source surrounding vessels operating under higher propeller loads. Generally, lower vessel speed, propeller speed and propeller loading will reduce cavitation and noise. Shallower propeller immersion when the ship is in ballast may also increase noise compared to fully laden ships (IMO 2009). The predominant sound frequencies associated with large vessels are in the range of 10Hz to 1kHz (OSPAR 2009), with main sound energy less than 200Hz (CEDA 2011).

Figure 4-13 Sound Frequency Ranges Associated with Shipping Operations



Source: IMO (2009)

Marine mammals use sound for many reasons such as communication, navigation, predator avoidance and prey capture (McCauley and Cato 2003, MMC 2007). It is suspected that changes in the local marine acoustic environment due to shipping noise have the potential to elevate ambient noise levels and mask communication signals and impact on biology and behaviour of marine species. Baleen whales (Suborder Mysticeti) are thought to be particularly sensitive to the low frequency sounds emitted by commercial ships (Southall 2005).

Little data are available relating to the sensitivity of Dugongs to shipping noise. Dugongs are reported to produce relatively low-level underwater vocalisations, producing sounds quantified by Anderson and Barclay (1995) within the range of 3 to 18kHz for chirp-squeaks and between 0.5 and 2.2kHz for barks.

The hearing capability of marine turtles is poorly understood. Hearing measurements made for a limited range of species indicate that marine turtles generally hear best at low frequencies and that the upper frequency limit of their hearing is likely about 1kHz.

The range of dolphin vocalisations is at higher frequencies (0.2 to 150kHz) and is mostly outside the primary range of shipping noise. However, these species may experience masking of communication when vessels are in close proximity (Okeanos 2008). Nevertheless dolphins commonly ride the bow waves of ships at sea, suggesting they are not disturbed by the sound.

Casper (2006) identified that while elasmobranchs can detect sounds, they do not have sensitive hearing compared to other marine animals or the ability to detect most natural sounds they encounter in the far field. Impacts to elasmobranch species from Project shipping activities would be unlikely.

Overall, the effects of underwater shipping noise on marine fauna are difficult to quantify and few controlled experimental data exist. Physiological effects may include hearing loss; however it is likely that individual animals move away from noise sources to avoid such impacts, and avoidance behaviour is well established in the peer reviewed literature as the common response to underwater noise when that noise reaches a certain threshold (e.g. Janik and Thompson 1996, Nowacek *et al.* 2001, Ng and Leung 2003, Hodgson and Marsh 2007, DeRuiter and Doukara 2012). Behavioural impacts may be more likely where persisting underwater noise causes extended displacement from foraging or breeding areas. The impact of underwater noise from Project shipping activities is discussed in **Sections 7.3.5.3** for marine turtles and **Section 9.4.4.3** and **9.5.4.3** for Dugongs and cetaceans. A further assessment of underwater noise impacts is provided in **Section 15.3**.

Existing Controls and Impact Mitigation

Over the past few years the potential for vessel noise impacts on marine mammals and other species has received attention from a number of national, international and non-government organisations. In February 2012 the IMO established an international correspondence group to develop non-mandatory guidelines for reducing underwater noise from commercial ships, focusing on propulsion, hull design, on-board machinery and operational modifications. The correspondence group will also examine available options for ship-quieting technologies and operational practices (IMO 2012b).

Propeller noise may alter as a result of damage to the propeller or marine growth if the propeller is stationary for at least several days to weeks. Any propeller damage to Project-related bauxite ships should be repaired during dry docking. Excessive vibrations from machinery and piping on board vessels will increase the noise volumes inside the ship and would be routinely corrected.

Project-related bauxite vessels would have low speed, direct drive engines, with propeller speeds of only about 100rpm when operating at full speed, reducing the probability of cavitation and excessive noise from the propulsion system. The hull form of Project vessels also reduces cavitation.

Project-related bauxite vessels would operate at reduced speeds while in Gladstone and the proposed Port areas thereby minimising the potential impact of shipping-related noise on marine fauna, such as Dugong and dolphin populations. Vessels transporting cargo or fuel to the Project area would also operate at reduced speeds while in port limits.

Likelihood of Impacts

As shown in **Appendix 4-C**, the likelihood of impacts occurring on listed threatened and migratory species from noise associated with Project-related shipping would be rare or unlikely (or nil for terrestrial species). This assessment is based on Project vessels implementing the controls and mitigations measures discussed above and the relatively small potential increase in overall Project-related shipping movements through the Torres Strait and GBR at maximum production (refer **Section 18.4.3**).

