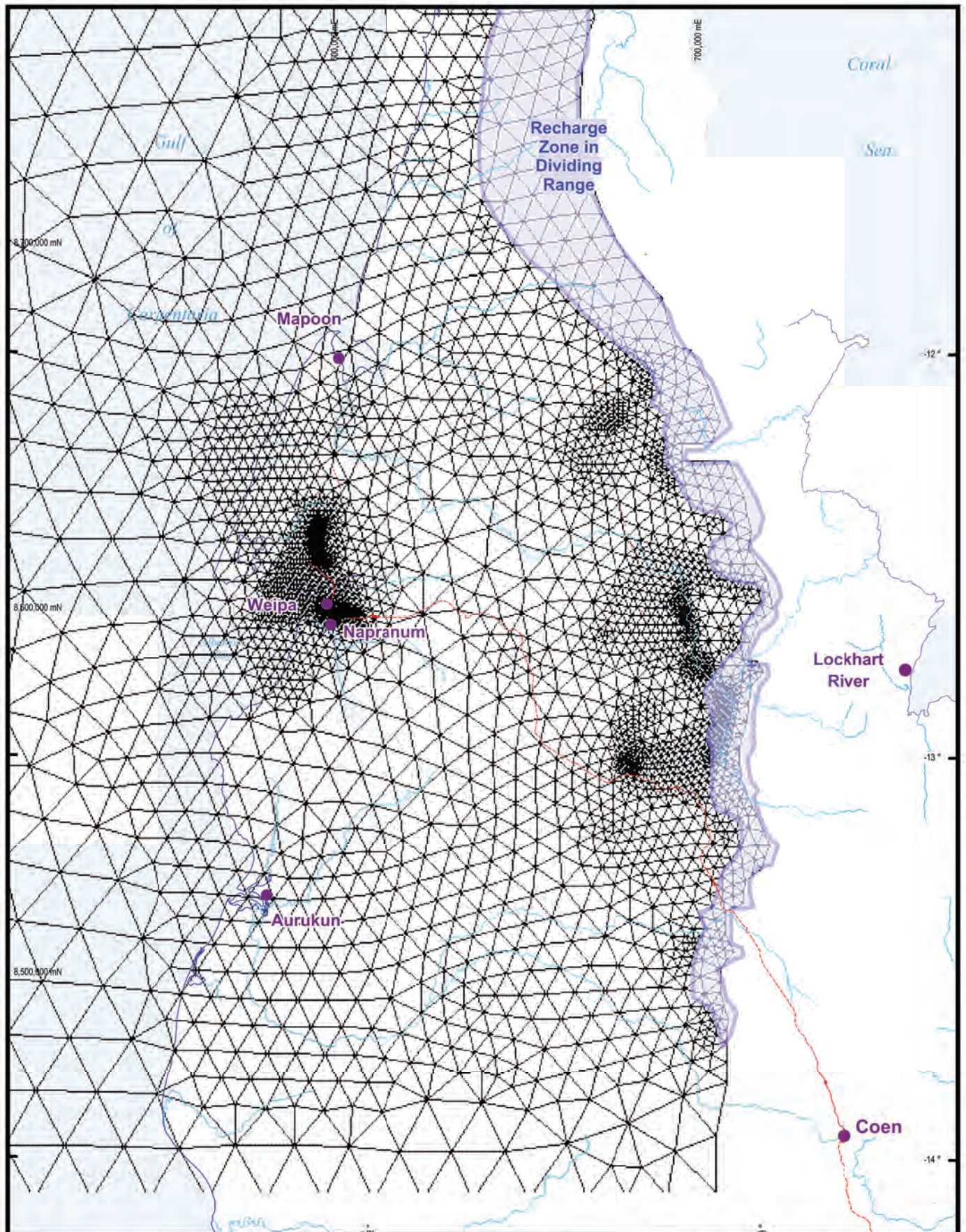


Appendix 16-A Artesian Groundwater







Rio Tinto Alcan

- Recharge area
- Township
- River
- Road/track

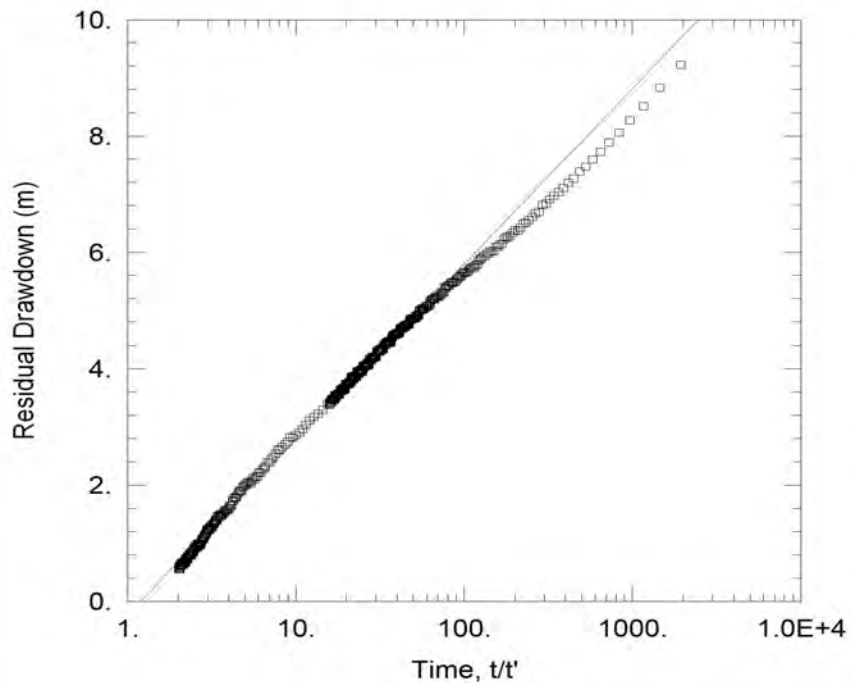
South of Embley Project
Appendix 16A: Fig. 1
Feflow Model
Finite Element Mesh



0

50km

Datum/Projection: GDA94/MGA Zone 54 Date: 01/08/2012



ART10 PUMPING TEST RECOVERY ANALYSIS

PROJECT INFORMATION

Company: Golder Associates
 Client: RTA Weipa
 Project: 077636002
 Location: Andoom Artesian Borefield
 Test Well: ART10
 Test Date: 17 Feb 2007

SOLUTION

Aquifer Model: Confined
 Solution Method: Theis (Recovery)
 $T = 375.3 \text{ m}^2/\text{day}$
 $S/S' = 1.2$

AQUIFER DATA

Saturated Thickness: 170. m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA

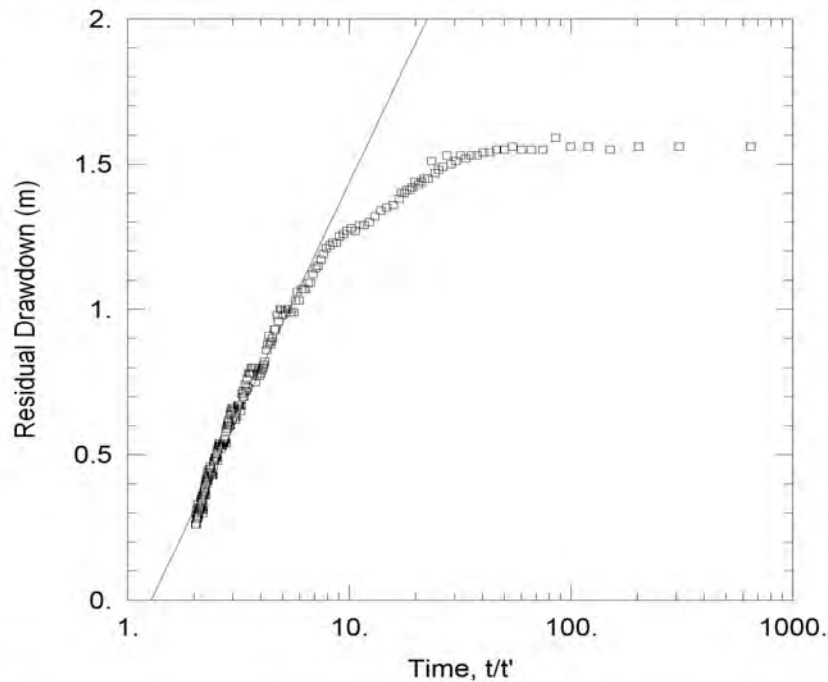
Pumping Wells			Observation Wells		
Well Name	X (m)	Y (m)	Well Name	X (m)	Y (m)
art10	0	0	□ art10	0.1	0

South of Embley Project

Appendix 16A: Fig. 2

ART10 Pumping Test Analysis for Drawdown at ART10

Date: 16/08/2012



ART10 PUMPING TEST -ART11 RECOVERY ANALYSIS

PROJECT INFORMATION

Company: Golder Associates
 Client: RTA Weipa
 Project: 077636002
 Location: Andoom Artesian Borefield
 Test Well: ART10
 Test Date: 17 Feb 2007

SOLUTION

Aquifer Model: Confined
 Solution Method: Theis (Recovery)
 $T = 704. \text{ m}^2/\text{day}$
 $S/S' = 1.284$

AQUIFER DATA

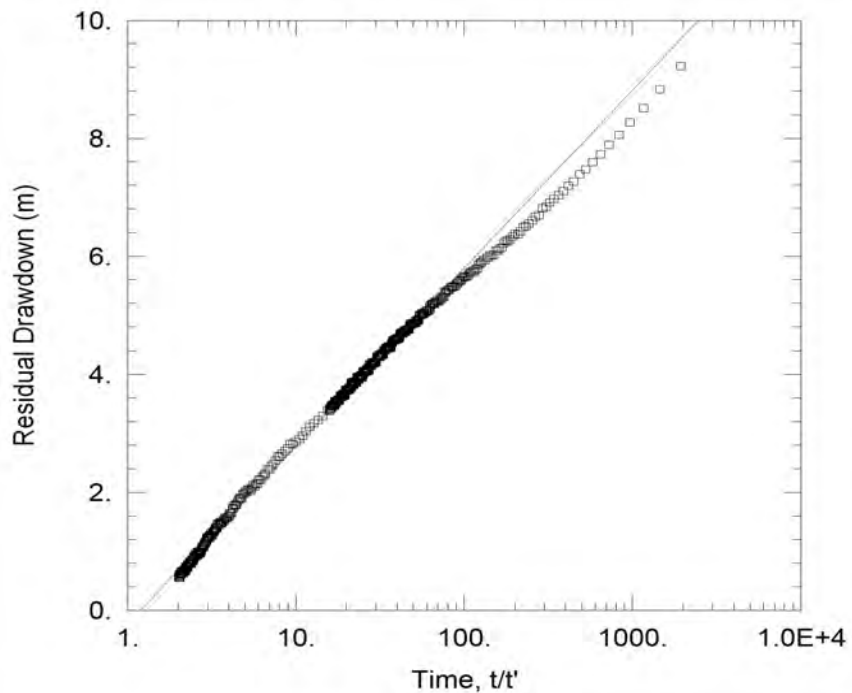
Saturated Thickness: 184. m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA

Pumping Wells		
Well Name	X (m)	Y (m)
ART10	0	0

Observation Wells		
Well Name	X (m)	Y (m)
□ ART11	2160	0



ART10 PUMPING TEST RECOVERY ANALYSIS

PROJECT INFORMATION

Company: Golder Associates
 Client: RTA Weipa
 Project: 077636002
 Location: Andoom Artesian Borefield
 Test Well: ART10
 Test Date: 17 Feb 2007

SOLUTION

Aquifer Model: Confined
 Solution Method: Theis (Recovery)
 $T = 375.3 \text{ m}^2/\text{day}$
 $S/S' = 1.2$

AQUIFER DATA

Saturated Thickness: 170. m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA

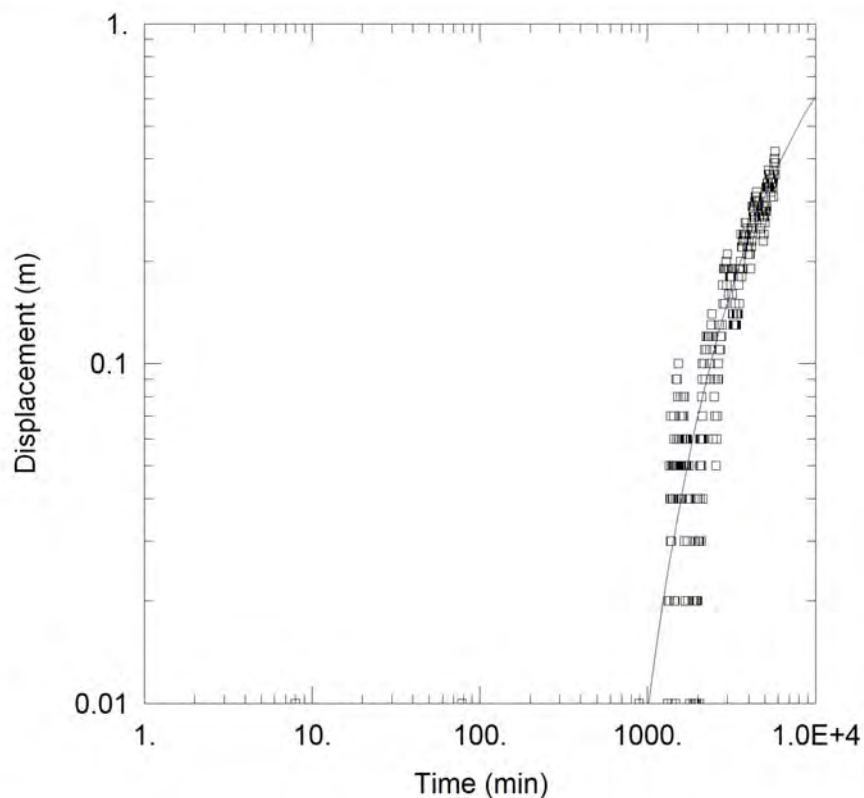
Pumping Wells			Observation Wells		
Well Name	X (m)	Y (m)	Well Name	X (m)	Y (m)
art10	0	0	□ art10	0.1	0

South of Embley Project

Appendix 16A: Fig. 4

ART10 Pumping Test Analysis for Drawdown at ART10

Date: 16/08/2012



ART10 PUMPING TEST - OBSERVATION WELL ART12

PROJECT INFORMATION

Company: Golder Associates
 Client: RTA Weipa
 Project: 077636002
 Location: ANDOOM ARTESIAN BOREFIELD
 Test Well: ART10
 Test Date: 13 - 17 Feb2007

SOLUTION

Aquifer Model: Confined
 Solution Method: Theis
 $T = 748.5 \text{ m}^2/\text{day}$
 $S = 0.0003429$
 $Kz/Kr = 1.$
 $b = 170. \text{ m}$

WELL DATA

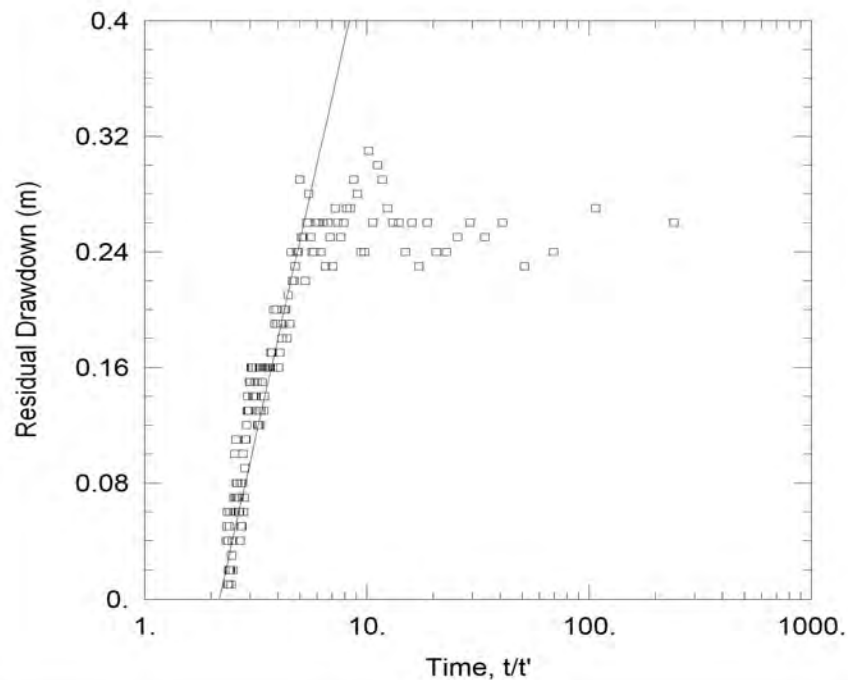
Pumping Wells		
Well Name	X (m)	Y (m)
ART10	0	0

