Broadmeadow East Mine Environmental Authority Amendment Application – Supporting Document

Bowen Coking Coal Limited

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Document control record

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1 Introduction

1.1 Overview

Bowen Coking Coal Limited (BCC) and its wholly owned subsidiary Coking Coal One Pty Ltd (the Proponent) have commissioned Aurecon Australasia Pty Ltd (Aurecon) to prepare the supporting information required for the submission of an Environmental Authority (EA) major amendment application for the Broadmeadow East (BME) Project (the Project). This document has been prepared in accordance with Sections 226 and 226A of the *Environmental Protection Act 1994* (EP Act).

BME is authorised by EA0002465 (latest version approved 2 February 2023) to operate an open cut coal mine on Mining Lease (ML) 70257. Covering an area of approximately 845 hectares (ha), it is located approximately 25 kilometres (km) north-east of Moranbah in Central Queensland's Bowen Basin region (refer Figure 1-1).

The scope of this amendment application relates to the following:

- proposed change to the backfill level for the Northern Pit and Southern Void, following updated results from technical studies, including groundwater modelling and water balance modelling
- proposal for the Southern Void to be assessed as a non-use management area (NUMA) after a final void assessment indicated long term predictions of declining water quality that would prevent pit water meeting stock watering guideline values in perpetuity
- proposed change to groundwater monitoring bore locations, following the update to the Groundwater Monitoring and Management Plan (GMMP), required by the EA
- proposed change to groundwater quality limits, following the completion of the updated baseline study required by Condition D2(h) of the EA
- proposed change to central pit terminology to clarify it is an in-pit spoil dump.

An amendment to EA0002465 is required in order to reflect the above changes.

Please note, this supporting document has been updated to address queries raised in an Information Request Notice, issued by the Department of Environment, Science and Innovation (DESI) on 2 May 2024.

Furthermore, the following documents in the Appendix have been updated to address DESI's Information Request Notice:

- Appendix A – Draft Environmental Authority
- Appendix B – Groundwater Report (KCB, 2024)
- Appendix D – Groundwater Quality Triggers Memorandum (KCB, 2024a)

Additionally, Table 5-4 of this document has been updated to further clarify which components of the Southern Void relate to the NUMA.

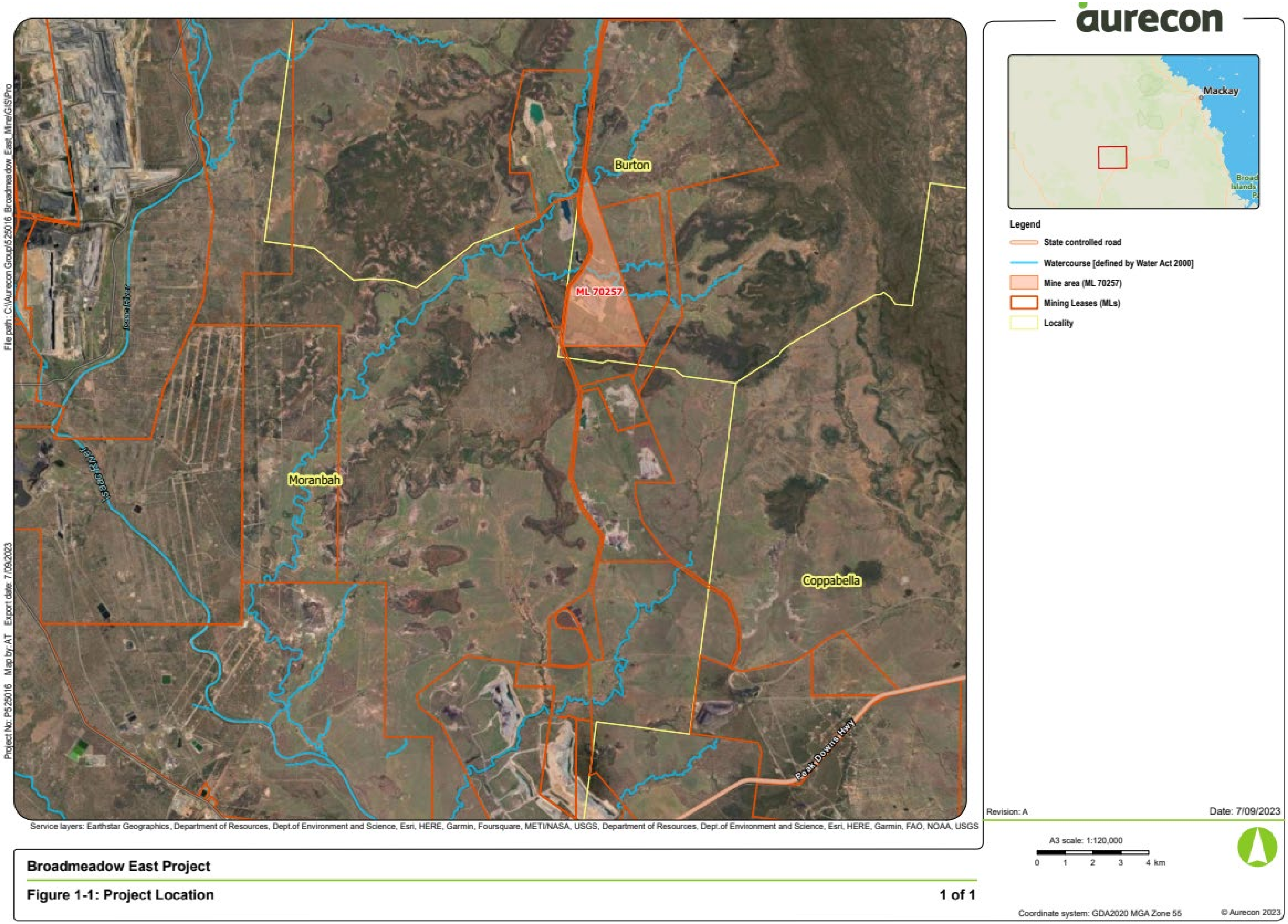

Figure 1.1 Project location

1.2 Regulatory context

The Queensland Government reformed the rehabilitation framework for resource activities, and implemented the Mined Land Rehabilitation Policy, through the *Mineral and Energy Resources (Financial Provisioning) Act 2018* and subsequent amendments to the EP Act. This new rehabilitation framework requires new and existing resource activities to develop and implement Progressive Rehabilitation and Closure Plans (PRCPs) within specified timeframes (i.e., transitional timeframes). The Proponent submitted a transitional PRCP on 29 September 2023, which was determined to be properly made. The administering authority issued an Information Request Notice on 22 November 2023, and the Proponent has until 25 November 2024 to provide a response.

The primary purpose of this EA amendment application is to ensure the rehabilitation criteria in EA0002465, as a Land Outcome Document (LOD), is consistent with the findings from technical studies as provided in the PRCP application.

1.3 Proponent

The Proponent is Coking Coal One Pty Ltd, a wholly-owned subsidiary of Bowen Coking Coal Limited. The registered address for the Proponent is:

Level 4, 167 Eagle Street
Brisbane QLD 4000
ABN: 89 615 317 907

Bowen Coking Coal is an independent coal producer trading on the Australian Securities Exchange (ASX) as 'BCB'.

Further information regarding Bowen Coking Coal can be obtained from: https://www.bowencokingcoal.com.au/.

1.4 Assessment methodology

This Supporting Document has been developed in compliance with the EP Act, Environmental Protection Regulation 2019 and its policies and guidelines. The most relevant policies and guidelines (including, but not limited to) are:

- Environmental Protection Regulation 2019
- Environmental Protection (Water and Wetland Biodiversity) Policy 2019
- Guideline: Major and minor amendments (DES, 2023a)
- Guideline: Approval processes for environmental authorities (DES, 2015)
- Guideline: Progressive rehabilitation and closure plans (PRC plans) (DES, 2023b)
- Information Sheet: Non-Use Management Areas (DES, 2020)
- Application requirements for activities with impacts to water (DES, 2013a)
- Application requirements for activities with impacts to land (DES, 2013b)

The Queensland Mine Rehabilitation Commissioner has also released a number of guidance documents around void modelling and post-mining land uses (PMLUs) which have been broadly considered during the preparation of this Supporting Document.

2 Project description

2.1 History

The Proponent purchased the undeveloped ML70257 (which was part of the Burton Coal complex) from Peabody (Burton Coal) Pty Ltd. This led to the de-amalgamation from nearby tenures and associated EA on 24 August 2020. Ownership of the ML was transferred in January 2021. Mine construction began in June 2022, and first coal was railed from the mine in October 2022.

2.2 Current operations

BME is authorised by EA0002465 on ML70257 to extract 1.9 million tonnes per annum of high-quality metallurgical coal annually over an estimated five-year mine life. The ML is 845 ha in size, with an approved disturbance area of 434 ha. The open pit is located centrally on the ML and runs south south-east to north north-west.

BME includes the following mine components:

- One open-cut pit (including Northern, Central and Southern sections)
- Mine infrastructure area
- Out of pit dumps (x2)
- Mine affected water storages (x2)
- Sediment dams (x4)
- Explosives compound
- Ancillary infrastructure (haul roads and tracks etc.).

Mining began at the northern portion of the proposed pit area and is progressively occurring along the resource in a southerly direction using the truck and shovel method.

The targeted coal resource within the ML is the Leichhardt seam of the Rangal Coal Measures (RCM) formation in the Bowen Basin. Other coal seams exist within the RCM, but these are not targeted because they are too thin or discontinuous to recover economically. The RCM is stratigraphically located above the high-ash, non-economic Girrah seam of the Fort Cooper Coal Measures.

The overburden has been initially placed in the two out of pit dumps and will be backfilled in-pit when sufficient dump room becomes available in 2024. Backfilling is a feature of truck and shovel operations that refers to the waste being hauled and dumped back to previously mined-out areas. Overburden will be placed within the pit as mining progressively moves south, leaving one residual void in the southern end of the pit (Southern Void) by the end of mine life.

The raw coal is transported off-site for processing and to port facilities by rail. There is no coal handling and preparation plant on the site therefore rejects and tailings are handled offsite at nearby facilities.

No public roads are located within the ML, only a series of mine access and private farm tracks. A haul road from the Burton Mine on ML70109 (located to the North of the Project) runs adjacent along the entire length of the western side of ML70257. The haul road leads to the Mallawa Train Load Out that connects to the Aurizon Goonyella Rail System.

2.3 Environmentally relevant activities

The Project has four environmentally relevant activities (ERAs) approved by EA0002465, being:

- Resource Activity, Schedule 3, 13: Mining black coal
- Resource Activity, Schedule 3, 09: A mining activity involving drilling, costeaning, pitting or carrying out geological surveys causing significant disturbance
- Ancillary Activity, Schedule 2, 60 – Waste disposal, 1: Operating a facility for disposing of, in a year, the following quantity of waste mentioned in subsection 1(a)—(d) more than 200,000t
- Ancillary Activity, Schedule 2, 60 – Waste disposal, 2: Operating a facility for disposing of, in a year, the following quantity of waste mentioned in subsection (1)(b), (c) more than 5,000t but not more than 10,000t.

No new ERAs are proposed as part of this application.

3 Self-assessment

3.1 Amendment application requirements

Chapter 5, part 7, division 2 of the EP Act describes the process which proponents must follow in requesting amendments to EAs. Specifically, sections 226 and 226A of the EP Act provide requirements for amendment applications. Table 3-1 references how each of the application requirements have been met for this application.

Table 3-1 EA amendment application requirements

Legislative requirement	Assessment of this application	Outcome
Section 226(1) An amendment application must—	-	-
(a) be made to the administering authority; and	The approved form for an EA amendment application is *Application to amend an environmental authority (ESR/2015/1733)*, which this report has been attached to.	Requirement has been met.
(b) be in the approved form; and	This application has been structured to meet the requirements of approved form ESR/2015/1733 and other relevant guidelines.	Requirement has been met.
(c) be accompanied by the fee prescribed by regulation; and	The application fee was paid during submission of the application form.	Requirement has been met.
(d) describe the proposed amendment; and	Refer to Section 4 of this report.	Requirement has been met.
(e) describe the land that will be affected by the proposed amendment; and	Refer to Section 4 of this report.	Requirement has been met.
(f) include any other document relating to the application prescribed by regulation.	N/A, no other documents required to be included.	N/A
(2) However, subsection (1)(d) and (e) does not apply to an application for a condition conversion.	N/A, this application does not relate to a condition conversion.	N/A
226AA Requirement for amendment application by holder of environmental authority and PRCP schedule	N/A, this EA does not have a related approved PRCP schedule at the time of application.	N/A
226A Requirements for amendment applications for environmental authorities (1) If the amendment application is for the amendment of an environmental authority, the application must also—	-	-
(a) describe any development permits in effect under the Planning Act for carrying out the relevant activity for the authority; and	N/A, there are no development permits in effect.	N/A
(b) state whether each relevant activity will, if the amendment is made, comply with the eligibility criteria for the activity; and	There are no eligibility criteria for the relevant activity as this is a site-specific EA.	N/A
(c) if the application states that each relevant activity will, if the amendment is made, comply with the eligibility criteria for the activity—include a declaration that the statement is correct; and	There are no eligibility criteria for the relevant activity as this is a site-specific EA.	N/A
(d) state whether the application seeks to change a condition identified in the authority as a standard condition; and	The application does not seek to change a standard condition.	Requirement has been met.

Legislative requirement	Assessment of this application	Outcome
(e) if the application relates to a new relevant resource tenure for the authority that is an exploration permit or GHG permit—state whether the applicant seeks an amended environmental authority that is subject to the standard conditions for the relevant activity or authority, to the extent it relates to the permit; and	N/A, this application does not relate to a new relevant resource tenure.	N/A
(f) include an assessment of the likely impact of the proposed amendment on the environmental values, including— **(i)** a description of the environmental values likely to be affected by the proposed amendment; and **(ii)** details of emissions or releases likely to be generated by the proposed amendment; and **(iii)** a description of the risk and likely magnitude of impacts on the environmental values; and **(iv)** details of the management practices proposed to be implemented to prevent or minimise adverse impacts; and **(v)** if a PRCP schedule does not apply for each relevant activity—details of how the land the subject of the application will be rehabilitated after each relevant activity ends; and	Refer to Section 5 of this report.	Requirement has been met.
(g) include a description of the proposed measures for minimising and managing waste generated by amendments to the relevant activity; and	Refer to Section 5.6 of this report.	Requirement has been met.
(h) include details of any site management plan or environmental protection order that relates to the land the subject of the application.	N/A, there are no site management plans or environmental protection orders that relate to the land.	N/A
(2) Subsection (1)(f) does not apply for an amendment application for an environmental authority if— (a) either— (i)the process under chapter 3 for an EIS for the proposed amendment has been completed; or (ii)the Coordinator-General has evaluated an EIS for the proposed amendment and there are Coordinator-General's conditions that relate to the proposed amendment; and	N/A, the process under chapter 3 for an EIS has not been completed for the proposed amendment.	N/A
(b) an assessment of the environmental risk of the proposed amendment would be the same as the assessment in the EIS mentioned in paragraph (a)(i) or the evaluation mentioned in paragraph (a)(ii).	N/A, the process under chapter 3 for an EIS has not been completed for the proposed amendment.	N/A
(3) Also, subsection (1)(a), (d), (e), (f), (g) and (h) does not apply to an application for a condition conversion.	N/A, the application is not for a condition conversion.	N/A

Legislative requirement	Assessment of this application	Outcome
(4) Despite subsection (1)(f), (g) and (h), if the amendment application is for an environmental authority for the prescribed ERA mentioned in the Environmental Protection Regulation 2019, schedule 2, section 13A— (a) it need only include the matters mentioned in subsection (1)(f)(i) to (iv), (g) and (h) to the extent the matters relate to fine sediment, or dissolved inorganic nitrogen, entering the water of the Great Barrier Reef or Great Barrier Reef catchment waters; and (b) subsection (1)(f)(v) does not apply for the amendment application.	N/A, the application does not relate to a prescribed ERA.	N/A

3.2 Assessment level decision

Under section 228 of the EP Act, the administering authority must decide whether the proposed amendment is a minor or major amendment, which constitutes an Assessment Level Decision. The criteria for determining whether an application is a major or minor amendment is provided in section 223 of the EP Act and is referenced in the Guideline Major and Minor Amendments (DES, 2023a).

Following advice issued from the administering authority on 26 October 2023 (refer **Appendix E**), and a review of the legislative criteria in the EP Act, it has been identified that this application likely constitutes a 'major' amendment on the basis that the main proposed amendment (i.e., Southern Void being a NUMA) does not appear to meet section 223(c) for a minor amendment (threshold) criteria, as shown in Table 3-2.

This section addresses part of *Section 13 – Describe the proposed amendment* of the application form.

Table 3-2 Assessment against minor amendment (threshold) criteria

Minor amendment (threshold) criteria	Assessment of proposed amendment	Meets criteria for minor amendment
a) is not a change to a condition identified in the authority as a standard condition, other than— (i) a change that is a condition conversion; or (ii) a change that is not a condition conversion but that replaces a standard condition of the authority with a standard condition for the environmentally relevant activity to which the authority relates; or (iii) a change that will not result in a change to the impact of the relevant activity on an environmental value; and	Section 4 describes the proposed amendments to the current EA conditions. There are no changes to EA conditions identified as standard conditions.	Yes
b) does not significantly increase the level of environmental harm caused by the relevant activity; and	The proposed amendments do not significantly increase the level of environmental harm caused by the relevant activity. The change in the rehabilitation outcome for the Southern Void, from a PMLU of water storage to a NUMA, follows further technical studies and is not because of a change in design. There is no proposed increased environmental harm from this outcome, but it is acknowledged there will be limitations to the use of water for stock watering in the long term. This supporting document demonstrates that the proposed change to the rehabilitation	Yes

Minor amendment (threshold) criteria	Assessment of proposed amendment	Meets criteria for minor amendment
	criteria (change in backfill level for Southern Void) will result in a better environmental outcome than authorised in the existing EA (discussed further in Section 5).	
c) does not change any rehabilitation objectives in the authority in a way likely to result in significantly different impacts on environmental values than the impacts previously permitted under the authority; and	The PMLU and 'rehabilitation objectives' currently set out for the Southern Void in Table G2 of EA0002465 currently identify a PMLU of water storage (to accommodate stock watering). This rehabilitation objective will change in order for the Southern Void to be considered a NUMA, and will result in different impacts than originally understood due to further recent technical studies. There is a proposed change to the rehabilitation criteria relating to the backfill level for the Southern Void in Table G2 (refer Section 8). This change will not result in significantly different impacts on environmental values than the impacts previously permitted under the EA, as justified in Section 5.	No
d) does not significantly increase the scale or intensity of the relevant activity; and	The proposed amendment does not increase the scale or intensity of the relevant activity.	Yes
e) does not relate to a new relevant resource tenure for the authority that is— **i.** a new mining lease; or **ii.** a new petroleum lease; or **iii.** a new geothermal lease under the *Geothermal Energy Act 2010*; or **iv.** a new greenhouse gas injection and storage lease under the *Greenhouse Gas Storage Act 2009*; and	The proposed amendment does not relate to a new relevant resource tenure for the EA.	Yes
f) involves an addition to the surface area for the relevant activity of no more than 10% of the existing area; and	The proposed amendment does not increase the existing surface area for the relevant activity.	Yes
g) for an environmental authority for a petroleum activity: **i.** involves constructing a new pipeline that does not exceed 150km; and **ii.** involves extending an existing pipeline so that the extension does not exceed 10% of the existing length of the pipeline; and	The proposed amendment does not relate to an EA for a petroleum activity.	N/A
h) if the amendment relates to a new relevant resource tenure for the authority that is an exploration permit or GHG permit—seeks, in the amendment application under section 224, an amended environmental authority that is subject to the standard conditions for the relevant activity or authority, to the extent it relates to the permit.	The proposed amendment does not relate to a new relevant resource tenure for the authority.	N/A

On 19 March 2024, DESI issued an Assessment Level Decision (ALD) Notice, which found that the application was properly made and a major amendment under the EP Act.

4 Description of proposed amendment

This section addresses *Section 13 – Describe the proposed amendment* of the application form, and also section 226(d) of the EP Act, which requires a detailed description of the proposed amendment.

No new areas of disturbance are proposed as part of this amendment application, outside of what is currently approved in *Appendix 1 Figure 1* and *Appendix 2 Figure 2* in EA0002465 (replicated in Figure 4-1).

The proposed amendments relate to land within the currently authorised disturbance area of EA0002465 and ML70257, as shown on Figure 4-1 and Figure 4-2.

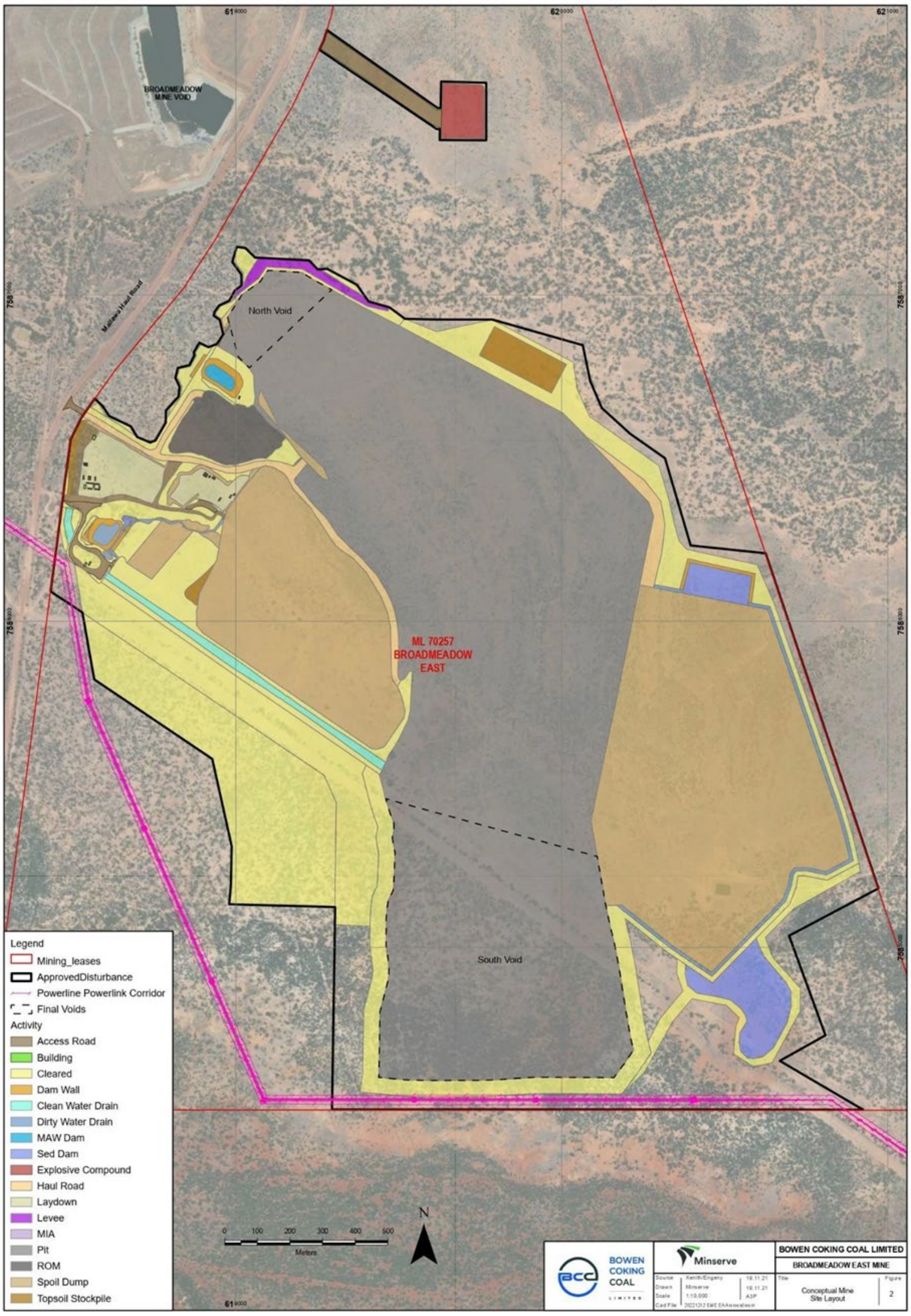

Figure 4.1 Mine Plan (Appendix 2, Figure 2 EA0002465)

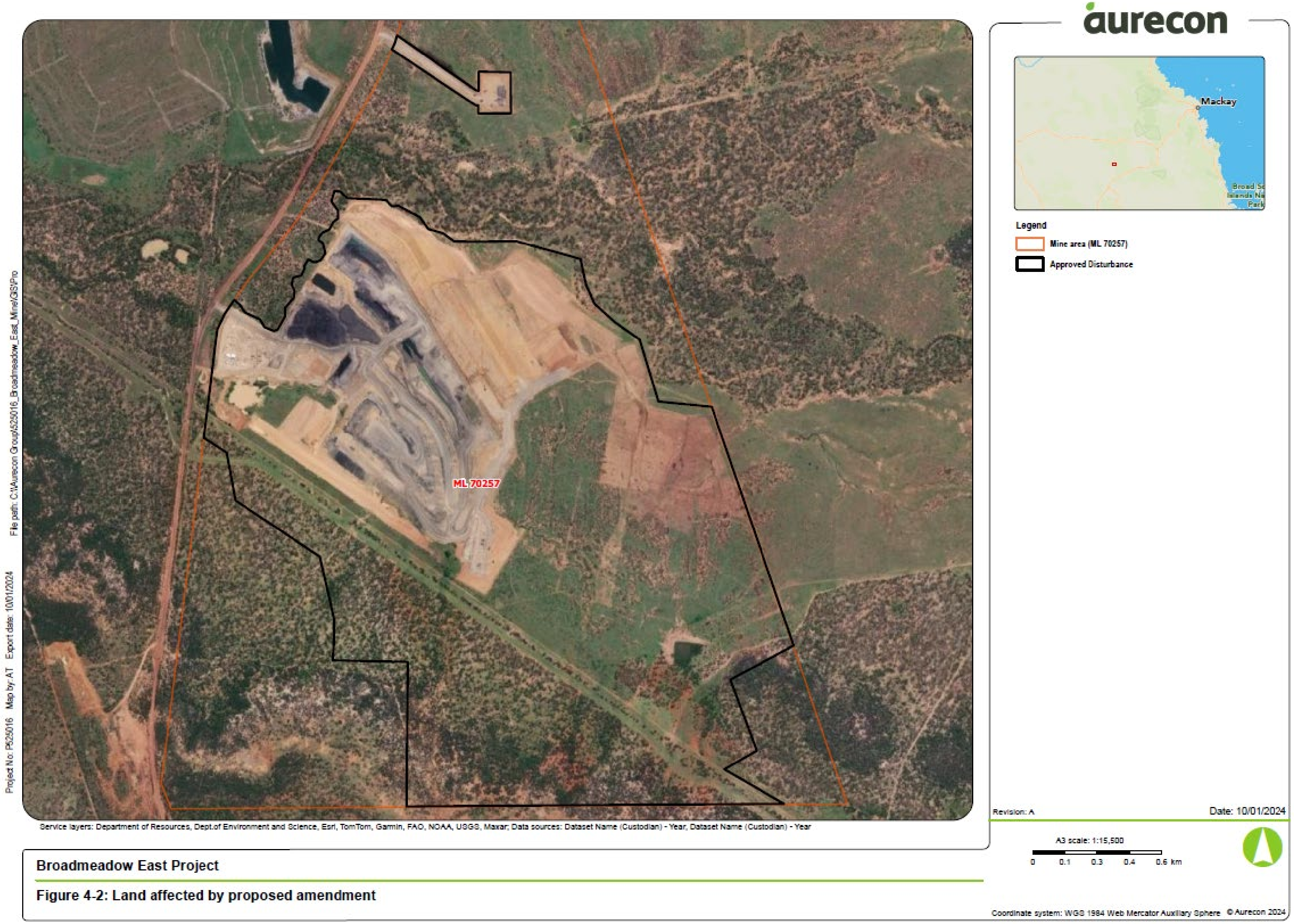

Figure 4.2 Land affected by proposed amendment

The scope of this amendment relates to the following:

- proposed change to the backfill level for the Northern Pit and Southern Void, following updated results from technical studies, including groundwater modelling and water balance modelling (refer **Appendix B** and **Appendix C**, respectively) (refer Section 4.1)
- proposal for the Southern Void to be assessed as a NUMA after a final void assessment indicated long term predictions of declining water quality that would prevent pit water meeting stock watering guideline values in perpetuity (refer Section 4.2)
- proposed change to groundwater monitoring bore locations, following the update to the Groundwater Monitoring and Management Plan (GWMMP), required by the EA (refer Section 4.3)
- proposed change to groundwater quality limits, following the completion of the updated baseline study required by Condition D2(h) of the EA (refer Section 4.4)
- proposed change to central pit terminology to clarify it is an in-pit spoil dump (refer Section 4.5).

These elements are further described below. The amendment does not propose to add or delete a location, tenure or activity, or to change the threshold of an activity.

4.1 Void backfill levels

As described in Section 1.2, a PRCP application has been submitted for the Project. Previously, a major amendment to the EA was approved in 2022, which updated the mining plan and included PMLUs and rehabilitation criteria following a range of technical baseline studies. In order to develop the PRCP application, a gap analysis was conducted between the 2021/2022 technical baseline studies and the requirements in the DESI Guideline: Progressive rehabilitation and closure plans (PRC Plans) (2023b).

As part of the preparation of the PRCP application as per the PRCP Guideline (DES, 2023b), updated technical studies for groundwater modelling, surface water balance and erosion modelling have been undertaken by the same technical experts who completed the 2021/2022 baseline studies. These updated studies are post-closure specific and are based on real time data and follow the most current technical guidelines and standards. The process of determining final landform and updating the technical studies was iterative, with ongoing meetings and data sharing between all parties involved with the technical studies and PRCP submission.

The current EA conditions, including rehabilitation criteria in *Appendix 5 Tables G1 and G2*, were written based on the outcomes of the 2021 baseline studies, which used preliminary data available at the time. In line with the philosophy of continuous improvement, the Proponent's aim was to update the mine plan as additional knowledge and data was obtained.

During the development of the PRCP application, the Proponent prioritised consistency with the outcomes of the EA, being the only Land Outcome Document (LOD). For instance, *Appendix 5 Tables G1 and G2* in the EA were reviewed in detail to ensure the proposed rehabilitation activities and post-closure landforms described in the PRCP are consistent with the EA.

4.1.1 Northern Pit

As stated above, updated groundwater modelling (KCB, 2024) was undertaken to support the PRCP application, which determined that if the Northern Pit (also referred to as the 'North Void' in *Appendix 2, Figure 2* of EA0002465) was left open, it has the potential to be a groundwater source, rather than a sink. The Proponent has subsequently made the decision to fully backfill the Northern Pit at the end of mine life, in order to ensure that it acts as a sink. This was discussed with the administering authority in a meeting on 30 August 2023.

The Proponent is not proposing to change the rehabilitation method, criteria or PMLU of the Northern Pit, as listed in *Appendix 5, Tables G1 and G2* of the EA, as backfilling will occur above the minimum nominated backfilled level (270 RL) and activities will therefore be compliant with the EA as the LOD.

The Northern Pit will be partially backfilled and available for use as bulk water storage at various stages of the mine life. This landform will be filled to the surrounding topography at the end of mine life when bulk water storage is no longer required.

4.1.2 Southern Void

Appendix 5, Table G1 of EA0002465 currently requires the rehabilitation method of Southern Void (also referred to as the 'South Void' in *Appendix 2, Figure 2* of EA0002465) to *"Backfill above the regional groundwater level, treat or remove exposed coal seams."*

Additionally, *Appendix 5, Table G2* of the EA requires the following for the Southern Void:

- Backfill above the groundwater level (water level based on conceptual modelling)
- Partial backfill according to above the groundwater level and as per the baseline groundwater assessment.

Updated groundwater modelling (KCB, 2024) has demonstrated that the baseline groundwater level for the Rangal Coal Measures aquifer impacted by the Southern Void is approximately 288 reduced level (RL)[1]. This application seeks to amend the EA to change the criterion in *Appendix 5, Table G2* to allow the Southern Void to be backfilled to a minimum of 225 RL (mAHD), which will include capping and covering of the coal seam. Updated mine plans, using the data from the updated technical baseline studies, indicate that the backfill level for the southern void will be approximately 225 RL (mAHD) and the final lake equilibrium level will be 250 RL (mAHD), with the majority of the lake sitting above the approximate 225 RL (mAHD).

The updated groundwater modelling (KCB, 2024) (refer **Appendix B**) and water balance (Engeny, 2024) (refer **Appendix C**) demonstrates that at the proposed backfill level of 225 RL (mAHD), the Southern Void lake will act as a sink, and the void lake will not overflow. Voids become sinks when the surrounding groundwater system flows into them. Therefore, the Southern Void will not have the potential to contaminate any other surface water bodies and groundwater aquifers. This is detailed further in Sections 5.1 and 5.2.

The following environmental outcomes required in the EA (as the LOD) will continue to be met:

- The Southern Void will act as a groundwater sink to the receiving environment (Condition G7)
- Maximum surface area of the Southern Void is 31 ha (Table G2)
- Maximum void depth for the Southern Void is 105 m (Table G2)
- Maximum void lake equilibrium level will not reach 300 m AHD for the Southern Void (Table G2).

BCC is also proposing a geotechnical Factor of Safety of $\geq$ 1.5 for the Southern Void.

4.2 Southern Void NUMA

Appendix 5, Table G2 of the BME EA currently requires the following for the Southern Void:

- PMLU of Water Storage
- Manage long term water quality for livestock consumption as per Australian and New Zealand Guidelines for Fresh and Marine Water Quality (the Guidelines).

The updated water balance assessment undertaken for the PRCP (Engeny, 2024) identified that the salinity of the Southern Void is forecast to continue to increase over time and the void water is unlikely to be suitable for livestock drinking long-term after mine closure. Therefore, the PMLU requires changing to a NUMA.

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[1] The groundwater level obtained from the current groundwater monitoring bore for the Rangal Coal Measures is 288 RL (mAHD) in the centre of the future Southern Void, and was used to inform the updated technical baseline studies. Previously the groundwater level (at a regional level) was understood to be 260 RL at historic monitoring bore BDW366P in the vicinity of the Project.

Advice was received from the administering authority dated 30 November 2023 (refer **Appendix E**) which advised the Proponent to modify the PMLU of the Southern Void through an EA amendment rather than via the PRCP process. Further justification for the NUMA is provided in Section 6.

4.3 Groundwater Monitoring Bores

Table D1 of the EA lists the 11 groundwater bores which must be monitored in accordance with Condition D3 of the EA. *Appendix 3 Figure 3 – Mine affected water release points and monitoring locations* from the EA shows the location of the currently authorised groundwater monitoring bores. This figure has been recreated below in Figure 4-3.

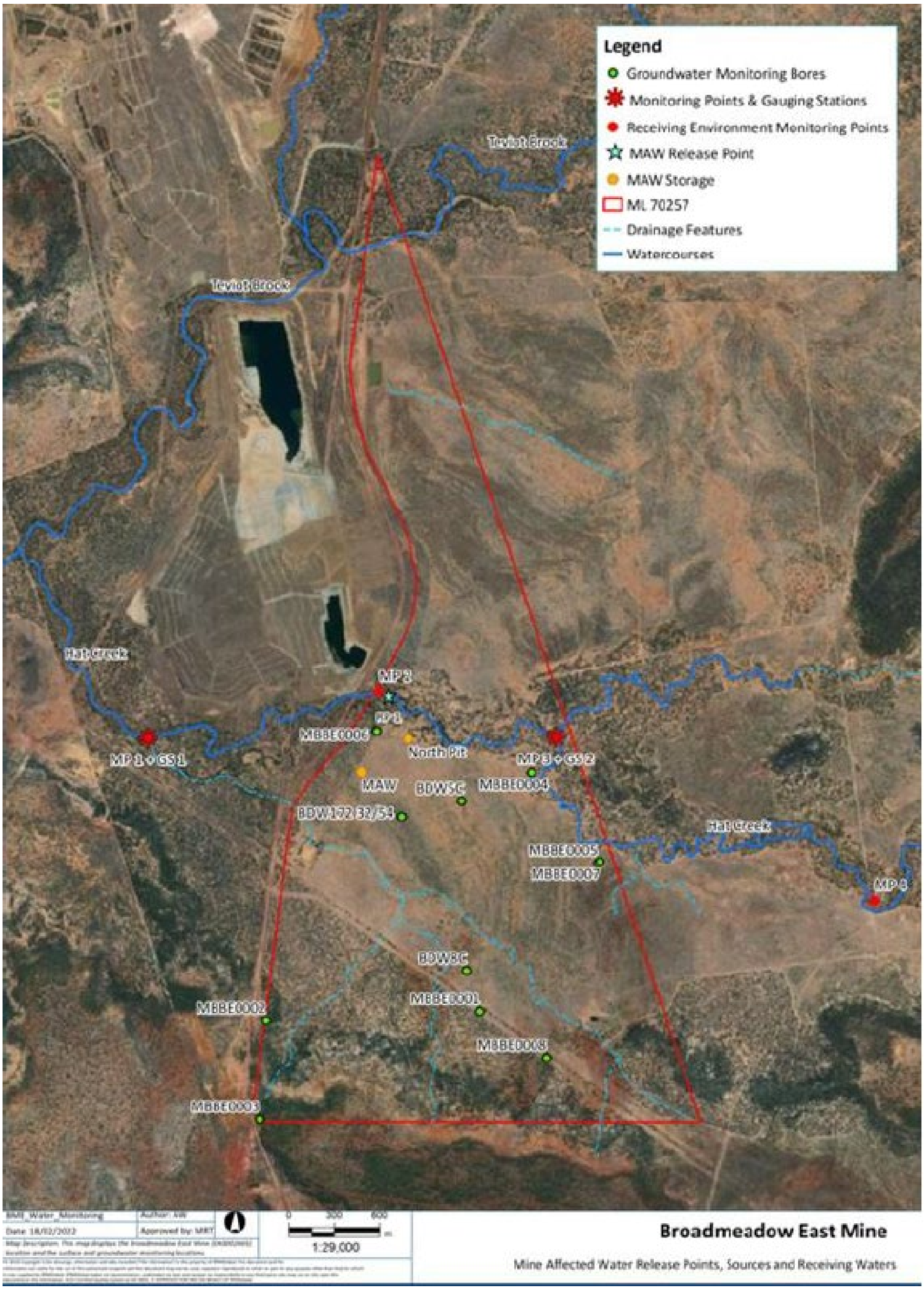


Figure 4.3 Location of currently authorised groundwater monitoring bores (Appendix 3, Figure 3 EA0002465)

Five of these groundwater bores (BDW5C, BDW8C, BDW172 (32), BDW172 (54), and MBBE0006) are located within the approved disturbance area and have been mined out. In addition, MBBE0001 is located within the approved disturbance area and is likely to be mined out at some point in the future.

Four replacement bores have been installed (MBBE0009, MBBE0010, MBBE0011, MBBE0012).

Condition D18 of the EA states that *"Any groundwater monitoring bores that are mined through during operations must be replaced with bores in the equivalent Screen Stratigraphy, and updated details provided in Table D1 - Groundwater monitoring locations and frequency."*

Therefore, this application proposes to amend Table D1 of the EA to remove the bores which have been mined out and add the replacement bores in equivalent stratigraphy locations.

The new replacement groundwater bores are listed in Table 4-1 below.

Table 4-1 Replacement Groundwater Bore Locations

Monitoring Point	Easting	Northing	Aquifer / Monitored Interval	Bore being replaced
	(MGA2020, Zone 55)			
MBBE0009	620376	7586715	Rangal Coal Measures	MBBE0001
MBBE0010	620362	7586723	Rewan Group	BDE172(32)
MBBE0011	619058	7587386	Alluvium	MBBE0006
MBBE0012	619797	7584702	Rangal Coal Measures	BDW8C

Compliance bore MBBE0001 will continue to be monitored until decommissioning, to ensure overlap with replacement bore MBBE0009.

The updated location of groundwater bores is shown in Figure 4-4.

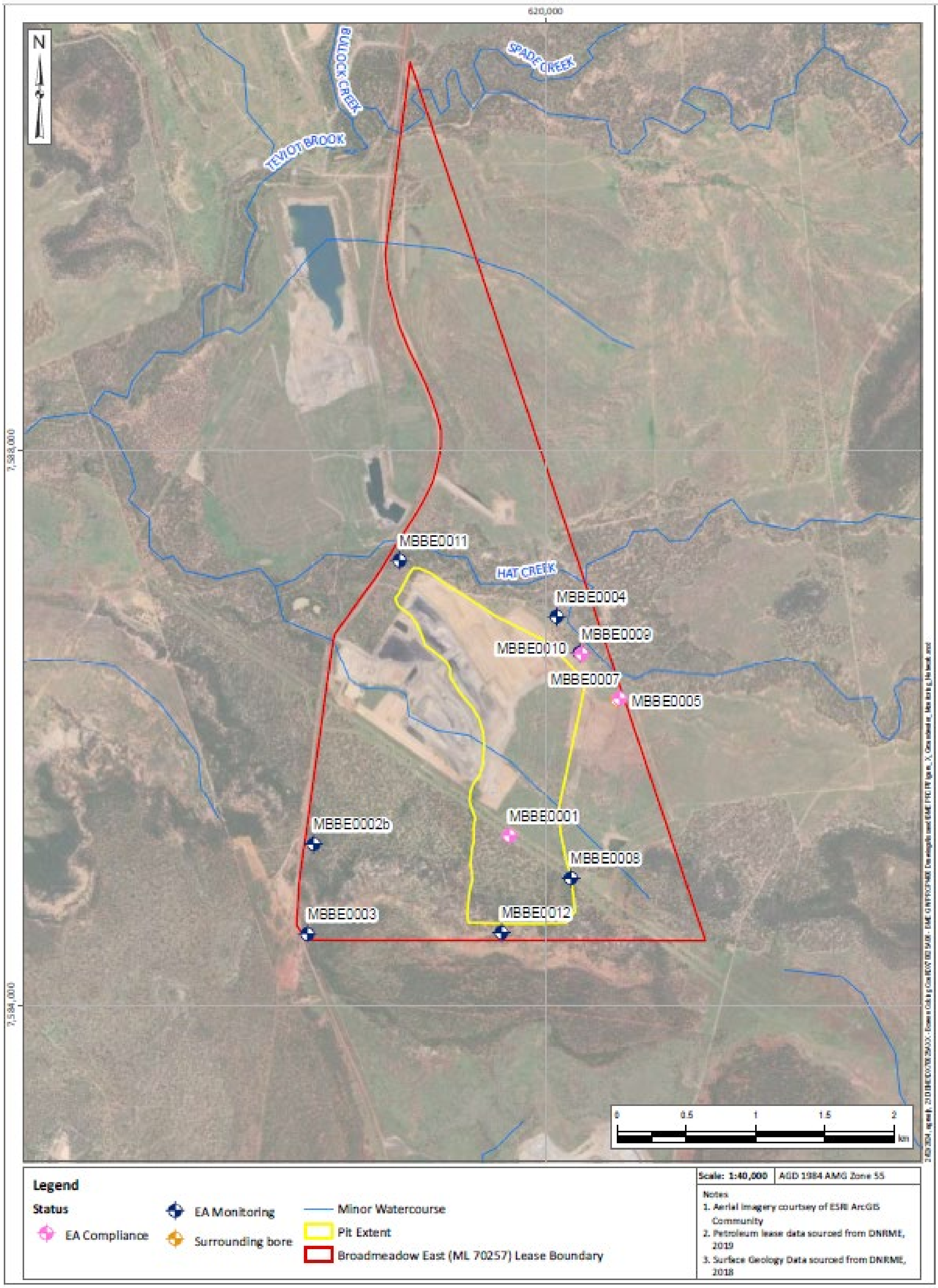


Figure 4.4 Updated Groundwater Monitoring Network

Source: KCB (2024a)

4.4 Groundwater Quality Limits

The current groundwater quality limits in Table D2 of the EA were calculated in February 2022 based on the small dataset available at the time. Triggers were then based on the 95th percentile results from all groundwater quality analyses from each monitoring bore i.e., 888.3 µS/cm for electrical conductivity (EC) for bore MBBE0001.

Given that additional groundwater quality data has since been collected as required under the EA (i.e., thirteen data points), trigger values should be recalculated as per the guidelines (DES, 2021).

KCB (2024a) has prepared a technical memo providing methodology and justification for the revised quality limits (refer **Appendix D**).

These updated groundwater quality limits are being submitted in accordance with Condition D2(h) of the EA, which states that "[*The baseline groundwater monitoring program must*] identify groundwater quality limits and triggers to update Table D2 - Groundwater quality limits and submit to the administering authority by 1 April 2024 if required".

4.5 Central In-Pit Spoil Dump

The EA currently uses the term "Central Pit" to describe the area between the Northern and Southern Voids which will be backfilled. The Proponent would like to modify this terminology to "Central in-pit spoil dump". This reflects that the area is not a separate pit or void at any point during mine life, but rather part of the gradual southerly progression of mining. The area will be backfilled with spoil as the mine progresses.

No changes to the rehabilitation criteria in *Appendix 5, Tables G1 and G2* of the EA are proposed. As this proposed change does not impact any environmental outcomes or impact mine operation, this change has not been assessed in detail in Section 5.

Note that the PRCP (RPM Global, 2023a) uses the term "Central Pit" as it was submitted on 29 September 2023, and the Proponent prioritised consistency between the PRCP and the EA, being the only LOD.

The Proponent now seeks to update the terminology in the EA (LOD), and if this change is approved, the PRCP application will be updated accordingly.

5 Assessment of environmental values

This section addresses *Section 22 – Environmental values* of the application form which requires an assessment of the likely impact of the proposed amendment on the environmental values, including—

(i) a description of the environmental values (EVs) likely to be affected by the proposed amendment; and

(ii) details of emissions or releases likely to be generated by the proposed amendment; and

(iii) a description of the risk and likely magnitude of impacts on the environmental values; and

(iv) details of the management practices proposed to be implemented to prevent or minimise adverse impacts; and

(v) if a PRCP schedule does not apply for each relevant activity—details of how the land the subject of the application will be rehabilitated after each relevant activity ceases.

The Proponent engaged specialist technical providers to determine how the Southern Void will operate during and post closure activities, as part of the PRCP submission. Technical impact assessments have been developed which support this EA amendment application and inform the proposed changes to EA conditions detailed in Section 8. These include:

- Hydrogeological assessment (KCB, 2024; refer **Appendix B**)
- Void water balance assessment (Engeny, 2024; refer **Appendix C**).

5.1 Surface water

The proposed amendments relating to void backfill levels (refer Section 4.1), the Southern Void NUMA (refer Section 4.2), groundwater bore locations (refer Section 4.3), and groundwater quality limits (refer Section 4.4) are covered in this section. The amendment relating to the central in-pit spoil dump name change (refer Section 4.5) does not relate to surface water and will not impact surface water values, and therefore is not discussed further in this section.

Figure 5-1 shows the mapped watercourses across the Project, including Hat Creek and Teviot Brook which are referenced in the following sections.

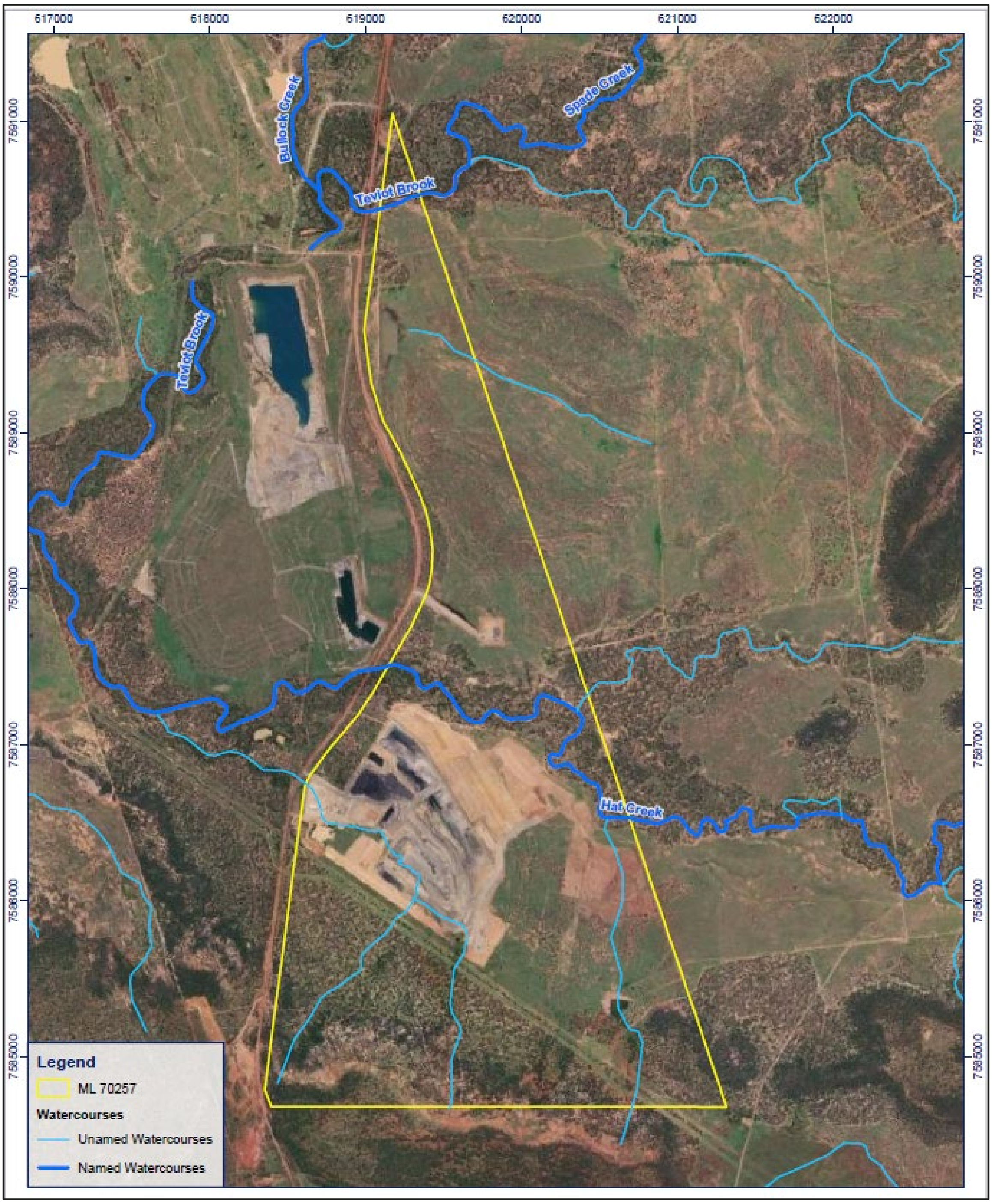


Figure 5.1 Watercourses mapped across the Project

Source: RPM Global (2023a)

5.1.1 Void backfill levels

The initial final void water balance study conducted in 2021 found that the Northern Pit may become a source of groundwater contamination in extreme climate scenarios. Subsequently, the Proponent agreed to partially backfill the Northern Pit to above the groundwater level in this area, which was understood to be 270 RL (mAHD) (reflected in *Appendix 5, Table G2* of the EA). Following an updated void water balance modelling exercise (Engeny, 2024), it has been determined that the Northern Pit should be fully backfilled (above the minimum level of 270 RL (mAHD) as per the EA) to avoid any risk of this landform acting as a groundwater source and to minimise risk to the receiving environment.

The Southern Void was initially designed to be partially backfilled above the regional groundwater level, which would allow the void to act as a groundwater sink rather than a source. Updated groundwater modelling (KCB, 2024) has demonstrated that the regional groundwater level for the Southern Void is approximately 288 RL (mAHD).

Following the updated technical baseline studies, which included void water balance modelling and groundwater modelling, it was determined that the Southern Void could be backfilled to a minimum of 225 RL (mAHD) and will still act as a groundwater sink and not result in harm to the receiving environment, including groundwater and surface water. Details of the process to determine this outcome have been included below.

The updated void water balance assessment (Engeny, 2024; refer **Appendix C**) was developed in compliance with the PRCP Guideline (DES, 2023b). The void equilibrium and maximum level results were compared with the regional groundwater levels supplied by the groundwater specialists (KCB, 2024) to determine whether the void is likely to act as a groundwater 'sink' or a 'source'. Accepted definitions of 'sink' and 'source' are provided below (Engeny, 2024), and further explained in Section 5.2 (Groundwater):

- Sink - A groundwater 'sink' refers to a void which has modelled equilibrium and/or maximum levels lower than the regional groundwater level. The hydraulic gradient generated by this change in levels would result in groundwater ingress to the pit (i.e. water will flow from outside the pit into it).
- Source - A groundwater 'source' refers to a void which has a net outflow of water from the void lake into the surrounding geology (generally identified by a water level above the regional groundwater level) where such outflow is not into the low-wall backfill material. In these cases, the hydraulic gradient could result in water within the pit seeping into groundwater systems (i.e. water will flow from inside the pit to the receiving environment).

The final void water balance model (WBM) was developed using GoldSim modelling software and was simulated for 300 years based on historical climate data with 131 realisations. The key model outputs for the Southern Void lake levels are summarised below and in Table 5-1 (Engeny, 2024):

- The modelling results show no modelled overflows from the residual Southern Void, therefore there is no predicted impact to the surrounding environment and EVs.
- The void lake levels are forecast to fluctuate over time as a result of prevailing climate conditions. The approximate Southern Void equilibrium level of 249 m AHD is 39.8 m below the pre-mining groundwater level of 288.8 m AHD.
- The maximum void lake level of 254.1 m AHD is 45.9 m below the pre-mining groundwater level, and therefore, based on the modelled results it is expected the Southern Void will have no potential net outflows to the local geology and regional groundwater and is considered a "groundwater sink".
- The void lake level generally rises over the initial 25 years following the cessation of mining.
- The salinity of the Southern Void is forecast to continue to increase over time due to the ongoing concentration of salt due to evaporation with no outflows of salt from the system. The WBM forecasts pit water salinity to be greater than 10,000 µS/cm within 70 years of closure.

Table 5-1 Southern Void water balance model results summary

Parameter	Value
Catchment Area (ha)	167
Void Equilibrium Level (m AHD)	249.0
Maximum Water Level (m AHD)	254.1
Void Spilling Elevation Level (m AHD)	300
Pre-mining Groundwater Level (m AHD) [1]	288.8
Void Equilibrium Volume (ML)	1,130
Ponded Area at Equilibrium (ha)	10.7
Average Void EC at 300 years (µS/cm)	36,254
Maximum Void EC at 300 years (µS/cm) [2]	131,306
Initial Void Filling Period (years)	25

Source: Engeny (2024)

Table notes:

1 Pre-mining ground water level for Southern Void from MBBE0001
2 The maximum EC represents the fluctuations in water quality due to evaporation resulting in concentration of salt in the pit lake during dry periods.

A graphical representation of the forecast void lake level is shown in Figure 5-2.

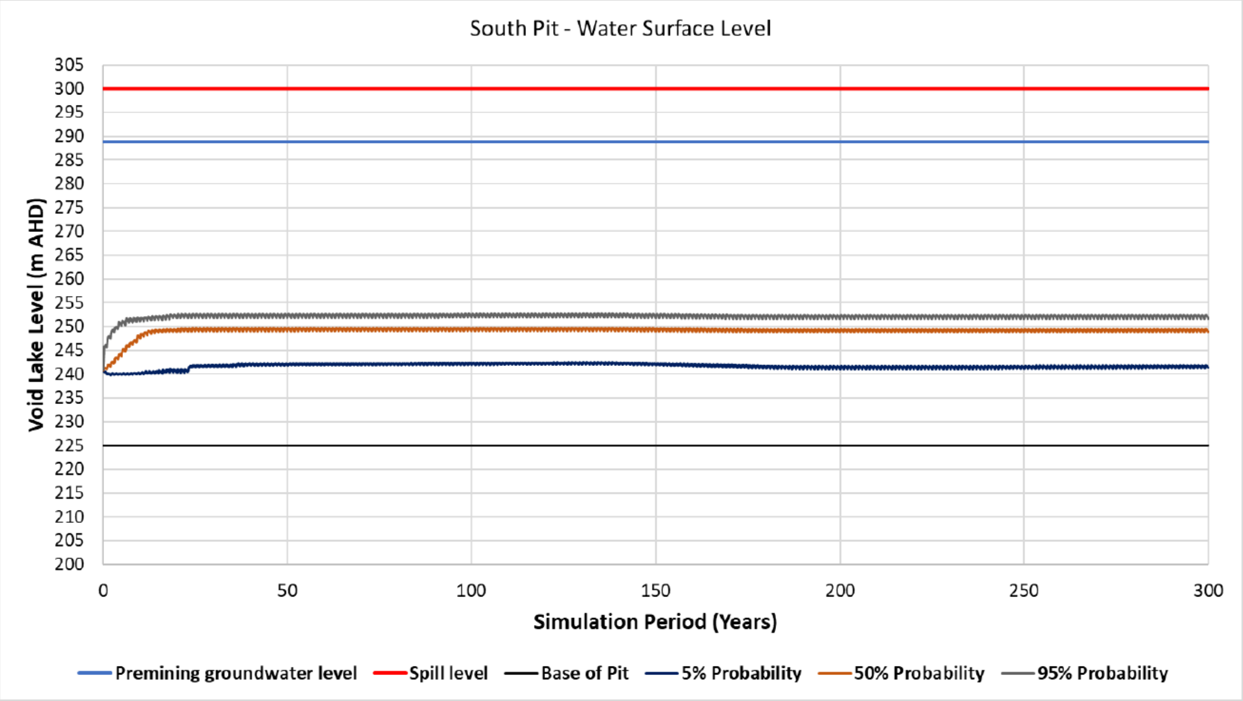


Figure 5.2 Southern Void – Water surface level

Source: Engeny (2024)

The final void water balance and flood modelling was initially undertaken in 2021 and updated in 2023 based on the final landform (including backfilled Northern Pit and changed backfill level for Southern Void). Two climate change sensitivities were applied in accordance with the Australian Rainfall and Runoff 2019 Guidelines. A two-dimensional hydraulic model using TUFLOW on final landform generated flood depth and velocity maps for the 50%, 20%, 10%, 1%, 0.1% annual exceedance probability (AEP) events and the Probable Maximum Flood (PMF).

The flooding risk profile found that drainage is required around the southern edge of the void and eastern landform, and that void inflows are caused by local catchment runoff. Flooding within Hat Creek is not anticipated to generate any inflows to the void based on flood results and groundwater levels (Engeny, 2024).

As stated above and in Section 5.2, it is important that the backfill level of the Southern Void (including estimated level of water in the void) is below the groundwater level, to ensure that the void acts as a sink rather than a source. The proposed change of the backfill level to 225 RL (mAHD) with a final lake equilibrium level of 250 RL (mAHD), will ensure that the level of water in the void does not exceed the baseline groundwater level in the area (approximately 288 RL (mAHD)) and that this void acts as a sink. Overall, the potential impact to the environmental value of surface water from the BME post-closure landform, and proposed change to backfill levels in the Southern Void, is considered to be low to negligible.

5.1.2 Southern Void NUMA

The void WBM discussed above also predicted void quality (salinity) using a mass balance approach and contaminant transport model.

Runoff entering the Southern Void is assumed to be completely mixed with any current storage. This provides an average salinity in the final void over the simulation period (Engeny, 2024). This does not account for the potential stratification of water quality within the void where partial mixing with different layers may occur. Although stratification is likely to occur in the Southern Void due to the average water depth within the void lake being 29 m, it is likely to be negligible in terms of risk due to the average salinity level results from the water balance observed as already potentially hyper saline.

Salinity generation rates for the assigned land use types are summarised in Table 5-2.

Table 5-2 Salinity Generation Rates for Land Use Types

Land Use Type	Salinity (µS/cm)	Source of Data
Natural	178	80th percentile water quality results of the tributaries of Burton Gorge Dam (Teviot Creek and Sandy Creek) were averaged and adopted for the purpose of the WBM
Mining Pit Floor	1,370	BME geochemical testing undertaken in February 2021
Rehabilitation Spoil	425	In absence of project specific water quality data for rehabilitated land use, the parameter has been sourced from the regional model that has been calibrated to the Isaac River

Source: Engeny (2024)

The WMB forecasts that the concentration of salts will continue to increase beyond the simulation period as there are negligible outflows of the salts from the residual void. The WBM Southern Void water quality results forecast pit water salinity over 10,000 µS/cm within 70 years of closure, 36,254 µS/cm at 300 years, and a maximum void salinity of 131,306 µS/cm (due to evaporation resulting in concentration of salt in the pit lake during dry periods) (Engeny, 2024). This is visualised in Figure 5-3.

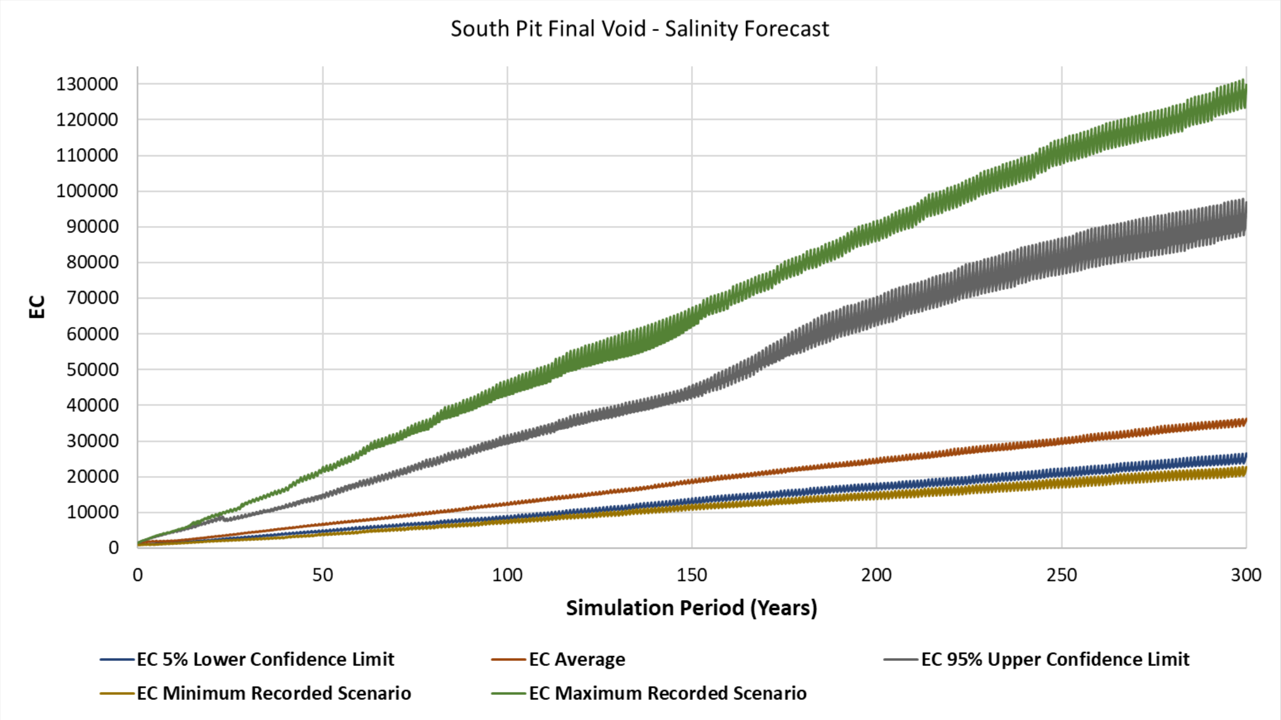


Figure 5.3 Southern Void – Salinity Forecast

Source: Engeny (2024)

The EA currently requires the Southern Void to "manage long term water quality for livestock consumption as per Australian and New Zealand Guidelines for Fresh and Marine Water Quality (the Guidelines)", to meet the criteria of a PMLU.

Recommended concentrations of total dissolved solids (TDS) and electrical conductivity (EC) in drinking water for livestock from Table 9.3.3 of the Guidelines are shown in Table 5-3.

Table 5-3 Tolerances of livestock to salinity in drinking water (beef cattle)

Tolerance	TDS (mg/L)	EC (µS/cm)
No adverse effects on animals expected	0-4,000	0-5,970
Animals may have initial reluctance to drink or there may be some scouring, but stock should adapt without loss of production	4,000-5,000	5,970-7,463
Loss of production and a decline in animal condition and health would be expected. Stock may tolerate these levels for short periods if introduced gradually	5,000-10,000	7,463-14,925

Table note: In natural waters, the EC is directly proportional to TDS. A typical Australian conversion factor of 0.67 has been used to convert TDS values from the Guidelines to EC µS/cm (for comparison with BME values).

As the WBM forecasts pit water salinity to be greater than 10,000 µS/cm within 70 years of closure, the water quality characteristics of the Southern Void will not be able to support a PMLU of livestock consumption in perpetuity. It is on this basis that the proponent is seeking a NUMA for the Southern Void. Further details on this are provided in Section 6.

5.1.3 Groundwater bore locations

This assessment of impacts to surface water relates to the proposed change of location for groundwater monitoring bores (refer Section 4.3).

The intent of the bores is to monitor for any potential impacts to groundwater caused by mining activities. The installation of groundwater monitoring bores is a low-risk activity with a small disturbance footprint. It is regularly performed as part of resource activities, and there are guidelines which outline how to undertake installation in accordance with best industry practice. BCC uses the guideline *Minimum Construction Requirements For Water Bores In Australia* (National Uniform Drillers Licensing Committee, 2020) to install and manage groundwater monitoring bores to meet Condition D17 of the EA.

Monitoring bores are already authorised in the EA, and condition D18 of the EA states that *"Any groundwater monitoring bores that are mined through during operations must be replaced…"* Therefore, it is considered that any impact to the environmental value of surface water from the installation of replacement bores is negligible, and balanced by the benefit they provide to groundwater environmental values.

5.1.4 Groundwater quality limits

This assessment of impacts to surface water relates to the proposed change to groundwater quality limits (refer Section 4.4). The new limits have been derived as per the guideline *Using monitoring data to assess groundwater quality and potential environmental impacts* (DES, 2021). The aim of this guideline is to calculate appropriate site-specific trigger values, to improve monitoring and early detection of environmental harm. The proposed amendment to groundwater quality limits will not impact surface waters.

5.2 Groundwater

The proposed amendments relating to void backfill levels (refer Section 4.1), groundwater bore locations (refer Section 4.3) and groundwater quality limits (refer Section 4.4) are covered in this section. Amendments relating to the Southern Void NUMA (refer Section 4.2) and central in-pit spoil dump (refer Section 4.5) do not relate to groundwater and will not impact groundwater values, and therefore are not discussed further in this section.

5.2.1 Void backfill levels

This assessment of impacts to groundwater relates to the proposed amendment to void backfill levels.

An updated hydrogeological assessment was undertaken of post-closure groundwater conditions to assess the final Northern Pit and Southern Void water elevation within the proposed post-closure landform (KCB, 2024; refer **Appendix B**).

Final pit void lake elevations were simulated by surface water specialists (Engeny, 2024) using a water balance model, as part of the surface water assessment. This water balance incorporated all contributing fluxes to the pit voids, including the groundwater inflow. The post-closure groundwater inflow flux was simulated for a range of pit void lake elevations, from the maximum inflow rate when groundwater levels are at the base of the pit to the pre-mining groundwater level elevation where no groundwater inflow is observed.

Post-closure steady-state elevations of the pit voids associated with the final landform were calculated from the water balance model. These steady-state elevations in the voids were applied to the groundwater model, using a General Head Boundary to simulate the post-closure groundwater conditions. Recharge and evaporation were not applied to the void, as this was captured in the water balance model. This simulation was conducted for a 500 year duration, using climate data, to allow surrounding groundwater levels to recover to equilibrium/steady-state conditions.

Figure 5-4 and Figure 5-5 show post-closure groundwater levels for the Rangal Coal Measures (RCM) and the Rewan Group (respectively) for 10, 50, 100 and 500 years post-closure. It was identified that the Southern Void is predicted to act as a groundwater sink, with localised groundwater flow from the south and southwest towards the final void.

Two formations indicate changes in groundwater levels as a result of the mining activities in the Project area; the RCM and the Rewan Group.

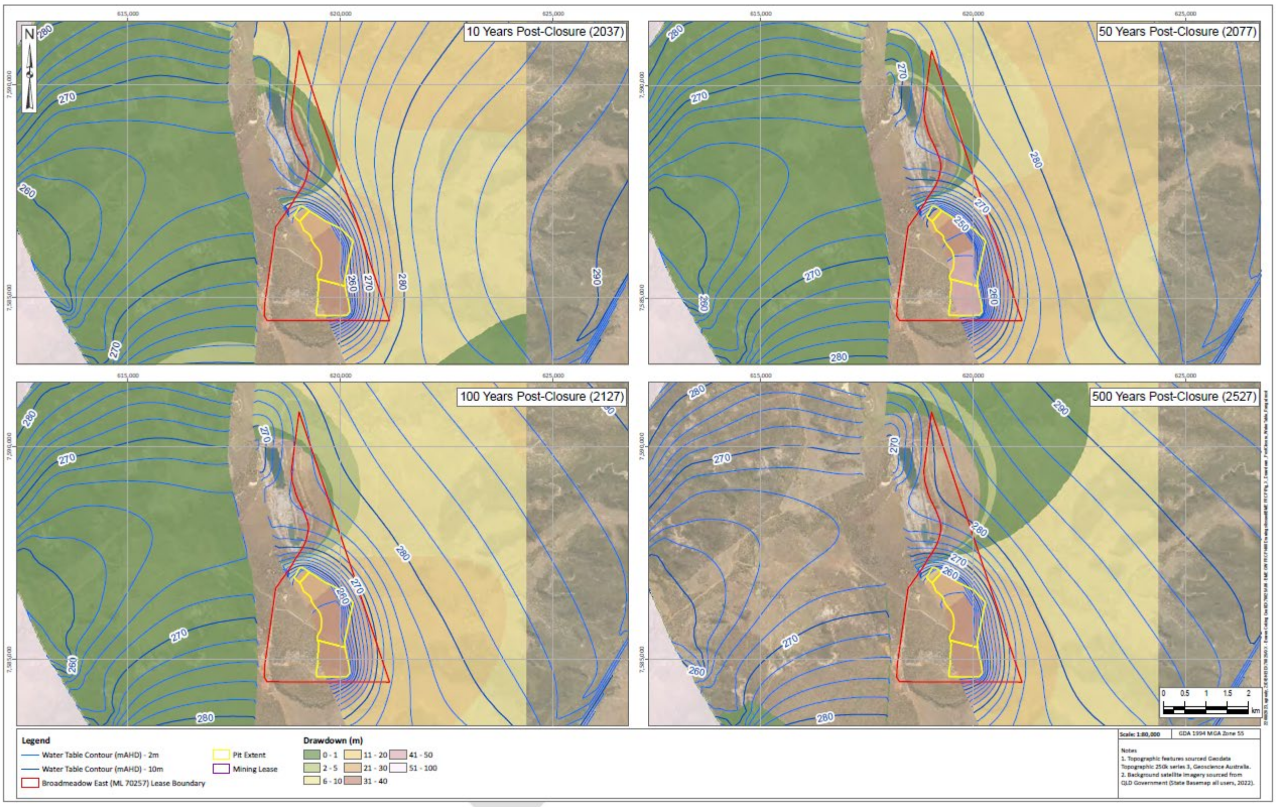


Figure 5.4 Post-Closure Head for RCM – 10, 50, 100 and 500 years Post-Closure

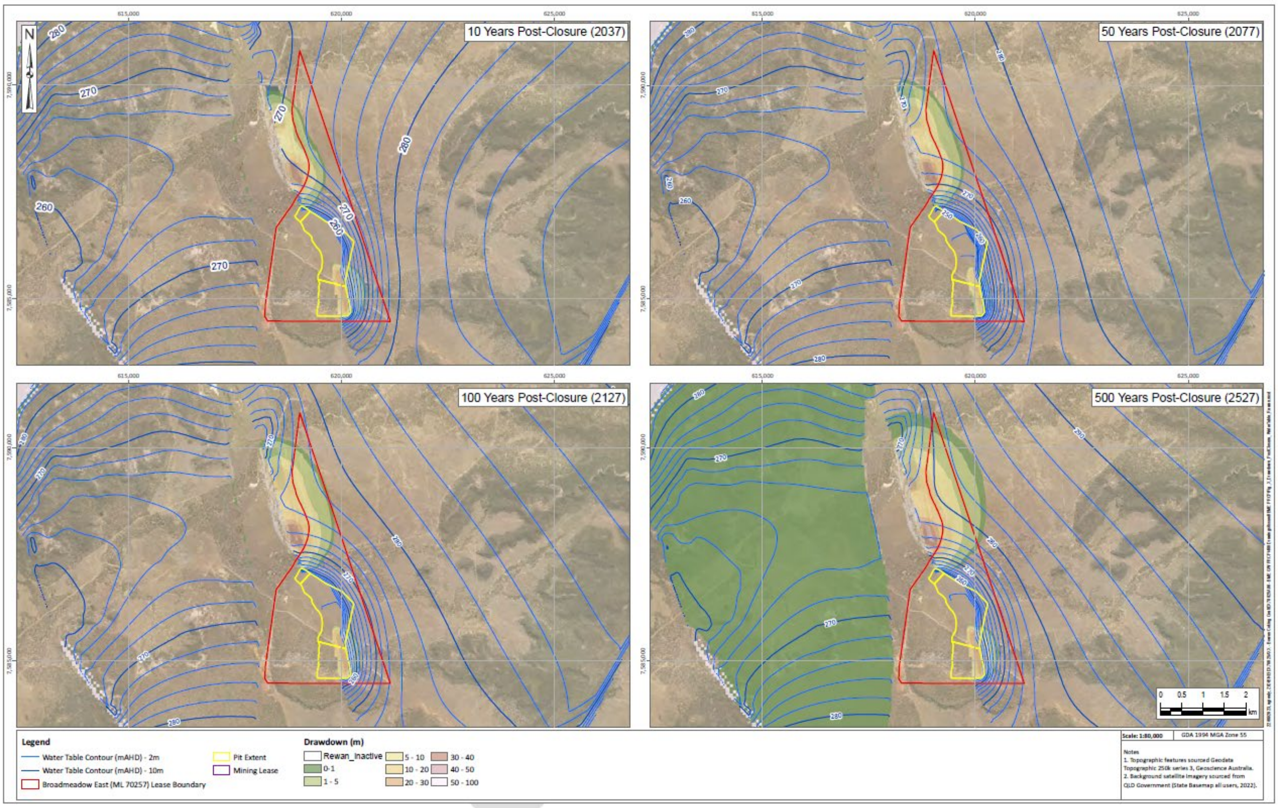


Figure 5.5 Post-Closure Head for Rewan Group – 10, 50, 100 and 500 years Post-Closure

Given the ephemeral nature of the alluvium and the lack of hydraulic connection with the underlying formations, no impact on groundwater receptors associated with the alluvium is predicted.

Changes in local groundwater quality associated with the post-closure landform may potentially occur if former voids behave as a ‘source’ rather than a ‘sink’, and the following is generally noted (KCB, 2024):

- Voids become sources when water levels rise to above pre-mining groundwater levels.
- Voids are referred to as sinks when the surrounding groundwater system flows into them.

The Southern Void is predicted to result in a groundwater sink following the recovery of groundwater levels to post-closure equilibrium conditions. Therefore, outflow from the void to the surrounding groundwater system is not predicted (KCB, 2024). As a result, the water quality of the void water is not predicted to impact the surrounding environment and associated environmental values. The Project has a number of groundwater trigger values in place within the EA to monitor key analytes including pH, sulfate, chloride and dissolved metals, designed to detect potential changes in groundwater quality and indicating potential impact. These trigger levels will remain relevant into the closure period.

Groundwater hosted in the hydrostratigraphic units underlying the Project is generally of a poor quality with low yields and high salinity. There are limited beneficial uses for the groundwater, which is supported by the limited number of water supply bores in the vicinity of the Project (KCB, 2024). Some bores have been identified as potential water supply bores and are located approximately 1.7 km south of BME, with one water supply bore in the northern portion of the mining lease.

Terrestrial groundwater dependent ecosystem (GDE) mapping across the Project area identified potential terrestrial GDEs located along Hat Creek. The potential terrestrial GDEs are generally associated with the alluvium aquifers (KCB, 2024). There is no predicted change to groundwater quality in the alluvium of Hat Creek and no predicted change to the groundwater levels during the closure period. Therefore, no discernible impacts to the potential terrestrial GDEs are predicted (KCB, 2024).

The potential impact to the environmental value of groundwater from the post-closure landform, and proposed change to backfill levels in the Southern Void, is considered to be low to negligible.

5.2.2 Groundwater bores

This assessment of impacts to groundwater relates to the proposed change of location for groundwater monitoring bores (refer Section 4.3).

The intent of the bores is to monitor for any potential impacts to groundwater caused by mining activities. The installation of groundwater monitoring bores is a low-risk activity with a small disturbance footprint. It is regularly performed as part of resource activities, and there are guidelines which outline how to undertake installation in accordance with best industry practice. BCC uses the guideline *Minimum Construction Requirements For Water Bores In Australia* (National Uniform Drillers Licensing Committee, 2020) to install and manage groundwater monitoring bores to meet Condition D17 of the EA.

Monitoring bores are already authorised in the EA, and condition D18 of the EA states that *"Any groundwater monitoring bores that are mined through during operations must be replaced…"* Therefore, it is considered that any impact to the environmental value of groundwater from the installation of replacement bores is negligible, and balanced by the benefit they provide to groundwater environmental values.

5.2.3 Groundwater quality limits

This assessment of impacts to groundwater relates to the proposed change to groundwater quality limits (refer Section 4.4). The new limits have been derived as per the guideline *Using monitoring data to assess groundwater quality and potential environmental impacts* (DES, 2021). The aim of this guideline is to calculate appropriate site-specific trigger values, to improve monitoring and early detection of environmental harm. In addition, KCB (2024a) has prepared a technical memo providing methodology and justification for the revised quality limits (refer **Appendix D**).

5.3 Wetlands

There are two wetland areas within ML70257 (as shown on Figure 5-6), being:

- An area of lacustrine wetland mapped around a large man-made dam towards the north of the lease
- An area of riverine wetland co-located with the mapped areas of Regional Ecosystem (RE) 11.3.25 along Hat Creek and Teviot Brook.

The riverine wetland is not classed as a Matter of State Environmental Significance (MSES), such as a Wetland Protection Area (WPA) or High Ecological Significance (HES), under the Queensland Wetland Mapping.

The proposed amendments relating to groundwater bore locations (refer Section 4.3) and groundwater quality limits (refer Section 4.4) are covered in this section. Amendments relating to void backfill levels (refer Section 4.1), the Southern Void NUMA (refer Section 4.2) and central in-pit spoil dump (refer Section 4.5) are not located in the wetland areas. As detailed in Section 5.1 and Section 5.2, the Southern Void is a sink, not a source, and therefore will have no impacts to wetlands above what has already been assessed and authorised.

Figure 5.6 Wetlands across the BME site

Source: RPM Global (2023a)

5.3.1 Groundwater bore locations

The proposed changes to groundwater monitoring bores includes the installation of replacement bore MBBE0011 in alluvium just south of Hat Creek, within the mapped riverine wetland area. The other three replacement bores (MBBE0009, MBBE0010, MBBE0012) are not located within wetland areas.

The intent of the bores is to monitor for any potential impacts to groundwater caused by mining activities. The installation of groundwater monitoring bores is a low-risk activity with a small disturbance footprint. It is regularly performed as part of resource activities, and there are guidelines which outline how to undertake installation in accordance with best industry practice. BCC uses the guideline *Minimum Construction*

Requirements For Water Bores In Australia (National Uniform Drillers Licensing Committee, 2020) to install and manage groundwater monitoring bores to meet Condition D17 of the EA.

Monitoring bores are already authorised in the EA, and condition D18 of the EA states that *"Any groundwater monitoring bores that are mined through during operations must be replaced…"* Therefore, it is considered that any impact to the wetland environmental values from the installation of replacement bores is negligible, and balanced by the benefit they provide to groundwater environmental values.

5.3.2 Groundwater quality limits

The change to quality limits relates only to bores MBBE0001, MBBE0007 and MBBE0009, none of which are located in a wetland area (refer Figure 5-7). MBBE0007 and MBBE0009 are located just south of the riverine wetland area. The new limits have been derived as per the guideline *Using monitoring data to assess groundwater quality and potential environmental impacts* (DES, 2021). The aim of this guideline is to calculate appropriate site-specific trigger values, to improve monitoring and early detection of environmental harm.

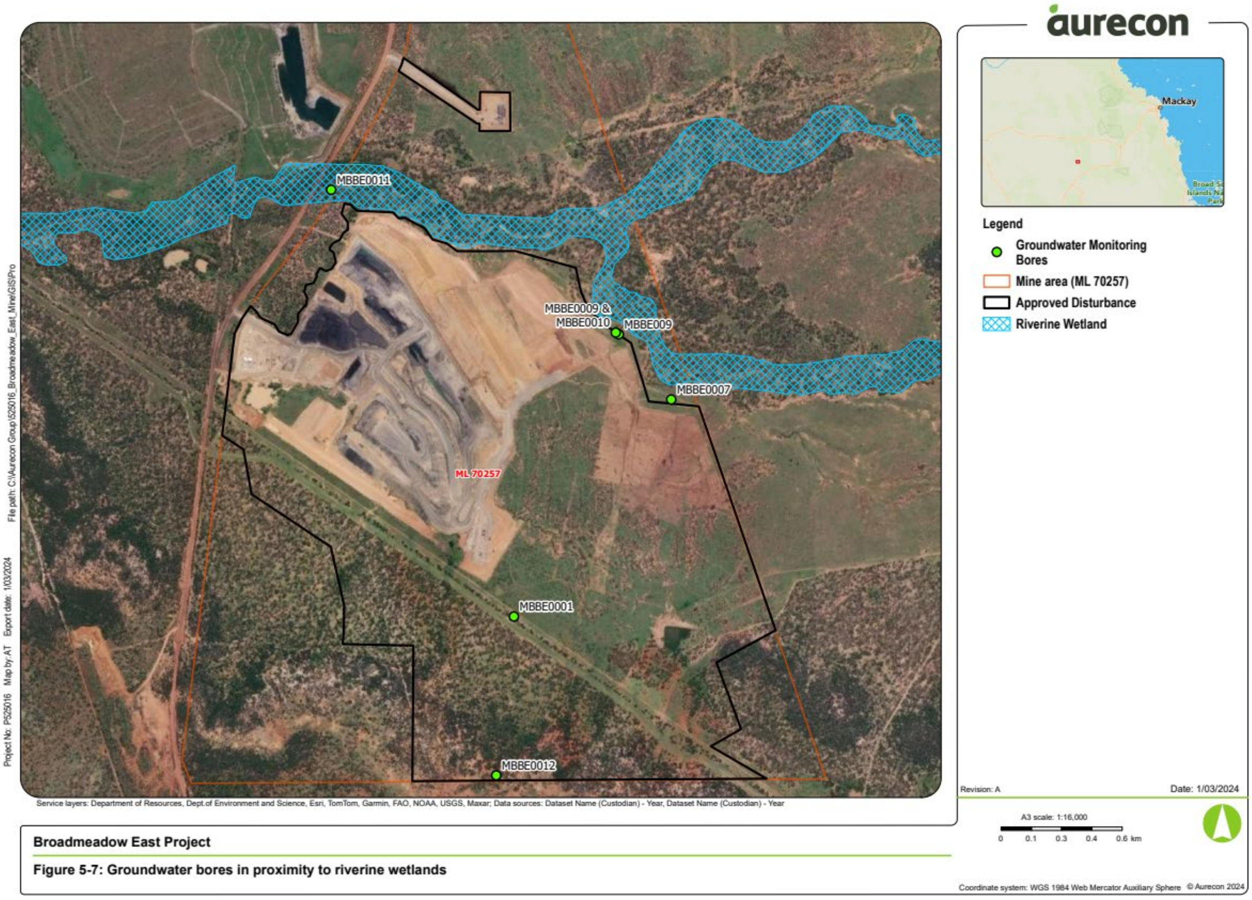


Figure 5.7 Bores in proximity to riverine wetlands surrounding BME

5.4 Air

The Project location is a considerable distance from any known sensitive receptors, with no sensitive receptors within a 10 km radius of the Project area (RPM Global, 2021). The proposed amendments will have a negligible impact on the environmental value of air.

Additionally, the proposed amendments do not seek to increase air quality levels authorised in Condition B2 of EA0002465. The Proponent currently implements monitoring and mitigation measures as detailed in the Air Quality Monitoring and Management Plan required by Condition B3 of EA0002465.

5.5 Acoustic

The previous major EA amendment for the Project (RPM Global, 2021) identified that activities will be well below the proposed noise limits for all sensitive receptors. Furthermore, there are no sensitive receptors in close vicinity to the project, as stated in Section 5.4.

The proposed amendments will not cause additional noise or vibration impacts. The Proponent currently implements noise and vibration monitoring and mitigation measures as detailed in the Noise and Vibration Management Plan required by Condition E2 of EA0002465.

5.6 Waste

This section also addresses *Section 23 – Waste* of the application form, which requires a description of the proposed measures for minimising and managing waste generated by amendments to the relevant activity.

The proposed amendments do not propose any change to the amount or type of waste, including regulated waste, being generated, handled or disposed of.

A Waste Management Plan has been developed and implemented for the Project which includes management and mitigation measures around the generation, handling and disposal of waste as is required by Condition F1 of EA0002465.

5.7 Land

The proposed amendments relating to void backfill levels and the Southern Void NUMA are covered in this section. The amendment relating to central in-pit spoil dump terminology does not relate to land and will not impact environmental values of land, and therefore is not discussed further in this section. Similarly, the change to groundwater quality limits will not impact environmental values of land, has been assessed for impacts to surface water and groundwater, and therefore is not discussed further in this section.

The amendment relating to groundwater bores is a low-risk activity with a small disturbance footprint, undertaken in accordance with Condition D17 of the EA which states that *"The construction… of groundwater bores…must be undertaken in a manner that prevents or minimises impacts to the environment..."* Therefore, this amendment is not discussed further in this section.

5.7.1 Void backfill levels

The proposed reduction in the backfill level of Southern Void will not result in any changes to the final landform design that compromise landform stability, increase erosion potential or result in the introduction of any new contaminants into the environment including impacts to lands or soils, above what is already authorised in EA0002465.

All other conditions of the EA will still be complied with, including the following 'safe' and 'stable' criteria from *Appendix 5 Table G2* to ensure the safety and stability of the Southern Void.

A number of mitigation measures will be implemented, as required by EA0002465, to minimise or avoid impacts to land. A geotechnical report and certification from an Appropriately Qualified Person (AQP), that the area has achieved stable condition, will be obtained as per Table G2 of the EA.

The proposed reduction in the backfill level of Southern Void does not introduce any new contaminants into the environment including impacts to lands or soils or seek to change existing measures required to design the landform and ensure its stability.

5.7.2 Final landform design

The final landform design for the Project is shown in Figure 5-8. It is proposed that this figure replace *Appendix 4 Figure 4 - Final Landform* in the EA (refer Section 8.1.4). As described throughout the PRCP (RPM Global, 2023a), the final landform consists of two out of pit dumps that closely border a predominantly backfilled pit to pre-mining topography with a Southern Void remaining in the location that mining ceases.

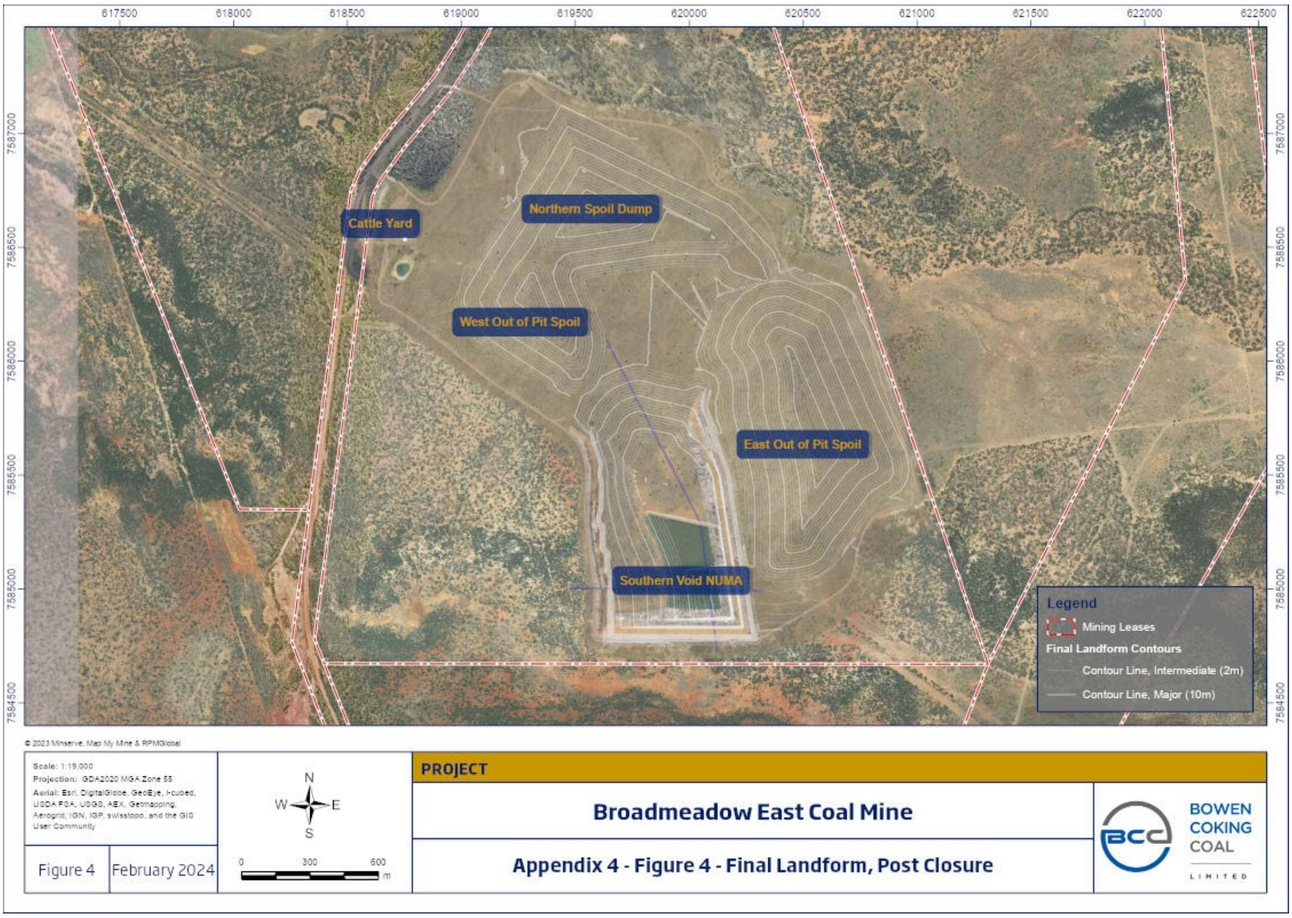


Figure 5.8 Final landform design

Source: RPM Global (2024), using data from Minserve

5.7.3 Southern Void NUMA

The Southern Void will border the central in-pit spoil dump (currently known as Central Pit) and be established during the final years of mine life. The pit floor includes the reshaped and topsoiled/seeded low wall and topsoiled ramp that will connect the rehabilitated central in-pit spoil dump to the void lake beach to allow livestock access in a controlled manner. The pit floor will become available for reshaping to the final landform during the two years post closure rehabilitation activities.