Therefore no further assessment of the impact from this threat is required for listed threatened and migratory species. The assessments for the GBRMP, GBRWHA, GBRNHP and CMA associated with vessel noise from Project-related shipping are provided in **Sections 10** to **13**.

4.5.3.12 Lighting

Threats

Light spilled from vessels while underway or at anchor can impact marine fauna that are active at night. Visual cues used for orientation, navigation, or other purposes may be disrupted by artificial light sources. The most disruptive light sources include fluorescent, metal halide and mercury vapour lights (Shaflik 1995).

Impacts from artificial lighting associated with Project-related shipping may include disorientation, attraction or repulsion, disruption to natural foraging and/or breeding behaviour patterns. Behavioural responses to light can alter foraging and breeding activity in marine turtles, seabirds, fish and cetaceans. The effects of increased artificial lighting on marine fauna are dependent on the intensity and wavelength of the light and the resilience of the species to light spill impacts. Effects are also dependent on the range of light spill into areas that are significant for breeding and foraging, and the timing that light spill occurs in relation to breeding and foraging activity (Deda *et al.* 2007).

Little empirical data exist relating to the impacts of light spill on marine fauna species. Artificial lighting has been linked to disorientation primarily in marine turtles, particularly during periods of nesting and hatching as they have a tendency to orientate towards brightness (Witherington and Martin 1996). Adult and juvenile marine turtles in Australia are known to forage in relatively shallow seagrass habitats (DSEWPaC 2012q) and are therefore less likely to be impacted by vessels that are transiting deeper waters along designated shipping routes.

Seabirds and migratory birds may be disorientated by artificial light produced from vessels. Birds may either be attracted to the light source itself or to prey that is attracted to light from vessels. Potential adverse impacts on seabirds attracted by artificial lighting may include collisions with vessels and disruption to normal behaviour and roosting patterns.

There is no direct evidence to suggest that artificial light sources impact on the migratory, feeding or breeding behaviours of marine mammals. Cetaceans may indirectly be attracted to food sources attracted to light spill from vessels.

The attraction of fish and fish larvae to artificial lighting has the potential to alter natural patterns of larval recruitment in proximity to ships at anchor (Marchesan *et al*. 2005). Any impact on larval recruitment patterns as a result of ship light spill is likely to be rare as ship anchoring would be highly localised.

Existing Controls and Impact Mitigation

All vessels must display some lighting at night to ensure they are visible to other marine traffic. This includes lighting that indicates the vessels' direction of travel and status, such as the ability to manoeuvre. The requirements for vessel lighting including colour, intensity and location, are prescribed in the *International Regulations for Preventing Collisions at Sea 1972* (COLREGS) and are regulated in Queensland through the *Transport Operations (Marine Safety) Regulations 2004* (Qld). Project vessels would comply with the international standards for vessel lighting in accordance with these regulations.

Other light sources on board Project-related bauxite vessels include deck lighting while in port to facilitate loading and unloading operations and internal lights used on the vessel at night, which are considered to be a relatively minor light source. Project-related bauxite vessels' bridge would be dimmed at night to aid visual navigation. Other controls include the following:

- ensuring lighting is minimised overall to that which is essential for vessel safety; and,
- shielding and/or recessing lights to minimise unnecessary light spill.

Project-related bauxite shipping would only anchor in the position and area designated by the VTS centre and in the designated anchoring area for commercial vessels in Gladstone Harbour. Waiting times on anchor are on average 24 hours.

Likelihood of Impacts

As shown in **Appendix 4-C**, the likelihood of impacts occurring to listed threatened and migratory species from lighting associated with Project-related shipping would be rare or unlikely (or nil for terrestrial species). This assessment is based on Project vessels implementing the controls and mitigation measures discussed above and the relatively small potential increase in overall Project-related shipping movements through the Torres Strait and GBR at maximum production.

Therefore no further assessment of the impact from this threat is required for listed threatened and migratory species. The assessments for the GBRMP, GBRWHA, GBRNHP and CMA associated with lighting from Project-related shipping are provided in **Sections 10** to **13**.