Observation Wells		
Well Name	X (m)	Y (m)
□ ART12	0	4210

South of Embley Project
Appendix 16A: Fig. 5

**ART10 Pumping Test Analysis
 for Drawdown at ART12**

Date: 16/08/2012



ART12 PUMPING TEST - ART10 RECOVERY ANALYSIS

PROJECT INFORMATION

Company: Golder Associates
 Client: RTA Weipa
 Project: 077636002
 Location: Andoom Artesian Borefield
 Test Well: ART12
 Test Date: 28 Feb 2007

SOLUTION

Aquifer Model: Confined
 Solution Method: Theis (Recovery)
 $T = 1829. \text{ m}^2/\text{day}$
 $S/S' = 2.179$

AQUIFER DATA

Saturated Thickness: 114. m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA

Pumping Wells		
Well Name	X (m)	Y (m)
ART12	0	0

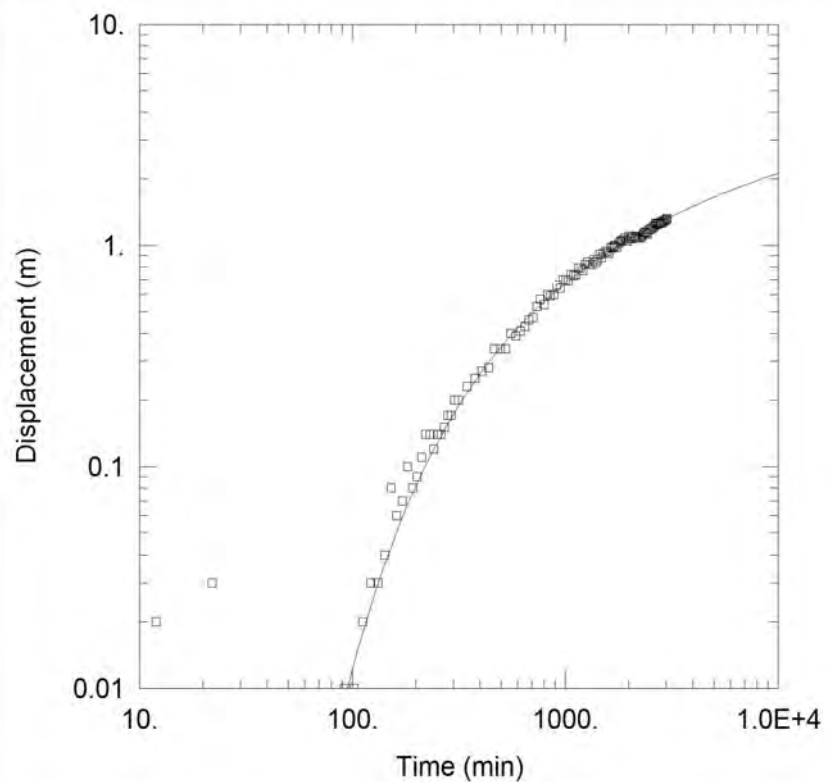
Observation Wells		
Well Name	X (m)	Y (m)
ART10	4210	0

South of Embley Project

Appendix 16A: Fig. 6

ART12 Pumping Test Analysis for Drawdown at ART10

Date: 16/08/2012



ART12 PUMPING TEST - OBSERVATION WELL ART11

PROJECT INFORMATION

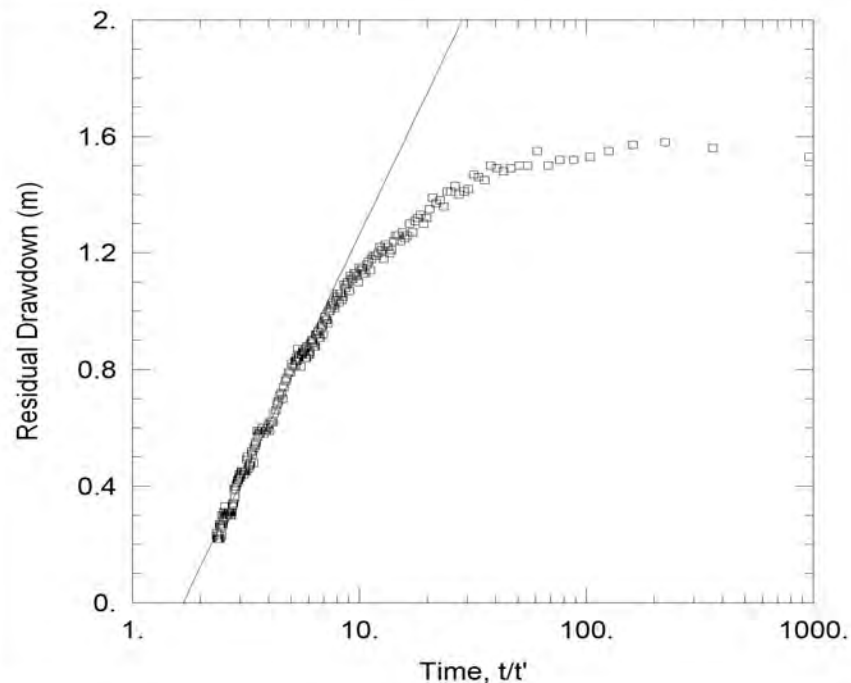
Company: Golder Associates
 Client: RTA Weipa
 Project: 077636002
 Location: ANDOOM ARTESIAN BOREFIELD
 Test Well: ART12 - 79 L/s (6178 m³/d)
 Test Date: 21 - 23 Feb2007

SOLUTION

Aquifer Model: Confined
 Solution Method: Theis
 T = 779. m²/day
 S = 0.0001421
 Kz/Kr = 1.
 b = 184. m

WELL DATA

Pumping Wells			Observation Wells		
Well Name	X (m)	Y (m)	Well Name	X (m)	Y (m)
ART12	0	0	ART11	0	2060



ART12 PUMPING TEST - ART11 RECOVERY ANALYSIS

PROJECT INFORMATION

Company: Golder Associates
 Client: RTA Weipa
 Project: 077636002
 Location: Andoom Artesian Borefield
 Test Well: ART12
 Test Date: 28 Feb 2007

SOLUTION

Aquifer Model: Confined
 Solution Method: Theis (Recovery)
 $T = 769.5 \text{ m}^2/\text{day}$
 $S/S' = 1.679$

AQUIFER DATA

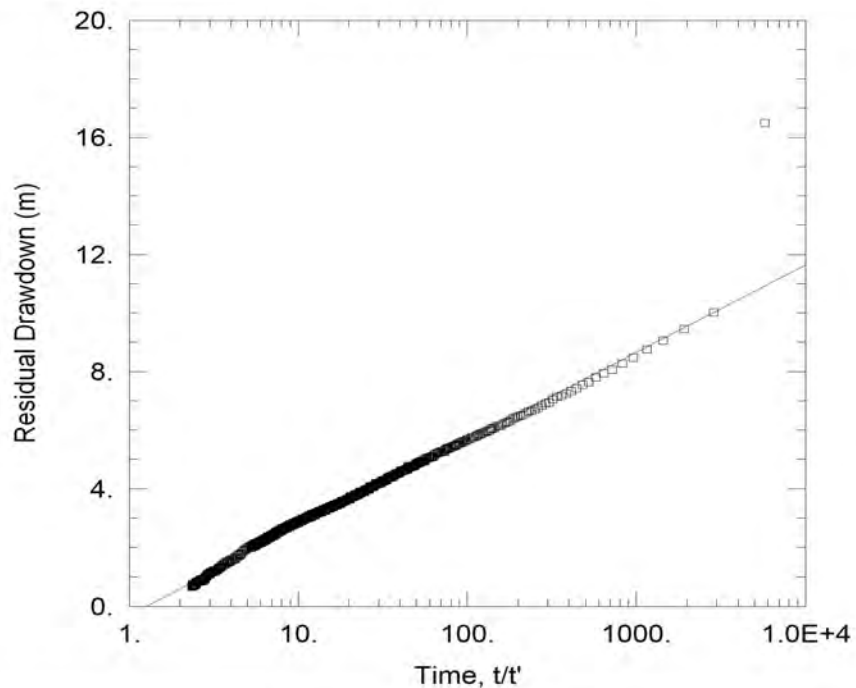
Saturated Thickness: 184. m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA

Pumping Wells		
Well Name	X (m)	Y (m)
ART12	0	0

Observation Wells		
Well Name	X (m)	Y (m)
ART11	2060	0



ART12 PUMPING TEST RECOVERY ANALYSIS

PROJECT INFORMATION

Company: Golder Associates
 Client: RTA Weipa
 Project: 077636002
 Location: Andoom Artesian Borefield
 Test Well: ART12
 Test Date: 28 Feb 2007

SOLUTION

Aquifer Model: Confined
 Solution Method: Theis (Recovery)
 $T = 419.3 \text{ m}^2/\text{day}$
 $S/S' = 1.259$

AQUIFER DATA

Saturated Thickness: 133. m

Anisotropy Ratio (K_z/K_r): 1.

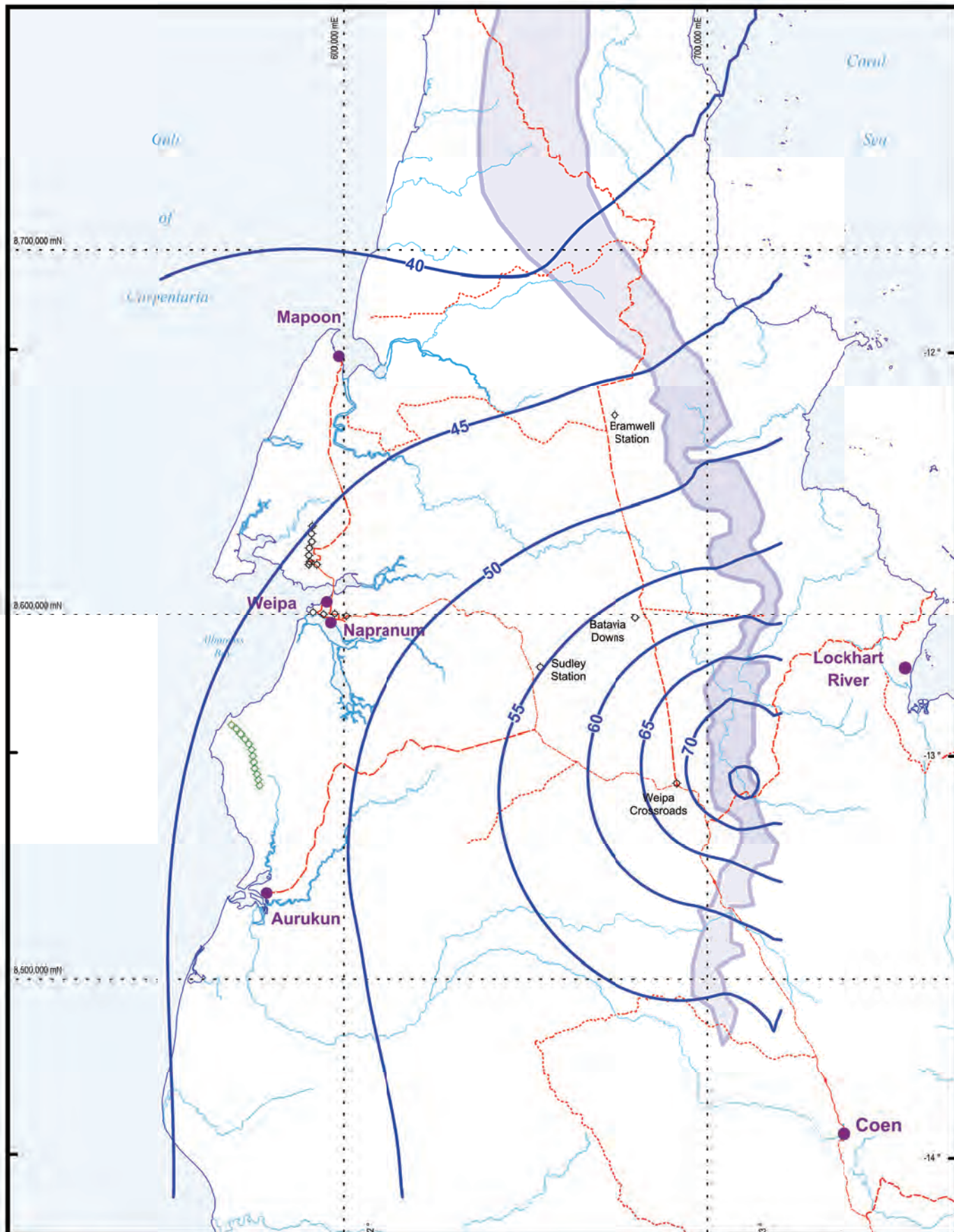
WELL DATA

Pumping Wells			Observation Wells		
Well Name	X (m)	Y (m)	Well Name	X (m)	Y (m)
art12	0	0	□ art12	0.1	0

South of Embley Project
Appendix 16A: Fig. 9

**ART12 Pumping Test Analysis
 for Recovery at ART12**

Date: 16/08/2012



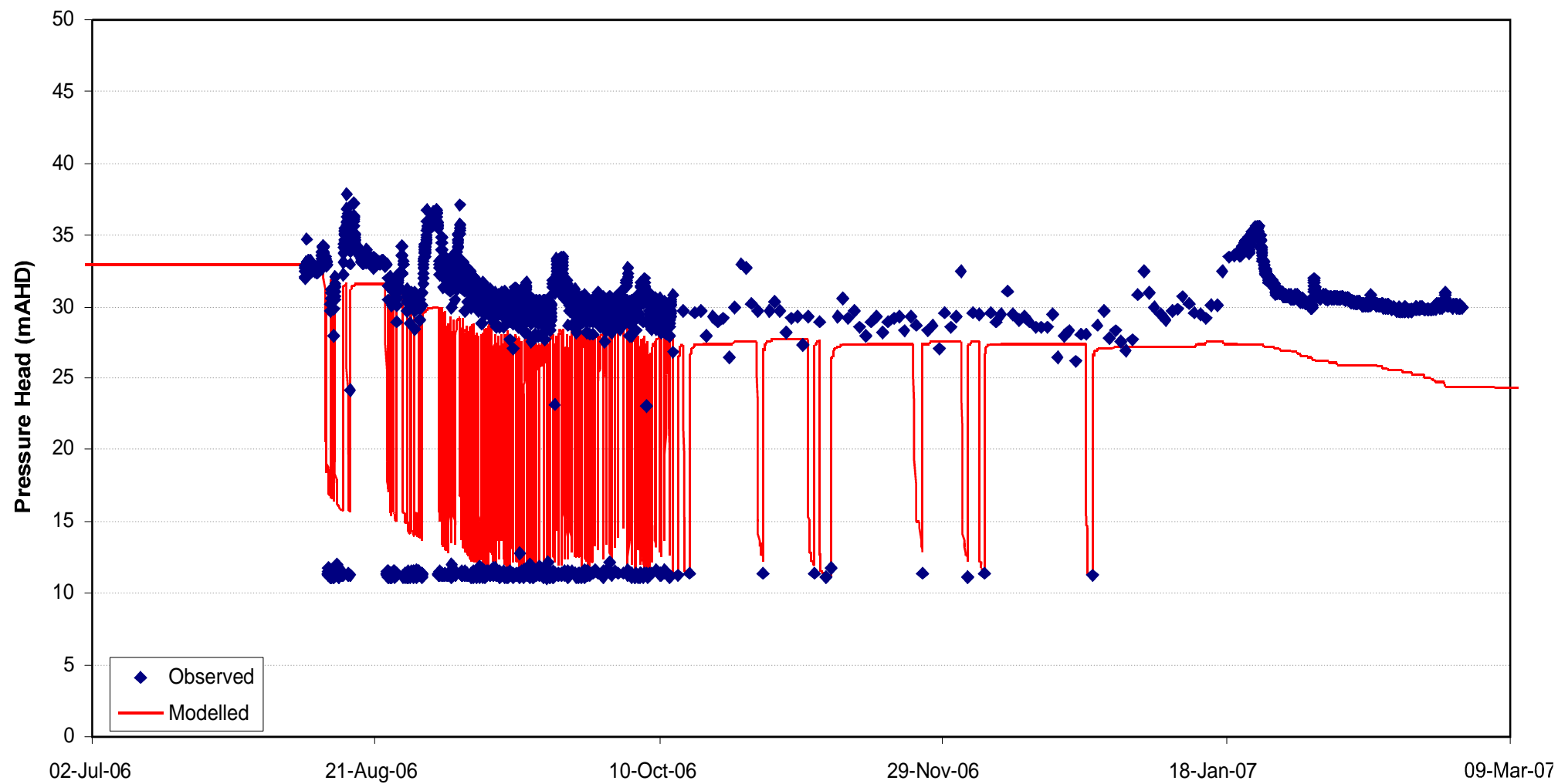
South of Embley Project
Appendix 16A: Fig. 10
Contoured Head (m AHD)
Calibration for 1971