The partial backfill of the Southern Void will cover the coal seam and will also have appropriate slopes to allow cattle to access the water source. The entire perimeter of the South Void will have a fence offset by 30 m from the edge, and gates will allow controlled access of livestock.

Although this application seeks to change components of the Southern Void from a PMLU of livestock drinking water to a NUMA, the landholders will still seek to use the water in the void for livestock (refer Section 7) whilst water quality is suitable for stock watering. As the WBM (refer Section 5.1.2) forecasts pit water salinity to be greater than >10,000 µS/cm within 70 years of closure, it is likely that the void water may be used for livestock drinking for the first few decades after mine closure, until water quality deteriorates to a point where this is no longer possible.

Drainage and pit protection infrastructure (e.g. levee/road) along the Southern Void highwall is proposed to remain post-closure to direct surface water around Southern Void towards Hat Creek to the North. This ensures the natural catchment area (~35 ha) that would otherwise report into the pit, is instead redirected towards Hat Creek and retained in the receiving environment catchment.

The Proponent has engaged with multiple stakeholders on the final landform design. Input, such as access, locations for grazing trials and preferred seeding mixes, have been considered in the development of the design. Consultation with the underlying pastoral landholder will be ongoing as the grazing trials are implemented and relevant monitoring data obtained (RPM Global, 2023a).

The Southern Void has been designed to meet criteria from the land outcome document (LOD), being Table G2 of the EA. Table 5-4 identifies criteria from the EA that relate to the NUMA. Figure 5-9 provides a visual representation of the NUMA area and design aspects. It is proposed that this figure be added as *Appendix 4 Figure 5 - Visualisation of final landform design aspects* in the EA (refer Section 8.1.5). Figure 5-10 and Figure 5-11 provide cross-sections of the Southern Void (NUMA and PMLU aspects).

Table 5-4 Final Southern Void NUMA dimensions and criteria

Design Aspect	Final Landform Criteria
Footprint	31 ha
Depth	105 m
End wall length	700 m
Highwall length	1200 m
Highwall and end wall slope (final pit walls (competent material))	70 degrees
Highwall and end wall slope (final pit walls (incompetent material))	45 degrees
Low wall length	1050 m
Low wall (final pit wall (incompetent material))	45 degrees
Inpit spoil slope (unrehabilitated)	Angle of repose nominally 37 degrees
Maximum void lake equilibrium level	Will not reach 300 m AHD
Surface water catchment	167 ha
Factor of Safety	≥1.5

A Factor of Safety (FoS) has been included in the above table, which was initially proposed in the major EA amendment of 2021 but was not included in Tables G1 or G2 of the EA at the time. When this FoS was proposed, it was developed in consideration of coal mining EAs in the local region with similar geologic profiles. The following coal mines were considered and had a similar FoS (≥1.5) for rehabilitated landforms (in both approved PRCP Schedules and EAs):

- Isaac River Coal Mine PRCP_EA100114091_V2
- New Lenton Coal Mine EPML00475513
- Middlemount Coal Mine EPML00716913

Geotechnical concerns are expected to be minimal and managed in line with standard industry practice. This is supported by a technical report prepared by RGS (2022) which found that, '*The Projects open pits are shallow (relative to other coal open pits) and the geotechnical issues associated with slumping or failure of the in-pit end tipped slopes will be managed using standard industry practices*.' This report (RGS, 2022) informed both the major EA amendment application in 2021, and subsequently the PRCP application.

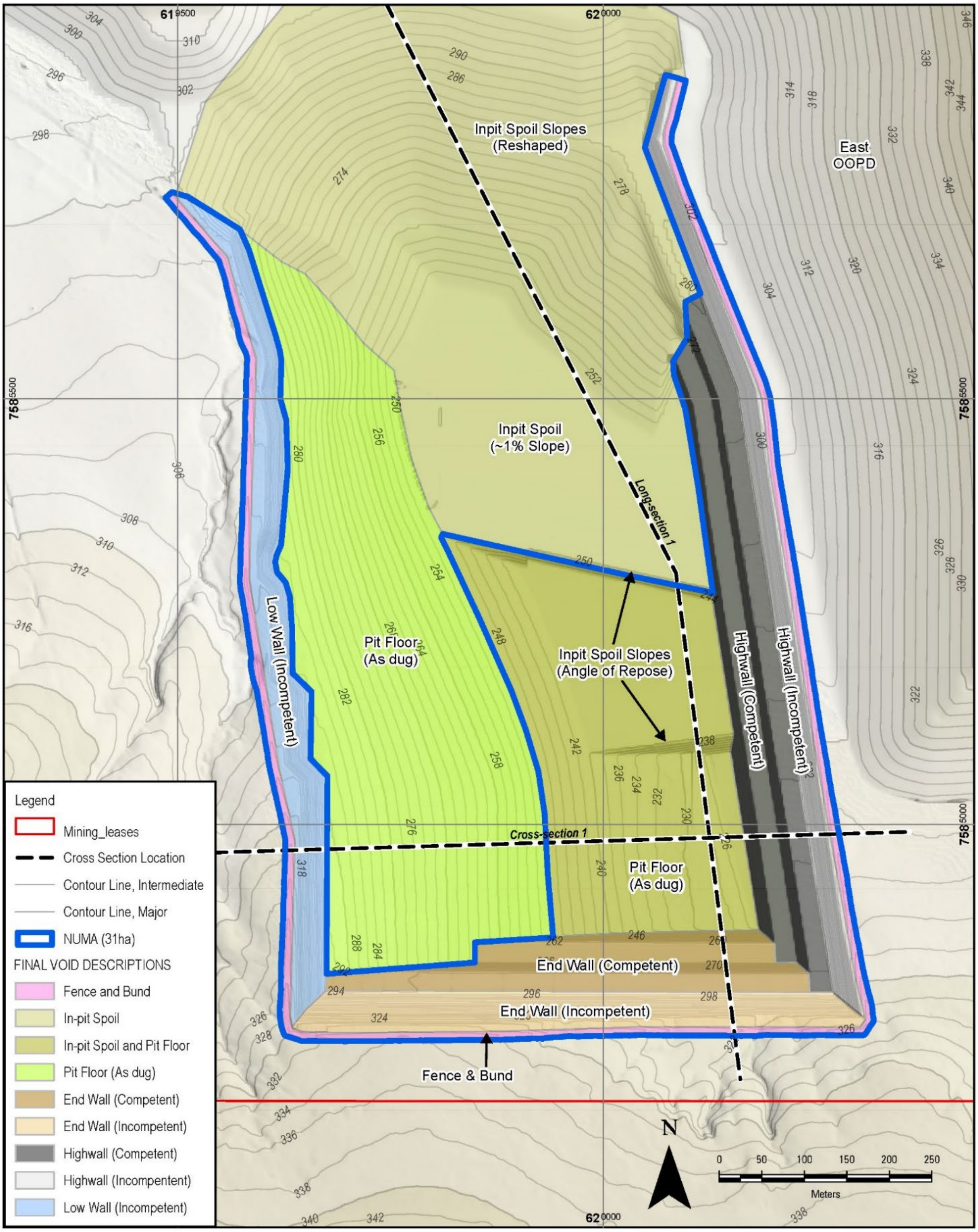


Figure 5.9 **Visualisation of final landform design aspects**

Source: Minserve (2024a)

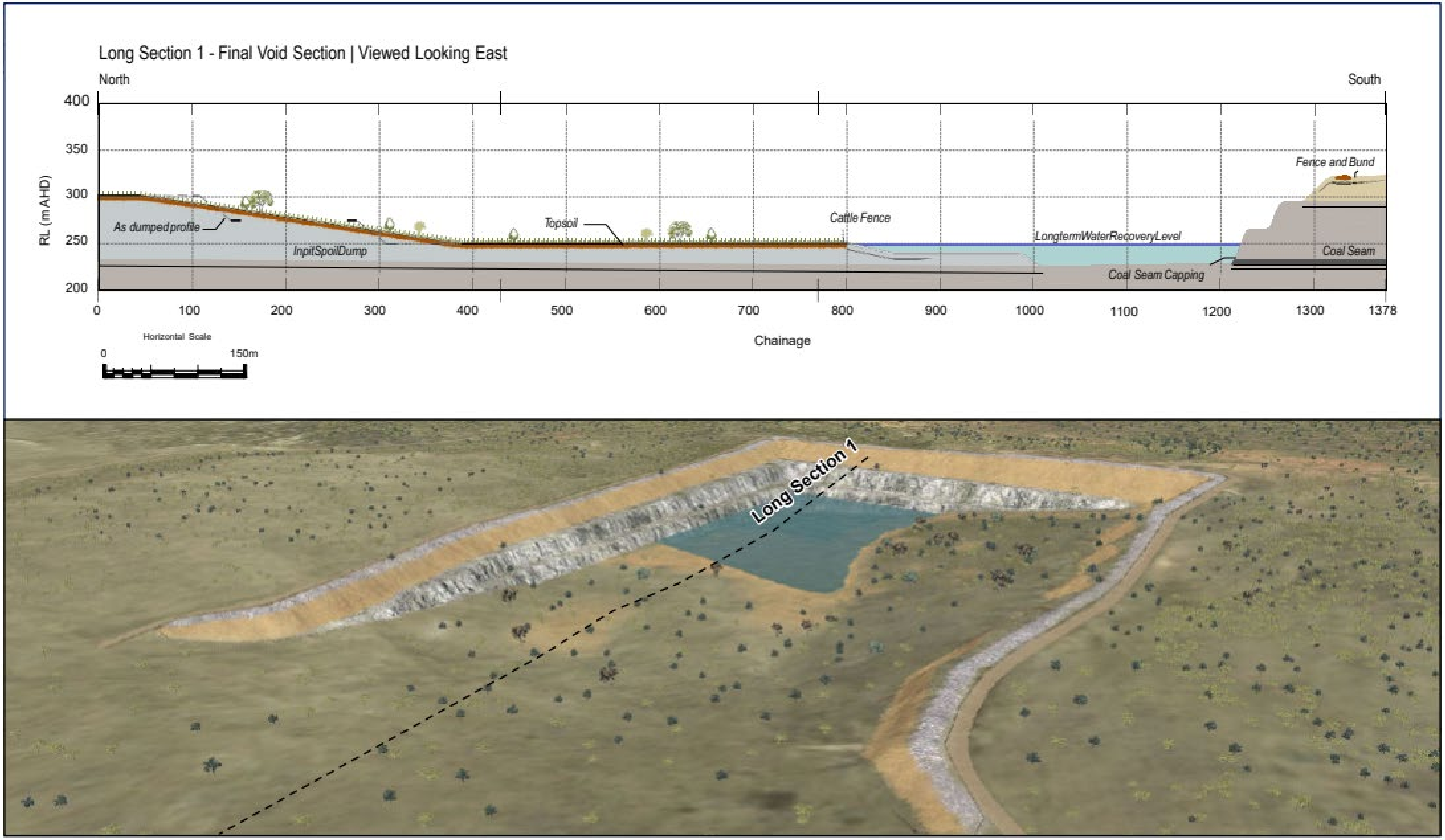


Figure 5.10 Final Southern Void Section (looking East and South)

Source: Minserve, recreated in RPM Global (2023a)

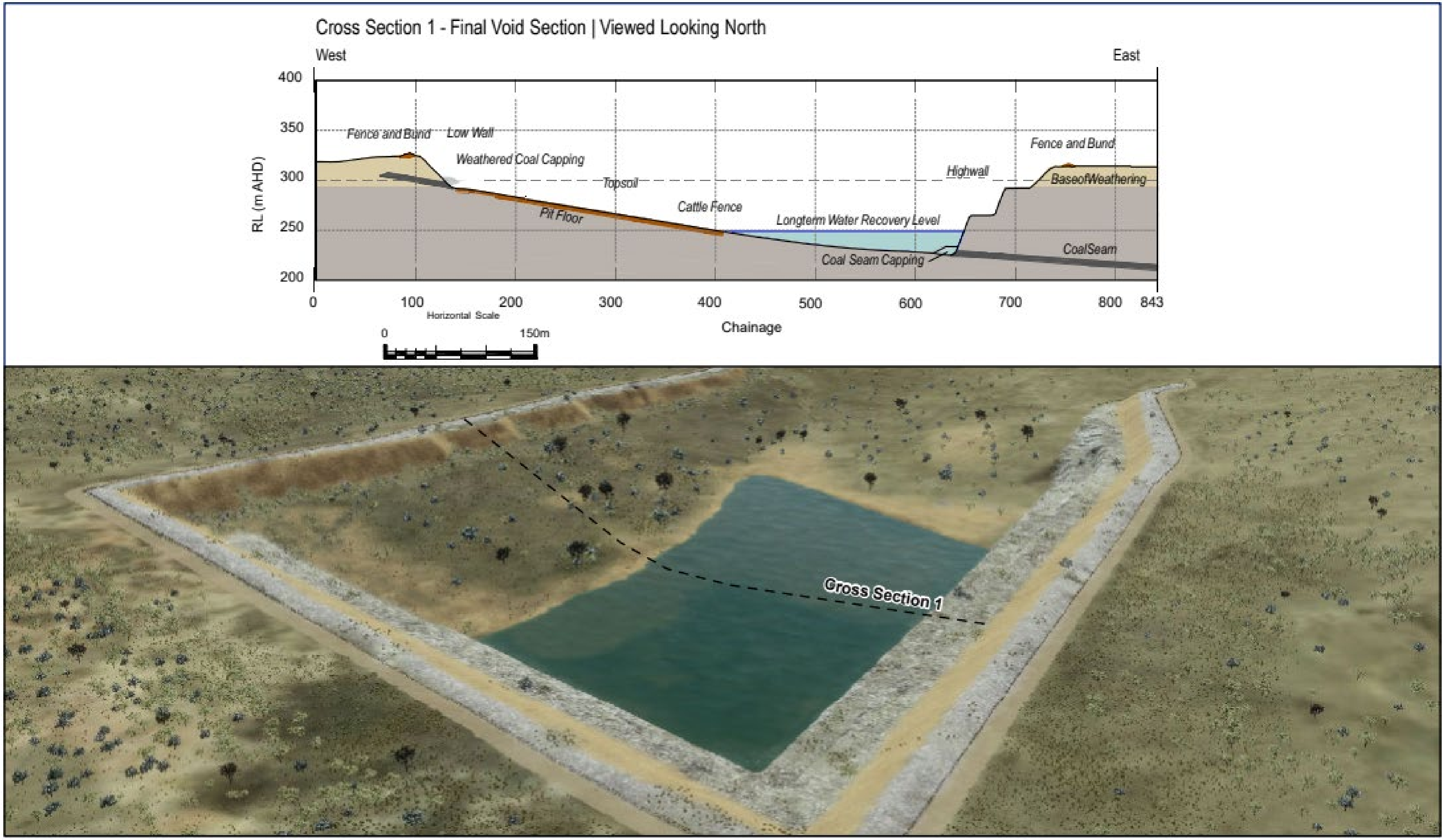


Figure 5.11 Final Southern Void Section (Looking North)

Source: Minserve, recreated in RPM Global (2023a)

5.7.4 Land Suitability Class

Table G1 of the EA includes both pre and post mining land suitability classes, referring to both cattle grazing and rainfed broadacre cropping. The pre-mining land suitability class is 4 and 5 for cattle grazing for most domains, while the post-mining land suitability class is authorised as 4 for cattle grazing across all relevant domains (not including the Southern Void which is requested to be a NUMA).

Additionally, in the Table G2 of the EA it states, '*Results, that rehabilitated areas meet the land suitability assessment that meets class 4 for cattle grazing as defined by the Guideline for Agricultural Land Evaluation in Queensland (2015)*'.

These pre- and post-mining land use suitability classes were determined as part of a soil and land assessment (SGM, 2021) to support a major EA amendment application in 2021. This assessment had regard to the *Guideline for coordinated projects involving clearing for agriculture (land suitability requirement)* (DNRME, 2018) and *Guideline for Agricultural Land Evaluation in Queensland* (DSITI & DNRM, 2015). With regards to the land suitability assessment for cattle grazing, SGM (2021) determined that approximately 91.1% of the mining lease was classified as Class 4 land, with nutrient deficiency as the limiting factor. The remaining ~8.9% was classified as Class 5 land, with salinity as the limiting factor (refer Figure 5.12).

The recent technical paper *Rehabilitated mined land suitability for beef cattle grazing in the Bowen Basin* (OQMRC, 2023), released by the Office of the Queensland Mine Rehabilitation Commissioner acknowledges that class 4 rehabilitated land may be used for grazing, with appropriate management techniques, including grazing management practices which considers shorter grazing periods if required due to climatic conditions (i.e., drought).

As such, the EA authorises class 4 cattle grazing as a post mining land use, which was originally supported by a soil and land assessment (SGM, 2021) which followed DSITI & DNRM (2015). Class 4 cattle grazing is also a supported post mining land use, if appropriate management techniques are applied (OQMRC, 2023).

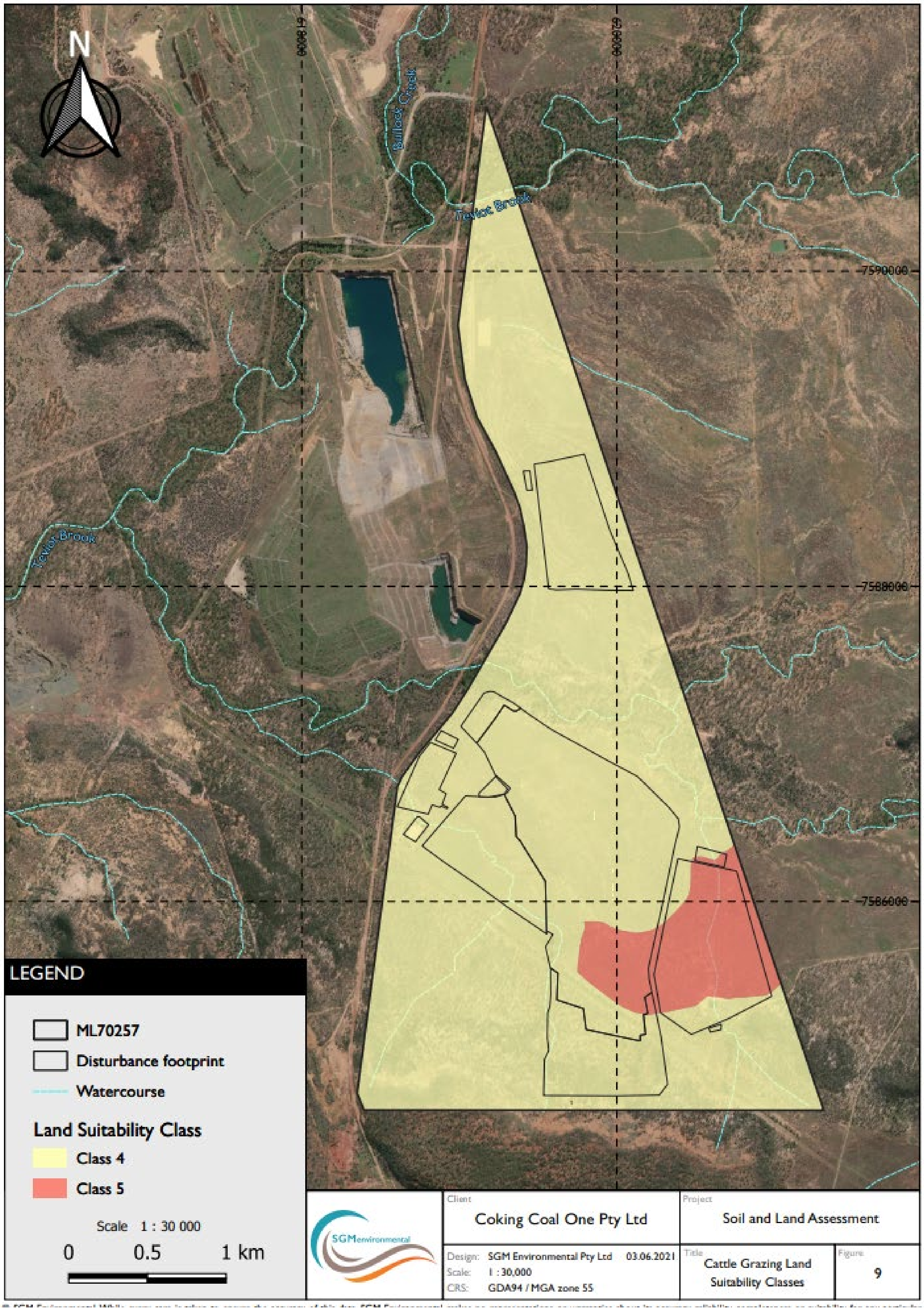


Figure 5.12 Land Suitability Class for Cattle Grazing

Source: SGM (2021)

In relation to management techniques to support class 4 cattle grazing outcome, BCC has committed to criteria and validation methods in the EA at Tables G1 and G2 which are considered appropriate to support the post mining land outcome, including:

a) Weed management
b) Erosion management
c) Ensuring resilience to fire and drought

d) Soil nutrient concentrations and nutrient cycling comparable to reference sites

The soil and land assessment (SGM, 2021), also outlined mitigation and contingency measures to ensure class 4 cattle grazing would be sustainable, including:

i. Managing soil erosion and sediment transport
ii. Dust mitigation
iii. Prevention of soil contamination
iv. Minimizing soil degradation
v. Soil management (i.e., volume, stripping, stockpile management and soil application)

Where suitable, these measures have been incorporated into the Broadmeadow East Mine Progressive Rehabilitation and Closure Plan (RPM Global, 2023a), including topsoil stockpile management and topsoil stripping depths and potential amelioration techniques (refer section 3.5.1.3).

Landholders routinely operate pastoral grazing practices on land that would be classified as class 4 under DSITI & DNRM (2015); with suitable, sustainable grazing management practices established over many generations. This applies to the current landholders and is expected to continue to apply post closure.

6 Justification for NUMA

The following section describes the inability of the residual void (Southern Void) to sustain a PMLU (Section 6.1), and the location, size and extent of the NUMA (Section 6.2).

A NUMA means an area of land the subject of a PRC plan that cannot be rehabilitated to a stable condition after all relevant activities for the PRC plan carried out on the land have ended. The Information Sheet: Non-use Management Areas (DES, 2020) states that the department's expectations for best practice management of a NUMA would result in the area being made safe and structurally stable so that it causes no environmental harm, despite a post-mining land use not being achievable. This is the Proponent's aim for the outcome of the Southern Void (refer Section 6.3).

The PRCP Guideline (DES, 2023b) states that DESI will not approve a NUMA unless the following is proven:

1. information demonstrating that the proposed footprint of each NUMA is as small as practicable
2. an assessment of the NUMA location options, having regard to the constraints of the resource location, with an analysis of the potential environmental harm and sensitivity of the surrounding environment of each option
3. a description of the proposed location of each NUMA and the environmental values of the surrounding environment
4. evidence showing how the proposed location will prevent or minimise environmental harm.

These aspects have been addressed in the following subsections (Sections 6.4 to 6.6).

A subsection on whether the void is in a floodplain is also included below (Section 6.7) to address this requirement of the NUMA information sheet.

6.1 Inability to sustain a PMLU

Currently, *Appendix 5, Table G2* of EA0002465 assigns the final land use for the Southern Void as PMLU – Water Storage (suitable for stock watering as per the Guidelines). For a PMLU to be acceptable to the administering authority, the Proponent must be able to rehabilitate the land to a stable condition.

In accordance with section 111A of the EP Act, land is in a stable condition if:

- the land is safe and structurally stable, and
- there is no environmental harm being caused by anything on or in the land, and
- the land can sustain a PMLU.

Section 6.3 outlines the technical studies which have been undertaken in relation to mine stability for the Project. Although the final Southern Void landform will cause no environmental harm, the predicted decline in water quality post-closure (refer Section 5.1.2) is no longer able to sustain the PMLU of Water Storage (suitable for stock watering) long-term as previously planned and must therefore be assessed as a NUMA.

Advice was received from the administering authority dated 30 November 2023 (refer **Appendix E**) which advised the Proponent to modify the PMLU of the Southern Void to a NUMA through an EA amendment rather than via the PRCP process.

6.2 Extent of NUMA

Figure 6-1 shows the nominated PMLUs that were submitted as part of the transitional PRCP on 29 September 2023 (noting this was before the administering authority advised that the Southern Void would not meet the PMLU criteria).

The area being nominated for the NUMA is the collective of the areas marked as "fence and bund" (orange), "south water storage – remnant walls" (brown), and "pit lake" (blue) in Figure 6-1. A visualisation of the NUMA is shown in Figure 6-2.

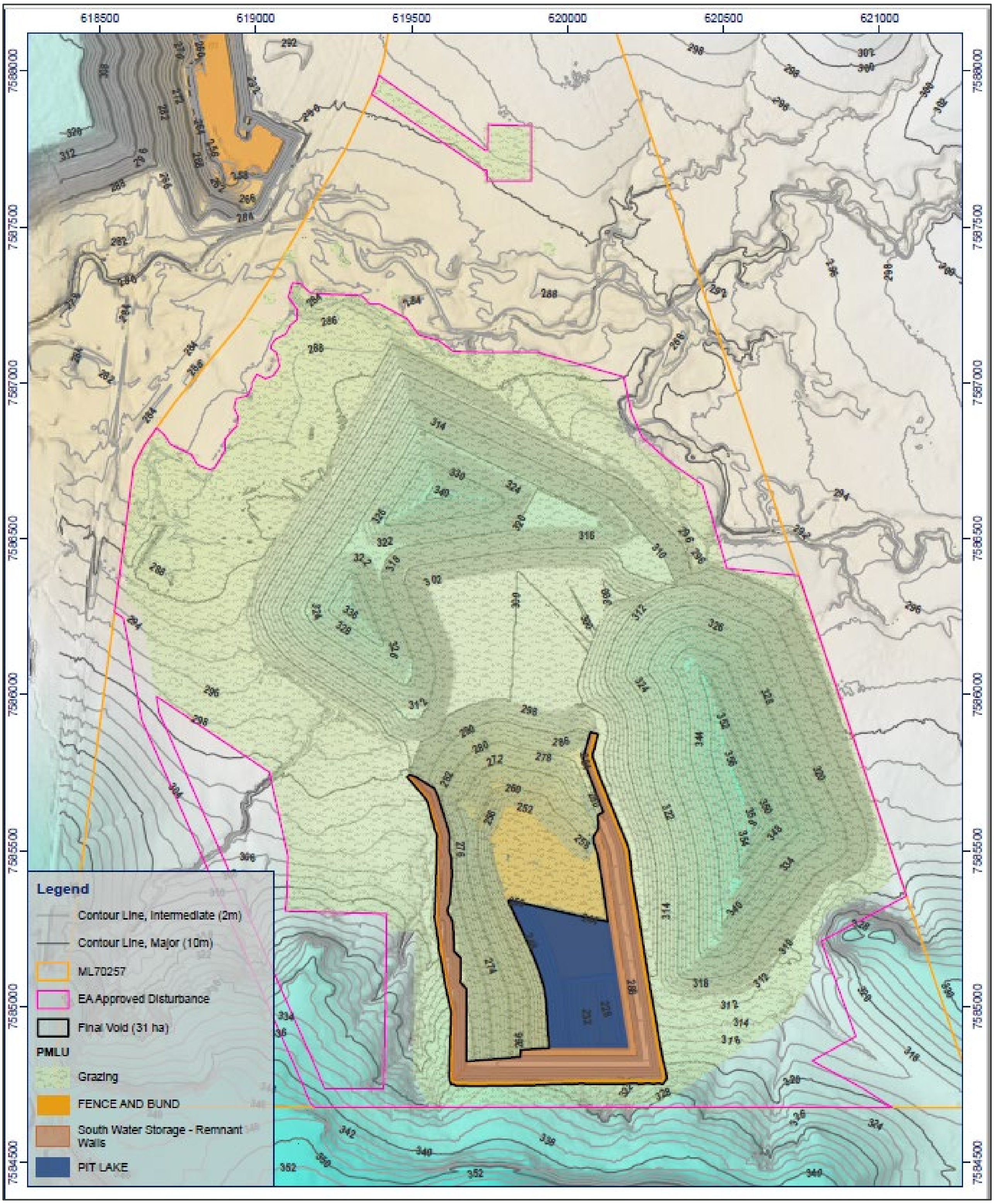


Figure 6.1 Nominated PMLUs

Source: RPM Global (2023a)

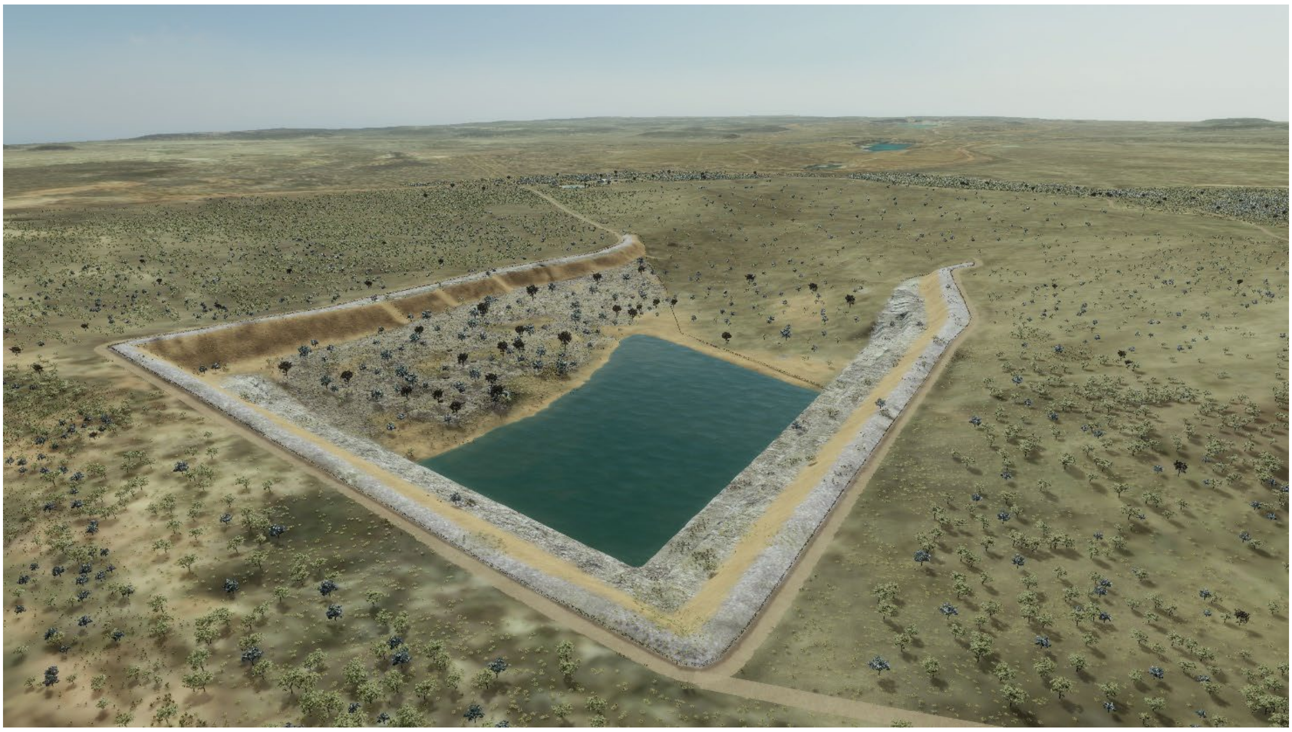


Figure 6.2 Visualisation of NUMA

Source: Minserve (2024b)

6.3 Safe and stable

The following technical studies have been undertaken in relation to mine stability for the Project:

- preliminary geotechnical assessment (GTS, 2021)
- mine material assessment and landform stability assessment (RGS, 2022)
- erodibility testing and erosion modelling on the 2023 final landform design (Landloch, 2023).

RGS (2022) noted that the Project's pit is shallow (relative to other open-cut coal pits), and that potential slumping or failure will be managed using standard industry practices.

Final landform construction management, technical supervision and QA/QC will be done by an AQP who can make sure that construction is carried out in accordance with the design plan. A QA/QC document would be prepared by an AQP to verify that the final landform design has been done in accordance with the design plan and is stable as per the PRCP.

A minimum Factor of Safety (FoS) has also been identified for the Southern Void (≥ 1.5) and included in the EA at Table G2.

6.4 Footprint minimisation

Approximately 10 ha of the 434 ha approved operational area of the Project will not be disturbed by the end of mine life (RPM Global, 2023a). As shown in Table 6-1, of the 424 ha disturbance area, 393 ha of the rehabilitated footprint will be a low intensity grazing PMLU, while 31 ha of rehabilitated land will be a NUMA for water storage (formerly a livestock watering PMLU). This equates to the Southern Void NUMA being approximately 7% of the total rehabilitated mine area. The areas in Table 6-1 are visualised in Figure 6-3.

Table 6-1 Final rehabilitated areas

Rehabilitation Areas	Description	Final land use	Area (ha)
RA1	Reshaped final landform	PMLU – Low intensity grazing	269
RA2	Mine infrastructure	PMLU – Low intensity grazing	71

Rehabilitation Areas	Description	Final land use	Area (ha)
RA3	Water infrastructure	PMLU – Low intensity grazing	22
RA4	Roads and access tracks	PMLU – Low intensity grazing	29
RA5	Exploration	PMLU – Low intensity grazing	1.6
RA6*	Southern Void water storage	NUMA – Water storage	31
		Total (approximate)	**424**

**Noting this will be changed to a Non-Use Management Area in the PRCP, once this EA amendment is approved.*

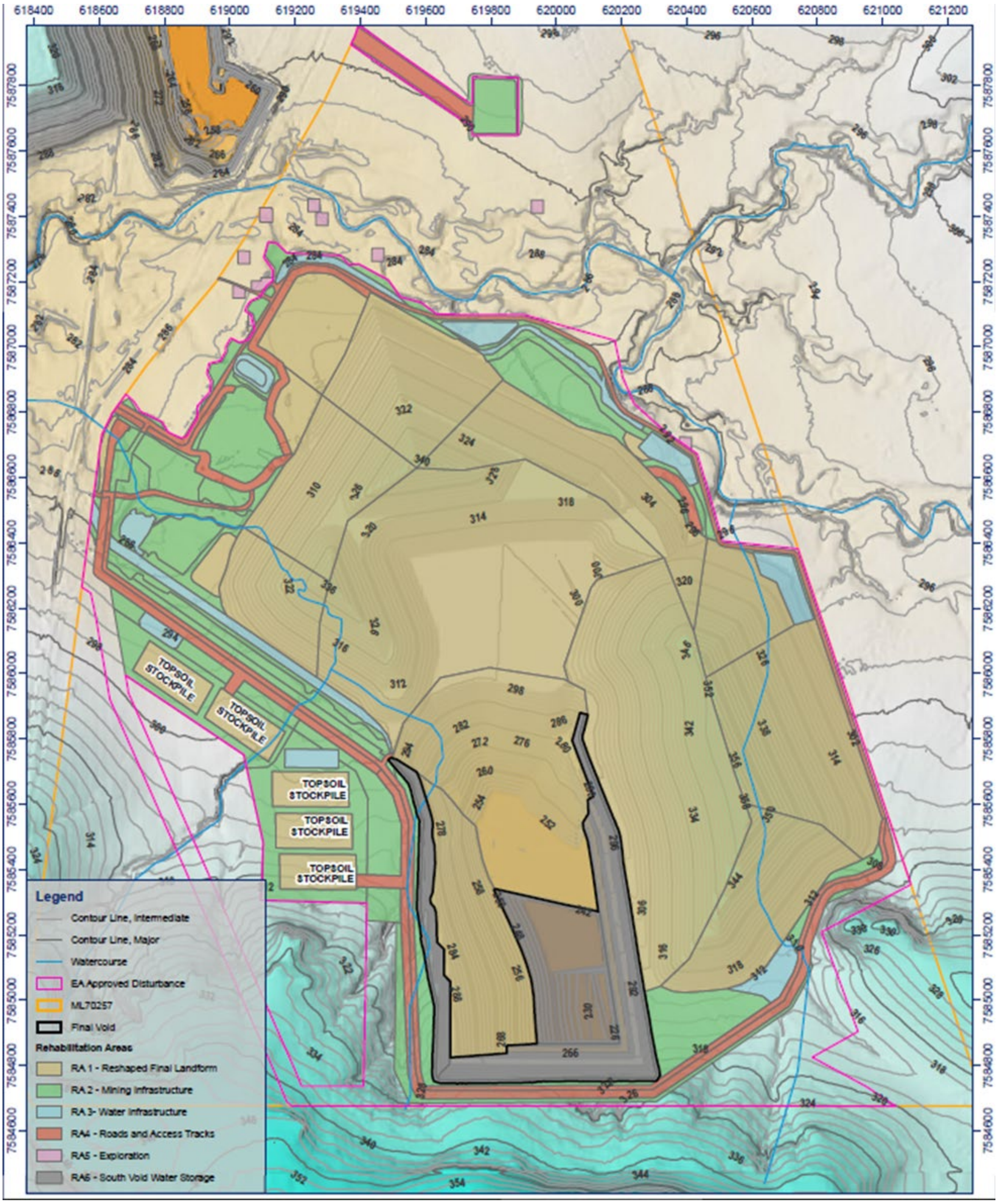


Figure 6.3 Rehabilitation Areas

Source: RPM Global (2023a)

As shown in Figure 6-3, the RA1 area surrounded by the RA6 high wall is classified as a "reshaped final landform", meaning it will be reshaped and topsoiled/seeded (RPM Global, 2023a). This area, which is part of the pit during operational life, is being specifically rehabilitated to minimise the size of the NUMA (RA6).

Other rehabilitation strategies to ensure minimisation of the Southern Void footprint include:

- void pit floor slopes ranging from 15 - 30% will be ripped and reshaped where necessary to achieve the rehabilitation criteria and minimise the final water storage (NUMA) size to 31 hectares.
- security fencing and safety bunds will surround the final NUMA low wall and high walls. The bunds near the wall crest will ensure water runoff over the walls is minimised to reduce potential erosion.
- remnant low wall weathered coal will be capped as part of the pit floor rehabilitation.
- partial backfill of the southern void will be undertaken as part of mining operations so that the void is minimised to achieve the final water storage size of 31 hectares.
- reshaping and rehabilitation works will ensure minimal exposed in-pit waste rock slopes.
- technical assessment of residual void design to confirm that the void will achieve post closure slopes and exhibit stability characteristics consistent with the relevant EA requirements.

Therefore, the size of the Southern Void NUMA has been minimised to as small as practicable, comprising 31 ha or ~7% of the total rehabilitated mine area.

6.5 Options analysis

Exploration and baseline technical studies were undertaken prior to the commencement of operations, in 2020 – 2021, to pinpoint the location of potential deposits (including Southern Void).

Environmental studies were simultaneously conducted on surface water, groundwater, land stability and erosion, air, noise, and ecology to aid in environmental management and approval, with impact assessments undertaken to inform how the mine could operate in a safe, economical, and environmentally and socially responsible manner. The environmental values and sensitivity of the environment surrounding the proposed NUMA and wider Project area are described in detail in the PRCP (RPM Global, 2023a).

Based on current technical knowledge, consistency with the regulatory requirements and obligations and the mines' unique characteristics, key management considerations and strategies for the proposed NUMA have been identified. A summary is provided below:

- Resource location and size:
  - the Southern Void location is approved in EA0002465 (refer section 6.6)
  - the size of the Southern Void NUMA has been minimised to 31 ha.
- Potential environmental harm:
  - the final mine design and plan identified that the Southern Void would be partially backfilled above the regional groundwater level – allowing the void to act a groundwater sink rather than a source which will prevent outflow from the void to the surrounding groundwater system with no impact to the surrounding environment and associated environmental values (i.e. harm minimisation).
  - the proposed reduction in the backfill level of Southern Void will not result in any changes to the final landform design that compromise landform stability, increase erosion potential or result in the introduction of any new contaminants into the environment including impacts to lands or soils, above what is already authorised in EA0002465.
- Sensitivity of the surrounding environment:
  - as described in the PRCP (RPM Global, 2023a), the regional topography of the mine is in an undulating valley of the Kerlong ranges that includes nearby mines with rehabilitated relevant activities with a similar final landform design.

- the Southern Void will not be seen from any sensitive receptor locations at ground level after it is transformed into water storage.
- as stated in the PRCP, the closest identified sensitive receptor to the Southern Void is Broadlea Station, approximately 12.5 km south of the final landform.

6.6 Location of NUMA

Condition G6 of EA0002465 states that only the residual void detailed in *Appendix 5 Table G1 Post Mine Land Use (PMLU) and Rehabilitation Methods* is permitted at the approved place located as per *Appendix 4 Figure 4 - Final Landform* (recreated in Figure 6-4). As such, the Proponent considers the location of the Southern Void NUMA to be already approved. This amendment seeks to change the rehabilitation outcomes associated with the residual void, from a PMLU to a NUMA.

The environmental values and sensitivity of the environment surrounding the proposed NUMA and wider Project area are described in detail in the PRCP (RPM Global, 2023a). An assessment of the potential impacts of the change from PMLU to NUMA is provided in Section 5 of this report.

Figure 6.4 Approved Final landform, post closure (EA0002465)

Source: BME Environmental Authority EA0002465

6.7 Void in floodplains

The Mined Land Rehabilitation Policy articulates the Queensland Government's expectations relating to voids situated in flood plains – the administering authority will not approve a proposed PRCP schedule that includes a void situated wholly or partly in a flood plain unless the void will be rehabilitated to a stable condition. New proposals to locate a void wholly or partly in a flood plain during the operational phase of a mine, must provide for the rehabilitation of the void to a stable condition at the end of the mine's life.

The main watercourse channel in the surrounding area is the Isaac River, which is located to the west of the ML boundary. As described in the groundwater report (KCB, 2024), Spade Creek and Hat Creek (tributaries of Teviot Brook and ultimately the Isaac River) flow through the north and central portions of the Project area, respectively. Unlike Isaac River, Spade Creek and Hat Creek do not have associated floodplains.

A small portion of the northern extent of the Project footprint overlies the mapped area of the Isaac River floodplain (refer Figure 6-5). However, as the proposed NUMA is in the southern area of the Project footprint, the void is not located near a floodplain.

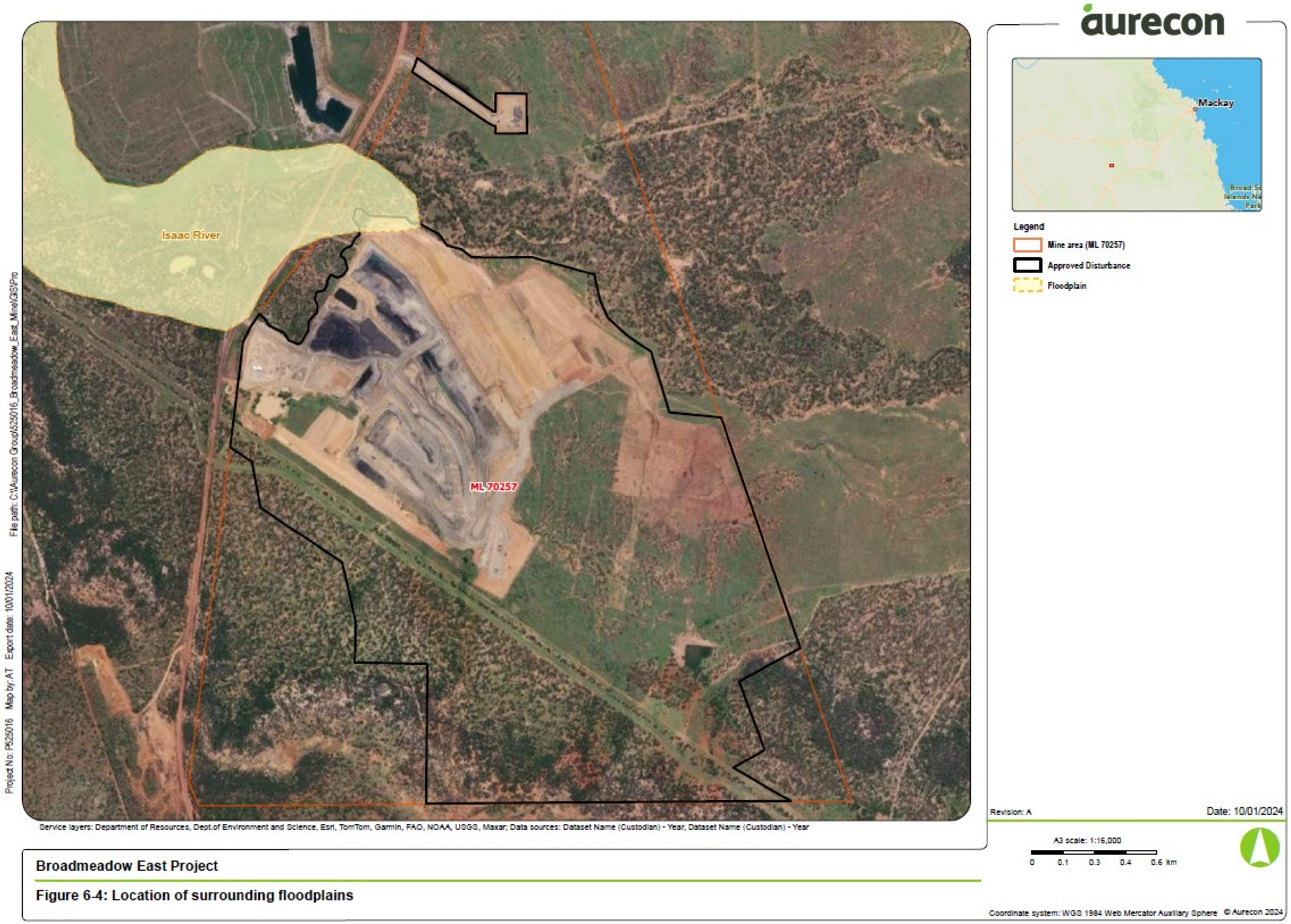


Figure 6.5 Location of surrounding floodplains

Section 41C of Environmental Protection Regulation 2019 (EP Regulation) states decision considerations for a void located wholly or partly in a flood plain as:

"A void is considered to be in a flood plain if modelling shows that, when all relevant activities carried out on the land have ended, the land is the same height as, or lower than, the level modelled as the peak water level 0.1% annual exceedance probability (AEP) for a relevant watercourse under the guideline Australian Rainfall and Runoff (2019) (ARR)."

As specified in the PRCP, the one void remaining post-closure (i.e. Southern Void) is not within a floodplain; however, it is subject to interaction with the localised overland flow that predominantly interacts with the perimeter of the rehabilitated final landform, including the Southern Void. A final landform flood assessment was conducted to address the requirements of the PRCP and to define the potential impacts on the receiving environment throughout and after the life of the mine (Engeny 2023). Flood modelling of final landform conditions was undertaken for selected design events (50%, 20%, 10%, 1%, 0.1% AEP and PMF modelled scenarios) and 1% and 0.1% AEP with climate change sensitivities The results for a 0.1% AEP event are included below as this is the value specified in the PRCP guideline (DES, 2023b) for consideration of voids in flood plains.

The 0.1% AEP flood depth mapping around the final landform is shown in Figure 6-6. The results of the flood assessment Engeny (2023) found that for a 0.1% AEP event:

- There would be an area of ponding against the eastern toe of the final landform (<0.6 m) with velocities against the landform of <1.5 m/s.
- There would be some areas of up to 1.8 m flood level and velocities exceeding 2 m/s around the western side, where drainage will be provided along the final landform edge at the toe of the embankment.
- No flood ingress into the void.
- There would be an area on the southeast side of the final landform where ponding will reach up to 2.5 m and velocities exceeding 3 m/s within the drain.
- There would be a flood depth of up to 1 m and velocities exceeding 1.5 m/s within the drain at the southeast side of the final landform.

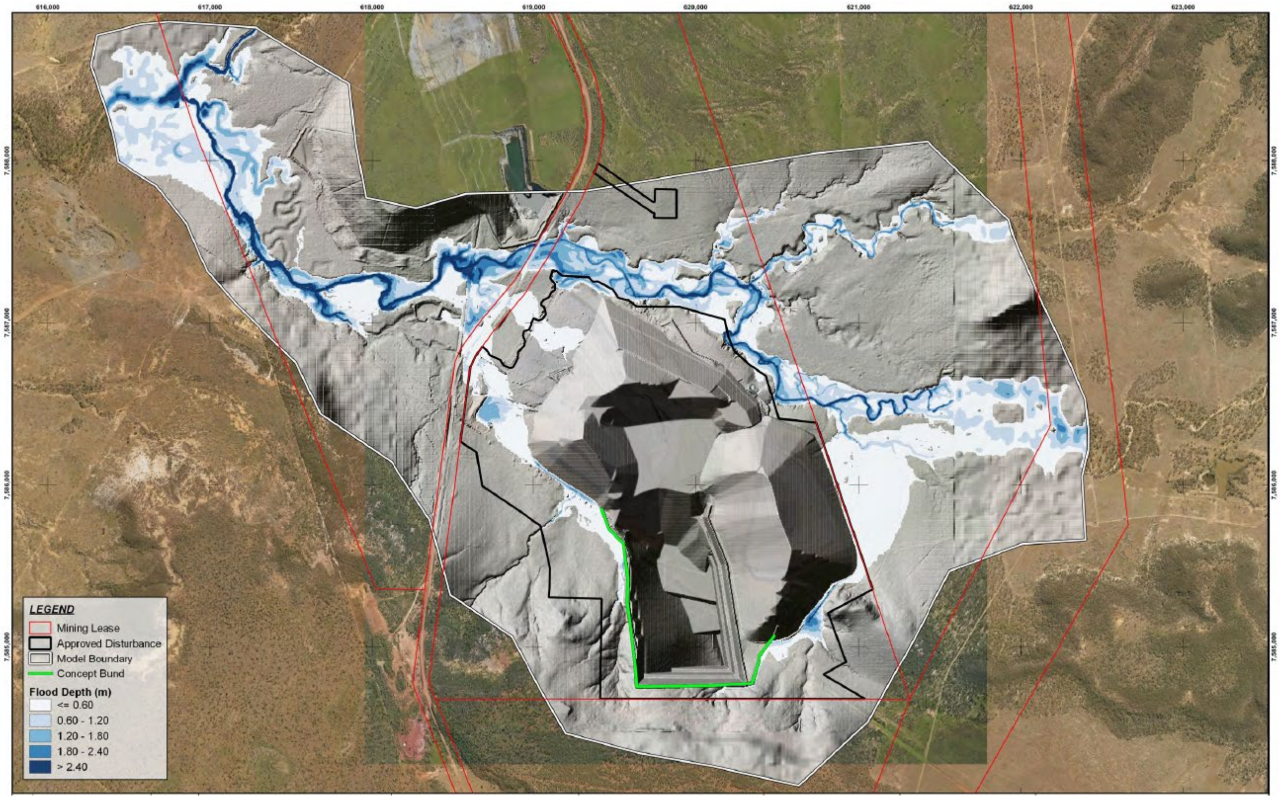


Figure 6.6 **0.1% AEP flood depth**

Source: Engeny (2023) – Appendix A9

7 Landholder engagement

The underlying land tenure of the entire ML is Lot 13 on Plan 178466 which is owned by a private landholder under a rolling pastoral lands lease due to expire on 30 September 2062.

On the 3 August 2023, the Proponent met with Malcolm and Sue Burston, the pastoral lease holders for Lot 13 on Plan 178566. The purpose of this meeting was to discuss the closure outcomes for the Project with the pastoral lease holders, who were identified as stakeholders as part of the development of the PRCP (i.e., consultation register).

The Southern Void was a key component of this discussion, and the Proponent described the outcome of water storage, and potential water quality degradation in the long term, for this domain and sought feedback from Malcolm and Sue Burston (RPM Global, 2023b). The following feedback was received:

- The pastoral lease holders would prefer for livestock to access the void lake directly via the final established ramp.
- It was proposed that the Proponent install controlled access to the water storage via a perimeter fence and gate at the ramp access point. The intent would be so the graziers could decide whether they would release the cattle to access the water storage, based on monitoring results.
- The pastoral lease holders will seek as much water storage as possible for livestock and potential irrigation, which may include mixing and diluting void water to improve quality in the longer term.

The above feedback has been considered as part of the development of the PRCP. For instance, the Southern Void will include fencing and gates, and slopes that are appropriate to allow cattle to access the water source.

Overall, the Burston's were generally satisfied with the proposed rehabilitation outcomes, including the design of the Southern Void and proposed backfill level.

Although this application seeks to change the Southern Void from a PMLU of livestock drinking water to a NUMA, the Burston's still seek to use the water in the void for livestock, whilst water quality is suitable for stock watering. As the WBM (refer Section 5.1.2) forecasts pit water salinity to be greater than >10,000 µS/cm within 70 years of closure, it is likely that the void water may be used for livestock drinking for the first few decades after mine closure, until water quality deteriorates to a point where this is no longer possible.

8 Proposed Condition Changes

This section addresses *Section 12 – Seek to vary conditions* of the application form, which requires:

a) Condition number(s)

b) Proposed change

c) Justification for the change.

The primary sections of the EA proposed to be changed are provided below in Sections 8.1.1 to 8.1.7. Justification for these changes was provided in Section 4. **Appendix A** is a word version of the current EA with tracked changes of all items proposed below.

In addition to the primary changes outlined in Sections 8.1.1 to 8.1.7, a number of minor changes administrative in nature are proposed (mostly relating to the terminology change of central pit). These are summarised below, but full conditions are not included. However, **Appendix A** contains all tracked changes.

Conditions requiring a change of terminology from central pit to ‘central in-pit spoil dump’ include the following:

- Condition F17
- Table G1 (disturbance area rows 2, 3 and 4)
- Table G2 (Central In-Pit Spoil Dump section).

In addition, sub-point e) of Condition G10 is proposed to be removed, which is "a study of void capability to support a PMLU of stock watering as per the relevant Water Quality Objectives". This is no longer relevant given the Southern Void is no longer proposed as a PMLU of stock watering.

8.1.1 Table D1 Groundwater monitoring locations and frequencies

Legend:

Green text = new

~~Red text with strikethrough~~ = proposed to be removed

Table 8-1 Proposed new wording of Table D1

Location Description	Monitoring Point	Environmental Value Monitoring	Easting (GDA20/ Zone 55)	Northing (GDA20/ Zone 55)	Pre-mining baseline standing water levels (mbTOC)[6]	Drawdown Trigger Levels (m)	Groundwater trigger elevation (mAHD)[4]	Monitoring Frequency
Monitoring Bores								
Rangal Coal Measure	MBBE0008	Groundwater	620294	7585092	~~19.59~~ 18.64	5	282.62	Quarterly measurements of SWL[5] Quarterly EC and pH Six monthly for remaining analytes
~~Rangal Coal Measure~~	~~BDW172 (54) [1]~~	~~Groundwater~~	~~619376~~	~~7586650~~	~~19.83~~	~~35~~	~~234.52~~	
~~Rangal Coal Measure~~	~~BDW8C [1]~~	~~Groundwater~~	~~619782~~	~~7585651~~	~~21.54~~	~~63~~	~~217.61~~	
Rangal Coal Measure	MBBE0012	Groundwater	619797	7584702	~~46.91~~ 46.43	10	~~336.49~~ 280.23	
~~Rangal Coal Measure~~	~~BDW5C [1]~~	~~Groundwater~~	~~619687~~	~~7586758~~	~~15.74~~	~~5~~	~~271.40~~	
~~Rewan Group~~	~~BDW172 (32) [1]~~	~~Groundwater~~	~~619376~~	~~7586650~~	~~13.32~~	~~7~~	~~269.03~~	
Rewan Group	MBBE0010	Groundwater	620362	7586723	~~19.5~~ 21.36	5	~~291.63~~ 267.23	
Tertiary Sediments	MBBE0002b [2]	Terrestrial GDE within the riparian corridor near Hat and Spade creek	618436	7585329	12.57	2	331.86	

Basalt	MBBE0003 [2]	Groundwater	618431	7584664	N.A	N.A ~~5~~	N.A	
Alluvium	MBBE0004 [2]	Terrestrial GDE within the riparian corridor near Hat and Spade creek	620205	7586976	N.A	N.A ~~2~~	N.A	
~~Alluvium~~	~~MBBE0006 [1, 2]~~	~~Terrestrial GDE within the riparian corridor near Hat and Spade creek~~	~~619173~~	~~7587205~~	~~N.A~~	~~2~~	~~N.A~~	
Alluvium	MBBE0011	Terrestrial GDE within the riparian corridor near Hat and Spade creek	619058	7587386	N.A	N.A	~~284.34~~ N.A	
Compliance Bores								
Rangal Coal Measures	MBBE0001 [1, 3]	Groundwater	619884	7585428	~~42.20~~ 17.11	57	~~206.01~~ 241	Quarterly measurements of SWL[1] Quarterly EC and pH Six monthly for remaining analytes[2]
Rewan Group	MBBE0007	Groundwater	620615	7586415	~~24.90~~ 18.22	23	~~249.92~~ 273	
Rangal Coal Measures	MBBE0009	Groundwater	620376	7586715	~~22.3~~ 24.74	3	~~291.65~~ 267.48	

NOTE:

1. *To be monitored until mined out.*
2. *Some bores are often dry and unavailable for water levels.*
3. *MBBE0001 to be replaced ~~in Year 3~~ by MBBE0009 ~~another bore~~*
4. *Groundwater trigger elevations are conversion of drawdown trigger levels(m) to mAHD – metres above Australian height Datum*
5. *Quarterly or more frequently following granting of this Environmental Authority*
6. *mbTOC – metres below top of casing*

8.1.2 Table D2 Groundwater quality limits

Legend:

Green text = new
~~Red text with strikethrough~~ = proposed to be removed

Table 8-2 Proposed new wording of Table D2 – Groundwater quality limits

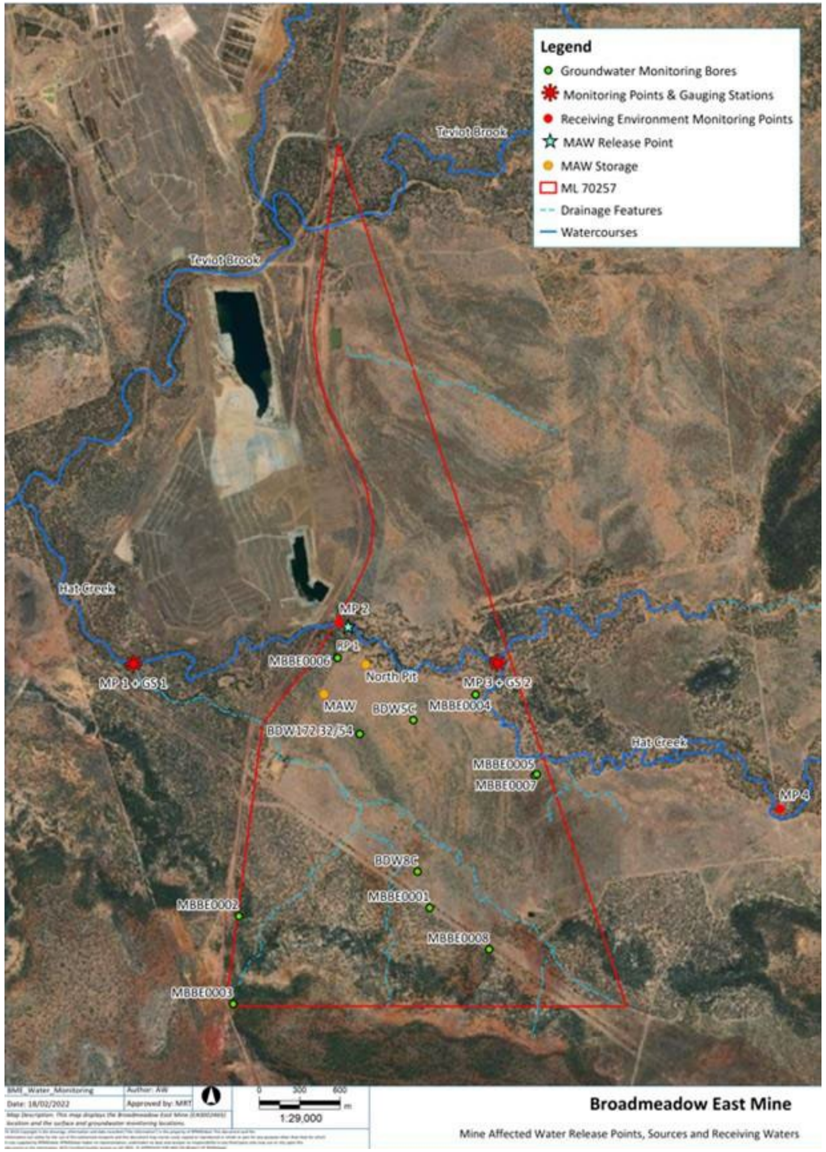
Monitoring point	**Parameter**	**pH**	**EC**	**Sulfate (SO₄)**	**Arsenic**	**Aluminium**	**Molybdenum**	**Selenium**	**Major ions**
	Sample	**Range**	**Max**	**Max**	**Max**	**Max**	**Max**	**Max**	**Interpretation Only**
	Unit	**pH units**	**(µS/cm)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	
MBBE0001		6.5 – 8.5	~~888.3~~ 901.7	~~0.5~~ 398	~~0.002~~ 0.013	0.08	~~0.001~~ 0.034	~~0.005~~ 0.013	
MBBE0007			~~48,540~~ 48,600	~~937.6~~ 961.5	~~0.005~~ 0.013	~~0.37~~ 0.055	~~0.025~~ 0.02	~~0.046~~ 0.013	
MBBE0009			16,000	398	0.013	0.055	0.034	0.005	

NOTE:

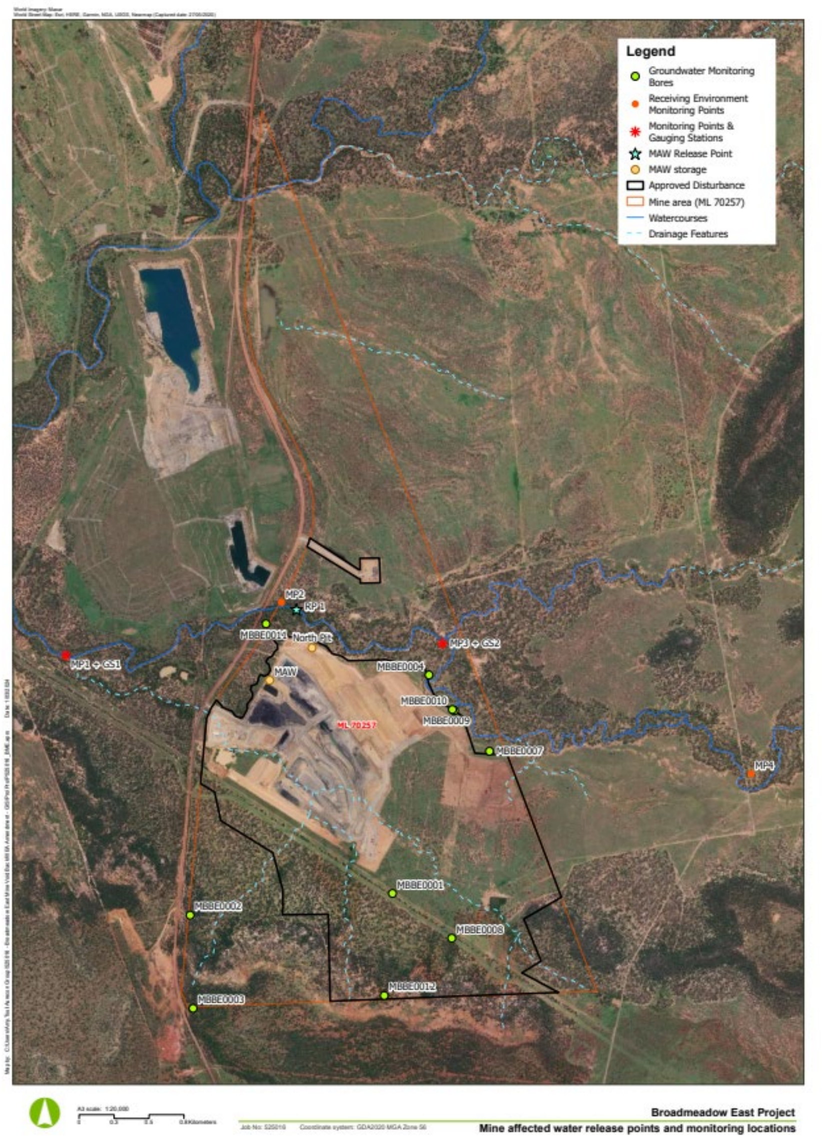
All metals must be measured as total (unfiltered) and dissolved (filtered). Trigger levels for metal apply if dissolved results exceed trigger. Triggers are based on 95th percentile results from all groundwater quality analyses from each monitoring bore.

8.1.3 Appendix 3 Figure 3 – Mine affected water release points and monitoring locations

Existing Figure in EA



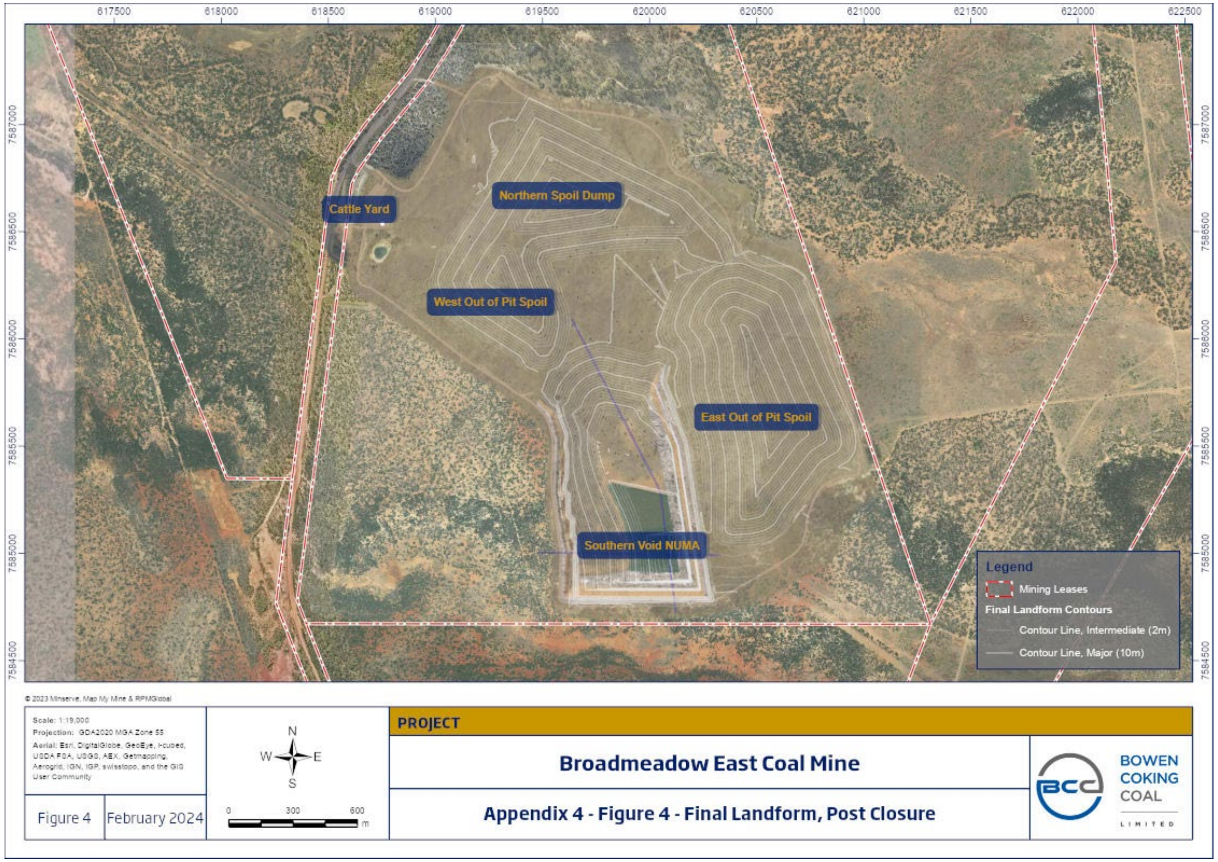
Proposed New Figure in EA



8.1.4 Appendix 4 Figure 4 – Final landform, post closure

<u>Existing Figure in EA</u>

<u>Proposed New Figure in EA</u>



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Scale: 1:19,000
Projection: GDA2020 MGA Zone 55
Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

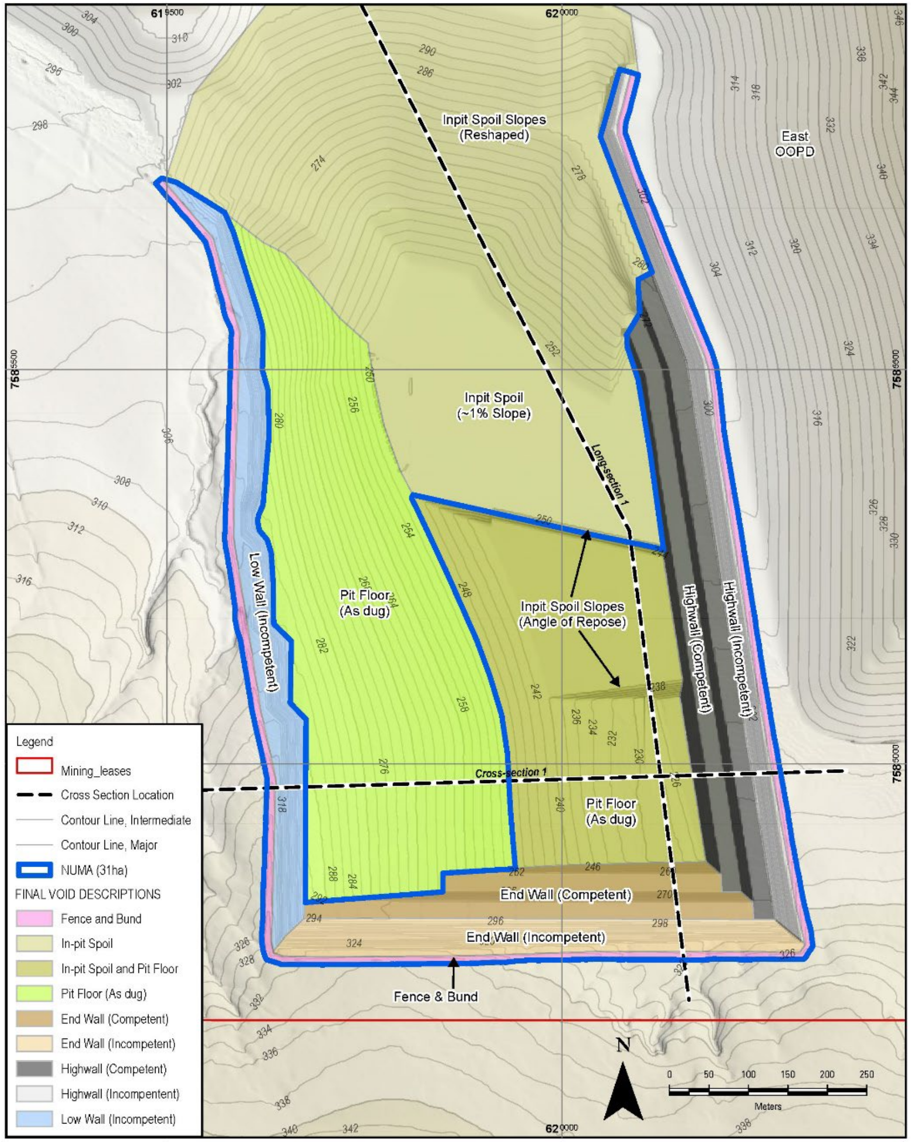
Figure 4 February 2024

Broadmeadow East Coal Mine

Appendix 4 - Figure 4 - Final Landform, Post Closure

8.1.5 Appendix 4 Figure 5 – Visualisation of final landform design aspects

<u>Proposed new figure in EA (no comparable existing figure)</u>



8.1.6 Appendix 5 Table G1 PMLU and Rehabilitation Methods

Legend:

Green text = new
~~Red text with strikethrough~~ = proposed to be removed

Table 8-3 Proposed new wording of Appendix 5 Table G1

Disturbance Area (DA)	Description	Pre-Mining Land Suitability Class		Rehabilitation Method	PMLU / NUMA	Post-Mining Land Suitability Class	
		Cattle Grazing	Rainfed Broadacre Cropping			Cattle Grazing	Rainfed Broadacre Cropping
4a. Southern Void - PMLU	The portion of the residual void remaining post mining at the southern pit extent that has a PMLU. Borders the ~~central backfilled void~~ central in-pit spoil dump	4 &5	4	▪ ~~Minimised void area and volume based on economic, engineering, geotechnical, geochemical, surface water and groundwater technical reporting outcomes (Condition G8).~~ ▪ ~~Design final slope angles of the high, low and end walls.~~ ▪ ~~Conduct long term water balance studies regarding void hydrology that includes surface water and groundwater assessments.~~ ▪ ~~Create a final void design plan. Predict long term water quality through geochemical modelling.~~ ▪ ~~Manage long term water quality for livestock consumption as per Australian and New Zealand Guidelines for Fresh and Marine Water Quality (the Guidelines).~~ ▪ ~~Backfill above the regional groundwater level, treat or remove exposed coal seams.~~ ▪ Develop specific rehabilitation strategies that includes monitoring, surveying, stability analysis and reporting.	~~Water storage~~ Low intensity grazing	4 (Low wall slopes)	N/A
4b. Southern Void - NUMA	The portion of the residual void remaining post mining at the southern pit extent that is a NUMA. Refer Appendix 4 Figure 5, area labelled “NUMA”.	4&5	4	▪ Minimised NUMA area based on economic, engineering, geotechnical, geochemical, surface water and groundwater technical reporting outcomes (Condition G8). ▪ Design final slope angles of the high, low and end walls. ▪ Conduct long term water balance studies	Water Storage (Non-Use Management Area)	N/A	N/A

Disturbance Area (DA)	Description	Pre-Mining Land Suitability Class		Rehabilitation Method	PMLU / NUMA	Post-Mining Land Suitability Class	
		Cattle Grazing	Rainfed Broadacre Cropping			Cattle Grazing	Rainfed Broadacre Cropping
				regarding void hydrology that includes surface water and groundwater assessments. - Backfill to a minimum of 225 RL, treat or remove exposed coal seams.			

8.1.7 Appendix 5 Table G2 PMLU and rehabilitation success criteria

Legend:

Green text = new
~~Red text with strikethrough~~ = proposed to be removed

Table 8-4 Proposed new wording of Appendix 5 Table G2

PMLU / NUMA	DA	Goals	Objectives/Indicators	Criteria	Validation Method
Southern Void - PMLU					
~~Water storage~~ Low intensity grazing	Southern Void	Safe Stable	a. Safety hazards in rehabilitation are as low as reasonably practical. b. Minimise void area. c. Stabilise walls and slopes.	▪ Install slopes and batters as per the void closure plan: • Overall slope: 15-30% • Vertical distance between berms: 20 m • Berm width: 5 m ~~• Final pit walls (Competent material): 70 degrees~~ ~~• Final pit walls (Incompetent material): 45 degrees~~ ~~• Inpit spoil slope (unrehabilitated): Angle of repose nominally 37 degrees~~ ~~• Void maximum surface area (31 ha).~~ ~~• Void maximum depth (105 m).~~ ~~• Maximum void lake equilibrium level will not reach 300 m AHD.~~ ~~• Backfill above the groundwater level (water level based on conceptual modelling).~~ ~~▪ Safety bund constructed at 2 m high, base width of 5 m from unweathered, freely draining, end- dumped rockfill at a minimum 20 m offset from the pit perimeter as per the closure plan.~~ ~~▪ Design the void as per the void closure plan.~~ ▪ Final shape implemented as per rehabilitation and management strategies included in the void closure plan. ▪ ~~Partial backfill according to above the groundwater level and as per the baseline groundwater assessment.~~ ▪ Geotechnical adequacy with a > 1.5 Factor of Safety (FoS).	▪ Geotechnical report and certification from an appropriately qualified and experienced person AQP that the area has achieved stable condition, including: • Residual void is geotechnically stable with FoS of > 1.5. ~~• Safety bund constructed in accordance with engineering requirements for height, based on crest width.~~ ~~• No public access to high wall or end wall areas.~~ ~~• Fence entire perimeter and bund to high wall areas.~~ • Absence of active rill/gully erosion ~~• Certification that drainage measures and structures have been appropriately established and are directing overland flow away from the highwall edge; and~~ • Certification that erosion and sediment control measures have been installed and are operating as designed ~~• Final void located outside of the Isaac River floodplain, as defined under the *Environmental Protection Act*.~~ • ~~Evidence, which has been certified by an appropriately qualified person, based on up to date groundwater modelling, that any final void lakes will not overflow nor potentially contaminate any other surface water bodies and groundwater~~

PMLU / NUMA	**DA**	**Goals**	**Objectives/Indicators**	**Criteria**	**Validation Method**
					~~aquifers.~~
		Non-polluting	Pit waters are contained such that they do not impact or interact surface or groundwater.	▪ Coal seams to be treated, removed or covered in the backfilling process. ▪ The installation of certified contours and drains as per design by an AQP (CPESC). ▪ Surface water quality of the receiving environment as per the water management plan. ▪ Groundwater aquifers maintain their pre-mining or reference bore water quality. ▪ Prescribed environmental matters maintain their pre-mining condition ▪ Groundwater quality as per the closure water management plan. ▪ No exposed hazardous material. ~~▪ Conduct a water balance study to assess the void surface and groundwater interactions.~~ ~~▪ Predict long term water quality for the overall final void system.~~	• Surface water and groundwater trigger limits assessed as per the frequencies noted in the closure water management plan. ~~• Certification by an AQP that the water level and quality will not cause harm to the surrounding environment.~~ • Groundwater monitoring demonstrates that the groundwater quality is within 95th percentile of the results of baseline pre-mining bore monitoring results, or when baseline is not available, reference bores which have not been impacted by mining activities.
		Self-sustaining	a. Adequate revegetation ~~and aquatic species richness~~. b. Littoral zone increases and linkages with terrestrial vegetation.	▪ Battered slopes with 60% vegetation cover as per the closure and revegetation plans. ▪ Structural, geotechnical and hydraulic factors based on the physical and chemical characteristics of the site. ▪ Spoil shaped to connect to the surrounding landscape where possible. ▪ No active erosion. ~~▪ Water quality suitable for stock watering as per Australian and New Zealand Guidelines for Fresh and Marine Water Quality (the Guidelines).~~	Post closure ~~aquatic,~~ flora and fauna ecological monitoring as per the monitoring plan.
Southern Void - NUMA					

Water Storage (Non-Use Management Area)	Southern Void	Safe
		Stable
			a. Safety hazards in rehabilitation are as low as reasonably practical.
			b. Minimise void area.
			c. Stabilise walls and
				▪ Install slopes and batters as per the void closure plan:
				  • Final pit walls (Competent material): 70 degrees
				  • Final pit walls (Incompetent material): 45 degrees
				  • Inpit spoil slope (unrehabilitated): Angle of repose nominally 37 degrees
				  • Maximum surface area (31 ha).
					▪ Geotechnical report and certification from an appropriately qualified and experienced person AQP that the area has achieved stable condition, including:
					  • Residual void is geotechnically stable with FoS of $\geq$ 1.5.
					  • Safety bund constructed in accordance

PMLU / NUMA	**DA**	**Goals**	**Objectives/Indicators**	**Criteria**	**Validation Method**
			slopes.	- Maximum depth (105 m). - Maximum void lake equilibrium level will not reach 300 m AHD. - Safety bund constructed at 2 m high, base width of 5 m from unweathered, freely draining, end- dumped rockfill at a minimum 20 m offset from the pit perimeter as per the closure plan. - Design the void as per the void closure plan. - Final shape implemented as per rehabilitation and management strategies included in the void closure plan. - Partial backfill to a minimum of 225 RL as per the void water balance modelling. - Geotechnical adequacy with a ≥ 1.5 Factor of Safety (FoS).	with engineering requirements for height, based on crest width. - No public access to high wall or end wall areas. - Fence entire perimeter and bund to high wall areas. - Absence of active rill/gully erosion - Certification that drainage measures and structures have been appropriately established and are directing overland flow away from the highwall edge; and - Certification that erosion and sediment control measures have been installed and are operating as designed - Final void located outside of the Isaac River floodplain, as defined under the *Environmental Protection Act*. - Evidence, which has been certified by an appropriately qualified person, based on up to date groundwater modelling, that any final void lakes will not overflow nor potentially contaminate any other surface water bodies and groundwater aquifers.
		Non-polluting	Pit waters are contained such that they do not impact or interact surface or groundwater.	- Coal seams to be treated, removed or covered in the backfilling process. - Surface water quality of the receiving environment as per the water management plan. - Groundwater aquifers maintain their pre-mining or reference bore water quality. - Prescribed environmental matters maintain their pre-mining condition - Groundwater quality as per the closure water management plan. - No exposed hazardous material. - Conduct a water balance study to assess the void surface and groundwater interactions. - Predict long term water quality for the overall final void	- Surface water and groundwater trigger limits assessed as per the frequencies noted in the closure water management plan. - Certification by an AQP that the water level and quality will not cause harm to the surrounding environment. - Groundwater monitoring demonstrates that the groundwater quality is within 95th percentile of the results of baseline pre-mining bore monitoring results, or when baseline is not available, reference bores which have not been impacted by mining activities.

PMLU / NUMA	DA	Goals	Objectives/Indicators	Criteria	Validation Method
				system.	
		Self-sustaining	N/A	- N/A	- N/A

Legend:

Green text = new
~~Red text with strikethrough~~ = proposed to be removed

9 Conclusion

The scope of this amendment application relates to the following:

- proposed change to the backfill level for the Northern Pit and Southern Void, following updated results from technical studies, including groundwater modelling and water balance modelling
- proposal for the Southern Void to be assessed as a non-use management area (NUMA) after a final void assessment indicated long term predictions of declining water quality that would prevent pit water meeting stock watering guideline values in perpetuity
- proposed change to groundwater monitoring bore locations, following the update to the Groundwater Monitoring and Management Plan (GMMP), required by the EA
- proposed change to groundwater quality limits, following the completion of the updated baseline study required by Condition D2(h) of the EA
- proposed change to central pit terminology to clarify it is an in-pit spoil dump.

An assessment of the proposed amendments against relevant environmental values was provided in Section 5, justifying that the proposed amendments do not significantly increase the level of environmental harm from the Project.

This application constitutes a major EA amendment under the EP Act, as it requires changes to the overarching ‘rehabilitation objectives’ in Table G2 of the EA0002465 and seeks approval for the Southern Void to be assessed as a NUMA rather than a PMLU. On 19 March 2024, DESI issued an Assessment Level Decision (ALD) Notice, which found that the application was properly made and a major amendment under the EP Act.

This amendment follows advice from the administering authority dated 30 November 2023 (refer **Appendix E**) which advised the Proponent to modify the PMLU of the Southern Void through an EA amendment rather than via the PRCP process. Details of and justification for the NUMA are provided in Section 6.

Given that the void is currently authorised as a PMLU in the LOD (i.e. EA0002465), and the only reason for changing this to a NUMA is the water quality not being suitable for stock watering in perpetuity, the Proponent considers that the proposed NUMA meets current best practice management. In addition, the water quality issue is confined to the area of the Southern Void, and the underlying pastoral holder is supportive of the proposed final landform and intends to utilise the pit water (refer Section 7).

This supporting document has also been updated to address queries raised in an Information Request Notice, issued by DESI on 2 May 2024.

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Appendix A

Draft Environmental Authority with Proposed Changes

Permit

Environmental Protection Act 1994

Environmental Authority EA0002465

This environmental authority is issued by the administering authority under Chapter 5 of the Environmental Protection Act 1994*.*

Environmental authority number: EA0002465

Environmental authority takes effect on 2 February 2023

Environmental authority holder(s)

Name(s)	Registered address
COKING COAL ONE PTY LTD	4/167 Eagle Street, Brisbane City, QLD 4000

Environmentally relevant activity and location details

Environmentally relevant activity/activities	Location(s)
Resource Activity, Schedule 3, 13: Mining black coal	ML70257
Resource Activity, Schedule 3, 09: A mining activity involving drilling, costeaning, pitting or carrying out geological surveys causing significant disturbance.	
Ancillary Activity, Schedule 2, 60(1): Operating a facility for disposing of, in a year, the following quantity of waste mentioned in subsection 1(a)—(d) more than 200,000t.	
Ancillary Activity, Schedule 2, 60(2): Operating a facility for disposing of, in a year, the following quantity of waste mentioned in subsection (1)(b)—(c) more than 5,000t but not more than 10,000t.	

Additional information for applicants

Environmentally relevant activities

The description of any environmentally relevant activity (ERA) for which an environmental authority (EA) is issued is a restatement of the ERA as defined by legislation at the time the EA is issued. Where there is any inconsistency between that description of an ERA and the conditions stated by an EA as to the scale, intensity or manner of carrying out an ERA, the conditions prevail to the extent of the inconsistency.

An EA authorises the carrying out of an ERA and does not authorise any environmental harm unless a condition stated by the EA specifically authorises environmental harm.

A person carrying out an ERA must also be a registered suitable operator under the *Environmental Protection Act 1994* (EP Act).

Contaminated land

It is a requirement of the EP Act that an owner or occupier of contaminated land give written notice to the administering authority if they become aware of the following:

- the happening of an event involving a hazardous contaminant on the contaminated land (notice must be given within 24 hours); or
- a change in the condition of the contaminated land (notice must be given within 24 hours); or
- a notifiable activity (as defined in Schedule 3) having been carried out, or is being carried out, on the contaminated land (notice must be given within 20 business days)

that is causing, or is reasonably likely to cause, serious or material environmental harm.

For further information, including the form for giving written notice, refer to the Queensland Government website www.qld.gov.au, using the search term 'duty to notify'.

Take effect

Please note that, in accordance with section 200 of the EP Act, an EA has effect:

a) if the authority is for a prescribed ERA and it states that it takes effect on the day nominated by the holder of the authority in a written notice given to the administering authority-on the nominated day; or

b) if the authority states a day or an event for it to take effect-on the stated day or when the stated event happens; or

c) otherwise- one the day the authority is issued.

However, if the EA is authorising an activity that requires an additional authorisation (a relevant tenure for a resource activity, a development permit under the *Planning Act 2016* or an SDA Approval under the *State Development and Public Works Organisation Act 1971*), this EA will not take effect until the additional authorisation has taken effect.

If this EA takes effect when the additional authorisation takes effect, you must provide the administering authority written notice within 5 business days of receiving notification of the related additional authorisation taking effect.

If you have incorrectly claimed that an additional authorisation is not required, carrying out the ERA without the additional authorisation is not legal and could result in your prosecution for providing false or misleading information or operating without a valid environmental authority.

Alison Cummings
Department of Environment and Science
Delegate of the administering authority
Environmental Protection Act 1994

Date Issued*:* 2 February 2023

Enquiries:
Business Centre (Coal)
Department of Environment and Science
PO Box 3028
EMERALD QLD 4720
Phone: (07) 4987 9320
Email: CRMining@des.qld.gov.au

Obligations under the *Environmental Protection Act 1994*

In addition to the requirements found in the conditions of this environmental authority, the holder must also meet their obligations under the EP Act, and the regulations made under the EP Act. For example, the holder must comply with the following provisions of the Act:

- general environmental duty (section 319)
- duty to notify environmental harm (section 320-320G)
- offence of causing serious or material environmental harm (sections 437-439)
- offence of causing environmental nuisance (section 440)
- offence of depositing prescribed water contaminants in waters and related matters (section 440ZG)
- offence to place contaminant where environmental harm or nuisance may be caused (section 443)

Other permits required

This permit only provides an approval under the *Environmental Protection Act 1994*. In order to lawfully operate you may also require permits / approvals from your local government authority, other business units within the department and other State Government agencies prior to commencing any activity at the site. For example, this may include permits / approvals with your local Council (for planning approval), the Department of Transport and Main Roads (to access state controlled roads), the Department of Natural Resources, Mines and Energy (to clear vegetation), and the Department of Agriculture and Fisheries (to clear marine plants or to obtain a quarry material allocation).

Obligations under the *Mining and Quarrying Safety and Health Act 1999*

If you are operating a quarry, other than a sand and gravel quarry where there is no crushing capability, you will be required to comply with the *Mining and Quarrying Safety and Health Act 1999*. For more information on your obligations under this legislation contact Mine Safety and Health at www.dnrme.qld.gov.au, or phone 13 QGOV (13 74 68) or your local Mines Inspectorate Office.

Development Approval

This permit is not a development approval under the *Planning Act 2016*. The conditions of this environmental authority are separate, and in addition to, any conditions that may be on the development approval. If a copy of this environmental authority is attached to a development approval, it is for information only, and may not be current. Please contact the Department of Environment and Science to ensure that you have the most current version of the environmental authority relating to this site.