4.5.3.13 Vessel Strikes on Marine Fauna

Threats

Vessel movements can result in injury or death of marine fauna as a result of vessel strikes. International data on vessel strikes of marine mammals is kept by the International Whaling Commission (IWC). The IWC database lists a total of 38 reported vessel strikes of whale species in Australia between 1988 and 2009. Based on the descriptions of the 11 reported strikes which occurred within the GBRWHA boundary during these years, nine could be attributed to faster moving

recreational, tourism vessels or other vessels less than 50ft in length. The remaining two strikes list the vessel type as unknown and a large commercial vessel. Conservatively assuming the unknown vessel strike was a large commercial vessel, there were two strikes in 21 years between 1988 and 2009, which equates to approximately 0.095 whale strikes per annum from large commercial vessels in the GBRWHA. It should be noted that these records rely on reporting by vessels and coastal states, so the data set may be incomplete. It is also possible for a large vessel to strike a marine mammal or marine turtle and be unaware that the incident has occurred. While most fatal or serious whale injuries reported involve strikes from larger vessels, most minor injuries involve collisions with vessels less than 45m (Laist *et al*. 2001). Globally, vessel strikes are considered likely to be a major cause of mortality for cetacean species (DEWHA 2008b).

Regulatory and voluntary measures have been implemented in various countries to minimise the risk of ships colliding with whales. These measures may include systems for reporting information on the known location of whales, and speed restrictions and vessel route management in areas or at times when high densities of whales are likely to be present. The IWC had established an international working group on the issue of vessel strikes, and the issue has also been raised at the IMO. Both groups are investigating feasible options for reducing the incidence of vessel strikes.

The listed threatened marine and migratory species that may be potentially susceptible to vessel strike along shipping routes associated with the Project are detailed in **Sections 4.5.1.8** and **4.5.1.9**. Further details are provided below.

Dugong

Since 1998 vessel strikes in Queensland have accounted for 5% of the confirmed Dugong deaths or injuries where the cause could be determined (EHP 2012e). Netting or entanglement in fishing gear and shark control nets was the cause of 6.2% of the confirmed incidents. Illegal hunting was the cause of 4.0% of the confirmed incidents. The majority of the deaths were from natural causes.

It is commonly accepted that vessel speed and water depth are the main factors affecting the risk of vessel strikes. The risk of vessel strike is higher for faster boats in shallower water.

The Project involves operating a passenger vessel between the Hornibrook and Hey River terminals and a barge between the Humbug terminal and the Hey River terminal. The operation of the passenger vessel and barge may increase the risk of vessel strike on Dugong in the Embley River estuary where seagrass beds are present. Transit lanes would be defined to reduce the overall area of disturbance from vessel activities. Transit lanes would follow the greatest water depths to avoid significant meadows of seagrasses (refer **Figure 4-3** to **Figure 4-7**) unless directed otherwise by the Regional Harbour Master. The passenger vessel would also be limited to a speed of 6 knots in water of less than 2.5m in depth when approaching berth.

Slow moving displacement vessels such as bulk carriers, barges and tugs pose a lower vessel strike risk.

While it may be possible that an individual may be struck by a ferry, it is unlikely that there would be an adverse impact on an important population of Dugong.

Whales

The likelihood of impact from vessel strike on whales would be similar for Dugong (unlikely) in the coastal waters given their size and similar mobility. Humpback whales migrate each winter into the GBRWHA to breed. Whales, including cow-calf pairs, may rest in the Whitsundays, Hervey Bay, Moreton Bay, the Swain Reefs complex, Bell Cay and the Palm Island Group.

Dolphins

Dolphin species are found to co-exist with coastal development including extensive port facilities (Hale *et al*. 1998). The most important area for Indo-Pacific Humpback Dolphins in Moreton Bay is the Port of Brisbane (Hale *et al*. 1998). Indo-Pacific Humpback Dolphins and Australian Snubfin Dolphins are also associated with port infrastructure at Cleveland Bay, Townsville (Parra *et al.* 2006). Bottlenose Dolphins also inhabit inshore areas where significant amounts of recreational vessel and commercial water-based activities occur including Moreton Bay (Chilvers *et al*. 2005), Richmond and Clarence Rivers (NSW) (Fury and Harrison 2008), and Port Stephens and Jervis Bay (NSW) (Möller *et al*. 2002).

The likelihood of impact from vessel strike on dolphins would be would be the same as for Dugongs and whales due to their greater mobility and ability to quickly respond to disturbances from slow moving displacement vessels such as bulk carriers.