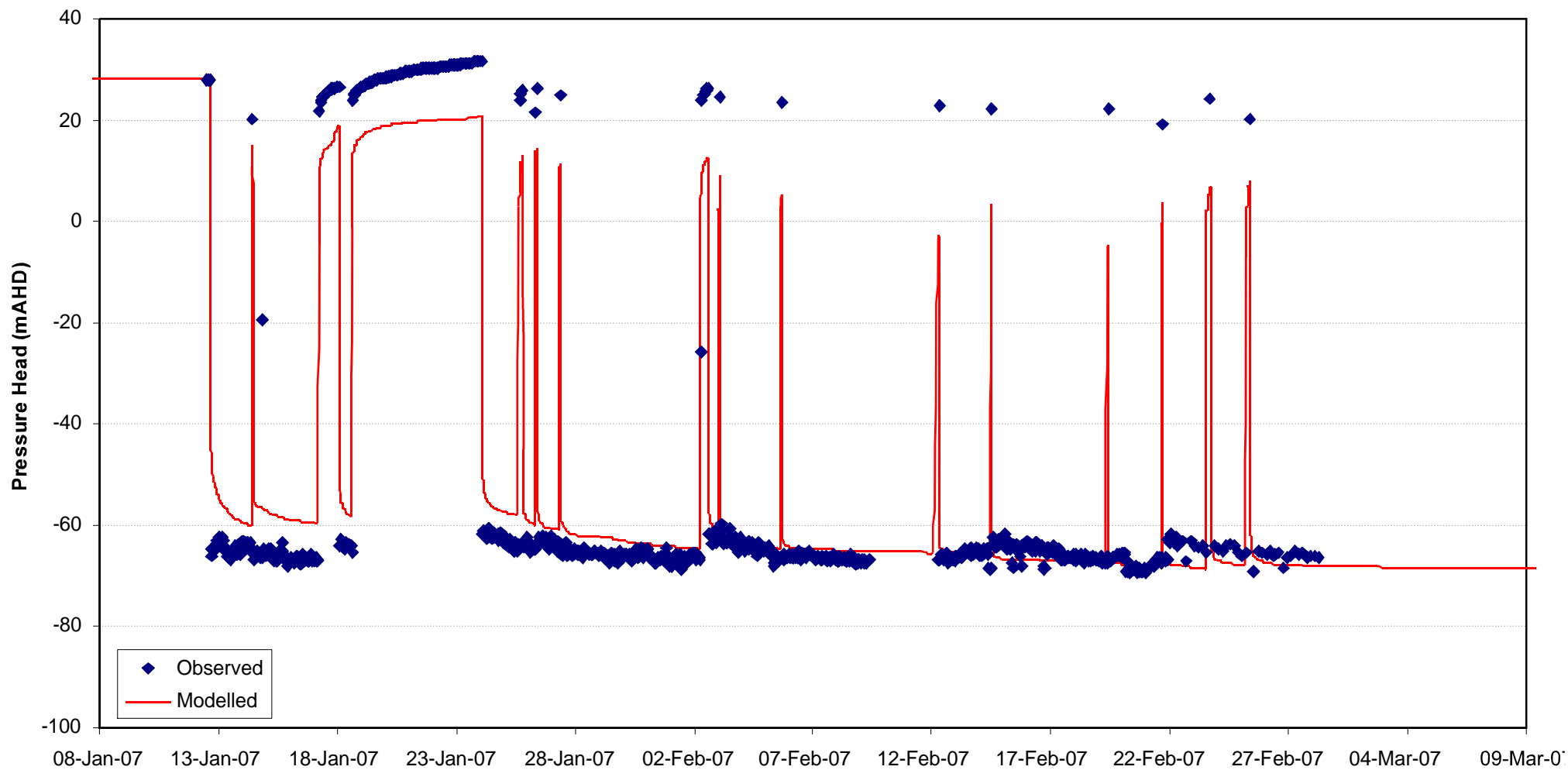
- Recharge area
- Township
- River
- Road/track
- Existing Borehole
- Proposed Borehole

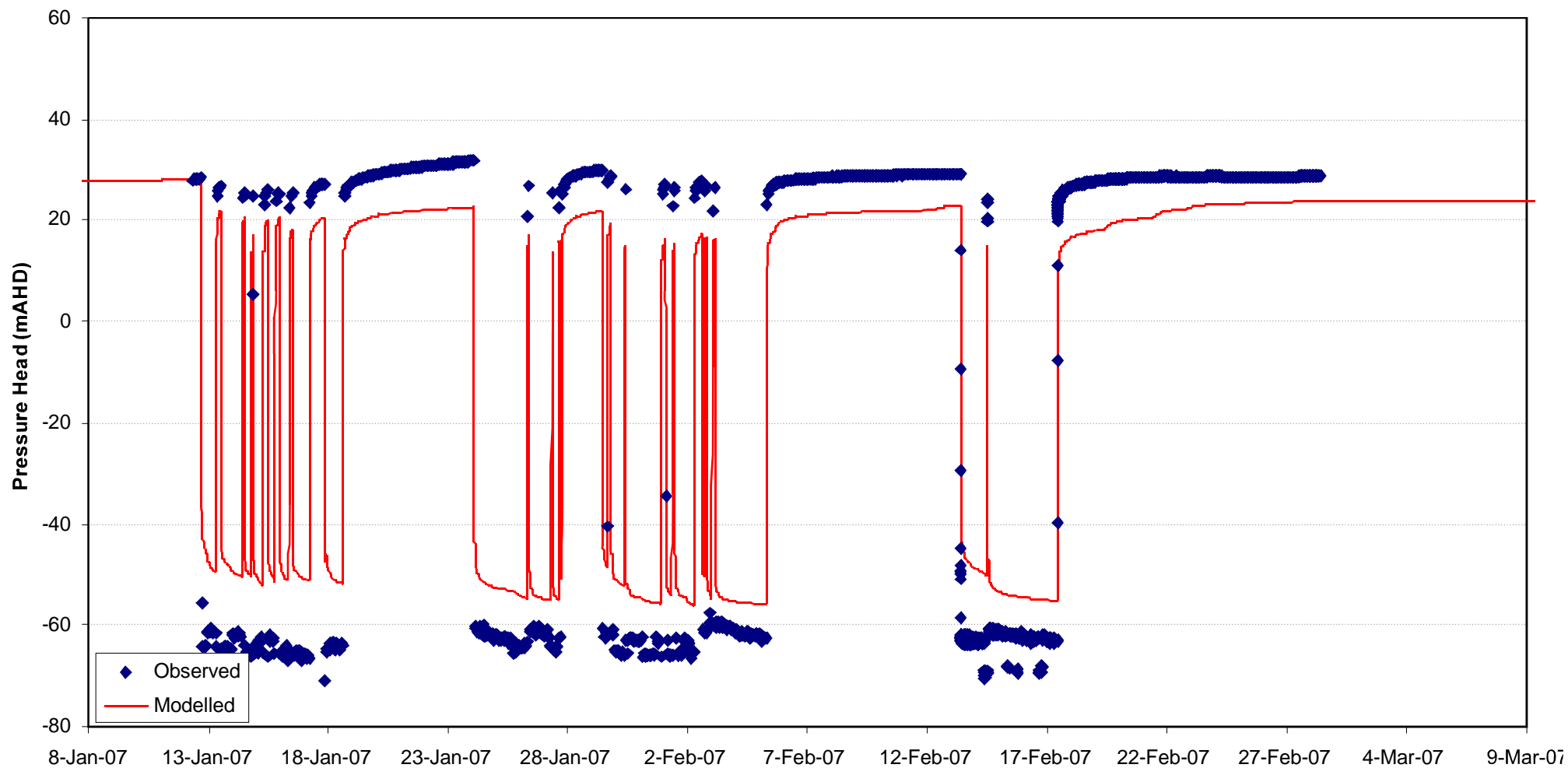


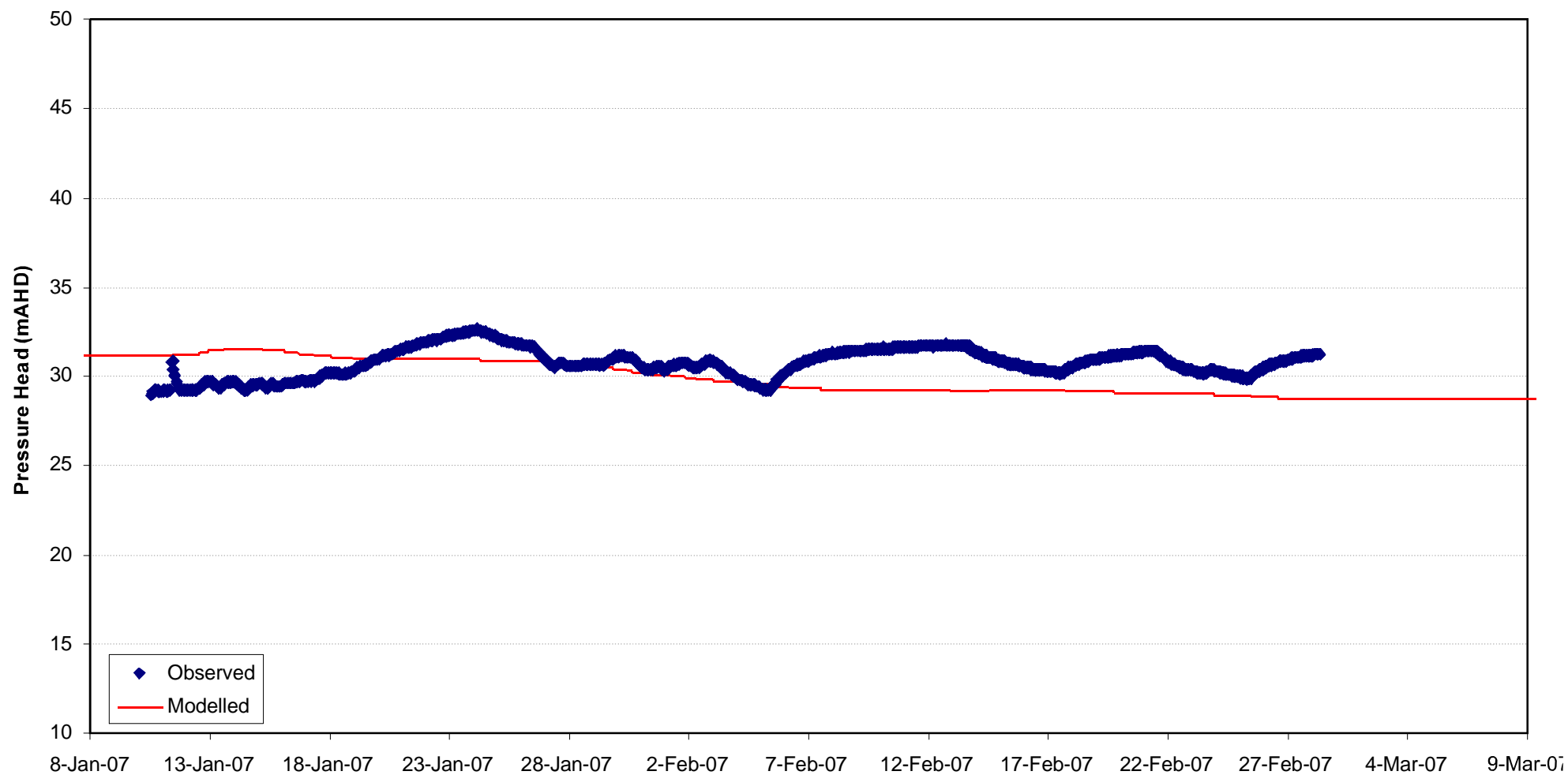
0 50km

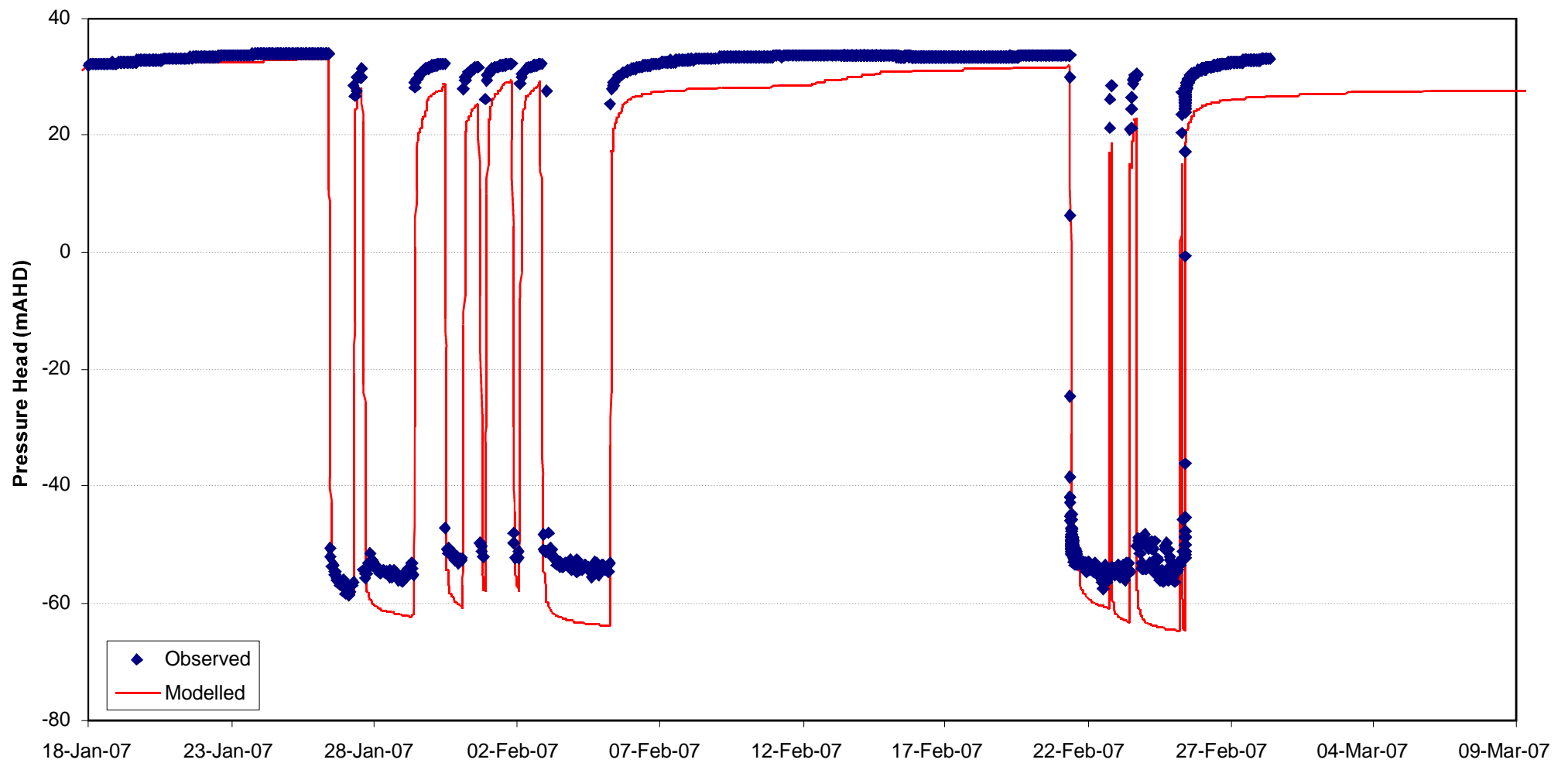
Datum/Projection: GDA94/MGA Zone 54 Date: 01/08/2012