Conditions of environmental authority

The environmentally relevant activity(ies) conducted at the location as described above must be conducted in accordance with the following site-specific conditions of approval. This environmental authority consists of the following Schedules and Appendices:

Schedule A	General
Schedule B	Air
Schedule C	Surface Water
Schedule D	Ground Water
Schedule E	Acoustic
Schedule F	Waste
Schedule G	Land
Schedule H	Regulated Structures

Conditions of environmental authority

Schedule A: General	
Condition number	**Condition**
A1	This environmental authority authorises environmental harm referred to in the conditions. Where there is no condition or this environmental authority is silent on a matter, the lack of a condition or silence does not authorise environmental harm.
A2	**Authorised activities** In carrying out the mining activity authorised by this environmental authority, disturbance of land: a) is authorised in the areas marked 'A' as depicted in **Figure 1 - Disturbance Map**; b) is not authorised in the areas marked 'B' as depicted in **Figure 1 - Disturbance Map**; and c) is only authorised in the areas marked 'C' as depicted in **Figure 1 - Disturbance Map** in accordance with **Conditions A3** and **A4**; and d) is limited to the historic boreholes in the areas marked 'D' as depicted in **Figure 1 - Disturbance Map,** and new disturbance is not authorised.
A3	Significant residual impacts to prescribed environmental matters are not authorised under this environmental authority or the *Environmental Offsets Act 2014.*
A4	Records demonstrating that each impact to a prescribed environmental matter did not, or is not likely to, result in a significant residual impact to that matter must be: a) completed by an appropriately qualified person; and b) kept for the life of the environmental authority.
A5	**Scope of activity** This environmental authority authorises the mining of up to **1.9 million tonnes** of run of mine (ROM) coal per annum (mtpa).
A6	**Maintenance of measures, plant and equipment** The environmental authority holder must ensure: a) that all measures, plant and equipment necessary to ensure compliance with the conditions of this environmental authority are installed; b) that such measures, plant and equipment are maintained in a proper condition; and c) that such measures, plant and equipment are operated in a proper manner.
A7	**Storage and handling of flammable and combustible liquids** Spillage of all flammable and combustible liquids must be contained within an on-site containment system and controlled in a manner that prevents environmental harm (other than trivial harm) and maintained in accordance with Section 5.8 of AS 1940 - *Storage and Handling of Flammable and Combustible Liquids of 2004*.

A8	**Monitoring and records** Record, compile and keep for a minimum of **five (5) years** all monitoring results required by this environmental authority and make available for inspection all or any of these records upon request by the administering authority.
A9	Monitoring and determinations required under any condition of this environmental authority must be conducted by an appropriately qualified person(s).
A10	**Management Plans and Reports** Management plans and reports required under any condition of this environmental authority must be developed by an appropriately qualified person.
A11	All records, reports, management plans, programs and compliance monitoring results required by this environmental authority, must be made available to the administering authority within **five (5) business days** of the administering authority's request.
A12	The holder of this environmental authority must, when requested by the administering authority, undertake relevant specified monitoring within a reasonable timeframe nominated or agreed to by the administering authority to investigate any complaint of environmental harm. The results of the investigation (including an analysis and interpretation of the monitoring results) and abatement measures, where implemented, must be provided to the administering authority within **10 business days** of completion of the investigation, or no later than **10 business days** after the end of the timeframe nominated by the administering authority to undertake the investigation.
A13	**Notification of emergencies, incidents and exceptions** All reasonable actions are to be taken to minimise environmental harm, or potential environmental harm, resulting from any emergency, incident or circumstances not in accordance with the conditions of this environmental authority.
A14	The holder of this environmental authority must notify the administering authority by written notification within **24 hours**, after becoming aware of any emergency or incident which results in the release of contaminants not in accordance, or reasonably expected to be not in accordance with, the conditions of this environmental authority.
A15	The notification of emergencies or incidents as required by **Condition A15** of this environmental authority must include, but not be limited to, the following: a) the holder of the environmental authority; b) the location of the emergency or incident; c) the number of the environmental authority; d) the name and telephone number of the designated contact person; e) the time of the release; f) the time the holder of the environmental authority became aware of the release; g) the suspected cause of the release; h) the environmental harm caused, threatened, or suspected to be caused by the release; and i) actions taken to prevent any further release and mitigate any environmental harm caused by the release.

A16	Within **10 business days** following the initial notification of an emergency or incident, or receipt of monitoring results, whichever is the latter, further written advice must be provided to the administering authority, including the following: a) results and interpretation of any samples taken and analysed; b) outcomes of actions taken at the time to prevent or minimise unlawful environmental harm; and c) proposed actions to prevent a recurrence of the emergency or incident.
A17	As soon as practicable, but not more than **six (6) weeks** following the conduct of any environmental monitoring performed in relation to the emergency or incident, which results in the release of contaminants not in accordance, or reasonably expected to be not in accordance with the conditions of this environmental authority, written advice must be provided of the results of any such monitoring performed to the administering authority.
A18	**Exploration activities** Exploration activities must be undertaken in accordance with the conditions contained in the *Eligibility criteria and standard conditions for exploration and mineral development projects* (ESR/2016/1985).
A19	**Complaint Response** All complaints received must be recorded including details of complainant, reasons for the complaint, investigations undertaken, conclusions formed, and actions taken. This information must be made available for inspection by the administering authority on request.
A20	**Third-party reporting** The holder of this environmental authority must: a) within **one (1) year** of the commencement of this environmental authority, obtain from an appropriately qualified person a report on compliance with the conditions of this environmental authority; b) obtain further such reports at regular intervals, not exceeding **three-yearly** intervals, from the completion of the report referred to above; and c) provide each report to the administering authority within **90 days** of its completion.
A21	Where a condition of this environmental authority requires compliance with a standard, policy or guideline published externally to this environmental authority and the standard is amended or changed subsequent to the issue of this environmental authority, the holder of this environmental authority must: a) comply with the amended or changed standard, policy, or guideline within two years of the amendment or change being made, unless a different period is specified in the amended standard or relevant legislation, or where the amendment or change relates specifically to regulated structures referred to in Schedule G, the time specified in that condition; and b) until compliance with the amended or changed standard, policy or guideline is achieved, continue to remain in compliance with the corresponding provision that was current immediately prior to the relevant amendment or change.

Schedule B: Air	
Condition number	**Condition**
B1	**Dust nuisance** The release of dust and/or particulate matter resulting from the mining activity must not cause an environmental nuisance to an environmental value for air.
B2	Dust and particulate matter emissions generated by the authorised mining activities must not exceed the following levels when measured at any area or place at which an air quality objective applies: a) Dust deposition of 120 milligrams per square metre per day, averaged over **one (1) month**, when monitored in accordance with the most recent version of Australian Standard AS3580.10.1 *Methods for sampling and analysis of ambient air—Determination of particulate matter—Deposited matter – Gravimetric method*. b) A concentration of particulate matter with an aerodynamic diameter of less than 10 micrometres (PM10) suspended in the atmosphere of 50 micrograms per cubic metre over a **24-hour** averaging time, monitored in accordance with the most recent version of either: i. Australian Standard AS3580.9.6 *Methods for sampling and analysis of ambient air—Determination of suspended particulate matter—* PM_{10} *high volume sampler with size-selective inlet – Gravimetric method*; or ii. Australian Standard AS3580.9.9 *Methods for sampling and analysis of ambient air—Determination of suspended particulate matter—* PM_{10} *low volume sampler—Gravimetric method*; or iii. Australian Standard AS3580.9.11 *Methods for sampling and analysis of ambient air—Determination of suspended particulate matter—* PM_{10} *beta attenuation monitors or* c) A concentration of particulate matter with an aerodynamic diameter of less than 2.5 micrometres (PM2.5) suspended in the atmosphere of 25 micrograms per cubic metre over a 24-hour averaging time, when monitored in accordance with the most recent version either of AS/NZS3580.9.10 *Methods for sampling and analysis of ambient air—Determination of suspended particulate matter—PM (sub)2.5(/sub) low volume sampler—Gravimetric method* or AS/NZS3580.9.12 (2013): *Determination of suspended particulate matter – PM2.5 beta attenuation monitors*.
B3	An Air Quality Monitoring and Management Plan must be developed and implemented within **12 months** of the commencement of mining activities and be made available to the administering authority upon request.

B4	The Air Quality Monitoring and Management Plan, as required by **Condition B3,** must include but not be limited to – a) an air quality monitoring program for PM10, PM2.5 and dust deposition showing: • air quality monitoring locations and frequency; • selection criteria for nominated air quality monitoring locations; • air quality monitoring parameters and limits; • details of monitoring equipment and methodology/standards followed for air quality monitoring; • details of at least one meteorological station capable of monitoring wind direction and speed; b) a Trigger Action Response Plan; c) a complaint response plan; and d) a requirement for review and update.
B5	If the monitoring indicates an exceedance of the relevant limits in **Condition B2**, then an investigation must be undertaken to determine whether the exceedance is due to emissions from the mining activity. If the authorised mining activities are found to be the cause of the exceedance, then the environmental authority holder must: a) address the complaint including the use of appropriate dispute resolution if required; and b) immediately implement dust abatement measures so that emissions of dust from the activity does not result in further environmental nuisance.

Schedule C: Water	
Condition number	**Condition**
C1	**Contaminant Release** Contaminants that will or have the potential to cause environmental harm must not be released directly or indirectly to any waters as a result of the authorised mining activities, except as permitted under the conditions of this environmental authority.
C2	Unless otherwise permitted under the conditions of this environmental authority, the release of mine affected water to waters must only occur from the release point specified in **Table C1 - Mine Affected Water Release Points, Sources and Receiving Waters** and depicted in **Figure 3 – Mine affected water release points and monitoring locations.**
C3	The release of mine affected water to waters in accordance with **Condition C2** must meet the sediment load concentration measured as Total Suspended Solids (mg/L) stated in **Table C2 - Contaminant Release Limits** for each release.

Table C1- Mine Affected Water Release Points, Sources and Receiving Waters

Release Point (RP)	**Easting (GDA20)**	**Northing GDA20)**	**Mine Affected Water Source and Location**	**Monitoring Point**	**Receiving Waters Description**
RP 1	619279	7587480	Mine affected water – MWD1 and North Pit	MP2	Hat Creek

C4	The release of mine affected water to internal water management infrastructure that is installed and operated in accordance with a Water Management Plan that complies with **Conditions C30** and **C31** is permitted.
C5	The release of mine affected water to waters in accordance with **Condition C2** must not exceed the release limits stated in **Table C2 - Contaminant Release Limits** when measured at the monitoring points specified in **Table C1 - Mine Affected Water Release Points, Sources and Receiving Waters** for each quality characteristic.
C6	The release of mine affected water to waters from the release point must be monitored at the locations specified in **Table C1 - Mine Affected Water Release Points, Sources and Receiving Waters** for each quality characteristic and at the frequency specified in **Table C2 – Contaminant Release Limits** and trigger investigation levels specified in **Table C3 - Release Contaminant Trigger Investigation Levels – Potential Contaminants**. NOTE: *The administering authority will take into consideration any extenuating circumstances prior to determining an appropriate enforcement response in the event* ***Condition C5*** *is contravened due to a temporary lack of safe or practical access. The administering authority expects the environmental authority holder to take all reasonable and practicable measures to maintain safe and practical access to designated monitoring locations.*

Table C2 - Contaminant Release Limits

Quality Characteristic	Release Limits	Monitoring frequency	Comment
Electrical conductivity (µS/cm)	baseflow: 720 µS/cm high flow: 250 µS/cm	Daily during release (the first sample must be taken within two (2) hours of commencement of release)	
pH (pH Unit)	6.5 (minimum) 8.5 (maximum)	Daily during release (the first sample must be taken within two (2) hours of commencement of release)	
Turbidity (NTU)	50	Daily during release (the first sample must be taken within two (2) hours of commencement of release)	Turbidity is required to assess ecosystems impact and can provide instantaneous results.
Total Suspended Solids (mg/L)	55	At commencement and prior to cessation of release (at a minimum) and weekly during a release [1]	Suspended solids are required to measure the performance of sediment and erosion control measures.
Sulphate (mg/L)	25	At commencement and prior to cessation of release (at a minimum) and weekly during a release [1]	
NOTE*: [1] The determination of suitability for release of water should be informed by monitoring undertaken prior to release.*			

Table C3 - Release Contaminant Trigger Investigation Levels – Potential Contaminants

Quality Characteristic	Trigger Levels	Comment on Trigger Level	Monitoring Frequency
Total Suspended Solids	55 (mg/L)	*For aquatic ecosystem protection, based on SMD Isaac River Sub-basin Environmental Values and Water Quality Objectives.*	Commencement of release and thereafter weekly during release
Total Dissolved Solids	4000 (mg/L)	*For aquatic ecosystem protection, based on SMD Isaac River Sub-basin Environmental Values and Water Quality Objectives.*	
Sulfate	<25 (mg/L)	*For aquatic ecosystem moderately disturbed, within Upper Isaac River catchment waters, based Isaac River Sub-basin Environmental Values and Water Quality Objectives 2011.*	
Aluminium	55 (µg/L)	*For aquatic ecosystem protection, based on SMD Isaac River Sub-basin Environmental Values and Water Quality Objectives.*	
Arsenic (As V)	13 (µg/L)	*For aquatic ecosystem protection, based on SMD guideline*	
Boron	940 (µg/L)	*For aquatic ecosystem protection, based on SMD guideline*	
Cadmium	0.2 (µg/L)	*For aquatic ecosystem protection, based on SMD guideline*	
Fluoride	2000 (µg/L)	*ANZECC stock water drinking guideline.*	
Lead	3.4 (µg/L)	*For aquatic ecosystem protection, based on SMD guideline*	
Manganese	1900 (µg/L)	*For aquatic ecosystem protection, based on SMD guideline*	
Mercury (inorganic)	0.06 (µg/L)	*For aquatic ecosystem protection, based on SMD guideline*	
Molybdenum	150 (µg/L)	*ANZECC stock water drinking guideline*	
Nickel	11 (µg/L)	*For aquatic ecosystem protection, based on SMD guideline*	
Chromium	1.0 (µg/L)	*For aquatic ecosystem protection, based on SMD Isaac River Sub-basin Environmental Values and Water Quality Objectives.*	
Copper	1.4 (µg/L)	*For aquatic ecosystem protection, based on SMD Isaac River Sub-basin Environmental Values and Water Quality Objectives.*	
Zinc	8 (µg/L)	*For aquatic ecosystem protection, based on SMD guideline*	
Selenium	5 (µg/L)	*For aquatic ecosystem protection, based on SMD guideline*	
Uranium	0.5 (µg/L)	*For aquatic ecosystem protection, based on LOR for ICPMS*	
Nitrate	400 (mg/L)	*ANZECC stock water drinking guideline*	
Silver	0.05 (µg/L)	*For aquatic ecosystem protection, based on SMD guideline*	
Petroleum hydrocarbons (C6-C9)	20 (µg/L)	*For aquatic ecosystem protection, based on LOR for GCMS*	
Petroleum hydrocarbons (C10-C36)	100 (µg/L)	*For aquatic ecosystem protection, based on LOR for GCMS*	
Sodium	180 (mg/L)	*Australian Human Drinking Water Guidelines. Trigger may require amendment if future advice from Queensland Health becomes available.*	
Barium	2000 µg/L	*Trigger from Australian Human Drinking Water Guidelines*	

NOTE:

1. All metals and metalloids must be measured as total (unfiltered) and dissolved (filtered). Trigger levels for metal/metalloids apply if dissolved results exceed trigger.

*2. The quality characteristics required to be monitored as per **Table C3** can be reviewed once the results of **two (2) years** of monitoring data is available, or if sufficient data is available to adequately demonstrate negligible environmental risk, and it may be determined that a reduced monitoring frequency is appropriate or that certain quality characteristics can be removed from **Table C3** by amendment.*

3. SMD – slightly moderately disturbed level of protection, guideline refers ANZG 2018.

4. LOR – typical reporting for method stated. ICPMS/CV FIMS/GCMS – analytical method required to achieve LOR.

C7	If any of the trigger levels specified in **Table C3 – Release contaminant trigger investigation levels - potential contaminants** are exceeded for any quality characteristic at the release point specified in **Table C1 – Mine affected water release points, sources and receiving waters** during a release event, the environmental authority holder must compare the downstream results in the receiving waters to the trigger values specified in **Table C3 – Release contaminant trigger investigation levels - potential contaminants** and: (a) Where the downstream results do not exceed the trigger values then no action is to be taken; or (b) Where the downstream results exceed the trigger values specified **Table C3 – Release contaminant trigger investigation levels - potential contaminants** for any quality characteristic, compare the results of the downstream site to the data from upstream background monitoring sites (specified in **Table C5 - Receiving waters contaminant trigger levels**); and: (i) where the downstream result is less than the upstream background monitoring site data for the quality characteristic, then no action is to be taken, or (ii) where the downstream result is greater than the upstream background monitoring site data, complete an investigation into the potential for environmental harm and provide a written report to the administering authority within **ninety (90) days** of receiving the result, outlining: (a) details of the investigations carried out; and (b) actions taken to prevent environmental harm. NOTE: *Where an exceedance of a trigger level has occurred and is being investigated, in accordance with* ***Condition C7(b)(ii)*** *of this condition, no further reporting is required for subsequent trigger events for that quality characteristic.*
C8	If an exceedance in accordance with **Condition C7(b)(ii)** is identified, the holder of the environmental authority must notify the administering authority, via WaTERS, within **twenty-four (24) hours** of receiving the result.
C9	**Mine Affected Water Release Events** The holder must ensure a stream flow gauging station/s is installed, operated, and maintained to determine and record stream flows at the locations and flow recording frequency specified in **Table C4 - Mine Affected Water Release During Flow Events**.
C10	The site-specific trigger values identified within **Table C3 - Release contaminant trigger investigation levels - potential contaminants** must be reviewed within **two (2) years** of the commencement of mining activities, or when sufficient monitoring data is available. The *Queensland Water Quality Guidelines* (2009) recommend a minimum of 18 samples collected at each site over at least **12** and preferably **24 months** (in order to capture two complete annual cycles). The administering authority must be notified in writing of the outcome of the review within **fourteen (14) days**.
C11	Notwithstanding any other condition of this environmental authority, the release of mine affected water to waters in accordance with **Condition C2** of this environmental authority must only take place during periods of natural flow events in accordance with the receiving water flow criteria for discharge specified in **Table C4 - Mine Affected Water Release during Flow Events** for the release point(s) specified in **Table C1 - Mine Affected Water Release Points, Sources and Receiving Waters**.

Table C4 - Mine Affected Water Release during Flow Events

Receiving waters/ stream	Release Point (RP)	Gauging Station (GS)	Gauging Station Easting (GDA20)	Gauging Station Northing (GDA20)	Receiving Water Flow Recording Frequency	Receiving Water Flow Criteria for discharge (m^3/s)[1]	Maximum release rate (m^3/s) (for all combined RP flows)	Electrical Conductivity and (micro-Siemens/cm)[2]
Hat Creek	1	1 Upstream	617623	7587216	Continuous (minimum daily)	Medium Flow 1 >0.5m^3/s	0.05m^3/s	720 µS/cm
						Medium Flow 2 >1.0m^3/s	0.1m^3/s	250 µS/cm
		2 Downstream	620310	7587196		Medium Flow 1 >0.5m^3/s	0.05m^3/s	720 µS/cm
						Medium Flow 2 >1.0m^3/s	0.1m^3/s	250 µS/cm

NOTE:

1 Flow triggers should be compared to natural flow only.
2 Prior to release commencement, an assessment of the water quality of the relevant mine affected water source must be undertaken and the Electrical Conductivity release limit and maximum release rate determined. This determined release limit and maximum release rate applies for the duration of the release

C12	The daily quantity of mine affected water released from each release point must be measured and recorded at the monitoring points in **Table C1 - Mine Affected Water Release Points, Sources and Receiving Waters**.
C13	Releases to waters must be undertaken so as: a) not to cause erosion of the bed and banks of the receiving waters; b) not to cause a material build-up of sediment in such waters; c) not result in any visible discolouration of receiving waters; or d) not result in any slick or other visible or odorous evidence of oil, grease or petrochemicals nor contain visible floating oil, grease, scum, litter or other objectionable matter.
C14	**Notification of Release Event** The environmental authority holder must notify the administering authority, via WaTERS, as soon as practicable and no later than **twenty-four (24) hours** after commencing to release mine affected water to the receiving environment in accordance with **Condition C2**. Notification must include the submission of the following information: a) release commencement date/time; b) details regarding the compliance of the release with the conditions including EC, turbidity, and pH within this environmental authority; c) release location (release point/s); d) release rate; e) release salinity; f) receiving water/s including flow rate when release occurred; g) expected cessation date; and h) expected volume to be discharged.
C15	The administering authority must be notified via WaTERS within **twenty-four (24) hours** after cessation of a release event notified under **Condition C14**. The release cessation notification must include the following information: a) release cessation date/time; b) details of the receiving water; including the natural flow rate; c) volume of water released; d) all in-situ water quality monitoring results; and e) any other matters pertinent to the water release event. NOTE: *Successive or intermittent releases occurring within* ***twenty-four (24) hours*** *of the cessation of any individual release can be considered part of a single release event and do not require individual notification for the purpose of compliance with* ***Conditions C14*** *and* ***C15****, provided the relevant details of the release are included within the notification provided in accordance with* ***Conditions C16, C17*** *and* ***C18****.*

C16	Within **twenty-eight (28) days** of the notification under **Condition C14**, the following information must be provided to the administering authority via WaTERS: a) confirmation of: (i) The release commencement date and time; (ii) The release cessation date and time; (iii) Details of the receiving water/s including the natural flow rate; (iv) Volume of water released; b) all in-situ and laboratory water quality monitoring results; c) details assessing compliance of the release with the conditions of **Schedule C – Surface Water** of this environmental authority (i.e. contamination limits, natural flow, discharge volume); d) whether the release resulted in any impacts to the receiving environment; and e) any other matter(s) pertinent to the water release event.
C17	**Notification of Release Event Exceedance** If the release limits defined in **Table C2 - Contaminant Release Limits** are exceeded, the holder of the environmental authority must notify the administering authority, via WaTERS, within **twenty-four (24) hours** of receiving the results.
C18	The environmental authority holder must, within **twenty-eight (28) days** of a release that is not compliant with the conditions of this environmental authority, provide a report to the administering authority, via WaTERS detailing: a) The reason for the release; b) The location of the release; c) The total volume of the release and which (if any) part of this volume was non-compliant; d) The total duration of the release and which (if any) part of this period was non-compliant; e) All water quality monitoring results (including all laboratory analyses); f) Identification of any environmental harm as a result of the non-compliance; g) All calculations; and h) Any other matters pertinent to the water release event.
C19	**Receiving Environment Monitoring and Contaminant Trigger Levels** The quality of the receiving waters must be monitored at the locations specified in **Table C5 - Receiving Water Monitoring Locations** for each quality characteristic and at the monitoring frequency stated in **Table C6 - Receiving Waters Contaminant Trigger Levels**.

C20	**Notification of release event exceedance** If quality characteristics of the receiving water at the downstream monitoring points exceed any of the trigger levels specified in **Table C6 - Receiving Waters Contaminant Trigger Levels** during a release event the environmental authority holder must compare the downstream results to the upstream results in the receiving waters and: a) where the downstream result is the same or a lower value than the upstream value for the quality characteristic then no action is to be taken; or b) where the downstream results exceed the upstream results, complete an investigation into the potential for environmental harm and provide a written report to the administering authority via WaTERS by **1 March** each year, outlining: i) details of the investigations carried out; and ii) actions taken to prevent environmental harm. NOTE: *Where an exceedance of a trigger level has occurred and is being investigated, in accordance with* ***Condition C20(b)*** *of this condition, no further reporting is required for subsequent trigger events for that quality characteristic.*
C21	**Monitoring of water storage quality** Water storages specified in **Table C7 – Water Storage Monitoring** must be monitored for: a) the water quality characteristics specified in **Table C2 – Contaminant release limits** and **Table C3 - Release contaminant trigger investigation levels - potential contaminants** at the monitoring locations and frequency specified in **Table C7 – Water Storage Monitoring**; and b) the volume of water held in each of the water storages specified in **Table C7 – Water Storage Monitoring**.

Table C5 - Receiving Water Monitoring Locations

Monitoring points	Receiving Waters Location Description	Easting (GDA20)	Northing (GDA20)
Upstream Background Monitoring Points			
MP3	On-lease, along Hat Creek at the convergence of two watercourse systems from the east	620310	7587196
MP4	Off-lease, along Hat Creek	622473	7586183
Downstream Monitoring Points			
MP1	Off-lease, at the convergence of Hat Creek and a tributary system from the south-east.	617623	7587216
MP2	On-lease, along Hat Creek, near the MAW release point and adjacent to the haul road.	619175	7587536

Table C6 - Receiving Waters Contaminant Trigger Levels

Quality characteristic	Trigger Level	Monitoring Frequency
pH	6.5 – 8.5	Daily during release
Electrical Conductivity (µS/cm)	250 (*NOTE: For protection against toxicity this may need to be reduced in some circumstances e.g. where in close proximity upstream of a drinking water dam or regional waterway.)*	
Total Suspended solids (mg/L)	55	Daily during release
Sulphate (SO_4^{2-}) (mg/L)	25 (*NOTE: Protection of drinking water Environmental Value.)*	
Turbidity (NTU)	50 (*NOTE: Turbidity may be required to assess ecosystems impacts and can provide instantaneous results.)*	

NOTE: *The determination of suitability for release of water should be informed by monitoring undertaken prior to release.*

Table C7 – Water Storage Monitoring

Water Storage Description	Easting(GDA20)	Northing (GDA20)	Monitoring Location	Frequency of Monitoring
Mine Water Dam 1 (MWD1)	619068	7586983	Dam wall	Quarterly
North Pit	619379	7587202	Dam wall	Quarterly

C22	**Receiving Environment Monitoring Program (REMP)** On the commencement of mining activities, the environmental authority holder must implement the Receiving Environment Monitoring Program (REMP) to monitor, identify and describe any adverse impacts to surface water environmental values, quality and flows due to the authorised mining activity. This must include monitoring the effects of the mine on the receiving environment periodically (under natural flow conditions) and while mine affected water is being discharged from the site. For the purposes of the REMP, the receiving environment is the waters of the Hat Creek and connected or surrounding waterways within 4 km downstream of the mining activity.

C23	The REMP must: a) Assess the condition or state of receiving waters, including upstream conditions, spatially within the REMP area, considering background water quality characteristics based on accurate and reliable monitoring data that takes into consideration temporal variation (e.g., seasonality); and b) Be designed to facilitate assessment against water quality objectives for the relevant environmental values that need to be protected; c) Include monitoring from background reference sites (e.g., upstream or background) and downstream sites from the release (as a minimum, the locations specified in **Table C5 - Receiving Water Monitoring Locations**; d) Specify the frequency and timing of sampling required in order to reliably assess ambient conditions and to provide sufficient data to derive site specific background reference values in accordance with the *Queensland Water Quality Guideline 2009* or its subsequent revisions. This should include monitoring during periods of natural flow irrespective of mine or other discharges; e) Include monitoring and assessment of dissolved oxygen saturation, temperature and all water quality parameters listed in **Table C2 -Contaminant Release Limits** and **Table C3** -**Release Contaminant Trigger Investigation Levels – Potential Contaminants**; f) Include, where appropriate, monitoring of metals/metalloids in sediments (in accordance with ANZG 2018, *Handbook for Sediment Quality Assessment 2005* and/or the most recent version of AS5667.1 *Guidance on Sampling of Bottom Sediments*); g) Include, where appropriate, monitoring of macroinvertebrates in accordance with the AusRivas methodology, h) Apply procedures and/or guidelines from ANZG 2018 and other relevant guideline documents; i) Describe sampling and analysis methods and quality assurance and control; and j) Incorporate stream flow and hydrological information in the interpretations of water quality and biological data.
C24	A REMP Design Document that addresses each criterion presented in **Conditions C22** and **C23** of this environmental authority must be maintained and submitted to the administering authority on request. Due consideration must be given to any comments made by the administering authority on the REMP Design Document and subsequent implementation of the program.
C25	A report outlining the findings of the REMP, including all monitoring results and interpretations in accordance with **Conditions C22** and **C23** of this environmental authority must be prepared annually. This must include: a) an assessment of background reference water quality; b) the condition of downstream water quality compared against water quality objectives, and c) the suitability of current discharge limits to protect downstream environmental values.
C26	**Water Reuse** Mine affected water may be piped or trucked or transferred by some other means that does not contravene the conditions of this environmental authority and deposited into artificial water storage structures, such as farm dams or tanks, or used directly at properties owned by the environmental authority holder or a third party (with the written consent of the third party).

C27	**Water general** All determinations of water quality and biological monitoring must be: a) performed by a person or body possessing appropriate experience and qualifications to perform the required measurements; b) made in accordance with methods prescribed in the latest edition of the administering authority's Monitoring and Sampling Manual; c) collected from the monitoring locations identified within this environmental authority, within **ten (10) hours** of each other where possible; d) carried out on representative samples; and e) analysed at a laboratory accredited (e.g., NATA) for the method of analysis being used. NOTE: ***Condition C27*** *requires the Monitoring and Sampling Manual to be followed and where it is not followed because of exceptional circumstances this should be explained and reported with the results.*
C28	**Annual water monitoring reporting** The following information must be recorded in relation to all water monitoring required under the conditions of this environmental authority and submitted to the administering authority in the specified format by **1 March** each year: a) the date on which the sample was taken; b) the time at which the sample was taken; c) the monitoring point at which the sample was taken; d) the measured or estimated daily quantity of mine affected water released from all release points; e) the release flow rate at the time of sampling for each release point; f) the results of all monitoring and details of any exceedances of the conditions of this environmental authority; and g) water quality monitoring data must be provided to the administering authority via WaTERS.
C29	**Temporary interference with waterways** Temporarily destroying native vegetation, excavating, or placing fill in a watercourse, lake, or spring necessary for and associated with mining operations must be undertaken in accordance with the Department of Regional Development, Manufacturing and Water (DRDMW) *Guideline – Riverine protection permit exemption requirements* (*WSS/2013/726*).
C30	**Water Management Plan** A Water Management Plan must be developed and implemented for the duration of the mining activities authorised under this environmental authority.

C31	The Water Management Plan must: a) Provide for effective management of actual and potential environmental impacts resulting from water management associated with the mining activity carried out under this environmental authority; and b) Be developed in accordance with the administering authority's guideline *Preparation of water management plans for mining activities* (ESR/2016/3111) or its successor and include: i) a contaminant source study; ii) site water balance and model; iii) onsite water quality sampling; iv) a water management system; v) saline drainage prevention and management measures; vi) acid rock drainage prevention and management measures; vii) erosion and sediment control measures; and viii) maintenance of water management and erosion and sediment control infrastructure; onsite sewage management system.
C32	The Water Management Plan required by **Condition C30** must be reviewed each calendar year and a report prepared. The report must: a) Assess the plan against the requirements under **Condition C31;** b) Include recommended actions to ensure actual and potential environmental impacts are effectively managed for the coming year; and c) Identify any amendments made to the Water Management Plan following the review.
C33	**Saline drainage** The holder of this environmental authority must ensure proper and effective measures are taken to avoid or otherwise minimise the generation and/or release of saline drainage.
C34	**Acid rock drainage** The holder of this environmental authority must ensure proper and effective measures are taken to avoid or otherwise minimise the generation and/or release of acid rock drainage.
C35	**Stormwater and water sediment controls** An Erosion and Sediment Control Plan must be developed and implemented in all stages of the mining activities on the site to minimise erosion and the release of sediment to receiving waters and contamination of stormwater.

C36	The Erosion and Sediment Control Plan must: a) demonstrate how erosion and sediment control measures detailed in the plan adequately minimise the release of sediment to receiving waters and must include at least the following: i) an assessment of the size and relevant characteristics of all catchment areas; ii) an assessment of relevant properties of soils and waste materials; iii) identification of receiving waters environmental values, water quality objectives and management intent; iv) specification of minimum design criteria for erosion and sediment control structures to meet the management intent of receiving waters; b) detail the locations and descriptions of all erosion and sediment control measures; and c) provide an audit schedule to ensure erosion and sediment control measures are maintained.
C37	The Erosion and Sediment Control Plan must be reviewed by an appropriately qualified person by **1 March** for each calendar year. The review must be documented and must: a) include a statement that the Erosion and Sediment Control Plan has been reviewed by an appropriately qualified person; b) assess the plan against the requirements of **Condition C36**; c) include recommended actions to ensure actual and potential environmental impacts are effectively managed; d) provide details and timelines of the actions to be taken; and e) identify any amendments made to the Erosion and Sediment Control Plan.
C38	Stormwater, other than mine affected water, is permitted to be released to waters from: a) erosion and sediment control structures that are installed and operated in accordance with the Erosion and Sediment Control Plan required by **Condition C35** of this environmental authority; and b) water management infrastructure that is installed and operated, in accordance with a Water Management Plan that complies with **Condition C30** for the purpose of ensuring water does not become mine affected water.
C39	Water that has come into contact with uncapped rejects, disposed in accordance with **Condition F16**, is considered mine affected water and must report to the mine affected water storages identified in **Table C7 – Water Storage Monitoring**.
C40	The maintenance and cleaning of any vehicles, plant or equipment must not be carried out in areas from which contaminants can be released into any receiving waters.
C41	Any spillage of wastes, contaminants or other materials must be cleaned up as quickly as practicable to minimise the release of wastes, contaminants or materials to any stormwater drainage system or receiving waters.
C42	**Sewage management** All sewage generated on site must be removed by a licensed contractor at regular intervals. A register must be maintained onsite to keep a track of amount of sewage generated, stored onsite and disposed of via licenced contractor.

Schedule D: Groundwater	
Condition number	**Condition**
D1	**Groundwater** The environmental authority holder must not release contaminants to groundwater.
D2	**Baseline groundwater monitoring program** A baseline groundwater monitoring program must be developed and implemented by an appropriately qualified person(s) (AQP). The baseline groundwater monitoring program must: a) include existing bores as shown in **Table D1 - Groundwater Monitoring Locations and Frequency** and any additional bores deemed necessary by an AQP and the administering authority. b) include at least **eight (8)** sampling events that are no more than **three (3) months** apart over a **twenty-four (24) month** period, to determine background groundwater quality; c) include a conceptual model used to determine the location of groundwater bores and justify; d) identify pre-mining baseline standing water levels and determine groundwater trigger elevations measured in metres above Australian Height Datum (mAHD); e) allow for the identification of natural groundwater level trends and groundwater contaminant limits; f) assess adequacy of monitoring bores network stated in **Table D1 - Groundwater Monitoring Locations and Frequency** to ensure monitoring of impacts within all aquifers present within the mining lease; g) assess adequacy of the monitoring bores depth to ensure predicted drawdown level could can be monitored; h) identify groundwater quality limits and triggers to update **Table D2 - Groundwater quality limits** and submit to the administering authority by **1 April 2024** if required; and i) propose a network of groundwater bores to detect changes, impacts and long-term threats on groundwater aquifers by the south residual void and rehabilitation activities specified in **Appendix 5 (Table G1- Table G1 Post Mine Land Use (PMLU) and Rehabilitation Methods** and **G2 PMLU and rehabilitation success criteria)**.
D3	**Groundwater compliance monitoring** Groundwater quality and levels must be monitored at the locations and frequencies defined in **Table D1 - Groundwater monitoring locations and frequency** and **Figure 3 – Mine affected water release points and monitoring locations** of this authority. NOTE: ***Figure 3*** *– Mine affected water release points and monitoring locations also shows location of groundwater monitoring bores.*
D4	Groundwater quality monitoring required by **Condition D3**, must be monitored for the parameters outlined in **Table D2 - Groundwater quality limits**. Results and analysis of

	groundwater monitoring must be submitted annually (for period January to December of the previous calendar year) to the administering authority via WaTERS by **1 March** of each calendar year.
D5	For groundwater level monitoring as per **Condition D3**, a groundwater drawdown fluctuation above the magnitude identified in **Table D1 - Groundwater level monitoring locations and frequency** for individual monitoring bores must be notified via WaTERS within fourteen (14) days following completion of monitoring.
D6	Results of monitoring of groundwater quality bores identified in **Table D1 - Groundwater Monitoring Locations and Frequency** must not exceed any of the contaminant limits specified in **Table D2 - Groundwater Quality triggers and limits** for the same monitoring bore on **three (3)** consecutive sampling occasions.
D7	**Exceedance notification** If the contaminant limits specified in **Table D2 - Groundwater Quality limits** are exceeded at the same monitoring bore on **three (3)** consecutive sampling occasions the holder of the environmental authority must notify the administering authority via WaTERS within **twenty-four (24) hours** of receiving the results.
D8	**Exceedance investigation** Within **fourteen (14) days** of notification given under **Conditions D5** and **D7,** an investigation must be completed to determine if the exceedance is a result of: a) mining activities authorised under this environmental authority; or b) seasonal/natural variation; or neighbouring land use resulting in groundwater impacts; or c) any other potential cause not related to the mining activity.
D9	If the investigation under **Condition D8** determines that the exceedance was caused by the mining activities authorised under this environmental authority, then a further investigation must be completed within **twenty-eight (28) days (or a timeframe agreed to with the administering authority)** to determine whether environmental harm has occurred or may occur, and the extent thereof.
D10	If the further investigation undertaken under **Condition D9** determines that environmental harm has occurred, or may occur, the following actions must be completed within **twenty-eight (28) days**: a) implementation of measures as soon as reasonably practicable to reduce environmental harm including potential environmental harm; and b) development of long-term mitigation measures to address any existing groundwater contamination and prevent recurrence of groundwater contamination which is implemented in a reasonable time period; and c) if environmental harm has occurred as a result of groundwater drawdown exceedances, i) determine any actions required to reduce the potential for environmental harm; and ii) determine any mitigation measures required to limit the drawdown in the affected groundwater resource; and d) document the steps taken under **Condition D10 (a), (b),** and **(c),** and provide the documentation to the administering authority within 14 days of implementation.

D11	The following information must be recorded in relation to all groundwater sampling: a) the date on which the sample was taken; b) the time at which the sample was taken; c) the monitoring point at which the sample was taken; and d) the results of all monitoring.
D12	Monitoring and sampling of groundwater must comply with the latest edition of the administering authority's *Monitoring and Sampling Manual*.
D13	**Groundwater Management and Monitoring Program** A Groundwater Management and Monitoring Program must be developed, certified and implemented by an appropriately qualified person for all stages of the mining activities (including construction, mining rehabilitation, and closure) to meet the following requirements: a) identify potential sources of contamination to groundwater aquifers from the authorised mining activity, including the south residual void; identifies all environmental values (including the Hat creek) that must be protected; b) details groundwater levels in all identified aquifers present across and adjacent to the site to confirm existing groundwater flow paths and their interaction with each other and interaction with the Hat Creek, Tivot Brook river system; c) estimates the groundwater inflow to any rehabilitated landforms and surface water ingress to groundwater from flooding events in the form of a groundwater model; d) maps showing the actual water level drawdown contours caused by the take of associated water for each groundwater aquifer details of any review undertaken of the numerical groundwater model and conceptual model; e) an assessment of any differences between the groundwater level impact predicted and actual impacts for corresponding periods in the most current numerical groundwater model; f) ensures all potential adverse groundwater impacts due to mining and rehabilitation activities are identified, monitored and mitigated; g) ensures groundwater monitoring and data analysis is undertaken to: i) detect any impacts to groundwater levels due to mining and rehabilitation activities; ii) detect any impacts to groundwater quality due to mining and rehabilitation activities; iii) determine compliance with **Condition D1**; and iv) determine trends in groundwater quality; h) provides an appropriate quality assurance and quality control program; i) documents groundwater management and monitoring methodologies undertaken for the duration of all mining activities and rehabilitation activities; and j) includes a review process to identify improvements to the program that includes addressing any comments provided by the administering authority.
D14	The Groundwater Management and Monitoring Program required by **Condition D13** must be updated by **30 November 2023** to incorporate data collected from the baseline groundwater monitoring program as detailed in **Condition D2**.
D15	**The Groundwater Management and Monitoring Program Review**

	The Groundwater Management and Monitoring Program required by **Condition D13,** and the data collected must be reviewed at least every **two (2) years** to determine if it continues to meet the requirements stated in **Condition D14**
D16	**The Groundwater Management and Monitoring Program Review Report** A report documenting the outcomes of the review required by **Condition D15** must be provided to the administering authority via WaTERS within **30 business days** from the date of completion of review and must at a minimum: a) show the location of the proposed groundwater bores to detect potential impacts from the mining and rehabilitation activities; b) include the target groundwater aquifer for each of the proposed groundwater bores; c) include the conceptual model used to determine the location of groundwater bores; d) state the methodology used to determine an appropriate number of groundwater bores to be installed; e) a schedule for the construction and commissioning of the groundwater bores; f) how impacts to prescribed environmental matters will be avoided as a result of the disturbance associated with the installation of the proposed bores; and g) standing water level for each of the groundwater bores.
D17	**Bore construction and maintenance and decommissioning** The construction, maintenance, and management of groundwater bores (including groundwater monitoring bores) must be undertaken in a manner that prevents or minimises impacts to the environment and ensures the integrity of the bores to obtain accurate monitoring.
D18	Any groundwater monitoring bores that are mined through during operations must be replaced with bores in the equivalent Screen Stratigraphy, and updated details provided in **Table D1 - Groundwater monitoring locations and frequency**.

Table D1- Groundwater monitoring locations and frequencies

Location Description	Monitoring Point	Environmental Value Monitoring	Easting (GDA20)	Northing (GDA20)	Pre-mining baseline standing water levels (mbTOC)[6]	Drawdown Trigger Levels (m)	Groundwater trigger elevation (mAHD)[4]	Monitoring Frequency
Monitoring Bores								
Rangal Coal Measure	MBBE0008	Groundwater	620294	7585092	18.64	5	282.62	Quarterly measurements of SWL[5] Quarterly EC and pH Six monthly for remaining analytes
Rangal Coal Measure	MBBE0012	Groundwater	619797	7584702	46.43	10	280.23	
Rewan Group	MBBE0010	Groundwater	620362	7586723	21.36	5	267.23	
Tertiary Sediments	MBBE0002b [2]	Terrestrial GDE within the riparian corridor near Hat and Spade creek	618436	7585329	12.57	2	331.86	
Basalt	MBBE0003 [2]	Groundwater	618431	7584664	N.A	N.A	N.A	
Alluvium	MBBE0004 [2]	Terrestrial GDE within the riparian corridor near Hat and Spade creek	620205	7586976	N.A	N.A	N.A	

Location Description	**Monitoring Point**	**Environmental Value Monitoring**	**Easting (GDA20)**	**Northing (GDA20)**	**Pre-mining baseline standing water levels (mbTOC)[6]**	**Drawdown Trigger Levels (m)**	**Groundwater trigger elevation (mAHD)[4]**	**Monitoring Frequency**
Alluvium	MBBE0011	Terrestrial GDE within the riparian corridor near Hat and Spade creek	619058	7587386	N.A	N.A	N.A	
Compliance Bores								
Rangal Coal Measures	MBBE0001 [1, 3]	Groundwater	619884	7585428	17.11	57	241	Quarterly measurements of SWL[1] Quarterly EC and pH Six monthly for remaining analytes[2]
Rewan Group	MBBE0007	Groundwater	620615	7586415	18.22	23	273	
Rangal Coal Measures	MBBE0009	Groundwater	620376	7586715	24.74	3	267.48	

NOTE:

1. *To be monitored until mined out.*
2. *Some bores are often dry and unavailable for water levels.*
3. *MBBE0001 to be replaced by MBBE0009*
4. *Groundwater trigger elevations are conversion of drawdown trigger levels(m) to mAHD – metres above Australian height Datum*
5. *Quarterly or more frequently following granting of this Environmental Authority*
6. *mbTOC – metres below top of casing*

Table D2 – Groundwater quality limits

Monitoring point	**Parameter**	**pH**	**EC**	**Sulfate (SO_4)**	**Arsenic**	**Aluminium**	**Molybdenum**	**Selenium**	**Major ions**
	Sample	**Range**	**Max**	**Max**	**Max**	**Max**	**Max**	**Max**	**Interpretation Only**
	Unit	**pH units**	**(µS/cm)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	
MBBE0001		6.5 – 8.5	901.7	398	0.013	0.08	0.034	0.013	
MBBE0007			48,600	961.5	0.013	0.055	0.02	0.013	
MBBE0009			16,000	398	0.013	0.055	0.034	0.005	

NOTE:

All metals must be measured as total (unfiltered) and dissolved (filtered). Trigger levels for metal apply if dissolved results exceed trigger.

Triggers are based on 95th percentile results from all groundwater quality analyses from each monitoring bore.

Schedule E: Noise and Vibration	
Condition number	**Condition**
E1	**Noise nuisance** Noise, vibration and air blast overpressure resulting from the authorised mining activities must not cause a nuisance at any sensitive receptor.
E2	A **Noise and Vibration Management Plan** must be implemented at the site and include the following as a minimum: a) be developed by an appropriately qualified person; b) identification of all potential sensitive receptors which may be affected by noise and vibration impacts from the mining activities; c) identification of all major sources of noise and vibration emissions that may occur as a result of the operation of the project; d) description of the procedures to manage the noise and vibration emissions from the sources identified; e) collection of noise and vibration data as per **Condition E3**; f) identifying adverse meteorological conditions likely to produce elevated levels of noise and vibration at a sensitive or commercial place due to mining activities; g) integration of noise and vibration control strategies; h) protocols for regular maintenance of plant and equipment, to minimise the potential for noise and vibration emissions; and i) description of procedures to be undertaken if any exceedance is detected.
E3	**Noise monitoring** Noise from the authorised mining activities must not exceed the limits specified in **Table E1 - Noise limits** and **Table E2 - Blasting Noise Limits** at any sensitive receptor. If the environmental authority holder can provide monitoring evidence at the time of the alleged exceedance that the limits defined in **Table E1 - Noise Limits** and **Table E2 - Blasting Noise Limits** , are not being exceeded then the holder is not in breach of **Condition E1** of this environmental authority.
E4	Monitoring required by **Condition E3** must be conducted in accordance with the administering authority's *Noise Measurement Manual* (ESR/2016/2195) and all recordings must include the following descriptor characteristics and matters: a) LAN,T (where N equals the statistical levels of 1, 10 and 90 and T = 1 hour) b) background noise LA90 c) the level and frequency of occurrence of impulsive or tonal noise and any adjustment and penalties to statistical levels d) atmospheric conditions including temperature, relative humidity and wind speed and directions e) effects due to any extraneous factors such as traffic noise f) location, date and time of monitoring g) if the complaint concerns low frequency noise, Max LpLIN,T and one third octave band measurements in dB(LIN) for centre frequencies in the 10 – 200 Hz range.

E5	If monitoring indicates exceedance of the limits in **Table E1 - Noise Limits** and **Table E2 - Blasting Noise Limits**, then the environmental authority holder must: a) address the complaint including the use of appropriate dispute resolution if required; and b) immediately implement noise abatement measures so that emissions of noise from the activity do not result in further environmental nuisance.
E6	If during monitoring as required by **Condition E3**, there is an exceedance of the relevant limits listed in **Table E1 - Noise limits** and **Table E2 - Blasting Noise Limits**, the administering authority must be notified of the exceedance occurring within **twenty-four (24) hours** as per **Condition A15**. The notification must also detail the actions taken in accordance with **Condition E5**.
E7	**Vibration nuisance** Subject to **Conditions A13** and **E8** of this environmental authority vibration from the mining activity must not cause an environmental nuisance, at any sensitive receptor.
E8	If the environmental authority holder can provide monitoring evidence that the limits defined in **Table E2 – Blasting Noise Limits**, are not being exceeded then the holder is not in breach of **Condition A13** of this environmental authority. Monitoring must include: a) peak particle velocity (mm/s); b) air blast overpressure level (dB linear peak); c) location of the blast/s within the mining area (including which bench level); d) atmospheric conditions including temperature, relative humidity and wind speed and direction; and e) location, date, and time of recording.
E9	Blast monitoring must be conducted in accordance with the most recent edition of the administering authority's guideline *Noise and vibration from blasting* (ESR/2016/2169) or relevant Australian Standards.
E10	For the purposes of **Condition E7** of this environmental authority, the mining activities will not cause environmental nuisance where noise from the mining activities does not exceed the criteria specified in **Table E2 – Blasting Noise Limits**.
E11	If monitoring indicates exceedance of the limits in **Table E2 – Blasting Noise Limits**, then the environmental authority holder must: a) address the complaint including the use of appropriate dispute resolution if required; and b) immediately implement noise abatement measures so that emissions of noise from the activity do not result in further environmental nuisance.
E12	Every explosive blast for the mining activity shall be designed by a competent person to achieve the criteria specified in **Table E2 – Blasting Noise Limits**.
E13	All relevant information pertaining to the design of every explosive blast for the mining activity in relation to the criteria specified in **Table E2 - Blasting Noise Limits** shall be kept in written and diagrammatic form.

Table E1 - Noise limits

Noise level dB(A)	**Monday to Sunday (including public holidays)**		
	7am - 6pm	**6pm - 10pm**	**10pm - 7am**
	Noise measured at a 'Sensitive receptor'		
$L_{Aeq, Adj, 1hr}$	40	40	35
$L_{A1, adj, 1hr}$	50	50	45

NOTE: *Table E1 does not purport to set operating hours for the mining activities.*

Table E2 - Blasting Noise Limits

Noise Level dB(A)	**Sensitive or commercial place**	
	7am – 6pm	**6pm – 7am**
Airblast overpressure	115 dB (Linear) Peak for 4 out of 5 consecutive blasts initiated and not greater than 120 dB (Linear) Peak at any time.	No blasting to occur
Ground vibration peak particle velocity	5mm/second peak particle velocity for 4 out of 5 consecutive blasts and not greater than 10 mm/second peak particle velocity at any time	No blasting to occur

NOTE: *Table E2 does not purport to set limits applicable to any particular explosive blast, rather sets design criteria for every explosive blast.*

Schedule F: Waste	
Condition number	**Condition**
F1	**Waste Management Plan** A Waste Management Plan must be developed and implemented for all stages of mining activities. The Waste Management Plan must at a minimum include the following: a) types and amounts of regulated waste generated, including rejects; b) description of how the types of regulated waste are generated and will be dealt with under the waste and resource management hierarchy; c) procedures for identifying and implementing opportunities to minimise the amount of regulated waste generated and improve practices employed; d) procedures for dealing with accidents, spills and incidents that may impact on waste management; e) staff training on matters relevant to regulated waste management; and f) mechanisms and dates for review of the waste management plan.
F2	Waste must not be burnt or allowed to burn on the site unless permitted by the administering authority.
F3	A designated area must be set aside for the segregation of economically viable recycling solid or liquid waste.
F4	Site contamination will be assessed at relinquishment of the mining tenure according to the *Environmental Protection Act 1994*, with results and any required remediation actions detailed in the Final Rehabilitation Report.
F5	Records of trade waste or material leaving the Mining Lease for recycling or disposal, including the final destination and method of treatment, in accordance with the *Environmental Protection Act 1994*, will be maintained and be made available for inspection by an authorised person or the administering authority.
F6	**Inert demolition and construction waste disposal** Inert demolition and construction waste must only be disposed of into the spoil emplacements disposal area consistent with the site Waste Management Plan.
F7	Deposited waste must be covered as soon as practicable to limit stormwater infiltration, prevent exposure of waste, and prevent issues arising from vectors and pest species.
F8	All reasonable and practicable measures must be taken to contain litter within the waste operations area, and retrieve litter released.
F9	The only types of regulated waste authorised to be disposed are scrap tyres and rejects.
F10	A register recording all volumes and locations of regulated waste disposed must be established and maintained to ensure that the information contained in the register is current and complete on any given day.

F11	**Storage of tyres** Scrap tyres stored awaiting disposal or transport for take-back and recycling, or waste-to-energy options must be stored in stable stacks and at least **ten (10) meters** from any other scrap tyre storage area, or combustible or flammable material, including vegetation.
F12	All reasonable and practicable fire prevention measures must be implemented, including removal of grass and other materials within a **ten (10) meter** radius of the scrap tyre storage area.
F13	Where no feasible recycling or waste to energy options are available, disposing of scrap tyres resulting from the mining activities in spoil emplacements is acceptable, provided tyres are placed as deep in the spoil as reasonably practicable.
F14	Scrap tyre waste disposal areas on the mining lease will be capped with two meters of inert material and revegetated in accordance with available and recognised best practice following the cessation of their use as disposal areas in a manner that will encourage run-off.
F15	Scrap tyres resulting from the mining activities disposed within the operational land must not impede saturated aquifers or compromise the stability of the consolidated landform.
F16	**Rejects disposal** The only regulated waste authorised to be disposed of under environmentally relevant activity 60(1) is rejects and it must be disposed in accordance with **Conditions F17** and **F18**.
F17	Rejects are authorised to be disposed of within spoil emplacements in the following disturbance areas: a) out of pit overburden dumps; and b) central in-pit spoil dump.
F18	Rejects must be disposed of according to, at a minimum, the following emplacement design criteria: a) each emplacement is not more than **50 metres** in width and **100 metres** in length; b) there is not less than **ten (10) metres** in between rejects emplacements; and c) each emplacement is not less than **ten (10) metres** from a spoil dump boundary.

Schedule G: Land and Biodiversity	
Condition number	**Condition**
G1	**Preventing contaminant release to land** Contaminants must not be released to land unless otherwise authorised by a condition of this environmental authority.
G2	**Topsoil** Topsoil resources that are suitable for use in rehabilitation must be salvaged ahead of mining disturbance for strategic use in rehabilitation of the mine area.
G3	A **Topsoil Management Plan** must be developed, implemented, and made available to the administering authority upon request. The Topsoil Management Plan must contain topsoil management strategies including but not limited to: a) Topsoil stripped and stockpiled in advance of mining activities; b) Measures to ensure that the mixing and erosion of topsoil and overburden stockpiles is prevented; and c) A topsoil inventory which identifies the topsoil requirements and availability of suitable topsoil on site for the mining activity must be maintained and made available on request by the administering authority.
G4	**Mineral Waste** A **Mineral Waste Management Plan** must be developed and implemented for the duration of the mining activities. The plan must include at a minimum: a) a program of progressive sampling and characterisation to identify the physical properties of mineral waste, the dispersive and non-dispersive material, salinity, acid and alkali producing potential, and metal concentrations; b) the availability or leachability of metals from mineral waste; c) a materials balance and disposal plan demonstrating how potentially acid forming, acid forming and sodic mineral waste will be selectively placed and/or encapsulated; d) where relevant, a sampling program to verify encapsulation and/or placement of potentially acid forming, acid-forming and sodic mineral waste; e) details as to how seepage and leachability from mineral waste will be managed both during operation and the foreseeable future; and f) mechanisms for review of the Mineral Waste Management Plan.
G5	**Rehabilitation and final landform design** All areas significantly disturbed by mining activities must be rehabilitated to a safe, stable, non-polluting landform with a self-sustaining vegetation cover in accordance with the following**:** a) **Appendix 5, Table G1 - Post Ming Land Use (PMLU) and Rehabilitation Methods**; b) **Appendix 5, Table G2 - PMLU Rehabilitation Success Criteria;** c) The Rehabilitation Management Plan required by **Condition G10**; and d) A Residual Void Design and Closure Plan required by **Condition G7.**

G6	**Residual Void Outcome** Only the residual void detailed in **Appendix 5**, **Table G1 - Post Mine Land Use (PMLU) and Rehabilitation Methods**, is permitted at the approved place located as per **Figure 4 - Final Landform.** The residual void must comply with its design requirements specified in **Appendix 5**, **Table G2 - PMLU Rehabilitation Success Criteria**
G7	The south residual void as detailed in **Appendix 5**, **Table G1 - Post Mine Land Use (PMLU) and Rehabilitation Methods** must act as groundwater sink to the receiving groundwater environment.
G8	A Residual Void Design and Closure Plan must be developed and submitted for a review to the administering authority by **29 September 2023**.
G9	Within **twenty (20) business days** of receiving comments from the administering authority as per **Condition G8**, a Residual Void Design and Closure plan must be updated by the AQP to address any comments suggested by the administering authority.
G10	A Residual Void (Southern void) Design and Closure Plan required by **Condition G8** must include, but is not limited to, the following details: a) a study of options available for minimising residual void area and volume; b) detailed design criteria and rehabilitation methodology of residual voids in accordance with **Appendix 5**, **Table G1 - Post Mine Land Use (PMLU) and Rehabilitation Methods** and **Table G2 - PMLU Rehabilitation Success Criteria**; c) a void hydrology study, addressing the long-term water balance in the void, connections to groundwater resources and water quality parameters in the long-term; d) a pit wall stability study, considering the effects of long-term erosion and weathering of the pit wall and the effects of significant hydrological events; e) a proposal/s for end of mine void rehabilitation success criteria and residual void areas and volumes; and f) post closure monitoring and management requirements. NOTE*: At the completion of decommissioning and rehabilitation, the residual void must be protected from Probable Maximum Floods (PMFs) from nearby watercourses such that the protection is sustainable for the foreseeable future.*

G11	**Rehabilitation Management Plan** A Rehabilitation Management Plan for all areas disturbed by the authorised mining activities must be developed and implemented by an appropriately qualified person that includes, at a minimum, the following: a) a map of proposed areas of rehabilitation including classification and status of rehabilitation; b) a strategy and schedule for the progressive rehabilitation of all disturbance during the life of mine; c) a strategy for weed and pest management which includes disturbed and rehabilitated areas; d) a strategy for successfully achieving rehabilitation requirements of this environmental authority; e) details of the grazing trials; f) details of landform design to achieve rehabilitation outcomes listed in **Appendix 5**, **Table G1 - Post Mine Land Use (PMLU) and Rehabilitation Methods** including end of mine design and schematic representation of final landform inclusive of: i. drainage design and features; ii. slope designs; iii. cover design; iv. erosion controls proposed on reformed land; g) details of how landform design will be consistent with surrounding topography; h) details of how the final land uses will align with local planning scheme requirements; i) specify the spoil characteristics, soil analysis and soil separation for use on rehabilitation; j) specify the topsoil requirements for the site and how topsoil will be managed for use in rehabilitation; k) details of any topsoil deficit and how any deficit will be managed for successful rehabilitation; l) details of rehabilitation methods to be applied to each domain as per **Appendix 5**, **Table G1 Post Mine Land Use (PMLU) and Rehabilitation Methods,** including defined water quality parameters for water structures to be retained onsite post mine; m) describe the monitoring of reference sites; n) description of rehabilitation indicators and how these will be monitored; o) description of management actions to address unsuccessful rehabilitation or redesign; p) description of wastewater collection and reticulation and treatment systems; q) description of any risks to groundwater and how these will be managed; and r) description of seepage and leachate management considerations.
G12	The Rehabilitation Management Plan required by **Condition G11** must be submitted to the administering authority for review and comment before **29 September 2023**.
G13	Within **twenty (20) business days** of receiving comments from the administering authority as per **Condition G12**, the Rehabilitation Management Plan must be updated by the appropriately qualified person to address any comments suggested by the administering authority.
G14	Rehabilitation must commence and be undertaken progressively in accordance with the Rehabilitation Management Plan required by **Condition G11.**
G15	**Rehabilitation Monitoring Program** A Rehabilitation Monitoring Program must be developed and implemented by an appropriately qualified person for the life of this environmental authority.

G16	A review of the Rehabilitation Monitoring Program required by **Condition G15** must occur at intervals no greater than **thirty-six (36) months** from the commencement of the mining activities.
G17	A report of the findings of the rehabilitation monitoring program review required by **Condition G16**. The report must contain the following: a) how the rehabilitation objectives in the Rehabilitation Management Plan required by **Condition G4** are being met; b) if the rehabilitation objectives are not being met, the corrective actions to be taken; c) a statistical analysis of how areas of rehabilitation compare to reference sites; d) a statistical analysis of how areas of rehabilitation are meeting the requirements of **Condition G11**; e) the sampling and monitoring intensity used in the Rehabilitation Monitoring Program required by **Condition G15**; and f) justification of the sampling and monitoring intensity used in the Rehabilitation Monitoring Program required by **Condition G15**.
G18	**Infrastructure** All infrastructure, constructed by or for the environmental authority holder during the mining activities including water storage structures, must be removed from the site prior to mining lease surrender, except where agreed in writing by the post mining landowner / holder. NOTE: *This is not applicable where the landowner/holder is also the environmental authority holder.*
G19	The characteristics of overburden must be determined prior to disturbance by mining to a standard sufficient to enable selective handling of materials required.
G20	Cleared vegetation from the site must be managed in accordance with the following hierarchy: a) reuse, e.g., use of logs and tree stumps as shelter for fauna in rehabilitated areas; b) recycle, e.g., mulching of vegetation and use in rehabilitation on the site; and c) other alternative management options implemented in a way that causes the least amount of environmental harm.
G21	**Chemical Storage** Chemicals and fuels stored, must be effectively contained and where relevant, meet Australian Standards, where such a standard is applicable. Where no standard exists, storage of such materials must be within an effective on-site containment system.

Schedule H: Regulated Structures	
Condition number	**Condition**
H1	**Assessment of consequence category** The consequence category of any structure must be assessed by a suitably qualified and experienced person in accordance with the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (ESR/2016/1933) at the following times: a) prior to the design and construction of the structure, if it is not an existing structure; or b) prior to any change in its purpose or the nature of its stored contents.
H2	A consequence assessment report and certification must be prepared for each structure assessed and the report may include a consequence assessment for more than one structure.
H3	Certification must be provided by the suitably qualified and experienced person who undertook the assessment, in the form set out in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (ESR/2016/1933).
H4	**Design and construction[1] of a regulated structure** **Conditions H5** to **H9** inclusive do not apply to existing structures.
H5	All regulated structures must be designed by, and constructed[2] under the supervision of, a suitably qualified and experienced person in accordance with the requirements of the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (ESR/2016/1933).
H6	Construction of a regulated structure is prohibited unless the holder has submitted a consequence category assessment report and certification to the administering authority has been certified by a suitably qualified and experienced person for the design and design plan and the associated operating procedures in compliance with the relevant condition of this authority.
H7	Certification must be provided by the suitably qualified and experienced person who oversees the preparation of the design plan in the form set out in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (ESR/2016/1933) and must be recorded in the Register of Regulated Structures.

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[1] Construction of a dam includes modification of an existing dam — refer to the definitions.

[2] Certification of design and construction may be undertaken by different persons.

H8	Regulated structures must: a) be designed and constructed in accordance with and conform to the requirements of the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (ESR/2016/1933); b) be designed and constructed with due consideration given to ensuring that the design integrity would not be compromised on account of: i) floodwaters from entering a regulated dam from any watercourse or drainage line; and ii) wall failure due to erosion by floodwaters arising from any watercourse or drainage line. c) for regulated dams that are dams associated with a failure to contain – seepage: have the floor and sides of the dam designed and constructed to prevent or minimise the passage of the wetting front and any entrained contaminants through either the floor or sides of the dam during the operational life of the dam and for any period of decommissioning and rehabilitation of the dam.
H9	Certification by the suitably qualified and experienced person who supervises the construction must be submitted to the administering authority on the completion of construction of the regulated structure, and state that: a) the 'as constructed' drawings and specifications meet the original intent of the design plan for that regulated structure; b) construction of the regulated structure is in accordance with the design plan.
H10	**Operation of a regulated structure** Operation of a regulated structure, except for an existing structure, is prohibited unless the holder has submitted to the administering authority: a) one electronic copy of the design plan and certification of the 'design plan' in accordance with **Condition H6**, and b) a set of 'as constructed' drawings and specifications, and c) certification of those 'as constructed drawings and specifications' in accordance with **Condition H9**, and d) where the regulated structure is to be managed as part of an integrated containment system for the purpose of sharing the DSA volume across the system, a copy of the certified system design plan. e) the requirements of this authority relating to the construction of the regulated structure have been met; f) The holder has entered the details required under this authority, into a Register of Regulated Dams; and g) There is a current operational plan for the regulated structures.
H11	Each regulated structure must be maintained and operated, for the duration of its operational life until decommissioned and rehabilitated, in a manner that is consistent with the current operational plan and, if applicable, the current design plan and associated certified 'as constructed' drawings.
H12	**Mandatory reporting level** **Conditions H14 to H17** inclusive only apply to regulated dams which have not been certified as low consequence category for 'failure to contain – overtopping'.

H13	The Mandatory Reporting Level (the MRL) must be marked on a regulated dam in such a way that during routine inspections of that dam, it is clearly observable.
H14	The holder must, as soon as practical and within **forty-eight (48) hours** of becoming aware, notify the administering authority when the level of the contents of a regulated dam reaches the MRL.
H15	The holder must, immediately on becoming aware that the MRL has been reached, act to prevent the occurrence of any unauthorised discharge from the regulated dam.
H16	The holder must record any changes to the MRL in the Register of Regulated Structures.
H17	**Design Storage Allowance** The holder must assess the performance of each regulated dam or linked containment system over the preceding November to May period based on actual observations of the available storage in each regulated dam or linked containment system taken **prior to 1 July** of each year.
H18	By **1 November** of each year, storage capacity must be available in each regulated dam (or network of linked containment systems with a shared DSA volume), to meet the Design Storage Allowance (DSA) volume for the dam (or network of linked containment systems).
H19	The holder must, as soon as possible and **within forty-eight (48) hours** of becoming aware that the regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on **1 November** of any year, notify the administering authority.
H20	The holder must, immediately on becoming aware that a regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on **1 November** of any year, act to prevent the occurrence of any unauthorised discharge from the regulated dam or linked containment systems.
H21	**Annual Inspection report** Each regulated structure must be inspected each calendar year by a suitably qualified and experienced person.
H22	At each annual inspection, the condition and adequacy of all components of the regulated structure must be assessed and a suitably qualified and experienced person must prepare an annual inspection report containing details of the assessment and include recommended actions to ensure the integrity of the regulated structure.
H23	The suitably qualified and experienced person who prepared the annual inspection report must certify the report in accordance with the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (ESR/2016/1933).

H24	The holder must: a) Within **twenty (20) business days** of receipt of the annual inspection report, provide to the administering authority: i) The recommendations section of the annual inspection report; and ii) If applicable, any actions being taken in response to those recommendations; and b) If, following receipt of the recommendations and (if applicable) actions, the administering authority requests a full copy of the annual inspection report from the holder, provide this to the administering authority within **ten (10) business days** of receipt of the request.
H25	**Transfer arrangements** The holder must provide a copy of any reports, documentation and certifications prepared under this authority, including but not limited to any Register of Regulated Structures, consequence assessment, design plan and other supporting documentation, to a new holder on transfer of this authority.
H26	**Decommissioning and rehabilitation** Dams must not be abandoned but be either: a) decommissioned and rehabilitated to achieve compliance with **Condition H28**; or b) be left in-situ for a beneficial use(s) provided that: i) it no longer contains contaminants that will migrate into the environment; ii) it contains water of a quality that is demonstrated to be suitable for its intended beneficial use(s); and iii) the administering authority, the holder of the environmental authority and the landholder agree in writing that the dam will be used by the landholder following the cessation of the environmentally relevant activity(ies).
H27	After decommissioning, all significantly disturbed land caused by the carrying out of the environmentally relevant activity(ies) must be rehabilitated to meet the following final acceptance criteria: a) the landform is safe for humans and fauna; b) the landform is stable with no subsidence or erosion gullies for at least **three (3) years**; c) any contaminated land (e.g. contaminated soils) is remediated and rehabilitated; d) not allowing for acid mine drainage; e) there is no ongoing contamination to waters (including groundwater); f) rehabilitation is undertaken in a manner such that any actual or potential acid sulfate soils on the area of significant disturbance are treated to prevent or minimise environmental harm in accordance with the *Instructions for the treatment and management of acid sulfate soils* (2001); g) all significantly disturbed land is reinstated to the pre-disturbed land suitability class; and h) for land that is not being cultivated by the landholder: i) groundcover, that is not a declared pest species is established and self-sustaining; ii) vegetation of similar species richness and species diversity to pre-selected analogue sites is established and self-sustaining; iii) the maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance caused by carrying out the resource activities;

	iv) for land that is to be cultivated by the landholder, cover crop is revegetated, unless the landholder will be preparing the site for cropping within **three (3) months** of the resource activities being completed.
H28	**Register of Regulated Structure** A Register of Regulated Structures must be established and maintained by the holder for each regulated dam.
H29	The holder must provisionally enter the required information in the Register of Regulated Structures when a design plan for a regulated structure is submitted to the administering authority.
H30	The holder must make a final entry of the required information in the Register of Regulated Structures once compliance with **Condition H10** to **H11** has been achieved.
H31	The holder must ensure that the information contained in the Register of Regulated Structures is current and complete on any given day.
H32	All entries in the Register of Regulated Structures must be approved by the chief executive officer for the holder of this authority, or their delegate, as being accurate and correct.

Definitions

Key terms and/or phrases used in this document are defined in this section. Applicants should note that where a term is not defined, the definition in the *Environmental Protection Act 1994*, its regulations or environmental protection policies must be used. If a word remains undefined it has its ordinary meaning.

"accepted engineering standards" in relation to dams, means those standards of design, construction, operation and maintenance that are broadly accepted within the profession of engineering as being good practice for the purpose and application being considered. In the case of dams, the most relevant documents would be publications of the Australian National Committee on Large Dams (ANCOLD), guidelines published by Queensland government departments, and relevant Australian and New Zealand Standards.

"acceptance criteria" means the measures by which the actions implemented to rehabilitate the land are deemed to be complete. The acceptance criteria indicate the success of the rehabilitation outcome or remediation of areas which have significantly been disturbed by the resource activities. Acceptance criteria may include information regarding:

a) vegetation establishment, survival and succession;

b) vegetation productivity, sustained growth and structure development;

c) fauna colonisation and habitat development;

d) ecosystem processes such as soil development and nutrient cycling, and the recolonisation of specific fauna groups such as collembola, mites and termites which are involved in these processes;

e) microbiological studies including recolonisation by mycorrhizal fungi, microbial biomass and respiration;

f) effects of various establishment treatments such as deep ripping, topsoil handling, seeding and fertiliser application on vegetation growth and development;

g) resilience of vegetation to disease, insect attack, drought and fire; and

h) vegetation water use and effects on ground water levels and catchment yields.

"acid sulfate soil(s)" means a soil or soil horizon which contains sulfides or an acid soil horizon affected by oxidation of sulfides.

"acid rock drainage" means any contaminated discharge emanating from a mining activity formed through a series of chemical and biological reactions when geological strata is disturbed and exposed to oxygen and moisture as a result of mining activity.

"administering authority" means the Department of Environment and Science or its successor.

"AEP" means the Annual Exceedance Probability, which is the probability that at least one event in excess of a particular magnitude will occur in any given year.

"airblast overpressure" means energy transmitted from the blast site within the atmosphere in the form of pressure waves. The maximum excess pressure in this wave, above ambient pressure is the peak airblast overpressure measured in decibels linear (dBL).

"ANZECC" means the **Australian and New Zealand Guidelines for Fresh Marine Water Quality 2000**

“annual inspection report” means an assessment prepared by a suitably qualified and experienced person containing details of the assessment against the most recent consequence assessment report and design plan (or system design plan);

a) against recommendations contained in previous annual inspections reports;

b) against recognised dam safety deficiency indicators;

c) for changes in circumstances potentially leading to a change in consequence category;

d) for conformance with the conditions of this authority;

e) for conformance with the ‘as constructed’ drawings;

f) for the adequacy of the available storage in each regulated dam, based on an actual observation or observations taken after 31 May each year but prior to 1 November of that year, of accumulated sediment, state of the containment barrier and the level of liquids in the **dam** (or network of linked containment systems);

g) for evidence of conformance with the current operational plan.

“APPEA Code” means the current APPEA, Code of Environmental Practice.

“appropriately qualified person” means a person who has professional qualifications, training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis on performance relative to the subject matter using the relevant protocols, standards, methods or literature.

“areas of pre-existing disturbance” means areas where environmental values have been negatively impacted as a result of anthropogenic activity and these impacts are still evident. Areas of pre-disturbance may include areas where legal clearing, logging, timber harvesting, or grazing activities have previously occurred, where high densities of weed or pest species are present which have inhibited re-colonisation of native regrowth, or where there is existing infrastructure (regardless of whether the infrastructure is associated with the authorised petroleum activities). The term ‘areas of pre-disturbance’ does not include areas that have been impacted by wildfire/s, controlled burning, flood or natural vegetation die-back.

“authority” means environmental authority (mining activities) under the *Environmental protection Act 1994*.

“AS2885” means the *Australian Standard Pipelines – Gas and Liquid Petroleum.*

“assessed” or **“assess”** by a suitably qualified and experienced person in relation to a hazard assessment of a structure, means that a statutory declaration has been made by that person and, when taken together with any attached or appended documents referenced in that declaration, all of the following aspects are addressed and are sufficient to allow an independent audit at any time:

a) exactly what has been assessed and the precise nature of that assessment;

b) the relevant legislative, regulatory and technical criteria on which the assessment has been based;

c) the relevant data and facts on which the assessment has been based, the source of that material, and the efforts made to obtain all relevant data and facts; and

d) the reasoning on which the assessment has been based using the relevant data and facts, and the relevant criteria.

“associated water” is defined in section 185 of the *Petroleum and Gas (Production and Safety) Act 2004* and means underground water taken or interfered with, if the taking or interference happens during the course of, or results from, the carrying out of another authorised activity under a petroleum authority, such as a petroleum well, and includes waters also known as produced formation water. The term includes all contaminants suspended or dissolved within the water.

“associated works” in relation to a dam, means:

a) operations of any kind and all things constructed, erected or installed for that dam; and

b) any land used for those operations.

“background noise level” means the sound pressure level, measured in the absence of the noise under investigation, as the LA90, T being the A-weighted sound pressure level exceeded for 90% of the measurement time period T of not less than 15 minutes, using Fast response.

“bed and banks” for a waters, river, creek, stream, lake, lagoon, pond, swamp, wetland or dam means land over which the water of the waters, lake, lagoon, pond, swamp, wetland or dam normally flows or that is normally covered by the water, whether permanently or intermittently; but does not include land adjoining or adjacent to the bed and banks that is from time to time covered by floodwater.

“beneficial use” in respect of dams means that the current or proposed owner of the land on which a dam stands, has found a use for that dam that is:

a) of benefit to that owner in that it adds real value to their business or to the general community,

b) in accordance with relevant provisions of the *Environmental Protection Act 1994*,

c) sustainable by virtue of written undertakings given by that owner to maintain that dam, and

d) the transfer and use have been approved or authorised under any relevant legislation.

“blasting” means the use of explosive materials to fracture-

a) rock, coal and other minerals for later recovery; or

b) structural components or other items to facilitate removal from a site or for reuse.

“bunded” means within bunding consistent with Australian Standard 1940.

“certification”, “certifying” or **“certified”** by an appropriately qualified and experienced person in relation to a design plan or an annual report regarding dams/structures, means that a statutory declaration has been made by that person and, when taken together with any attached or appended documents referenced in that declaration, all of the following aspects are addressed and are sufficient to allow an independent audit at any time:

a) exactly what is being certified and the precise nature of that certification;

b) the relevant legislative, regulatory and technical criteria on which the certification has been based;

c) the relevant data and facts on which the certification has been based, the source of that material, and the efforts made to obtain all relevant data and facts; and

d) the reasoning on which the certification has been based using the relevant data and facts, and the relevant criteria.

“chemical” means:

a) an agricultural chemical product or veterinary chemical product within the meaning of the *Agricultural and Veterinary Chemicals Code Act 1994* (Commonwealth); or

b) a dangerous good under the Australian Code for the Transport of Dangerous Goods by Road and Rail approved by the Australian Transport Council; or

c) a lead hazardous substance within the meaning of the *Workplace Health and Safety Regulation 1997*;

d) a drug or poison in the Standard for the Uniform Scheduling of Drugs and Poisons prepared by the Australian Health Ministers’ Advisory Council and published by the Commonwealth; or

e) any substance used as, or intended for use as:
   - i) a pesticide, insecticide, fungicide, herbicide, rodenticide, nematicide, miticide, fumigant or related product; or
   - ii) a surface active agent, including, for example, soap or related detergent; or
   - iii) a paint solvent, pigment, dye, printing ink, industrial polish, adhesive, sealant, food additive, bleach, sanitiser, disinfectant, or biocide; or
   - iv) a fertiliser for agricultural, horticultural or garden use; or
   - v) a substance used for, or intended for use for mineral processing or treatment of metal, pulp and paper, textile, timber, water or wastewater; or
   - vi) manufacture of plastic or synthetic rubber.

“clearing” means:

a) in relation to grass, scrub or bush – the removal of vegetation by disturbing root systems and exposing underlying soil (including burning), but does not include –
   - i) the flattening or compaction of vegetation by vehicles if the vegetation remains living; or
   - ii) the slashing or mowing of vegetation to facilitate access tracks; or
   - iii) the clearing of noxious or introduced plant species; and

b) in relation to trees – cutting down, ringbarking, pushing over, poisoning or destroying in any way.

“commercial place” means a workplace used as an office or for business or commercial purposes, which is not part of the mining activity and does not include employees accommodation or public roads.

“competent person” means a person with the demonstrated skill and knowledge required to carry out the task to a standard necessary for the reliance upon collected data or protection of the environment.

“completion criteria” these are the standards that are to be met by successful rehabilitation. They will generally be in the form of numerical values that can be verified by measurement of the indicators selected for the rehabilitation objectives. They may include an element based on time, e.g. the criterion has been achieved for 7 consecutive years for 95 percent of the area.

“consequence” in relation to a structure as defined, means the potential for environmental harm resulting from the collapse or failure of the structure to perform its primary purpose of containing, diverting or controlling flowable substances.

“consequence category” means a category, either low, significant or high, into which a structure is assessed as a result of the application of tables and other criteria in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933)*.

“construction” includes building a new regulated structure and modifying or lifting an existing regulated structure.

“contaminate” means to render impure by contact or mixture.

“contaminated” means the substance has come into contact with a contaminant.

“contaminant” – a contaminant can be:

a) a gas, liquid or solid; or

b) an odour; or

c) an organism (whether alive or dead), including a virus; or

d) energy, including noise, heat, radioactivity and electromagnetic radiation; or

e) a combination of contaminants.

“control measure” means any action or activity that can be used to prevent or eliminate a hazard or reduce it to an acceptable level.

“dam” means a land-based structure or a void that is designed to contain, divert or control flowable substances, and includes any substances that are thereby contained, diverted or controlled by that land-based structure or void and associated works. However; a dam does *not* mean a fabricated or manufactured tank or container designed to a recognised standard, *nor* does a dam mean a land-based structure where that structure is designed to an Australian Standard. In case there is any doubt, a levee (dyke or bund) is a dam, but (for example) a bund designed for spill containment to AS1940 is *not* a dam.

“dam crest volume” means the volume of material (liquids and/or solids) that could be within the walls of a dam at any time when the upper level of that material is at the crest level of that dam. That is, the instantaneous maximum volume within the walls, without regard to flows entering or leaving (for example, via spillway).

“declared pest plants” are listed in Schedule 2 of the Land *Protection (Pest and Stock Route Management) Regulation 2003*.

“design plan” is the documentation required to describe the physical dimensions of the dam, the materials and standards to be used for construction of the dam, and the criteria to be used for operating the dam. The documents must include design and investigation reports, specifications and certifications, together with the planned decommissioning and rehabilitation works and outcomes. A design plan may include ‘as constructed’ drawings.

“design storage allowance” or **“DSA”** means the minimum storage required in a dam at the first of November each year in order to meet the hydraulic performance requirements.

“development approval” means a development approval under the *Integrated Planning Act 1997* or the *Sustainable Planning Act 2009* in relation to a matter that involves an environmentally relevant activity under the *Environmental Protection Act 1994*.

“disturbance” of land includes:

a) compacting, removing, covering, exposing or stockpiling of earth;

b) removal or destruction of vegetation or topsoil or both to an extent where the land has been made susceptible to erosion;

c) carrying out mining within a watercourse, waterway, wetland or lake;

d) the submersion of areas by tailings or hazardous contaminant storage and dam/structure walls;

e) temporary infrastructure, including any infrastructure (roads, tracks, bridges, culverts, dam/structures, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc.) which is to be removed after the mining activity has ceased; or

f) releasing of contaminants into the soil, or underlying geological strata.

However, the following areas are not included when calculating areas of ‘disturbance’:

g) areas off lease (e.g. roads or tracks which provide access to the mining lease);

h) areas previously disturbed which have achieved the rehabilitation outcomes;

i) by agreement with the administering authority, areas previously disturbed which have not achieved the rehabilitation objective(s) due to circumstances beyond the control of the mine operator (such as climatic conditions);

j) areas under permanent infrastructure. Permanent infrastructure includes any infrastructure (roads, tracks, bridges, culverts, dam/structures, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc.) which is to be left by agreement with the landowner.

k) disturbance that pre-existed the grant of the tenure.

“dwelling” means any of the following structures or vehicles that is principally used as a residence –

a) a house, unit, motel, nursing home or other building or part of a building; or

b) a caravan, mobile home or other vehicle or structure on land; or

c) a watercraft in a marina.

“EC” means electrical conductivity

“effluent” treated wastewater discharged from sewage treatment plants.

“end” means the stopping of the particular activity that has caused a significant disturbance in a particular area. It refers to, among other things, the end of a seismic survey or the end of a drilling operation. It does not refer to the end of all related activities such as rehabilitation. In other words, it does not refer to the ‘completion’ of the particular activity, the time at which the petroleum authority ends or the time that the land in question ceases to be part of the authority. Under the APPEA Code ‘completion’ refers to the point at which the particular survey, program or operation has been rehabilitated and abandoned.

“end of pipe” means the location at which water is released to waters or land.

“environmental authority” means an environmental authority under Chapter 5 of the *Environmental Protection Act 1994.*

“environmental authority holder” means the holder of this environmental authority.

“environmental nuisance” is defined in section 15 of the *Environmental Protection Act* 1994 and is unreasonable interference or likely interference with an environmental value caused by:

a) aerosols, fumes, light, noise, odour, particles or smoke; or

b) an unhealthy, offensive or unsightly condition because of contamination; or

c) another way prescribed by regulation**.**

“environmentally relevant activity” means an environmentally relevant activity as defined under Section 18 of the *Environmental Protection Act 1994* and listed in the *Environmental Protection Regulation 1998.*

“equivalent person” means an equivalent person as defined in Item 63 of Schedule 2 in the Environmental Protection Regulation 2008.

“emergency action plan” means documentation forming part of the operational plan held by the holder or a nominated responsible officer, that identifies emergency conditions that sets out procedures and actions that will be followed and taken by the structure owner and operating personnel in the event of an emergency. The actions are to minimise the risk and consequences of failure, and ensure timely warning to downstream communities and the implementation of protection measures. The plan must require structure owners to annually update contact.

“**existing structure”** means a structure that was in existence prior to the adoption of this schedule of conditions under the authority.

“fill” means any kind of material in solid form (whether or not naturally occurring) capable of being deposited at a place but does not include material that forms a part of, or is associated with, a structure constructed in a watercourse, wetland or spring including a bridge, road, causeway, pipeline, rock revetment, drain outlet works, erosion prevention structure or fence.

“floodplain” has the meaning in the *Water Act 2000* and means an area of reasonably flat land adjacent to a watercourse that:

- is covered from time to time by floodwater overflowing from the watercourse; and
- does not, other than in an upper valley reach, confine floodwater to generally follow the path of the watercourse; and
- has finer sediment deposits than the sediment deposits of any bench, bar or in-stream island of the watercourse.

“floodwater” means water overflowing, or that has overflowed, from waters, river, creek, stream, lake, pond, wetland or dam onto or over riparian land that is not submerged when the watercourse or lake flows between or is contained within its bed and banks.

“flowline” is a small diameter pipeline through which fluids move on a petroleum lease before being sold.

“flowable substance” means matter or a mixture of materials which can flow under any conditions potentially affecting that substance. Constituents of a flowable substance can include water, other liquids fluids or solids, or a mixture that includes water and any other liquids fluids or solids either in solution or suspension.

“hazardous contaminant” means a contaminant that, if improperly treated, stored, disposed of or otherwise managed, is likely to cause serious or material environmental harm because of –

a) its quantity, concentration, acute or chronic toxic effects, carcinogenicity, mutagenicity, corrosiveness, explosiveness, radioactivity or flammability; or

b) its physical, chemical or infectious characteristics.

“hazardous waste” means a substance, whether liquid, solid or gaseous that, if improperly treated, stored, disposed of or otherwise managed, is likely to cause environmental harm.

“hazard” in relation to a dam as defined, means the potential for environmental harm resulting from the collapse or failure of the dam to perform its primary purpose of containing, diverting or controlling flowable substances.

“hazard category” means a category, either low significant or high, into which a dam is assessed as a result of the application of tables and other criteria in *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams* (EM635), prepared by the administering authority, as amended from time to time.

“high bank” - the defining bank is the terrace or bank or, if no bank is present, the point on the active floodplain which confines the average annual peak flows.

“hydraulic performance” means the capacity of a regulated dam to contain or safely pass flowable substances based on a probability (AEP) of performance failure specified for the relevant hazard category in the *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams* (EM635).

"Holder" means:

a) where this document is an environmental authority, any person who is the holder of, or is acting under, that environmental authority; or

b) where this document is a development approval, any person who is the registered operator for that development approval.

"inert demolition and construction waste" means non-putrescible waste arising from construction or demolition activity. It may include materials such as brick, timber, concrete and steel.

"infrastructure" means water storage dams, roads and tracks, buildings and other structures built for the purpose of resource activities but does not include other facilities required for the long term management of mining impacts or the protection of potential resources. Such other facilities include dams, waste rock dumps, voids, or ore stockpiles and buildings as well as other structures whose ownership can be transferred and which have a residual beneficial use for the next owner of the operational land or the background landowner.

"LA10, adj, 10 mins" means the A-weighted sound pressure level, (adjusted for tonal character and impulsiveness of the sound) exceeded for 10% of any 10-minute measurement period, using Fast response.

"LA1, adj, 10 mins" means the A-weighted sound pressure level, (adjusted for tonal character and impulsiveness of the sound) exceeded for 1% of any 10-minute measurement period, using Fast response

"LA, max adj, T" means the average maximum A-weighted sound pressure level, adjusted for noise character and measured over any 10 minute period, using Fast response.

"lake" includes –

a) lagoon, swamp or other natural collection of water, whether permanent or intermittent; and

b) the bed and banks and any other element confining or containing the water.

"land" in the "land schedule" of this document means land excluding waters and the atmosphere.

"land capability" as defined in the DME 1995 Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland.

"land suitability" as defined in the DME 1995 Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland.

"land degradation" includes the following:

a) soil erosion;

b) rising water tables;

c) the expression of salinity;

d) mass movement by gravity of soil or rock;

e) stream bank instability; and

f) a process that results in declining water quality.

“LA MAX adj T” is the adjusted average maximum A-weighted sound pressure level measured over a time period T. The maxima must be measured on a sound level meter with a frequency weighting that corresponds to perceived loudness (*A* weighting) and the meter must be set to the *fast* response time weighting. The measured values are to be adjusted upwards by 2dB(A) to 5dB(A) if the noise source has tonal characteristics. The measuring period must be in excess of five minutes. The arithmetic average of the adjusted maxima, after eliminating any extraneous noise peaks, is the measure used to characterise the noise environment. (This measure will generally be similar to a percent exceedance of 10% or less. Refer to Australian Standard AS1055.)

“land use” term to describe the selected use of the land, which is planned to occur after the cessation of resource activities.

“leachate” means a liquid that contains soluble, suspended or miscible contaminants likely to have been derived from material which is stored, processed or disposed of on site and which the liquid has passed through or emerged from, or is likely to have passed through or emerged from.

“levee” means a dam, dyke or bund that is designed only to provide for the containment and diversion of stormwater or flood flows from a contributing catchment, or containment and diversion of flowable substance resulting from unplanned releases from other works of infrastructure, during the progress of those stormwater or flood flows or those unplanned releases; and does not store any significant volume of water or flowable substances at any other times.

“litter” refers to scattered items of rubbish (less than 200 litres), such as cigarette butts, discarded food wrappers and beverage containers.

“licenced waste disposal facility” is a facility approved under a development approval and operated by a holder of a registration certificate for environmentally relevant activity item number 75 under Schedule 1 of the *Environmental Protection Regulation 2008*.

“limited regulated waste” means any of the following regulated wastes, asbestos, clinical waste or quarantine waste that has been rendered non-infectious, fish processing waste, food processing waste, poultry processing waste, tyres or treatment tank sludge or residue produced in the carrying out of an activity in relation to sewage treatment and water supply activities.

“linear infrastructure” means powerlines, pipelines, flowlines, roads and access tracks.

“low consequence dam” means any dam that is not a high or significant consequence category as assessed using the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933).

“mandatory reporting level” or **“MRL”** means a warning and reporting level determined in accordance with the criteria in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (EM635) published by the administering authority.

“manual” means the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (EM635) published by the administering authority.

“maximum extent of impact” means the total, cumulative, residual extent and duration of impact to a prescribed environmental matter that will occur over a project’s life after all reasonable avoidance and reasonable on-site mitigation measures have been, or will be, undertaken.

“mg/L” means milligrams per litre.

“mining activity” means

a) an activity that is an authorised activity for a mining tenement under the *Mineral Resources Act 1989*; or

b) another activity that is authorised under the *Mineral Resources Act 1989* that grants rights over land.