Marine Turtles

There is the possibility of impacts on marine turtles from passenger vessel strike in the Embley estuary as they are faster moving vessels than the bulk carriers. However, the barge/ferry terminals are not in areas that have habitat likely to be frequently utilised by marine turtles and hence the likelihood of impact on marine turtles from passenger vessel strike is unlikely.

In 2010 there were 875 records of stranded and/or dead marine turtles throughout Queensland, including 544 Green Turtles, 61 Flatback Turtles, 44 Hawksbill Turtles, 37 Loggerhead Turtles and 17 Olive Ridley Turtles (Biddle and Limpus 2011). A further 172 records were of unidentified marine turtle species. Eighteen strandings were recorded during 2010 from the Gulf of Carpentaria, including 10 entanglements in ghost nets. The remoteness of the Gulf of Carpentaria means that reporting from this area is expected to be less comprehensive than for east coast locations. For the 12 years of reporting from January 1999 to December 2010, strandings and/or dead marine turtles from the Gulf of Carpentaria were generally less than 3% of the total reports for Queensland (EHP 2012e).

Olive Ridley Turtles heavily dominate the species composition of stranded and/or dead turtles found in the Gulf of Carpentaria, and the majority of these are entangled in ghost fishing nets. For other species, the majority of strandings occur on the east coast of Queensland. Most incidences reported are from Moreton Bay and Townsville.

The data do not indicate that there are any significant numbers of dead marine turtles with vessel strike markings from the Weipa or Western Cape York region. Most incidences are from Moreton Bay and Townsville. This situation is unlikely to change as a result of Project -related shipping activities.

Bulk carriers would be slower moving than the passenger vessel and would provide marine turtles a greater opportunity to avoid them. Many marine turtle species are found in higher densities in shallow areas where there is suitable feeding substrate such as algae growing on coral reefs and seagrasses whereas the bulk carriers would be travelling in deeper waters.

Seabirds

Seabirds returning to roosting locations at night may be attracted to artificial lighting emitted from ships, resulting in collisions that can cause injury or death. Collisions with vessels may also result in sub-lethal impacts to birds, including disorientation, exhaustion and depletion of energy reserves. Where adult birds are returning from foraging trips during the breeding season, vessel strikes may result in decrease rates of chick provisioning and breeding success (Wiese *et al*. 2001).

Existing Controls and Impact Mitigation

Any incident involving an RTA owned vessel striking marine fauna would be investigated and if required, reported to EHP. When Project-related bauxite vessels are underway in Designated Shipping Areas, ships' masters have the ability to take avoidance action, such as reducing speed if marine megafauna such as whales are spotted in their path. It should be noted that the time for Project-related bauxite vessels of such large size to change speed and bearing is not rapid and that it is also difficult to predict animal movement.

Vessel strikes generally occur when there is a large number of fast, small vessels (e.g. less than 6m long) operating in shallow water where avoidance behaviour by marine fauna is effectively reduced. Speed appears to be a key issue affecting the frequency of incidents, with 89% of vessel strikes examined involving vessels travelling in excess of 14 knots (Laist *et al*. 2001). Project-related bauxite vessels would be large and slow moving (14 knots being the usual maximum cruising speed) and would be travelling more slowly and under pilotage in shallow or confined marine areas where susceptible marine fauna are more commonly found.

As discussed in **Section 4.5.3.12**, lighting on board the vessels while underway or at anchor would be limited to that required for navigational and operational safety, thereby minimising the risk of attraction of birds that may be injured by colliding with a vessel.

Likelihood of Impacts

As shown in **Appendix 4-C**, the likelihood of impacts occurring on listed threatened and migratory species from vessel strikes associated with Project-related shipping would be rare or unlikely (or nil for terrestrial species). This assessment is based on the following:

- Project-related bauxite vessels would be slow moving and would provide marine species a greater opportunity to avoid them;
- many marine turtle species are found in higher densities in shallow areas where there is suitable feeding substrate such as algae growing on coral reefs and seagrasses whereas the bulk carriers would be travelling in deeper waters;
- dolphins, Dugongs and whales have sufficient mobility and ability to quickly respond to disturbances from slow moving displacement vessels such as bulk carriers;
- the Embley River estuary where the faster moving vessels would operate is not a significant marine turtle habitat and the proposed transit lanes would follow the greatest water depths to avoid significant meadows of seagrasses (Dugong habitat); and,
- the passenger vessel would also be limited to a speed of 6 knots in water of less than 2.5m in depth when approaching berth.