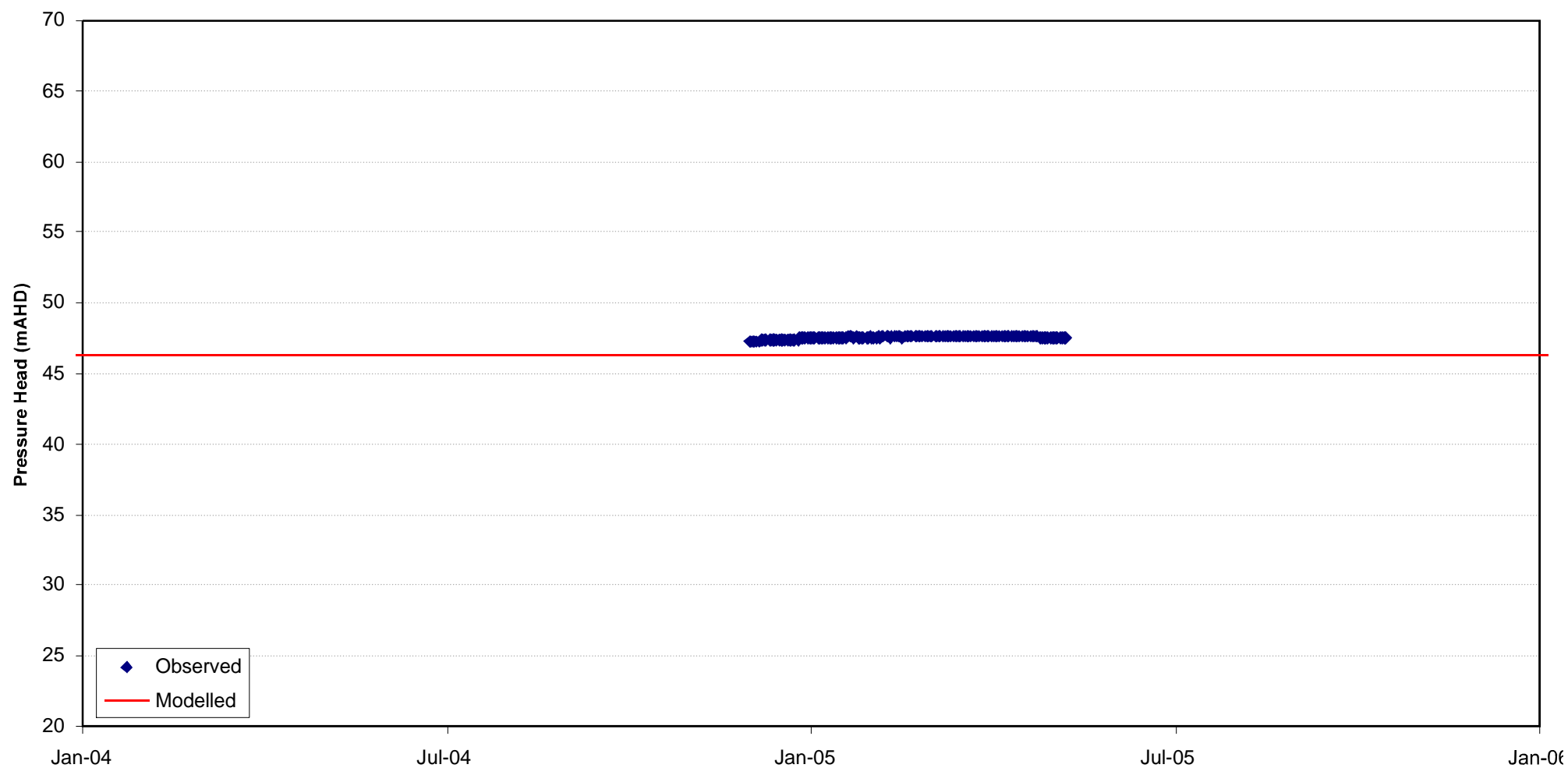


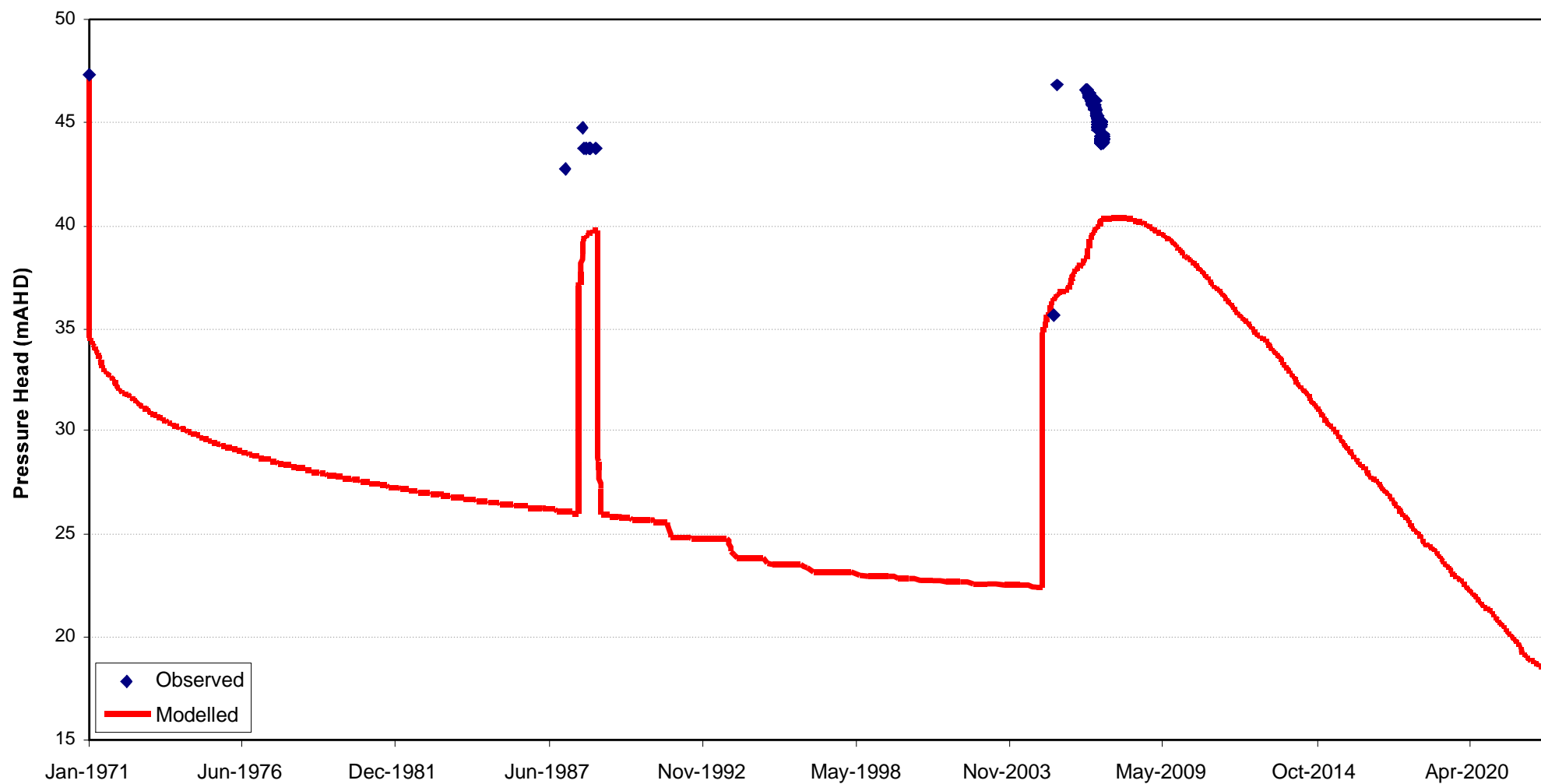


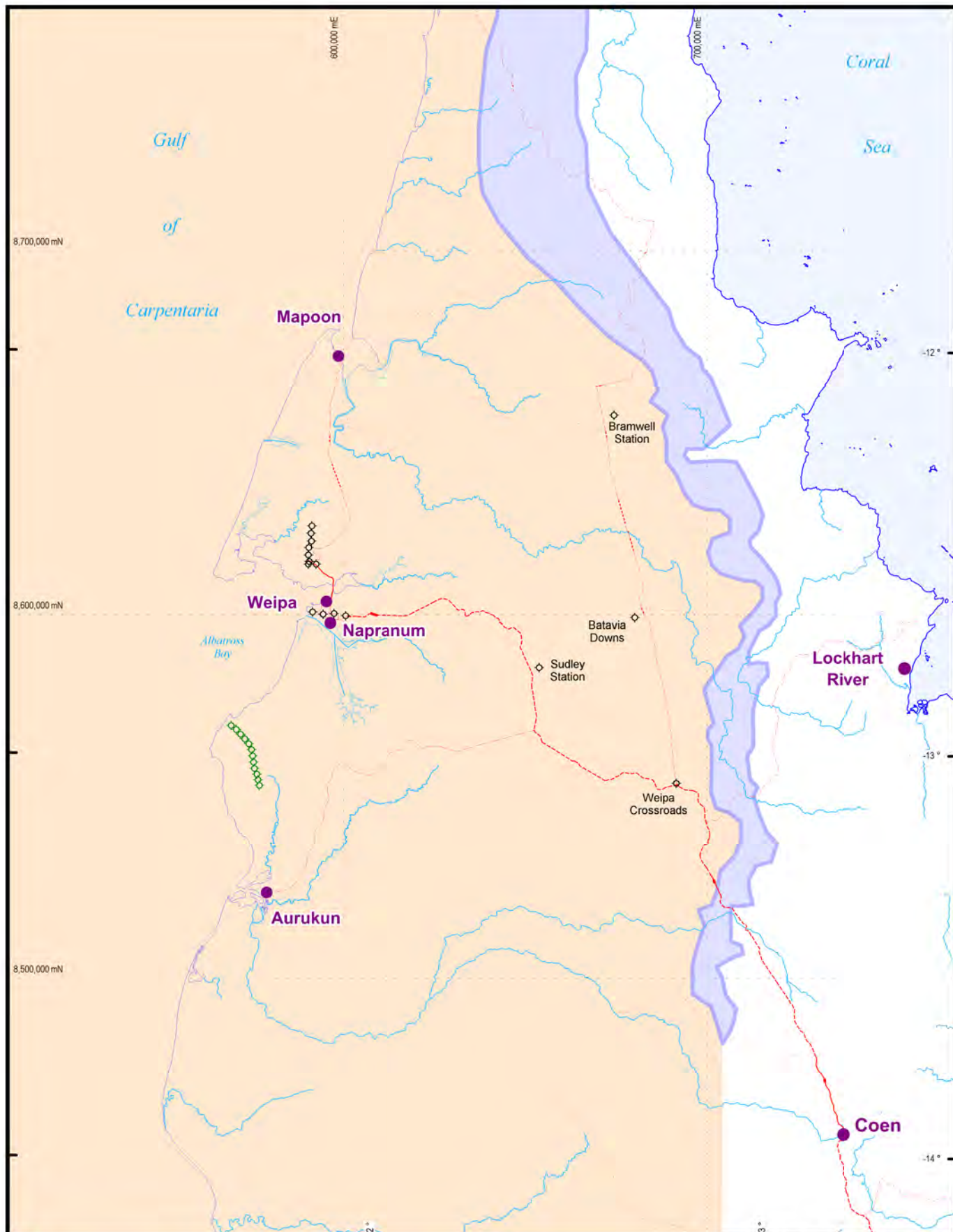




















South of Embley Project

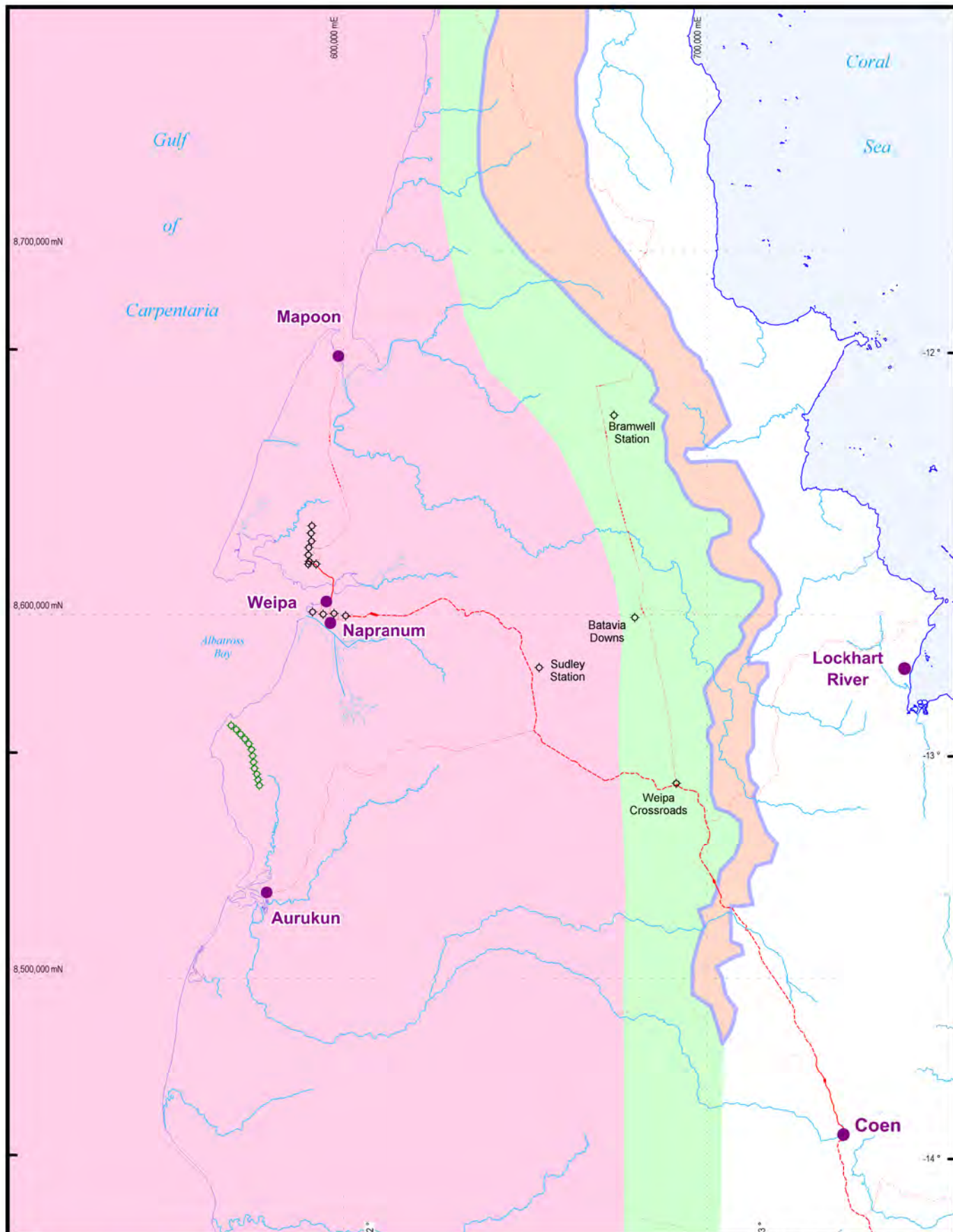
**Appendix 16A: Fig. 19
Feflow Model Hydraulic
Conductivity Distribution**

- | | | | |
|---|-------------------|---|---------|
|  | Recharge area |  | 1.6 m/d |
|  | Township |  | 1.0 m/d |
|  | River | | |
|  | Road/track | | |
|  | Existing Borehole | | |
|  | Proposed Borehole | | |



0 50km

Datum/Projection: GDA94/MGA Zone 54 Date: 01/08/2012



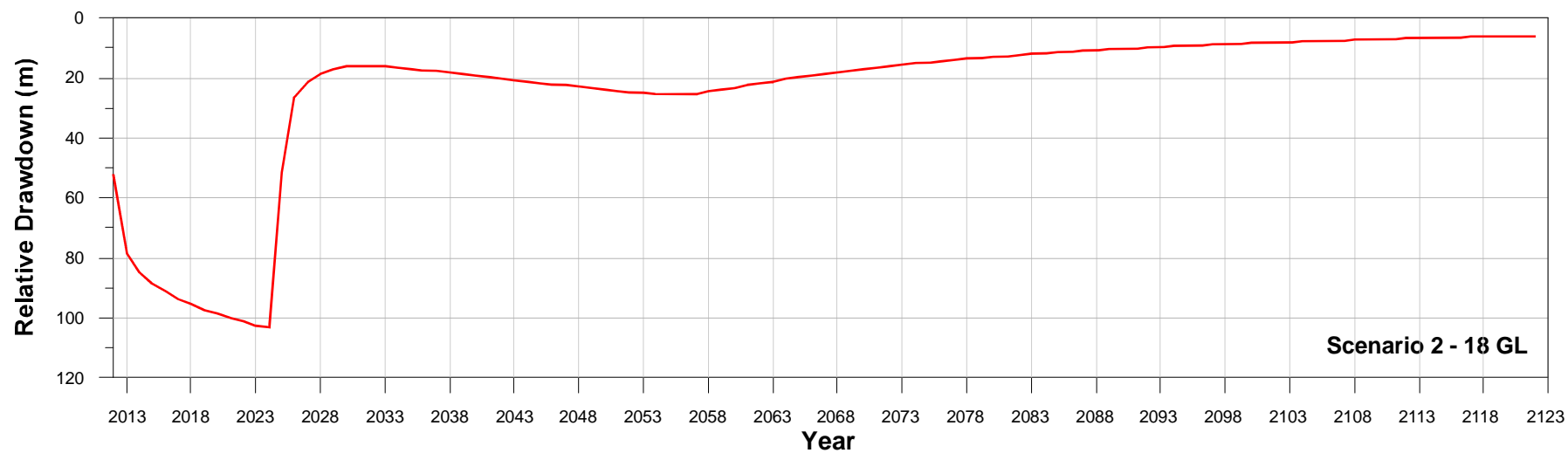
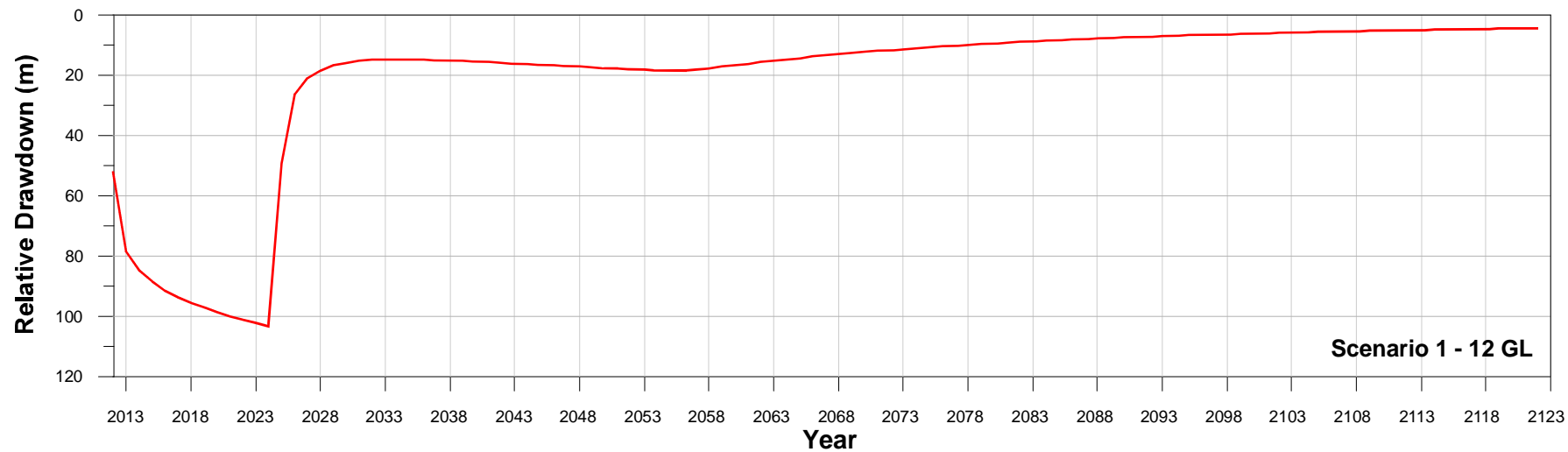
South of Embley Project
Appendix 16A: Fig. 20
Feflow Model Specific
Yield Distribution