“mine affected water”:

a) means the following types of water:

  i) pit water, tailings dam water, processing plant water;

  ii) water contaminated by a mining activity which would have been an environmentally relevant activity under Schedule 2 of the *Environmental Protection Regulation 2008* if it had not formed part of the mining activity;

  iii) rainfall runoff which has been in contact with any areas disturbed by mining activities which have not yet been rehabilitated, excluding rainfall runoff discharging through release points associated with erosion and sediment control structures that have been installed in accordance with the standards and requirements of an Erosion and Sediment Control Plan to manage such runoff, provided that this water has not been mixed with pit water, tailings dam water, processing plant water or workshop water;

  iv) groundwater which has been in contact with any areas disturbed by mining activities which have not yet been rehabilitated;

  v) groundwater from the mine’s dewatering activities;

  vi) a mix of mine affected water (under any of paragraphs i)-v) and other water;

  vii) associated water, coal seam gas water or produced water from the mine’s petroleum activities.

b) does not include surface water runoff which, to the extent that it has been in contact with areas disturbed by resource activities that have not yet been completely rehabilitated, has only been in contact with:

  i) land that has been rehabilitated to a stable landform and either capped or revegetated in accordance with the acceptance criteria set out in the environmental authority but only still awaiting maintenance and monitoring of the rehabilitation over a specified period of time to demonstrate rehabilitation success; or

  ii) land that has partially been rehabilitated and monitoring demonstrates the relevant part of the landform with which the water has been in contact does not cause environmental harm to waters or groundwater, for example:

    1) areas that are been capped and have monitoring data demonstrating hazardous material adequately contained with the site;

    2) evidence provided through monitoring that the relevant surface water would have met the water quality parameters for mine affected water release limits in this environmental authority, if those parameters had been applicable to the surface water runoff; or

    3) both.

“mineral waste” means mining materials resulting from the extraction of coal including overburden, interburden, waste rock and rejects.

“measures” includes any measures to prevent or minimise environmental impacts of the mining activity such as bunds, silt fences, diversion drains, capping, and containment systems.

“NATA” means National Association of Testing Authorities, Australia.

“natural flow” means the flow of water through waters caused by nature.

“nature” includes:

a) ecosystems and their constituent parts; and

b) all natural and physical resources; and

c) natural dynamic processes.

“non-polluting” means having no adverse impacts upon the receiving environment.

“notice of election” has the meaning in section 18(2) *Environmental Offsets Act 2014*.

“noxious” means harmful or injurious to health or physical well-being.

“offensive” means causing reasonable offence or displeasure; is disagreeable to the sense; disgusting, nauseous or repulsive, other than trivial harm.

“operational land” means the land associated with the project for which this environmental authority has been issued.

“operational plan” includes:

a) normal operating procedures and rules (including clear documentation and definition of process inputs in the DSA allowance); and

b) contingency and emergency action plans including operating procedures designed to avoid and/or minimise environmental impacts including threats to human life resulting from any overtopping or loss of structural integrity of the regulated structure.

“overland flow water” means water, including floodwater, flowing over land, otherwise than in a watercourse or lake:

a) after having fallen as rain or in any other way; or

b) after rising to the surface naturally from underground.

“peak particle velocity (ppv)” means a measure of ground vibration magnitude which is the maximum rate of change of ground displacement with time, usually measured in millimetres/second (mms^{-1}).

“permanent infrastructure” includes any infrastructure (roads, tracks, bridges, culverts, dams, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads, pipelines etc.) which is to be left by agreement with the landowner.

“progressive rehabilitation” means rehabilitation (defined below) undertaken progressively or a staged approach to rehabilitation as mining operations are ongoing.

“process water” means water used or produced during the mineral development activities.

“Prescribed environmental matters” has the meaning in section 10 of the *Environmental Offsets Act 2014*, and in section 5 of the *Environmental Offsets Regulation 2014*.

“receiving environment” means all groundwater, surface water, land, and sediments that are not disturbed areas authorised by this environmental authority.

“receiving waters” means all groundwater and surface water that are not disturbed areas authorised by this environmental authority.

“reference site” (or analogue site) may reflect the original location, adjacent area or another area where rehabilitation success has been completed for a similar biodiversity. Details of the reference site may be as photographs, computer generated images and vegetation models etc.

“Register of Regulated structures" includes**:**

a) date of entry in the register;

b) name of the structure , its purpose and intended/actual contents;

c) the consequence category of the structure as assessed using the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (EM635);

d) dates, names, and reference for the design plan plus dates, names, and reference numbers of all document(s) lodged as part of a design plan for the structure;

e) name and qualifications of the suitably qualified and experienced person who certified the design plan and 'as constructed' drawings;

f) for the regulated structure, other than in relation to any levees –

  i) the dimensions (metres) and surface area (hectares) of the structure measured at the footprint of the structure;

  ii) coordinates (latitude and longitude in GDA94) within five metres at any point from the outside of the dam including its storage area

  iii) dam crest volume (megalitres);

  iv) spillway crest level (metres AHD).

  v) maximum operating level (metres AHD);

  vi) storage rating table of stored volume versus level (metres AHD);

  vii) design storage allowance (megalitres) and associated level of the dam (metres AHD);

  viii) mandatory reporting level (metres AHD);

g) the design plan title and reference relevant to the structure;

h) the date construction was certified as compliant with the design plan;

i) the name and details of the suitably qualified and experienced person who certified that the constructed dam was compliant with the design plan;

j) details of the composition and construction of any liner;

k) the system for the detection of any leakage through the floor and sides of the dams only;

l) dates when the regulated structure underwent an annual inspection for structural and operational adequacy, and to ascertain the available storage volume for 1 November of any year;

m) dates when recommendations and actions arising from the annual inspection were provided to the administering authority;

n) dam water quality as obtained from any monitoring required under this authority as at 1 November of each year.

“regulated dam” means any dam in the significant or high consequence category as assessed using the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)* published by the administering authority.

“regulated waste” means non-domestic waste mentioned in schedule 7 of the *Environmental Protection Regulation 2008* (whether or not it has been treated or immobilised), and includes –

a) for an element – any chemical compound containing the element; and

b) anything that has contained the waste.

“rehabilitation objectives” the end points that rehabilitation aims to achieve. They may be described in terms of future land use, biodiversity values, conservation values, health and safety outcomes, aesthetics or social outcomes or combinations of these.

“rehabilitation indicators” an indicator is something that can be measured and audited according to an established protocol and used to evaluate changes in a system.

“**rehabilitation”** or “**rehabilitated”** means the process of reshaping and revegetating land to restore it to a stable landform and in accordance with acceptance criteria and, where relevant, includes remediation of contaminated land.

“**rejects**” means any of the following from the processing of run-of-mine coal, including any sediment containing hydrocarbons:

a) breaker rejects;

b) coarse rejects;

c) mid/fine size rejects;

d) ultra-fines that have been dewatered; or

e) any combination of rejects under any of paragraphs a to d.

“release” of a contaminant into the environment includes –

a) to deposit, discharge, emit or disturb the contaminant; and

b) to cause or allow the contaminant to be deposited, discharged, emitted or disturbed; and

c) to fail to prevent the contaminant from being deposited, discharged, emitted or disturbed; and

d) to allow the contaminant to escape; and

e) to fail to prevent the contaminant from escaping.

“representative” means a sample set which covers the variance in monitoring or other data either due to natural changes or operational phases of the resource activities.

“Resource activity” is an activity that involves—

(a) a geothermal activity; or

(b) a GHG storage activity; or

(c) a mining activity; or

(d) a petroleum activity.

“residual void” means an open pit resulting from the removal of ore and/or waste rock which will remain following the cessation of all mining activities and completion of rehabilitation processes.

“riverine area” refers to the land confined to the flood flow channel of a watercourse.

“Run of mine (ROM) coal” means raw coal which has been extracted as part of the mining activities and has not been subject to any form of processing, crushing, screening or washing.

“saline drainage” The movement of waters, contaminated with salt(s), as a result of the mining activity.

“Scheme fund” means the scheme fund established under the *Mineral and Energy Resources (Financial Provisioning) Act 2018*, section 24.

“sensitive place” means:

a) a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or

b) a motel, hotel or hostel; or

c) an educational institution; or

d) a medical centre or hospital; or

e) a protected area under the *Nature Conservation Act 1992*, the *Marine Parks Act 1992* or a World Heritage Area; or

f) a public park or gardens.

“sewage” means the used water of person’s to be treated at a sewage treatment plant.

“self sustaining” means an area of land which has been rehabilitated and has maintained the required acceptance criteria without human intervention for a period nominated by the administering authority.

“significant residual impact” has the meaning in section 8 *Environmental Offsets Act 2014.*

“significantly disturbed” or **“significant disturbance”** or **“significant disturbance to land or areas”** has the meaning in Schedule 12, section 4 of the *Environmental Protection Regulation 2008*. Land is significantly disturbed if—

a) it is contaminated land; or

b) it has been disturbed and human intervention is needed to rehabilitate it—

   i) to a condition required under the relevant environmental authority; or

   ii) if the environmental authority does not require the land to be rehabilitated to a particular condition—to the condition it was in immediately before the disturbance.

“site” means the area within the petroleum authority or authorities to which the environmental authority relates.

“spillway” means a weir, channel, conduit, tunnel, gate or other structure designed to permit discharges form the structure, normally under flood conditions or in anticipation of flood conditions.

“spring” means the land to which the water rises naturally from below the ground and the land over which the water then flows.

“stable” has the meaning in Schedule 5 of the *Environmental Protection Regulation 2008* and, for a site, means the rehabilitation and restoration of the site is enduring or permanent so that the site is unlikely to collapse, erode or subside.

“storm water” means all surface water runoff from rainfall.

“suitably qualified person” means a person who has professional qualifications, training or skills or experience relevant to the nominated subject matters and can give authoritative assessment, advice and analysis about performance relevant to the subject matters using relevant protocols, standards, methods or literature.

“suitably qualified and experienced person” in relation to dams means one who is a Registered Professional Engineer of Queensland (RPEQ) under the provisions of the *Professional Engineers Act 1988*, OR registered as a National Professional Engineer (NPER) with the Institution of Engineers Australia, OR holds equivalent professional qualifications to the satisfaction of the administering authority for the Act; AND the administering authority for the Act is satisfied that person has knowledge, suitable experience and demonstrated expertise in relevant fields, as set out below:

a) knowledge of engineering principles related to the structures, geomechanics, hydrology, hydraulics, chemistry and environmental impact of dams; and

b) a total of five years of suitable experience and demonstrated expertise in at least four of the following categories, with the 'geomechanics of dams' category being compulsory:

   i) geomechanics of dams with particular emphasis on stability, geology and geochemistry.
   ii) investigation, design or construction of dams.
   iii) operation and maintenance of dams.
   iv) hydrology with particular reference to flooding, estimation of extreme storms, water management or meteorology.
   v) hydraulics with particular reference to sediment transport and deposition, erosion control, beach processes.
   vi) hydrogeology with particular reference to seepage, groundwater.
   vii) solute transport processes and monitoring thereof.
   viii) dam safety.

"synthetic based drilling mud" means a mud where the base fluid is a synthetic oil, consisting of chemical compounds which are artificially made or synthesised by chemically modifying petroleum components or other raw materials rather than the whole crude oil

"system design plan" means a plan that manages an integrated containment system that shares the required DSA and/or ESS volume across the integrated containment system.

"top soil" means the top layer of soil, alluvium or weathered rock that forms a suitable plant growth medium. Top soil should be non-crusting and low in salinity.

"trivial harm" means environmental harm which is not material or serious environmental harm and will not cause actual or potential loss or damage to property of an amount of, or amounts totalling more than $5,000.

"void" means any man-made, open excavation in the ground.

"waste" as defined in section 13 of the *Environmental Protection Act 1994*.

"waste and resource management hierarchy" has the meaning given by the *Waste Reduction and Recycling Act 2011*.

"water" means –

a) water in waters or spring;
b) underground water;
c) overland flow water; or
d) water that has been collected in a dam.

"watercourse" means a watercourse as defined under Chapter 2 of the *Water Act 2000*.

"waterlogging" is the saturation of soil by soil water.

"waste water" means used water from the activity, process water or contaminated storm water.

"water quality" means the chemical, physical and biological condition of water.

“waters” includes –

a) river, creek, stream in which water flows permanently or intermittently either:
  i) in a natural channel, whether artificially improved or not; or
  ii) in an artificial channel that has changed the course of the river, creek or stream; or
b) lake, lagoon, pond, swamp, wetland, dam; or
c) unconfined surface water; or
d) storm water channel, storm water drain, roadside gutter; or
e) bed and banks and any other element of a river, creek, stream, lake, lagoon, pond, swamp, wetland, storm water channel, storm water drain, roadside gutter or dam confining or containing water; or
f) groundwater; or
g) non-tidal or tidal waters (including the sea); or
h) any part-thereof.

“water year” means the 12-month period from 1 July to 30 June. “**watercourse”** - means a river, creek or stream in which water flows permanently or intermittently in a visibly defined channel (natural, artificial or artificially improved) with:

(a) continuous bed and banks;
(b) an extended period of flow for some months after rain ceases, and
(c) an adequacy of flow that sustains basic ecological processes and maintains biodiversity.

“wet season” means the time of year, covering one or more months, when most of the average annual rainfall in a region occurs. For the purposes of DSA determination this time of year is deemed to extend from 1 November in one year to 31 May in the following year inclusive.

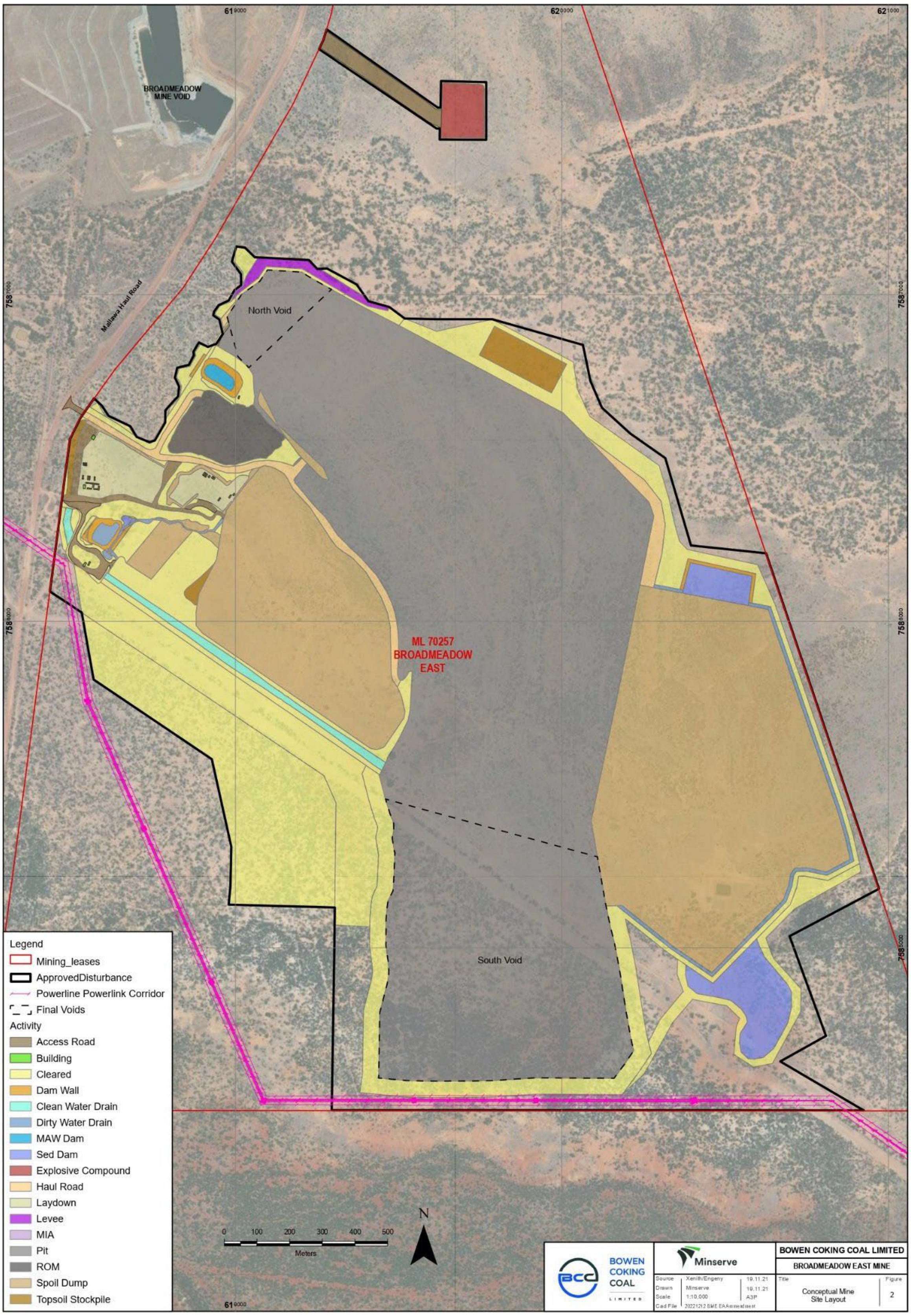
“wet season” means the time of year, covering one or more months, when most of the average annual rainfall in a region occurs. For the purposes of DSA determination this time of year is deemed to extend from 1 November in one year to 31 May in the following year inclusive.

“wetland” means an area shown as a wetland on a ‘Map of referable wetlands’, a document approved by the chief executive (environment). A map of referable wetlands can be viewed at www.ehp.qld.gov.au.

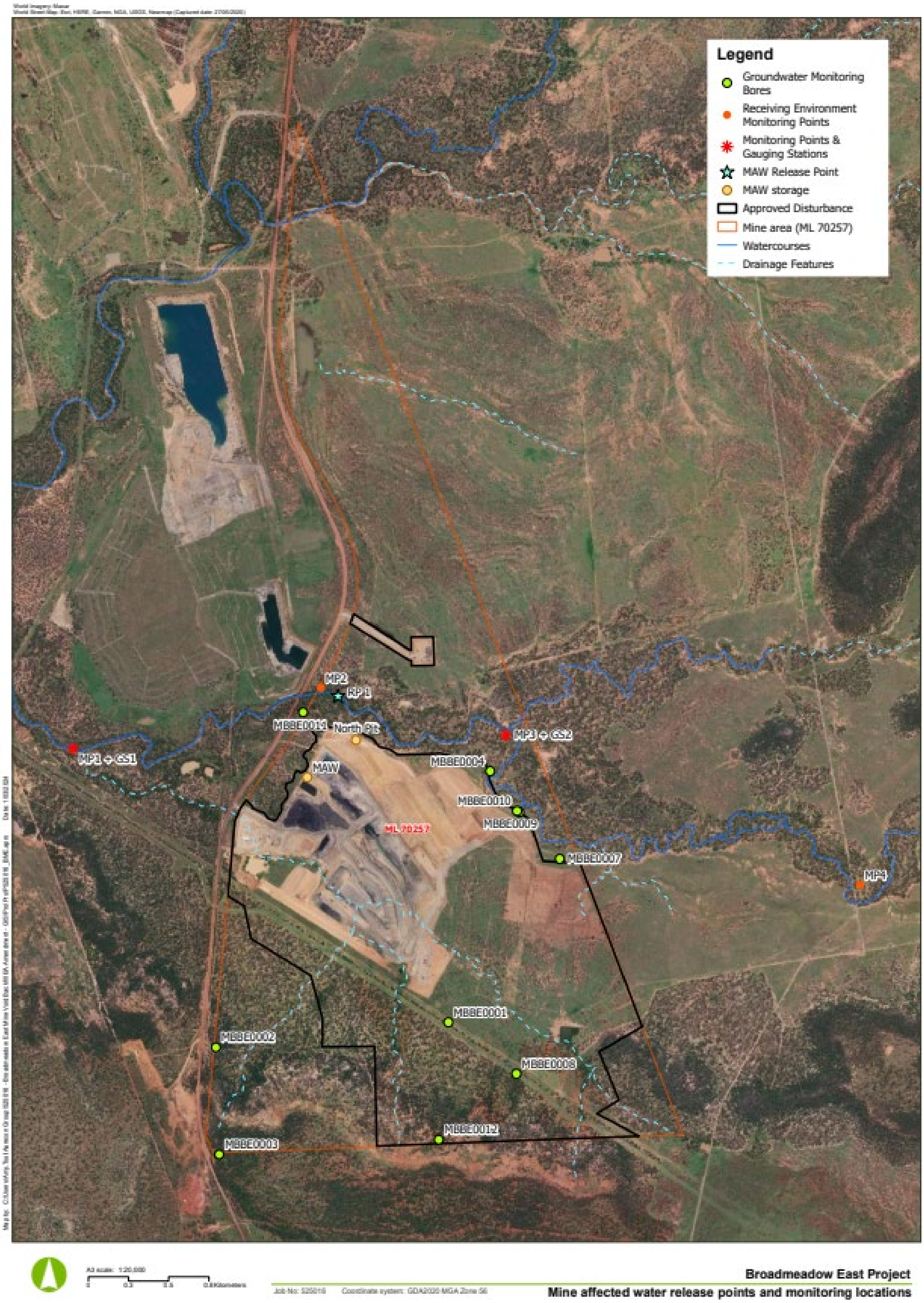
“µg/L” means micrograms per litre.

Appendix 1 Figure 1 – Disturbance Map

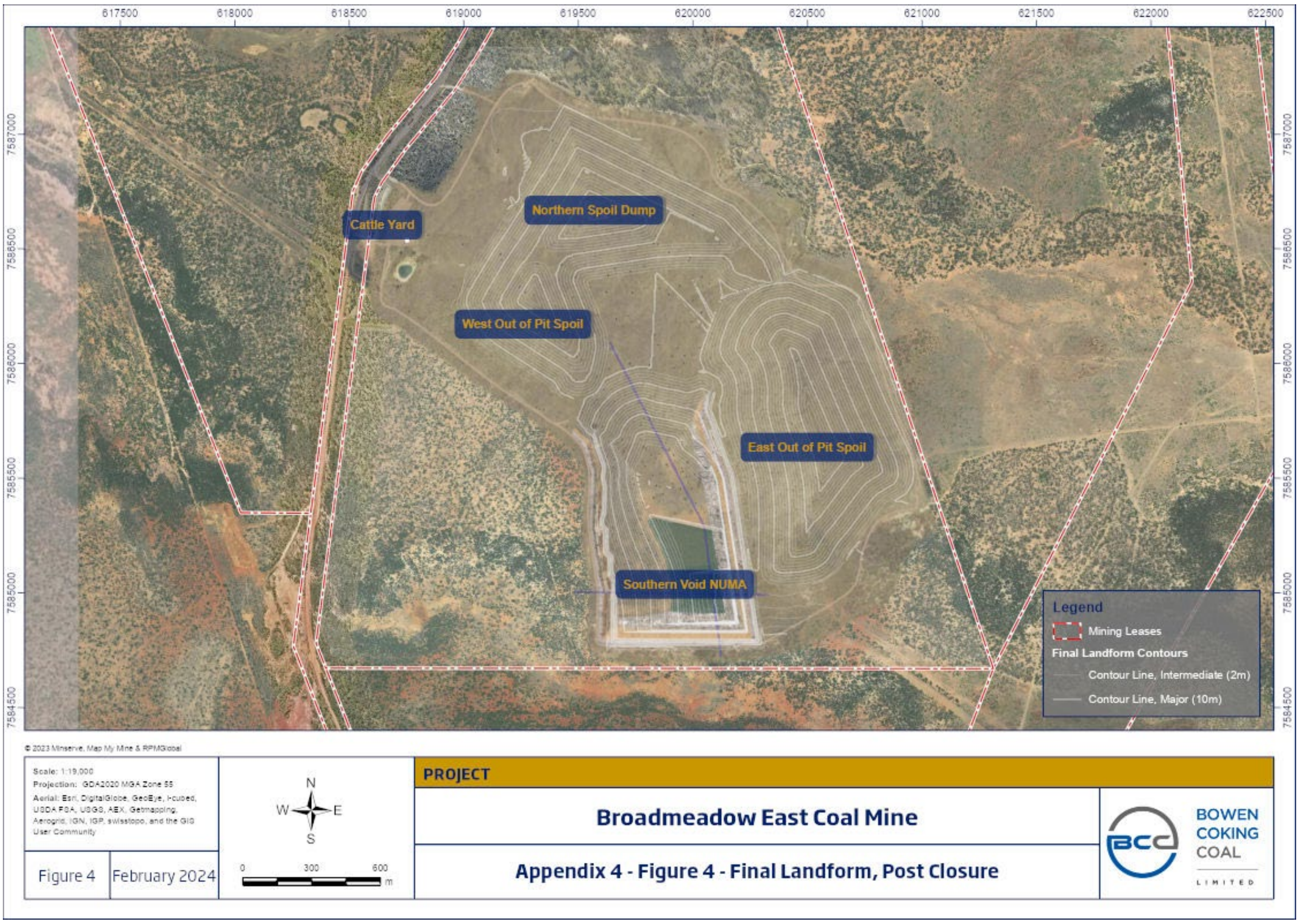
Appendix 2 Figure 2 – Mine Plan



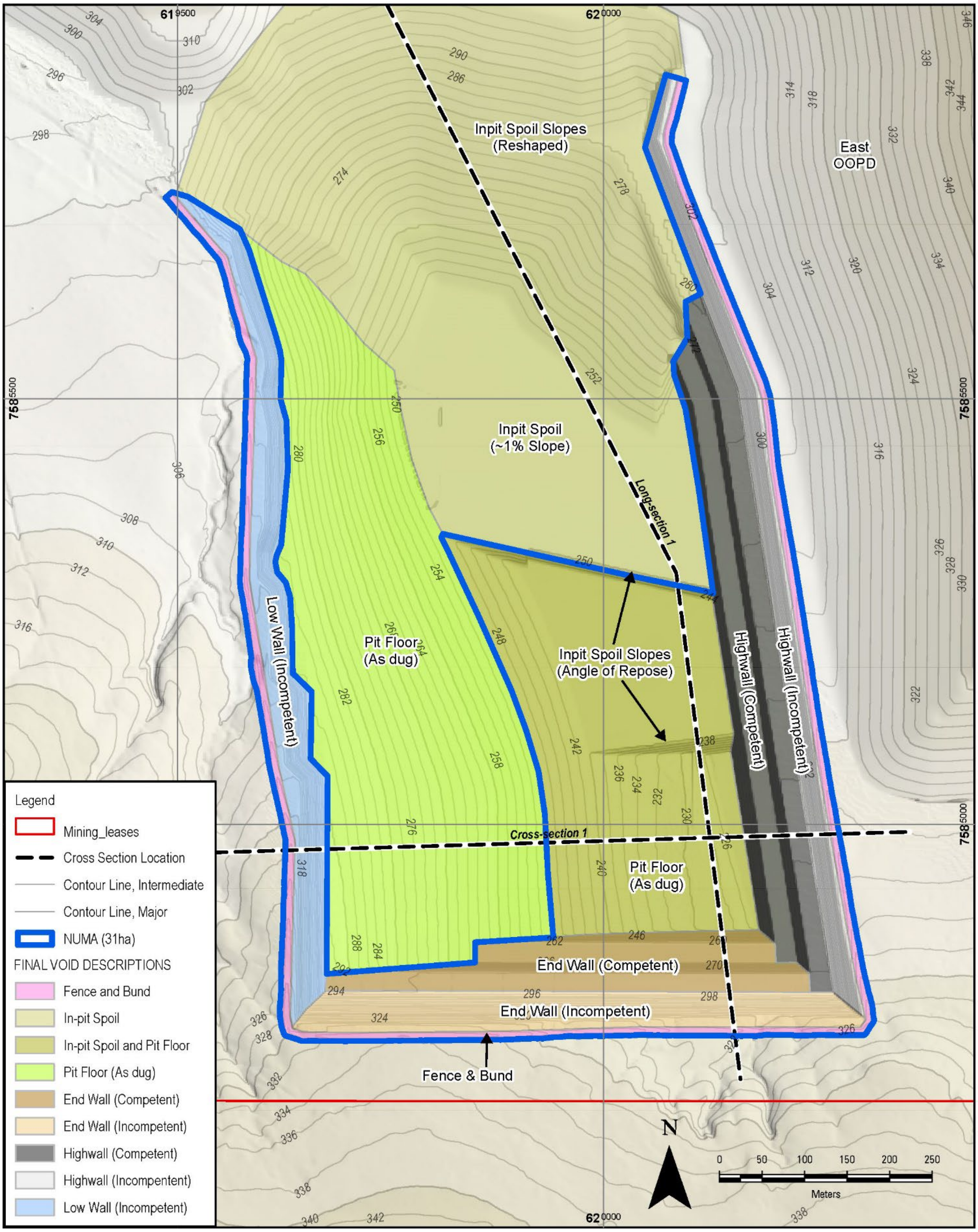
Appendix 3 Figure 3 – Mine affected water release points and monitoring locations



Appendix 4 Figure 4 – Final landform, post closure



Appendix 4 Figure 5 – Visualisation of final landform design aspects



Appendix 5

Table G1 Post Mine Land Use (PMLU) and Non-Use Management Area (NUMA) Rehabilitation Methods

Disturbance Area (DA)	**Description**	**Pre-Mining Land Suitability Class**		**Rehabilitation Method**	**PMLU**	**Post-Mining Land Suitability Class**	
		Cattle Grazing	**Rainfed Broadacre Cropping**			**Cattle Grazing**	**Rainfed Broadacre Cropping**
1. Out of Pit dumps (OOPD)	Two OOPDs border the eastern and western boundaries of the pit area.	4 &5	4 &5	▪ Confirm the engineering and design final landform plans with associated QA/QC methods. ▪ Bulk earthworks to achieve required landform and slopes as per design and proposed methods within the Environmental Management System (EMS). ▪ 5m capping of any rejects stored in the OOPD with overburden that is non-reactive (geochemically and physically inert). ▪ General reshaping and pushing/trimming to achieve final landform. ▪ Fill in associated sediment dams when no longer required as per updated Erosion and Sediment Control Plan (ESCP). ▪ Install long term erosion and sediment control systems/features as per closure ESCP based on achieved groundcover and landform stability. ▪ Remediate subsidence and erosion before sourcing, delivering, and spreading growth media. ▪ Apply ameliorants and fertilisers to growth media before and after application (based on QA/QC process). ▪ Trim/rip, apply seeding and irrigate. ▪ If possible, rehabilitation trials on areas that have been progressively rehabilitated. ▪ Monitoring and reporting as per Rehabilitation Monitoring Program required under **Condition G15.**	Low-intensity grazing	4	4
2. Northern Pit	The residual void created at the start of the pit development and used for bulk water storage over the	4	4	▪ Dewater (for use in dust suppression) prior to rehab. ▪ Backfill to 270 RL.	Low-intensity grazing	4	4

Disturbance Area (DA)	Description	Pre-Mining Land Suitability Class		Rehabilitation Method	PMLU	Post-Mining Land Suitability Class	
		Cattle Grazing	Rainfed Broadacre Cropping			Cattle Grazing	Rainfed Broadacre Cropping
	operational mine life. Borders the central in-pit spoil dump. The final depth will be backfilled to 270 RL (above groundwater levels post closure).			▪ Reshaping, trimming and construction of long-term drainage/ESC. ▪ Cover exposed coal seams with 2 or more meters of NAF material. Develop specific rehabilitation strategies that includes monitoring, surveying, stability analysis and reporting.			
3. Central in-pit spoil dump	Central portion of the previously active pit area that is backfilled as the resource is extracted and the mining moves in a southern direction. The area will be backfilled to a final height of 310 RL (above groundwater level post closure).	4 &5	4 &5	▪ Conduct long term water balance studies regarding void hydrology that includes surface water and groundwater assessments. ▪ A suitably qualified person to conduct a geotechnical assessment of the final landform. ▪ A suitably qualified person to conduct an assessment of hydraulic properties of the backfilled material to ascertain potential for instability. ▪ Update flood modelling according to final design, geochemical and stability assessments. ▪ General reshaping and pushing/trimming to achieve final landform. ▪ 5m capping of any rejects stored in the central in-pit spoil dump with overburden that is non-reactive (geochemically and physically inert). ▪ Rejects are buried above the expected (post-closure) groundwater level. ▪ Fill in associated sediment dams. ▪ Install long term erosion and sediment control systems/features. ▪ Remediate subsidence and erosion before sourcing, delivering, and spreading growth media. ▪ Apply ameliorants and fertilisers to growth media before and after application (based on QA/QC process). ▪ Trim/rip, apply seeding and irrigate. ▪ If possible, rehabilitation trials. ▪ Monitoring and reporting.	Low-intensity grazing	4	4

Disturbance Area (DA)	**Description**	**Pre-Mining Land Suitability Class**		**Rehabilitation Method**	**PMLU / NUMA**	**Post-Mining Land Suitability Class**	
		Cattle Grazing	**Rainfed Broadacre Cropping**			**Cattle Grazing**	**Rainfed Broadacre Cropping**
4a. Southern Void - PMLU	The portion of the residual void remaining post mining at the southern pit extent that has a PMLU. Borders the central in-pit spoil dump.	4 &5	4	▪ ▪ Develop specific rehabilitation strategies that includes monitoring, surveying, stability analysis and reporting.	Low-intensity grazing	4 (Low wall slopes)	N/A
4b. Southern Void - NUMA	The portion of the residual void remaining post mining at the southern pit extent that is a NUMA. Refer Appendix 4 Figure 5, area labelled "NUMA".	4&5	4	▪ Minimised NUMA area based on economic, engineering, geotechnical, geochemical, surface water and groundwater technical reporting outcomes (Condition G8). ▪ Design final slope angles of the high, low and end walls. ▪ Conduct long term water balance studies regarding void hydrology that includes surface water and groundwater assessments. ▪ Backfill to a minimum of 225 RL, treat or remove exposed coal seams.	Water Storage (NUMA)	N/A	N/A

5. Water management infrastructures.	Water infrastructure includes: 1. Existing farm dam at the northern tip of the ML which will remain post closure as per the existing landholder agreement (to remain post closure). 2. Five sediment dams (rehabilitation at closure). 3. One clean water dam. (Rehabilitation at closure) 4. One MAW dam (rehabilitation at closure). 5. North pit flood diversion levee (A regulated structure). 6. North-eastern levee (integrated into the final landform). 7. Five groundwater monitoring bores will remain until the completion of the post closure monitoring program.	4	4	▪ Conduct land contamination investigation. ▪ Remove fencing and signage. ▪ Dewater (for use in dust suppression) prior to rehab if applicable. ▪ Remove the top 250 mm of sediment and burry it. ▪ General reshaping and pushing/trimming to achieve final landform. ▪ Trim/rip, apply seeding and irrigate. ▪ Monitoring and reporting.	Low-Intensity Grazing	4	4

Disturbance Area (DA)	Description	Pre-Mining Land Suitability Class		Rehabilitation Method	PMLU	Post-Mining Land Suitability Class	
		Cattle Grazing	Rainfed Broadacre Cropping			Cattle Grazing	Rainfed Broadacre Cropping
6. Mining Industrial Area (MIA), explosives storage area and exploration	Workshops, ROM, offices, waste, explosives and chemical storage.	4	4	▪ Remove buildings. ▪ Disconnect services, empty tanks, and licenced removal of contaminated water. ▪ Remove and proper disposal of road surface and fencing. ▪ Rehabilitate remaining boreholes not required for post closure monitoring. ▪ Conduct contaminated land investigation and remediate any contaminated soils. ▪ Remove and properly dispose of general and regulated waste. ▪ Remove imported fill used to raise MIA (treat as contaminated) and encapsulate in backfilled pit or open waste dumps.	Low-intensity grazing	4	4
7. Roads, tracks and cleared areas	Internal roads, tracks and cleared areas associated with haulage, site and powerline access.	4 &5	4 &5	▪ Remove signage and other non-permanent markers. ▪ General reshaping and pushing trimming to achieve pre-disturbance contours (including re-establishment of bed and banks). ▪ Installation of long terms erosion and sediment control systems where required. ▪ Source, cart and spread growth media. ▪ Rip and seed. ▪ Monitoring and reporting.	Low-intensity grazing	4	4

Table G2 PMLU and Non-Use Management Area (NUMA) rehabilitation success criteria

PMLU	DA	Goals	Objectives/Indicators	Criteria	Validation Method
1 Out of Pit Dumps					
Low intensity Grazing	Out of Pit Dumps	Safe	Safety hazards in rehabilitation are similar to surrounding unmined landscapes	Hazard assessment by a suitably qualified and experienced person	Risk is as low as reasonably practical (ALARP) in accordance with *AS/NZS ISO 31000:2009 Risk Management.*
		Stable	a. Landform development and reshaping/re-profiling b. Surface preparation. c. Structurally sound with no major slumping. d. No exposed hazardous material. e. No major erosion.	Outer slopes: ▪ 15% as per landform design. ▪ Vertical distance between berms: 20 m ▪ Berm width: 5 m ▪ Drainage outward away from void towards original topo drainage paths. Inner slopes (into full backfill area): ▪ 12% as per landform design. ▪ Vertical distance between berms: 20 m ▪ Berm width: 5 m ▪ Drainage outward away from void towards original topo drainage paths. Subsidence ▪ Subsidence monitored pre and post wet season and addressed accordingly. Factor of Safety ▪ Geotechnical adequacy with 1.5 Factor of Safety.	▪ Certification from an AQP that the area has achieved stable condition. ▪ All rehabilitated areas are geo-technically stable for the intended post mining grazing land use, with no active areas of rill or gully erosion, and; drainage follows appropriate drainage paths.
		Non-polluting	a. Surface Run off is minimised and is non-polluting to land and receiving waters[1] b. No environmental harm.	**Receiving environment contaminant limit -** ○ pH – 6.5-8.5 ○ EC - baseflow 720 µS/cm[a] ○ high flow 250 µS/cm[b] ○ Turbidity - 50 NTU ○ Arsenic – 13 µg/L ○ Molybdenum – 0.15mg/L ○ Selenium – 5 µg/L	▪ Assessment of soil health and suitability has been completed by an AQP. ▪ Receiving water quality indicators do not exceed specified criteria limits ▪ Groundwater monitoring demonstrates that the

PMLU	DA	Goals	Objectives/Indicators	Criteria	Validation Method
				○ Sulfate - 25 mg/L ○ Suspended solids - 55 mg/L[b] ▪ Groundwater aquifers maintain their pre-mining or reference bore water quality. ▪ Erosion rate of <5 t/ha/yr and 10.0 t/ha/yr as determined by landform design. ▪ The installation of certified contours and drains as per design by an AQP (CPESC). ▪ 5m capping of rejects within OOPD with overburden that is non-reactive (geochemically and physically inert).	groundwater quality is within 95th percentile of the results of baseline pre-mining bore monitoring results, or when baseline is not available, reference bores which have not been impacted by mining activities. ▪ Certification by an AQP that rejects are buried under geochemically and physically inert overburden with a minimum cover thickness of 5m.

PMLU	DA	Goals	Objectives/Indicators	Criteria	Validation Method
		Self-Sustaining	a. Adequate revegetation. b. Ameliorate spoil as required to a depth of a minimum of 200 mm to suitably stabilise the landform and c. promote vegetative establishment.	▪ Groundcover 60% perennial pasture biomass. ▪ Less than 5% of declared weeds (excluding Parthenium weed- *Parthenium hysterophorus)* ▪ Land Class suitability 4 for grazing. ▪ Abundance of declared weeds is less than reference sites. ▪ No active areas of rill or gully erosion and drainage follows the appropriate drainage paths. ▪ Resilience to fire and drought. ▪ Soil nutrient concentrations and nutrient cycling comparable to reference sites.	▪ Results, that rehabilitated areas meet the land suitability assessment that meets class 4 for cattle grazing as defined by the Guideline for Agricultural Land Evaluation in Queensland (State Department of Queensland 2015). ▪ Certification of less than 5% declared weed and pest species identified in rehabilitated areas ▪ Post closure flora and fauna monitoring as per the monitoring plan.
Northern pit (Partial Backfill)					
Low intensity grazing	Northern pit (Partial Backfill)	Safe	a. Safety hazards in rehabilitation are similar to surrounding unmined landscapes b. Provide a safe landscape for humans and animals post closure.	▪ Hazard assessment by a suitably qualified and experienced person ▪ Backfill level (water level based on groundwater conceptual modelling): 270RL ▪ No access to steep zones through the construction of safety bunds at 2 m high, base width of 5 m from unweathered, freely draining, end-dumped rockfill at a minimum 20 m offset from the depression perimeter as per the void closure plan.	Risk is as low as reasonably practical (ALARP) in accordance with *AS/NZS ISO 31000:2009 Risk Management.*

PMLU	DA	Goals	Objectives/Indicators	Criteria	Validation Method
		Stable	Stabilise walls and slopes.	▪ Final shape implemented as per rehabilitation and management strategies included in the void closure plan. ▪ Partial backfill according to appropriate groundwater level and as per the methods and techniques from the void closure plan. ▪ Slopes less than 20%., to be re-assessed and designed as per the chemical and physical characteristics of the site ▪ Geotechnical adequacy with 1.5 Factor of Safety. ▪ Structural, geotechnical and hydraulic factors based on the physical and chemical characteristics of the site. ▪ Spoil shaped to connect to the surrounding landscape where possible. ▪ No active erosion or gullies.	▪ Geotechnical report and certification from an AQP that the area has achieved stable condition as per the criteria.
		Non-polluting	Surface Run off or any discharge, seepage is non-polluting to land, surface water[1] and ground water	▪ Removal of all mine affected water for use in dust suppression prior to backfilling. ▪ Removal of potential contaminated sediments that may be identified in the land contamination survey. ▪ The installation of certified contours and drains as per design by an AQP (CPESC). **Receiving environment contaminant limit -** ○ pH – 6.5-8.5 ○ EC - baseflow 720 µS/cm[a] ○ high flow <250 µS/cm[b] ○ Turbidity - 50 NTU ○ Arsenic – 13 µg/L	▪ Land contamination survey results. ▪ Groundwater monitoring demonstrates that the groundwater quality is within 95th percentile of the results of baseline pre-mining bore monitoring results, or when baseline is not available, reference bores which have not been impacted by mining activities. ▪ Certification by an AQP that the groundwater level and

PMLU	DA	Goals	Objectives/Indicators	Criteria	Validation Method
				○ Molybdenum – 0.15mg/L ○ Selenium – 5 µg/L ○ Sulfate - 25 mg/L ○ Suspended Solids - 55 mg/L[b] - Groundwater aquifers maintain their pre-mining or reference bore water quality. - Prescribed environmental matters maintain their pre-mining condition - Coal seams will be removed or covered in the backfilling process. - No exposed hazardous material.	quality will not cause harm to the surrounding environment. - Receiving water quality indicators do not exceed specified criteria limits.
		Self-sustaining	a. Adequate revegetation and aquatic species richness. b. Littoral zone increases and linkages with terrestrial vegetation.	- Battered slopes with 60% perennial pasture biomass as per the closure and revegetation plans. - Land Class 4 for grazing. - Less than 5% of declared weeds (excluding Parthenium weed- *Parthenium hysterophorus)* - Resilience to fire and drought. - Grazing vegetation resilient to disease, drought and fire. - Soil nutrient concentrations, nutrient cycling and vegetation diversity and cover comparable to reference sites. - -Establishment of a mix of perennial grasses suitable for grazing in the area.	- Results, that rehabilitated areas meet the land suitability assessment that meets class 4 for cattle grazing as defined by the Guideline for Agricultural Land Evaluation in Queensland (State Department of Queensland 2015). - Post closure flora and fauna ecological monitoring as per the monitoring plan.
Central in-pit spoil dump (full backfill)					
Grazing	Central in-pit spoil dump (full backfill)	Safe	Safety hazards in rehabilitation are similar to surrounding unmined landscapes	Hazard assessment by a suitably qualified and experienced person	Risk is as low as reasonably practical (ALARP) in accordance with *AS/NZS ISO 31000:2009 Risk Management.*

PMLU	DA	Goals	Objectives/Indicators	Criteria	Validation Method
		Stable	▪ Landform development and reshaping/re-profiling. Hydraulic assessment conducted to determine instability from floodwaters. ▪ Surface preparation.	▪ Contoured to the surrounding topography as per landform design. ▪ Subsidence monitored pre and post wet season and addressed accordingly. ▪ Slopes less than 20% ▪ Geotechnical adequacy with 1.5 Factor of Safety ▪ Final shape implemented as per rehabilitation and management strategies included in the void closure plan.	▪ Certification from an AQP that the area has is geotechnically stable condition.
		Non-polluting	Surface run off is minimised and is non-polluting to land and receiving waters[1]	▪ Maximum erosion rate of <5 t/ha/yr and 10.0 t/ha/yr as determined by landform design. ▪ The installation of certified contours and drains as per design by an AQP (CPESC). ▪ Drainage outward away from void towards and/original topo drainage paths. **Receiving environment contaminant limit** - ○ pH – 6.5-8.5 ○ EC - baseflow 720 µS/cm[a] ○ high flow <250 µS/cm[b] ○ Turbidity - 50 NTU ○ Arsenic – 13 µg/L ○ Molybdenum – 0.15mg/L ○ Selenium – 5 µg/L ○ Sulfate - 25 mg/L ○ Suspended Solids - 55 mg/L[b] ▪ Groundwater aquifers maintain their pre-mining or reference bore water quality. ▪ Groundwater quality as per the water management plan.	▪ Contaminated land survey conducted by an AQP to ensure there is no contamination that will prohibit the establishment of the PMLU. ▪ Receiving water quality indicators do not exceed specified criteria limits ▪ Groundwater monitoring demonstrates that the groundwater quality is within 95th percentile of the results of baseline pre-mining bore monitoring results, or when baseline is not available, reference bores which have not been impacted by mining activities. ▪ Certification by an AQP that rejects are buried under geochemically and

PMLU / NUMA	DA	Goals	Objectives/Indicators	Criteria	Validation Method
				▪ Coal seams to be treated, removed or covered in the backfilling process. ▪ 5m capping of rejects within central in-pit spoil dump with overburden that is non-reactive (geochemically and physically inert).	physically inert overburden with a minimum cover thickness of 5m.
		Self-sustaining	Adequate revegetation and connectivity to the surrounding landscape including into the final voids.	▪ Groundcover is 60% perennial pasture biomass as per the revegetation plan. ▪ Land Class 4 for grazing. ▪ Less than 5% of declared weeds (excluding Parthenium weed- *Parthenium hysterophorus)*. ▪ No active areas of rill lor gully erosion and drainage follows the appropriate drainage paths. ▪ Resilience to fire and drought.	▪ Results, that rehabilitated areas meet the land suitability assessment that meets class 4 for cattle grazing as defined by the Guideline for Agricultural Land Evaluation in Queensland (State Department of Queensland 2015). Certification that less than 5% of weed and pest species identified in Rehabilitation Areas Post closure flora and fauna monitoring as per the monitoring plan.
Southern Void - PMLU					
Low-intensity grazing	Southern Void	Safe	a. Safety hazards in rehabilitation are as low as reasonably practical. b. Minimise void area. c. Stabilise walls and slopes.	▪ Install slopes and batters as per the void closure plan: ○ Overall slope: 15-30% ○ Vertical distance between berms: 20 m ○ Berm width: 5 m ○ ○ ▪ ▪ Final shape implemented as per rehabilitation and management strategies included in the void closure plan. ▪ Geotechnical adequacy with a >1.5	▪ Geotechnical report and certification from an appropriately qualified and experienced person AQP that the area has achieved stable condition, including: • Residual void is geotechnically stable with FoS of >1.5 • Absence of active rill/gully erosion • Certification that erosion
		Stable			

PMLU / NUMA	DA	Goals	Objectives/Indicators	Criteria	Validation Method
				Factor of Safety (FoS).	and sediment control measures have been installed and are operating as designed •

PMLU	DA	Goals	Objectives/Indicators	Criteria	Validation Method
		Non-polluting	Pit waters are contained such that they do not impact or interact surface or groundwater.	▪ Coal seams to be treated, removed or covered in the backfilling process. ▪ The installation of certified contours and drains as per design by an AQP (CPESC). ▪ Surface water quality of the receiving environment as per the water management plan. ▪ Groundwater aquifers maintain their pre-mining or reference bore water quality. ▪ Prescribed environmental matters maintain their pre-mining condition ▪ Groundwater quality as per the closure water management plan. ▪ No exposed hazardous material.	▪ Surface water and groundwater trigger limits assessed as per the frequencies noted in the closure water management plan. ▪ Groundwater monitoring demonstrates that the groundwater quality is within 95th percentile of the results of baseline pre-mining bore monitoring results, or when baseline is not available, reference bores which have not been impacted by mining activities.
		Self-sustaining	a. Adequate revegetation. b. Littoral zone increases and linkages with terrestrial vegetation.	▪ Battered slopes with 60% vegetation cover as per the closure and revegetation plans. ▪ Structural, geotechnical and hydraulic factors based on the physical and chemical characteristics of the site. ▪ Spoil shaped to connect to the surrounding landscape where possible. ▪ No active erosion.	Post closure flora and fauna ecological monitoring as per the monitoring plan.

PMLU / NUMA	DA	Goals	Objectives/Indicators	Criteria	Validation Method
Southern Void - NUMA					
Water Storage (Non-Use Management Area)	Southern Void	Safe Stable	a. Safety hazards in rehabilitation are as low as reasonably practical. b. Minimise void area. c. Stabilise walls and slopes.	▪ Install slopes and batters as per the void closure plan: ○ Final pit walls (Competent material): 70 degrees ○ Final pit walls (Incompetent material): 45 degrees ○ Inpit spoil slope (unrehabilitated): Angle of repose nominally 37 degrees ○ Maximum surface area (31 ha). ○ Maximum depth (105 m). ○ Maximum Void lake equilibrium level will not reach 300 m AHD. ▪ Safety bund constructed at 2 m high, base width of 5 m from unweathered, freely draining, end-dumped rockfill at a minimum 20 m offset from the pit perimeter as per the closure plan. ▪ Design the void as per the void closure plan. ▪ Partial backfill to a minimum of 225 RL as per the void water balance modelling. ▪ Geotechnical adequacy with a ≥1.5 Factor of Safety (FoS).	▪ Geotechnical report and certification from an appropriately qualified and experienced person AQP that the area has achieved stable condition, including: • Residual void is geotechnically stable with FoS of ≥1.5 • Safety bund constructed in accordance with engineering requirements for height, based on crest width. • No public access to high wall or end wall areas. • Fence entire perimeter and bund to high wall areas. • Absence of active rill/gully erosion • Certification that drainage measures and structures have been appropriately established and are directing overland flow away from the highwall edge; and • Certification that erosion and sediment control measures have been installed and are operating

PMLU / NUMA	DA	Goals	Objectives/Indicators	Criteria	Validation Method
					as designed • Final void located outside of the Isaac River floodplain, as defined under the *Environmental Protection Act.* • Evidence, which has been certified by an appropriately qualified person, based on up to date groundwater modelling, that any final void lakes will not overflow nor potentially contaminate any other surface water bodies and groundwater aquifers.
		Non-polluting	Pit waters are contained such that they do not impact or interact surface or groundwater.	▪ Coal seams to be treated, removed or covered in the backfilling process. ▪ Surface water quality of the receiving environment as per the water management plan. ▪ Groundwater aquifers maintain their pre-mining or reference bore water quality. ▪ Prescribed environmental matters maintain their pre-mining condition ▪ Groundwater quality as per the closure water management plan. ▪ No exposed hazardous material. ▪ Conduct a water balance study to assess the void surface and groundwater interactions. ▪ Predict long term water quality for the overall final void system.	▪ Surface water and groundwater trigger limits assessed as per the frequencies noted in the closure water management plan. ▪ Certification by an AQP that the water level and quality will not cause harm to the surrounding environment. ▪ Groundwater monitoring demonstrates that the groundwater quality is within 95th percentile of the results of baseline pre-mining bore monitoring results, or when baseline is not available, reference bores which have not been impacted by mining activities.

PMLU / NUMA	DA	Goals	Objectives/Indicators	Criteria	Validation Method
		Self-sustaining	N/A	▪ N/A	▪ N/A
Water management Infrastructure (to be rehabilitated)					
Low intensity grazing	Water management infrastructure Includes: 1. Four sediment dams (rehabilitation at closure). 3. One clean water dam. 4. One MAW dam 5. North pit flood diversion levee. 6. North-eastern levee (integrated into the final landform if not required). 7. Five groundwater monitoring bores will remain until the completion of the post closure monitoring program.	Safe	Safety hazards in rehabilitation are similar to surrounding unmined landscapes	Hazard assessment by a suitably qualified and experienced person	Risk is as low as reasonably practical (ALARP) in accordance with *AS/NZS ISO 31000:2009 Risk Management*.
		Stable	a. Dewatering and landform profiling in line with surrounding topography. b. Surface preparation.	Subsidence and erosion are monitored and addressed. 60% perennial pasture groundcover is achieved.	▪ Progressive rehabilitation certification under the EP Act. ▪ Contaminated land survey conducted by an AQP to ensure there is no contamination that will prohibit the establishment of the PMLU. ▪ Receiving water quality indicators do not exceed specified limits ▪ Groundwater monitoring demonstrates that the groundwater quality is within 95th percentile of the results
		Non-polluting	a. Desilting 200m. b. Land investigations. c. Surface run off is minimised and is non-polluting to land and receiving waters[1]	**Receiving environment contaminant limit** - ○ pH – 6.5-8.5 ○ EC - baseflow 720 µS/cm[a] ○ high flow <250 µS/cm[b] ○ Turbidity - 50 NTU ○ Arsenic – 13 µg/L ○ Molybdenum – 0.15mg/L ○ Selenium – 5 µg/L ○ Sulfate - 25 mg/L ○ Suspended Solids - 55 mg/L[b]	
		Self-sustaining	Adequate revegetation.		

PMLU	DA	Goals	Objectives/Indicators	Criteria	Validation Method
				▪ Groundwater aquifers maintain their pre-mining or reference bore water quality. ▪ Groundcover is 60% perennial pasture biomass as per the revegetation plan. ▪ Land Class 4 for grazing. ▪ Less than 5% of declared weeds (excluding Parthenium weed- *Parthenium hysterophorus)*. ▪ No active areas of rill or gully erosion and drainage follows the appropriate drainage paths. ▪ Resilience to fire and drought.	of baseline pre-mining bore monitoring results, or when baseline is not available, reference bores which have not been impacted by mining activities. ▪ Certification that less than 5% of weed and pest species identified in Rehabilitation Areas. ▪ Results, that rehabilitated areas meet the land suitability assessment that meets class 4 for cattle grazing as defined by the Guideline for Agricultural Land Evaluation in Queensland (State Department of Queensland 2015). ▪ Post closure flora and fauna monitoring as per the monitoring.
Water management Infrastructure (to be retained)					
Water storage (above ground landholder dam to be retained)	Water infrastructure 1. Existing farm dam at the northern tip of the ML which will remain post closure as per the existing landholder	Safe	a. Fencing in place where appropriate in consultation with the landholder b. Surface preparation. c. Landholder accepts the condition of the	Subsidence and erosion are monitored and addressed.	Contaminated land survey conducted by an AQP to ensure there is no contamination that will prohibit the establishment of the PMLU.
		Stable		Area adequately accessible to livestock.	

PMLU	DA	Goals	Objectives/Indicators	Criteria	Validation Method
	agreement (to remain post closure). 2. Sediment Dam 4 (southeast).		infrastructure including its structural integrity.		
		Non-polluting	a. Water quality sampling. b. Desilting 200m. c. Land investigations.	Farm dam water quality must be suitable for release into watercourse in compliance with the EA prior to surrender (as per Section 1.3 of the current agreement).	
		Self-sustaining	Structurally sound at the time of handover.	No active areas of rill or gully erosion and drainage follows the appropriate drainage paths.	
MIA/Exploration/Explosives					
Grazing	MIA/exploration/ Explosives	Safe	a. Landform profiling in line with surrounding topography. b. All exploration drill holes have been rehabilitated. c. Drill holes grouted and casings cut to ground level. d. Surface preparation.	▪ 'Requirements for Water Bores in Australia' (Australian Government, February 2012) or latest edition. ▪ No active erosion rills or gullies present. ▪ 60% groundcover of perennial pasture biomass is achieved.	▪ Progressive rehabilitation certification under the EP Act. ▪ All exploration drill holes have been rehabilitated in accordance with the applicable Australian Standard or guideline. ▪ Certification that less than 5% of weed and pest species identified in Rehabilitation Areas.
		Stable			
		Non-polluting	a. All services disconnected, buildings and infrastructure removed. b. Contaminated soil identified and removed in	**Receiving environment contaminant limit -** ○ pH – 6.5-8.5 ○ EC - baseflow 720 µS/cm^a ○ high flow <250 µS/cm^b ○ Turbidity - 50 NTU ○ Arsenic – 13 µg/L ○ Molybdenum – 0.15mg/L ○ Selenium – 5 µg/L	▪ Contaminated land survey conducted by an AQP to ensure there is no contamination that will prohibit the establishment of the PMLU.

PMLU	DA	Goals	Objectives/Indicators	Criteria	Validation Method
			accordance with relevant guidelines and standards. c. Surface run off is non-polluting to land and receiving waters[1]	○ Sulfate - 25 mg/L ○ Suspended Solids - 55 mg/L[b] ▪ Wastes are managed according to waste and resource management hierarchy. ▪ No exposed hazardous materials at surface determined by results of site contaminated land investigation including exposure due to erosion.	▪ Receiving water quality indicators do not exceed specified criteria limits
		Self-sustaining	Adequate revegetation.	▪ Groundcover is 60% perennial pasture cover/ biomass ▪ Land Class 4 for grazing ▪ Less than 5% of declared weeds (excluding Parthenium weed- *Parthenium hysterophorus)* ▪ No active areas of rill or gully erosion and drainage follows the appropriate drainage paths. ▪ Resilience to fire and drought. ▪ Soil nutrient concentrations and nutrient cycling comparable to reference sites.	▪ Certification that less than 5% of declared weed and pest species identified in Rehabilitation Areas. ▪ Post closure flora and fauna monitoring as per the monitoring plan. ▪ Results, that rehabilitated areas meet the land suitability assessment that meets class 4 for cattle grazing as defined by the Guideline for Agricultural Land Evaluation in Queensland (State Department of Queensland 2015).
Roads, tracks and cleared areas					
Grazing	Roads, tracks and cleared areas	Safe Stable	a. Landform profiling in line with surrounding topography. b. Surface preparation.	▪ Subsidence and erosion are monitored and addressed. ▪ 60% perennial pasture groundcover is achieved.	▪ Progressive rehabilitation certification under the EP Act. ▪ Contaminated land survey conducted by an AQP to

PMLU	DA	Goals	Objectives/Indicators	Criteria	Validation Method
		Non-polluting	a. Signage and fencing removed. b. Contaminated soil identified and removed in accordance with relevant guidelines and standards.	▪ Surface water quality of the receiving environment as per the water management plan. ▪ Land Class 4 for grazing. ▪ Less than 5% of declared weeds (excluding Parthenium weed- *Parthenium hysterophorus)*. ▪ Abundance of declared weeds is less than reference sites. ▪ No active areas of rill lor gully erosion and drainage follows the appropriate drainage paths. ▪ Resilience to fire and drought.	ensure there is no contamination that will prohibit the establishment of the PMLU. ▪ Receiving water quality indicators do not exceed limits specified in Table C2. ▪ Certification that less than 5% of declared weed and pest species identified in Rehabilitation Areas. ▪ Post closure flora and fauna monitoring as per the monitoring plan. ▪ Results, that rehabilitated areas meet the land suitability assessment that meets class 4 for cattle grazing as defined by the Guideline for Agricultural Land Evaluation in Queensland (State Department of Queensland 2015).
		Self-sustaining	Adequate revegetation.		

END OF ENVIRONMENTAL AUTHORITY

Appendix B
Groundwater Report

Bowen Coking Coal

Environmental Authority Amendment Application

Groundwater Report

Final

DX70025A06

July 2024

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CLARIFICATIONS REGARDING THIS REPORT

This report is an instrument of service of Klohn Crippen Berger (KCB). The report has been prepared for the exclusive use of Bowen Coking Coal (Client) for an initial application to the BME Progressive Rehabilitation and Closure Plan, and it may not be relied upon by any other party without KCB's written consent.

This report is an update of the Groundwater Report provided to Bowen Coking Coal on 27 September 2023 in support of their PRCP and is in response to a Request for Information (RFI) received from Department of Environment, Science and Innovation (DESI) on 22 November 2023 after the submission of a major Environmental Authority (EA) Amendment. The structure of the original report has not been changed, and still reflects the information required to support a PRCP application.

KCB has prepared this report in a manner consistent with the level of care, skill and diligence ordinarily provided by members of the same profession for projects of a similar nature at the time and place the services were rendered. KCB makes no warranty, express or implied.

Use of or reliance upon this instrument of service by the Client is subject to the following conditions:

1. The report is to be read in full, with sections or parts of the report relied upon in the context of the whole report.
2. The observations, findings and conclusions in this report are based on observed factual data and conditions that existed at the time of the work and should not be relied upon to precisely represent conditions at any other time.
3. The report is based on information provided to KCB by the Client or by other parties on behalf of the client (Client-supplied information). KCB has not verified the correctness or accuracy of such information and makes no representations regarding its correctness or accuracy. KCB shall not be responsible to the Client for the consequences of any error or omission contained in Client-supplied information.
4. KCB should be consulted regarding the interpretation or application of the findings and recommendations in the report.
5. This report is electronically signed and sealed and its electronic form is considered the original. A printed version of the original can be relied upon as a true copy when supplied by the author or when printed from its original electronic file.

1 INTRODUCTION

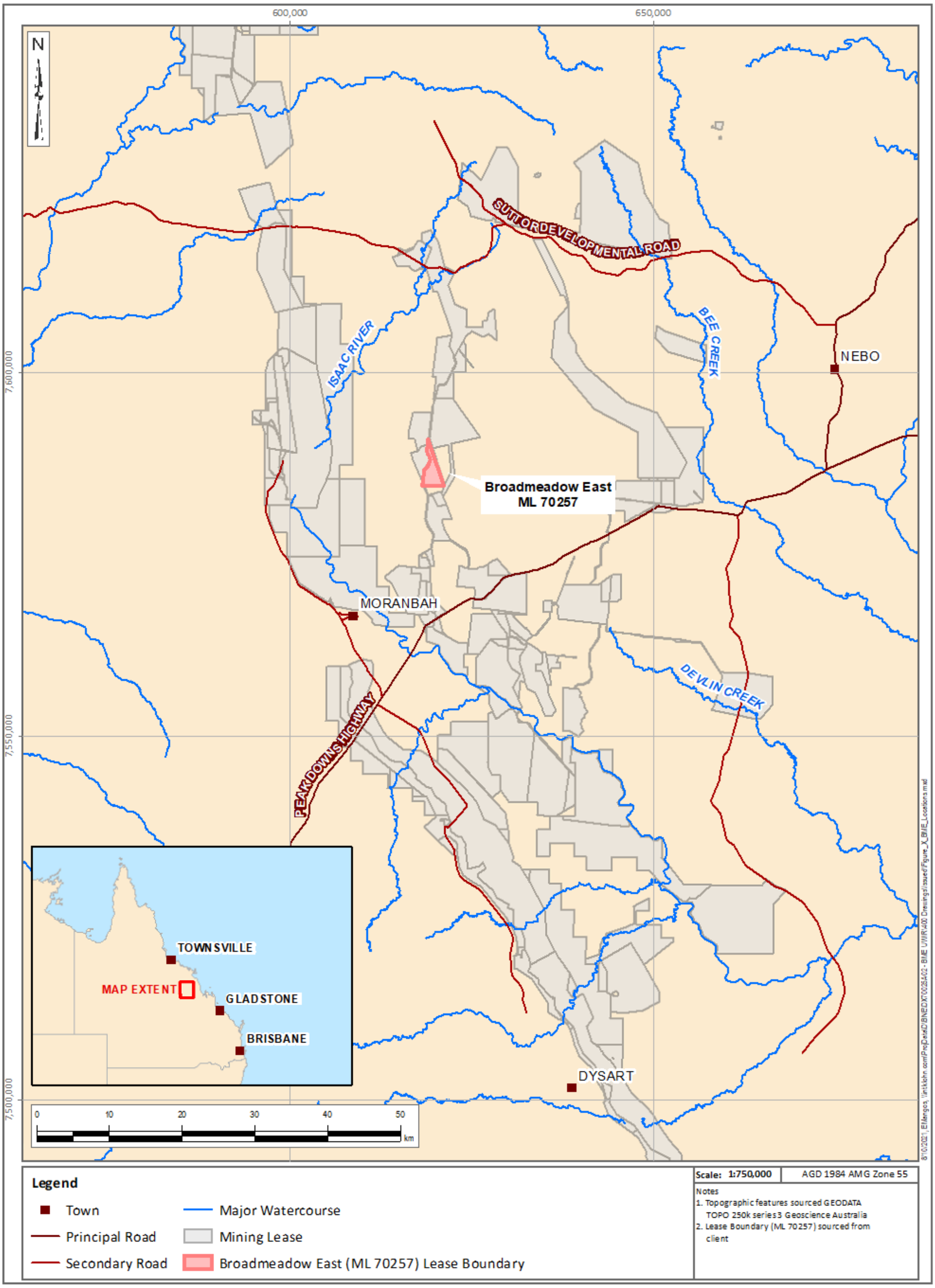
KCB Australia Pty Ltd (KCB) have been commissioned by Coking Coal One Pty Ltd (CCO), a wholly owned subsidiary of Bowen Coking Coal Limited (BCC), to complete a hydrogeological assessment to support the development of the Broadmeadow East (BME) Progressive Rehabilitation and Closure Plan (PRCP).

1.1 Background

BCC owns the BME open cut mine (Mine) located on mining lease (ML) 70257. The Project comprises an area of ~845 ha and is in the northern Bowen Basin, approximately 25 km northeast of Moranbah (Figure 1.1).

Operations at BME are conducted in accordance with Environmental Authority (EA) EA0002465, under the Queensland *Environmental Protection Act 1994* (the EP Act). EA0002465 includes conditions related to groundwater (D1 to 18) and was last amended in February 2023.

BCC is required to prepare a PRCP for submission to the Queensland Government. A PRCP is an element of the Queensland Government's Mined Land Rehabilitation Policy (State of Queensland 2021a) and the EP Act. The EP Act (State of Queensland 2022) requires that all areas disturbed within the relevant mining tenure are rehabilitated to a post-mining land use (PMLU), or managed as a non-use management area (NUMA).



Notes
1. Topographic features sourced GEODATA TOPO 250k series 3 Geoscience Australia
2. Lease Boundary (ML 70257) sourced from client

Figure 1.1 Location of BME

1.2 Scope of Work

A hydrogeological assessment is a requirement of the overarching PRCP. The Guideline: Progressive Rehabilitation and Closure Plans PRCP guideline (DES 2021) includes the following requirements for hydrogeology, and Table 1.1 indicates where in this report each requirement is addressed.

Table 1.1 PRCP Guideline Requirements for Hydrogeology

PRCP Guideline Requirements for Hydrogeology	Section Addressed in this Report
Determining the groundwater occurrence including the existence of, and depth to, aquifers and aquitards	Section 4.2
Locating groundwater recharge locations locally and regionally	Section 4.2
Groundwater quality within each of the aquifers and from surface expressions (i.e. seeps and springs)	Section 4.4 Section 4.5.2 Appendix III
Current and potential future uses of groundwater including existing groundwater extraction bores	Section 4.5.1
Groundwater flow direction and velocity, including field tests to determine hydraulic conductivity	Section 4.2
The development of potentiometric mapping and hydrostratigraphic cross sections	Section 4.2 Section 4.3
Groundwater modelling to inform an understanding of potential changes to groundwater level from dewatering or mine waste storage	Section 5.2 Appendix IV
Groundwater modelling to determine whether the void is acting as a sink or a source for groundwater	Section 5.2 Appendix IV
Cones of depression and associated impacts (as per Section 3.6.3 of PRCP Guideline)	Section 5.2 Section 6 Appendix IV

2 REGULATORY FRAMEWORK

This section describes the relevant regulations and requirements relevant to this hydrogeological assessment, prepared to support BME's PRCP.

2.1 Mineral Resources Act 1989

Underground and open cut mining activities are authorised under the *Mineral Resources Act 1989,* (State of Queensland 2021e). The *Mineral Resources Act 1989* is an Act to provide for the assessment, development and utilisation of mineral resources to the maximum extent practicable consistent with sound economic and land use management (State of Queensland 2021e).

2.2 Environmental Protection Act 1994

The *Environmental Protection Act 1994* (State of Queensland 2022) is an Act with the objective of protecting Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).

This *Act* states that 'to carry out an environmentally relevant activity (ERA) an EA is required'. BME operate under the conditions EA0002465, authorised under the Queensland *Environmental Protection Act 1994* (EP Act) (State of Queensland 2021d).

Section 754 of the *Environmental Protection Act 1994* provides details related to requirements for mining EA holders to prepare a proposed PRCP.

2.3 Mineral and Energy Resources (Financial Provisioning) Act 2018

The *Mineral and Energy Resources (Financial Provisioning) Act 2018* (State of Queensland 2021c) was passed by Queensland Government in November 2018 as part of a broad package of reforms to improve rehabilitation and financial assurance outcomes in the resources sector. The Act was passed to replace the financial assurance arrangements for resource activities under the *Environmental Protection Act 1994.* Changes included a new financial provisioning scheme, changes to how the estimated rehabilitation cost for an EA is calculated and amendments to the *Environmental Protection Act 1994* to introduce new requirements for the progressive rehabilitation and closure of mined land.

2.4 Mined Land Rehabilitation Policy

The Queensland Government have established the Mined Land Rehabilitation Policy as they are committed to ensuring land disturbed by mining activities is rehabilitated to a safe and stable landform that does not cause environmental harm and is able to sustain an approved PMLU (State of Queensland 2021b).

A critical element of the Mined Land Rehabilitation Policy is the PRCP. The aim of the plan is to provide certainty about timing of rehabilitation. The plan will include binding, time-based milestones for actions that achieve progressive rehabilitation and will ultimately support the transition of the mine site's future use.

2.5 PRCP Guideline

DES published a PRCP guideline (ESR/2019/4964), the purpose of which is to assist applicants in developing a PRCP. The guideline was developed using contemporary best practice and industry standards, in line with the *Environmental Protection Act 1994* and the Mined Land Rehabilitation Policy (DES 2021).

The PRCP guideline has been used to assist with this hydrogeological assessment to support BME's PRCP.

2.6 Environmental Values

The Environmental Protection Act 1994 defines an Environmental Value (EV) as:

- A quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety; or
- Another quality of the environment identified and declared to be an EV under an Environmental Protection policy or regulation.

Under the *Environmental Protection Act 1994,* the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (State of Queensland 2019) is established as subordinate legislation to achieve the object of the Act in relation to Queensland waters.

The BME site is located in the Isaac River catchment. The *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* provides defined EVs and water quality objectives (WQOs) for the Isaac River catchment under Schedule 1 of the policy and are detailed in DEHP[1]. EVs for the Isaac River catchment are presented in Table 2.1 and include both the values for surface water and groundwater.

Table 2.1 Summary of Environmental Values

Water	Environmental Values											
	Aquatic Ecosystem	Irrigation	Farm Supply / Use	Stock Water	Aquaculture	Human Consumer	Primary Recreation	Secondary Recreation	Visual Recreation	Drinking Water	Industrial Use	Cultural And Spiritual
Isaac northern tributaries – developed areas	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Isaac groundwater	✓	✓	✓	✓			✓			✓		✓

✓ denotes the EV is selected for protection. Blank indicates that the EV is not chosen for protection.

The *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (EPP Water) identifies environmental values for Queensland waters and wetlands to be enhanced or protected (aquatic ecosystems, water for drinking, water supply, water for agriculture, industry, and recreational use) and states water quality guidelines and WQOs for enhancing or protecting those environmental values.

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[1] Note that the Queensland Department of Environment and Heritage Protection (DEHP) is now the Department of Environment and Science (DES)

The Isaac River Sub-basin Environmental Values and WQOs were established under a previous version of the EPP Water in September 2011. *It is noted that draft review consultation materials for the Fitzroy Basin were released for comment in 2017 but the review remains incomplete.*

More specifically, BME is located within the Isaac Northern Tributaries section of the Sub-basin, for which there are 'developed areas' values. For this overall region, Table 1 of the Isaac River Sub-basin Environmental Values and WQOs 2011 lists all Environmental Values - aquatic ecosystems, irrigation, farm supply/use, stock water, human consumer, primary and secondary recreation, visual recreation, drinking water, industrial use and cultural/spiritual values. BME's Receiving Environment Monitoring Program (REMP), as detailed in Condition C23 of the EA, is directed to addressing the parameters applicable to the area are for the protection of aquatic ecosystems.

The surface water resources, and the associated riparian habitat are described as *moderately disturbed*, owing primarily to the historical and ongoing grazing land use and the infrastructure overlays listed above.

2.6.1 Default Water Quality Guidelines and Water Quality Objectives

The WQOs for the Isaac Groundwaters (Zone 34) have been identified for both the shallow (Tertiary sediments) and deep systems (Permian units). The ANZG proposed default guideline values (DGVs) for indicators have been identified for aluminium, arsenic, molybdenum, and selenium. These are presented in Table 2.2.

Table 2.2 Default Guideline Values and WQOs for Key Analytes at BME

Indicator	Default Guidelines and WQOs						
	ANZG Default (mg/L) (Slightly to Mod. Disturbed - 80th Percentile)	Isaac Groundwaters (Zone 34) mg/L					
		Shallow (<30m)			Deep (>30m)		
		20th	50th	80th	20th	50th	80th
pH	-	7.10	7.75	8.10	7.40	7.80	8.03
Electrical conductivity (µS/cm)	-	498	2,150	8,910	3,419	6,100	16,000
Sulfate (mg/L)	-	12	140	318	25	138	398
Aluminium (mg/L)	0.055*	-	-	-	-	-	-
Arsenic (mg/L)	0.024*	-	-	-	-	-	-
Iron (mg/L)	-	0.000	0.030	0.140	0.000	0.050	0.246
Molybdenum (mg/L)	0.034^	-	-	-	-	-	-
Selenium (mg/L)	0.005#	-	-	-	-	-	-
TRH (C6-C9) (ug/L)	-	-	-	-	-	-	-
TRH (C6-C36) (ug/L)	-	-	-	-	-	-	-

*95% level of species protection recommended for slightly to moderately disturbed ecosystems
^ Unknown level of species protection
# To account for the bioaccumulating nature of this toxicant, it is recommended that the 99% species protection limit is used for slightly to moderately disturbed ecosystems.

3 OVERVIEW OF OPERATIONS

3.1 Current and Planned Operations

The Project is within the 947 ha, undeveloped ML70257 that was formerly a part of the Burton Coal Mine, located to the northeast of Moranbah in Central Queensland's Bowen Basin. CCO commercially acquired the Project from Peabody (Burton Coal) Pty Ltd in mid-2020 and ML ownership was officially transferred on January 27, 2021.

Clearing, topsoil removal, and establishment of the Mining Industrial Area (MIA) commenced in 2022.

The Project includes:

- Two Out of Pit dumps (OOPD), identified as West OOPD and East OOPD;
- North Pit;
- Central backfilled Pit;
- Southern Void;
- Water Management Infrastructures (i.e., sediment dams, MAW dam, North pit levee, groundwater monitoring bores);
- Mining Industrial Area (MIA); and
- Road, tracks and cleared areas.

Produced coal is processed offsite at a nearby wash plant. Existing rail infrastructure is used in transporting coal to port facilities.

The active Life of Mine (LOM) is an estimated five (5) years, during which an expected 8.3 million run of mine (ROM) tonnes will be extracted. The open pit and associated infrastructure are centrally located on the southern section of the Project area (Figure 3.1). Production is expected to continue until 2027, when closure and rehabilitation will start and continue for the subsequent five (5) years until 2032.

The target coal seam for this Project is the Leichardt seam which forms part of the Permian Rangal Coal Measures. These seams are separated by interbeds of carbonaceous mudstone, siltstone and sandstone. The Permian Rangal Coal Measures outcrop and sub-crop within the Project area and are overlain by the Rewan Group and underlain by the Fort Cooper Coal Measures.

Clearing and construction of the previously undeveloped mining area began in mid-2022. Vegetation was progressively cleared, grubbed, and stockpiled to preserve the topsoil and reduce erosion potential. The topsoil is stockpiled in two locations to avoid double handling and be easily accessible to the first areas of the developed area eligible for progressive rehabilitation. The first stockpile is adjacent to the northern portion of the pit and is no longer receiving topsoil. The second topsoil stockpile area is south of the West OOPDs and is where the remainder of reclaimed topsoil will be stockpiled until available for use in rehabilitation activities.

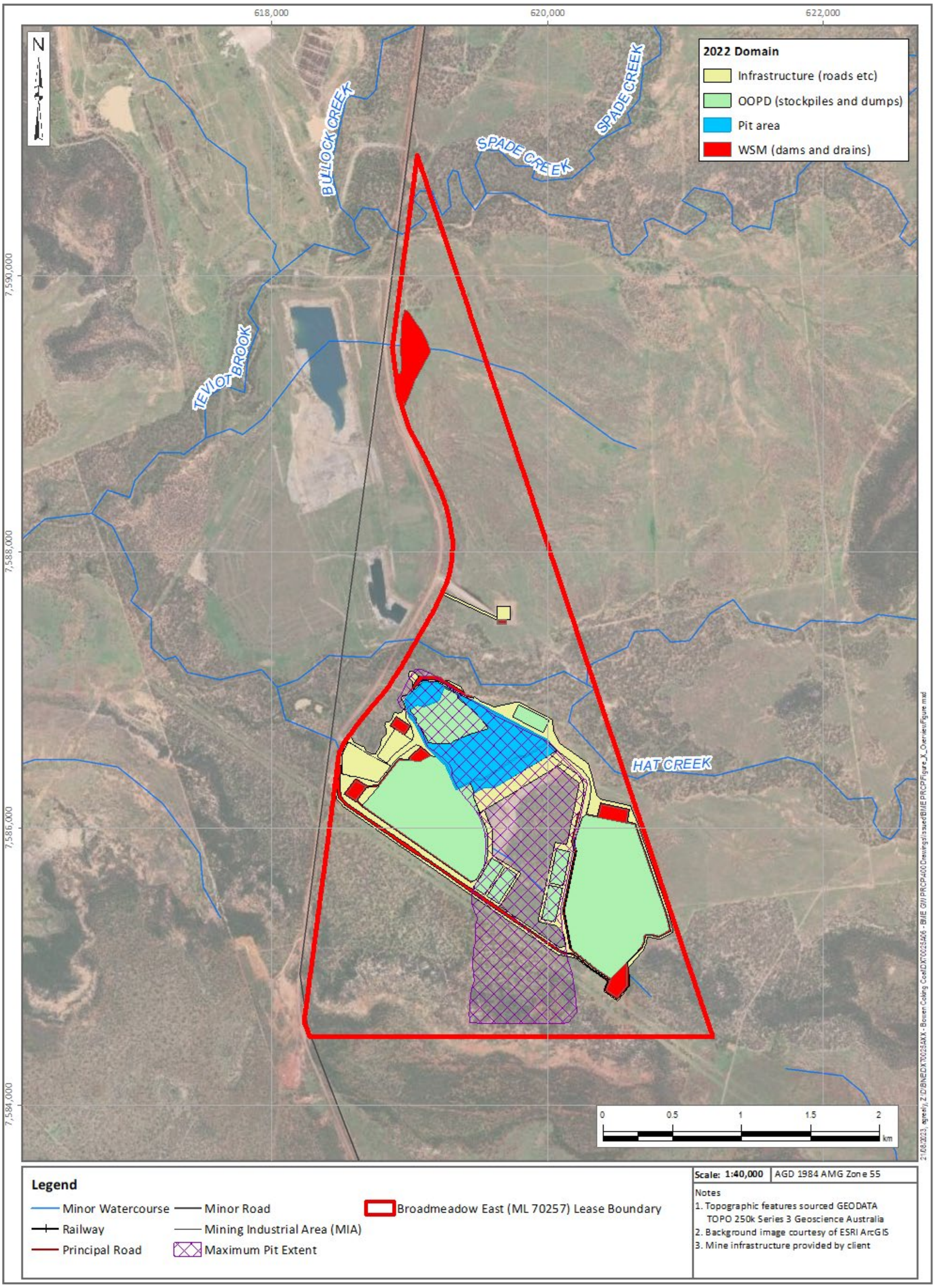


Figure 3.1 Project Overview

Mining commenced on the northern extent of the deposit in the last quarter of 2022 after sufficient overburden was removed. The initial overburden has been placed in the two OOPDs that will likely reach capacity during the first two years of operation. Overburden will also be placed within the pit as mining progressively moves south, resulting in a final void in the southern extent of the pit.

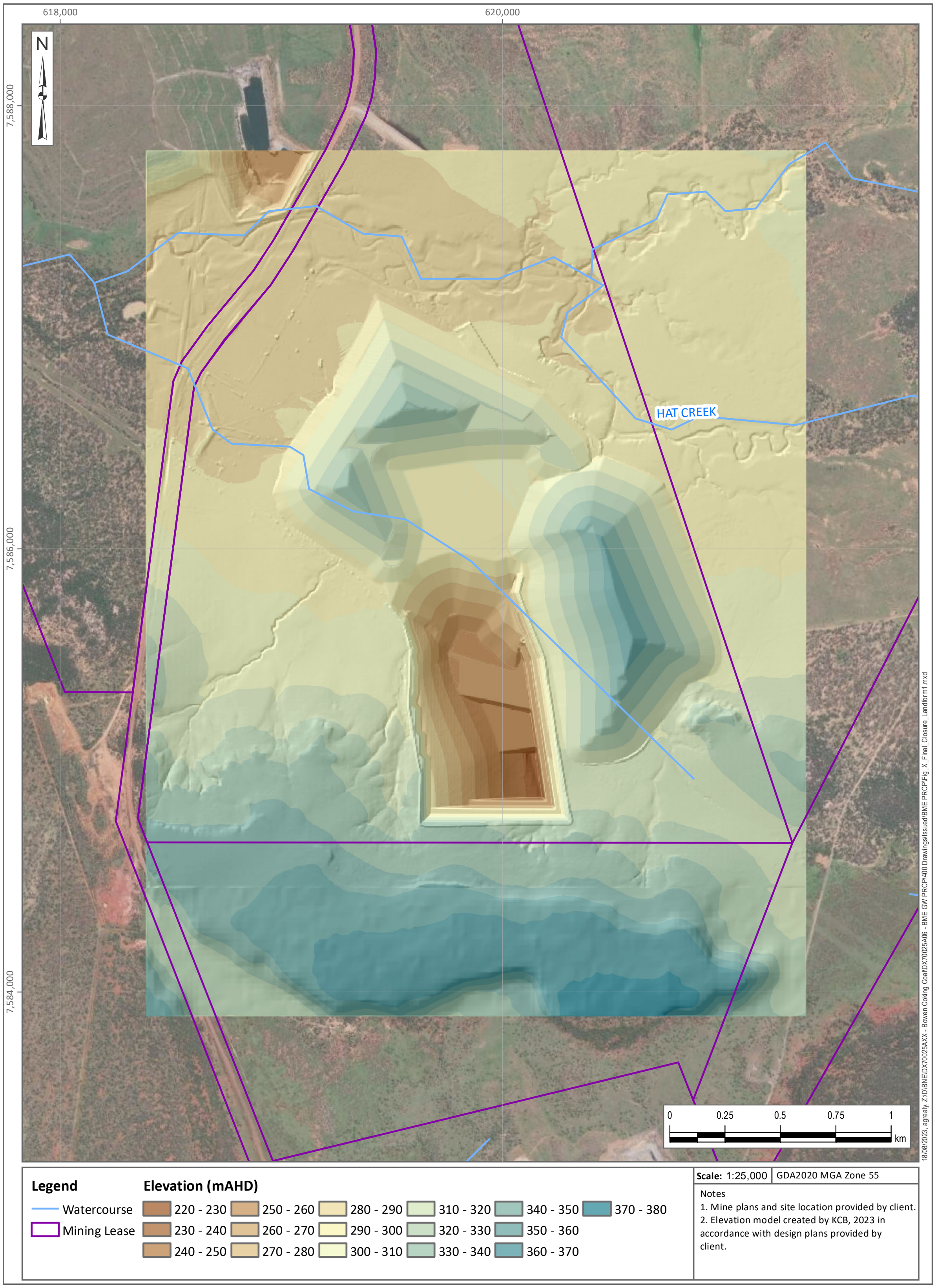
Mining will proceed in a southerly direction along the strike of the coal seams, with the pit excavated in a series of horizontal terraces, exposing the coal and waste on every bench.

At the cessation of mining, there will be one residual void in the southern end of the pit. The northern portion of the pit will be partially backfilled and kept available for use as bulk water storage during operation. This landform will be filled to the surrounding topography at the end of mine life when bulk water storage is no longer required. The southern void will be constructed as a water storage PMLU subject to the Residual Void (Southern void) Design and Closure Plan required by Condition G8 of the EA.

3.2 Closure Strategy

Following the cessation of mining operations at BME in 2028, the Project will enter a closure phase. Mining operations and the associated dewatering will cease, and the groundwater system will be allowed to recover. Rehabilitation strategies for the residual voids have been considered as part of the overarching PRCP scope (completed by others), and a final landform design has been prepared.

The final landform is shown on Figure 3.2, with the details discussed in Table 3.1.



Notes
1. Mine plans and site location provided by client.
2. Elevation model created by KCB, 2023 in accordance with design plans provided by client.

Figure 3.2 Proposed Final Landform

Table 3.1 Planned Closure Landform Details/Criteria*

Domain	Reshape Profile Parameters
North Pit	▪ Backfill level to natural ground level (water level based on groundwater conceptual modelling): 270mAHD. ▪ Slopes less than 15%.
Central backfilled pit	▪ Contoured to the surrounding topography as per landform design. ▪ Slopes less than 15%. ▪ 5 m capping of rejects within central backfilled pit with overburden that is non-reactive (geochemically and physically inert).
Southern Void	▪ Install slopes and batters as per the void closure plan. ▪ Overall slope: 15%. ♦ Final pit walls (Competent material): 70 degrees. ♦ Final pit walls (Incompetent material): 45 degrees. ♦ Underwater slopes: Angle of repose ~37 degrees. ▪ Void maximum surface area (31 ha). ▪ Void maximum depth (105 m). ▪ Maximum void lake equilibrium level will not reach 300 mAHD. ▪ Surface drainage direction: into the void. ▪ Backfill above the groundwater level (water level based on conceptual modelling). ▪ Safety bund constructed at 2 m high, base width of 5 m from unweathered, freely draining, end-dumped rockfill at a minimum 20 m offset from the pit perimeter as per the closure plan.
Out of Pit Dumps (OOPD)	Outer slopes: ▪ 15% as per landform design, and drainage outward away from OOPD towards original topo drainage paths. Inner slopes (into full backfill area). ▪ 12% as per landform design, and drainage outward away from void towards original topo drainage paths.

**Taken from Table 2 in EA0002465*

3.3 Surrounding Mines

There are several mining leases surrounding the Project. These are shown on Figure 3.3, and include:

- South of the Project is Broadmeadow Central (ML70338), with the Broadlea North Mine (ML 70345) located 3 km further south.
- Immediately west is the former Broadmeadow West (ML 70256) held by Peabody.
- North of the Project area are other Mining leases of the Burton Mine held by Peabody (ML 70258, ML 70259, ML 70252) and Ironbark No.1 (ML 700024) held by Fitzroy. (CQ) Pty Ltd.
- Arrow Energy and Blue Energy operate several of the CSG gas fields located within a 10 km radius of the Project area.