Therefore no further assessment of the impact from this threat is required for listed threatened and migratory species. The assessments for the GBRMP, GBRWHA, GBRNHP and CMA associated with vessel strike from Project-related shipping are provided in **Sections 10** to **13**.

4.5.3.14 Marine Species Introductions

Threats

Ballast Water and Sediments

To allow for safe sailing while empty, ships take up ballast water for stability and to manage vessel manoeuvrability. Ballast water is pumped through a filtration system into the specialised ballast tanks

located throughout the hull of a vessel. Total ballast water volumes for a DPPV may be in the order of 60,000m^3. This ballast water is then discharged either prior to or during the loading of cargo. The global translocation of seawater through ships' ballast has long been recognised as a vector for transferring marine organisms (particularly planktonic larvae) around the world. Sediments that accumulate in ships' ballast tanks can also pose a significant risk of marine introductions. In some cases there is the potential for trans-located species to become significant marine pests in their new location, threatening ecological and economic values.

The increased speed at which modern ships can travel and the close proximity of Australia to south-east Asian ports means that there is a greater chance of foreign organisms surviving in ballast water and establishing in Queensland ports (CRC Reef Research Centre 2004). The risk of marine species introductions via ballast water is greatest where the ballast water has been taken on board in shallow waters, or from areas or times where there may be high densities of invertebrate larvae. Establishment of introduced species also depends on suitable conditions for that species, such as water temperature and suitable substrate.

Hull Biofouling

Hull biofouling was traditionally seen as a problem because of the impact it had on vessel sailing efficiency and fuel use. More recently hull biofouling on ships has received increased international attention for its potential to act as a vector for translocating marine pest species. It is now considered that hull biofouling may be at least as important a vector for introducing marine pest species as ballast water (GISP 2008). In July 2011, to address this issue the IMO adopted the voluntary *Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species* (the Biofouling Guidelines) (IMO 2011). The Biofouling Guidelines (IMO 2011) recommend a range of control measures aimed at reducing the incidence of biofouling, including design, antifouling coating, and maintenance and management protocols.

All vessels experience some degree of biofouling from microscopic organisms such as microalgae and bacteria, and macrofouling such as barnacles, mussels, polychaete worms, bryozoans and algae (Godwin 2003). As vessels move between ports there is potential for some of these organisms to detach from the hull and become established in a new marine location, providing that receiving environmental conditions are suitable. As with species introduced through ballast water, there is the potential that any introduced species may become an environmental or economic pest.

The risk of marine pest species incursions occurring from biofouling varies depending on the following:

- vessel design and construction, including the presence of niche areas such as sea chests in the hull;
- the vessel operating profile, including speed and time spent at anchor;
- vessel routes and ports of call; and,
- the vessel's maintenance history including the anti-fouling coating system, dry-docking and hull cleaning practices (Floerl 2004).

Currently, Queensland has no recorded established invasive marine pests, however a total of 26 invasive marine pests are listed as posing a potential threat to Queensland's marine environment (Hayes *et al*. 2004). Introduced marine pest species may impact the marine environment by outcompeting native species for food and space, and altering habitats and food web function (GISP 2008). Significant economic impacts to commercial fisheries and aquaculture operations may result from predation by marine pests or through infection of commercial species by introduced pathogens.

Economic impacts may also result from the damage caused to marine infrastructure or vessels by encrusting pest species that attach to underwater surfaces such as water intakes (GISP 2008).

Studies indicate that the majority of established marine invasive species occur in or around ports or harbours. This may be related to the higher temperatures typical of ports that trigger spawning of mature fouling communities; the presence of extensive areas of artificial substrates suitable for settlement of larvae; high densities of international vessels, and in-water or land-based hull cleaning facilities (GISP 2008).

Extensive surveying for marine pest species has been undertaken at the Port of Weipa and no invasive marine pest incursions have been recorded (Hoedt *et al*. 2001, PCQ 2007 and 2009). While no invasive species have been found, at least two introduced species were identified in the 1999 baseline survey (Hoedt *et al*. 2001). The detailed baseline survey of the Port of Weipa has been supplemented since 2006 by inspection every three months of larval monitoring devices installed in the port and targeted surveys of high-risk areas in the port. This monitoring was instigated following the discovery of the high-risk species Asian green mussel (*Perna viridis*) on a non-trading vessel that had been in the Port of Weipa. No Asian green mussels or other non-indigenous species have been detected since the monitoring began in 2006 (PCQ 2009).