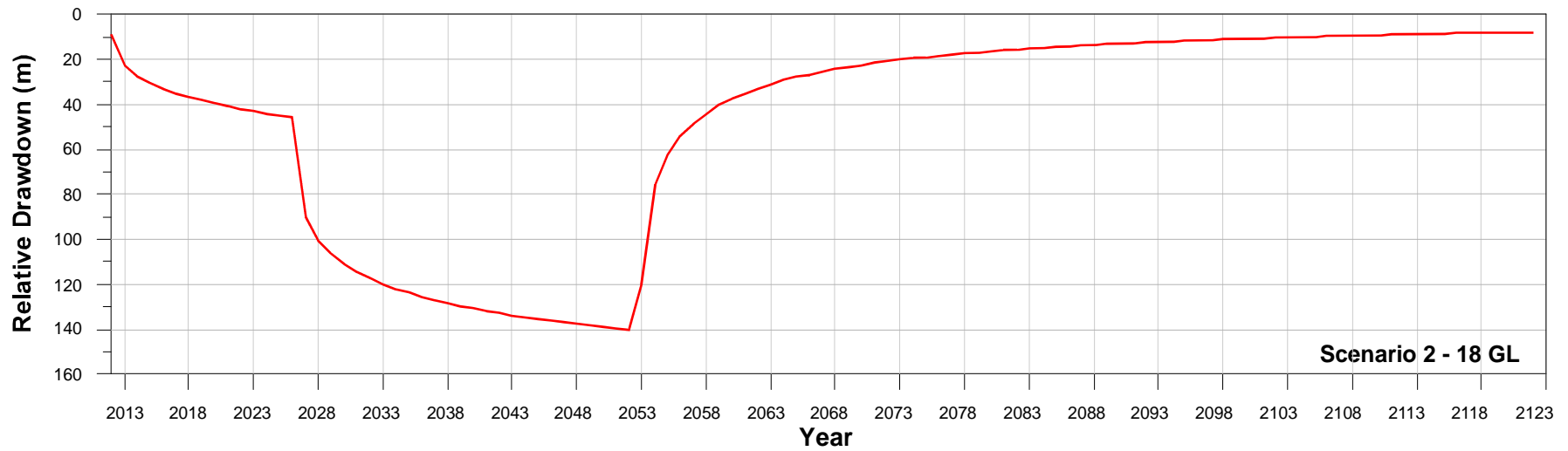
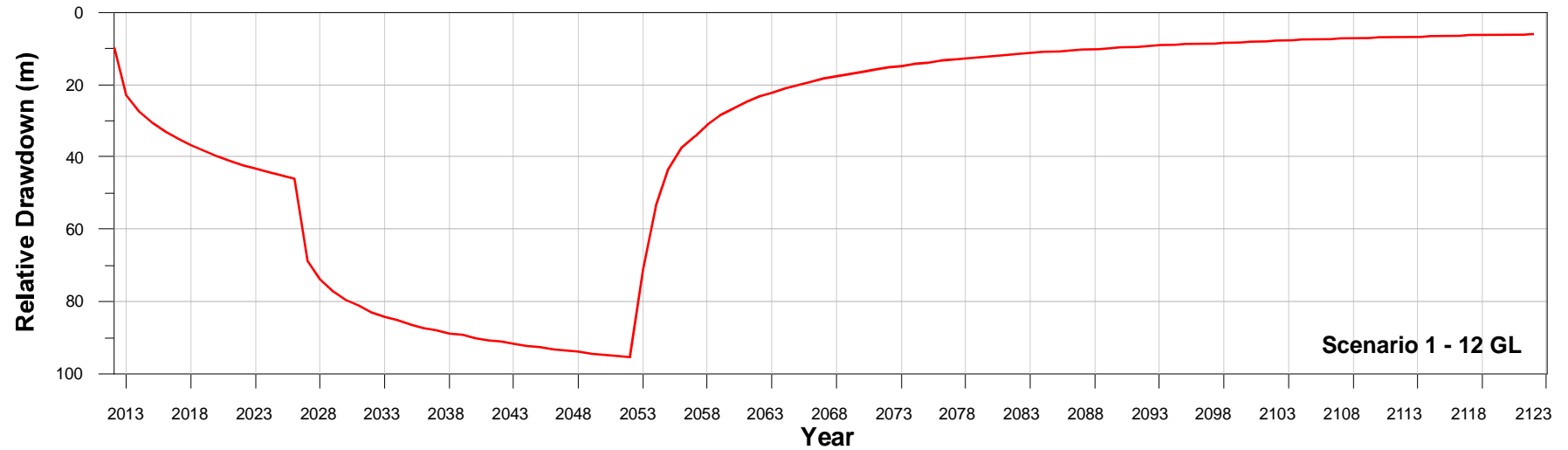
- | | |
|-------------------|------|
| Recharge area | 0.05 |
| Township | 0.10 |
| River | 0.20 |
| Road/track | |
| Existing Borehole | |
| Proposed Borehole | |

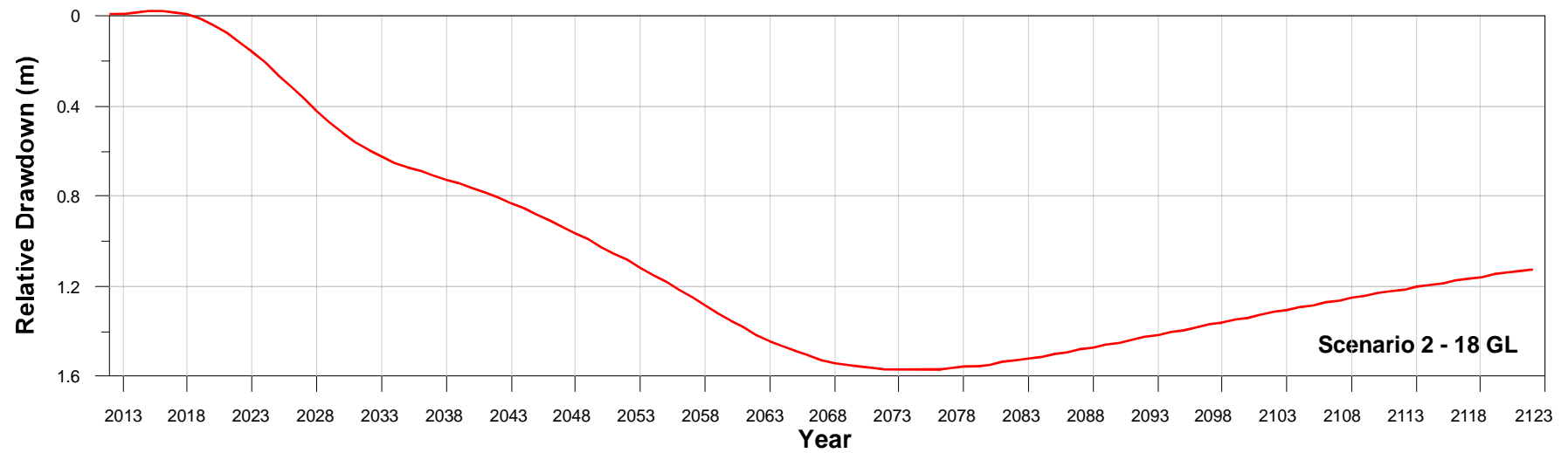
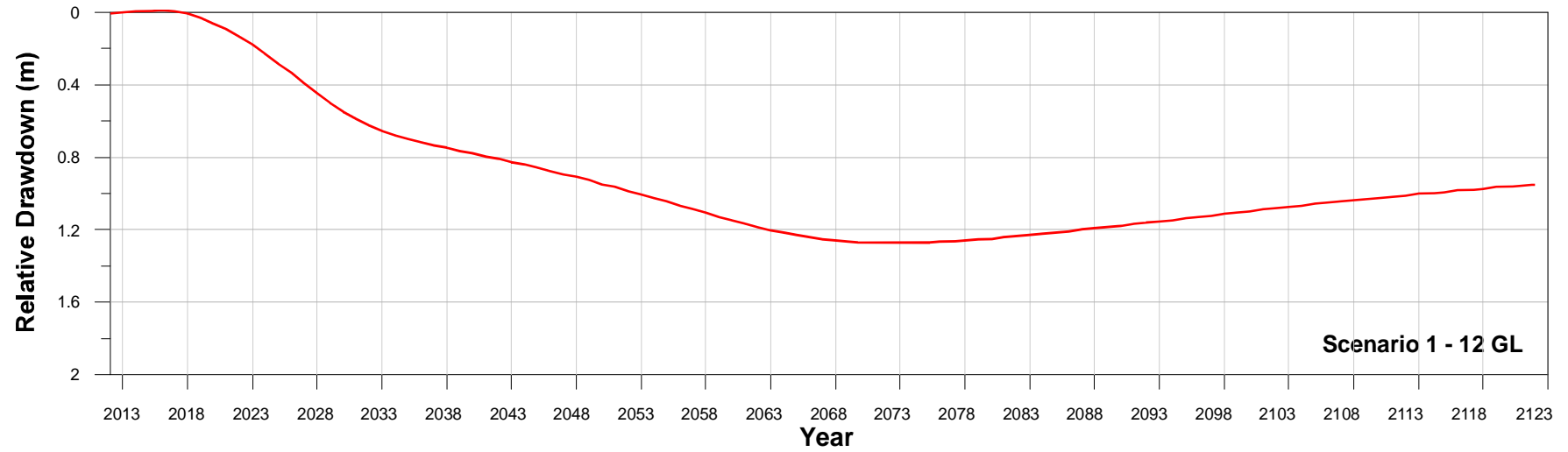


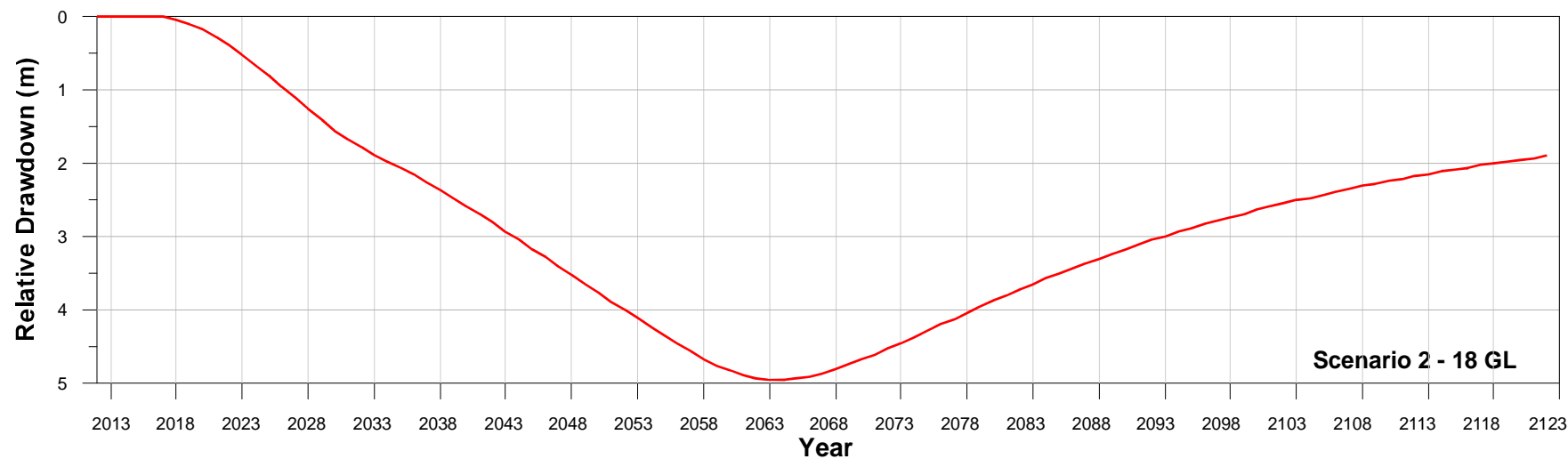
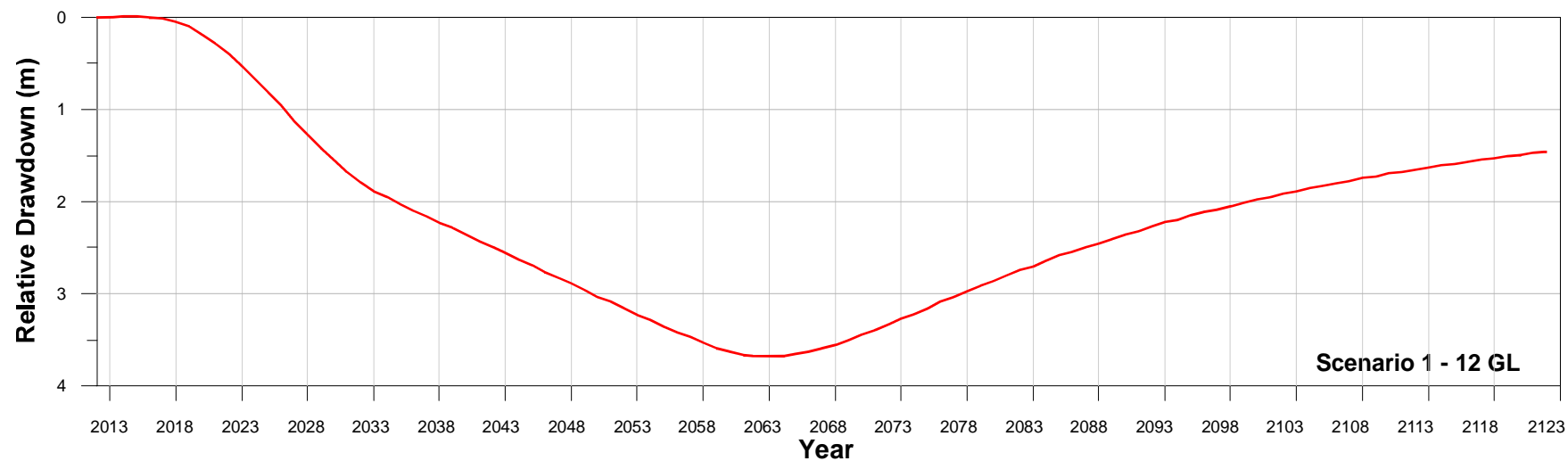
0 50km