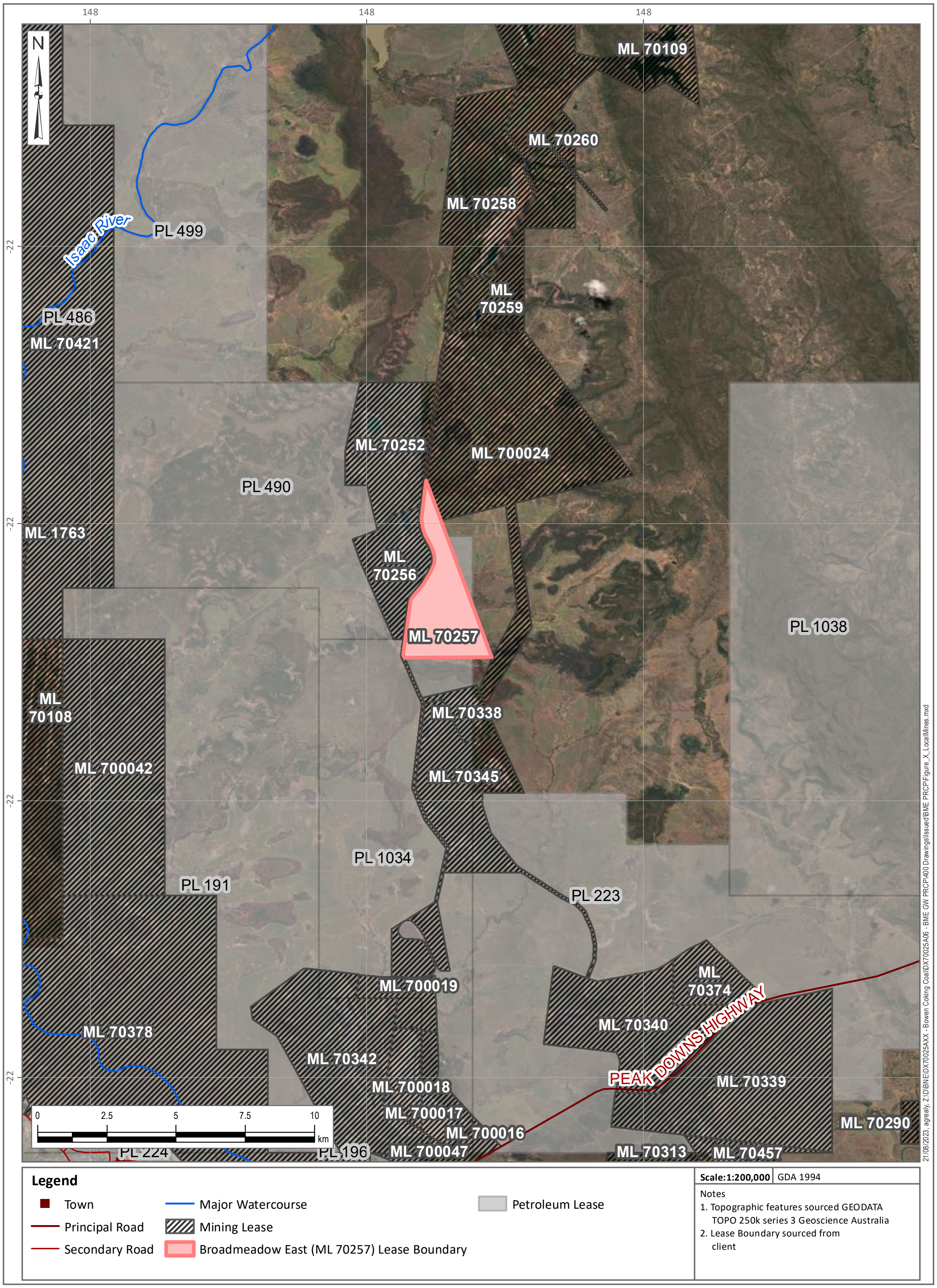


Figure 3.3 Surrounding Mining Projects

3.4 Groundwater Monitoring Network

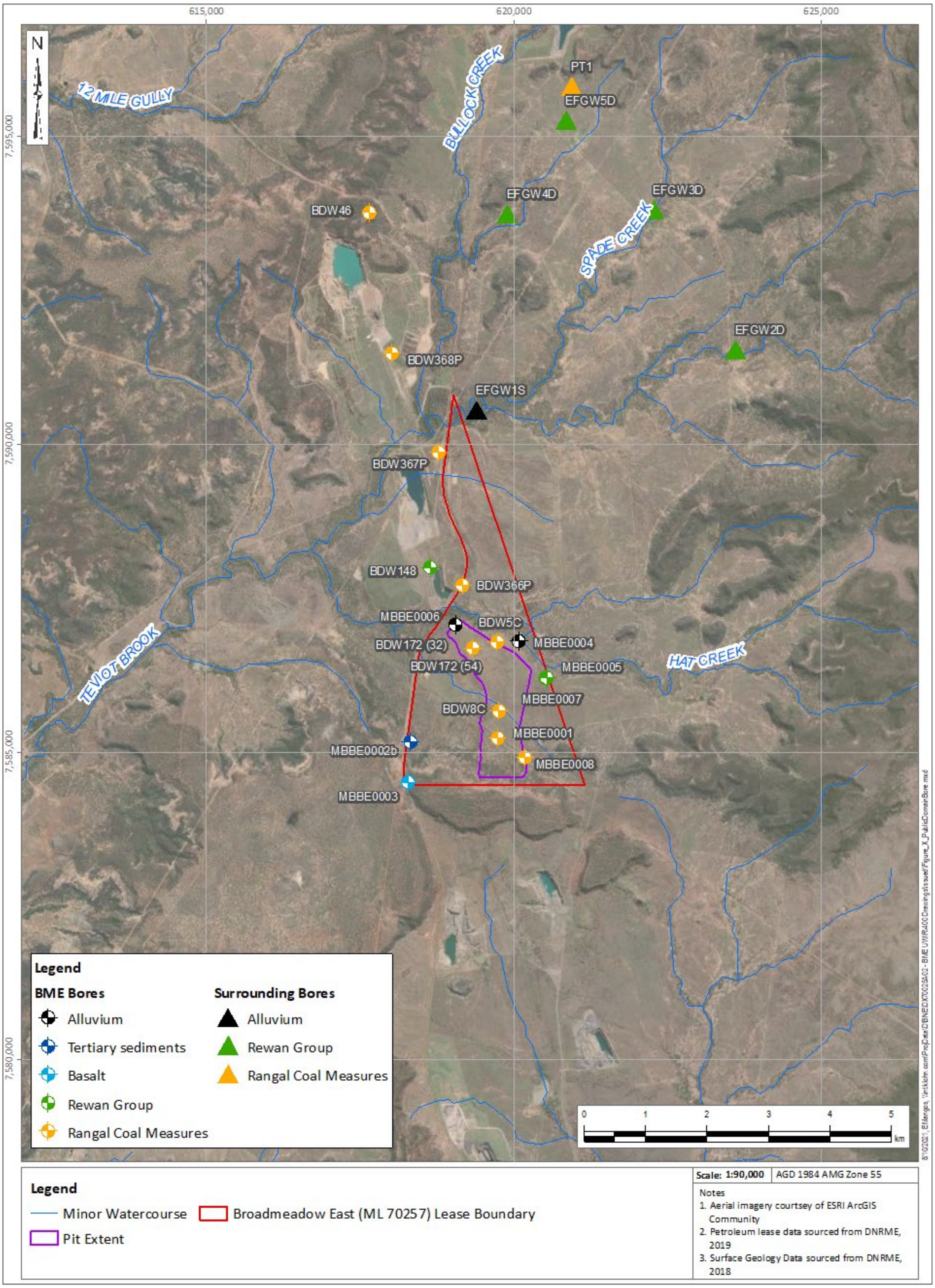
The current groundwater monitoring network at BME includes 11 monitoring bores, which are screened at varying depths in five hydrostratigraphic units. The current bore network are listed in the BME EA and were selected to monitor potential changes in groundwater conditions due to the mining activities in BME (KCB 2021a).

The groundwater monitoring network at and surrounding BME are presented in Table 3.2 and shown in Figure 3.4.

Table 3.2 Groundwater Monitoring Network

Bore ID	Location (AMG84, Zone 55)		Surface Elevation (mAHD)	Depth (m)	Screened unit	Current Status (August 2023)
	Easting (m)	Northing (m)				
BME Monitoring Bores						
MBBE0008	620181	7584916	304.5	135	Rangal Coal Measures	Ongoing monitoring
BDW172(54)	619333	7586689	289	54	Rangal Coal Measures	Mined out as of Q2 2022
BDW8C	619762	7585670	302	99	Rangal Coal Measures	Ongoing monitoring. To be replaced in Q3/4 2023
BDW5C	619731	7586791	292	79	Rangal Coal Measures	Mined out as of Q3 2022. To be replaced in Q3/4 2023
BDW172(32)	619333	7586689	289	32	Rewan Group	Mined out as of Q2 2022. To be replaced in Q3/4 2023
MBBE0002b	618324	7585162	323	60	Tertiary Sediments	Ongoing monitoring
MBBE0003	618281	7584512	346	20	Basalt	Ongoing monitoring
MBBE0004	620081	7586800	290	6	Alluvium	Ongoing monitoring
MBBE0006	619056	7587072	284	6	Alluvium	Ongoing monitoring
BME Compliance Bores						
MBBE0001	619739	7585223	304.5	67	Rangal Coal Measures	Ongoing monitoring, to be replaced in Q3/4 2023
MBBE0007	620535	7586212	297.1	52	Rewan Group	Ongoing monitoring
Regional Monitoring Network						
BDW366P	619163	7587709	290	94	Rangal Coal Measures	Not monitored
BDW367P	618778	7589869	289	186	Rangal Coal Measures	Not monitored
BDW368P	618014	7591478	295	131	Rangal Coal Measures	Not monitored
BDW46	617649	7593762	338	251	Rangal Coal Measures	Not monitored
PT1	620938	7595822	329	138	Rangal Coal Measures	Not monitored
BDW148	618641	7587996	289	54	Rewan Group	Not monitored
EFGW2D	623609	7591549	308	25	Rewan Group	Not monitored
EFGW3D	622271	7593815	306	30	Rewan Group	Not monitored
EFGW4D	619888	7593747	300	40	Rewan Group	Not monitored
EFGW5D	620848	7595275	320	59	Rewan Group	Not monitored
EFGW1S	619392	7590558	283	11	Alluvium	Not monitored

Monitoring data from these bores were used to refine model calibration and to supplement groundwater level and quality data to conceptualise the hydrogeological environment surrounding the mine. These surrounding bores are shown in Figure 3.4.



Notes
1. Aerial imagery courtsey of ESRI ArcGIS Community
2. Petroleum lease data sourced from DNRME, 2019
3. Surface Geology Data sourced from DNRME, 2018

Figure 3.4 BME Monitoring and Regional Monitoring Bores

4 HYDROGEOLOGICAL CONCEPTUAL MODEL

4.1 Physical Setting

4.1.1 Climate

The climate of the Project area is classified as sub-tropical continental, characterised by high variability in rainfall, temperature and evaporation, typical of the Central Queensland region, based on the modified Köppen classification system (BOM 2005).

Long-term rainfall data[2] was sourced from the Scientific Information for Landowners database (SILO) at Latitude -21.80, Longitude 148.15, located within the Project area. Summary statistics for rainfall, temperature, and evaporation are presented in Table 4.1 (DES 2023).

Mean maximum temperatures range between 33°C in the summer months and 23°C in the winter months. Mean minimum temperatures range between 21°C in the summer months and 9°C in the winter months. Daily evaporation rates are generally high and exceed rainfall throughout the year. The highest rainfall occurs during December to February, with the lowest rainfall occurring during April to October.

Table 4.1 Climate Statistics

Site	SILO Point Longitude 148.15, Latitude -21.80			
Statistic Element	Mean Max. Temperature (°C)	Mean Min. Temperature (°C)	Mean Monthly Evaporation (mm)*	Mean Monthly Rainfall (mm)
Period of record	**1970 to 2023**	**1970 to 2023**	**1970 to 2023**	**1970 to 2023**
January	32.8	21.5	213.8	105.8
February	32.1	21.3	173.1	98.7
March	31.1	19.9	177.0	67.2
April	28.7	17.0	141.9	34.5
May	25.7	13.5	115.5	33.4
June	23.1	10.0	92.8	21.9
July	23.0	8.8	103.2	22.1
August	25.0	10.0	133.4	21.3
September	28.2	13.2	172.8	10.6
October	31.0	16.7	214.5	30.3
November	32.4	19.1	223.5	63.6
December	33.2	20.8	229.1	96.4
Annual	**28.9**	**16.0**	**165.9**	**50.5**

The rainfall data was analysed to produce a cumulative rainfall departure (CRD) trend (Figure 4.1). CRD trends present a running deviation of long-term actual rainfall against the average. This provides seasonal-scale identification of trends (wet/dry) and longer term (e.g., decadal) deviation from average conditions. These trends result in a natural tempering of peaks for rainfall events, and therefore support the correlation of rainfall events to aquifer responses.

The CRD highlights the cyclic wet-dry seasonal climate of the site. An overall declining trend, with below average rainfall occurred from 2013 to 2021. The CRD indicates a slightly increasing trend from 2021 to present, signifying above average rainfall conditions.

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[2] Rainfall data from 1 Jan 1970 to 24 April 2023

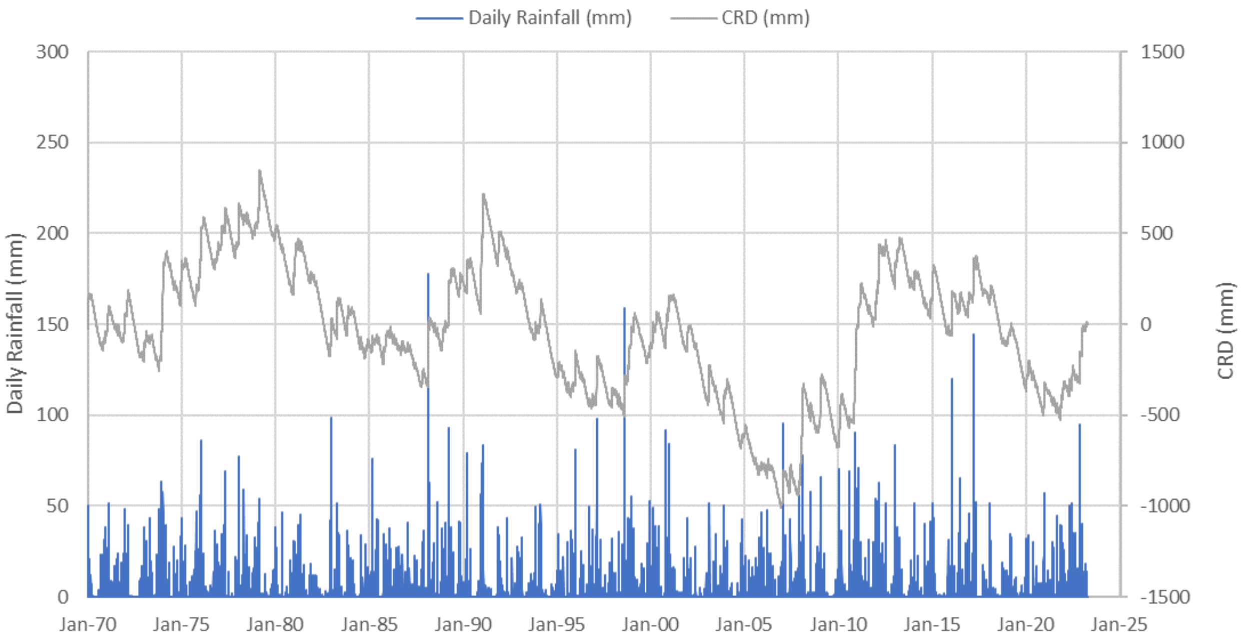

Figure 4.1 **Daily Rainfall and Cumulative Rainfall Departure Trend**

4.1.2 Topography and Drainage

The Project is located in the Isaac River catchment, a sub-basin of the upper Fitzroy Basin. The Isaac River catchment covers an area of approximately 22,000 km^2 and discharges to the Connors River approximately 140 km to the southeast of the Project area, and subsequently into the Fitzroy River a further 180 km southeast. The Isaac River is located approximately 12 km to the west of the Project and flows in a north to south direction.

The Project is located within the Teviot Brook catchment, a sub-catchment of the Isaac River with an area of approximately 260 km^2. Watercourses within the Teviot Brook catchment are ephemeral with highly variable flows, characterised by short duration flows associated with episodic storm events during the wet season. Hat Creek, a tributary of Teviot Brook, flows from east to west and comprises numerous minor tributaries that transect the Project.

Topography across the Project area range between ~275 mAHD towards the northwest and ~380 mAHD in the southeast, as presented in Figure 4.2. To the south of the Project area is a residual Tertiary laterite hill rising approximately 40 m above the general land surface.

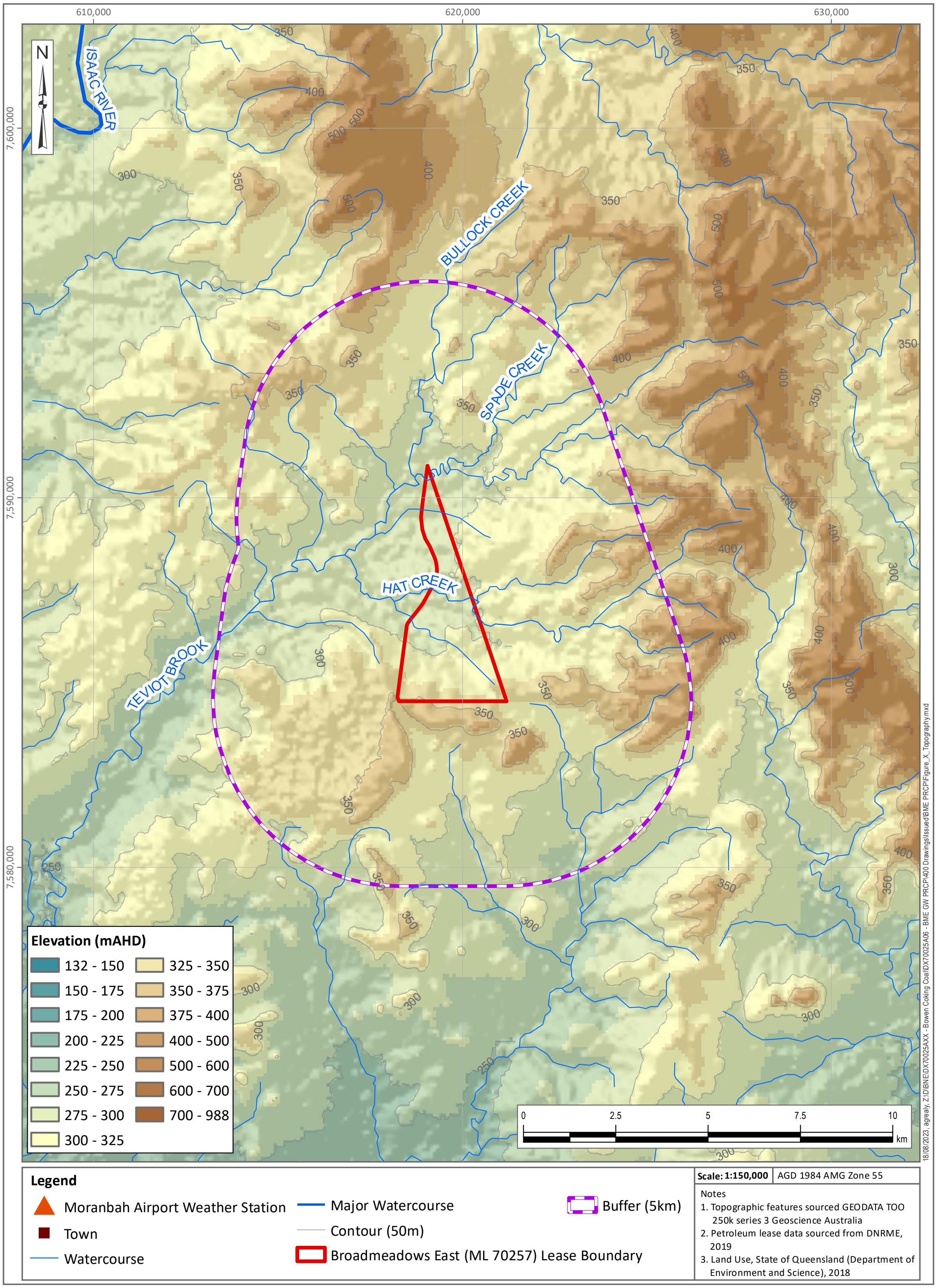

Figure 4.2 **Topography and Drainage of the Project Area**

4.1.3 Regional Geology

The Bowen Basin is the northernmost part of the 1,800 km long Bowen-Gunnedah-Sydney Basin in eastern Queensland and New South Wales. The Project is in the western part of the central Bowen Basin. The basin comprises an accumulation of Permian and Triassic sediments. The economic coal seams in the Bowen Basin lie within the Permian Blackwater and Back Creek Groups. The Moranbah coal measures are within the Back Creek Group, while the Fort Cooper and Rangal Coal Measures exist within the Blackwater Group. All are late Permian coal bearing sequences which were deposited in terrestrial (Blackwater Group) and marine environments (Back Creek Group). This Permian coal strata are overlain by the Triassic Rewan and Clematis Groups. The economic coal seam deposits specific to the Project target area occur within the Rangal Coal Measures.

The surface geology and bedrock geology within the vicinity of the Project area are provided in Figure 4.3 and Figure 4.4; while a summary of the stratigraphy is provided in Table 4.2.

Quaternary alluvium is present across the entire Hat Creek extent within the Project area. The alluvium comprises sands, silts and clays associated with stream channels and flood deposits and ranges in thickness from 3 m to 4 m in the Project area.

Tertiary sediments are also present to the south of Hat Creek and typically consists of semi-consolidated quartz sandstone, clayey sandstone, mudstone and conglomerate and fluvial lacustrine sediments. The Suttor Formation, mapped as *Tu*, has been extensively weathered and reworked during the Tertiary and Quaternary, resulting in an upper profile that includes Tertiary and Quaternary colluvial sheetwash deposits and residual soils (regolith) that comprise clay, silt, sand, gravel and soil.

Tertiary basalt has been mapped to the south of the Project area and comprises a heterogeneous profile of vesicular and massive basaltic lavas with minor tuff and ash. While not confirmed within the Project area to date, previous investigations at surrounding sites have indicated that a Tertiary sand is often present beneath the basalt paleochannel (KCB 2020a). Where present, this unit is often referred to as basal sand.

There are two Triassic units identified within the vicinity of the Project area: the Clematis Group, and the Rewan Group. Outcrop of the Clematis Group is observed to the northeast of the Project area is not encountered within the Project area. The Rewan Group is present across the Project area and represents a prominent lithological unit that separates the underlying Permian coal measures from the overlying shallow Cenozoic stratigraphy.

The Permian Rangal Coal Measures (RCM) is the primary coal bearing unit at BME. This unit outcrops and sub-crops within the Project area and is overlain by the Rewan Group and underlain by the Fort Cooper Coal Measures. The target coal seam for this Project in the RCM is the Leichhardt seam, which is separated from the Vermont seam (not targeted) by interbeds of carbonaceous mudstone, siltstone and sandstone.

Table 4.2 Summary of Stratigraphy in BME

Age	Group	Unit	Average thickness (m)	Lithology
Quaternary	-	Recent alluvium	0 – 20	Soil, clay, silt, sand, gravel.
Tertiary	-	Sediments (Suttor Formation and Duaringa Formation)	15	Sandstone, mudstone, conglomerate, siltstone.
	-	Basalt	25	Olivine basalt of Clermont Springsure basalt Province.
Triassic	Rewan Group		6	Red and green mudstone, green lithic sandstone, occasional pebble conglomerate.
Upper Permian	Blackwater Group	Rangal Coal Measures	90	Carbonaceous mudstone, siltstone, sandstone. Coal seams: ▪ Burton Seam (splitting to the Leichhardt and Vermont Seam).
		Fort Cooper Coal Measures	25	Coal seams, carbonaceous shale, mudstone, sandstone, siltstone, conglomerate. ▪ Girrah Seam

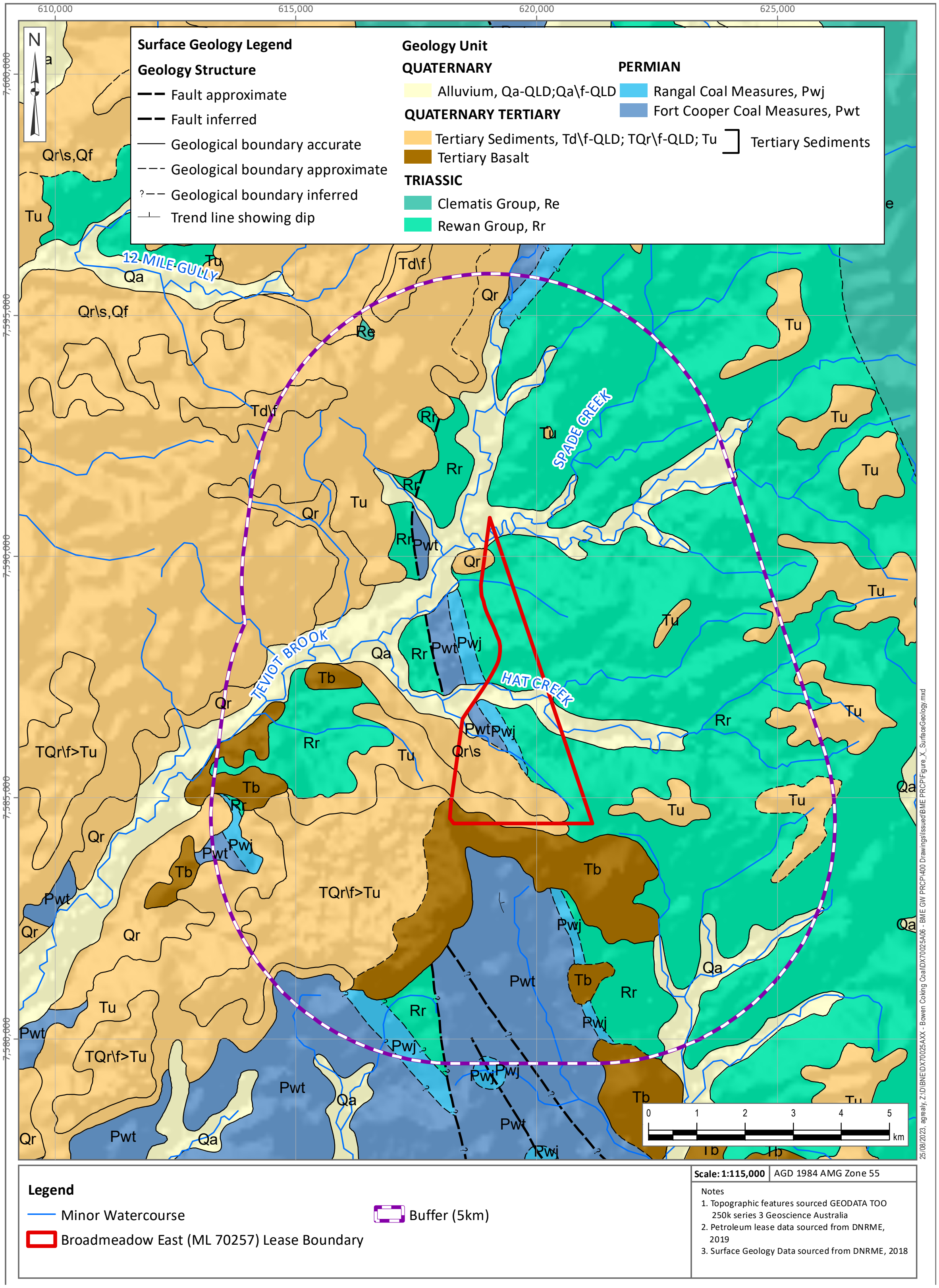

Figure 4.3 **Mapped Surface Geology**

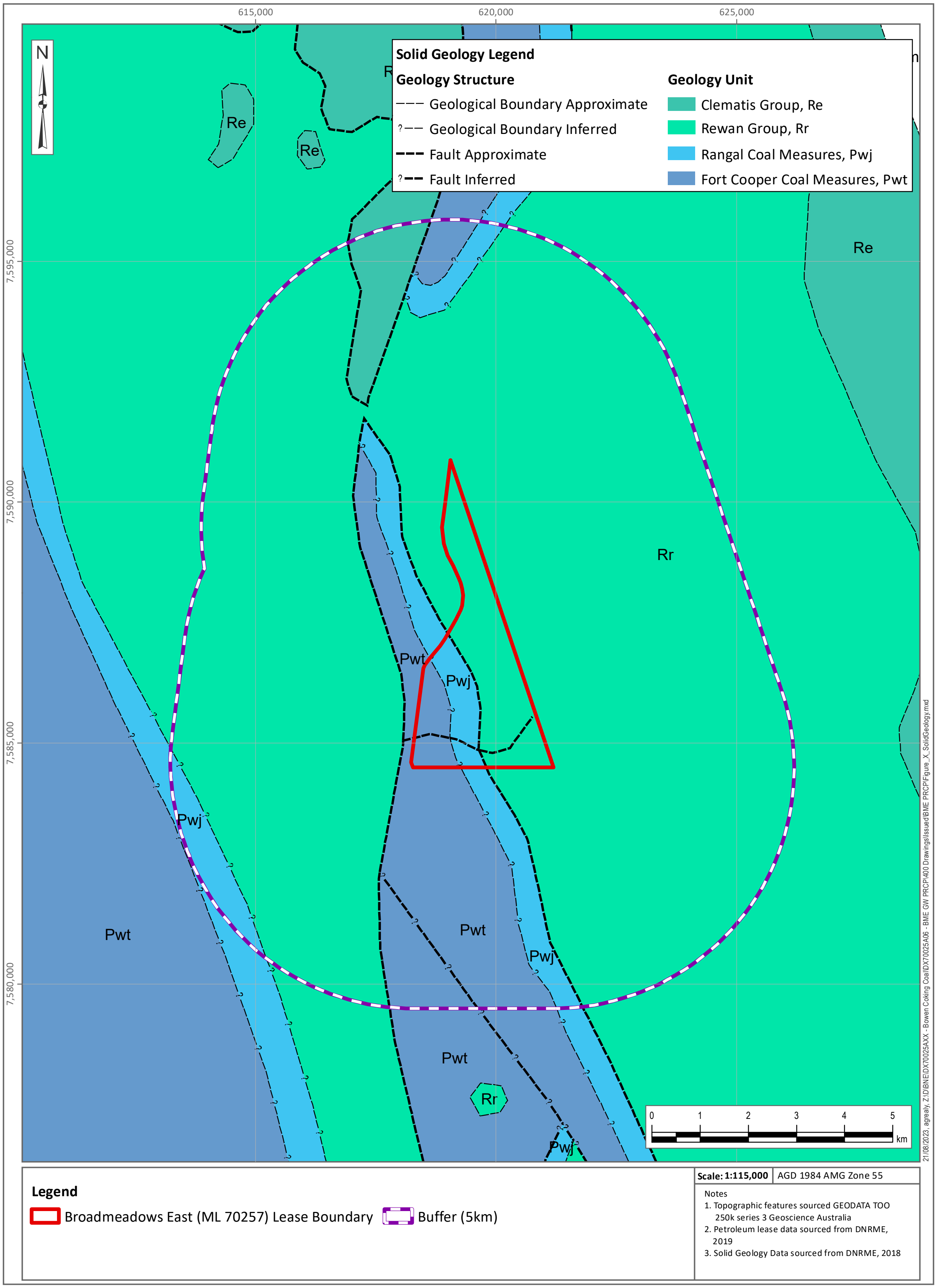

Figure 4.4 Mapped Bedrock Geology

4.2 Hydrostratigraphic Units

The hydrostratigraphic units of relevance are based on the geological units summarised in Table 4.2 and presented in Figure 4.5. Details for each of the hydrostratigraphic units are provided in the following sections.

4.2.1 Quaternary Alluvium

Spade Creek and Hat Creek, tributaries of Teviot Brook and ultimately the Isaac River, flow through the north and central portions of the Project area, respectively. Within the vicinity of the Project area, the distribution of alluvium is limited to these ephemeral watercourses and their associated floodplains.

Previous hydrogeological investigations (KCB 2018) were undertaken downstream and to the west of the Project area and showed that the regional groundwater table is typically located several metres below the base of the alluvium (associated with Teviot Brook). This signifies that the alluvium is perched above the regional groundwater system, typically dry and unsaturated. Drilling and bore installations completed as part of field investigations confirmed that the alluvium associated with Hat Creek and Spade Creek are also typically dry (KCB 2021b). Drilling results within the Project area show that the thickness of the alluvium ranges from 3 m to 4 m (KCB 2021a).

Based on referenced investigations completed in the vicinity of the Project area (KCB 2018) the hydraulic conductivity of the alluvium is highly variable and is a function of the relative proportions of sand and fine clay and silt. Typically, the unconsolidated sediments of the smaller tributaries of the surface water catchment (e.g., Hat Creek, Spade Creek) comprise bed sands within the watercourse channel. This differs from larger watercourses (e.g., Isaac River) where alluvial terraces have formed on floodplains adjacent to the main watercourse channel. The alluvium associated with the bed sand have a higher hydraulic conductivity than the floodplain alluvium, however, these bed sands are localised to the smaller creek channels. The hydraulic conductivity of the bed sand ranges from 8.9 m/d to 45 m/d (KCB 2018).

Mechanisms for groundwater recharge to the alluvium include:

- Direct rainfall infiltration to the alluvium; and
- Seepage of surface water into the creek bed during seasonal flow events in the creek. Based on stream gauging from surrounding projects the surface water flow in the creek is anticipated to be limited to short duration events during and immediately following sustained seasonal rainfall. These flow events result in discrete, short duration recharge events through the alluvium that will dissipate to the surrounding groundwater regime and/or flow downstream within the alluvium.

Regionally, the piezometric surface and groundwater flows within the alluvium is a compartmentalised reflection of surface topography when groundwater is present within this unit. Within the Project area, groundwater flow in the alluvium is from east to west and follows the gradient and alignment of Hat Creek.

There are currently two monitoring bores in the Hat Creek alluvium; MBBE0004 located upstream of the Project, and MBBE0006 located downstream of the Project. The monitoring records for MBBE0004 and MBBE0006 confirm that the alluvium is predominantly dry (KCB 2022).

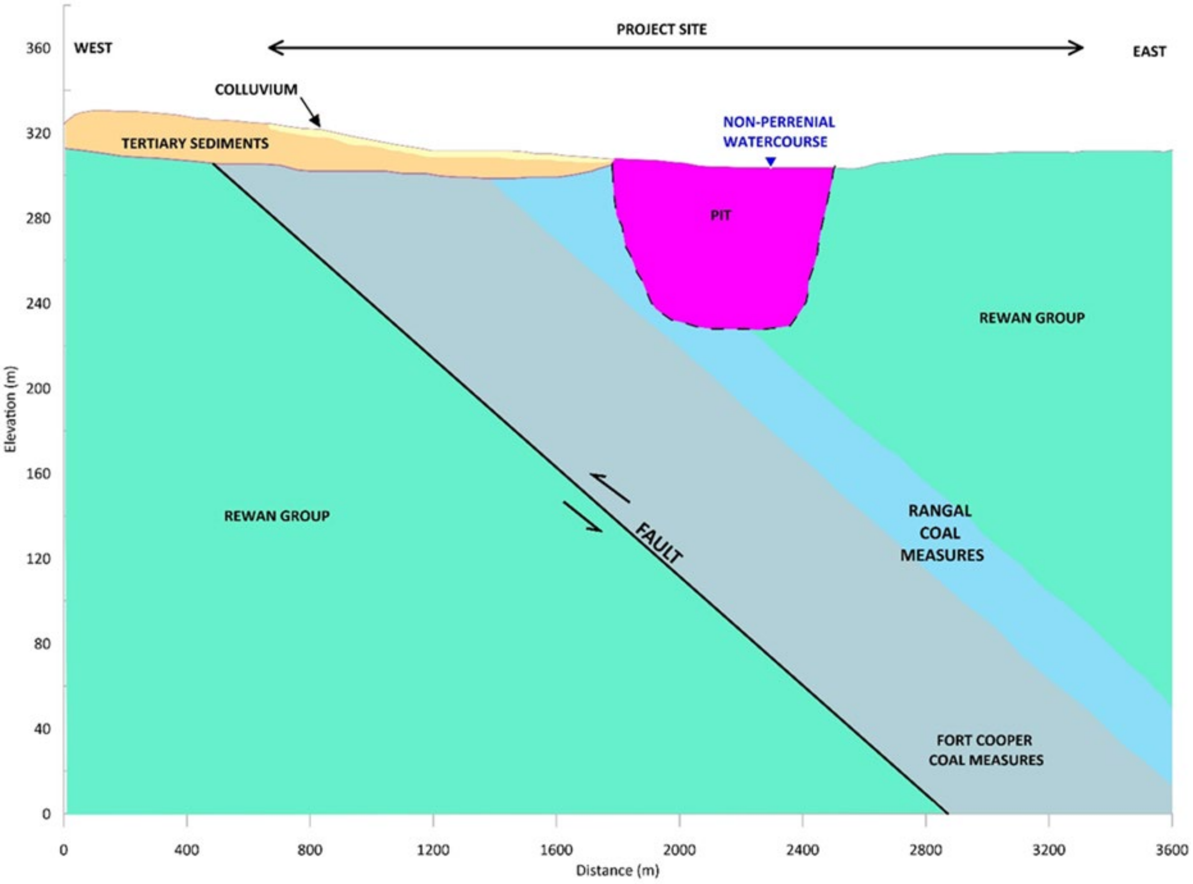

Figure 4.5 Cross Section of Project Area

4.2.2 Tertiary Sediments

The Tertiary sediments comprises a heterogeneous profile of semi-consolidated quartz sandstone, clayey sandstone, mudstone and conglomerate, fluvial lacustrine sediments, and minor interbedded basalt. These sediments form a thin veneer of up to 15 m in thickness and are predominantly located to the south of the Project area, and sporadically within a 5 km buffer.

The Tertiary sediments do not store significant groundwater and are not considered a significant aquifer. As with the alluvium, these units are typically located above the regional groundwater table and are therefore generally dry. As a result, site specific testing of the hydraulic conductivity for this unit was unable to be undertaken. However, hydraulic testing has been completed on the Tertiary sediments unit at surrounding projects (KCB 2018). Results from the test work completed on surrounding projects indicate that the hydraulic conductivity for the Tertiary sediments ranges from 7 x 10^{-4} m/d to 1.22 m/d. In the vicinity of the Project area, groundwater in the Tertiary sediments is observed to the west of the proposed pit area.

Recharge to the Tertiary sediments is interpreted to occur as a result of direct rainfall infiltration, where the sediments outcrop at surface, and where present, downwards leakage from the overlying alluvium.

Groundwater level records from MBBE0002 indicate limited change in the water level during the monitoring period, which is a reflection of limited recharge to the Tertiary sediments.

4.2.3 Tertiary Basalt

The Tertiary basalt underlies the Tertiary sediments and overlies the Rewan Group, typically occurring as a single composite unit comprising massive and vesicular lava, tuff, and ash flows. The upper basalt profile mapped to the south of the Project area is highly weathered and comprises a basaltic clay.

Tertiary basalt is mapped to the south of the Project area and is present in the southwest of the lease. Monitoring bore MBBE0003 is the only bore within the Project area installed in the Tertiary basalt. No basalt was encountered in any other bore in the Project area; therefore, the southern edge of the Project area corresponds with the northern extent of the basalt. The presence of this basalt corresponds with a topographic high and is limited in its extent, likely to be a basalt plug or minor flow. The basalt on the mining lease represents a thin veneer of basalt, which typically comprise weathered and/or massive basalt that has very low hydraulic conductivity, as opposed to the basalt further south in the centre of the unit which is likely to have more typically compartmentalised zones of high hydraulic conductivity with the presence of groundwater. The basalt encountered in MBBE0003 was 15 m thick and dry (KCB 2021b). Limited occurrence of groundwater is observed in the vicinity of the mining area, as observed through basalt monitoring bore MBBE0003 (KCB 2022).

The hydraulic properties of the basalt can vary considerably as groundwater is primarily stored within highly compartmentalised fractures and vesicular zones (KCB 2018).

The Tertiary basalt is a key water bearing unit in the Bowen Basin. However, within the vicinity of the Project area there is limited occurrence of this unit. Tertiary basalt is present in the southern extent of the Project area, is relatively thin (~7 m), highly weathered and unsaturated. As a result, it was not possible to conduct hydraulic testing of the encountered basalt. Hydrogeological investigations completed at surrounding projects included hydraulic testing of the weathered Tertiary basalt (KCB 2018; 2020b). Results of these tests estimate the range of hydraulic conductivity to be 0.002 m/d to 2.6 m/d.

4.2.4 Triassic Rewan Group

The Rewan Group is a thin interbedded sequence of siltstone, claystone and minor fine-grained sandstone that overlies the Permian coal measures. This unit outcrops across majority of the eastern portion of the Project area and sub-crops beneath the alluvium, Tertiary sediments and basalt where present. The Rewan Group is uniformly saturated at depth and may become unsaturated where it outcrops or sub-crops above the regional groundwater table.

The Rewan Group is recognised as a regional aquitard and acts as a confining unit overlying the Permian sediments.

The measured hydraulic conductivity of the Rewan Group within the Project area is 2.4 m/d (KCB 2021b). In comparison, the tested Rewan Group units at surrounding projects indicate a hydraulic conductivity range from 1 x 10^{-3} m/d to 6.5 m/d (KCB 2018; 2020b). In general, the Rewan Group is recognised as a regional aquitard and acts as a confining unit overlying the Permian coal measures; and is typically characterised by low primary porosity.

The groundwater level records from most of these bores indicate limited variability in levels over the duration of the monitoring period (Jan 2000 to March 2023), with limited variability as a result of seasonal changes, indicating limited connectivity with overlying strata or the surface water system.

4.2.5 Permian Coal Measures

The Permian coal measures include the Rangal Coal Measures and the Fort Cooper Coal Measures. These comprise alternating layers of fine to medium grained sandstone, siltstone and coal, including the target Leichhardt and Upper Vermont seams of the Rangal Coal Measures. Permian strata occur across the Project area as a regular layered sedimentary sequence dipping to the east, with outcrops of these units observed within the Project area and sub-cropping beneath the Rewan Group towards the east. The Permian strata also sub-crop beneath the alluvium, Tertiary sediments and basalt within the vicinity of the Project area.

Individual coal seams form the principal water bearing strata within the coal measures and are therefore typically saturated throughout their full thickness; but may become unsaturated where they outcrop or sub-crop above the regional groundwater table. Groundwater storage and movement occurs within the coal seam cleats and fissures and within open fractures that intersect the seams. Data shows limited changes in water levels in the coal measures due to seasonal climatic variability, indicating limited connectivity with overlying strata the surface water system.

Hydraulic tests estimated the hydraulic conductivity of the Leichhardt seam to be ranging from 0.19 m/d to 0.36 m/d (KCB 2021b). These values correlate with other hydraulic tests completed on the Leichhardt seam at surrounding projects (KCB 2020b), with an estimated hydraulic conductivity ranging from 0.07 m/d to 2.3 m/d. Hydraulic testing have also been completed on the Rangal Coal Measures overburden/interburden between the coal, which have resulted in an estimated hydraulic conductivity of 1 x 10^{-5} m/d to 2 m/d.

4.2.6 Structural Features

Geological mapping completed in the vicinity of the Project area have identified a north-south striking regional fault structure located to the west of the Project area. Movement along this fault plane has caused the uplift and associated erosion of the Permian coal measures to the east of the fault, resulting in the outcrop and sub-crop of the Permian strata. Similar north-south striking regional faults are present across the Bowen Basin, which display hydraulic characteristics that restrict groundwater flow in the horizontal direction.

A north-south cross section of the Project Area is shown in Figure 4.6 and indicates top of coal seam layer, depth of mining area, final landform and final pit depths.

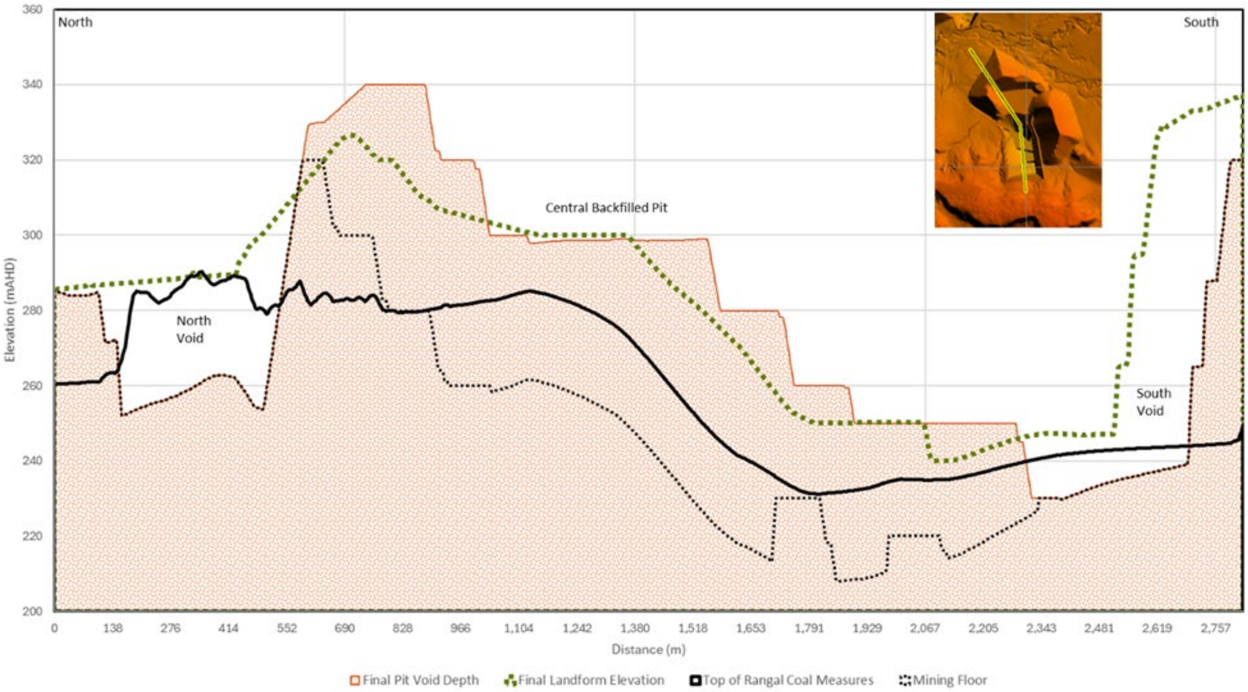

Figure 4.6 Cross Section Across BME Project Area from North to South

4.3 Groundwater Levels and Flow

A summary of the groundwater levels and flow conditions for each of the relevant hydrostratigraphic units across the Project area is provided in the following sections. The depth to groundwater level across the Project site is provided in Figure 4.7. Hydrographs are presented for the different hydrostratigraphic units in Figure 4.8 to Figure 4.10 and Figure 4.12.

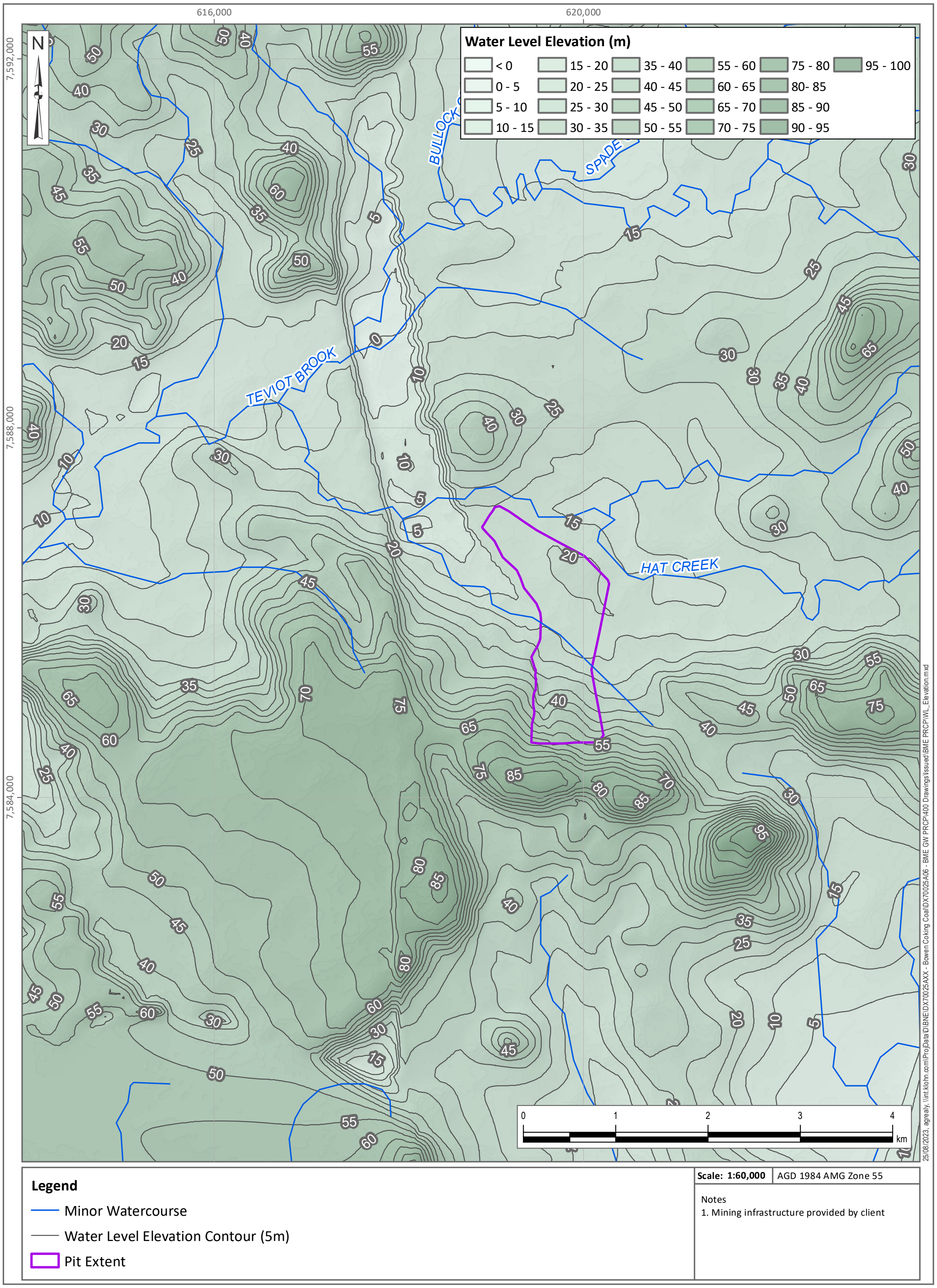

Figure 4.7 Depth to Regional Groundwater Level at the End 2021

4.3.1 Quaternary Alluvium

Bore EFGW1S has been monitored for groundwater levels historically and installed adjacent to Teviot Brook, screening the alluvium, to the north of the Project area. Groundwater levels in this bore (Figure 4.8), over the period of monitoring, fluctuate by up to 3 m, with higher water levels observed during the wet season and lower water levels observed during the dry season. Groundwater levels show a good correlation to the CRD trend, which is also presented on the hydrograph.

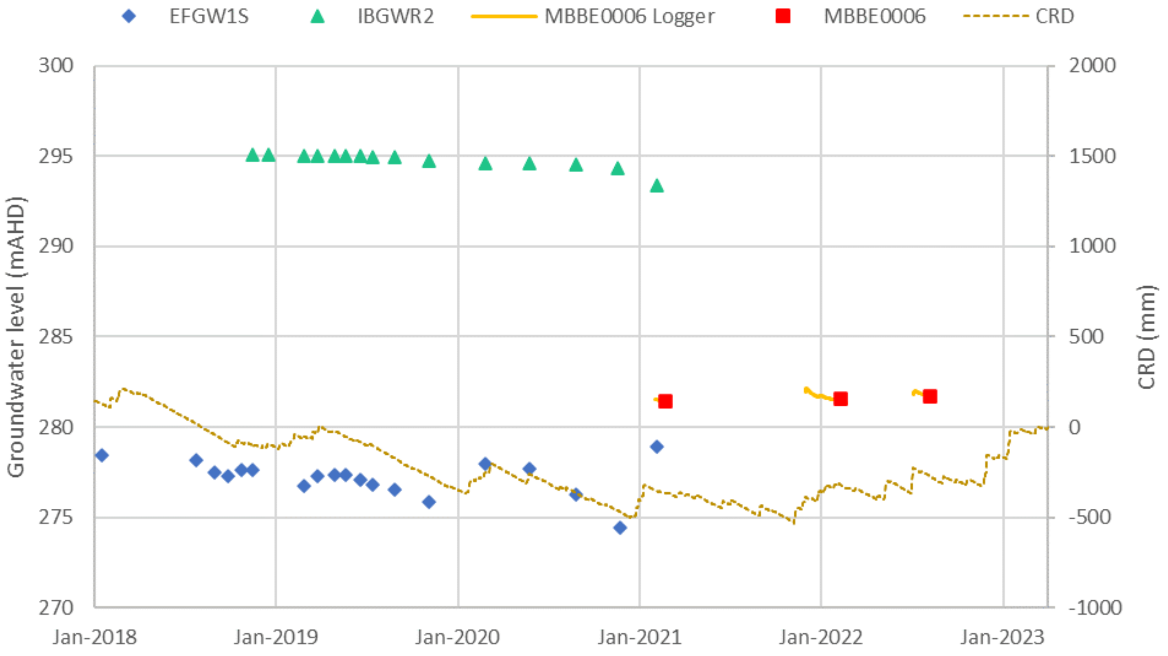

Figure 4.8 Groundwater Elevation Hydrograph – Bores Screened in the Alluvium

Groundwater levels in IBGWR2 have remained relatively stable with limited change during monitoring from 2018 to 2023. In comparison to Hat Creek, the watercourse adjacent to the north of the proposed pit, Teviot Brook is a larger watercourse with a larger accumulation of alluvium and a higher potential for groundwater storage. Between 2018 and 2021 some groundwater levels were measured at EFGW1S and IBGWR2 and these varied between 2 mbGL[3] and 7 mbGL.

Two monitoring bores have been installed in the alluvium associated with Hat Creek (MBBE0004 and MBBE0006) within the Project area. Since installation (January 2021) no groundwater has been observed within these bores. Figure 4.8 indicates that the alluvium becomes saturated following rainfall events, due to the contribution of surface water recharge into the system. There is no permanent groundwater in the alluvium. As a comparison, groundwater levels in the underlying Rewan Group are ~17.5 mbGL (MBBE007) indicating disconnection between the alluvium and the deeper system. Groundwater in the alluvium is ephemeral and dependent on the input of surface water (following rainfall events). The 2023 groundwater updated model does not predict a change to the groundwater level in this unit as a result of the open cut development.

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[3] mbGL – metres below ground level

4.3.2 Tertiary Sediments

The Tertiary sediments are recharged by direct infiltration from rainfall where these sediments are present at the surface. Short duration recharge also occurs via seepage from the alluvium (where present) for short periods following surface water flow events. However, due to the limited thickness of the Tertiary sediments in the vicinity of the Project area (maximum thickness of ~15 m) some infiltration occurs to the underlying hydrostratigraphic units.

To the west of the proposed pit is one monitoring bore (MBBE0002) screened in the Tertiary sediments (Figure 4.9). Groundwater was not encountered during the drilling and installation of this bore as part of the site investigation program. However, subsequent groundwater monitoring rounds have encountered groundwater within the bore, with the data indicating limited recharge to the Tertiary sediments. Groundwater levels varied between 11.5 to 11.9 mbGL for the period April 2021 to March 2023.

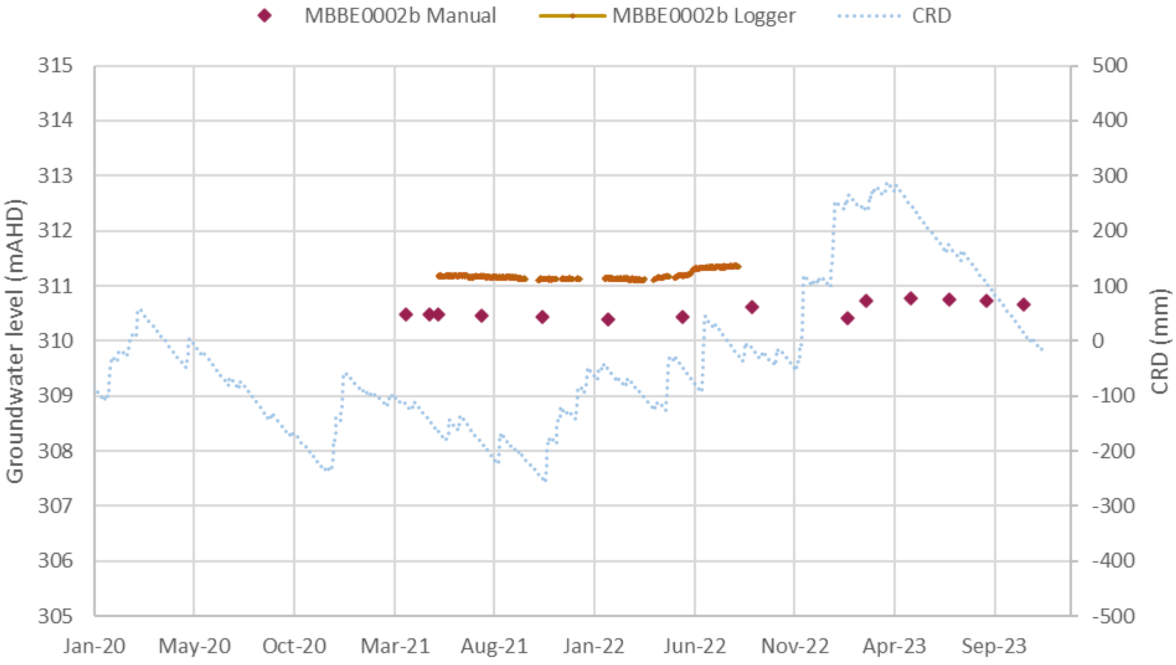

Figure 4.9 Groundwater Elevation Hydrograph – Bores Screened in the Tertiary Sediments

4.3.3 Tertiary Basalt

The Tertiary basalt typically underlies the Tertiary sediments and overlies the Rewan Group or Permian Coal measures, and as a single composite unit comprising massive and vesicular lava, tuff and ash flows. The upper basalt profile is highly weathered and comprises a basaltic clay.

Tertiary basalt is mapped to the south of the Project area and is present in the southwest of the lease. MBBE0003 was installed in the southwest corner of the mining lease, and this is also the only bore that intersected the Tertiary Basalt in the Project area. The basalt encountered in MBBE0003 is 15 m thick and dry (KCB 2021b). Groundwater is not observed in this monitoring bore.

4.3.4 Rewan Group

Groundwater level hydrographs from monitoring bores screened within the Rewan Group (Figure 4.10) comprise bores located approximately 4 to 5 km to the north of the Project area; EFGW2D, EFGW3D, EFGW4D, EFGW5D and IBGWR1; and two bores located within the Project area; BDW172(32) and MBBE0007. The groundwater level records from most of these bores indicate limited variability in levels over the duration of the monitoring period (Jan 2000 to March 2023), with limited seasonal variability, indicating limited hydraulic connection with overlying strata or the surface water system. Groundwater levels in EFGW5D (located northeast of the Project area) have fluctuated from ~285 mAHD to ~298 mAHD during the monitoring period.

Across the Project area, the Rewan Group is identified as the uppermost strata in the stratigraphic profile that hosts the regional groundwater level. The depth to groundwater level in the Rewan Group ranges from 17.5 mbGL to 27 mbGL across the Project area.

Figure 4.11 illustrates observed groundwater elevations in bores MBBE0007, MBBE0010 and BDW172(32) screened in the Rewan Group and groundwater flow direction is from south to north.

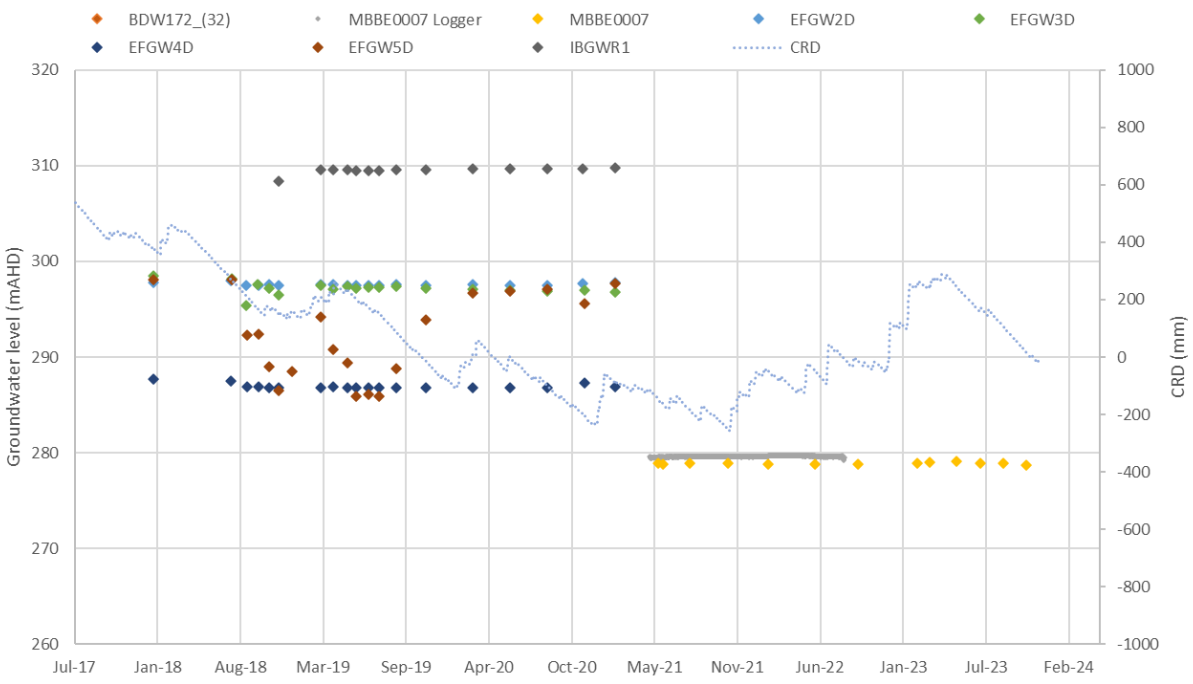

Figure 4.10 Groundwater Elevation Hydrograph – Bores Screened in the Rewan Group

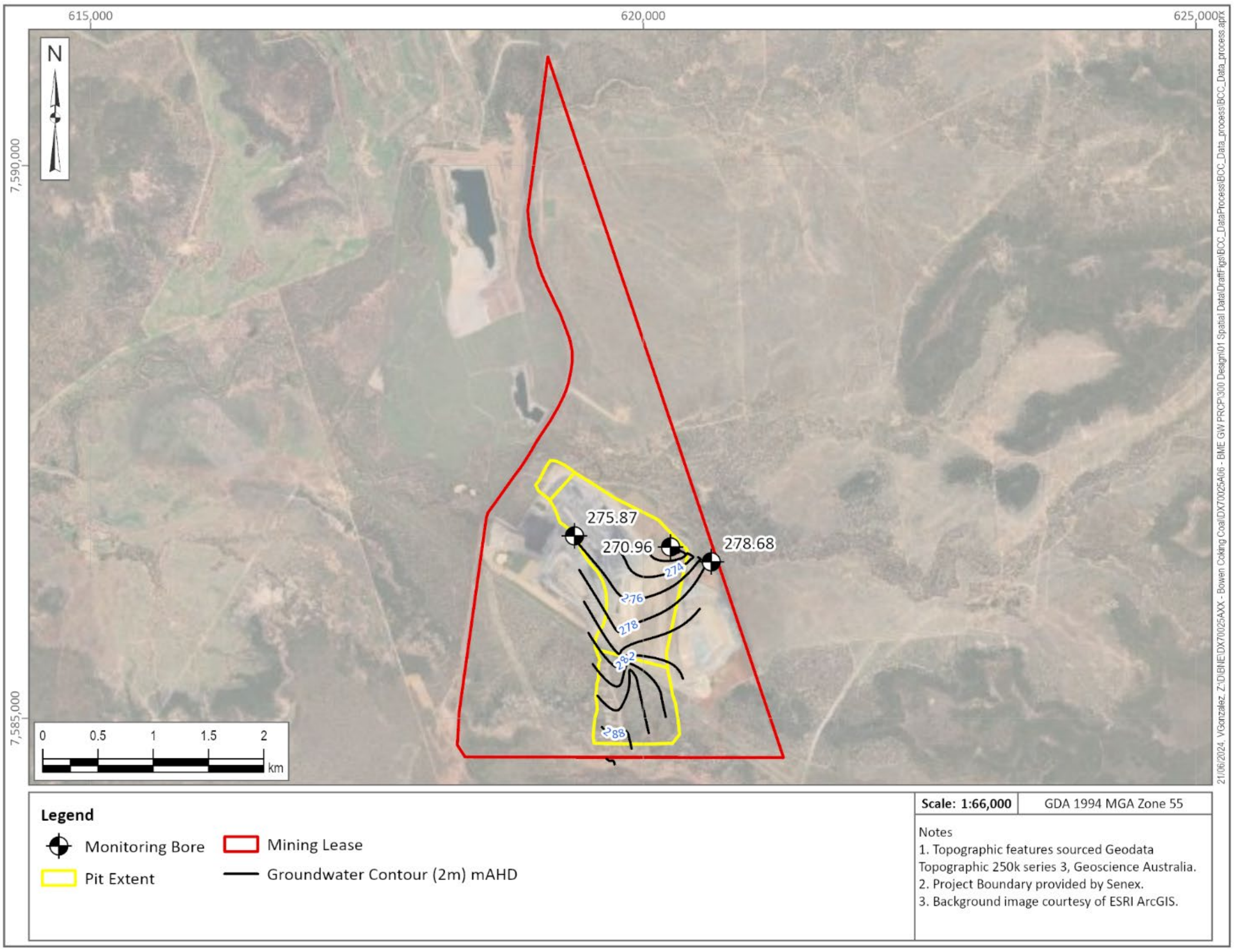

Figure 4.11 Groundwater Elevation Hydrograph – Bores Screened in the Rewan Group

4.3.5 Rangal Coal Measures

The groundwater level hydrographs for the Rangal Coal Measures (Figure 4.12) identifies limited changes in groundwater levels for the duration of the monitoring period, with the exception of monitoring bores located adjacent to mining activities where mine dewatering and groundwater level recovery trends are observed (e.g. BDW366P, BDW368P). There are also limited changes in water levels due to seasonal climatic variability, indicating limited connectivity with overlying strata and the surface water system.

Conceptually, the interpreted groundwater flow direction in the Permian coal measures is towards west-southwest, which is a subdued reflection of the surface topography. However, historical coal mining activities in the vicinity of the Project area has resulted in zones of depressurisation in the groundwater, particular in the vicinity of adjacent residual open pit voids where pit lakes, in connection with the groundwater system, are present. These pit lakes have caused a reduction in the potentiometric surface creating a hydraulic gradient towards the pit lake. Therefore, the current groundwater flow direction in the vicinity of the Project area is a reflection of this hydraulic gradient, with groundwater flowing towards these pit lakes (i.e., towards the northwest).

Groundwater levels fluctuated between 10.9 mbGL and 21.0 mbGL for the period January 2006 to March 2023.

Figure 4.13 illustrates observed groundwater elevations in bores MBBE0001, MBBE0008, MBBE0009, MBBE0012 and BDW8C screened in the Rangal Coal Measures.

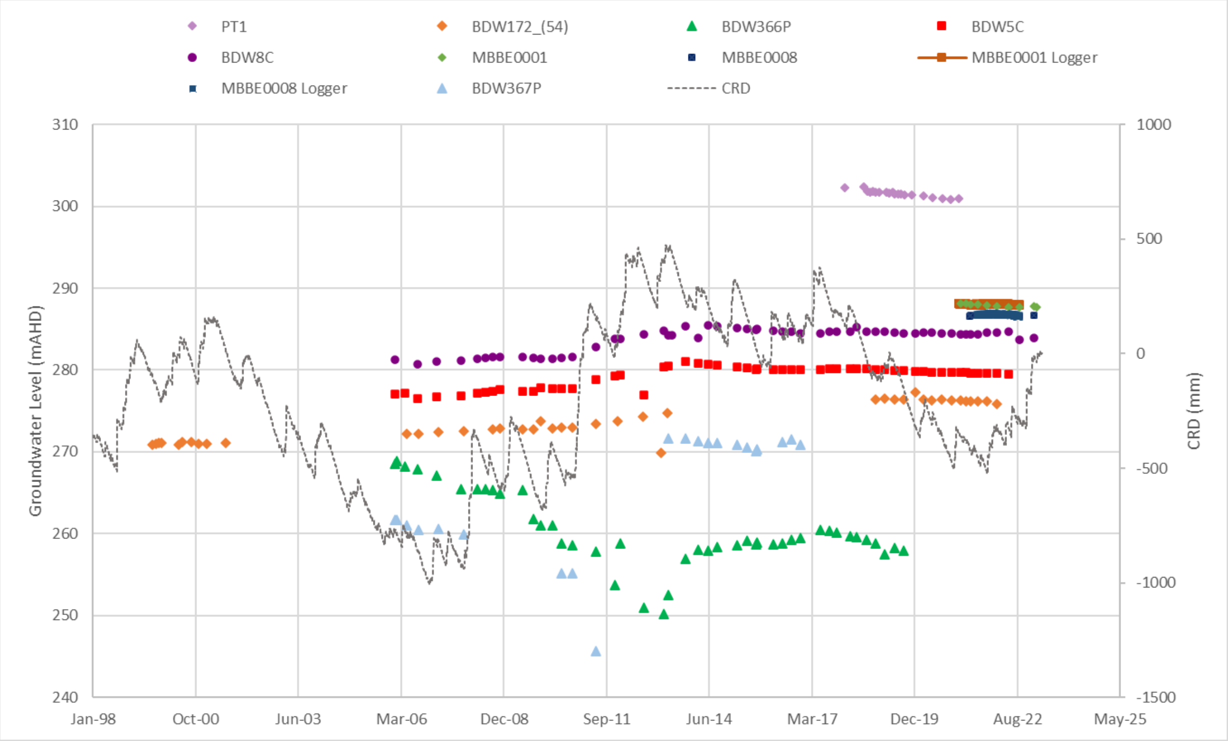

Figure 4.12 **Groundwater Elevation Hydrograph – Bores Screened in the Rangal Coal Measures**

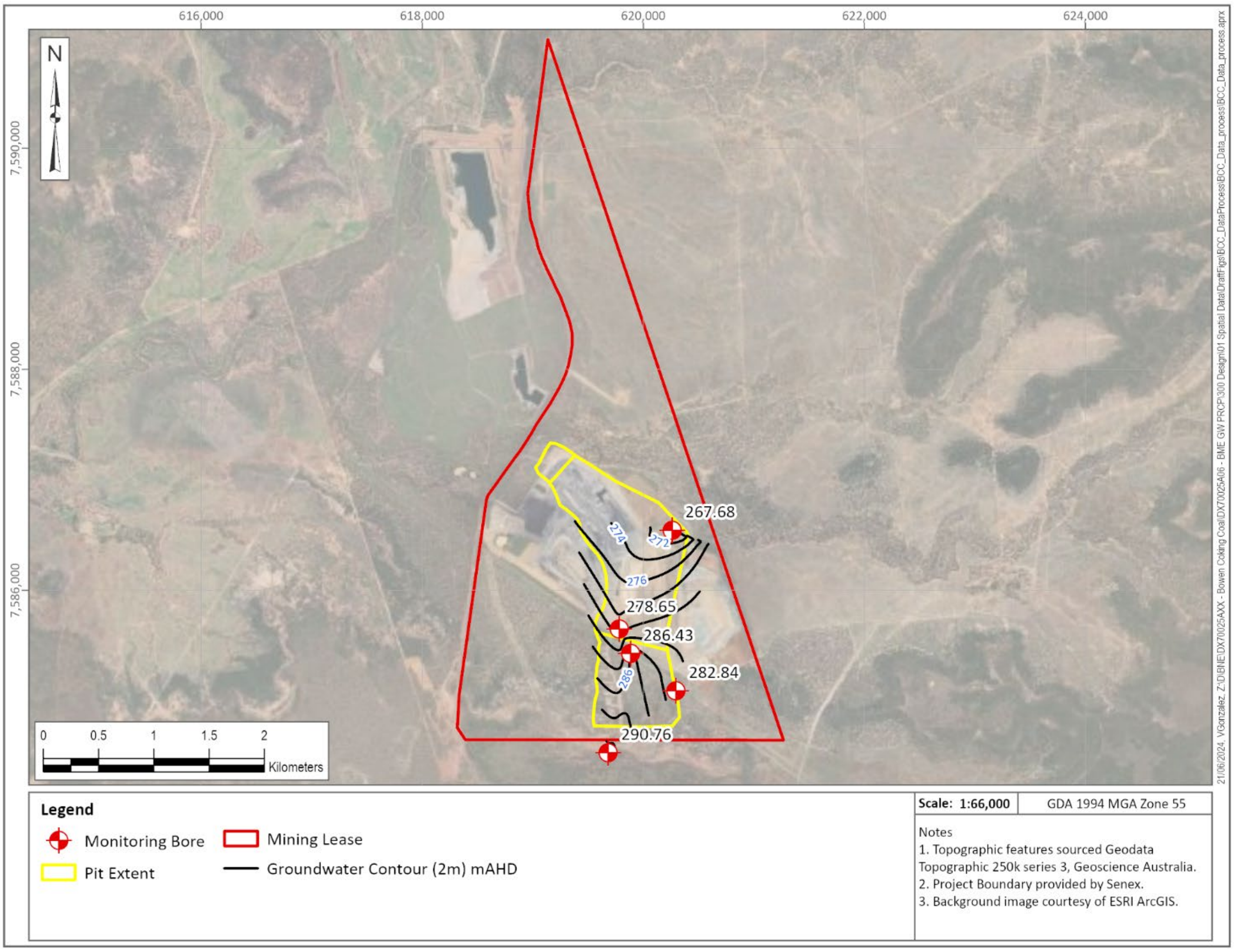

Figure 4.13 Observed Groundwater Elevation – Bores Screened in the Rangal Coal Measures

4.4 Groundwater Quality

Groundwater quality data provides useful information on the hydrogeological regime, as it is influenced by interaction with the aquifer matrix, and groundwater recharge/discharge processes. Groundwater quality samples have been collected from the various monitoring bores between 2006 and 2023 and are presented in Figure 4.14.

Previous site investigations identified that groundwater was accessible only in the Tertiary sediments, Rewan Group and Rangal Coal Measures within the Project area.

Piper and Durov plots provide an understanding of the hydrochemical composition of the groundwater, with the addition of pH and EC as additional differentiators. The plots for the groundwater quality from bores in the vicinity of the Project area (Figure 4.14) indicates that the proportion of major ionic constituents for the three main hydrostratigraphy units are relatively similar, with the dominant water types being Na/K–SO_4 to Na/K–HCO_3.

A review of groundwater quality data from the current Project groundwater monitoring network (as per EA0002465) indicates that the water quality in the Project area remains relatively stable, and the key parameters noted in the EA are within baseline levels.

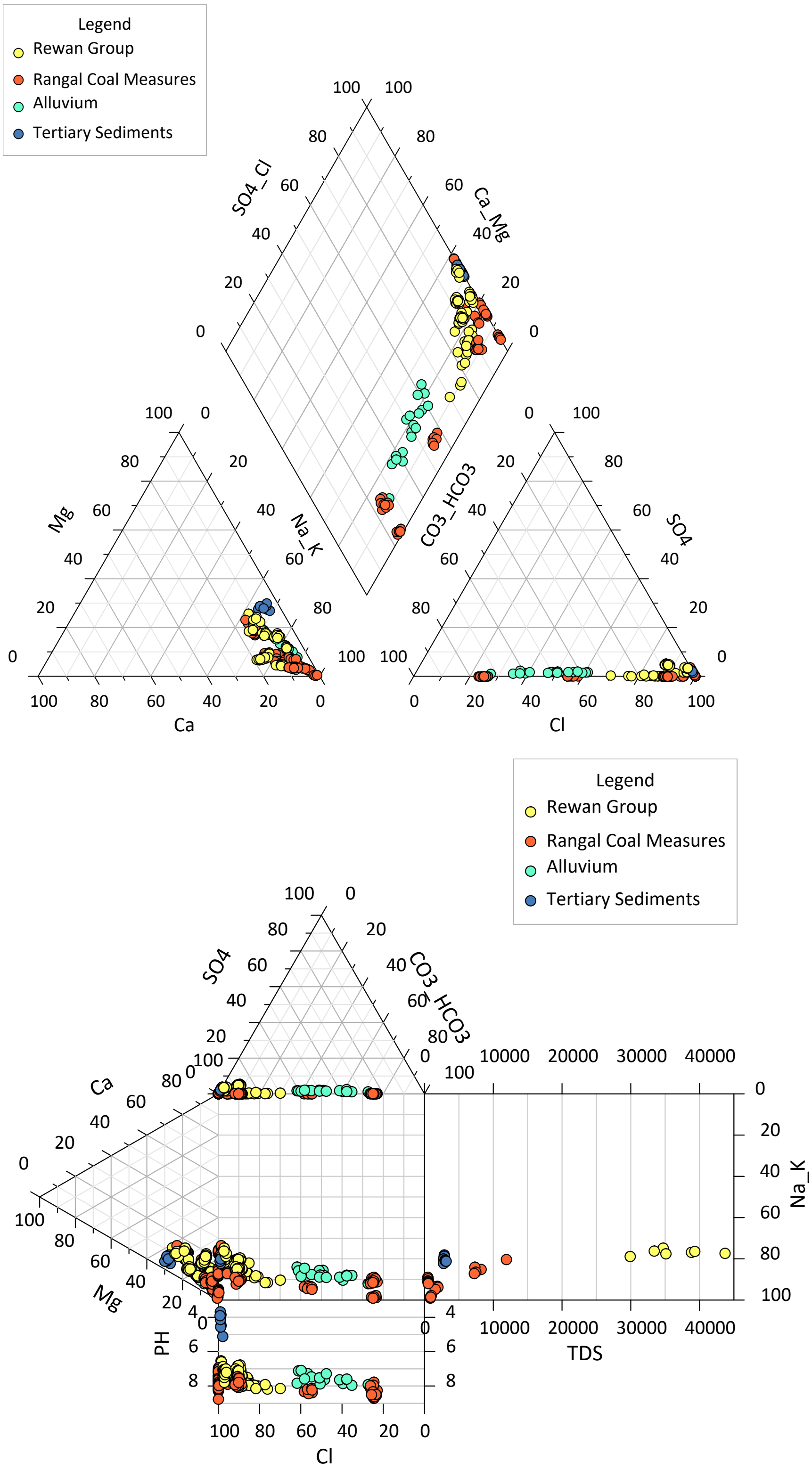

Figure 4.14 **Piper and Durov Plots for Groundwater Samples Collected across the surrounding Project Area from 2006 to 2023**

Figure 4.15, Figure 4.16, and Figure 4.17 present the timeseries plots of pH, EC and sulfate for groundwater sampled from monitoring bores in the Rewan Group across the Project area. Neutral groundwater conditions exist in the Rewan Group bores.

Groundwater from MBBE0007 displayed an EC of 48,600 µS/cm (recorded in February 2022), before declining for the remainder of the reporting period. Sulfate concentrations in MBBE0007 displayed a slight increasing trend, ranging from 876 mg/L to 956 mg/L.

Rewan Group

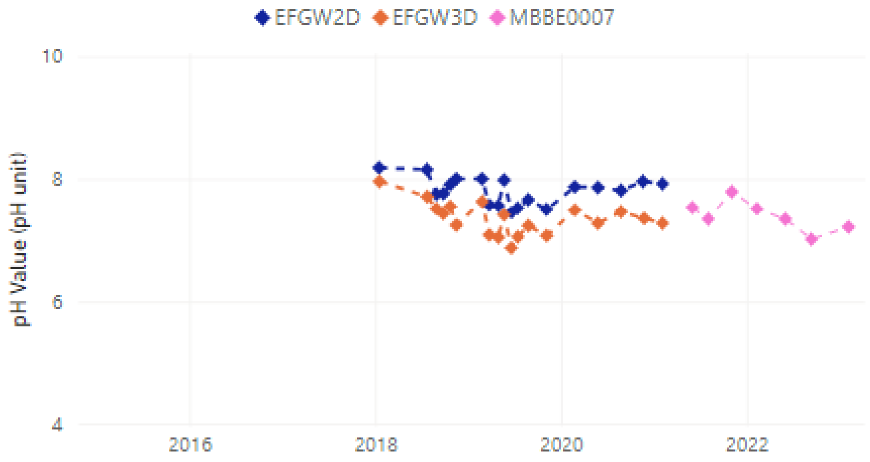

Figure 4.15 Transient pH Groundwater Quality Results for Rewan Group

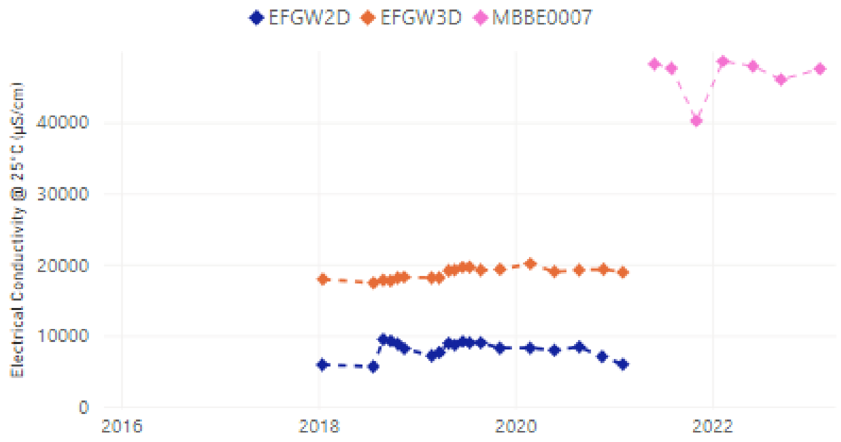

Figure 4.16 Transient EC Groundwater Quality Results for Rewan Group

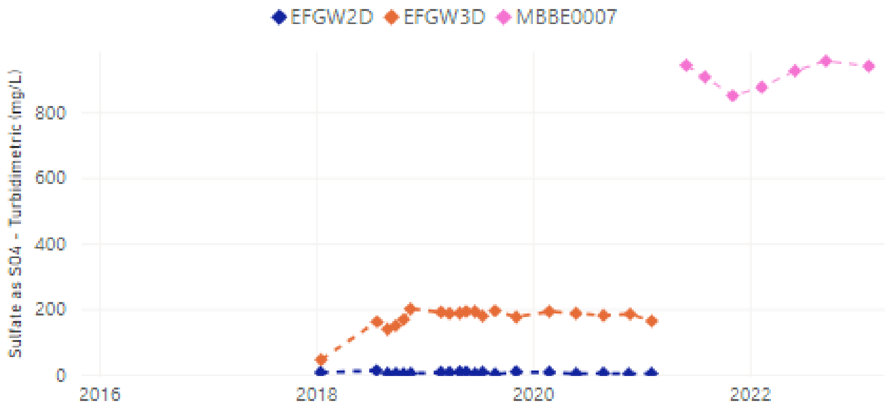

Figure 4.17 Transient Sulfate Groundwater Quality Results for Rewan Group

Rangal Coal Measures

Figure 4.18, Figure 4.19, and Figure 4.20 present the timeseries plots of pH, EC and sulfate for groundwater sampled from monitoring bores in the Rangal Coal Measures across the Project area. Monitoring bores screened within Rangal Coal Measures have neutral to alkaline pH and have stable EC values except for BDW5C which recorded a rise in EC in February 2022 before declining in June 2022. This bore has since been mined out. EC concentrations have remained stable below 1500 µS/cm for currently monitored bores (MBBE0001 and MBBE0008). Sulfate concentrations in the groundwater from Rangal Coal Measures bores remained stable at <1 mg/L.

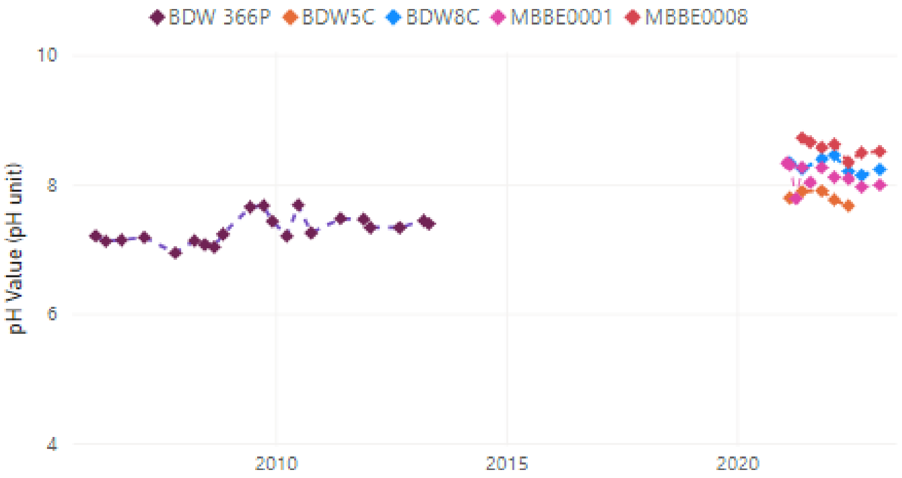

Figure 4.18 Transient pH Groundwater Quality Results for Rangal Coal Measures

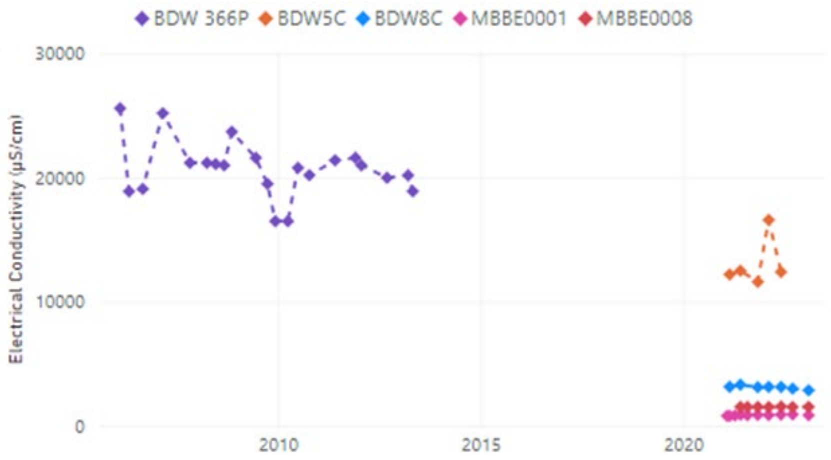

Figure 4.19 Transient EC Groundwater Quality Results for Rangal Coal Measures

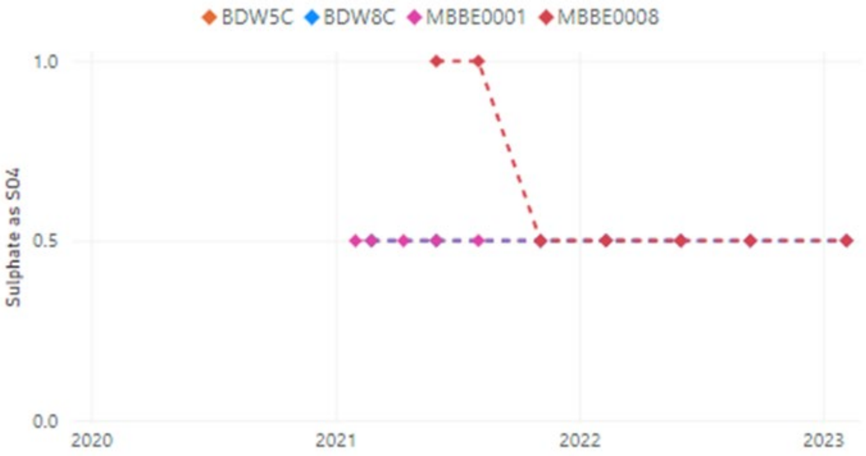

Figure 4.20 Transient Sulfate Groundwater Quality Results for Rangal Coal Measures

Tertiary Sediments

Figure 4.21, Figure 4.22, and Figure 4.23 present the timeseries plots of pH, EC and sulfate for groundwater sampled from monitoring bores in the Tertiary Sediments across the Project area. Bore MBBE0002b recorded declining pH values ranging from 5.12 to 3.69. Bore MBBE0002b showed declining sulfate concentrations for the monitoring period.

Figure 4.21 Transient pH Groundwater Quality Results for Tertiary Sediments

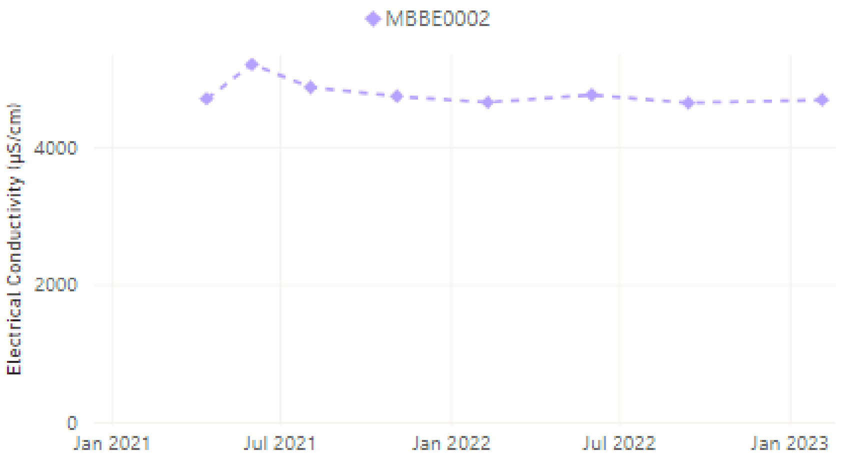

Figure 4.22 Transient EC Groundwater Quality Results for Tertiary Sediments

Figure 4.23 Transient Sulfate Groundwater Quality Results for Tertiary Sediments

4.5 Receptors

4.5.1 Registered Groundwater Users

A total of 43 registered bores are present within the 5 km buffer of the Project. Figure 4.24 presents the location of these registered bores, which comprise:

- 1 bore screened in the Quaternary alluvium;
- 3 bores screened in in the Tertiary sediments;
- 8 bores screened in the Tertiary basalt;
- 3 bores screened in the Rewan Group;
- 15 bores screened in the Rangal Coal Measures;
- 4 bores screened in the Blackwater Group; and
- 9 bores screened in the Fort Cooper Coal Measures.

Of the 43 registered bores two bores are recorded as water supply bores in the Department of Regional Development, Manufacturing and Water (DRDMW) groundwater bore database, with the remainder being mine monitoring bores. RN81908 is inferred to be screened within the Rewan Group, and RN105678 is inferred to be screened within the Tertiary basalt.

Further investigations into the water supply bores (RN81908 and RN105678) have been completed by the proponent, which included site inspections and discussions with the pastoral lease manager. The site inspections did not identify the presence of the bores or any associated infrastructure for groundwater abstraction; and discussion with the pastoral lease manager indicated that there are no water supply bores located within or in the immediate vicinity of ML70257. Therefore, these bores will not be considered as potential third-party groundwater supply bores (i.e. potential groundwater receptors) as part of this assessment.