Existing Controls and Impact Mitigation

In 2001 Australia amended the *Quarantine Act 1908* (Cth) to require the management of internationally-sourced ballast water in all ships arriving from overseas. These vessels must exchange at least 95% of their ballast water volume outside the Australian territorial sea, and as far as possible from land and in deep water (>200m where possible). They must provide a pre-arrival report to the AQIS) to demonstrate that they have complied with this requirement before they enter Australian ports. AQIS prohibits the discharge of ballast water (other than potable water from a municipal drinking supply) that has been taken up from ports or coastal waters outside Australian territorial waters. Sediments that accumulate in ships' ballast tanks also pose a significant risk of marine introductions, and the discharge of sediments from ballast tanks is prohibited in Australian waters.

Australia is a signatory to the *International Convention for the Control and Management of Ships Ballast Water and Sediments 2004* (the Ballast Water Convention). The Ballast Water Convention has not yet entered into force, but when it does it will apply to all ships entering Australian waters. The convention prescribes requirements for ballast water treatment systems on new build ships to further reduce the risk of accidental introductions of marine species. A number of IMO type approved treatment systems have now been developed and it is expected that these will begin to be placed onto new build ships in the near future in anticipation of the entry into force of the Ballast Water Convention.

The National System for the Prevention and Management of Marine Pest Incursions was implemented in 2008 to combat the potential threat from marine pests and provides the framework for establishing marine pest prevention, management and response arrangements. The Australian Emergency Marine Pest Plan 2005 complements the national AQUAVETPLAN to combat emergency animal diseases in the marine environment (DERM 2012a).

The primary means of biofouling prevention and control is the use of an anti-fouling coating system applied to exposed surfaces, the use of biofouling resistant materials for piping and unpainted components, and the use of marine growth prevention systems for sea chests and internal seawater cooling systems. Vessels that present the highest risk of heavy biofouling are those with poor

maintenance of the biofouling coating system and long periods between hull cleaning, and those that travel very slowly or spend long periods at anchor.

Project-related shipping operations would minimise the risk of marine species introductions through the following:

- all vessels owned and contracted by RTA would manage ballast water through a ballast water management plan which would comply with Australian mandatory requirements and the International Convention for the Control and Management of Ships Ballast Water and Sediments (IMO 2004);
- the majority of Project vessels that would travel through Torres Strait and the GBR to Gladstone travel only on domestic routes, and would not collect ballast water outside Australia or be exposed to foreign species that may foul the vessels' hulls;
- the AQIS pre-arrival reporting requirements would be complied with;
- once a bauxite vessel is at berth it would be loaded/unloaded without delay except for unplanned events (time at berth is dependent on tides and about 24hrs in Weipa and 48hrs in Gladstone). The shipping schedule would be managed as best as possible to minimise queuing and delay at anchor, this would include suspending shipping, where possible, during maintenance of Port facilities;
- vessels would be subject to hull inspections and surveys, hull cleaning and renewal of antifouling coating systems every 2 ½ years as part of class requirements;
- all hull cleaning and dry-docking would be undertaken overseas for Project-related bauxite vessels;
- vessels would be maintained in a good state of repair and any damage that may have impacted on the antifouling coating system would be rapidly addressed; and,
- underwater marine surveys would be undertaken in the proposed Port area, allowing for rapid identification and response to any introduced macro-marine pest incursions.

Likelihood of Impacts

As shown in **Appendix 4-C**, the likelihood of impacts occurring on listed threatened and migratory species from the introduction of pest species associated with Project-related shipping would be rare (or nil for terrestrial species). This assessment is based on Project vessels implementing the controls and mitigation measures discussed above and that the majority of Project vessels passing through the Torres Strait and the GBR to Gladstone would travel only on domestic routes, and would not collect ballast water outside Australia or be exposed to foreign species that may foul the vessels' hulls.

Therefore no further assessment of the impact from this threat is required for listed threatened and migratory species. The assessments for the GBRMP, GBRWHA, GBRNHP and CMA associated with marine species introductions from Project-related shipping are provided in **Sections 10** to **13**.