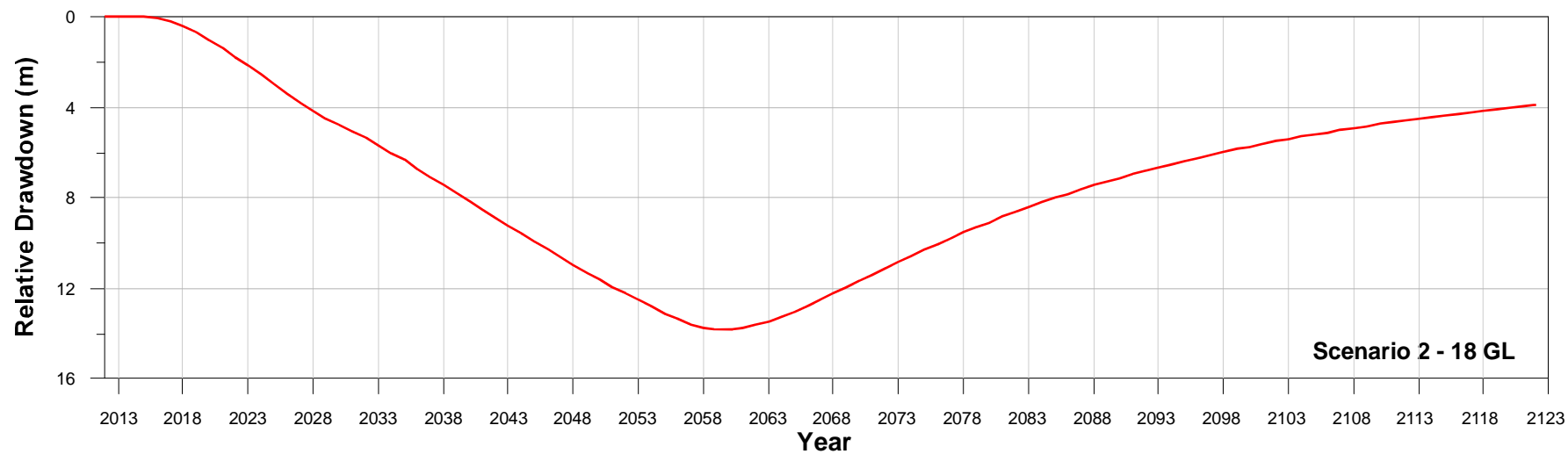
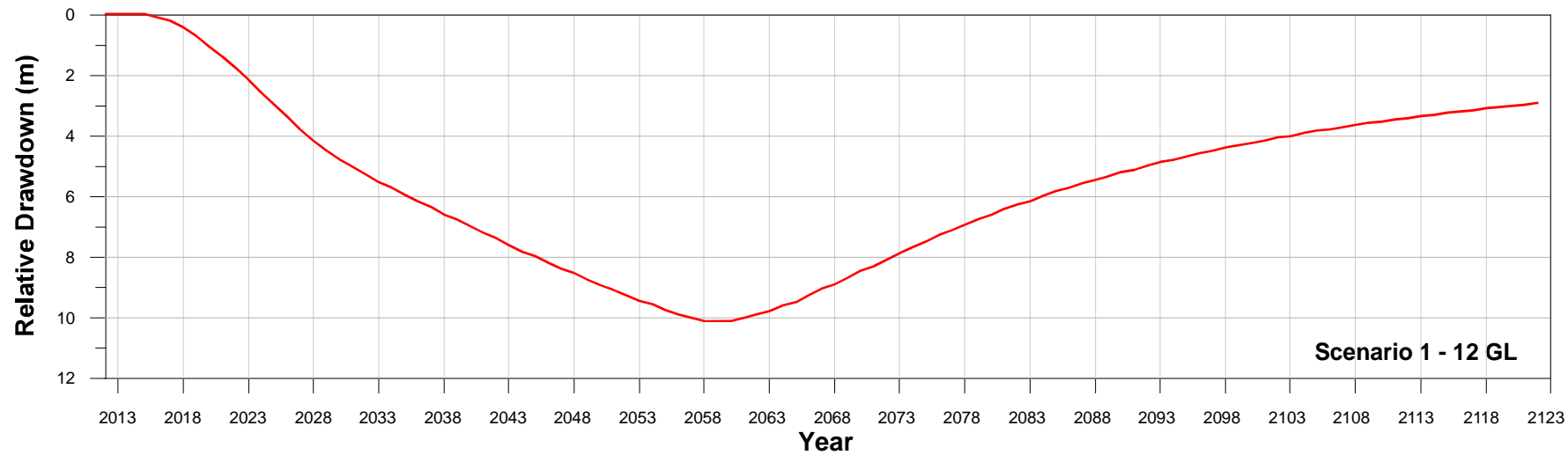
Datum/Projection: GDA94/MGA Zone 54 Date: 01/08/2012

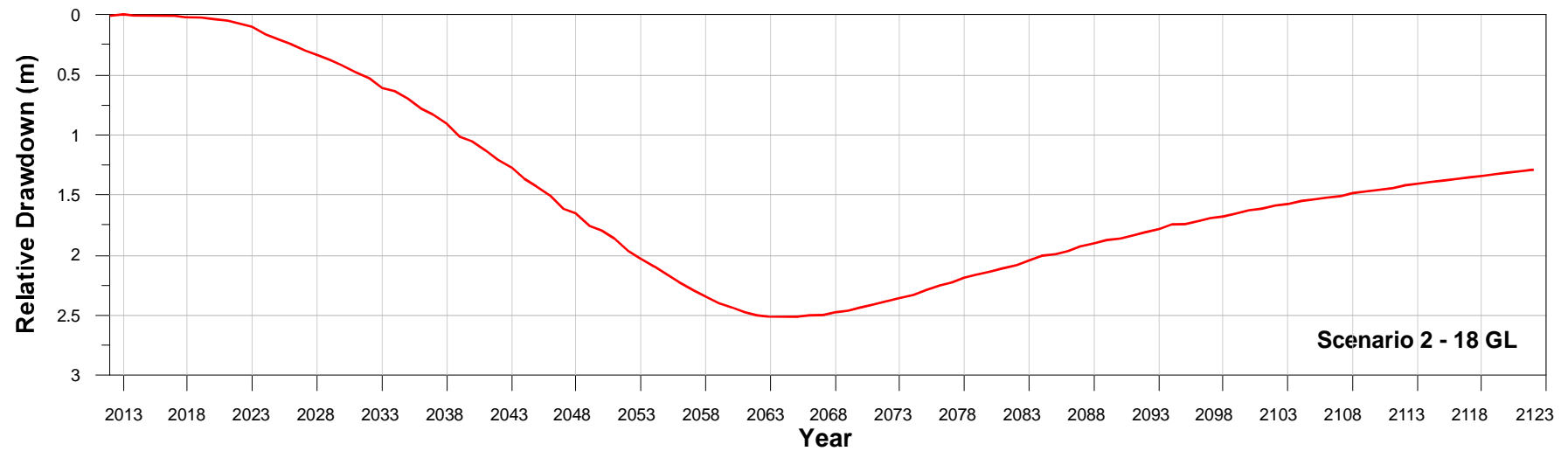
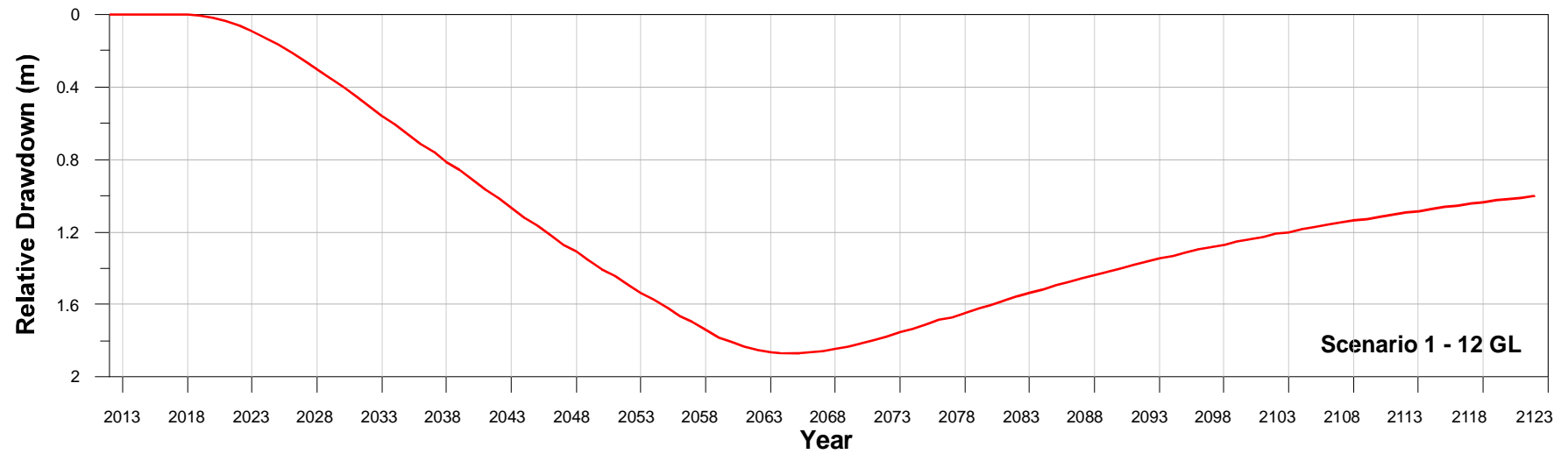


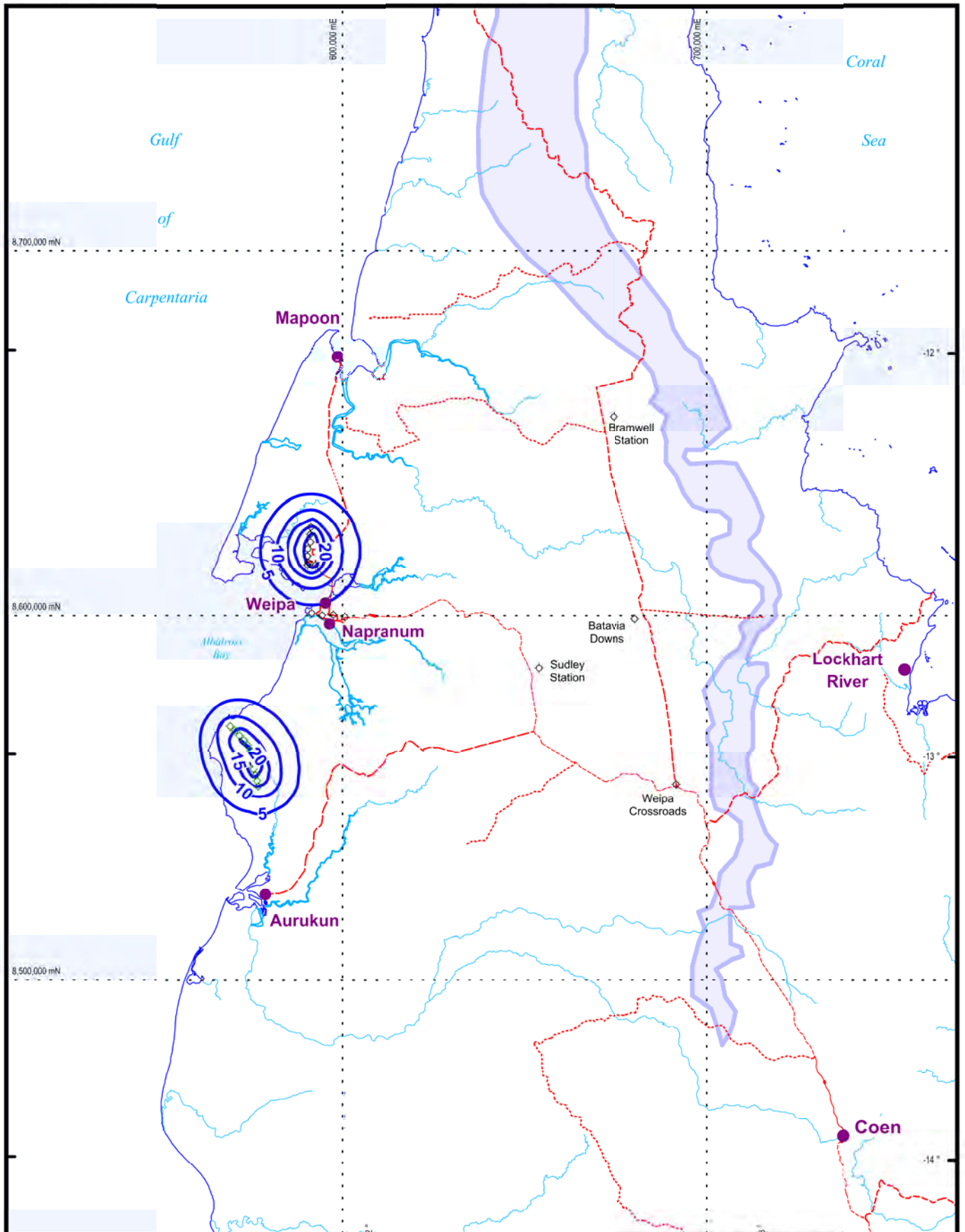












South of Embley Project

Appendix 16A: Fig. 27

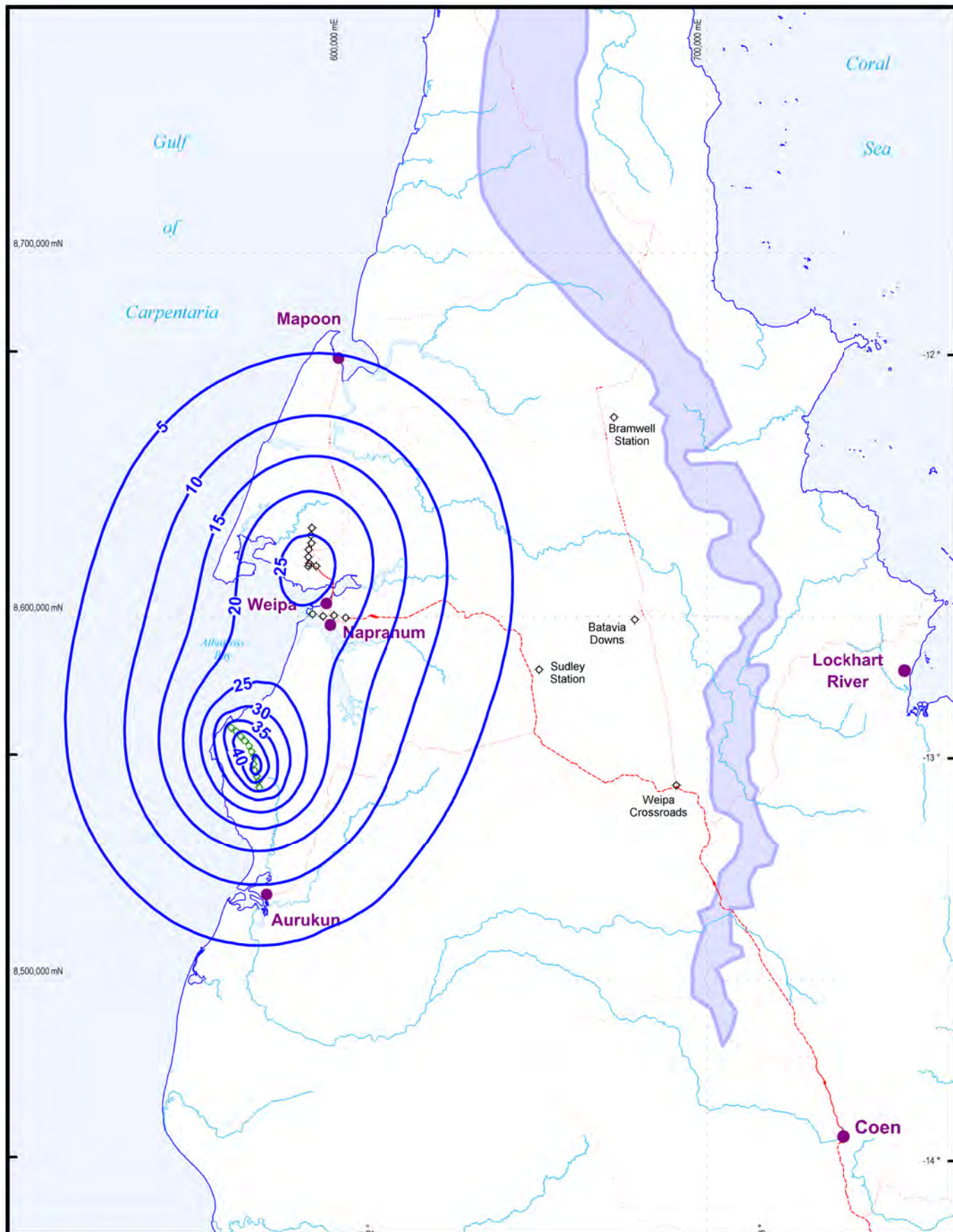
Predicted Drawdown Contours
Scenario 1 (12 GL) - 2013 (Yr 1)

- Recharge area
- Township
- River
- Road/track
- Existing Borehole
- Proposed Borehole