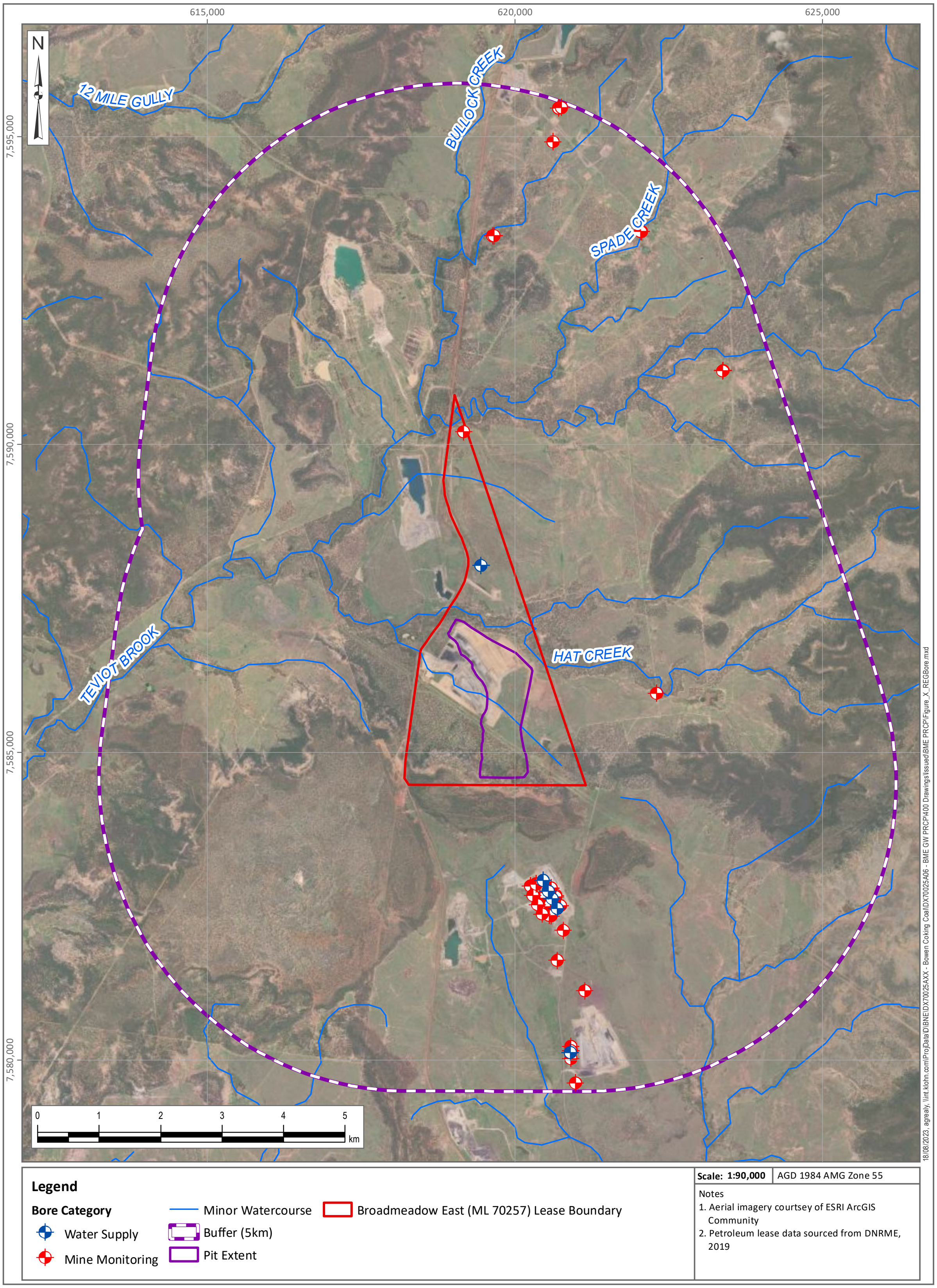

Figure 4.24 Location of Registered Groundwater Bores within 5 km of the Project area

4.5.2 Groundwater and Surface Water Interaction

Public domain information of mapped springs and wetlands (DNRME 2023), indicate that there are no known springs or wetlands located within 5 km of the project area.

4.5.3 Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystem (GDE) mapping provided in Queensland Globe (DNRME 2023) collates information from a number of sources into a central database, including published research and interpreted remote sensing data. These areas mapped in the GDE Atlas represent potential GDEs that access groundwater to meet all or some of its water requirements. This includes terrestrial vegetation, subsurface fauna communities and some vegetation which is associated with a surface water body.

Figure 4.25 presents the mapped GDE areas in the vicinity of the Project that have potential for GDEs to be present.

Based on the GDE database and mapping, Moderate Potential Aquatic GDEs as well as Moderate Potential Terrestrial GDEs are associated with the alluvium adjacent to Hat Creek and “low” potential GDE vegetation located in the southwest corner of the Project area.

Field verification surveys, completed as part of the Baseline Ecological Assessment for the EAR (Nitro Solutions 2020), confirmed the presence of several vegetation communities located within these mapped GDE areas. Areas of moderate GDE potential consisted entirely of RE 11.3.25 which was dominated by *Eucalyptus tereticornis* (Blue Gum). The communities associated with this vegetation species are restricted to the riparian corridors along Hat and Spade Creeks. The remaining areas mapped as having potential to contain terrestrial GDEs (TGDEs) have been field verified and determined to be unlikely to support TGDEs. The field verification process also determined the presence of Aquatic GDEs to be unlikely along Hat Creek. Further details on the field verification process is provided in the Baseline Ecological Assessment report (Nitro Solutions 2020).

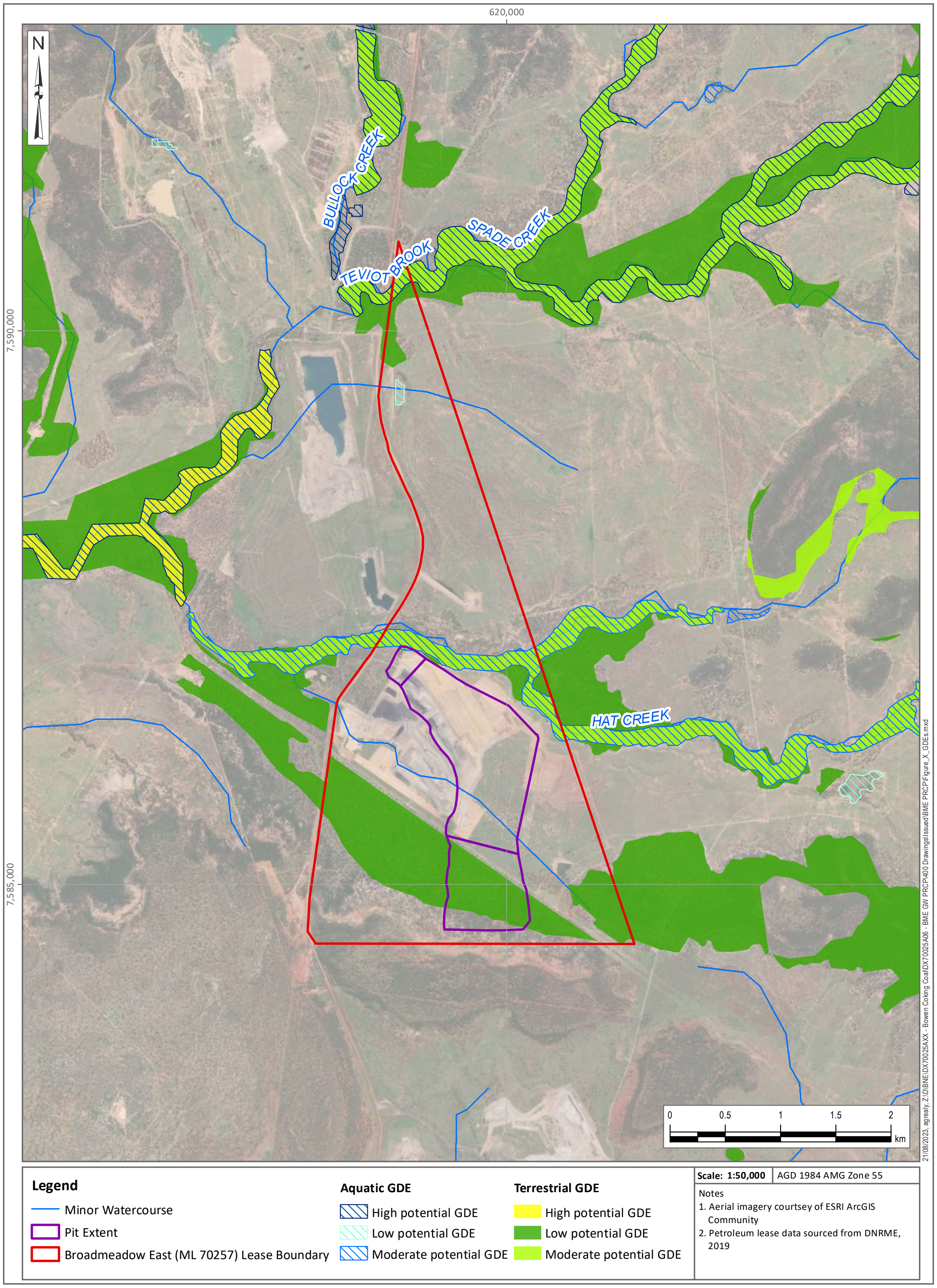

Figure 4.25 Desktop Review of Potential Terrestrial and Aquatic GDEs (from NitroSolutions)

5 NUMERICAL GROUNDWATER MODEL

A numerical groundwater flow model developed for the groundwater assessment that supported the BME regulatory approval process was used to support the development of the BME PRCP, by predicting changes in groundwater levels and flow during operations and into closure. The objectives of the model include:

- Estimating groundwater inflow / outflow in the final void; and
- Predicting the extent and area of influence of groundwater level drawdown associated with the final void.

The 3D numerical groundwater flow model was developed using the MODFLOW-USG platform to represent the conceptual hydrogeological model described in Section 4. A detailed description of the modelling methodology is provided in Appendix IV.

The numerical model represents the key hydrostratigraphic units with six layers. The area of the model extent is approximately 280 km^2. The model boundaries are defined by topography and hence coincides locally with groundwater divide conditions; which represents the northeast, northwest and southeast boundaries. The southwestern boundary of the model domain is located at a distance from the Project area.

The physical structure of the groundwater model was based on the detailed geological model provided by Zenith and RPM Global (formerly NitroSolutions), and datasets sourced from the public domain. Model development was supplemented by published geological maps, digital geological surfaces, DRDMW groundwater database, and information from surrounding mining operations and published approval documents.

5.1 Calibration

The Australian Groundwater Modelling Guidelines (Barnett et al. 2012a) were used to guide the calibration process. A detailed description of the model calibration is provided in Appendix IV.

The calibration model run was initiated as a steady-state simulation with boundary conditions applied to replicate known mining developments before March 2019. After this initial model conditioning period, the model then progresses to transient mode, during which quarterly stress periods are then implemented.

Model calibration was conducted based on groundwater level measurements. These measurements were compiled from 18 monitoring bores for which reliable water level measurements were available. Monitoring bores BDW172(54), BDW172(32), BDW5C, and BDW8C have been decommissioned due to the progression of the open pits, however, monitoring records from these decommissioned bores have been used as part of the calibration process. In total, 192 individual measurements were used in the calibration process. A number of monitoring bores installed across the Project area in the shallow hydrostratigraphic units (e.g. Quaternary alluvium, Tertiary sediments, Tertiary basalt) are dry, indicating unsaturated conditions, and resulting in no groundwater level records. Despite the lack of groundwater level records from the upper hydrostratigraphic units, this unsaturated characteristic also provided a calibration criteria for the model.

The calibrated groundwater model was used to predict groundwater inflows, changes in groundwater levels and the associated groundwater level drawdown extent in response to the remaining mining operations and post-closure conditions.

5.2 Predictive Modelling of Groundwater Flow

The simulation of post-closure groundwater conditions was undertaken to assess the final Northern Pit and Southern Void water elevation within the proposed post-closure landform. Final pit void lake elevations were simulated by Engeny using a water balance model, as part of the surface water assessment. This water balance incorporated all contributing fluxes to the pit voids, including the groundwater inflow. The post-closure groundwater inflow flux was simulated for a range of pit void lake elevations, from the maximum inflow rate when groundwater levels are at the base of the pit to the pre-mining groundwater level elevation where no groundwater inflow is observed. These fluxes were provided to Engeny as inputs for the surface water modelling.

Post-closure steady-state elevations of the pit voids associated with the final landform were calculated by Engeny from the water balance model. These steady-state elevations in the voids were applied to the groundwater model, using a General Head Boundary (GHBs) to simulate the post-closure groundwater conditions. Recharge and evaporation were not applied to the void, as this was captured in the Engeny water balance model. This simulation was conducted for a 500-year duration, using climate data provided by Engeny, to allow surrounding groundwater levels to recover to post-closure equilibrium / steady-state conditions.

The predicted post-closure water levels for the Rangal Coal Measures are provided in Figure 5.1 to Figure 5.4 for 10-, 50-, 100- and 500-years post-closure. The results show that the void is predicted to develop as a groundwater sink, with groundwater flowing towards the void. Water levels at the Central and North Pits recover slower than in the south, probably due to influence from nearby mining activity to the west of the Project Area.

A summary of the potential impacts to the groundwater resource associated with the post-closure landform and recovered groundwater levels is provided in Section 6.

Figure 5.1 to Figure 5.9 illustrates the maximum drawdown elevation in the different geological layers with representative monitoring bores in each layer.

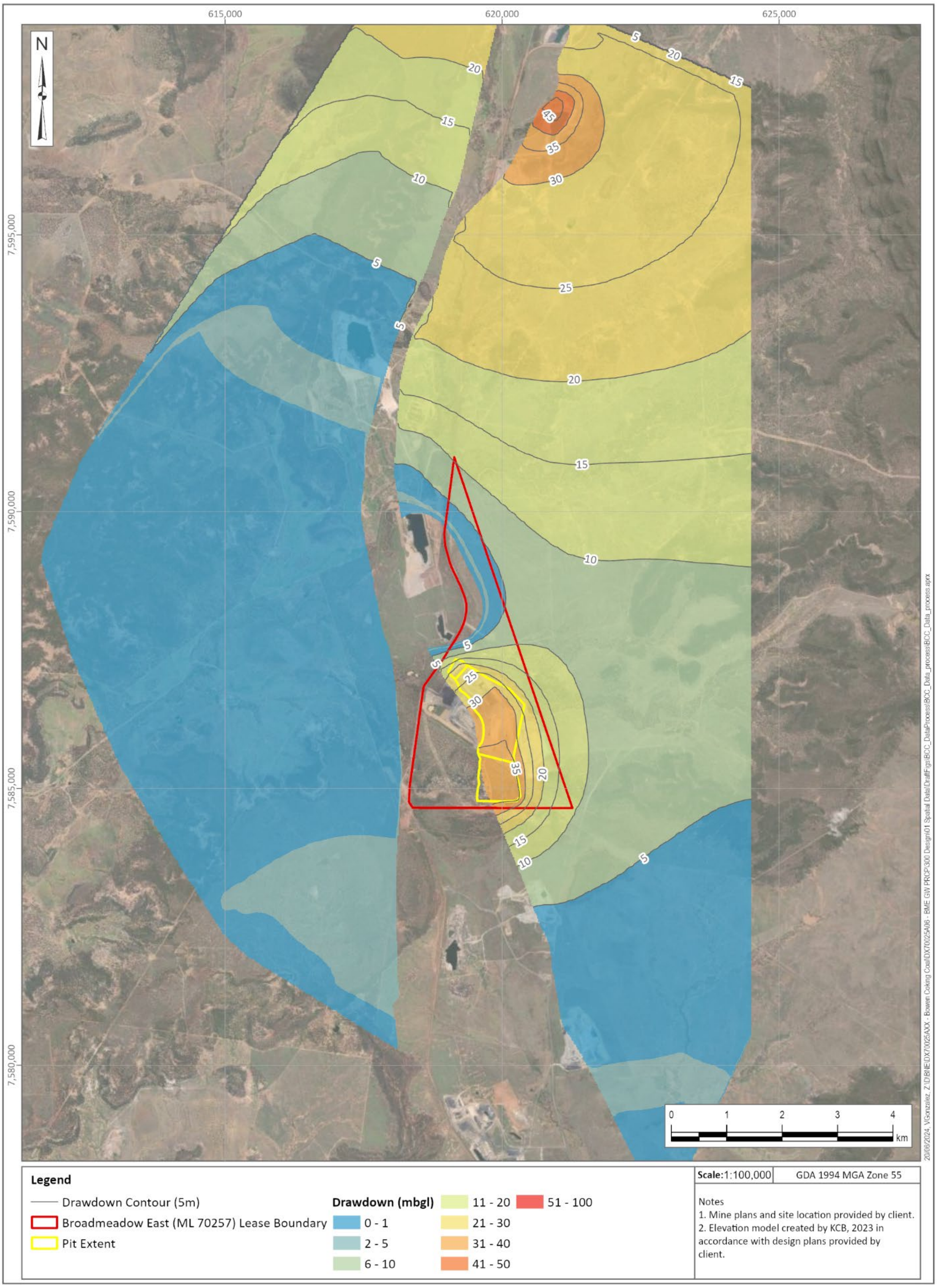

Figure 5.1 **Post-Closure Drawdown and Elevation for Rangal Coal Measures – 10 Years Post-Closure**

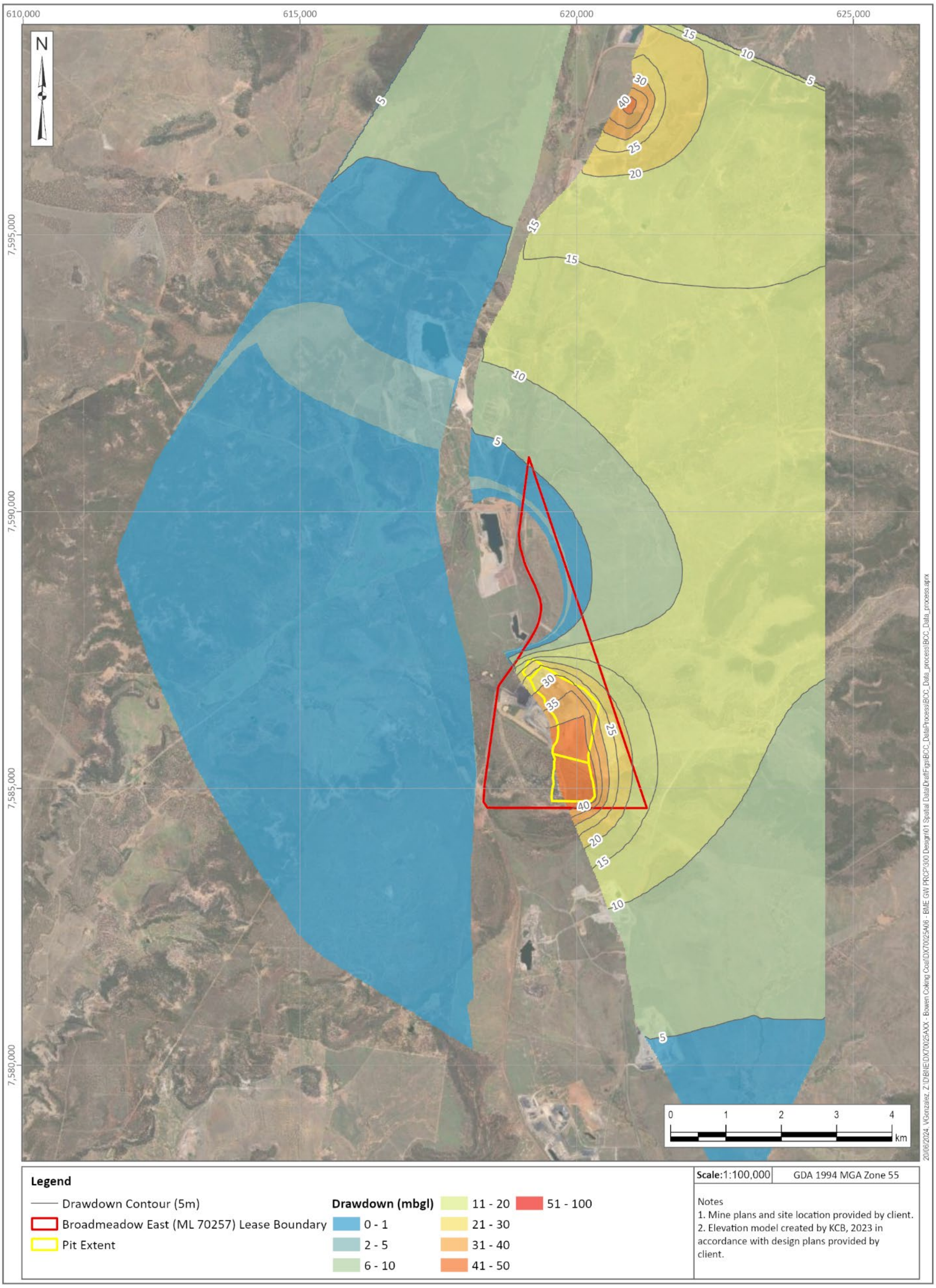

Figure 5.2 Post-Closure Drawdown and Elevation for Rangal Coal Measures – 50 Years Post-Closure

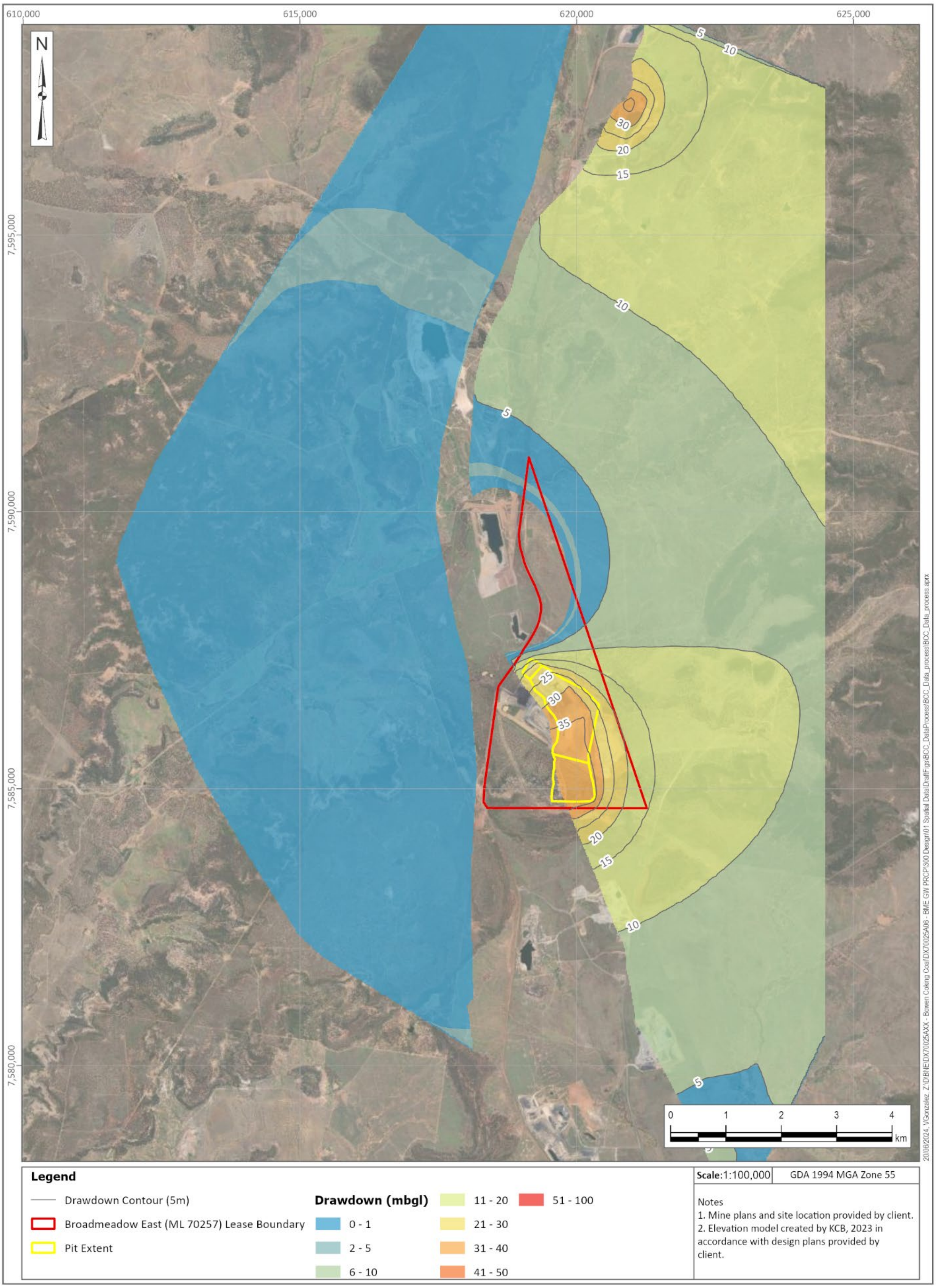

Figure 5.3 Post-Closure Drawdown and Elevation for Rangal Coal Measures – 100 Years Post-Closure

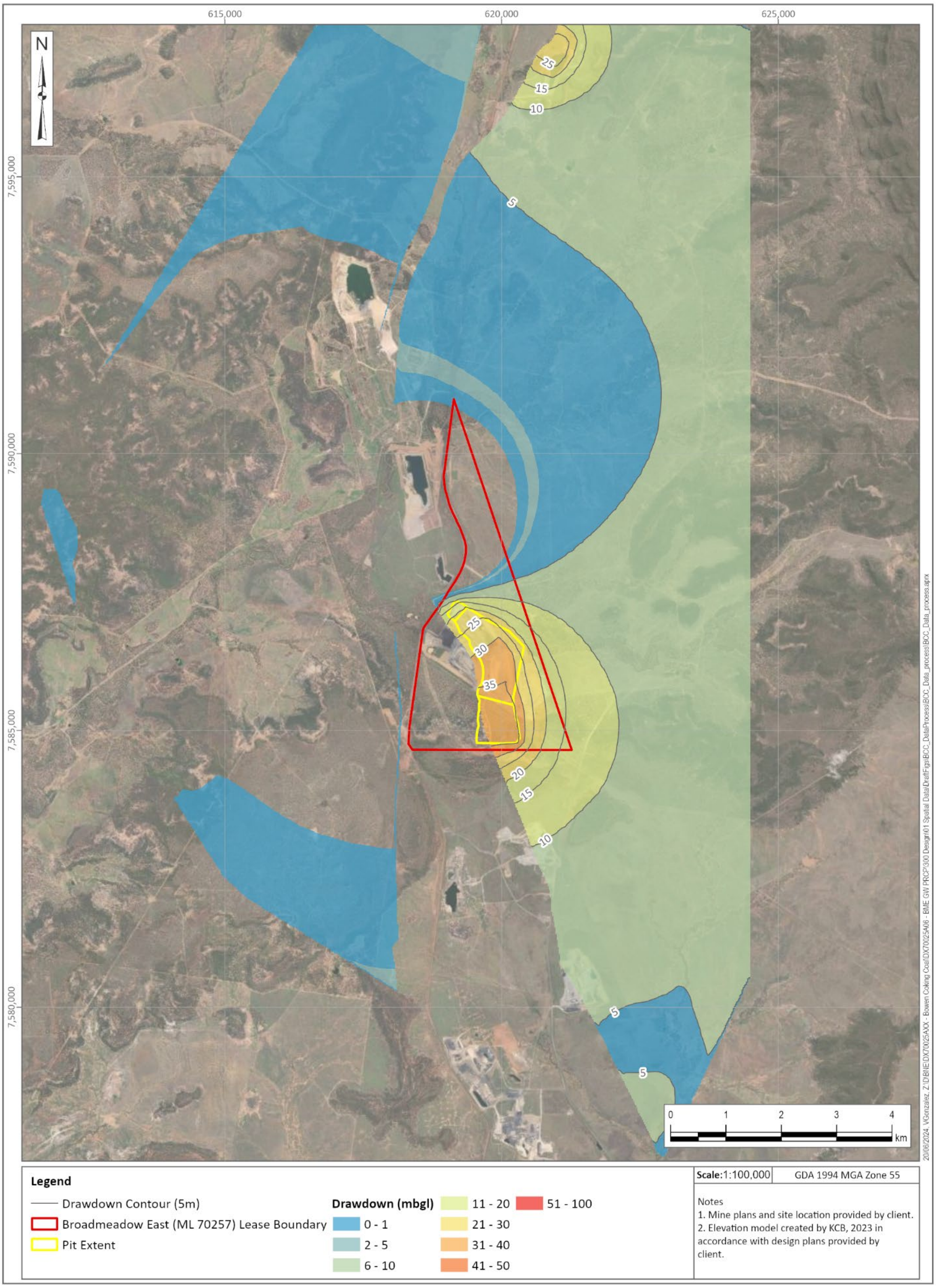

Figure 5.4 Post-Closure Drawdown and Elevation for Rangal Coal Measures – 500 Years Post-Closure

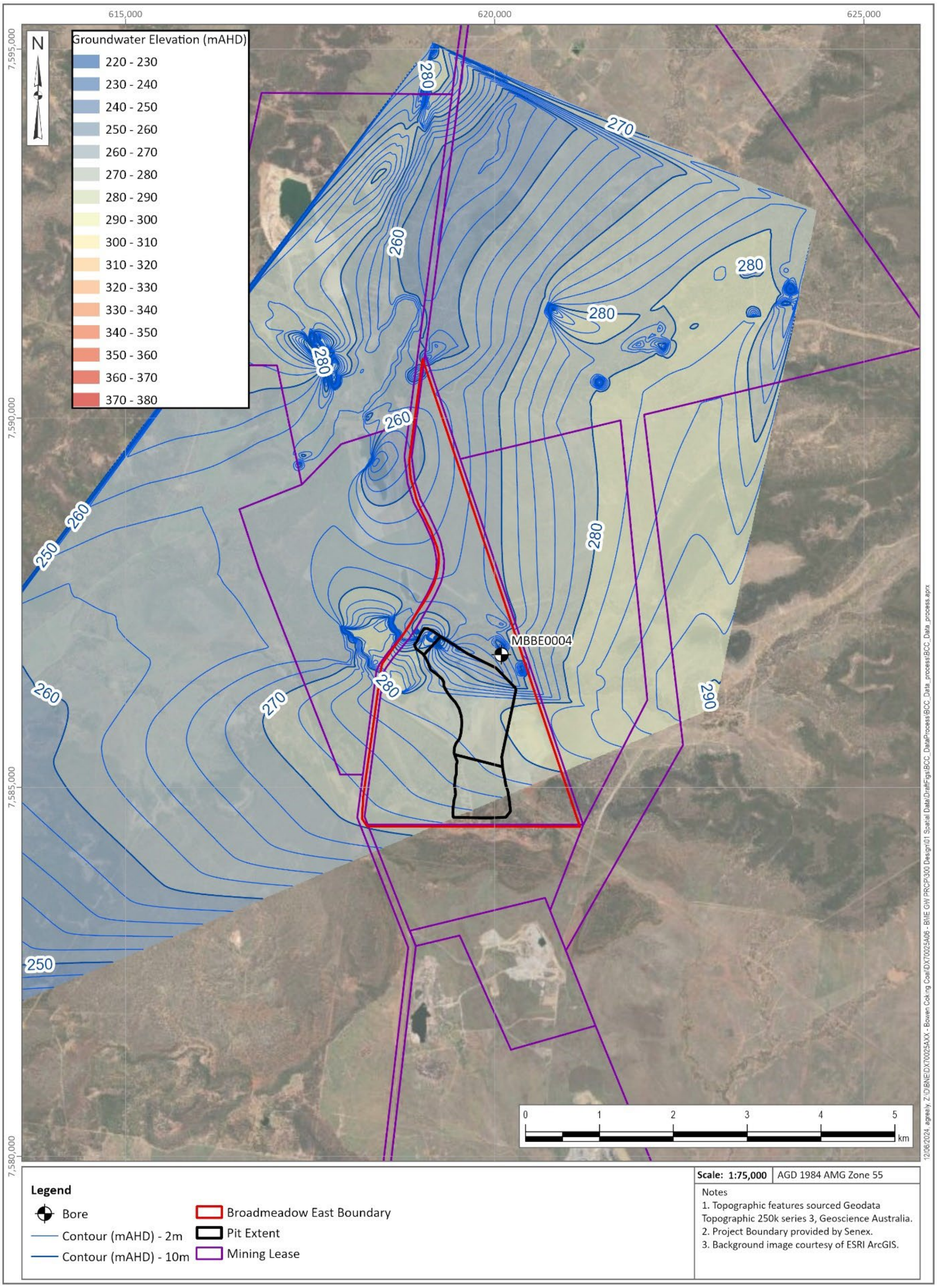

Figure 5.5 Predicted Maximum Groundwater Drawdown Elevation – Layer 1 (Alluvium)

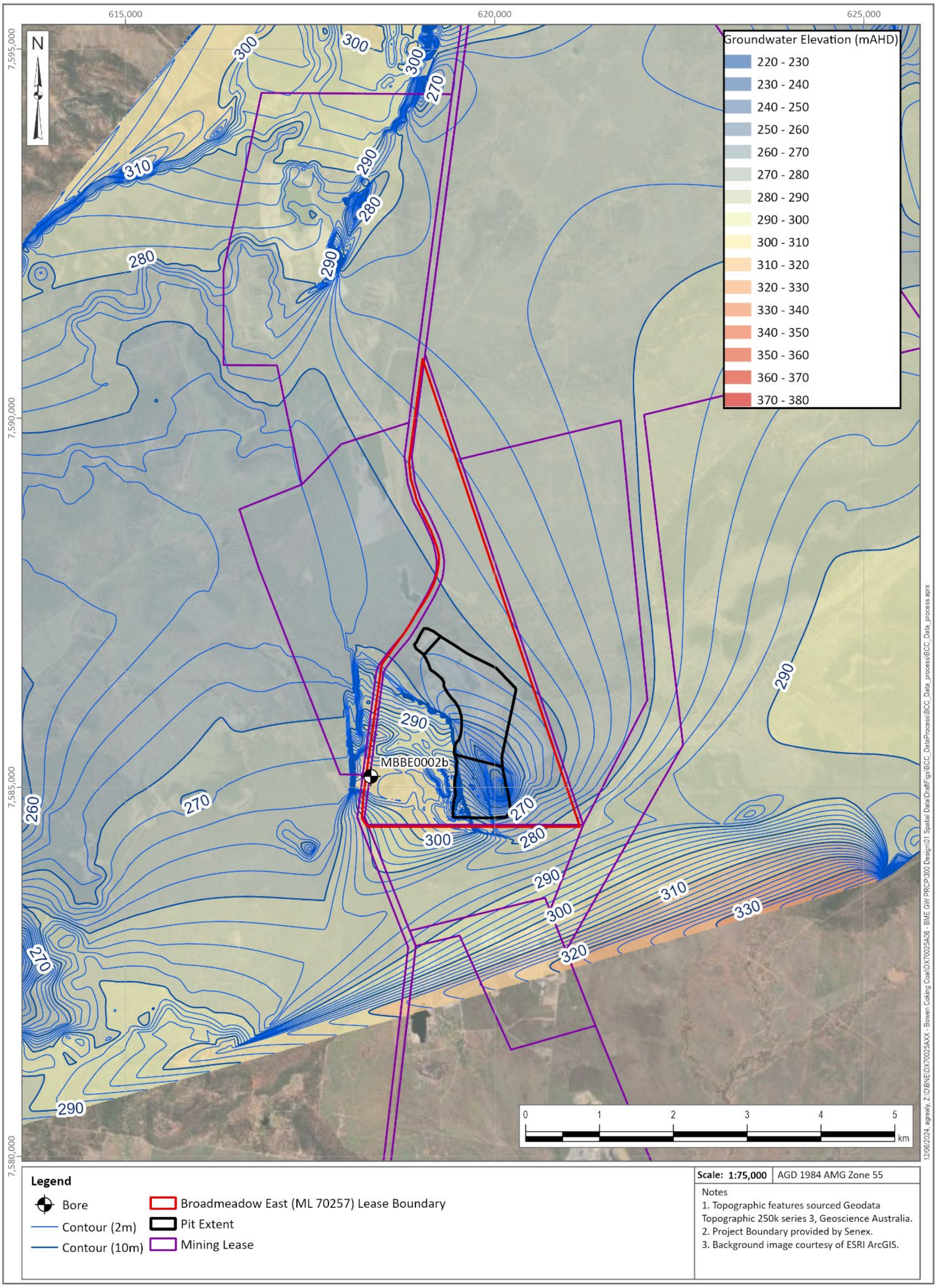

Figure 5.6 **Predicted Maximum Groundwater Drawdown Elevation – Layer 2 (Tertiary Sediments)**

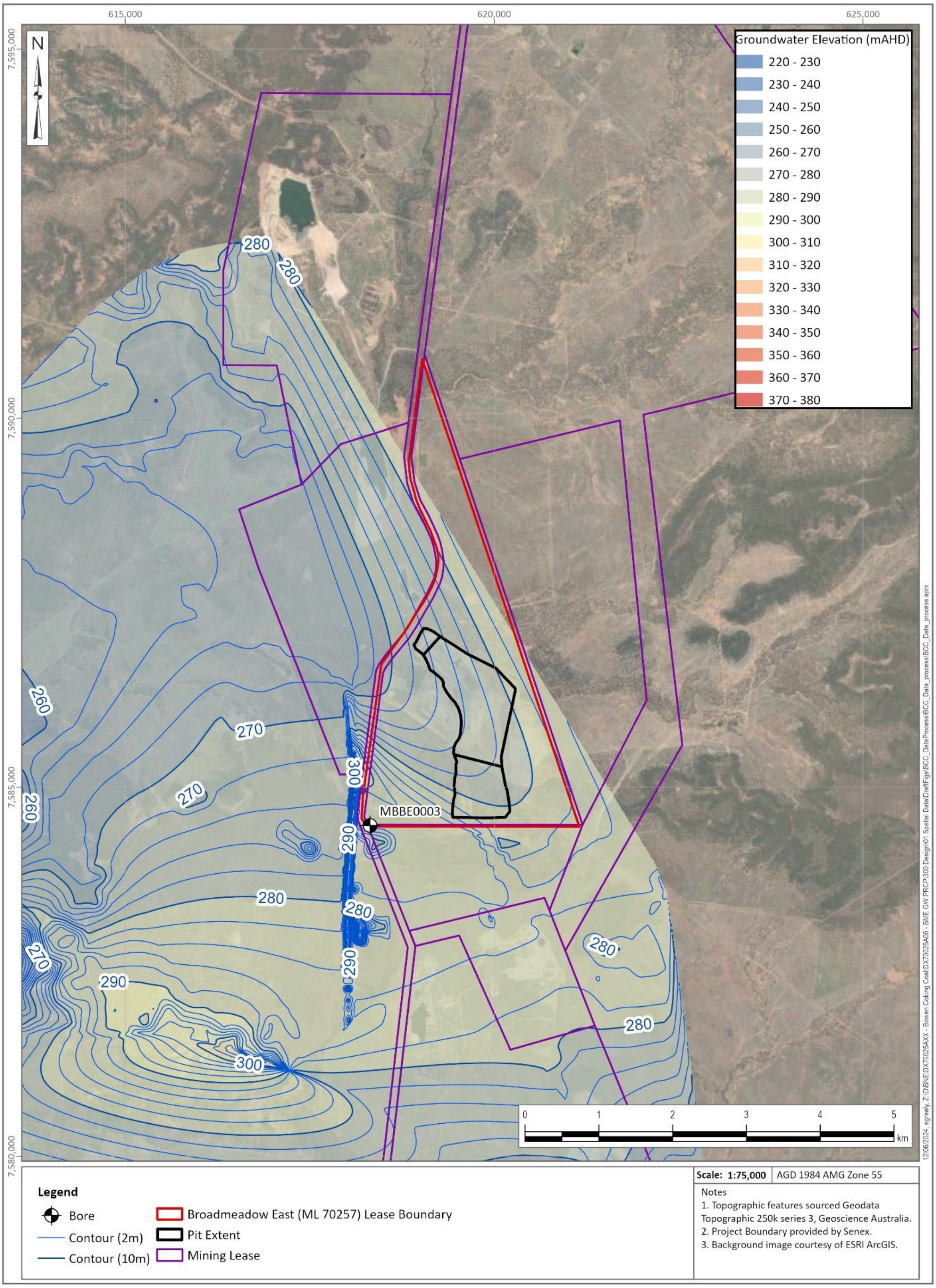

Figure 5.7 Predicted Maximum Groundwater Drawdown Elevation – Layer 3 (Tertiary Basalt)

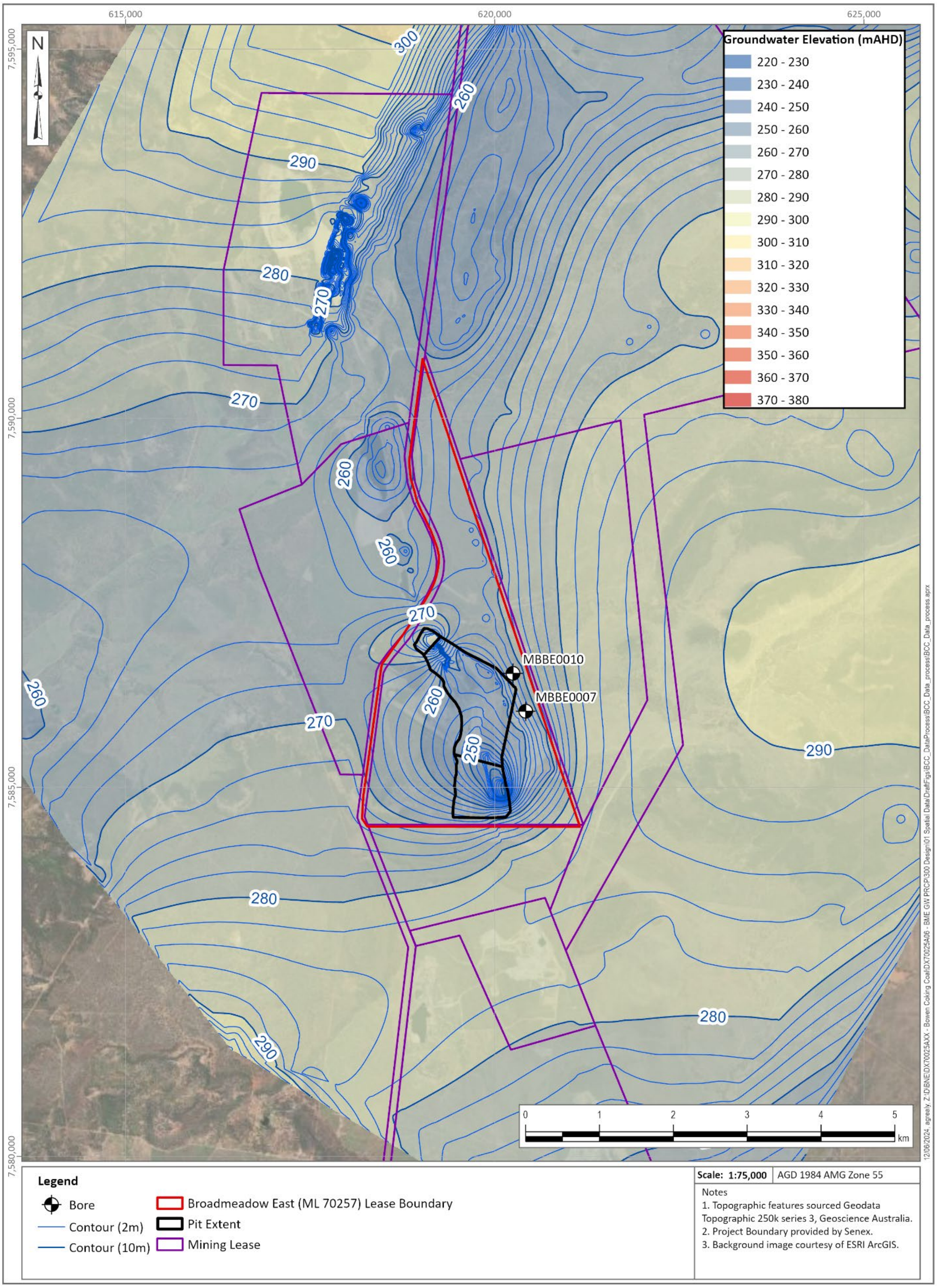

Figure 5.8 Predicted Maximum Groundwater Drawdown Elevation – Layer 4 (Rewan Group)

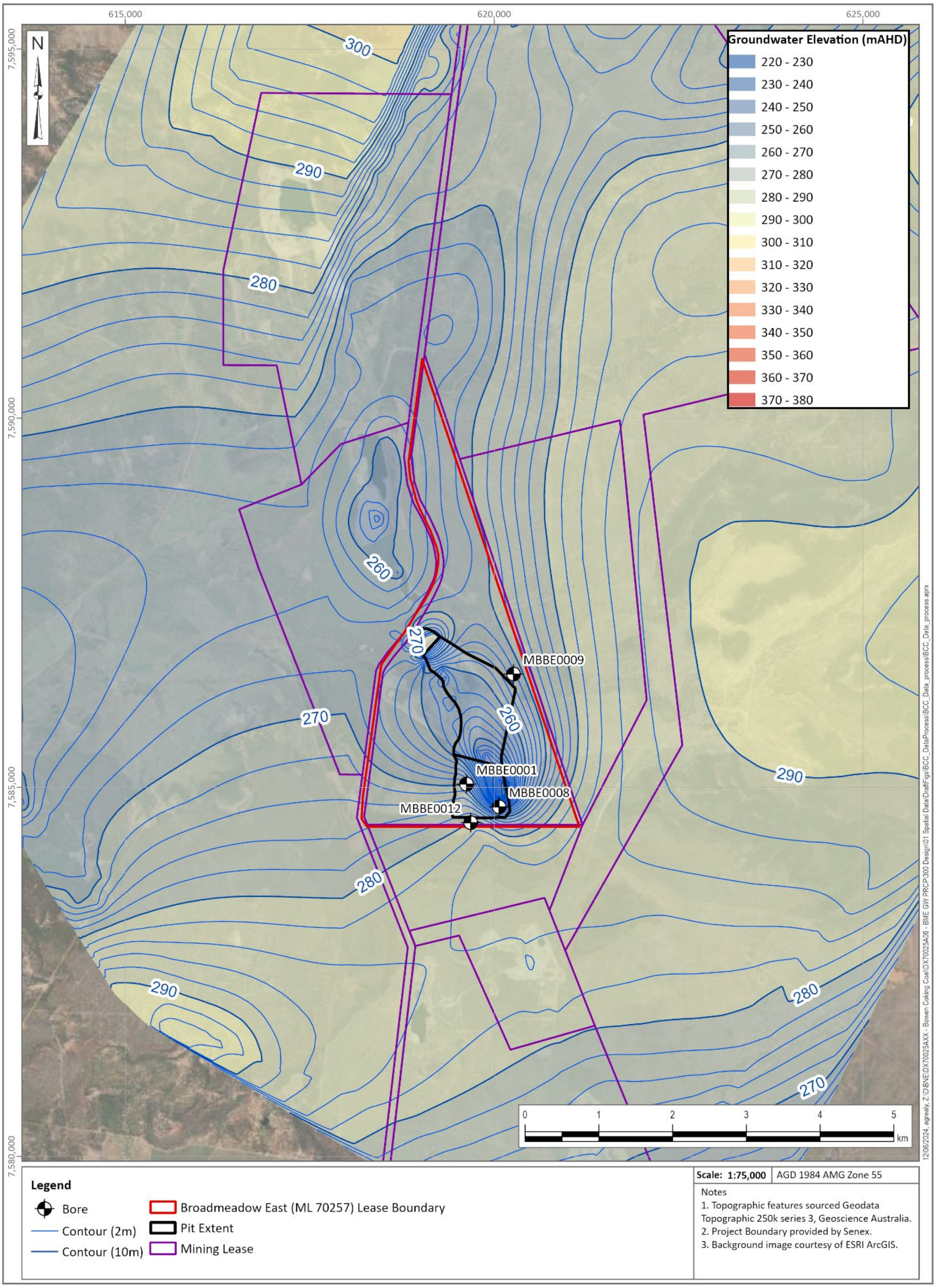

Figure 5.9 **Predicted Maximum Groundwater Drawdown Elevation – Layer 5 (Rangal Coal Measures)**

5.3 Climate Change Scenario

The post-closure simulation was undertaken using climate predictions from the CSIRO/BOM "*Climate Change in Australia. Climate Information, Projections, Tools and Data*" for the Australia East Coast Cluster and subcluster. These climate predictions represent the "high level projections" for rainfall and evapotranspiration from the CSIRO/BOM study and allows the assessment of potential impacts to groundwater resources as a result of climate change.

A total net reduction in rainfall of 5% was incorporated in the rainfall recharge calculations and applied to the BME model. The 5% reduction in the annual rainfall takes into account the 2% reduction in annual rainfall predictions and the increase in evapotranspiration.

Results from the model prediction with current predicted climate change show very little to no impact on groundwater levels (Figure 5.10) at compliance monitoring bore MBBE0007.

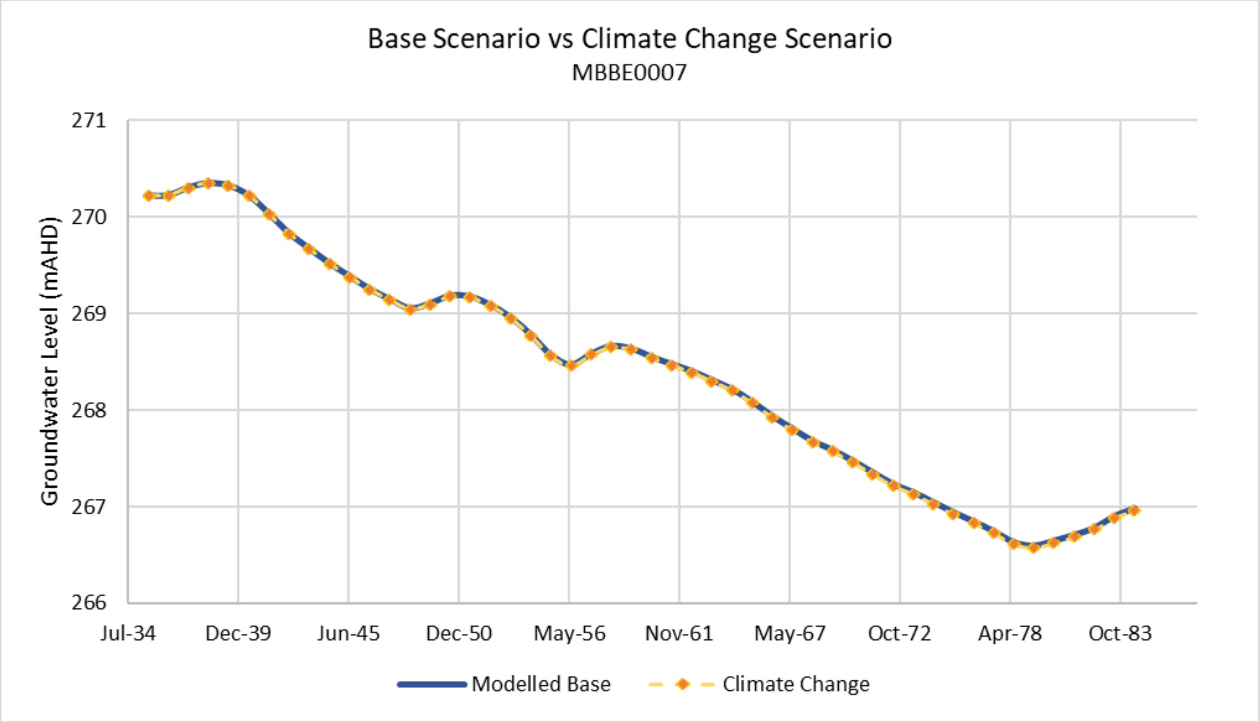

Figure 5.10 Comparison of Climate Change Scenario vs Base Scenario

6 IMPACT ASSESSMENT

6.1 Post-Closure Groundwater Levels

The post-closure groundwater levels for the Rangal Coal Measures are provided in Figure 5.1 to Figure 5.4 respectively. The results show that the void is predicted to develop as a groundwater sink, with groundwater flowing towards the void.

The Southern Void is predicted to act as a groundwater sink, with localised groundwater flow from the south and southwest towards the final void.

Two formations indicate changes in groundwater levels as a result of the mining activities in the Project area; the Rewan Group and the Rangal Coal Measures.

Along the Hat Creek some Moderate Potential Aquatic GDEs as well as Moderate Potential Terrestrial GDEs are associated with the alluvium. However, no drawdown of groundwater levels is expected for the alluvium, and therefore no impact is expected on the GDEs.

Given the ephemeral nature of the alluvium and the lack of hydraulic connection with the underlying formations, no impact on groundwater receptors associated with the alluvium is predicted.

6.2 Post-Closure Groundwater Quality

Changes in local groundwater quality associated with the post-closure landform may potentially occur if former voids behave as a 'source[4]' rather than a 'sink'[5].

The South Void is predicted to result in a groundwater sink following the recovery of groundwater levels to post-closure equilibrium conditions. Therefore, outflow from the void to the surrounding groundwater system is not predicted. As a result, the water quality of the void water, is not predicted to impact the surrounding environment and associated environmental values. BME has a number of groundwater trigger values in place for key analytes including pH, sulfate, chloride and dissolved metals, designed to detect potential changes in groundwater quality and indicating potential impact. These trigger levels remain relevant into the closure period.

6.3 Potential Impacts to Environmental Values

Groundwater hosted in the hydrostratigraphic units underlying the BME Project area is generally of a poor quality with low yields and high salinity. There are limited beneficial uses for the groundwater, which is supported by the limited number of water supply bores in the vicinity of the BME. Some bores have been identified as potential water supply bores and are located ~1.7 km south of BME, with one water supply bore in the northern portion of the mining lease. TGDE mapping across the Project area identified potential TGDEs located along Hat Creek (Section 4.5). The potential TGDEs are generally associated with the alluvium aquifers.

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[4] Voids become sources when water levels rise to above pre-mining groundwater levels.

[5] Voids are referred to as sinks when the surrounding groundwater system flows into them.

There is no predicted change to groundwater quality in the alluvium of Hat Creek and no predicted change to the groundwater levels during the closure period. Therefore, no discernible impacts to the potential TGDEs are predicted.

The potential impact to environmental values (refer to Table 2.1) from the BME post-closure landform is considered to be low to negligible.

7 CLOSING

We would like to thank you for the opportunity to work on this assignment. Should you have any questions, please do not hesitate to contact the undersigned.

KCB AUSTRALIA PTY LTD.

Carly Waterhouse
Senior Hydrogeologist, Project Manager

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APPENDIX I

Monitoring Program

Appendix I – BME Monitoring Bore Details

Table I-1 Groundwater Monitoring Bores at BME

Bore ID	Location (GDA 20 Zone 55)		Screened unit	Pre-mining baseline standing water levels (mbTOC)[6]	Groundwater trigger elevation (mAHD)[4]	Frequency
	Easting (m)	Northing (m)				
Monitoring Bores						
MBBE0008	620294	7585092	Rangal Coal Measures	18.64	282.62	Quarterly measurements of SWL[5] Quarterly EC and pH Six-monthly for remaining analytes
BDW172(54)[1]	619376	7586650	Rangal Coal Measures	19.83	234.52	
BDW8C[3]	619782	7585651	Rangal Coal Measures	21.54	217.61	
BDW5C[1]	619687	7586758	Rangal Coal Measures	15.74	271.4	
BDW172(32) [3]	619376	7586650	Rewan Group	13.32	269.03	
MBBE0002b[2]	618436	7585329	Tertiary Sediments	12.57	331.86	
MBBE0003[2]	618431	7584664	Basalt	-	-	
MBBE0004[2]	620205	7586976	Alluvium	-	-	
MBBE0006[3, 2]	619173	7587205	Alluvium	-	-	
Compliance Bores						
MBBE0001 [1,3]	619884	7585428	Rangal Coal Measures	17.11	241	Quarterly measurements of SWL Quarterly EC and pH Six-monthly for remaining analytes
MBBE0007	620615	7586415	Rewan Group	18.22	273	

1. To be monitored until mined out.
2. Some bores are often dry and unavailable for water levels.
3. To be replaced in Q3/4 2023 due to location of bore in proposed pit footprint.
4. Groundwater trigger elevations are conversion of drawdown trigger levels to metres above Australian Height Datum (mAHD).
5. Quarterly or more frequently following the grant of EA0002465.
6. mbTOC – metres below top of casing.

Table I-2 Groundwater quality limits*

Monitoring Point	**Parameter**	**pH**	**EC**	**Sulfate (SO4)**	**Arsenic**	**Aluminium**	**Molybdenum**	**Selenium**	**Major ions**
	Sample	Range	Max	Max	Max	Max	Max	Max	Interpretation only
	Unit	pH units	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	
MBBE0001		6.5-8.5	888.3	0.5	0.002	0.08	0.001	0.005	
MBBE0007			48,540	937.6	0.005	0.37	0.025	0.046	

**Table D2 in EA0002465*

NOTE:

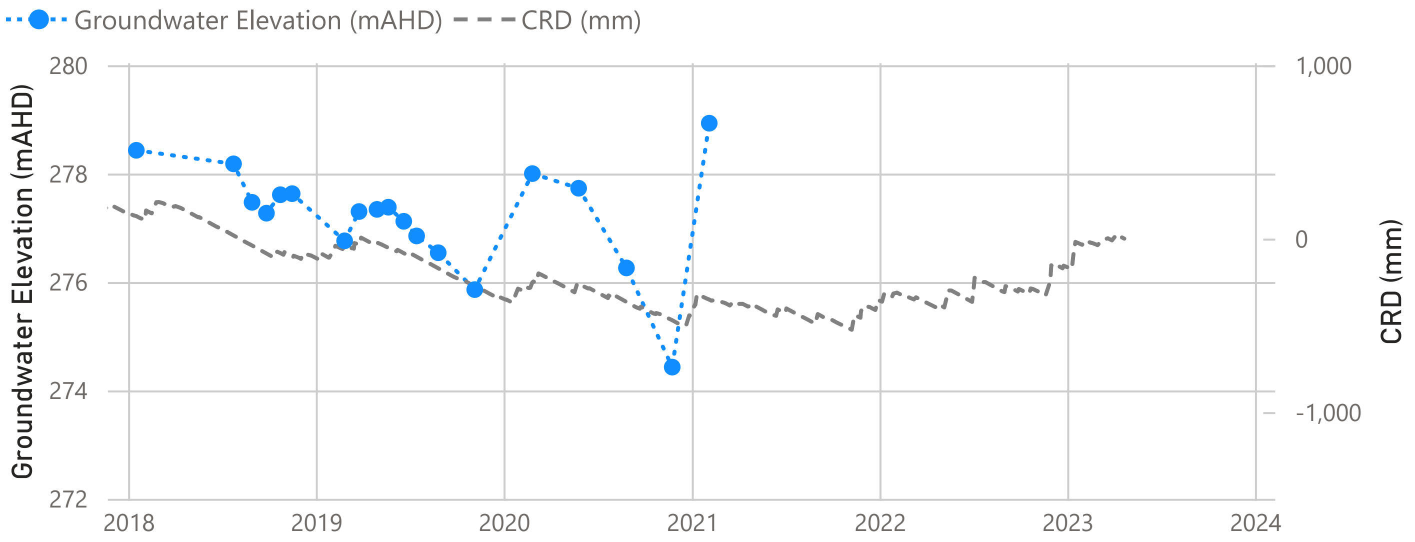
All metals must be measured as total (unfiltered) and dissolved (filtered). Trigger levels for metal apply if dissolved results exceed trigger.
Triggers are based on 95th percentile results from all groundwater quality analyses from each monitoring bore.

APPENDIX II

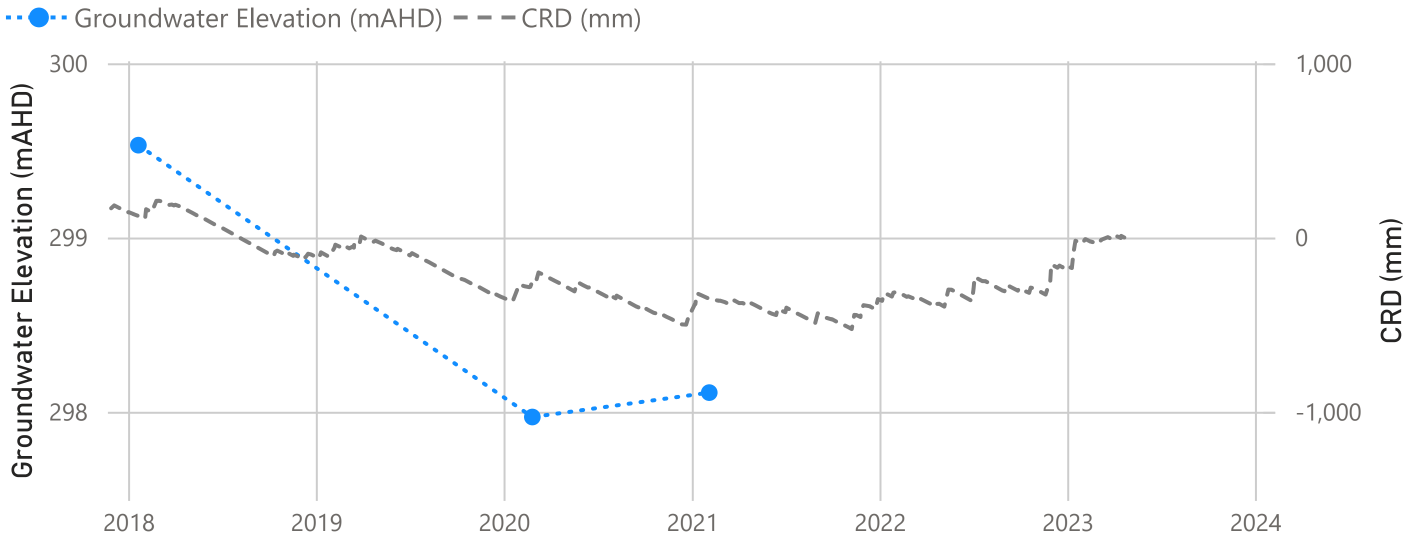
Groundwater Elevation Hydrographs

Alluvium

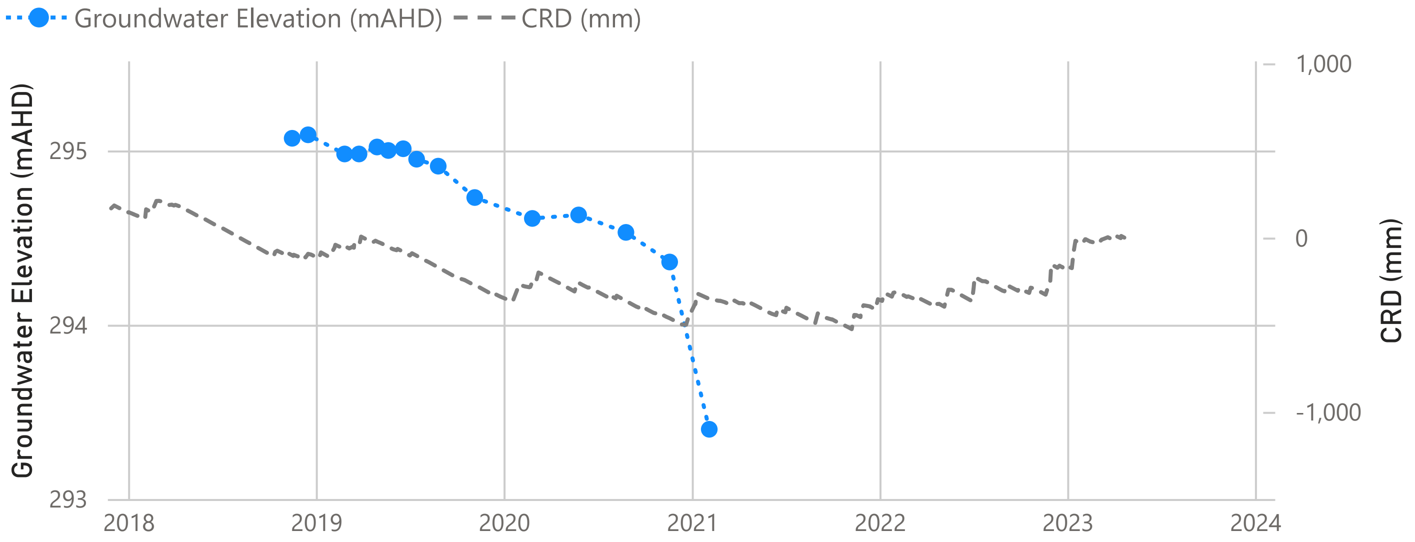
EFGW1S



EFGW4S

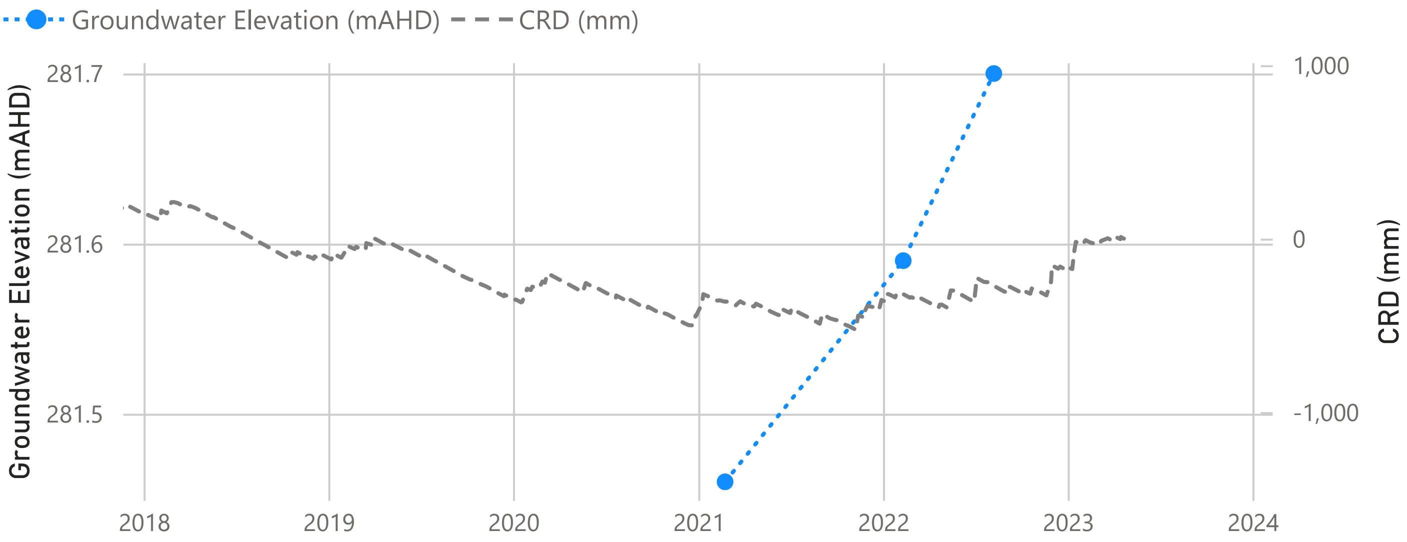


IBGWR2



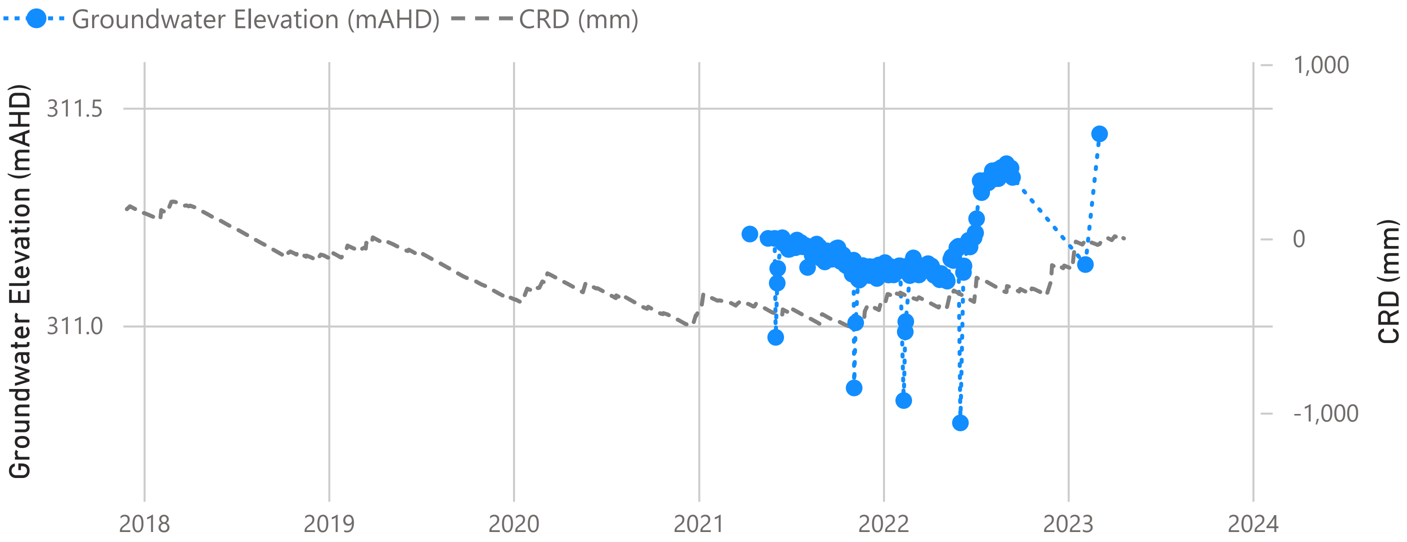
Alluvium

MBBE0006



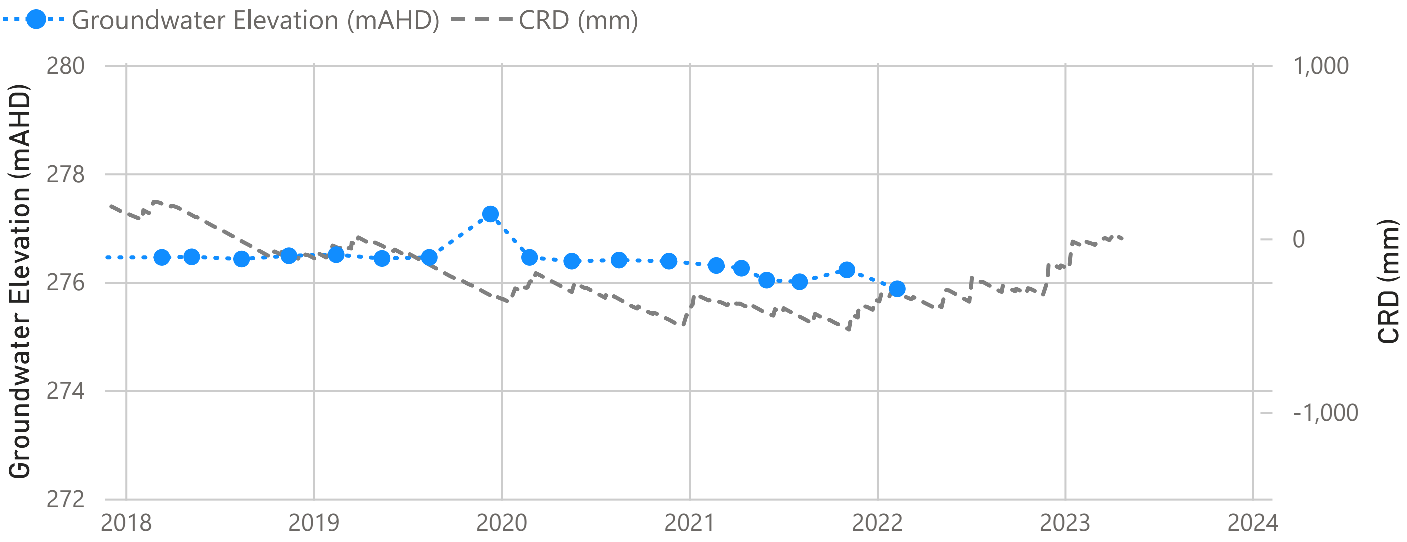
Tertiary Sediments

MBBE0002b

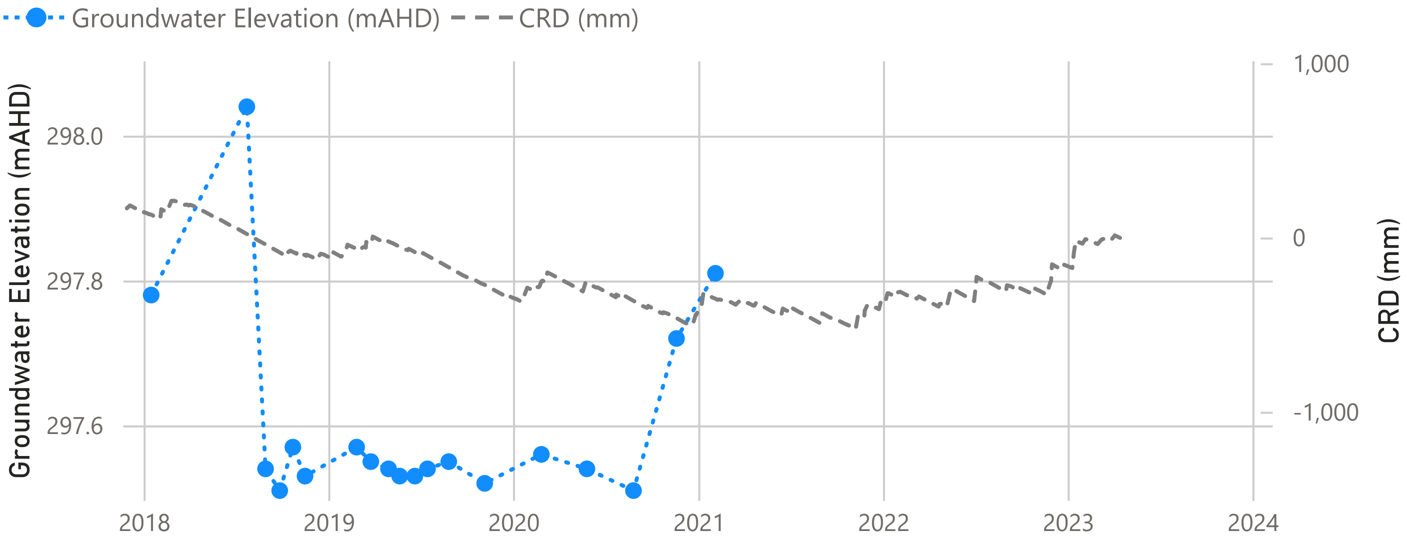


Rewan Group

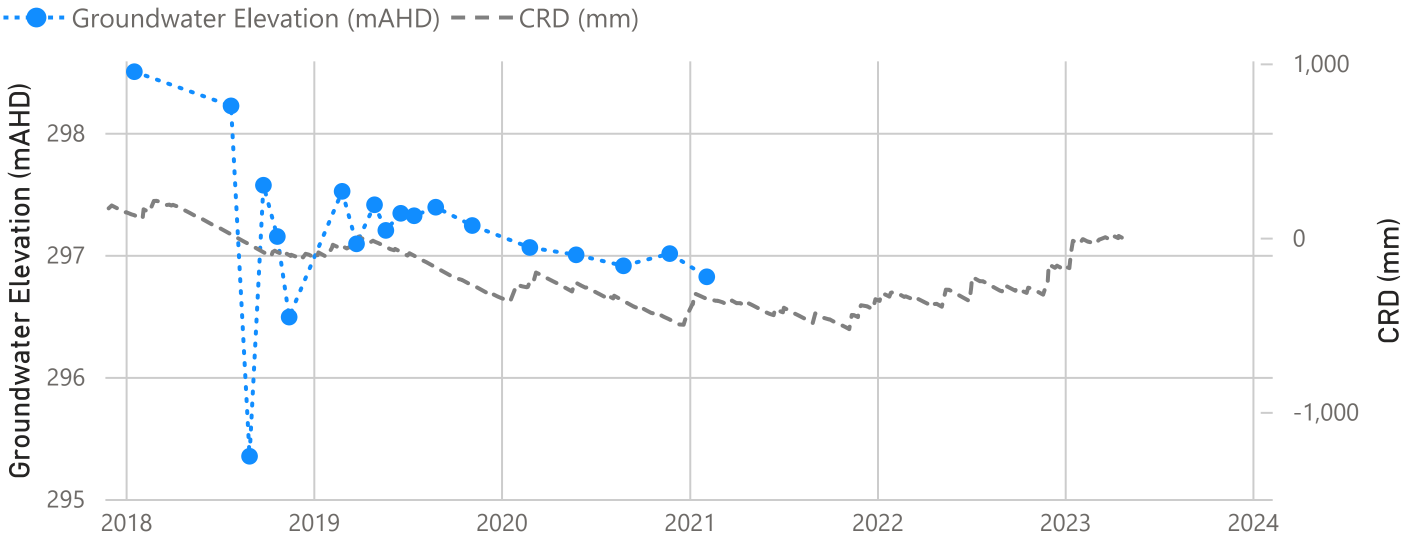
BDW172_(32)



EFGW2D

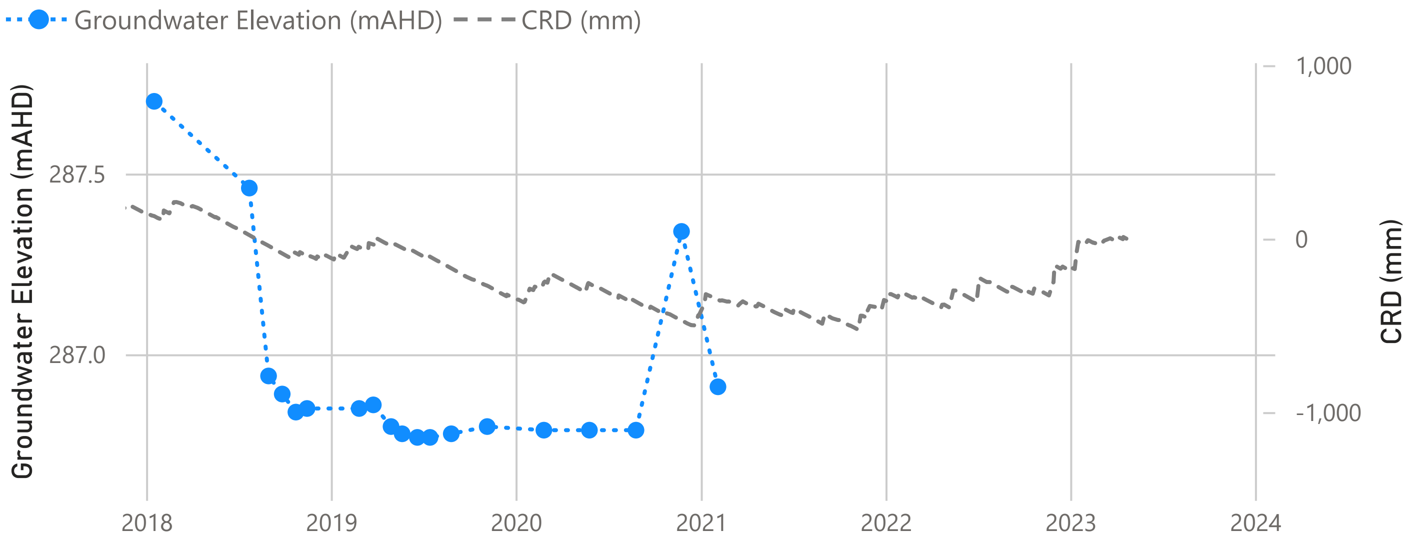


EFGW3D

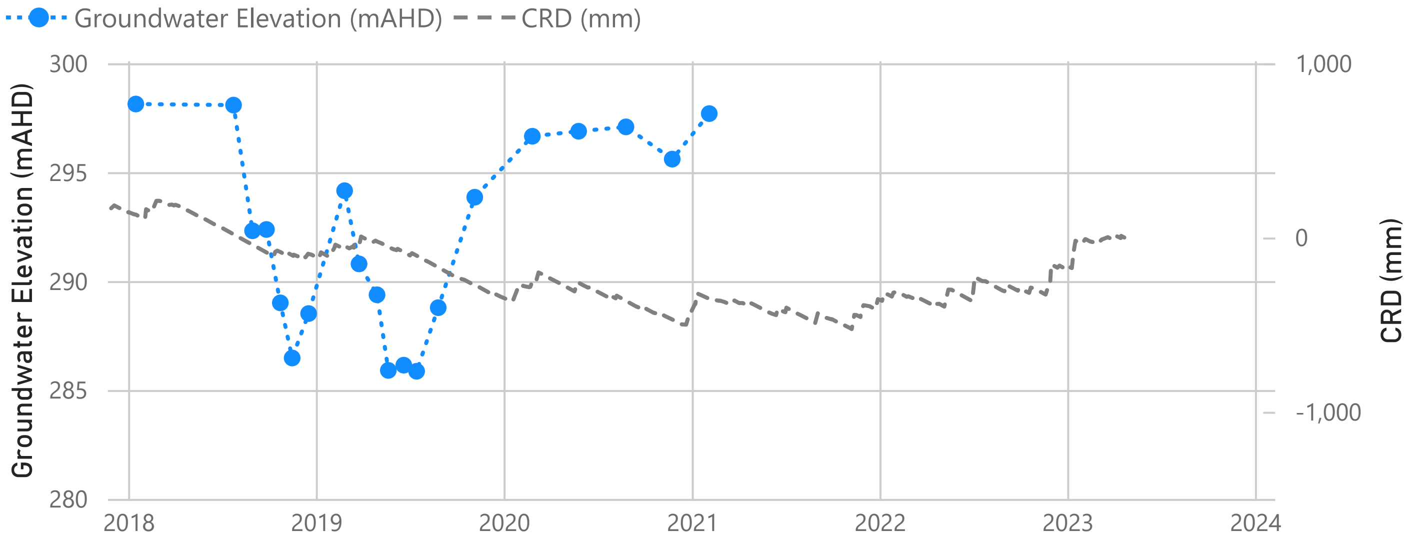


Rewan Group

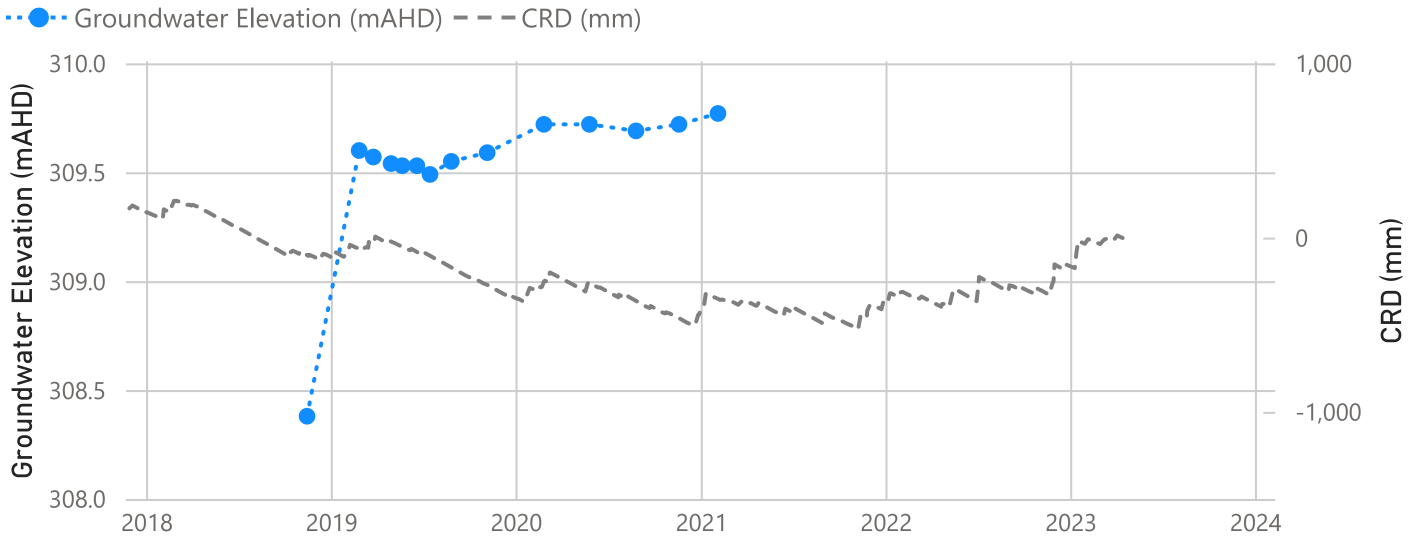
EFGW4D



EFGW5D

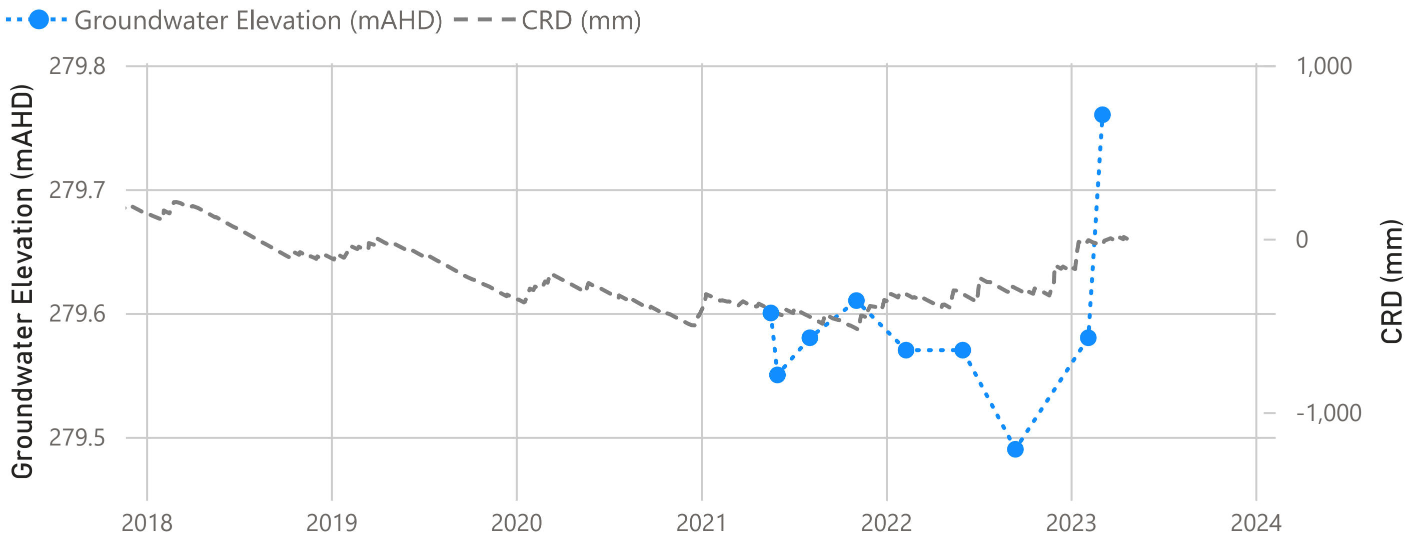


IBGWR1



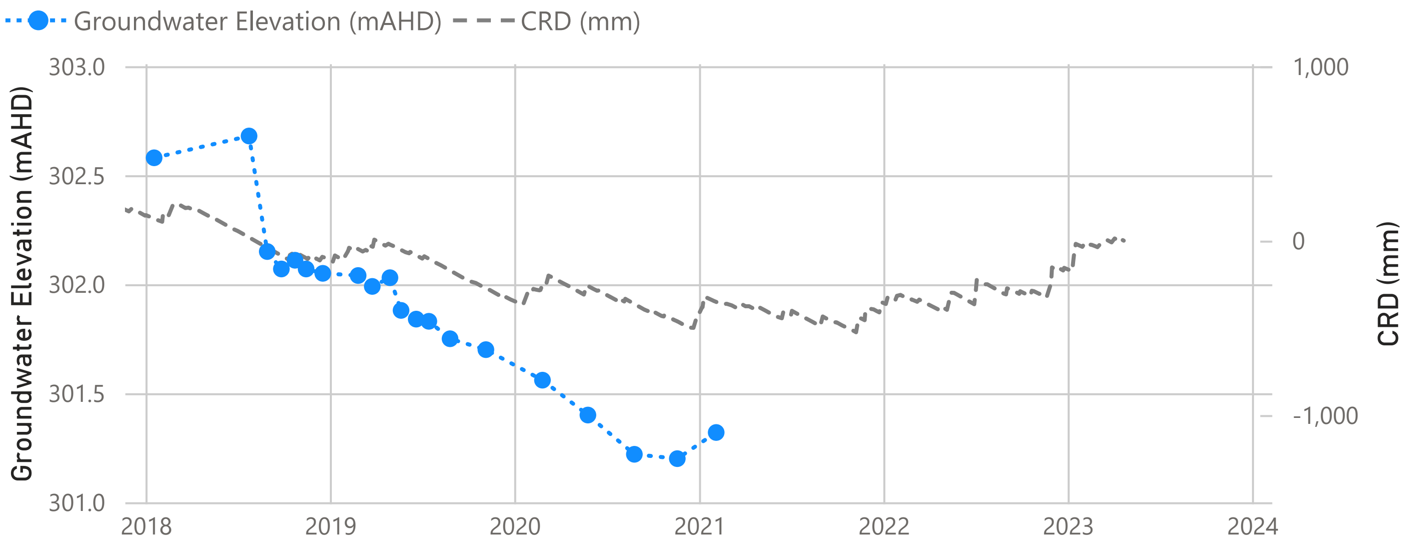
Rewan Group

MBBE0007



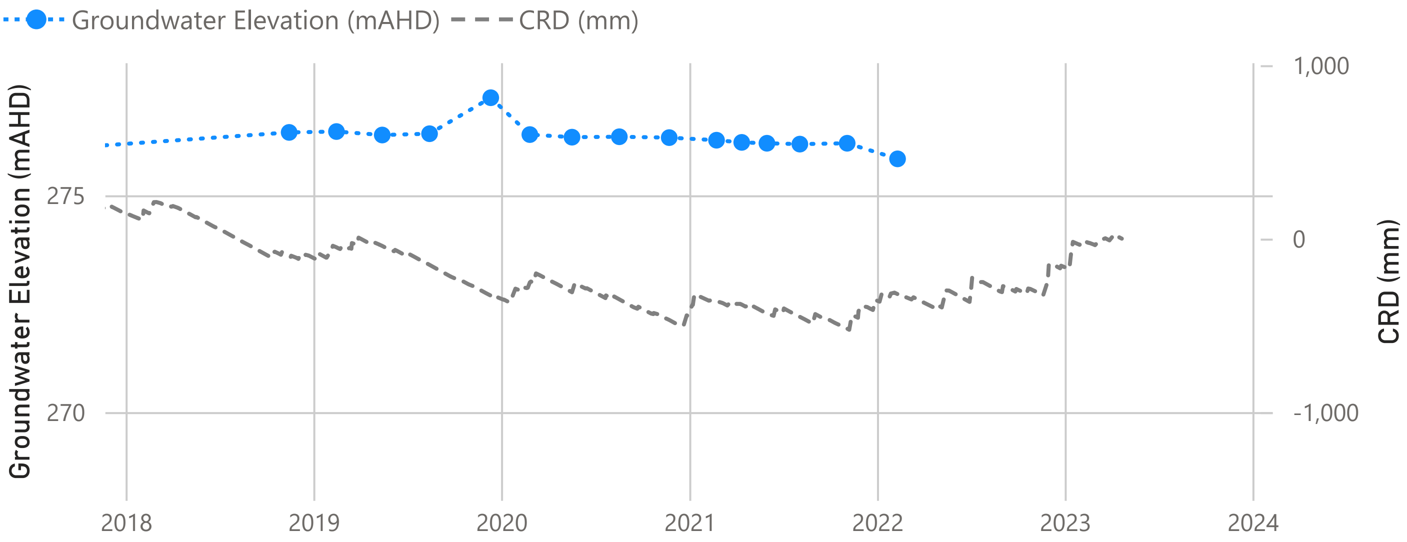
Rangal Coal Measures

PT1

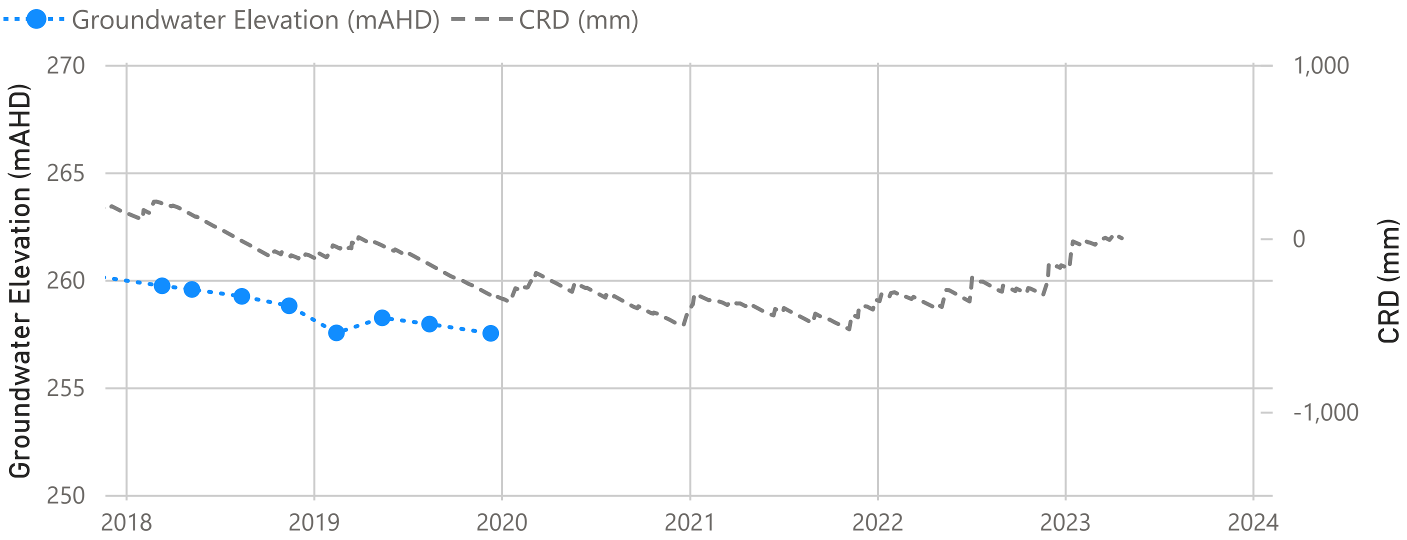


Rangal Coal Measures

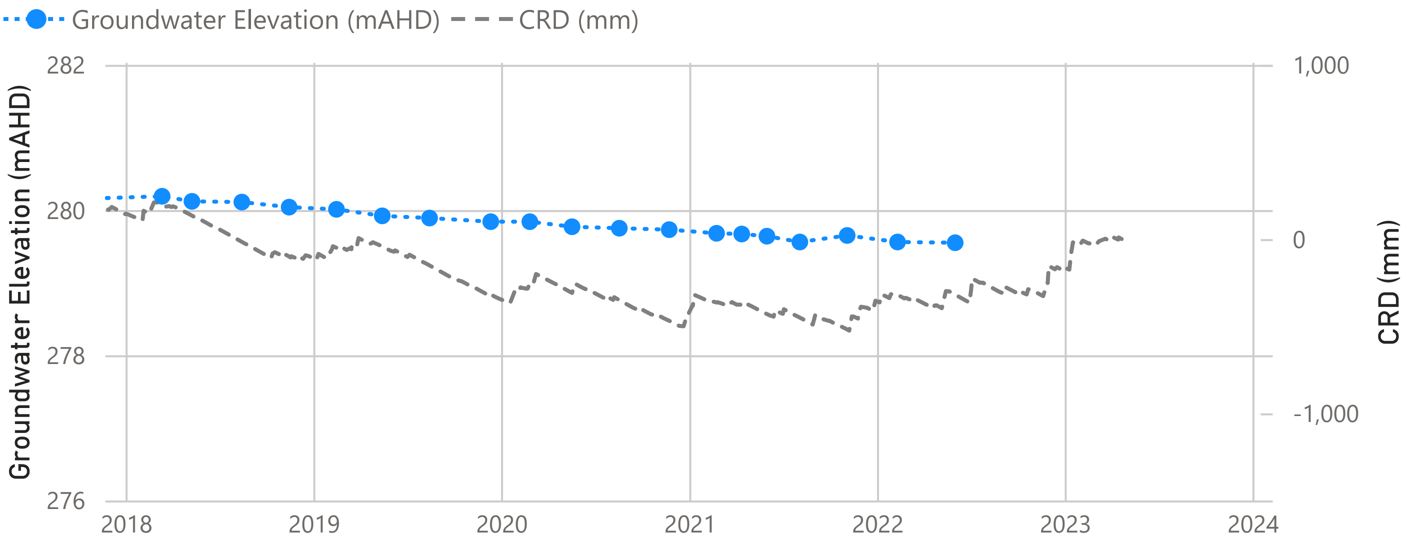
BDW172_(54)