0 50km

Datum/Projection: GDA94/MGA Zone 54 Date: 01/08/2012



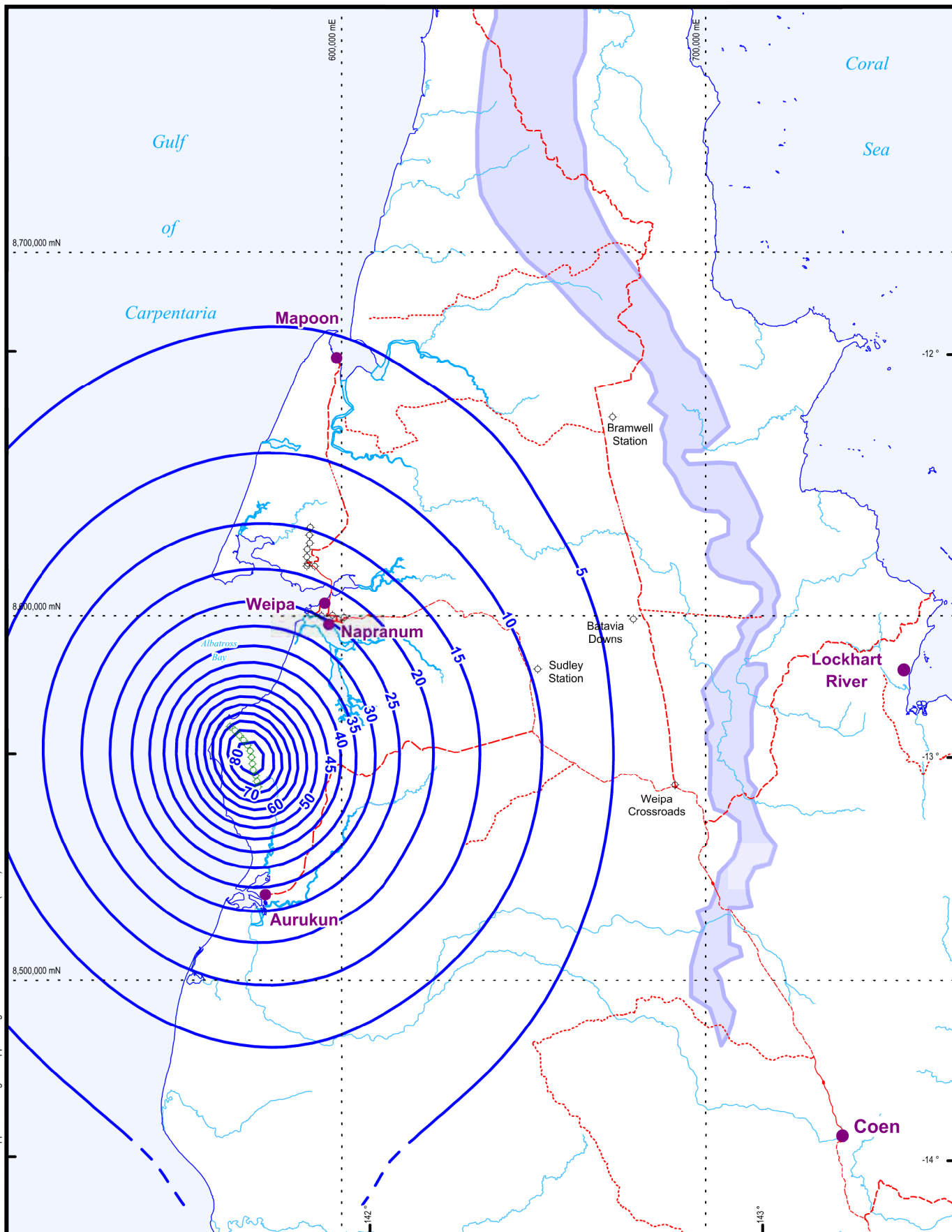
- Recharge area
- Township
- River
- Road/track
- Existing Borehole
- Proposed Borehole

South of Embley Project
Appendix 16A: Fig. 28
Predicted Drawdown Contours
Scenario 1 (12 GL) - 2026 (Yr 13)



0 50km

Datum/Projection: GDA94/MGA Zone 54 Date: 01/08/2012



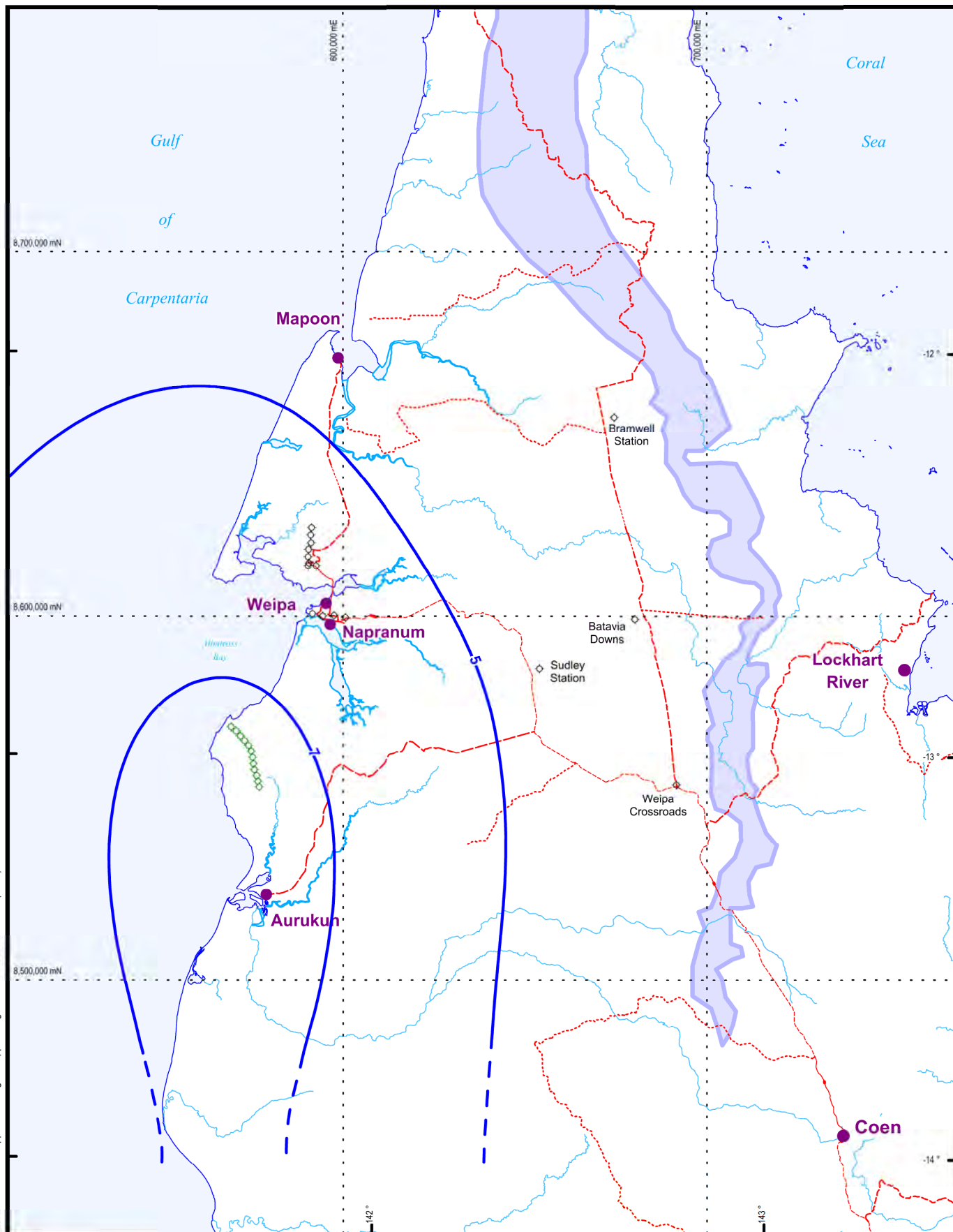
- Recharge area
- Township
- River
- Road/track
- Existing Borehole
- Proposed Borehole
- Predicted drawdown
- Predicted drawdown overestimated by model boundary condition

South of Embley Project
Appendix 16A: Fig. 29
Predicted Drawdown Contours
Scenario 1 (12 GL) - 2053 (Yr 40)



0 50km

Datum/Projection: GDA94/MGA Zone 54 Date: 28/02/2013



Rio Tinto Alcan

- Recharge area
- Township
- River
- Road/track
- Existing Borehole
- Proposed Borehole

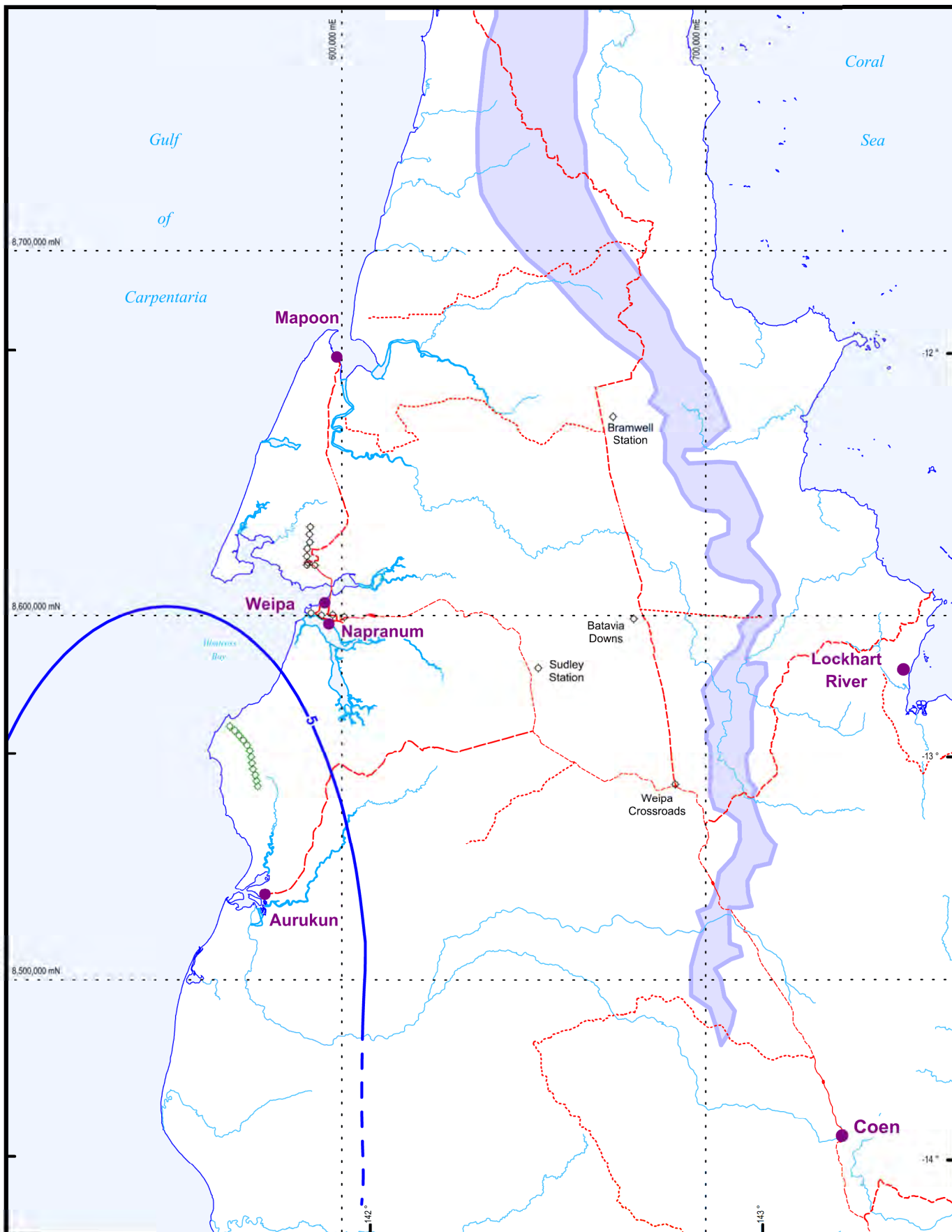
- Predicted drawdown
- Predicted drawdown overestimated by model boundary condition

South of Embley Project
Appendix 16A: Fig. 30
Predicted Drawdown Contours
Scenario 1 (12 GL) - 2103 (Yr 90)



0 50km

Datum/Projection: GDA94/MGA Zone 54 Date: 28/02/2013



Rio Tinto Alcan

- Recharge area
- Township
- River
- Road/track
- Existing Borehole
- Proposed Borehole

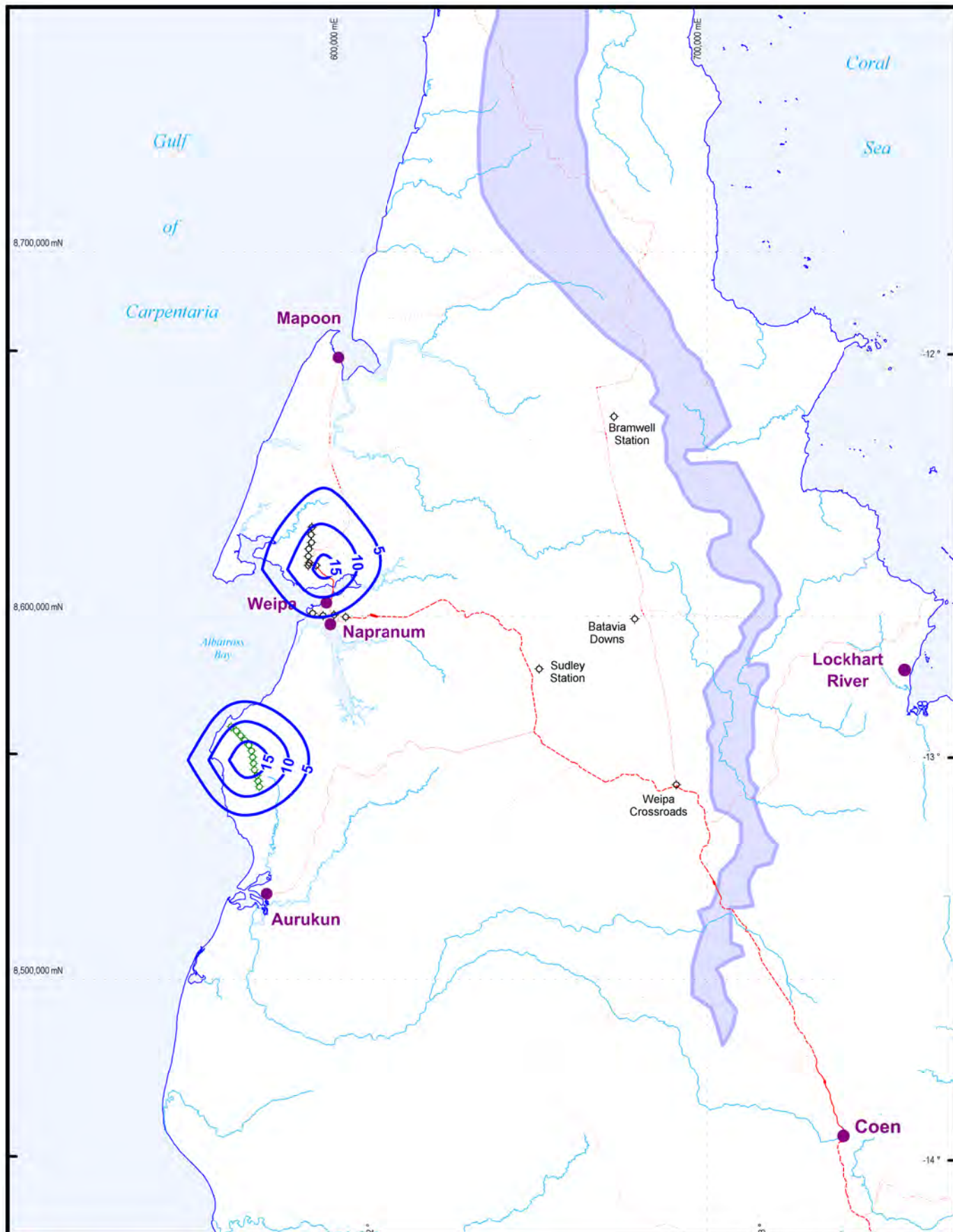
- Predicted drawdown
- Predicted drawdown overestimated by model boundary condition

South of Embley Project
Appendix 16A: Fig. 31
Predicted Drawdown Contours
Scenario 1 (12 GL) - 2123 (Yr 110)