BDW366P

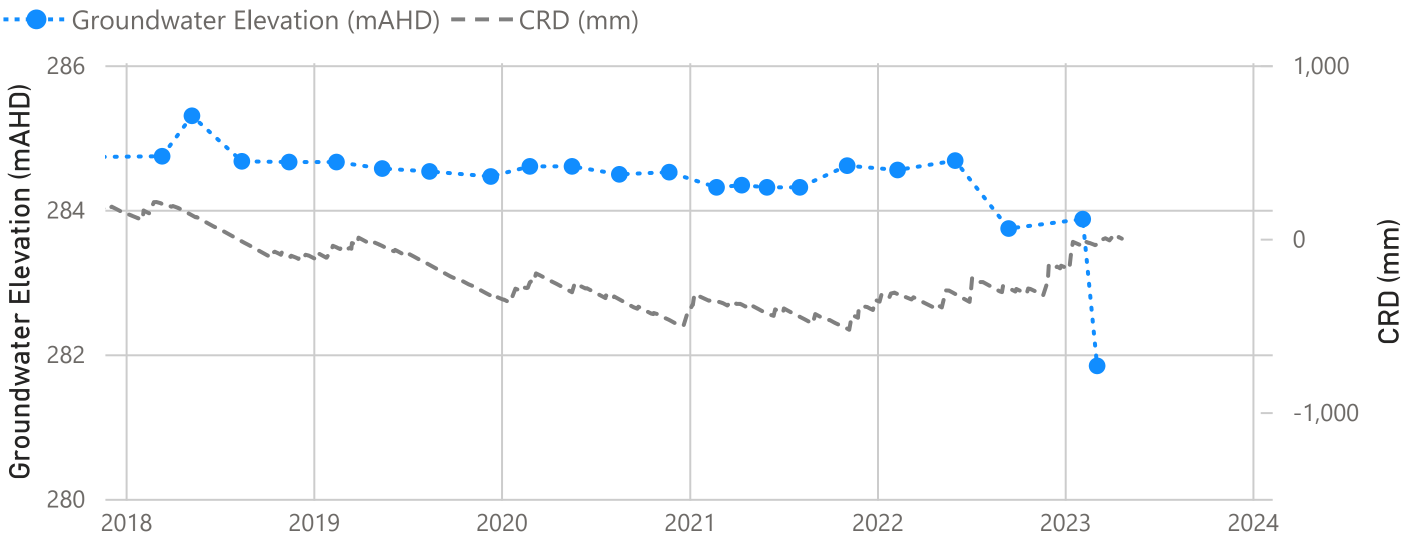


BDW5C

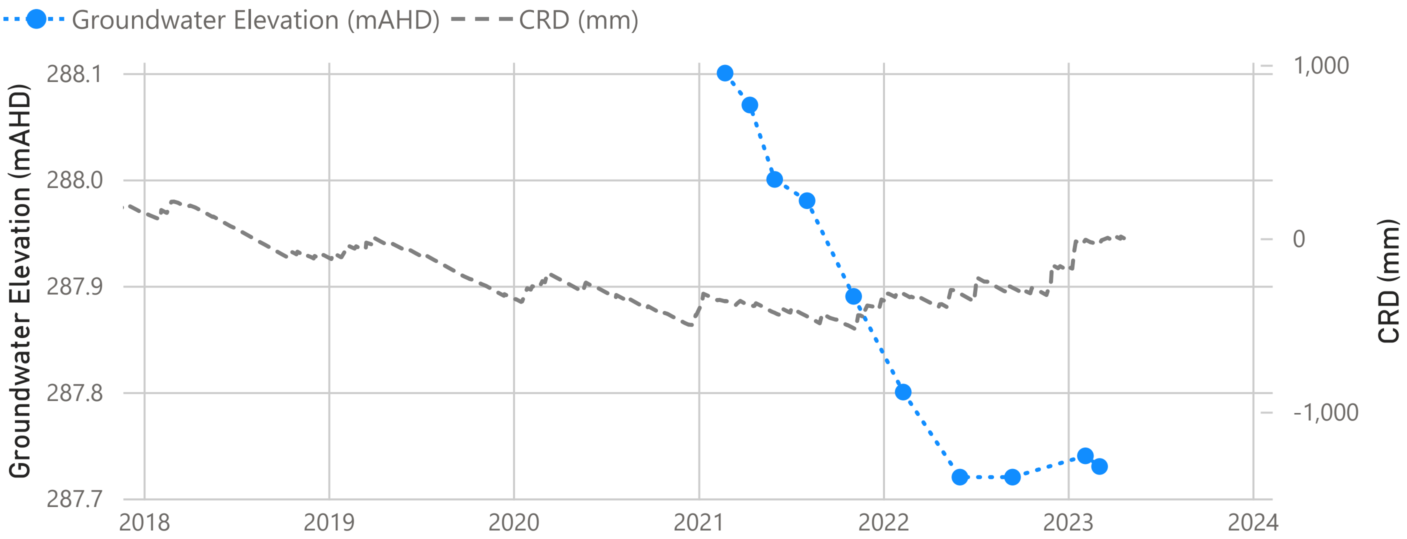


Rangal Coal Measures

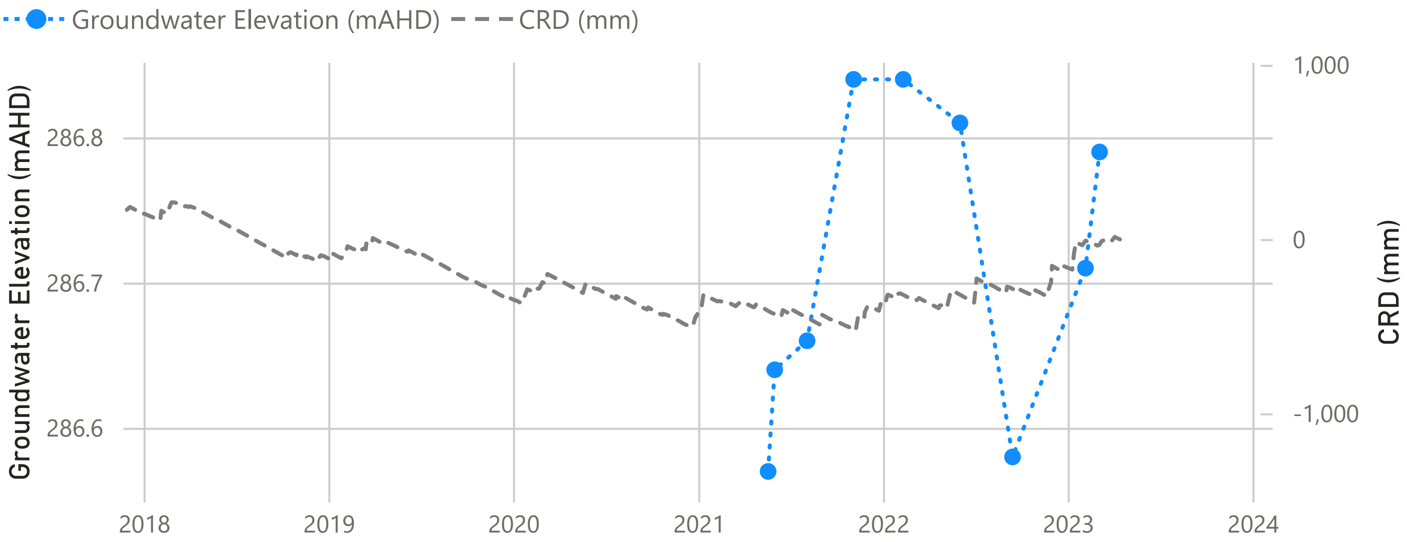
BDW8C



MBBE0001



MBBE0008



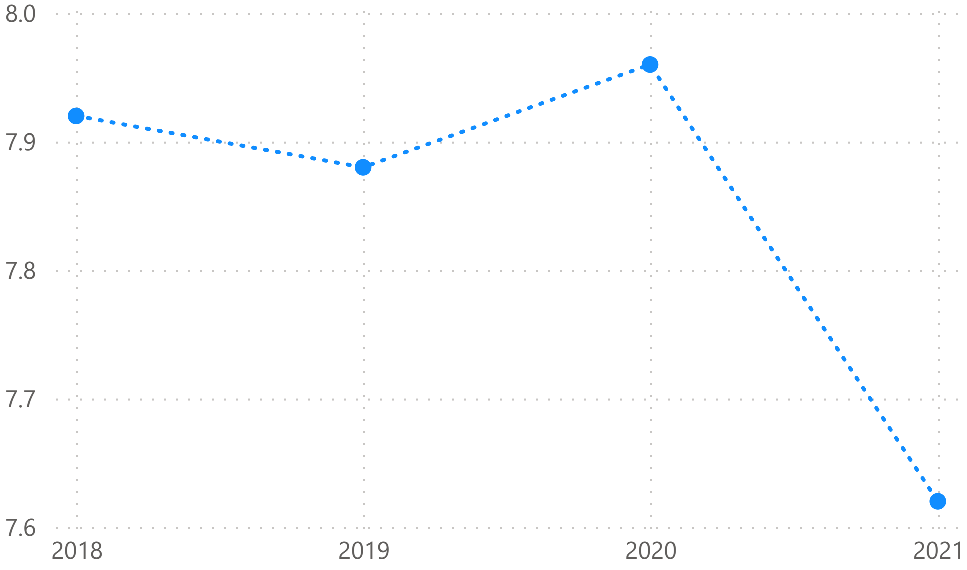
APPENDIX III

Groundwater Chemistry Graphs

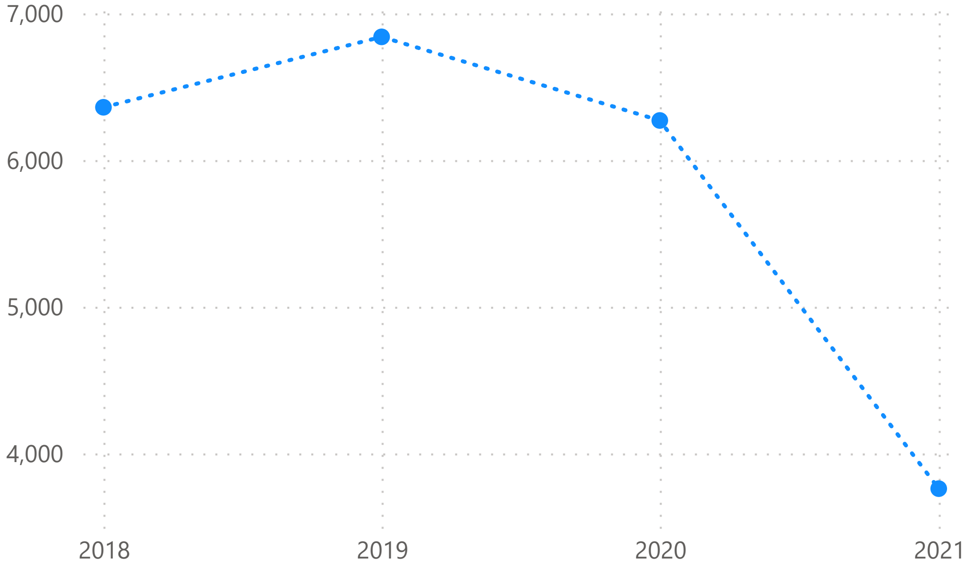
Alluvium

● EFGW1S

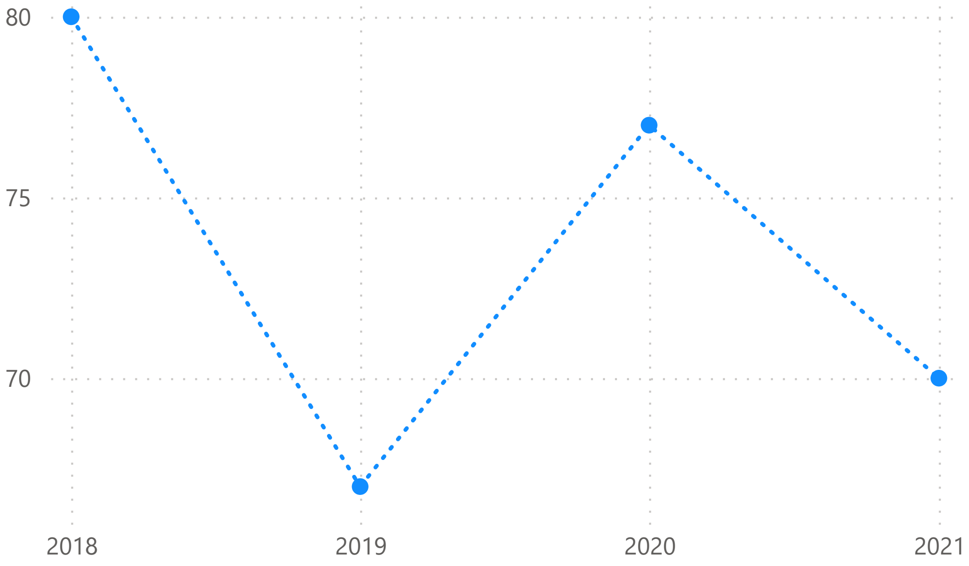
pH (pH unit)



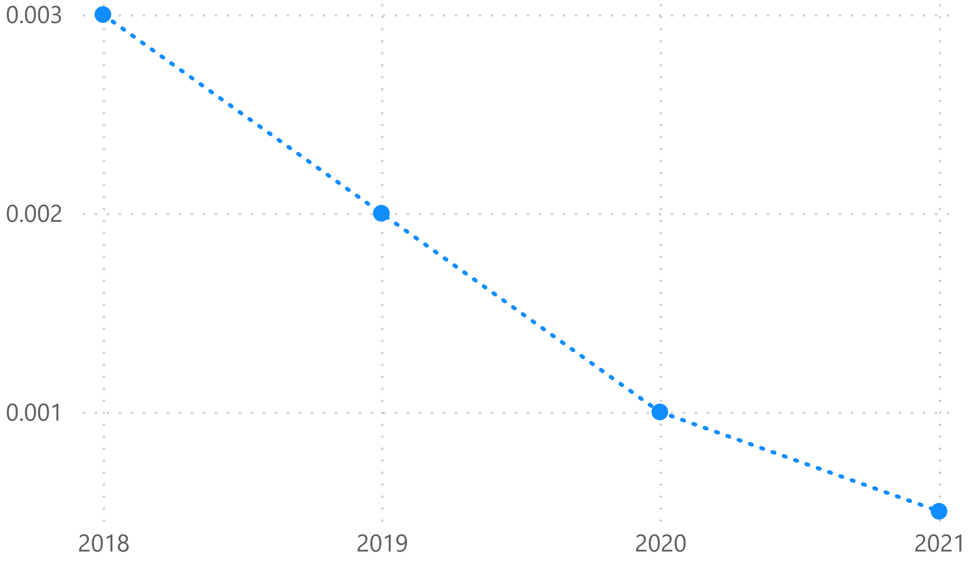
EC (uS/cm)



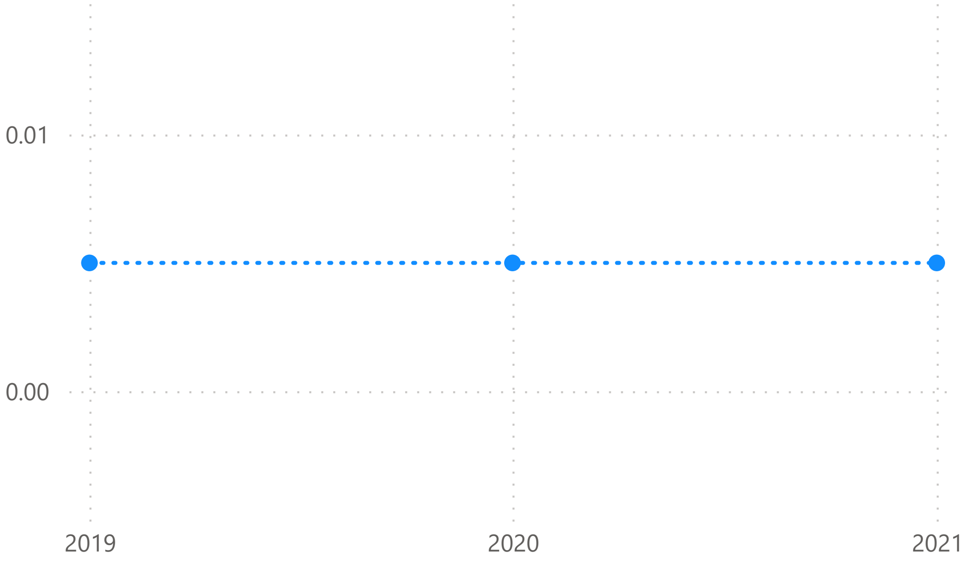
Sulfate (mg/L)



Dissolved Arsenic (mg/L)



Dissolved Aluminium (mg/L)



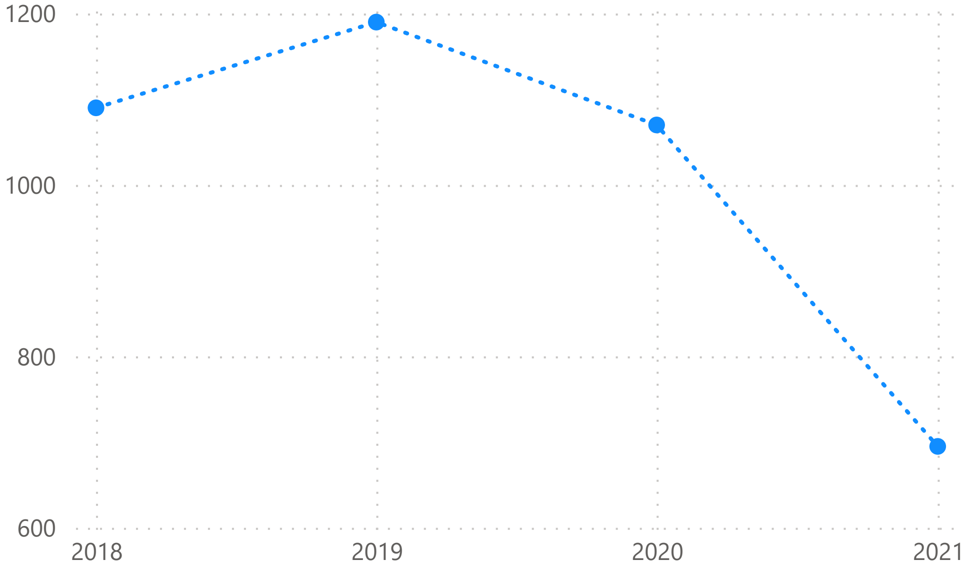
Dissolved Molybdenum (mg/L)

No Dissolved Molybdenum data for EFGW1S

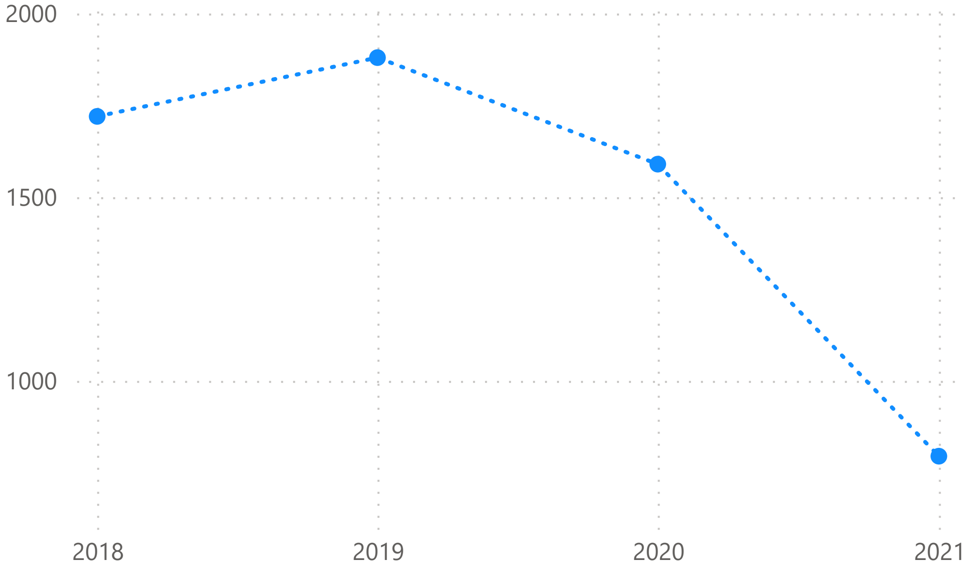
Dissolved Selenium (mg/L)

No Dissolved Selenium data for EFGW1S

Sodium (mg/L)



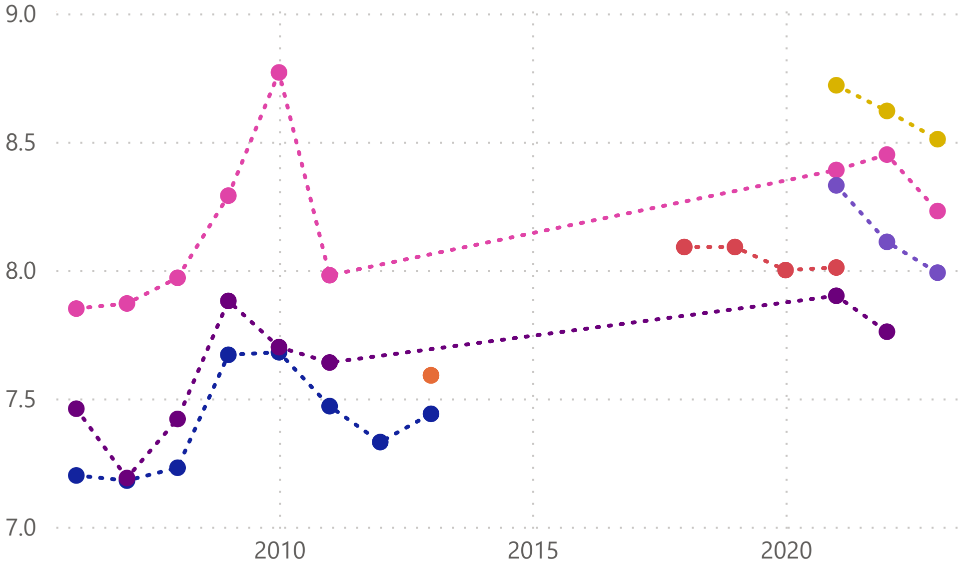
Chloride (mg/L)



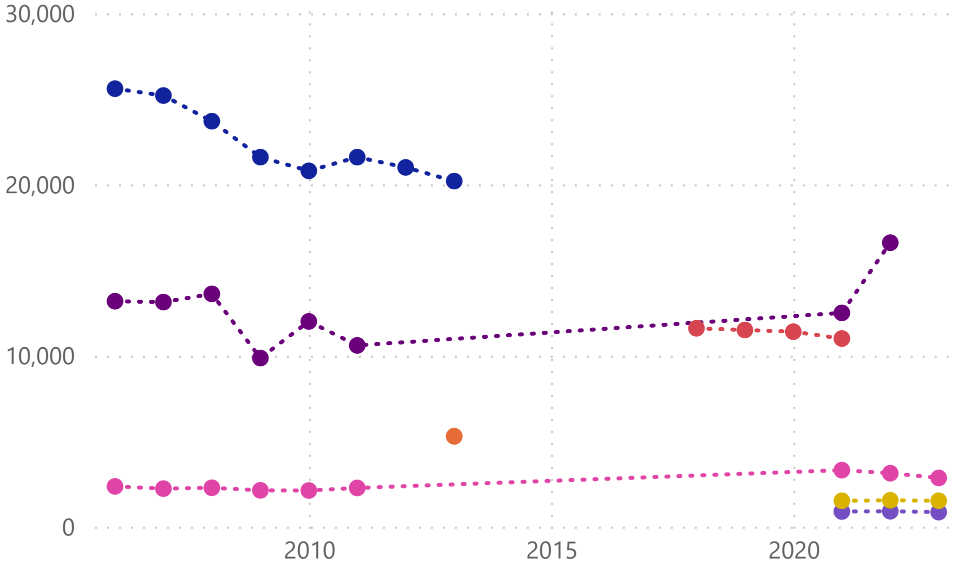
Rangal Coal Measures

● BDW 366P ● BDW368P ● BDW5C ● BDW8C ● MBBE0001 ● MBBE0008 ● PT1

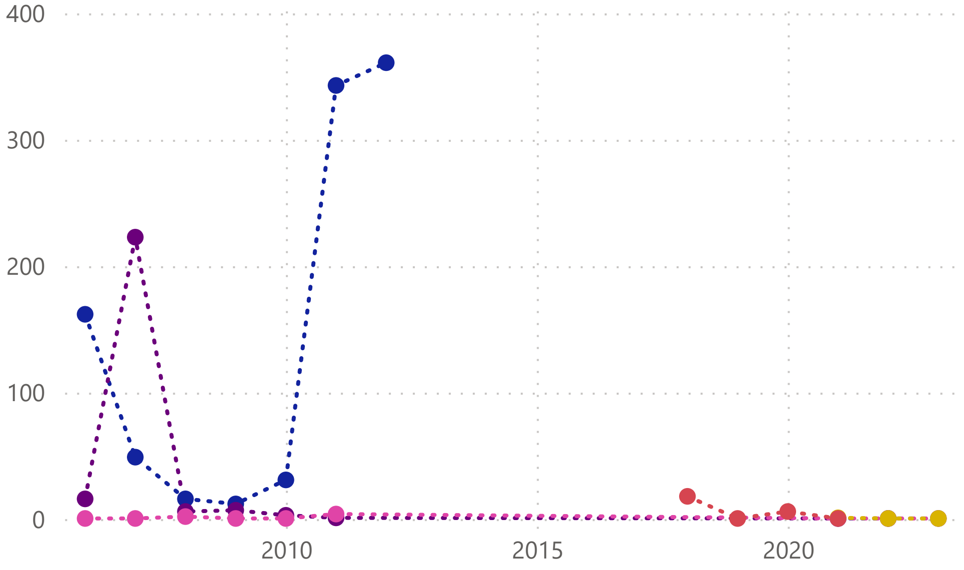
pH (pH unit)



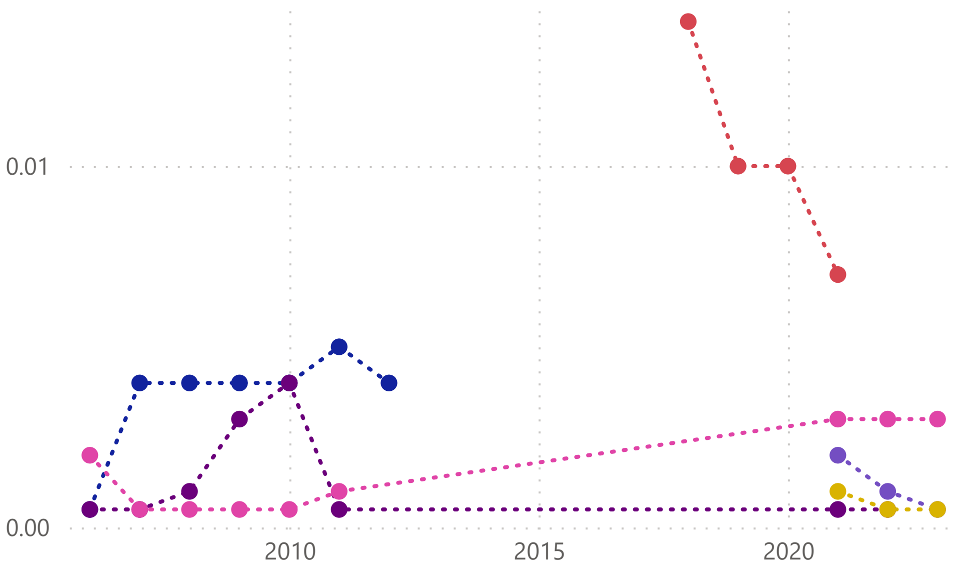
EC (uS/cm)



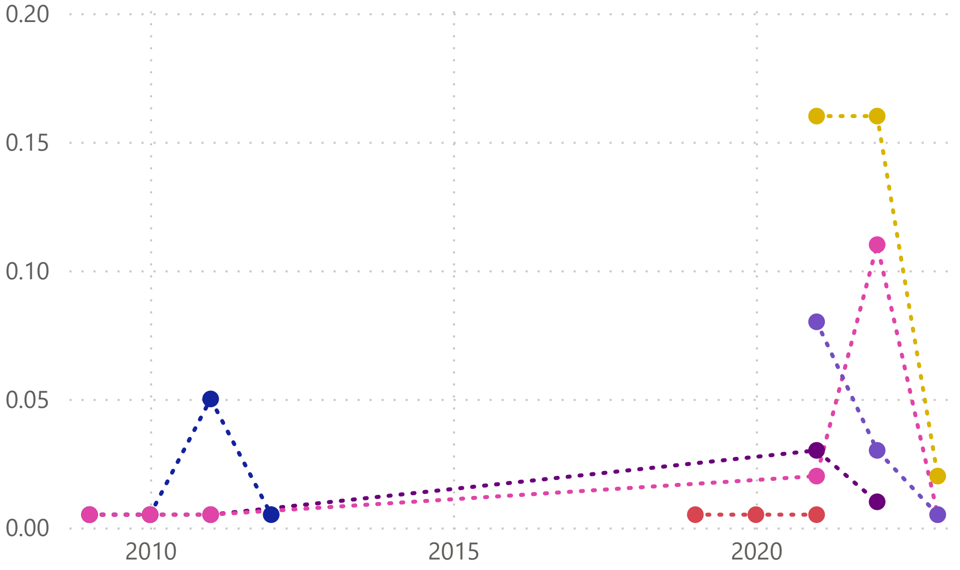
Sulfate (mg/L)



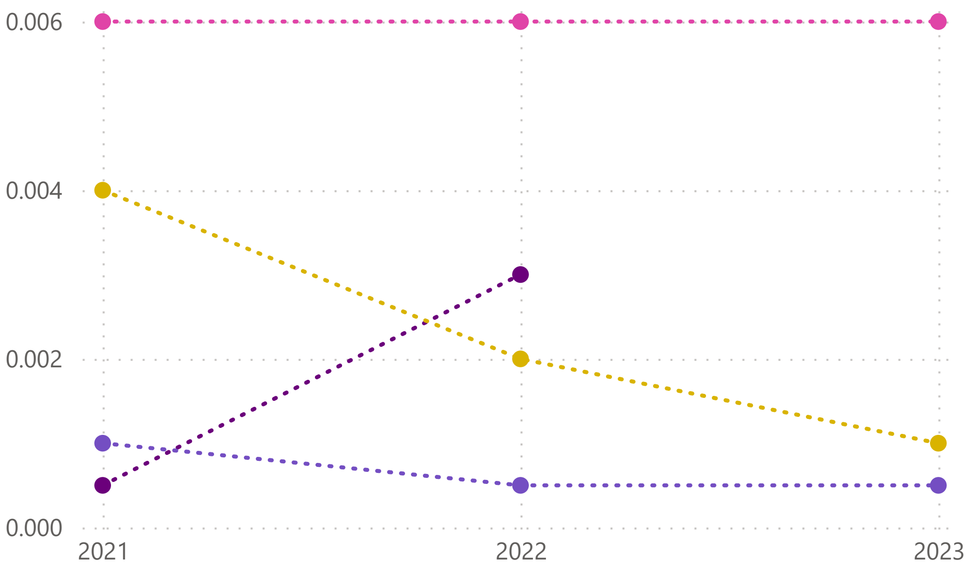
Dissolved Arsenic (mg/L)



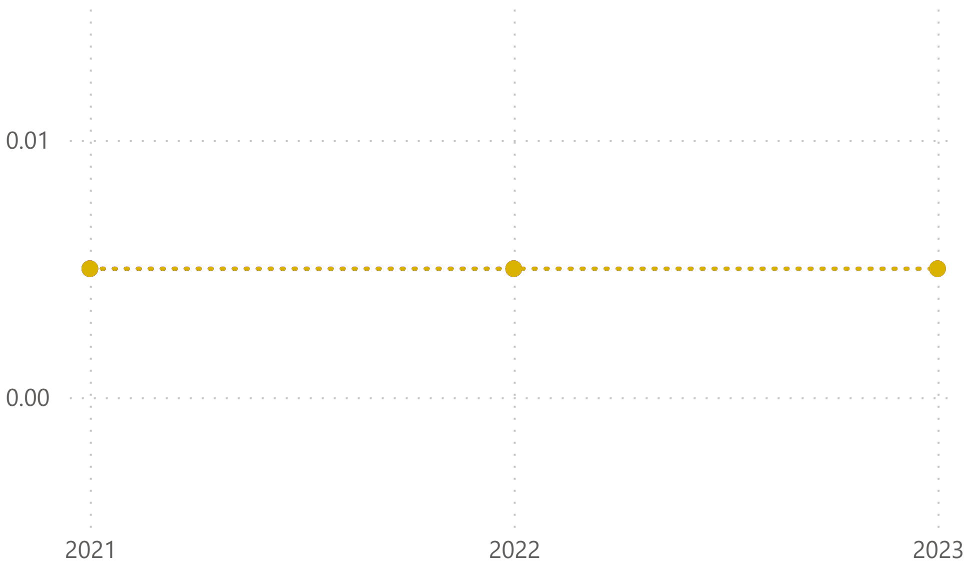
Dissolved Aluminium (mg/L)



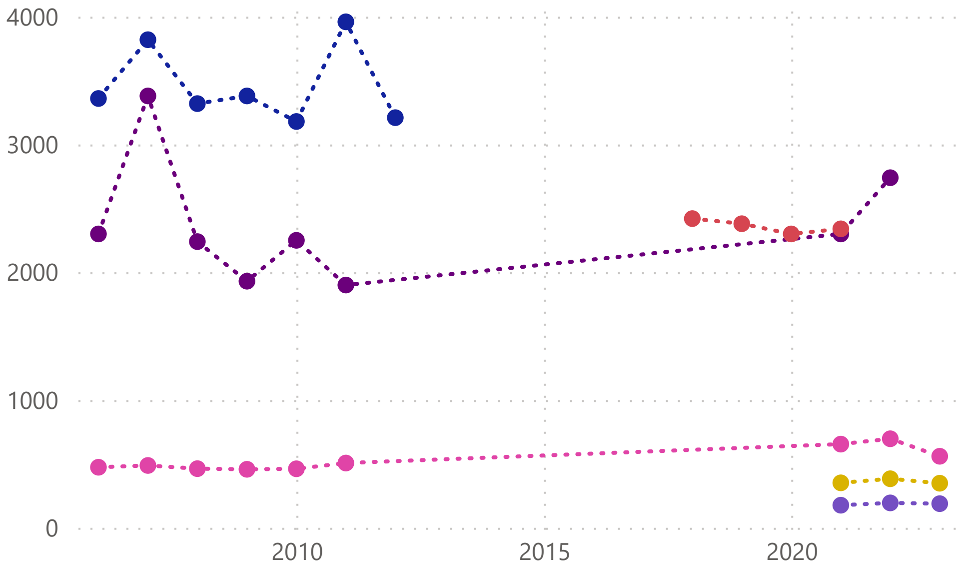
Dissolved Molybdenum (mg/L)



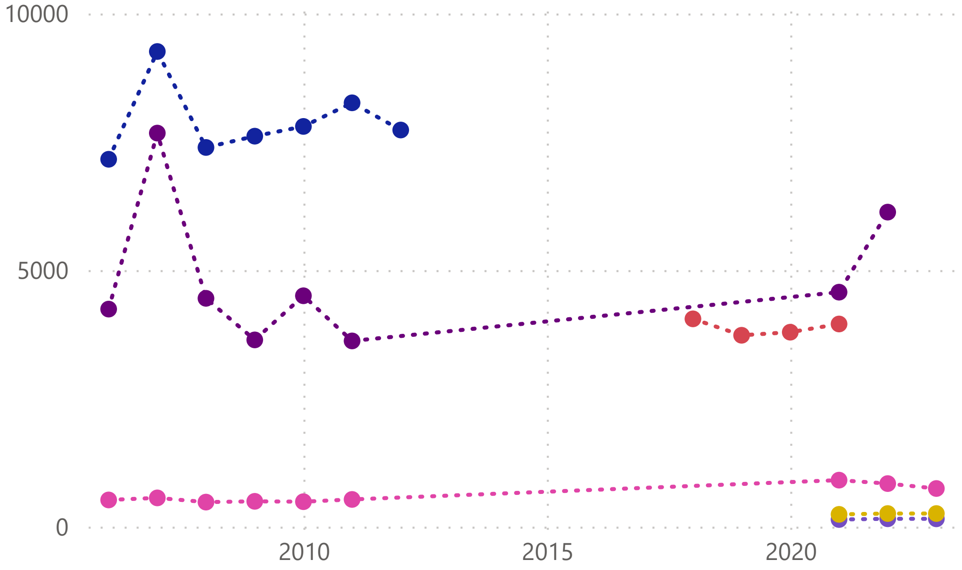
Dissolved Selenium (mg/L)



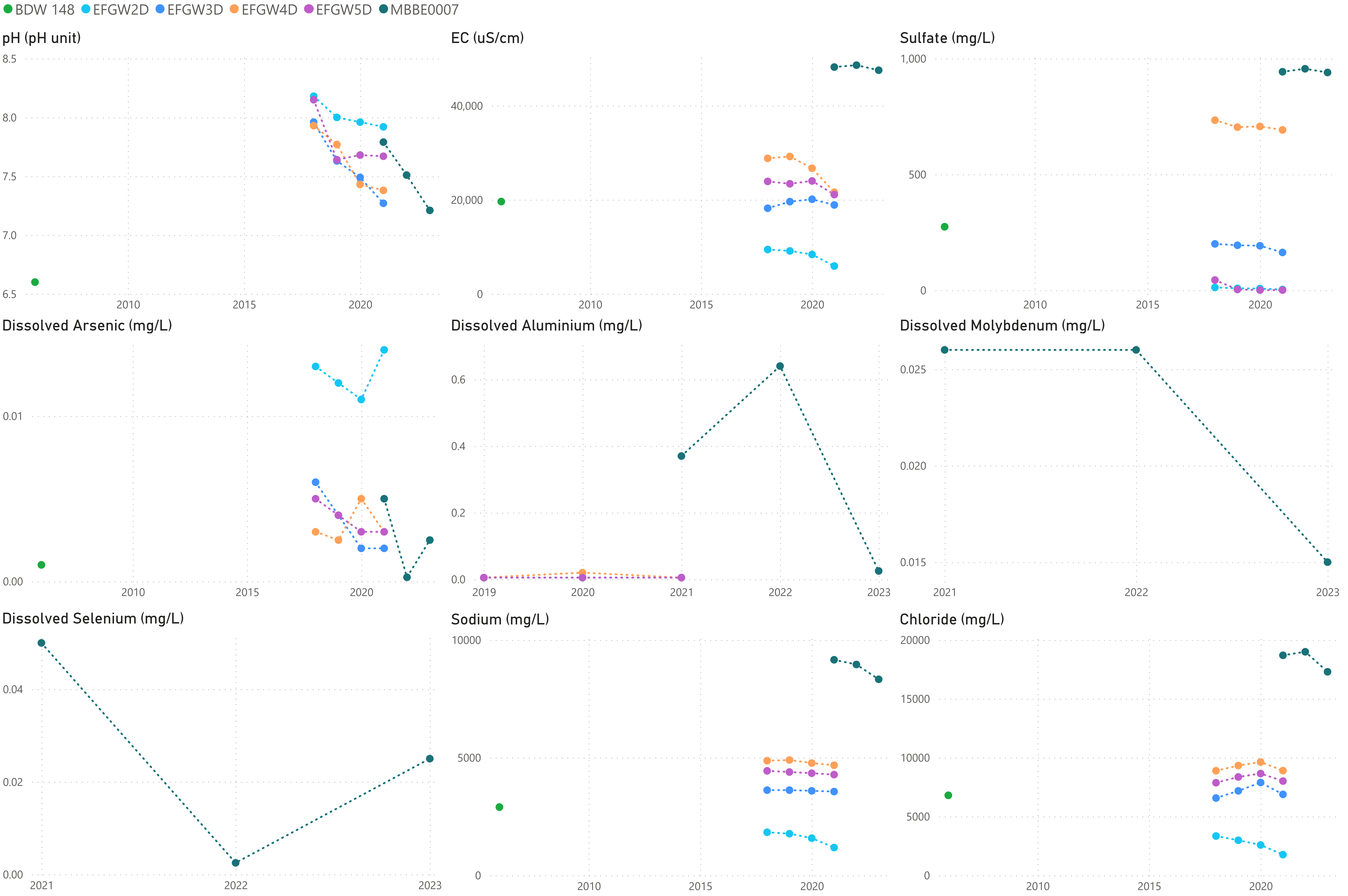
Sodium (mg/L)



Chloride (mg/L)



Rewan Group



pH (pH unit)

EC (uS/cm)

Sulfate (mg/L)

Dissolved Arsenic (mg/L)

Dissolved Aluminium (mg/L)

Dissolved Molybdenum (mg/L)

Dissolved Selenium (mg/L)

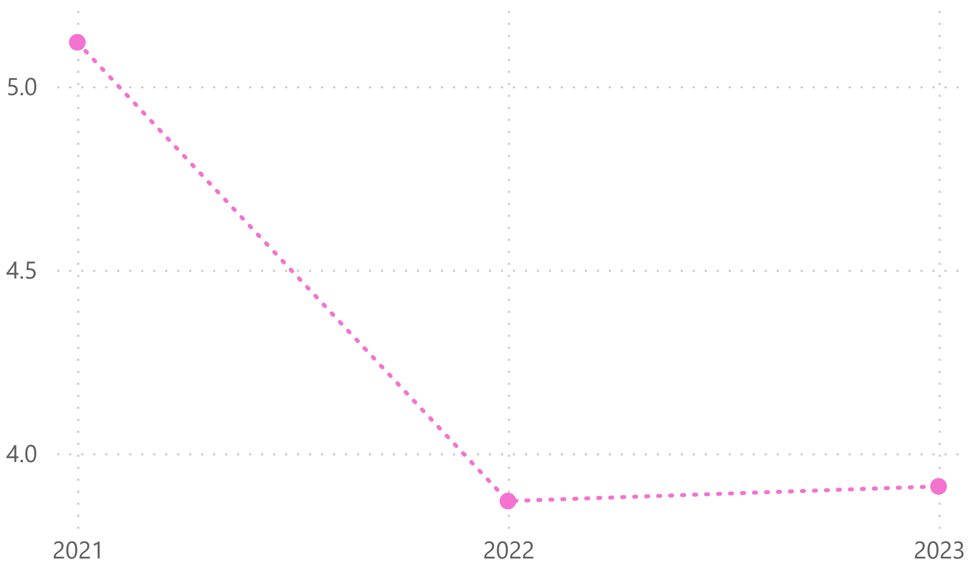
Sodium (mg/L)

Chloride (mg/L)

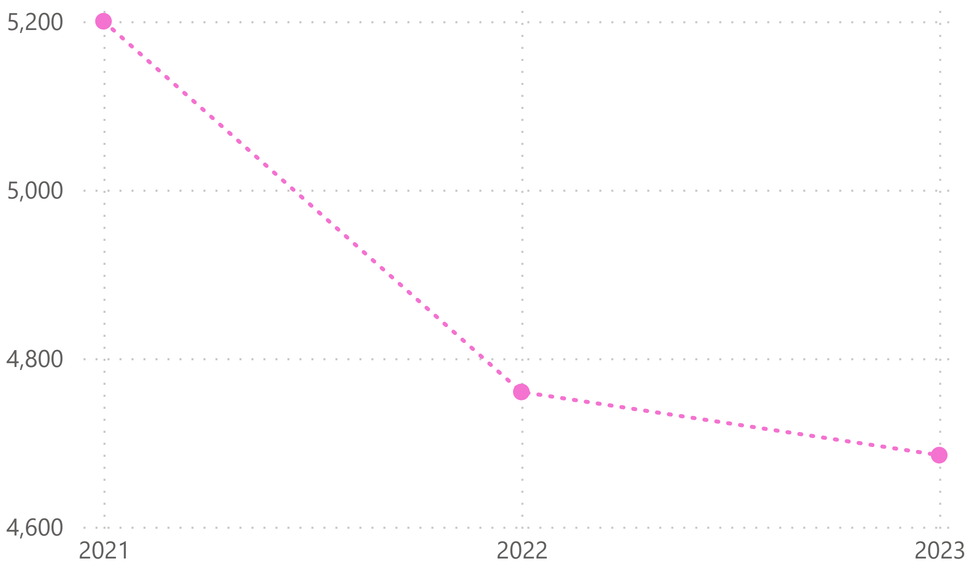
Tertiary Sediments

● MBBE0002

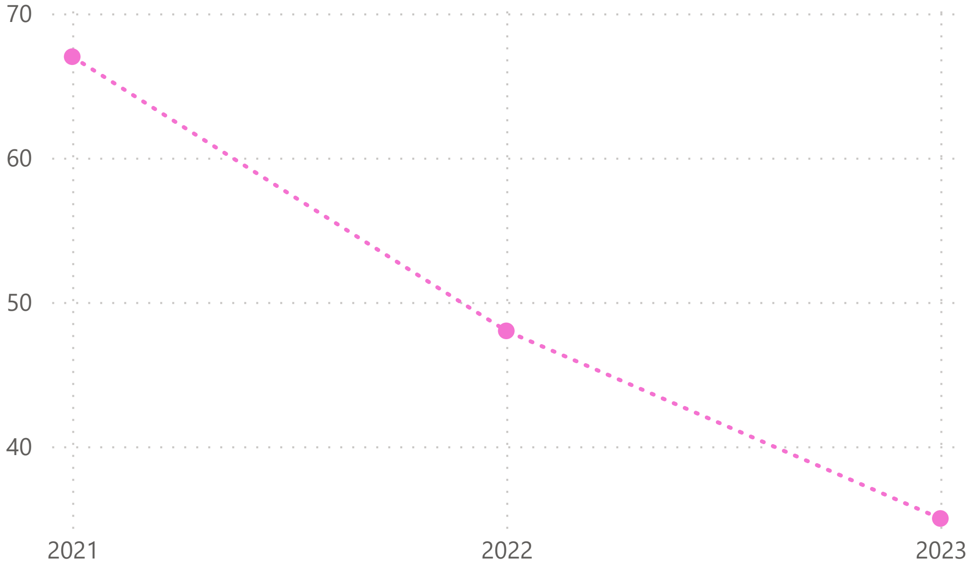
pH (pH unit)



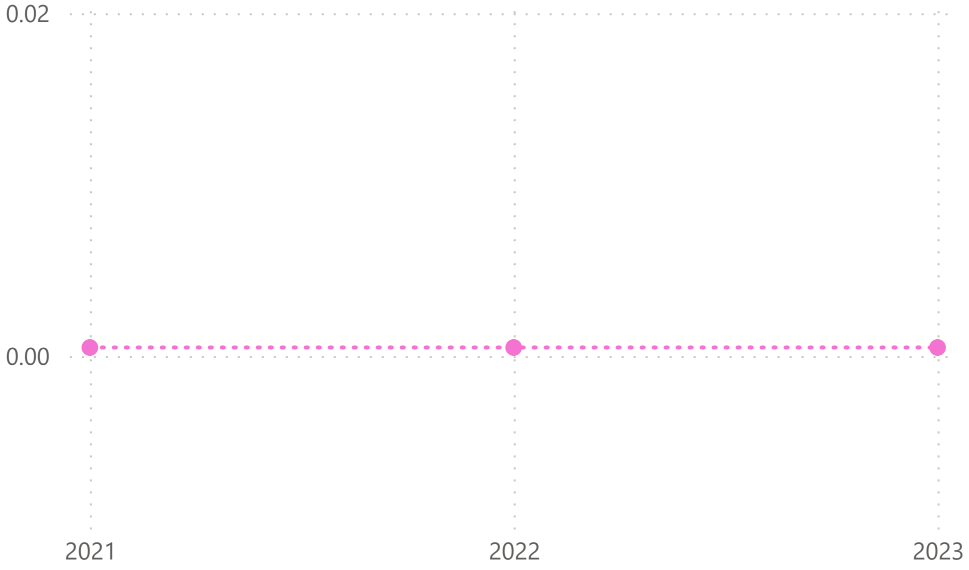
EC (uS/cm)



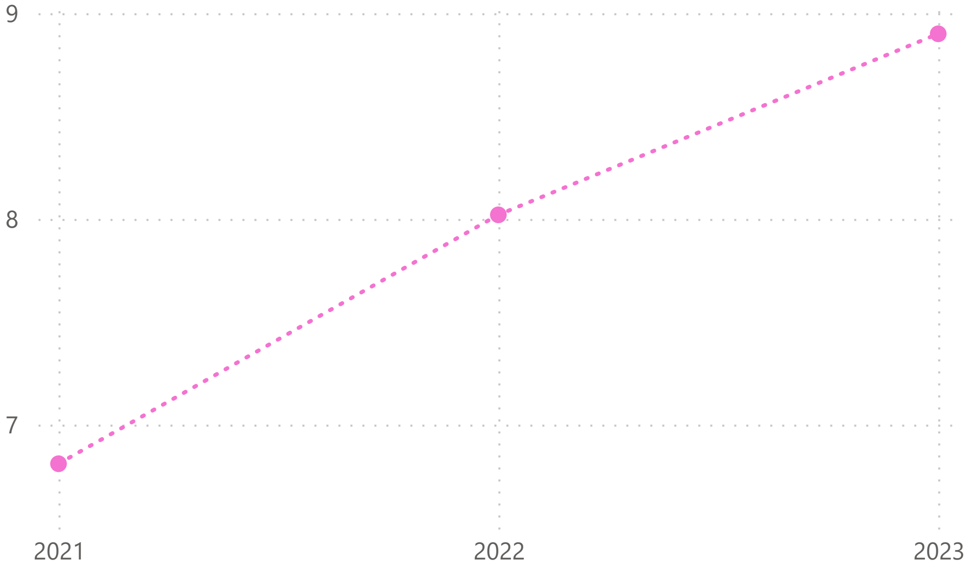
Sulfate (mg/L)



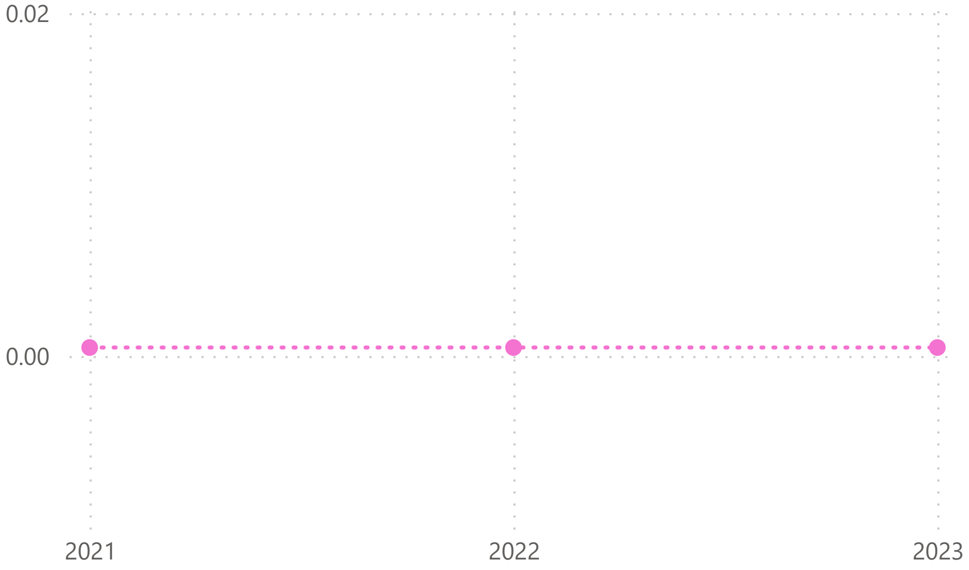
Dissolved Arsenic (mg/L)



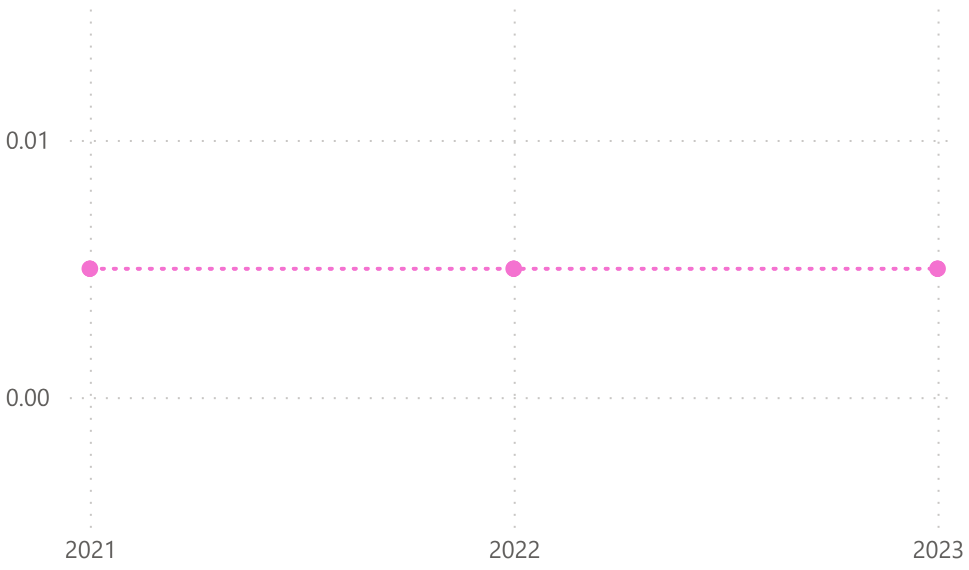
Dissolved Aluminium (mg/L)



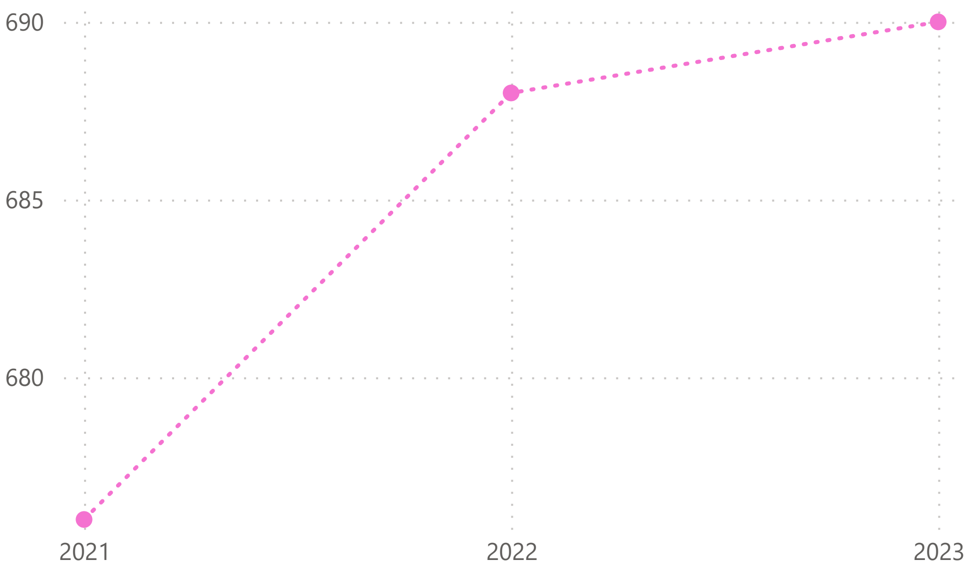
Dissolved Molybdenum (mg/L)



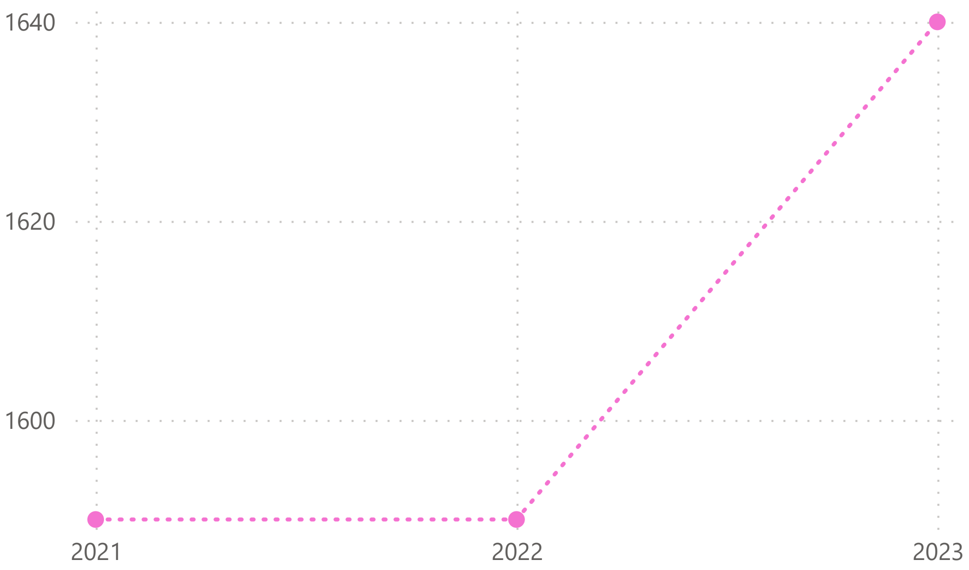
Dissolved Selenium (mg/L)



Sodium (mg/L)



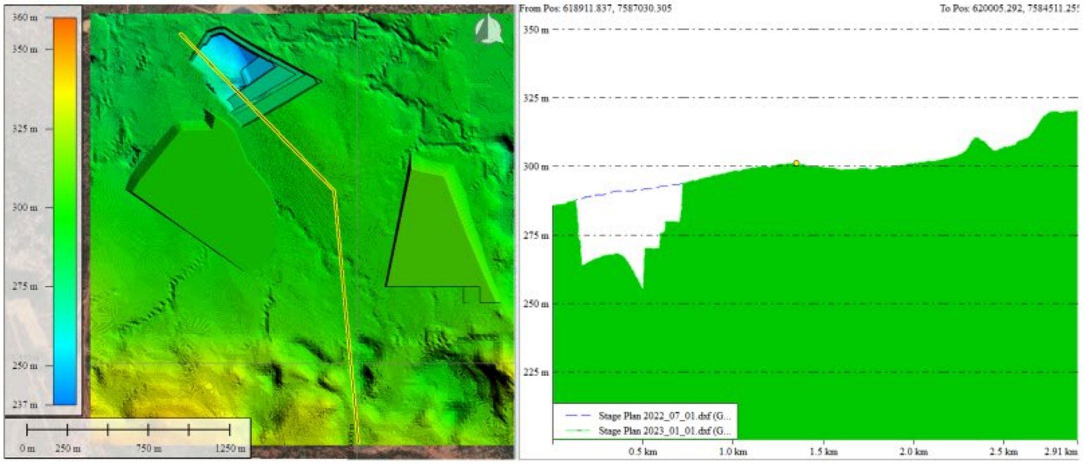
Chloride (mg/L)



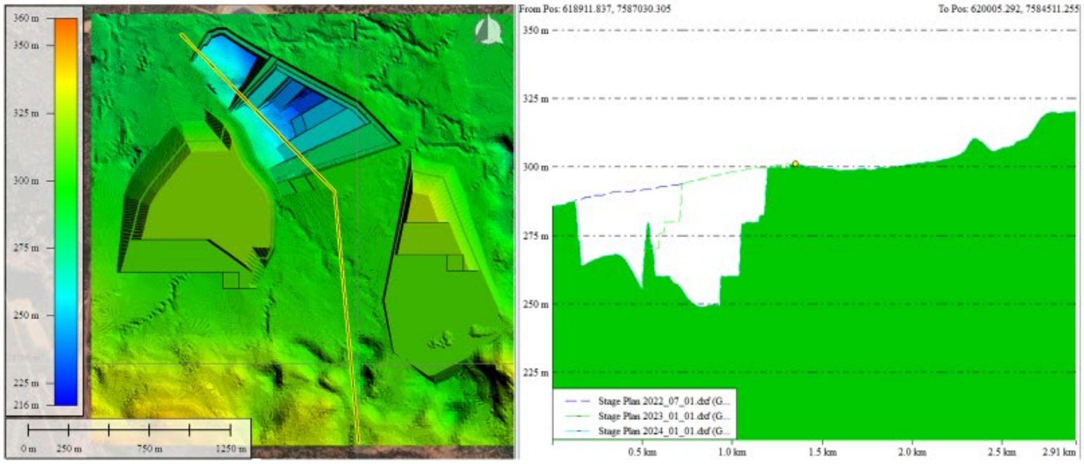
APPENDIX IV

Numerical Groundwater Modelling

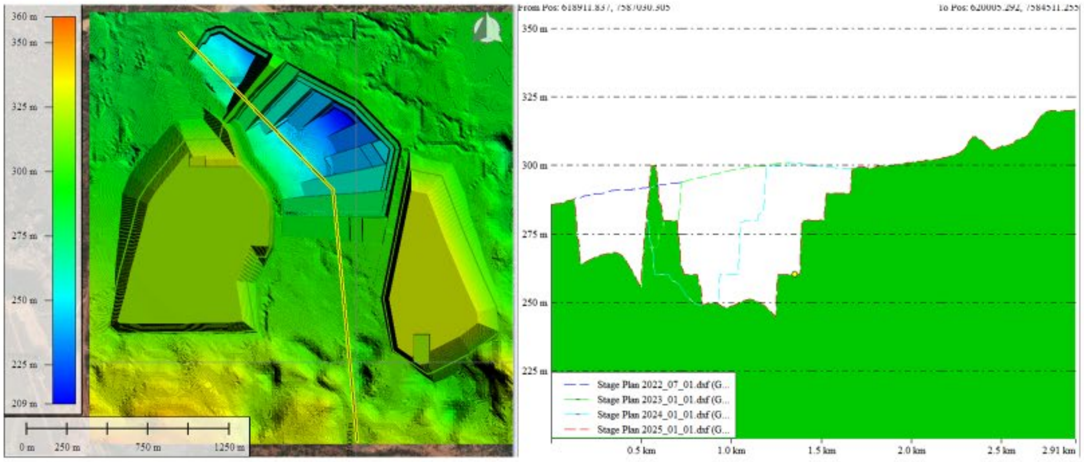
Mine Plan Stage – January 2023



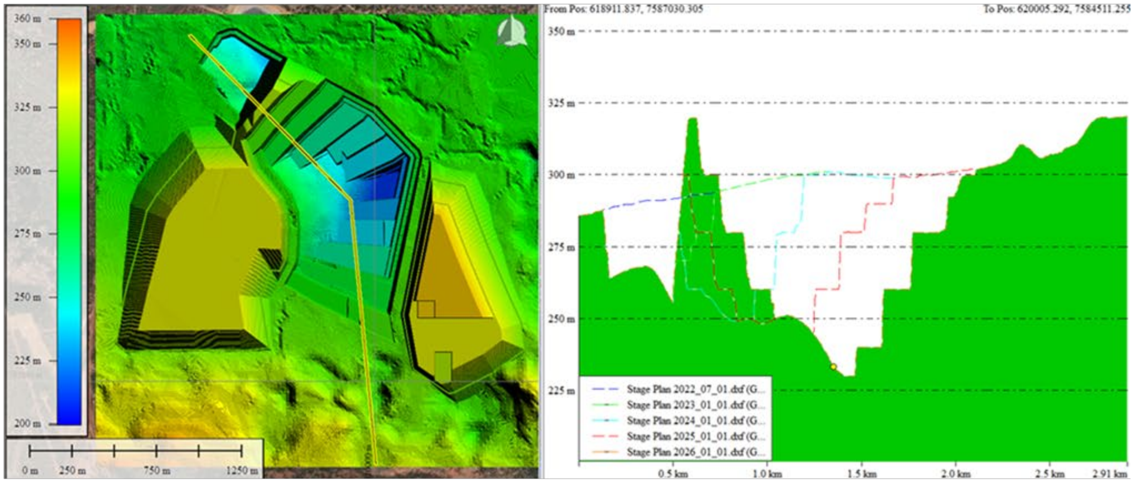
Mine Plan Stage – January 2024



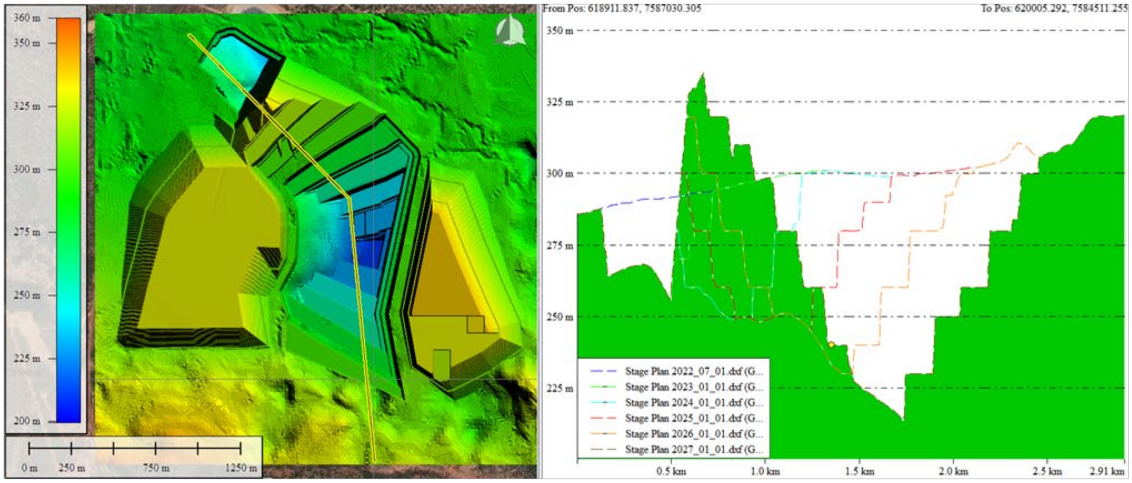
Mine Plan Stage – January 2025



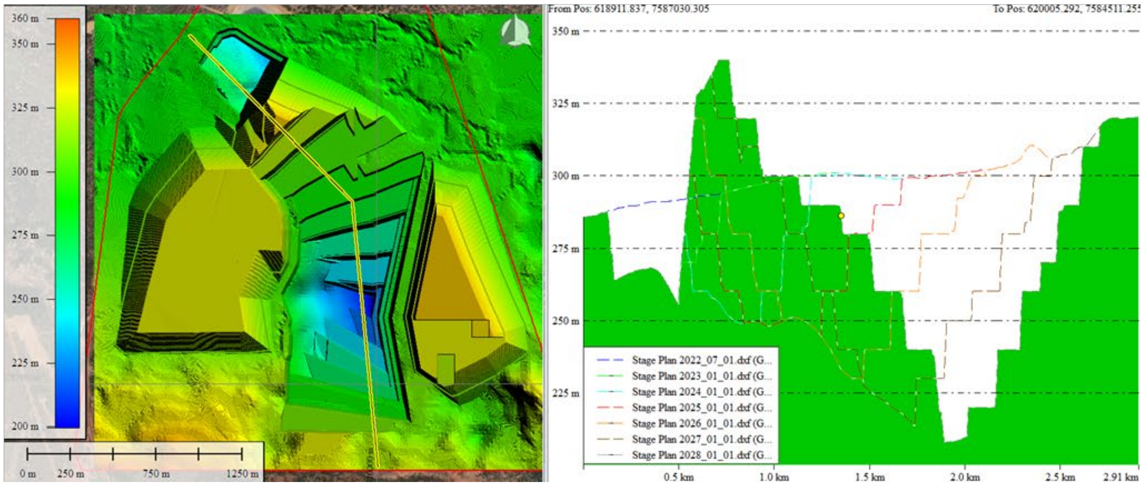
Mine Plan Stage – January 2026



Mine Plan Stage – January 2027



Mine Plan Stage – January 2028



Appendix IV
Numerical Groundwater Modelling

IV-1 MODEL OBJECTIVES

A numerical groundwater model has been constructed to support the BME Progressive Rehabilitation and Closure Plan (PRCP) to predict changes in groundwater levels and flow during operations and into closure. The objectives of the model include:

- Estimating groundwater inflow / outflow in the final voids; and
- Predicting the extent and area of influence of groundwater level drawdown associated with the final voids.

The numerical groundwater model has been constructed and simulated with consideration of the Australian Groundwater Modelling Guidelines (Barnett et al. 2012) and the requirements of the PRCP Guideline (DES 2021).

IV-2 MODEL HISTORY

This groundwater model was initially developed for the Broadmeadows East Groundwater Impact Assessment (KCB 2021). The model was developed to simulate the existing conditions of the groundwater regime and provide predictions of the potential impacts of the proposed mining activities. The model was updated for the PRCP project through:

- Recalibration of the model to include the most recent groundwater monitoring data;
- Incorporation of the most recent operational plan; and
- Incorporation of the post-closure landform.

IV-3 MODEL CONSTRUCTION

IV-3.1 Model Code

The water-bearing formations within the Project area are complex systems. Due to the processes that formed the upper Tertiary units, along with the folding nature of the pre-Tertiary sediments, and the influence of the regional thrust fault all modelled units (with the exception of the bottom model layer) are discontinuous across the model domain. This is a challenge to reproduce using modelling platforms that are based on regular grid arrangements, as all layers are required to be laterally extensive across the model domain.

MODFLOW-USG is an “unstructured grid” version of MODFLOW that has the capabilities to use an irregular grid structure with arbitrary cell/node connections. This enables focused grid refinement to occur in areas where detail is important, without the need for continuation of grid refinement to the extents of the model domain. It also facilitates implementation of pinching-out layers and/or layer discontinuities within the modelled domain. In complex models, this can greatly reduce the number of grid cells within the model domain and thus greatly reduce model runtimes. In addition, MODFLOW-USG implements an “upstream weighting” formulation of the groundwater flow equation that allows cells to dewater and re-saturate with relative impunity, ideal for simulating mining activities where dewatering and groundwater recovery is prominent. For these reasons, MODFLOW-USG was selected for this assessment.

IV-3.2 Model Domain and Hydrogeological Study Area

Figure IV-3.1 and Figure IV-3.2 presents the spatial extents of the groundwater flow model domain and covers ~280km^2. The model domain was selected to reflect the regional hydrostratigraphic units while also considering there is sufficient lateral extent to include relevant historical, existing and approved future (if present) mining operations in the region. In setting the model domain, the potential extent of Project groundwater impacts was also considered. In detail, this included:

- The established model domain boundaries are primarily defined by topography and hence coincides locally with groundwater divide conditions; which represents the northeast, northwest and southeast boundaries. The model domain also encompasses the mining activities in the vicinity of Project area.
- The southwestern boundary of the model domain is located at a distance from the Project area such that drawdown impacts resulting from the proposed mining activities are not interpreted to extend to the boundary.

IV-3.3 Application of Conceptual Model

The development of the groundwater flow model was based on the conceptualisation of the hydrogeological system. This conceptualisation is described in the main PRCP report. The hydrogeological conceptualisation is a descriptive representation of the groundwater flow system and stresses. The closer the numerical model represents the conceptual understanding, and the site conditions, the better the performance of the model in making predictions (Anderson and Woessner 1992). The conceptual understanding defines the key processes of the groundwater system with consideration to the influence of stresses (Barnett et al. 2012)

The application of the conceptual understanding to the groundwater flow model required synthesis and description of the geological framework and consideration of the groundwater flow systems at and in the vicinity of the Project area.

A thrust fault to the west of the Project area has upthrown and subsequently eroded the overlying Triassic strata to expose the Rangal Coal Measures. The position of the thrust fault defines the location of significant hydrostratigraphic unit displacement and has been represented by model layer elevations and hydraulic property changes. In this conceptual setting the fault restricts groundwater flow as a flow barrier in the horizontal direction.

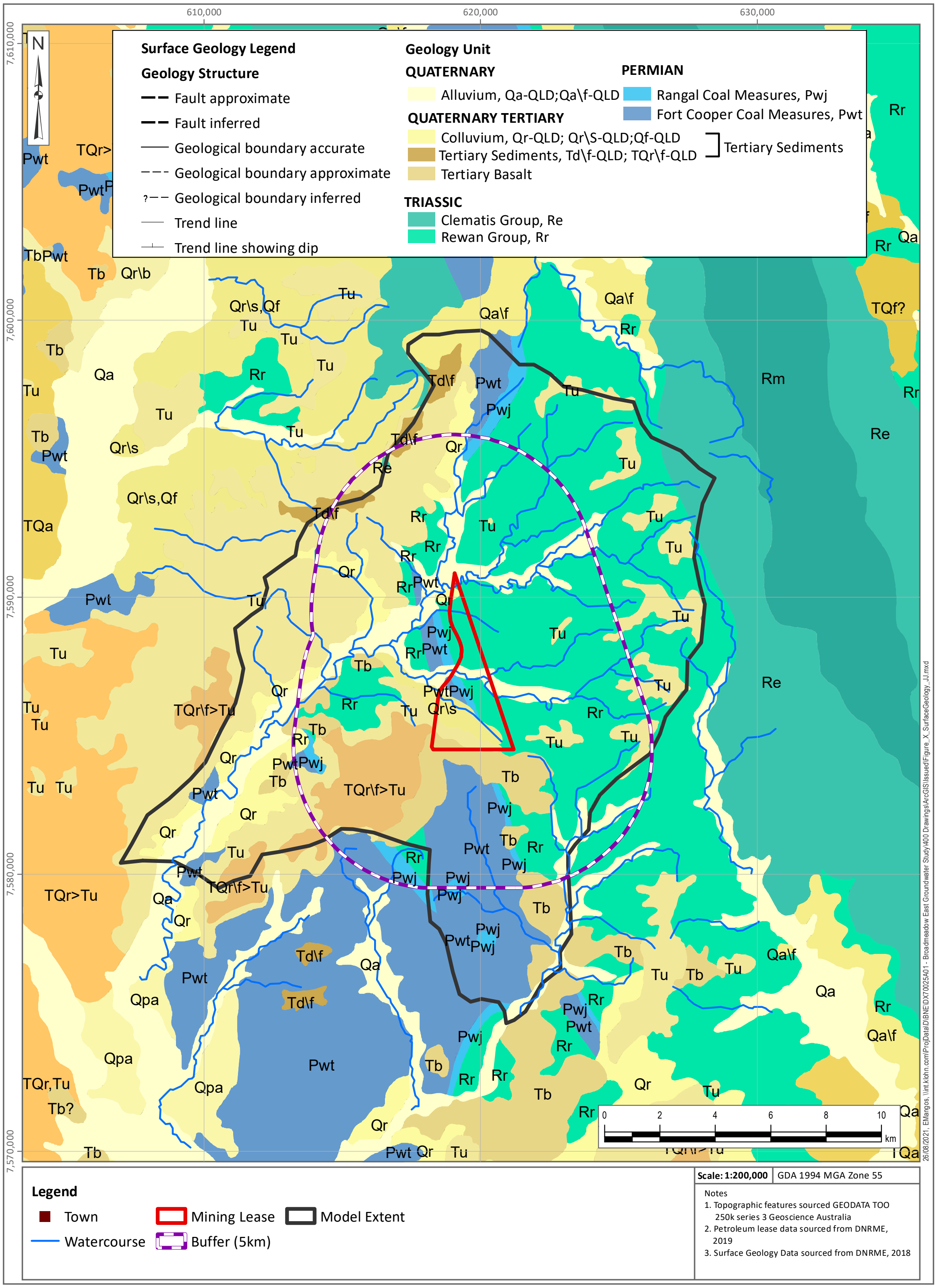
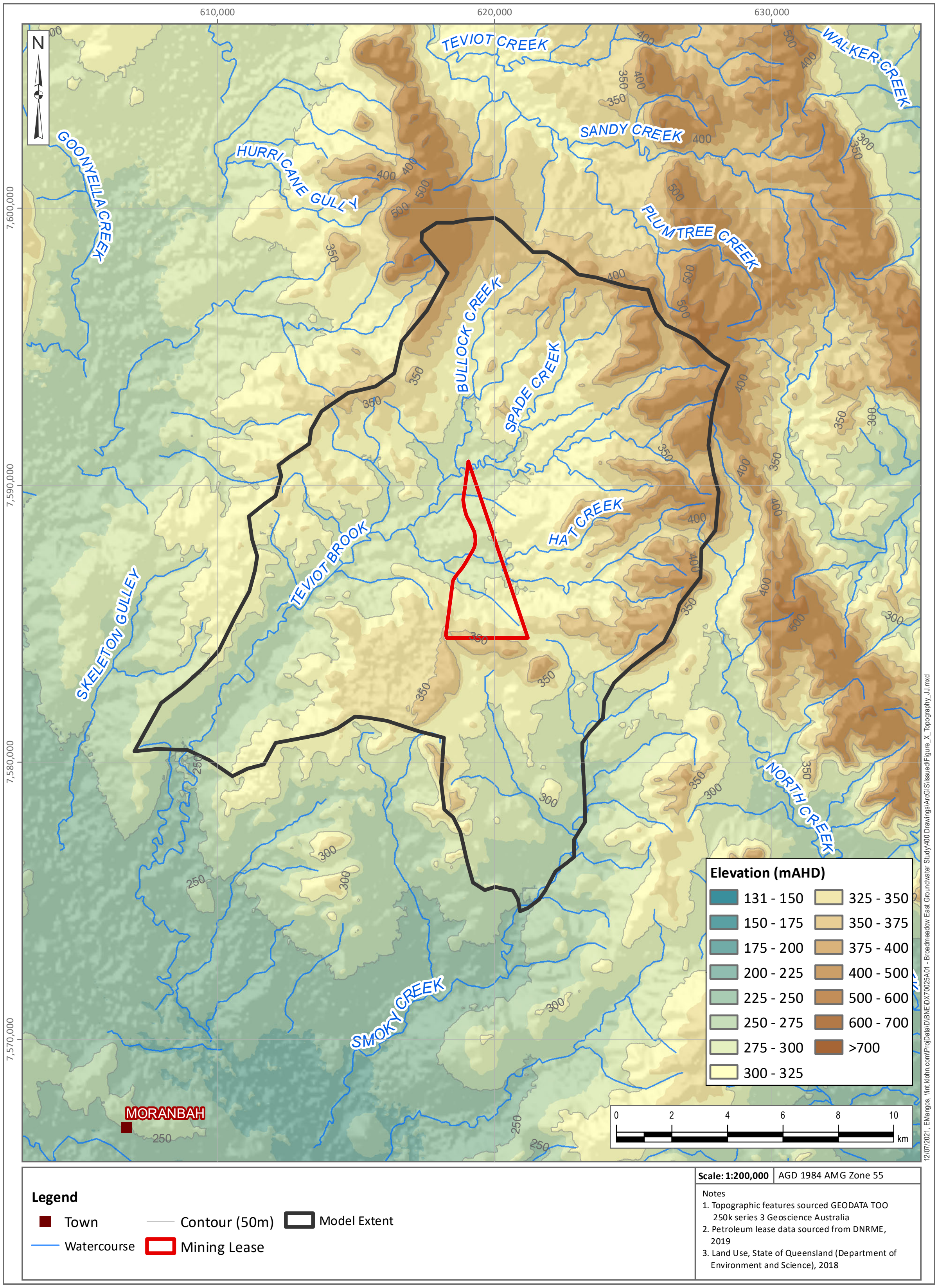


Figure IV-3.1 Surface Geology with Numerical Groundwater Model Extent



Notes
1. Topographic features sourced GEODATA TOO 250k series 3 Geoscience Australia
2. Petroleum lease data sourced from DNRME, 2019
3. Land Use, State of Queensland (Department of Environment and Science), 2018

Figure IV-3.2 Surface Topography with Numerical Groundwater Model Extent

IV-3.4 Model Processing and Discretisation

Algomesh was used to develop an unstructured grid based on Voronoi polygons and to calculate cell connectivity along with geometries of connected cell interfaces necessary for execution of the MODLOW-USG model. Grid mesh refinement was focused on the extent of the Quaternary alluvium, major surface water drainage lines, major structures and the proposed mine development areas. The key hydrostratigraphic units were refined with average mesh size ranges from 300 to 350 m, and the minimum allowable internal angle in any single cell was set to 30 degrees. The mining area was discretised into fine rectangular meshes with orientations in line with the mining schedule. The minimum cell thickness was set at 0.2 m, and as a result, Algomesh pinched-out all cells that have a thickness of <0.2 m.

The resulting grid cell mesh developed from these settings is shown in Figure IV-3.3 and Figure IV-3.4. Six model layers were used to represent the hydrostratigraphic units underlying the Project area; these are discussed further in the following section. The final model grid comprises 45,733 active cells.

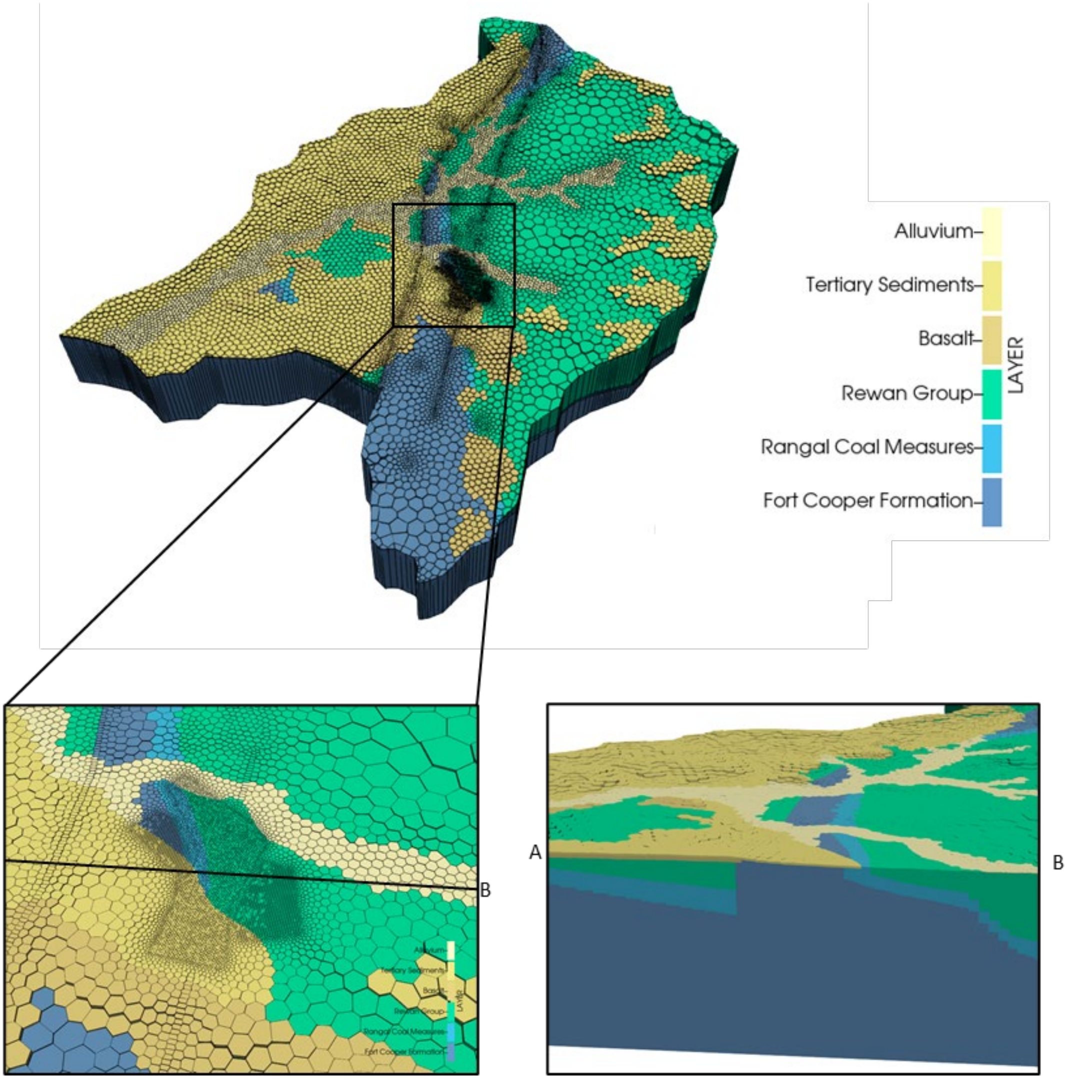
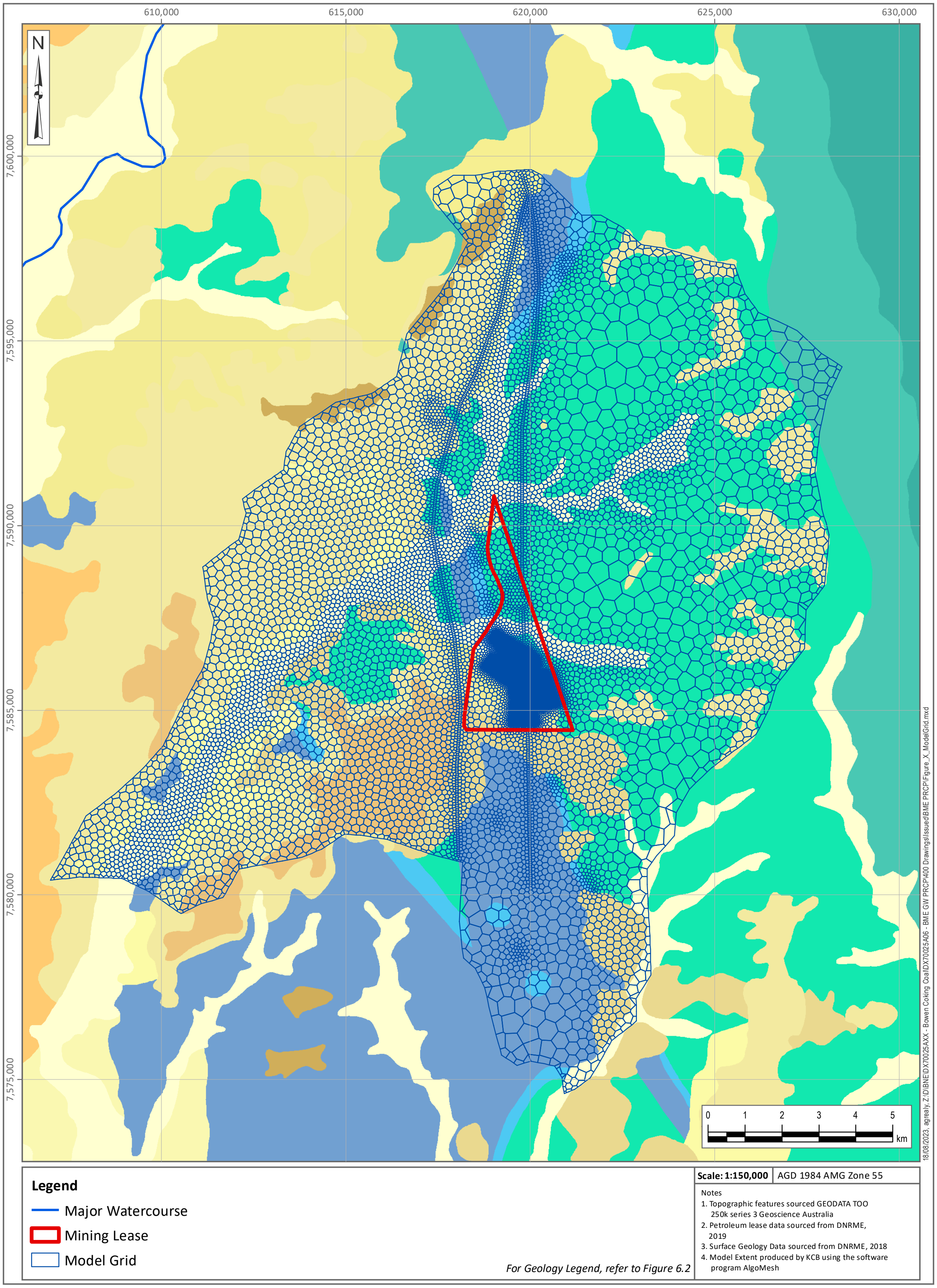


Figure IV-3.3 3D Diagram of Groundwater Model Geometry (Vertical Exaggeration = 2x)



For Geology Legend, refer to Figure 6.2

Notes
1. Topographic features sourced GEODATA TOO 250k series 3 Geoscience Australia
2. Petroleum lease data sourced from DNRME, 2019
3. Surface Geology Data sourced from DNRME, 2018
4. Model Extent produced by KCB using the software program AlgoMesh

Figure IV-3.4 Groundwater Model Domain and Grid Mesh

IV-3.5 Units and Datum

The time unit for the model is days and the length unit is metres. In the horizontal plane the model uses the AMG84 Zone 55 projection, while the vertical datum is the Australian Height Datum (AHD) in metres.