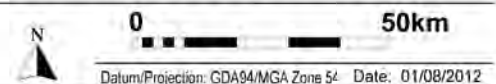
0 50km

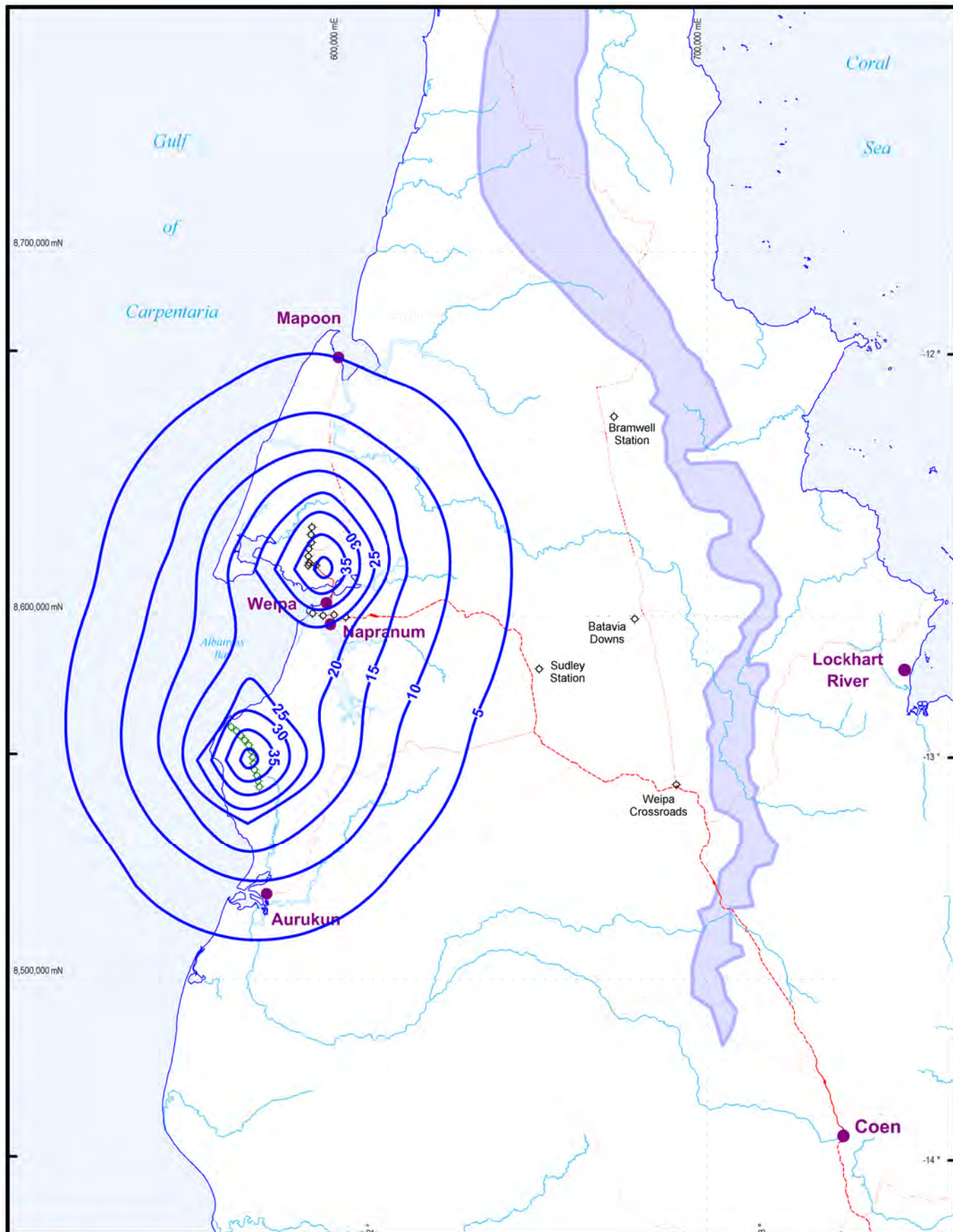
Datum/Projection: GDA94/MGA Zone 54 Date: 28/02/2013



- Recharge area
- Township
- River
- Road/track
- Existing Borehole
- Proposed Borehole

South of Embley Project
Appendix 16A: Fig. 32
Predicted Drawdown Contours
Scenario 2 (18 GL) - 2013 (Yr 1)





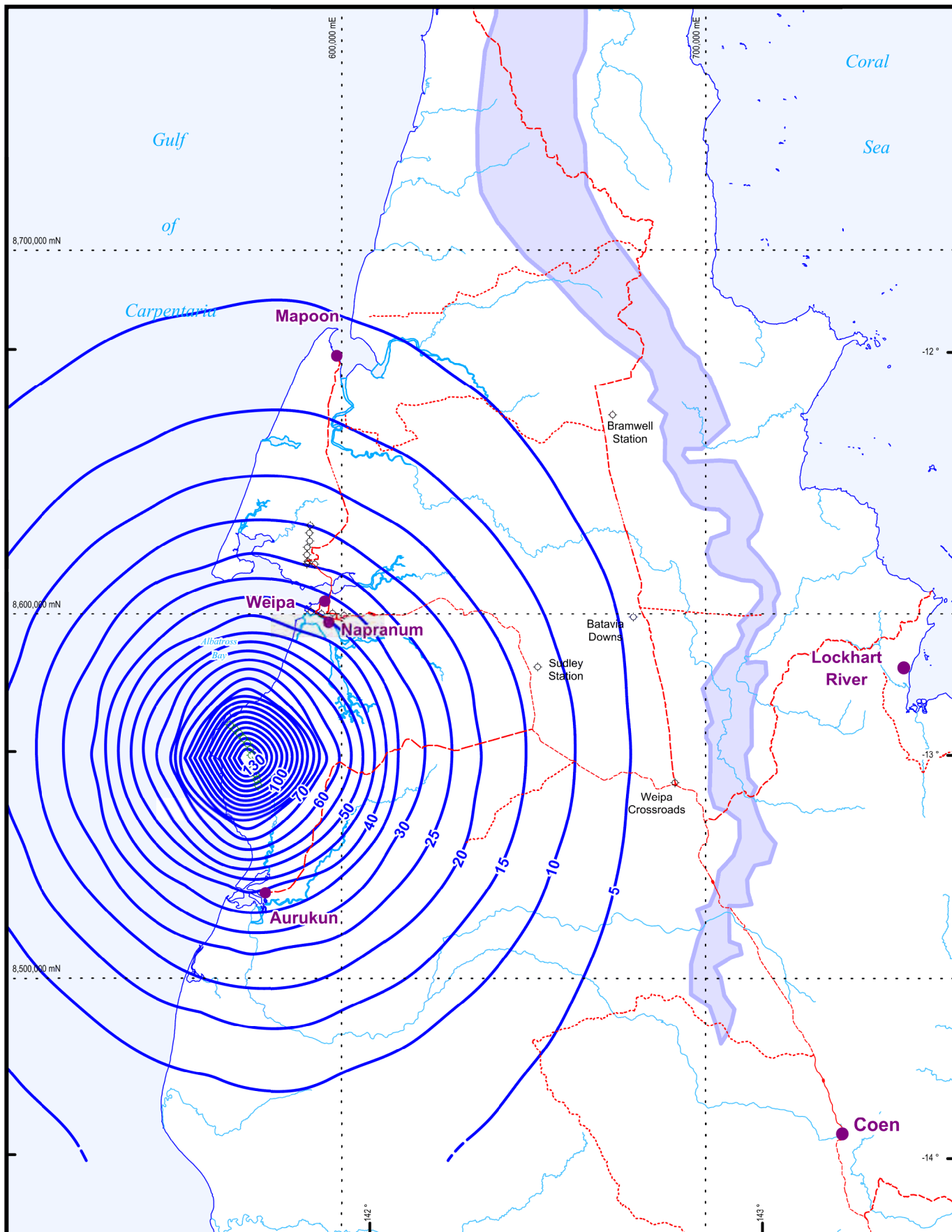
- Recharge area
- Township
- River
- Road/track
- Existing Borehole
- Proposed Borehole

South of Embley Project
Appendix 16A: Fig. 33
Predicted Drawdown Contours
Scenario 2 (18 GL) - 2026 (Yr 13)



0 50km

Datum/Projection: GDA94/MGA Zone 54 Date: 01/08/2012



- | | |
|-------------------|--|
| Recharge area | Predicted drawdown |
| Township | Predicted drawdown overestimated by model boundary condition |
| River | |
| Road/track | |
| Existing Borehole | |
| Proposed Borehole | |

South of Embley Project

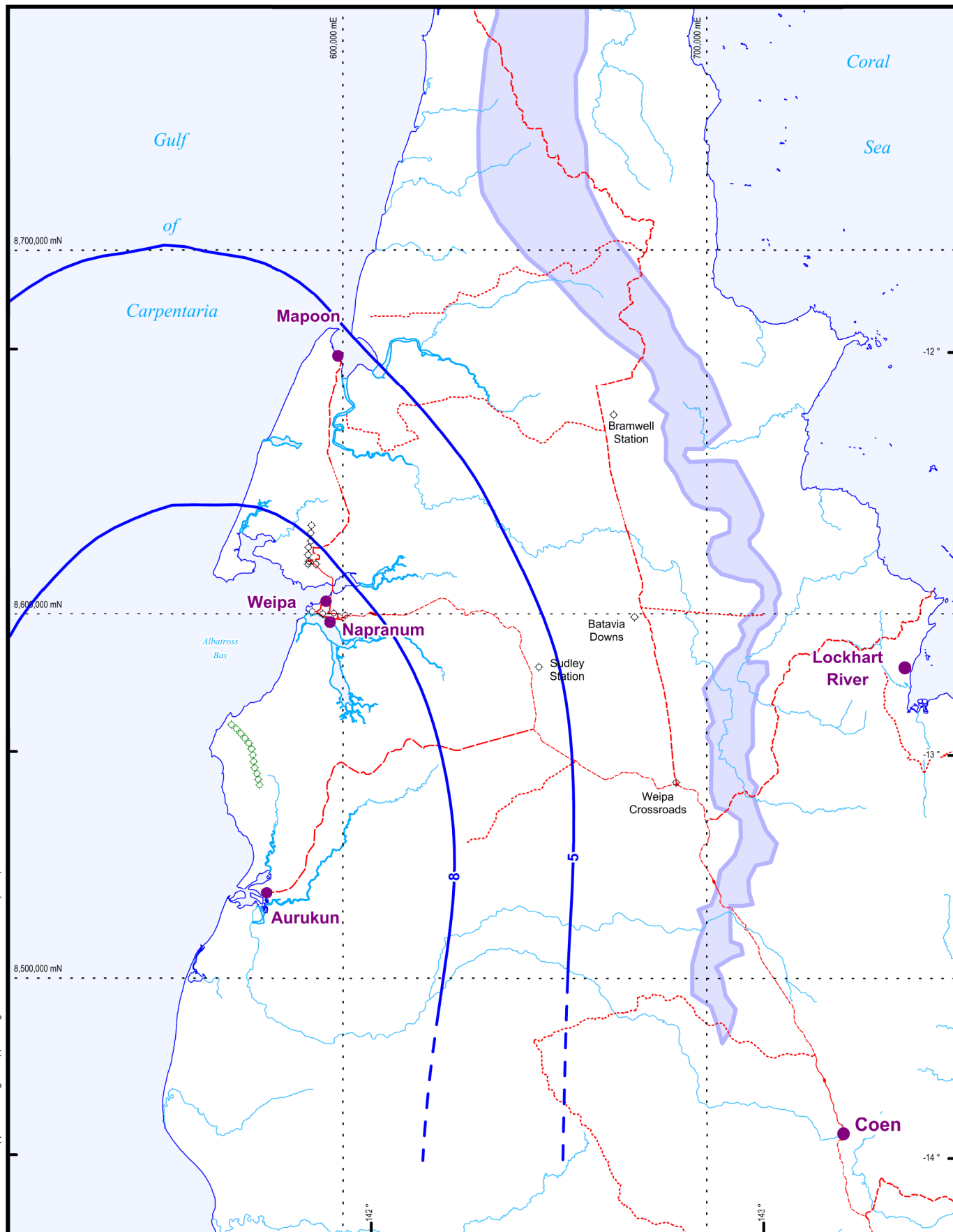
Appendix 16A: Fig. 34

Predicted Drawdown Contours Scenario 2 (18 GL) - 2053 (Yr 40)



0 50km

Datum/Projection: GDA94/MGA Zone 54 Date: 28/02/2013



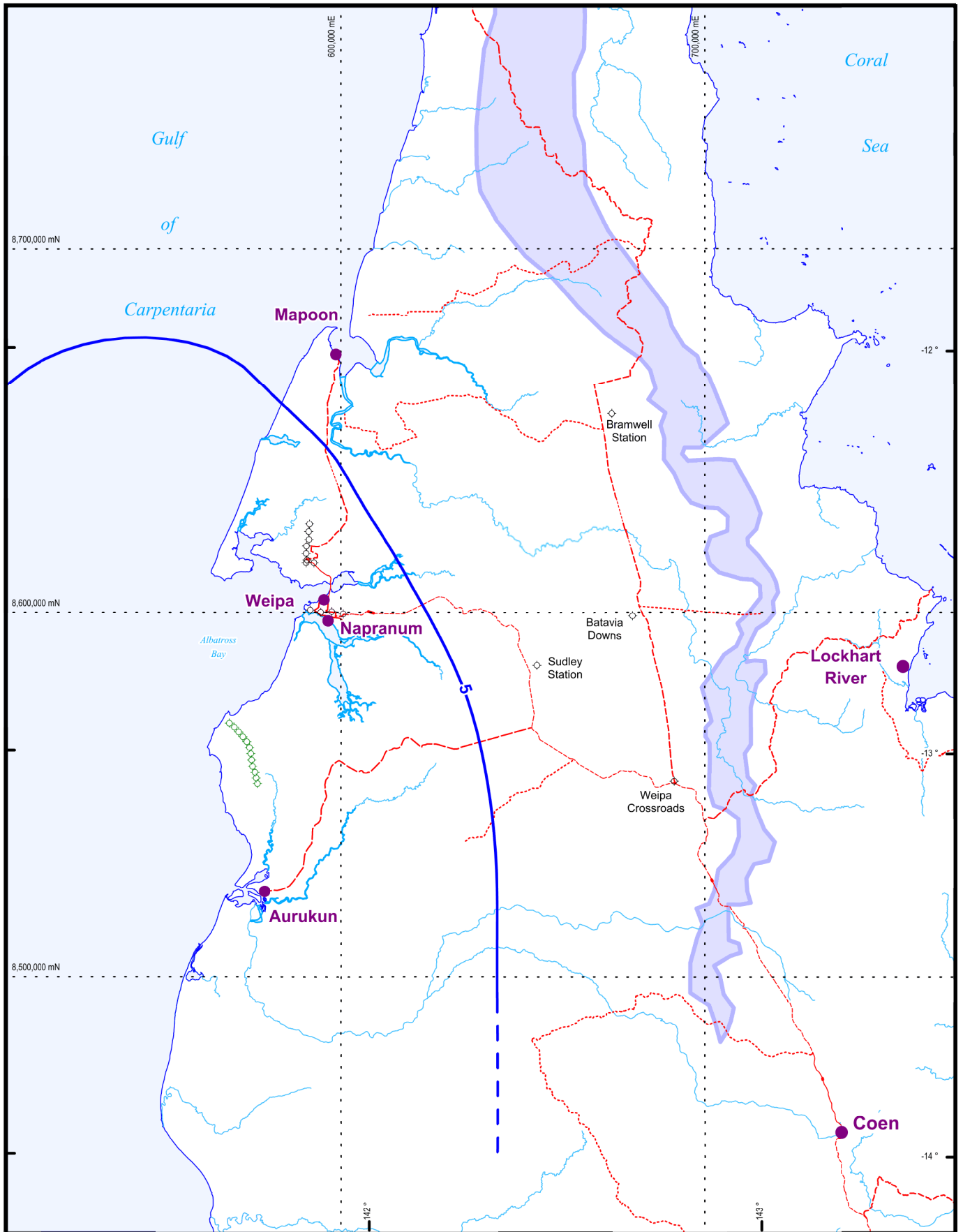
- | | | | |
|--|-------------------|--|--|
| | Recharge area | | Predicted drawdown |
| | Township | | Predicted drawdown overestimated by model boundary condition |
| | River | | |
| | Road/track | | |
| | Existing Borehole | | |
| | Proposed Borehole | | |

South of Embley Project
Appendix 16A: Fig. 35
Predicted Drawdown Contours
Scenario 2 (18 GL) - 2103 (Yr 90)



0 50km

Datum/Projection: GDA94/MGA Zone 54 Date: 28/02/2013



Rio Tinto Alcan

- Recharge area
- Township
- River
- Road/track
- Existing Borehole
- Proposed Borehole

- Predicted drawdown
- Predicted drawdown overestimated by model boundary condition

South of Embley Project
Appendix 16A: Fig. 36
Predicted Drawdown Contours
Scenario 2 (18 GL) - 2123 (Yr 110)



0 50km

Datum/Projection: GDA94/MGA Zone 54 Date: 28/02/2013