IV-3.6 Model Layers

The hydrostratigraphy of the Project area is represented by six (6) layers, which are predominantly discontinuous across the model domain. Table IV-3.1 and Figure IV-3.5 present the model layers and the primary geological units that are represented by each.

Table IV-3.1 Summary of Model Layers

Model Layer	Hydrogeological Unit	Geological Age
1	Alluvium	Quaternary
2	Tertiary Sediments	Tertiary
3	Basalt	
4	Rewan Group	Triassic
5	Rangal Coal Measures	Permian
6	Fort Cooper Coal Measures	

The Rangal Coal Measures are represented as one layer in the model, with the bottom of the Rangal Coal Measures representing the base of mining. Mining and dewatering occurs to the bottom of the Rangal Coal Measures and therefore the all coal seams and interburden units are captured within this layer and assigned the proportional average hydraulic properties of all layers. Hydraulic properties assigned are conservative but still represents the maximum water level drawdown and extent from the layer. This conservative approach has been adopted since the development of the first numerical groundwater model for the Project.

The surfaces that were used to develop the above layers are derived from the following:

1. Surfaces and isopachs provided by Zenith and RPM Golbal (formerly NitroSolutions).
2. Borehole logs from Geological Survey of Queensland drilled investigation holes.
3. Publicly available CSG drilling logs accessed from the QDEX database.
4. Surfaces and data from the Bowen Basin Supermodel 2000.
5. Outcrop locations of surface geology mapping.

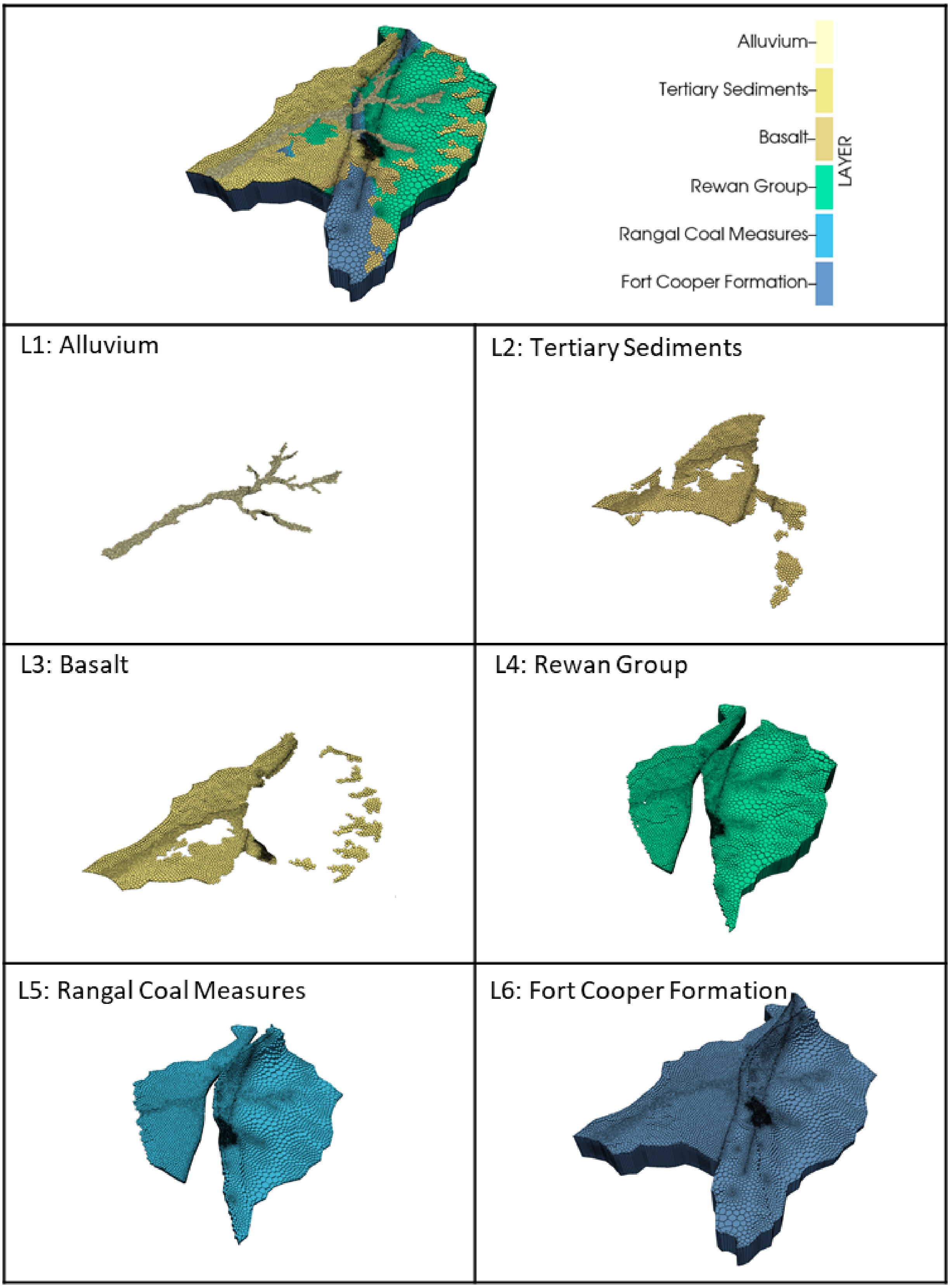


Figure IV-3.5 Layer Extents and Morphology in the Numerical Groundwater Model

IV-3.7 Model Boundary Conditions

Boundary conditions are necessary for the solution of the 3D groundwater flow equation that is implemented by MODFLOW-USG. These boundary conditions establish the groundwater fluxes, levels/pressures and stresses within the model.

The following boundary conditions have been adopted in the BME model:

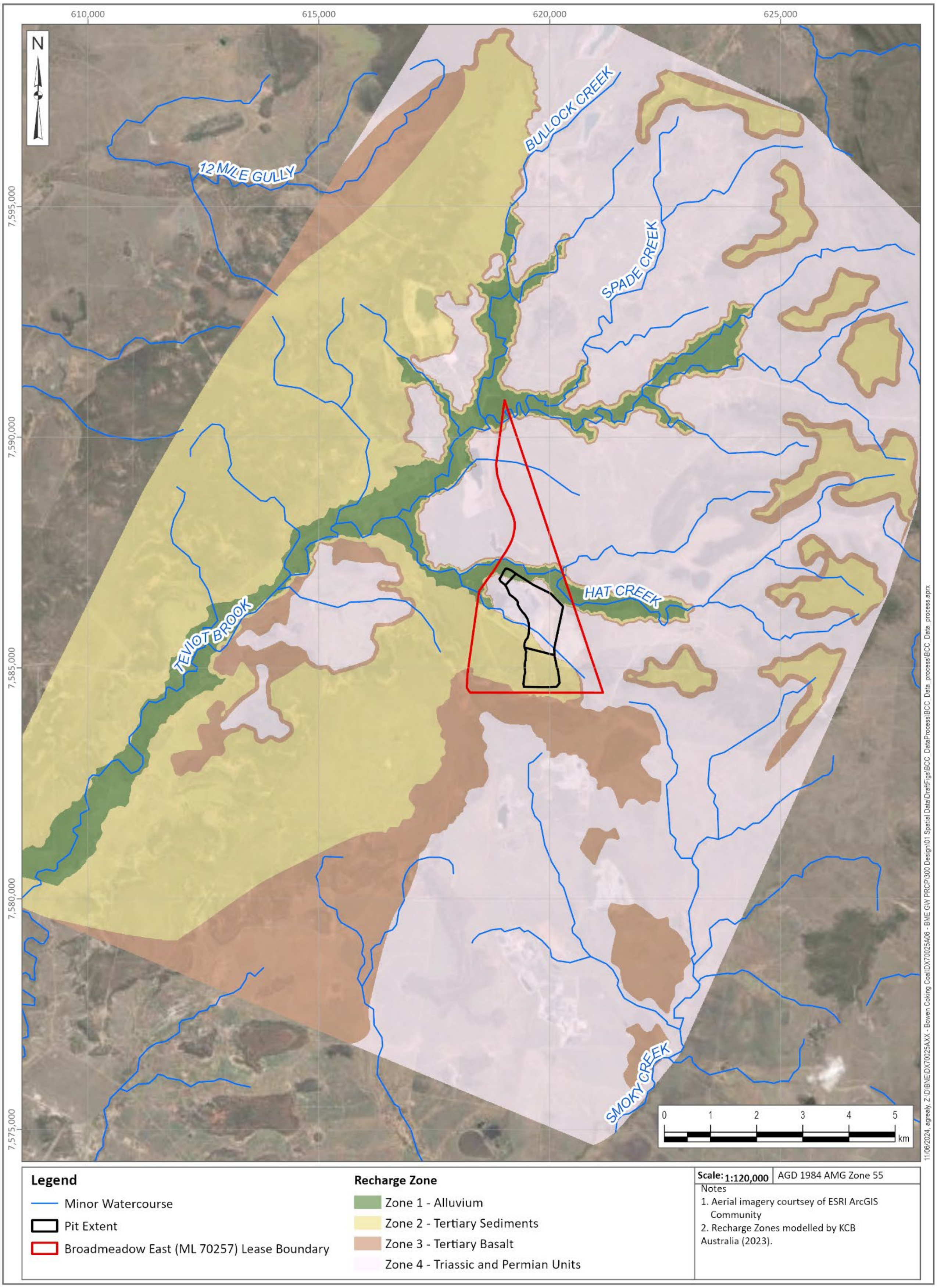
Recharge

Groundwater recharge was applied in zones (Figure IV-3.6) based on the extents of outcropping geological units, using the RCH package of MODFLOW. The four recharge zones defined for this model are the extents/outcrop of: Quaternary alluvium, Tertiary sediments, Tertiary basalt, and Triassic and Permian units.

Recharge rates for the model have been calculated as a percentage of historically recorded quarterly rainfall totals. The percentage of rainfall that enters the model as recharge in each zone was adjusted during calibration.

Evapotranspiration

Evapotranspiration is a boundary component of the water budget for the groundwater system. In this model, it has been implemented using the MODFLOW EVT package. A uniform extinction depth has been applied across the domain and set at 1.5 m below the natural surface, below which evaporative losses from the groundwater surface are zero. Where the groundwater elevation is above this level, water is removed from the system at a maximum rate of 1,200 mm/annum. This value is adopted from the average areal potential evapotranspiration map (BOM 2008); which is based on a standard 30-year climatology from 1961-1990.



Notes
1. Aerial imagery courtesy of ESRI ArcGIS Community
2. Recharge Zones modelled by KCB Australia (2023).

Figure IV-3.6 Recharge Zones

Drains

Drains cells have been used to simulate open cut activities across the model domain with the application of the MODFLOW Drains package (DRN). In the Project area, drains are placed in all layers above and including the target coal seam layer, in accordance with the mining schedule. Reference drain elevations were specified in accordance with this schedule, while conductance values for these drain cells were set nominally high values of more than 10 m^2/day.

The major water courses in the model domain are also represented using the drain cells. The surface drainage system of the area is ephemeral in nature, and when stream flows do happen, they are usually rapid and persist for short periods of time. In these drain cells the reference head was specified as the model top, and a conductance was calculated to be consistent with the hydraulic conductivity and dimensions of the cell in which they are placed.

A "no flow" boundary condition was applied to the base of the model located below the Fort Cooper Coal Measures. This boundary is located at a significant depth below the Project mining area and has no material influence on the model results.

General Head

General Head Boundary (GHB) cells (GHB package) were assigned around the active perimeter of the model domain and are applied to all layers of the model. Use of this boundary type allows for the representation of the regional groundwater flow. Conductance values applied to the GHB cells were calculated to be consistent with hydraulic conductivity values for each hydrostratigraphic unit and the dimensions of the boundary cells. A reference head for these cells was obtained from steady-state model heads in a pre-development scenario. This boundary is sufficiently distant from the Project area so as not to materially influence model prediction performance.

IV-3.8 Application of Hydraulic Parameters

Hydraulic properties for the model layers, corresponding to the various hydrostratigraphic units have been applied under the assumption of homogeneity across the model domain. Vertical hydraulic conductivity in all layers is calibrated as a factor of the horizontal hydraulic conductivity.

IV-3.9 Calibration Process and Metrics

Model calibration was performed based on the adjustment of model parameter values to allow better replication of historical observations of the system. The outcome of the calibration process also provides the initial conditions for transient predictive simulations used to assess changes to the groundwater regime through operations and closure.

The transient period used for model calibration consists of quarterly stress periods over the duration March 2019 to January 2023. This was preceded by a steady-state stress period to condition the model prior to the transient calibration. A quarterly stress period sequence was adopted for the predictive model runs.

IV-3.9.1 Calibration Approach

The Project area is located in a part of the Bowen Basin that is heavily exploited and comprises numerous mining operations that have previously been in operation. As a result, groundwater levels from monitoring bores adjacent to historical operations reflect the impacts of these mining activities (e.g. drawdown due to dewatering, recovery at the cessation of mining operations). Without an understanding of the historical mining activities and associated schedules, it is difficult to match modelled results with certain monitoring bores as part of the calibration process. Therefore, a review of the available monitoring bore network was undertaken to identify monitoring bores, and associated groundwater level records, that could be incorporated into the calibration process. Calibration focused on the more recent system conditions over the period March 2019 to January 2023.

The calibration model run was initiated as a steady-state simulation with boundary conditions applied to replicate known mining development before March 2019. After this initial model conditioning period, the model then progresses to transient mode for the aforementioned calibration period, during which quarterly stress periods are then implemented. This stress period interval readily accommodates the variations in rainfall records. All observations used as calibration targets pertain to the transient component of the simulation. A total of 28 adjustable parameters were used, and include hydraulic conductivities, storage properties and recharge factors.

IV-3.9.2 Calibration Targets

The calibration dataset comprised groundwater level measurements. These measurements were compiled from 18 monitoring bores for which reliable water level measurements were available over the transient calibration simulation period. In total, 192 individual measurements from monitoring bores were used in the calibration process. A number of monitoring bores installed across the Project area in the upper hydrostratigraphic units (e.g. Quaternary alluvium, Tertiary sediments, Tertiary basalt) are dry, indicating unsaturated conditions, and resulting in no groundwater level records. Despite the lack of groundwater level records from the upper hydrostratigraphic units, this unsaturated characteristic also provided a calibration criteria for the model.

Figure IV-3.7 presents a comparison between groundwater level measurements and the calibrated model output equivalents. A residual plot map is shown in Figure IV-3.7 and displays the distribution of the residual values across the area. During calibration, all measurements of the calibration dataset were given equal weight, resulting in the extraction of maximum information from the calibration dataset during estimation of parameters.

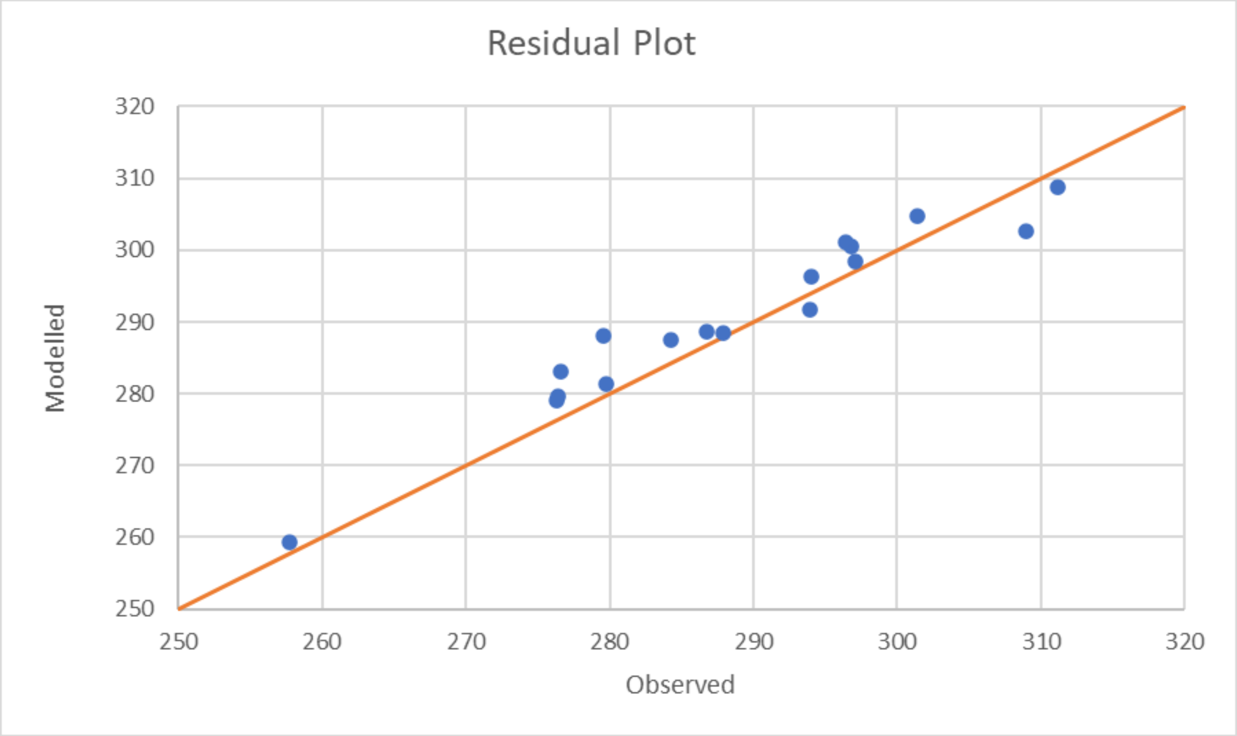


Figure IV-3.7 Calibration Residuals Results

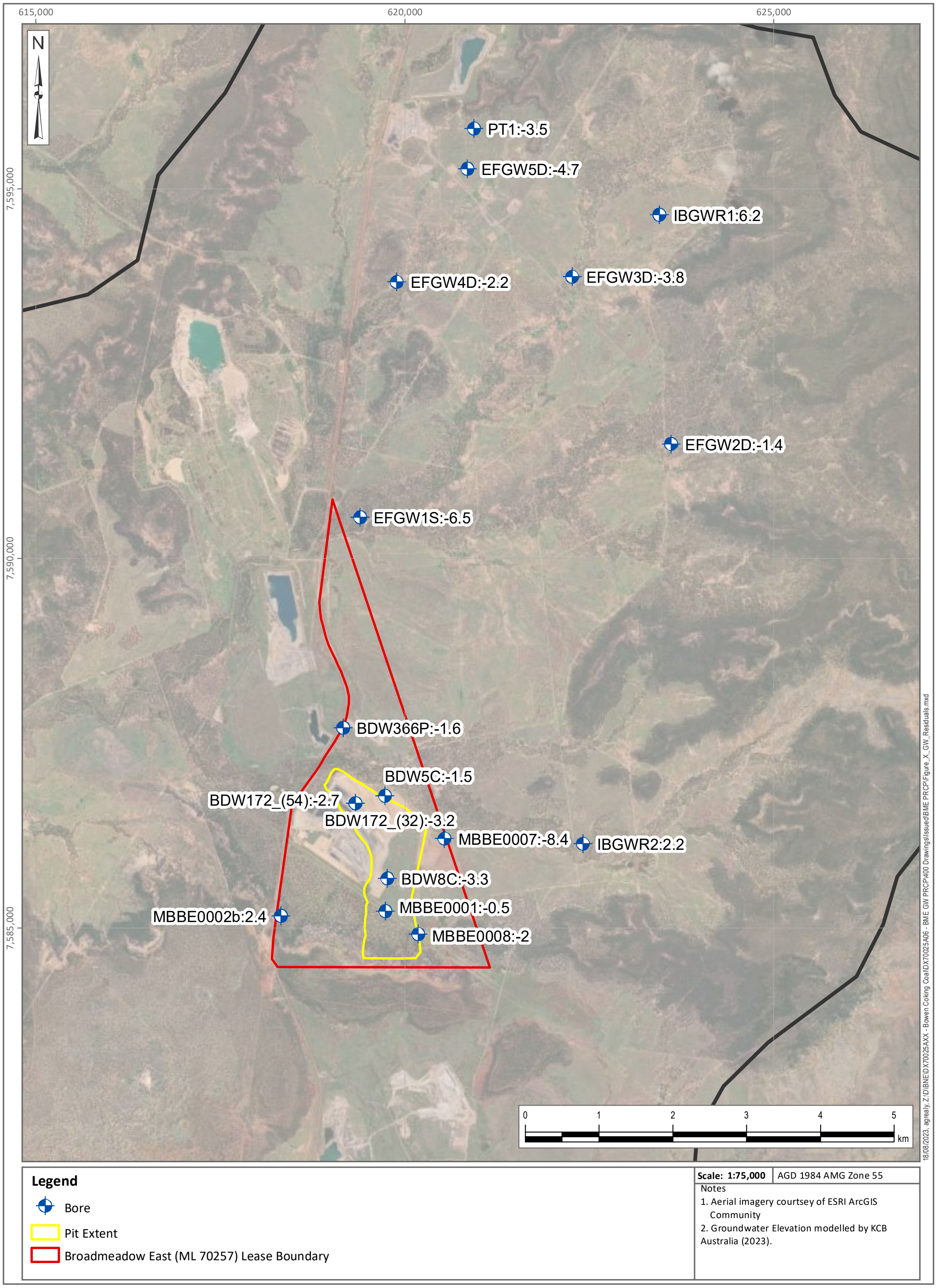


Figure IV-3.8 Residual plot map

Table IV-3.2 presents statistics from the calibration process. The scaled root Mean Square (SRMS) of errors from the calibration is 7.5%, which is within the guidance limits recommended by the Australian Groundwater Modelling Guidelines (Barnett et al. 2012) of 10% SRMS.

Table IV-3.2 Summary Model Calibration Performance

Statistical Metric	Value
Number of Observations	192
RMS error (m)	4.0
Scaled RMS (%)	7.5
Mean Sum of Residuals (m)	-2.1*
Scaled Mean Sum of Residuals (%)	-3.8
Correlation coefficient	0.89

**Negative value means overestimation; Positive value means underestimation.*

The groundwater elevation results for the end of the calibration period are shown in Figure IV-3.9.

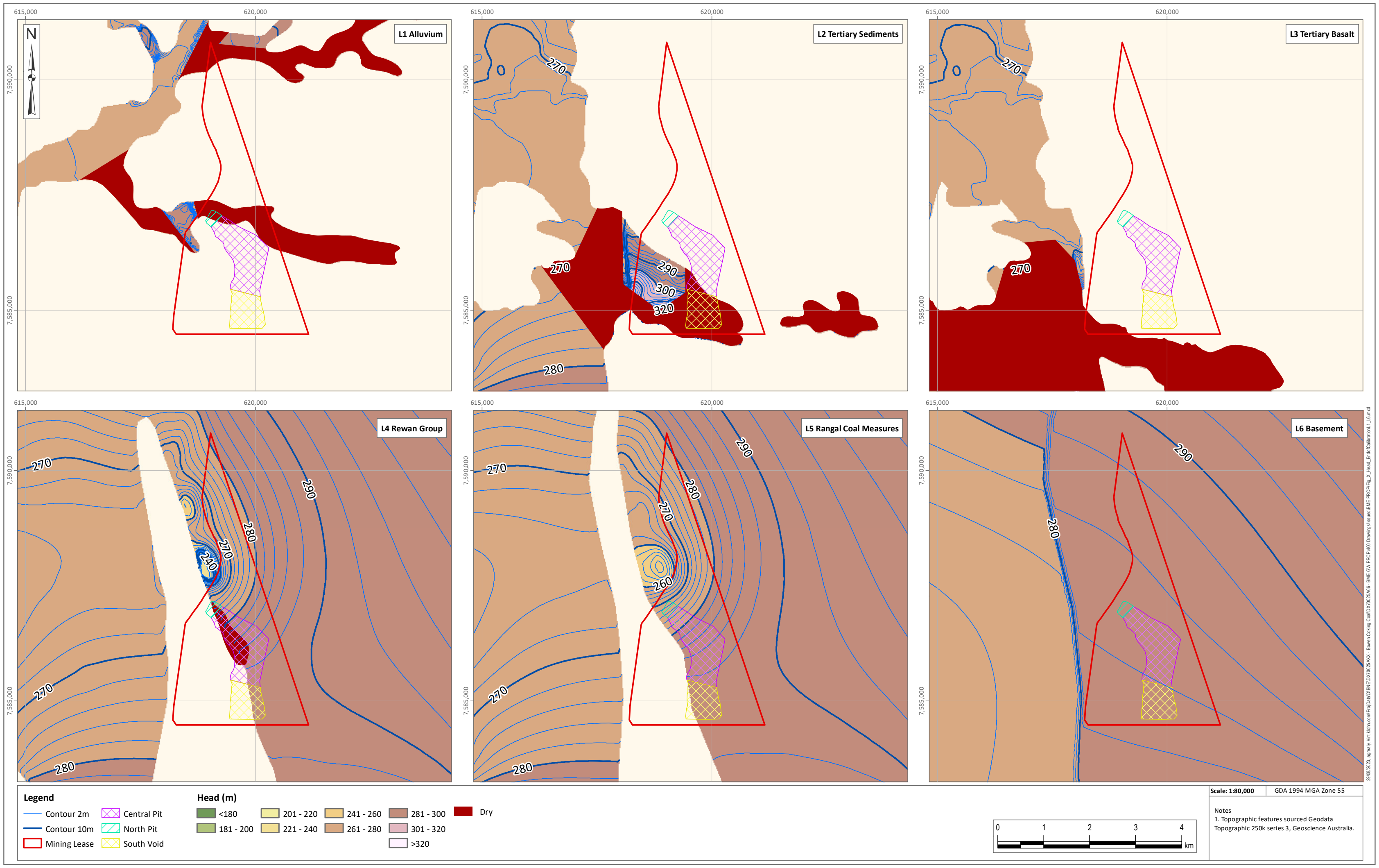


Figure IV-3.9 Groundwater Elevation at End of Calibration Period.

IV-3.10 Calibration Hydrographs

Hydrographs demonstrating the fit between modelled and measured observations, achieved through the calibration process, are shown in Figure IV-3.10.

The transient calibration results are based on monitored groundwater levels for each of the key hydrostratigraphic units within the vicinity of the Project area, in conjunction with data from monitoring bores located just outside of the Project area; which highlights the lateral and vertical distribution of the calibration targets.

Observed groundwater level monitoring records display seasonal variability, and these trends are successfully reflected by the transient calibration simulation. Therefore, the model calibration is considered robust and adequate for undertaking subsequent predictive simulations.

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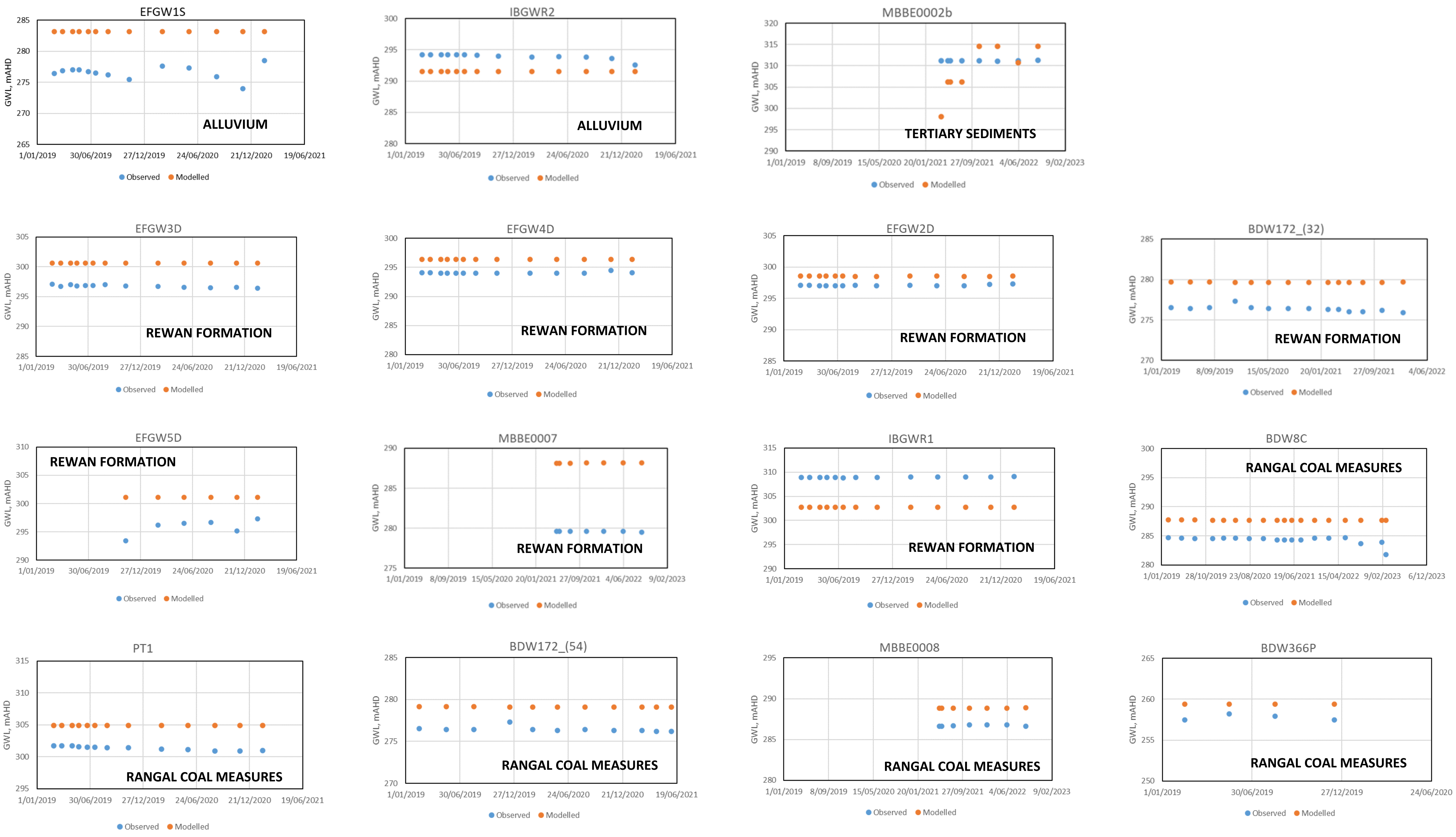


Figure IV-3.10 Modelled and Observed Hydrographs

IV-3.11 Calibrated Hydraulic Parameters

Table IV-3.3 provides a summary of calibrated hydraulic property values for each hydrostratigraphic unit represented in the model.

Table IV-3.3 Summary Calibrated Hydraulic Properties

Geological Unit	Calibrated Kxy (m/d)	Calibrated Kz (m/d)	Calibrated Specific Yield (-)	Calibrated Specific Storage (m^{-1})
Quaternary Alluvium	21.1	7.46	2.10E-01	5.13E-04
Tertiary Sediments	0.53	0.02	1.28E-03	4.86E-06
Tertiary Basalt	4.60	0.11	8.63E-03	2.64E-04
Rewan Group	0.0159	0.0011	7.08E-04	1.47E-05
Rangal Coal Measures	0.0037	0.0003	2.90E-03	1.33E-05
Fort Cooper Coal Measures	0.0019	4.33E-05	8.00E-04	3.14E-05

IV-3.12 Calibrated Recharge Rates

Recharge in the model was calculated as a percentage of recorded rainfall during each stress period of the calibration model run. Recharge values for the modelled recharge zones are provided in Table IV-3.4.

Table IV-3.4 Summary Calibrated Recharge Rates

Modelled Recharge Zone	Recharge (m/d)
Quaternary Alluvium	1.28E-06
Tertiary Sediments	9.32E-07
Tertiary Basalt	2.02E-07
Triassic and Permian Units	6.21E-08

IV-3.13 Calibrated Water Balance

The mass balance error of the transient calibration model represents the difference between model inflows and model outflows as calculated by the model. An error of approximately 1% is considered acceptable (Anderson and Woessner 1992). The water budget for the final stress period of the transient calibration model is presented in Table IV-3.5. A uniform extinction depth of 1.5 m below the ground surface has been applied across the model domain, therefore, when the groundwater level is below this depth losses from the model via evapotranspiration does not occur. During model calibration groundwater elevations are deeper than the prescribed extinction depth, therefore, an outflow flux vis evapotranspiration does not occur.

The results indicate a water balance error of less than 1%, and therefore convergence of the numerical solution of the groundwater flow problem has been achieved.

Table IV-3.5 Summary Water Balance at the End of Calibration Period

Water Budget Item	Inflow (m^3/day)	Outflow (m^3/day)
Storage	0.4	200.4
Recharge (Rainfall deep drainage)	418.6	0
GHB Throughflow (Regional flow across model extents and Current mines)	1,342.6	1,561.1
Evapotranspiration (from surface heating/vegetation)	0	0
TOTAL	**1,761.6**	**1,761.6**
Mass Balance error	**<1%**	

IV-3.14 Sensitivity Analysis

A sensitivity analysis was performed to assess the response of the model to varying hydraulic properties and recharge rates. This analysis provides a comparison of the influence of these properties on the outcomes of predictions made by the model.

Parameters that were assessed during predictive sensitivities were grouped and varied in the following manner:

- Horizontal (Kh) and vertical (Kv) hydraulic conductivity of all layers was varied by 10 % above and below their calibrated values;
- Specific storage (Ss) and specific yield (Sy) values for all layers was varied by 10 % above and below their calibrated values; and
- Recharge rates were varied by 10 % above and below their calibrated values.

Table IV-3.6 Summary results from Sensitivity Analysis

Statistical Metric	Base Case	Conductivity × 0.1	Recharge × 0.1	Ss & Sy × 0.1	Conductivity × 10	Recharge × 10	Ss & Sy × 10
Number of Observations	192						
RMS error (m)	4.0	15.6	7.7	3.8	17.2	15	3.8
Scaled RMS (%)	7.0	29.1	14.3	7.0	32.0	27.8	7.0
Mean Sum of Residuals (m)	-2.1	-10.6	2.1	-1.4	10.7	-10.2	-1.5
Scaled Mean Sum of Residuals (%)	-3.8	-19.7	3.9	-2.7	19.8	-19	-2.8
Correlation coefficient	0.89	0.89	0.7	0.92	0.83	0.9	0.92

IV-3.15 Model Classification

Barnett et al. (2012) developed a system to classify the confidence level of groundwater flow models based on the calibration process used, as well as the predictive capability of the model. Three classes of models were developed for the BME model: Class 1, Class 2, and Class 3. A Class 3 model has the greatest confidence level, and a Class 1 model has the least. Factors to consider when determining model confidence level are:

- Data availability;
- Calibration procedures;
- Consistency between calibration and predictive analyses; and
- Stresses induced on the model.

The model outlined in this report is considered a Class 2 model because:

- A transient calibration was undertaken, and mining-induced groundwater trends have been replicated;
- Independent observations and calculations were used to support the calibration process; and
- The water balance error is less than 1%.

The model meets the criteria for a Class 2 model and exceeds the criteria for a Class 1 model. The exceedance of the Class 1 classification is driven by the following:

- Model is calibrated and key calibration statistics have been achieved;
- Calibration has been undertaken to transient conditions; and
- Model parameters are within the range of conceptualised hydraulic parameters.

The model is therefore classified as being a suitable tool for assessing groundwater impacts that may arise as a result of the Project.

IV-4 MODEL PREDICTIONS

IV-4.1 Predictions Overview

Simulations to support the PRCP included two stages:

1. Simulation of the remaining operations from the end of the calibration period (2023) to the end of operations (2028).
2. Simulation of post-closure for a period of 1,000 years.

IV-4.2 Remaining Operations Simulation

IV-4.2.1 Model Set-Up

A predictive simulation was carried out until the end of operations in 2028 using the calibrated transient model. This included completion of the mining schedule within the open pit. Bowen Coking Coal provided KCB a mining schedule consisting of six-monthly dxf images. These files reflect mine progression from 2022 to 2028 and are illustrated in Addendum IV-A. The numerical model incorporated these files to simulate the mine schedule.

The simulation comprised quarterly stress periods for a six-year duration starting at the final time step of the transient calibration, which represents current conditions. The future climate (rainfall and evaporation) sequence applied to the model was inferred from climate modelling data from CSIRO. Water levels in the voids for the remaining operations were provided by Engeny. All other boundary conditions were carried over from the transient model.

Relevant parameters (hydraulic conductivity and specific yield) were assigned different values for the spoil/backfill in the North Void, Central backfilled pit, and South Void at timesteps informed by mine schedule plan. For example, a hydraulic conductivity of 10m/day was assigned to the backfill in North and South voids, and 1m/day for the Central pit. A specific yield (Sy) of 0.99 was assigned to the North and South voids and 0.2 to the C entral pit.

IV-4.2.2 Final Water Table

In Figure IV-4.1 the predicted difference in head between End of Calibration and End of Mining period is displayed.

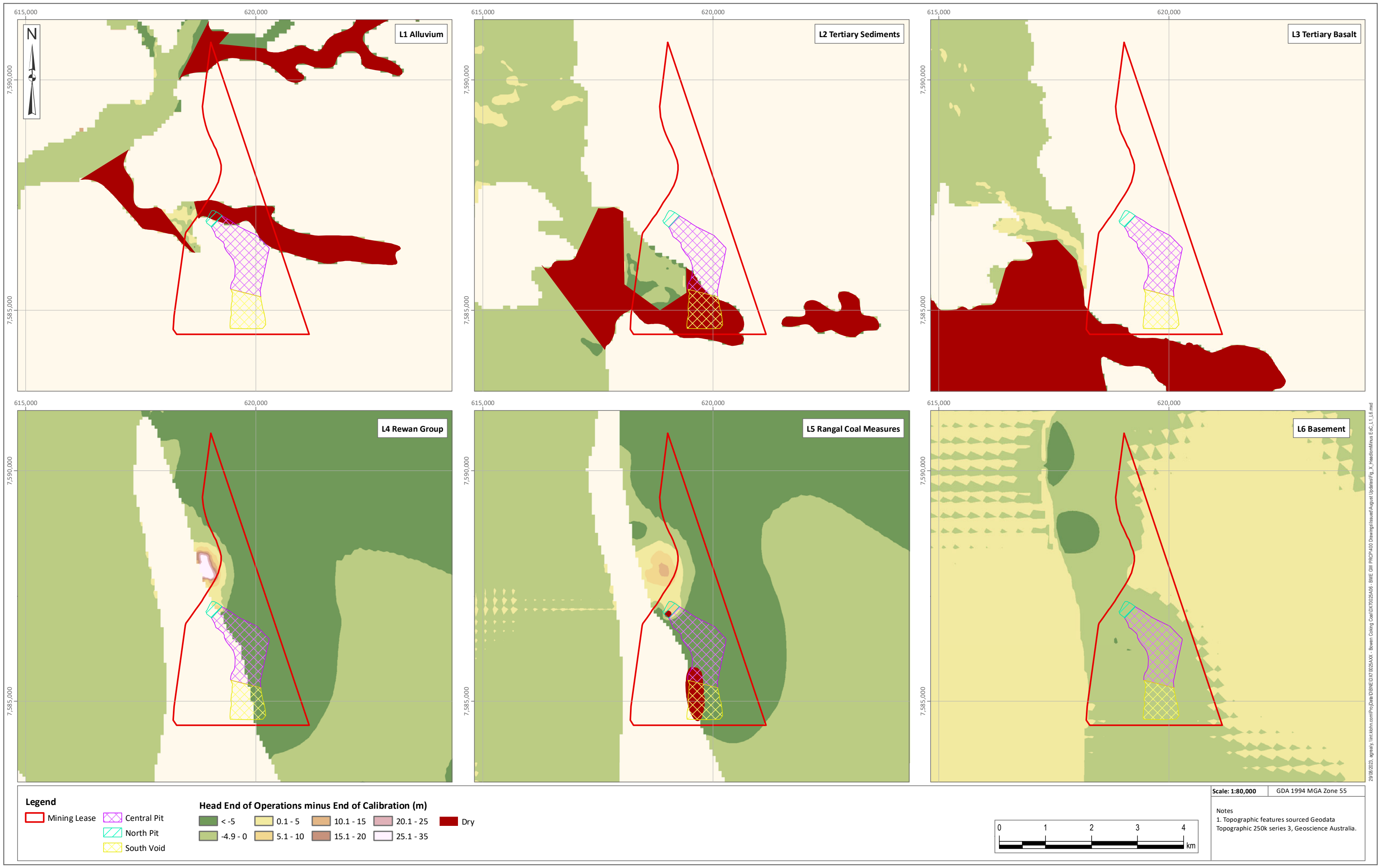


Figure IV-4.1 End of Operations Groundwater Head Difference – Model Layers

IV-4.3 Post-Closure

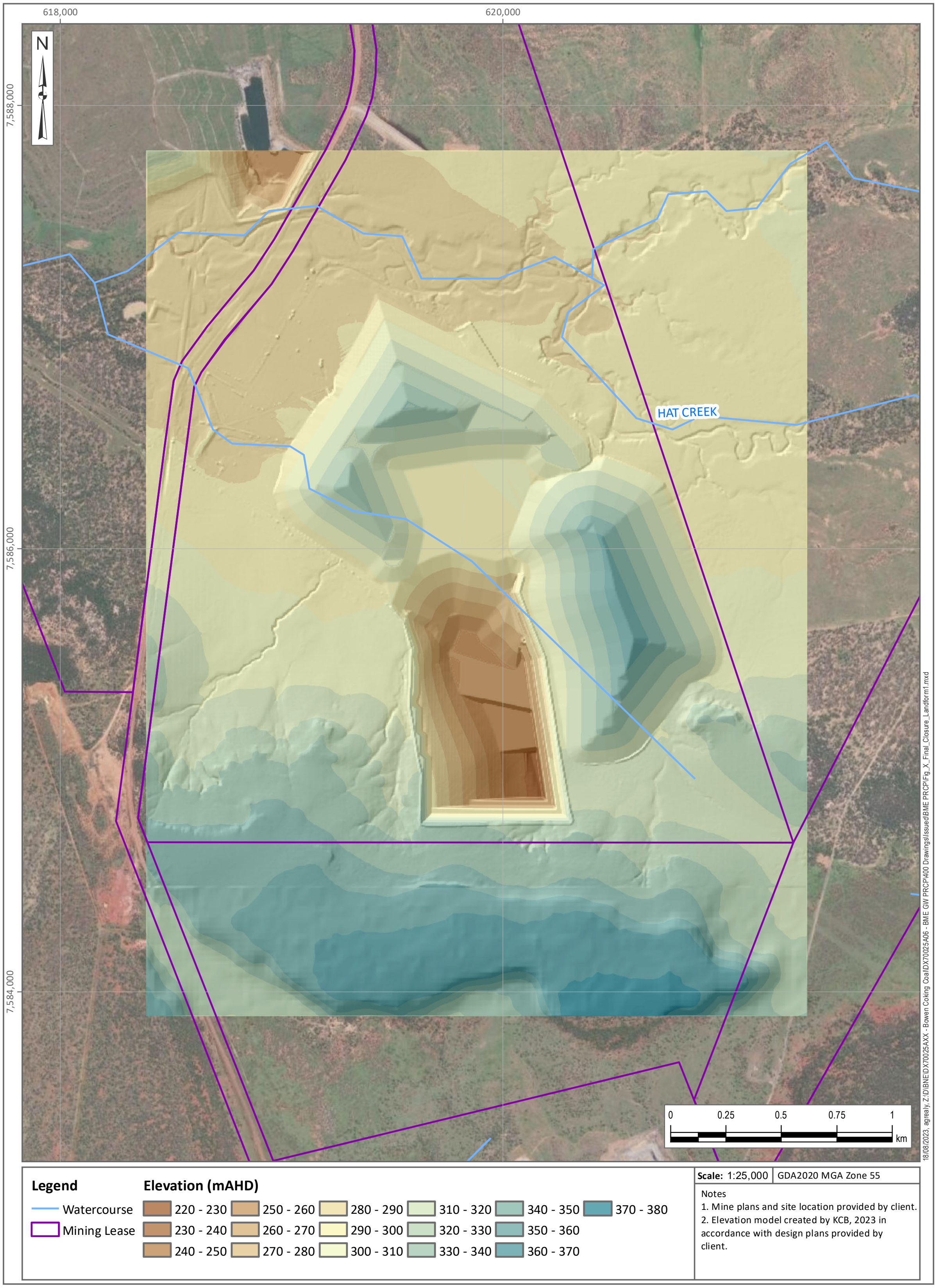
The simulation of post-closure groundwater conditions was undertaken to assess the final void water elevation within the proposed post-closure landform. The top surface of the model was updated to reflect the proposed post-closure landform, as shown in Figure IV-4.2. All active drains used to simulate dewatering were removed in the model to allow the system to recover.

Final pit void lake elevations were simulated by Engeny using a water balance model, as part of the surface water assessment. This water balance incorporated all contributing fluxes to the pit void, including the groundwater inflow.

The post-closure steady-state elevation of the pit void associated with the final landform were calculated by Engeny from the water balance model. The final void level was re-applied within the groundwater model using a GHB. Recharge and evaporation were not applied to the void as this was captured in the water balance model to identify the post-closure steady-state elevation.

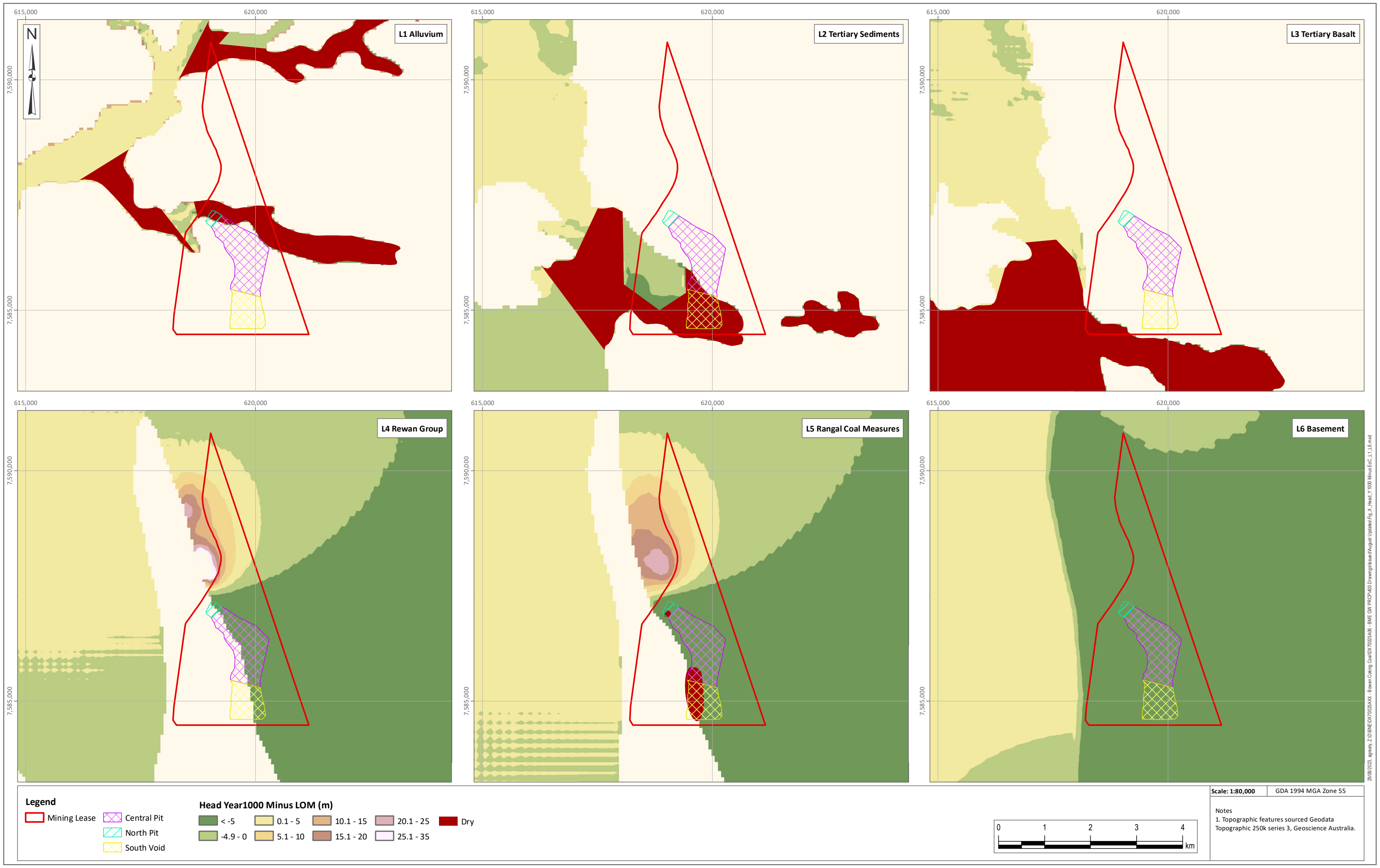
The average final level for the southern void is 250 mAHD, with long-term water levels in the void varying from 242 to 256 mRL.

The elevations for the void were applied to the groundwater model, using a GHB to simulate the post-closure groundwater conditions. The difference in groundwater head between End of Calibration period and 1000-years post-closure is shown in Figure IV-4.3.



Notes
1. Mine plans and site location provided by client.
2. Elevation model created by KCB, 2023 in accordance with design plans provided by client.

Figure IV-4.2 Final Landform Elevation and Void Modelled



Notes
1. Topographic features sourced Geodata Topographic 250k series 3, Geoscience Australia.

Figure IV-4.3 Groundwater Head Difference for End of Calibration and 1000-years Post-closure – Model Layers

REFERENCES

Anderson, Mary P., and William W. Woessner. 1992. *Applied Groundwater Modeling: Simulation of Flow and Advective Transport*. San Diego: Academic Press.

Barnett, B, LR Townley, V E A Post, RE Evans, RJ Hunt, LJM Peeters, S Richardson, AD Werner, A Knapton, and A Boronkay. 2012. ‘Australian Groundwater Modelling Guidelines’. Waterlines Report. Canberra: National Water Commission.

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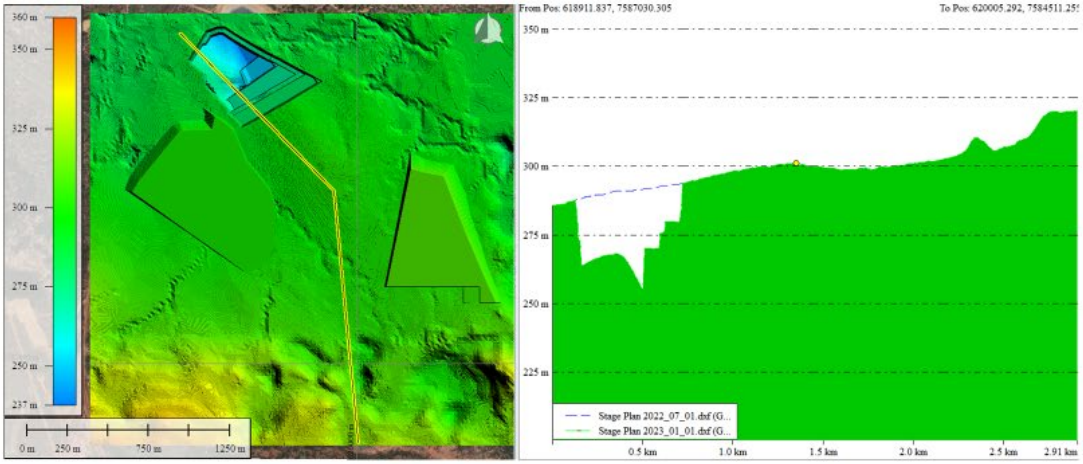
DES. 2021. ‘Guideline: Progressive Rehabilitation and Closure Plans (PRC Plans)’. ESR/2019/4964; Version 2.00. Queensland Government, Department of Environment and Science. https://environment.des.qld.gov.au/__data/assets/pdf_file/0026/95444/rs-gl-prc-plan.pdf.

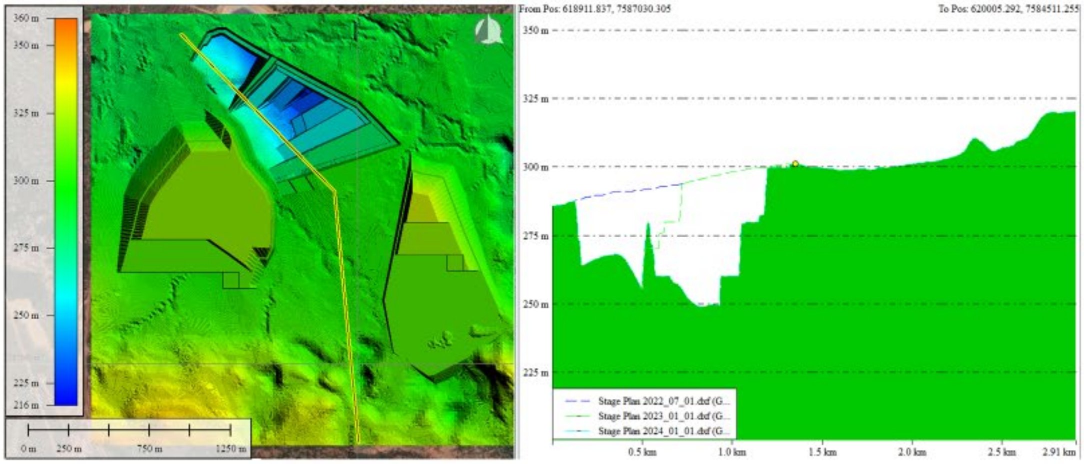
ADDENDUM IV-A

Yearly Mine Progression Schedule

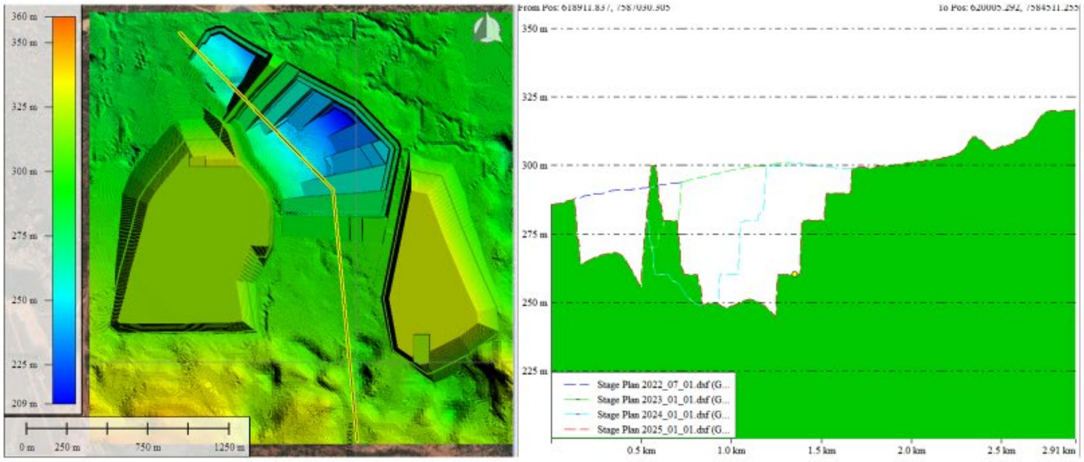
Mine Plan Stage – January 2023



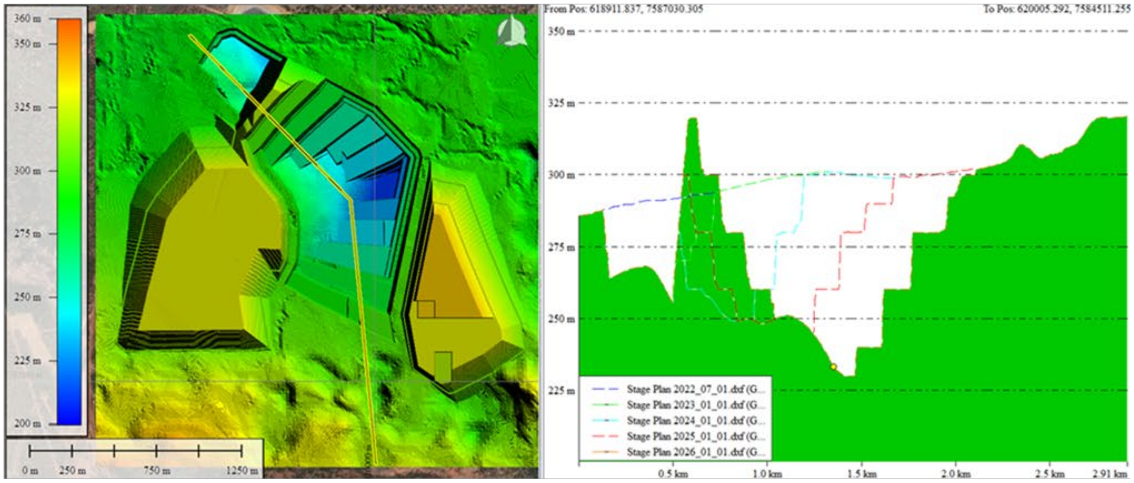
Mine Plan Stage – January 2024



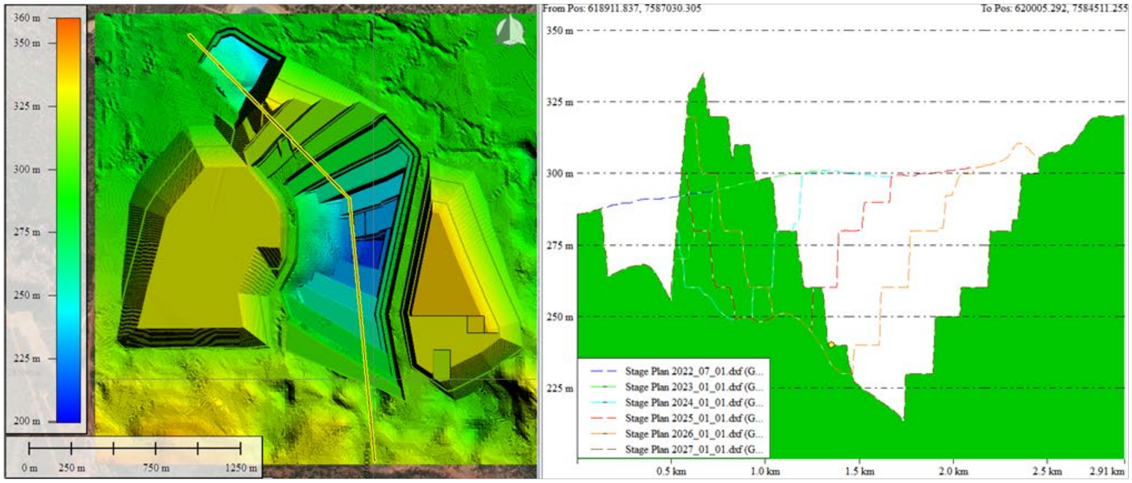
Mine Plan Stage – January 2025



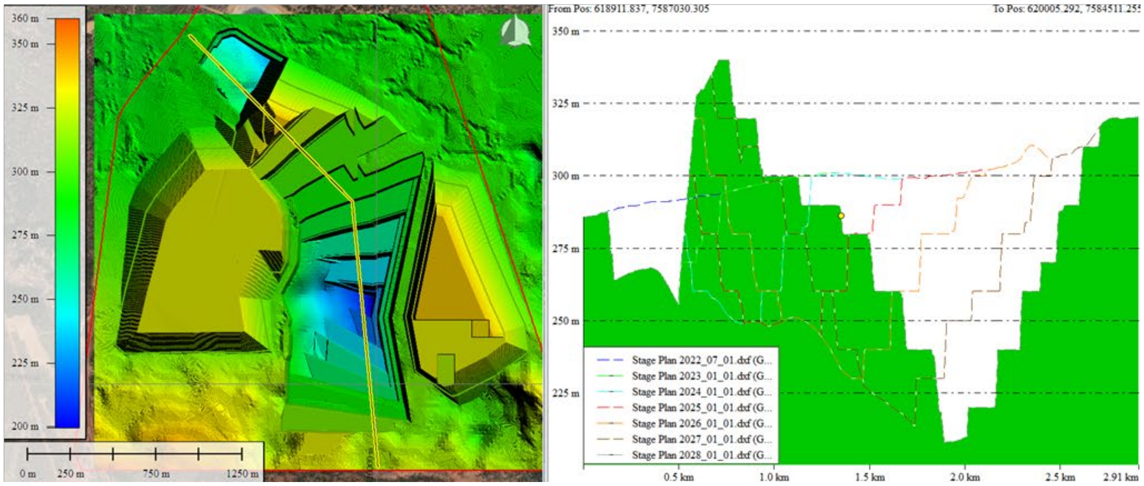
Mine Plan Stage – January 2026



Mine Plan Stage – January 2027



Mine Plan Stage – January 2028



Monitoring Point	Type	Group	Basin	Stream	~~Latitude~~ Easting (GDA20/Zone 55)	~~Longitude~~ Northing (GDA20/Zone 55)	Surface RL (m)	Install Date	Depth (m)	Screened Section (m)
eg. 422308C	*eg. Groundwater*	*eg. Alluvium*								
MBBE0001	Groundwater Compliance Bore	Rangal Coal Measures			619884	7585428	304.50	27/01/21	67.6 (mbGL)	63 to 66
MBBE0002b	Terrestrial GDE (riparian corridor near Hat and Spade Creek) Monitoring Bore	Tertiary Sediments			618436	7585329	323.00	28/01/21	60 (mbGL)	10 to 13
MBBE0003	Groundwater Monitoring Bore	Basalt			618431	7584664	346.00	28/01/21	20 (mbGL)	4 to 7
MBBE0004	Groundwater Monitoring Bore	Alluvium			620205	7586976	290.00	29/01/2021	6 (mbGL)	2 to 5
MBBE0005	Groundwater Monitoring Bore	Rewan Group			620519	7586210	284.00	29/01/2021	12 (mbGL)	4 to 7
MBBE0006	Mined Through	Alluvium			619173	7587205	284.00	29/01/2021	6 (mbGL)	N/A
MBBE0007	Groundwater Compliance Bore	Rewan Group			620615	7586415	297.10	16/04/2021	52 (mbGL)	40 to 46
MBBE0008	Groundwater Monitoring Bore	Rangal Coal Measures			620294	7585092	304.50	19/04/2021	135 (mbGL)	130 to 133
MBBE0009	Replacement - Groundwater Compliance Bore	Rangal Coal Measures			620376	7586715	291.65	18/10/2023	166 (mbGL)	104 to 110
MBBE0010	Replacement - Groundwater Monitoring Bore	Rewan Group			620362	7586723	291.63	20/10/2023	58 (mbGL)	52 to 58
MBBE0011	Replacement - Groundwater Monitoring Bore	Alluvium			619058	7587386	284.34	17/10/2023	8 (mbGL)	3 to 6
MBBE0012	Replacement - Groundwater Monitoring Bore	Rangal Coal Measures			619797	7584702	335.72	15/10/2023	58 (mbGL)	51 to 57
BDW172 (32)	Mined Through	Rewan Group			619376	7586650	289.00	August-99	32 (mbGL)	N/A
BDW172 (54)	Mined Through	Rangal Coal Measures			619376	7586650	289.00	August-99	54 (mbGL)	N/A
BDW5C	Mined Through	Rangal Coal Measures			619687	7586758	292.00	January-06	99 (mbGL)	N/A
BDW8C	Mined Through	Rangal Coal Measures			619782	7585651	302.00	January-06	79 (mbGL)	N/A

Monitoring Point	Date	Aluminium - Dissolved (µg/L)	Antimony - Dissolved (µg/L)	Arsenic - Dissolved (µg/L)	Boron - Dissolved (µg/L)	Electrical Conductivity (µS/cm)	Cadmium - Dissolved (µg/L)	Chromium - Dissolved (µg/L)	Cobalt - Dissolved (µg/L)	Copper - Dissolved (µg/L)	Lead - Dissolved (µg/L)	Manganese - Dissolved (µg/L)	Molybdenum - Dissolved (µg/L)	Nickel - Dissolved (µg/L)	pH (pH Units)	Selenium - Dissolved (µg/L)	Uranium - Dissolved (µg/L)	Vanadium - Dissolved (µg/L)	Zinc - Dissolved (µg/L)	Sulfate (mg/L)	Mercury- Dissolved (mg/L)	Free Cyanide (mg/L)	Weak Acid Dissociable Cyanide (mg/L)	Fluoride (mg/L)
BDW172 (32)	24/02/2021																							
BDW172 (32)	13/04/2021																							
BDW172 (32)	1/06/2021																							
BDW172 (32)	3/08/2021																							
BDW172 (32)	4/11/2021																							
BDW172 (32)	10/02/2022																							
BDW172 (54)	24/02/2021																							
BDW172 (54)	13/04/2021																							
BDW172 (54)	1/06/2021																							
BDW172 (54)	3/08/2021																							
BDW172 (54)	4/11/2021																							
BDW172 (54)	10/02/2022																							
BDW5C	24/02/2021	30	<1	<1		12200							<1		7.79	<10				<1	<0.0001			
BDW5C	13/04/2021																							
BDW5C	1/06/2021	<10	<1	<1		12500							<1		7.89	<10				<1	<0.0001			
BDW5C	3/08/2021																							
BDW5C	4/11/2021	10	<1	<1		11600							<1		7.9	<10				<1	<0.0001			
BDW5C	10/02/2022	10	<1	<1		16600							3		7.76	<10				<1	<0.0001			
BDW5C	2/06/2022	<10	<1	<1		12400							<1		7.67	<10				<1	<0.0001			
BDW5C	14/09/2022																							
BDW8C	24/02/2021	10	<1	3		3140							6		8.33	<10				<1	<0.0001			
BDW8C	13/04/2021																							
BDW8C	1/06/2021	<10	<1	2		3310							5		8.24	<10				<1	<0.0001			
BDW8C	3/08/2021																							
BDW8C	4/11/2021	20	<1	3		3110							6		8.39	<10				<1	<0.0001			
BDW8C	10/02/2022	20	<1	3		3130							6		8.45	<10				<1	<0.0001			
BDW8C	2/06/2022	10	<1	3		3130							6		8.2	<10				<1	<0.0001			
BDW8C	14/09/2022	110	<1	3		3050							5		8.37	<10				<1	<0.0001			
BDW8C	5/02/2023																							
BDW8C	5/03/2023	<10	<10	3		2700							6		8.49	<10				<1	<0.0001			
BDW8C	10/05/2023	20	<1	3		2630							4		8.34	<10				2	<0.0001			
BDW8C	7/07/2023	<10	<1	2		2520							3		8.32	<10				3	<0.0001			
BDW8C	31/08/2023	<10	<1	<1		1880							<1		8.3	<10				<1	<0.0001			
MBBE0001	23/02/2021																							
MBBE0001	24/02/2021	70	1	2		801							1		8.3	<10				<1	<0.0001			
MBBE0001	13/04/2021	80	<1	1		828							<1		7.78	<10				<1	<0.0001			
MBBE0001	1/06/2021	80	1	2		894							1		8.26	<10				<1	<0.0001			
MBBE0001	3/08/2021	60	<1	1		856							1		8.03	<10				<1	<0.0001			
MBBE0001	4/11/2021	40	<1	1		875							1		8.26	<10				<1	<0.0001			
MBBE0001	10/02/2022	30	<1	1		864							<1		8.11	<10				<1	<0.0001			
MBBE0001	2/06/2022	30	<1	1		903							<1		8.09	<10				<1	<0.0001			
MBBE0001	14/09/2022	10	<1	1		909							<1		7.96	<10				<1	<0.0001			
MBBE0001	5/02/2023																							
MBBE0001	5/03/2023	<10	<1	<1		896							<1		8.22	<10				<1	<0.0001			
MBBE0001	10/05/2023	20	<1	<1		896							<1		8.29	<10				<1	<0.0001			
MBBE0001	7/07/2023	20	3	<1		947							<1		8.2	<10				<1	<0.0001			
MBBE0001	31/08/2023	<10	<1	<1		860							<1		8.01	<10				<1	<0.0001			
MBBE0001	27/10/2023	20	<1	<1		943							<1		8.13	<10				<1	<0.0001			
MBBE0001	7/12/2023	<10		<1		858	<0.1	<1	<1	<1	<1		<1	<1	7.99	<0.2	<1		14	<0.500	<0.0001			
MBBE0002	23/02/2021																							
MBBE0002	13/04/2021	2500	<1	<1		4700							<1		5.12	<10				67	<0.0001			
MBBE0002	19/05/2021																							
MBBE0002	1/06/2021	4720	<1	<1		5200							<1		4.48	<10				53	<0.0001			
MBBE0002	3/08/2021	6730	<1	<1		4870							<1		4.57	<10				48	<0.0001			
MBBE0002	4/11/2021	6810	1	<1		4740							<1		4.13	<10				40	<0.0001			
MBBE0002	10/02/2022	6770	<1	<1		4650							<1		3.86	<10				48	<0.0001			
MBBE0002	2/06/2022	6430	6	<1		4760							<1		3.87	<10				46	<0.0001			
MBBE0002	14/09/2022	8020	<1	<1		4780							<1		3.69	<10				40	<0.0001			
MBBE0002	5/02/2023																							
MBBE0002	5/03/2023	8900	<1	<1		4880							<1		3.49	<10				35	<0.0001			
MBBE0002	10/05/2023	9520	<1	<1		5210							<1		3.56	<10				34	<0.0001			
MBBE0002	7/07/2023	9650	<1	<1		5440							<1		3.55	<10				32	<0.0001			
MBBE0002	31/08/2023	9180	<1	<1		5170							<1		3.76	<10				30	<0.0001			
MBBE0002	26/10/2023	9030	<1	<1		5390							<1		3.67	<10				29	<0.0001			
MBBE0002	7/12/2023	8860		<1		5070	1.1	61	78	24	3		<1	228	3.56	0.5	11		219	33.6	<0.0001			
MBBE0003	23/02/2021																							
MBBE0003	13/04/2021																							
MBBE0003	1/06/2021																							
MBBE0003	3/08/2021																							
MBBE0003	4/11/2021																							
MBBE0003	10/02/2022																							
MBBE0003	2/06/2022																							
MBBE0003	14/09/2022																							
MBBE0003	5/02/2023																							
MBBE0003	5/03/2023																							
MBBE0003	10/05/2023																							
MBBE0003	27/10/2023																							
MBBE0003	7/12/2023																							
MBBE0004	23/02/2021																							
MBBE0004	13/04/2021																							
MBBE0004	1/06/2021																							
MBBE0004	3/08/2021																							
MBBE0004	4/11/2021																							
MBBE0004	10/02/2022																							
MBBE0004	2/06/2022																							
MBBE0004	14/09/2022																							
MBBE0004	5/02/2023																							
MBBE0004	5/03/2023																							
MBBE0004	10/05/2023																							
MBBE0004	27/10/2023																							
MBBE0004	7/12/2023																							
MBBE0005	23/02/2021																							
MBBE0005	13/04/2021																							
MBBE0005	1/06/2021																							
MBBE0005	3/08/2021																							
MBBE0005	4/11/2021																							
MBBE0005	10/02/2022																							
MBBE0005	2/06/2022																							
MBBE0005	14/09/2022																							
MBBE0005	5/02/2023																							
MBBE0005	5/03/2023																							
MBBE0005	10/05/2023																							
MBBE0005	27/10/2023																							
MBBE0005	7/12/2023																							
MBBE0006	23/02/2021																							
MBBE0006	24/02/2021																							
MBBE0006	13/04/2021																							
MBBE0006	1/06/2021																							
MBBE0006	3/08/2021																							
MBBE0006	4/11/2021																							
MBBE0006	10/02/2022																							
MBBE0006	2/06/2022																							
MBBE0006	8/08/2022																							
MBBE0006	14/09/2022																							
MBBE0007	19/05/2021																							
MBBE0007	1/06/2021	370	<10	<10		48200							21		7.53	<100				943	<0.0001			
MBBE0007	3/08/2021	<50	<5	<5		47600							20		7.34	<50				907	<0.0001			
MBBE0007	4/11/2021	<50	<5	<5		40200							26		7.79	<50				850	<0.0001			
MBBE0007	10/02/2022	<50	<5	<5		48600							20		7.51	<50				876	<0.0001			
MBBE0007	2/06/2022	640	<5	<5		47900							26		7.34	<50				926	<0.0001			
MBBE0007	14/09/2022	<50	<5	<5		56400							15		7.63	<50				956	<0.0001			
MBBE0007	5/02/2023																							
MBBE0007	6/03/2023	<50	<5	<5		45200							15		7.52	<50				940	<0.0001			
MBBE0007	10/05/2023	<50	<5	<5		43000							15		7.66	<50				966	<0.0001			
MBBE0007	7/07/2023	<50	<5	<5		47900							27		7.47	<50				912	<0.0001			
MBBE0007	31/08/2023	<50	<5	<5		45400							10		7.45	<50				927	<0.0001			
MBBE0007	27/10/2023	70	<5	<5		46300							12		7.58	<50				991	<0.0001			
MBBE0007	7/12/2023	<50		<5		48600	<0.5	<5	<5	<5	<5		9	<5	7.4	<2	<5		<25	1060	<0.0001			
MBBE0008	19/05/2021																							
MBBE0008	1/06/2021	90	<1	1		1520							3		8.72	<10				1	<0.0001			
MBBE0008	3/08/2021	120	<1	1		1510							4		8.65	<10				1	<0.0001			
MBBE0008	4/11/2021	160	<1	1		1520							2		8.57	<10				<1	<0.0001			
MBBE0008	10/02/2022	160	1	<1		1510							2		8.62	<10				<1	<0.0001			
MBBE0008	2/06/2022	90	<1	<1		1550							1		8.34	<10				<1	<0.0001			
MBBE0008	14/09/2022	50	<1	<1		1510							1		8.49	<10				<1	<0.0001			
MBBE0008	5/02/2023	20	<1	<1		1521							1		8.51	<10				<1	<0.0001			
MBBE0008	5/03/2023	20	<1	<1		1500							1		8.6	<10				<1	<0.0001			
MBBE0008	10/05/2023	60	<1	<1		1520							<1		8.47	<10				1	<0.0001			
MBBE0008	7/07/2023	50	<1	<1		1570							<1		8.52	<10				<1	<0.0001			
MBBE0008	31/08/2023	30	<1	<1		1440							<1		8.29	<10				<1	<0.0001			
MBBE0008	27/10/2023	60	<1	<1		1550							<1		8.34	<10				<1	<0.0001			
MBBE0008	7/12/2023	30		<1		1560	<0.1	<1	<1	1	<1		1	<1	8.23	<0.2	<1		30	1.59	<0.0001			
MBBE0009	27/10/2023	<10	<1	2		11100							8		7.94	<10				42	<0.0001			
MBBE0009	3/11/2023																							
MBBE0009	7/12/2023	<10		4		9160	<0.1	<1	<1	<1	<1		22	<1	8.32	0.4	4		<5	48.2	<0.0001			
MBBE0010	27/10/2023	<10	17	22		23300							<1		7.7	<10				122	<0.0001			
MBBE0010	3/11/2023																							
MBBE0010	7/12/2023	<10		12		19800	<0.1	<1	6	<1	<1		2	8	7.04	<2	8		25	43.7	<0.0001			
MBBE0011	7/12/2023																							
MBBE0012	27/10/2023	<10	2	2		737							<1		7.88	<10				44	<0.0001			
MBBE0012	3/11/2023																							
MBBE0012	13/11/2023																							
MBBE0012	13/11/2023	<10	<1	<1		626							<1		8.13	<10				39	<0.0001			
MBBE0012	7/12/2023	10		<1		642	<0.1	<1	<1	<1	<1		<1	<1	7.89	<0.2	<1		<5	40.6	<0.0001			

MonitoringPoint	Date	Calcium	Magnesium	Sodium	Potassium	Chloride	Sulphate	Bicarbonate	CarbonateAlkalinity	Total Alkalinity as CaCO3	Hydroxide Alkalinity as CaCO3
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
BDW172_(32)	24/02/2021										
BDW172_(32)	13/04/2021										
BDW172_(32)	1/06/2021										
BDW172_(32)	3/08/2021										
BDW172_(32)	4/11/2021										
BDW172_(32)	10/02/2022										
BDW172_(54)	24/02/2021										
BDW172_(54)	13/04/2021										
BDW172_(54)	1/06/2021										
BDW172_(54)	3/08/2021										
BDW172_(54)	4/11/2021										
BDW172_(54)	10/02/2022										
BDW5C	24/02/2021	278	90	2230	13	4570	<1	111	<1	111	<1
BDW5C	13/04/2021										
BDW5C	1/06/2021	294	84	2110	14	4330	<1	112	<1	112	<1
BDW5C	3/08/2021										
BDW5C	4/11/2021	256	84	2300	14	4400	<1	118	<1	118	<1
BDW5C	10/02/2022	472	182	2740	17	6130	<1	200	<1	200	<1
BDW5C	2/06/2022	250	91	2440	14	4360	<1	112	<1	112	<1
BDW5C	14/09/2022										
BDW8C	24/02/2021	28	14	642	5	907	<1	367	4	371	<1
BDW8C	13/04/2021										
BDW8C	1/06/2021	28	14	622	6	828	<1	377	<1	377	<1
BDW8C	3/08/2021										
BDW8C	4/11/2021	25	13	655	5	805	<1	380	12	392	<1
BDW8C	10/02/2022	26	14	601	5	840	<1	370	16	386	<1
BDW8C	2/06/2022	25	14	697	5	815	<1	351	<1	351	<1
BDW8C	14/09/2022	26	11	593	5	827	<1	388	16	404	<1
BDW8C	5/02/2023										
BDW8C	5/03/2023	19	10	560	4	744	<1	350	21	371	<1
BDW8C	10/05/2023	21	10	556	5	692	2	334	8	342	<1
BDW8C	7/07/2023	16	9	489	4	641	3	377	6	383	<1
BDW8C	31/08/2023	11	6	420	3	531	<1	291	12	302	<1
MBBE0001	23/02/2021										
MBBE0001	24/02/2021	11	8	160	6	140	<1	230	<1	230	<1
MBBE0001	13/04/2021	12	8	161	6	130	<1	226	<1	226	<1
MBBE0001	1/06/2021	11	7	157	6	131	<1	236	<1	236	<1
MBBE0001	3/08/2021	10	7	167	6	137	<1	237	<1	237	<1
MBBE0001	4/11/2021	10	7	177	6	133	<1	252	<1	252	<1
MBBE0001	10/02/2022	10	7	171	5	147	<1	249	<1	249	<1
MBBE0001	2/06/2022	11	7	195	6	149	<1	235	<1	235	<1
MBBE0001	14/09/2022	10	6	179	5	154	<1	264	<1	264	<1
MBBE0001	5/02/2023										
MBBE0001	5/03/2023	10	6	189	5	153	<1	243	<1	243	<1
MBBE0001	10/05/2023	11	6	190	6	156	<1	227	3	230	<1
MBBE0001	7/07/2023	11	7	182	5	155	<1	266	<1	266	<1
MBBE0001	31/08/2023	10	6	174	5	150	<1	234	<1	234	<1
MBBE0001	27/10/2023	10	6	198	5	144	<1	252	<1	252	<1
MBBE0001	7/12/2023	9	6	175	5	153	<0.500	231	<1	231	<1
MBBE0002	23/02/2021										
MBBE0002	13/04/2021	73	152	669	2	1520	67	5	<1	5	<1
MBBE0002	19/05/2021										
MBBE0002	1/06/2021	57	145	612	3	1530	53	<1	<1	<1	<1
MBBE0002	3/08/2021	52	147	658	2	1590	48	<1	<1	<1	<1
MBBE0002	4/11/2021	48	149	676	2	1520	40	<1	<1	<1	<1
MBBE0002	10/02/2022	39	135	639	1	1460	48	<1	<1	<1	<1
MBBE0002	2/06/2022	35	134	648	1	1480	46	<1	<1	<1	<1
MBBE0002	14/09/2022	40	158	688	2	1590	40	<1	<1	<1	<1
MBBE0002	5/02/2023										
MBBE0002	5/03/2023	35	165	690	1	1640	35	<1	<1	<1	<1
MBBE0002	10/05/2023	40	171	694	2	1670	34	<1	<1	<1	<1
MBBE0002	7/07/2023	37	177	681	1	1670	32	<1	<1	<1	<1
MBBE0002	31/08/2023	37	171	636	1	1690	30	<1	<1	<1	<1

MBBE0002	26/10/2023	38	177	700	1	1680	29	<1	<1	<1	<1
MBBE0002	7/12/2023	31	162	659	2	1620	33.6	<1	<1	<1	<1
MBBE0003	23/02/2021										
MBBE0003	13/04/2021										
MBBE0003	1/06/2021										
MBBE0003	3/08/2021										
MBBE0003	4/11/2021										
MBBE0003	10/02/2022										
MBBE0003	2/06/2022										
MBBE0003	14/09/2022										
MBBE0003	5/02/2023										
MBBE0003	5/03/2023										
MBBE0003	10/05/2023										
MBBE0003	27/10/2023										
MBBE0003	7/12/2023										
MBBE0004	23/02/2021										
MBBE0004	13/04/2021										
MBBE0004	1/06/2021										
MBBE0004	3/08/2021										
MBBE0004	4/11/2021										
MBBE0004	10/02/2022										
MBBE0004	2/06/2022										
MBBE0004	14/09/2022										
MBBE0004	5/02/2023										
MBBE0004	5/03/2023										
MBBE0004	10/05/2023										
MBBE0004	27/10/2023										
MBBE0004	7/12/2023										
MBBE0005	23/02/2021										
MBBE0005	13/04/2021										
MBBE0005	1/06/2021										
MBBE0005	3/08/2021										
MBBE0005	4/11/2021										
MBBE0005	10/02/2022										
MBBE0005	2/06/2022										
MBBE0005	14/09/2022										
MBBE0005	5/02/2023										
MBBE0005	5/03/2023										
MBBE0005	10/05/2023										
MBBE0005	27/10/2023										
MBBE0005	7/12/2023										
MBBE0006	23/02/2021										
MBBE0006	24/02/2021										
MBBE0006	13/04/2021										
MBBE0006	1/06/2021										
MBBE0006	3/08/2021										
MBBE0006	4/11/2021										
MBBE0006	10/02/2022										
MBBE0006	2/06/2022										
MBBE0006	8/08/2022										
MBBE0006	14/09/2022										
MBBE0007	19/05/2021										
MBBE0007	1/06/2021	1730	1220	8130	84	18700	943	116	<1	116	<1
MBBE0007	3/08/2021	1710	1390	9160	75	18500	907	106	<1	106	<1
MBBE0007	4/11/2021	1450	1540	8870	74	18600	850	142	<1	142	<1
MBBE0007	10/02/2022	1300	1530	8040	69	18700	876	139	<1	139	<1
MBBE0007	2/06/2022	1230	1770	8960	73	18600	926	157	<1	157	<1
MBBE0007	14/09/2022	1080	1470	8400	68	19000	956	218	<1	218	<1
MBBE0007	5/02/2023										
MBBE0007	6/03/2023	1200	1600	8330	73	17300	940	208	<1	208	<1
MBBE0007	10/05/2023	1390	1140	8420	93	16500	966	144	<1	144	<1
MBBE0007	7/07/2023	1240	1480	8910	77	17400	912	234	<1	234	<1
MBBE0007	31/08/2023	1410	1080	8390	104	16600	927	142	<1	142	<1
MBBE0007	27/10/2023	1520	1080	8190	102	17200	991	152	<1	152	<1
MBBE0007	7/12/2023	1350	1010	7710	99	16100	1060	142	<1	142	<1
MBBE0008	19/05/2021										

MBBE0008	1/06/2021	4	<1	323	5	234	1	408	25	433	<1
MBBE0008	3/08/2021	2	1	340	4	240	1	408	25	433	<1
MBBE0008	4/11/2021	3	1	352	3	235	<1	434	25	459	<1
MBBE0008	10/02/2022	4	<1	342	3	246	<1	431	30	461	<1
MBBE0008	2/06/2022	4	1	384	2	248	<1	421	22	442	<1
MBBE0008	14/09/2022	6	1	353	2	256	<1	469	23	492	<1
MBBE0008	5/02/2023	4	1	349	2	256	<1	418	28	446	<1
MBBE0008	5/03/2023	4	<1	349	2	255	<1	418	28	446	<1
MBBE0008	10/05/2023	8	2	372	3	260	1	394	20	414	<1
MBBE0008	7/07/2023	5	1	342	2	249	<1	448	27	475	<1
MBBE0008	31/08/2023	8	2	343	2	254	<1	409	13	422	<1
MBBE0008	27/10/2023	7	1	370	2	239	<1	445	13	457	<1
MBBE0008	7/12/2023	7	2	322	2	282	1.59	429	<1	429	<1
MBBE0009	27/10/2023	196	82	2150	20	4040	42	150	<1	150	<1
MBBE0009	3/11/2023										
MBBE0009	7/12/2023	64	45	1800	44	3290	48.2	37	<1	37	<1
MBBE0010	27/10/2023	721	368	4030	27	8800	122	126	<1	126	<1
MBBE0010	3/11/2023										
MBBE0010	7/12/2023	588	189	3410	20	7080	43.7	88	<1	88	<1
MBBE0011	7/12/2023										
MBBE0012	27/10/2023	11	11	130	7	106	44	164	<1	164	<1
MBBE0012	3/11/2023										
MBBE0012	13/11/2023										
MBBE0012	13/11/2023	8	12	118	7	75	39	164	<1	164	<1
MBBE0012	7/12/2023	8	11	109	6	82	40.6	162	<1	162	<1

Station Name	Station Number	Date	Rainfall (mm)
SILO -Wentworth station	34015	1/01/2021	0
SILO -Wentworth station	34015	2/01/2021	0
SILO -Wentworth station	34015	3/01/2021	0
SILO -Wentworth station	34015	4/01/2021	0
SILO -Wentworth station	34015	5/01/2021	0
SILO -Wentworth station	34015	6/01/2021	25.1
SILO -Wentworth station	34015	7/01/2021	2.5
SILO -Wentworth station	34015	8/01/2021	24
SILO -Wentworth station	34015	9/01/2021	42.5
SILO -Wentworth station	34015	10/01/2021	7.4
SILO -Wentworth station	34015	11/01/2021	4.2
SILO -Wentworth station	34015	12/01/2021	0
SILO -Wentworth station	34015	13/01/2021	0
SILO -Wentworth station	34015	14/01/2021	0
SILO -Wentworth station	34015	15/01/2021	0
SILO -Wentworth station	34015	16/01/2021	0
SILO -Wentworth station	34015	17/01/2021	0
SILO -Wentworth station	34015	18/01/2021	0
SILO -Wentworth station	34015	19/01/2021	0
SILO -Wentworth station	34015	20/01/2021	0
SILO -Wentworth station	34015	21/01/2021	0
SILO -Wentworth station	34015	22/01/2021	0
SILO -Wentworth station	34015	23/01/2021	0
SILO -Wentworth station	34015	24/01/2021	0
SILO -Wentworth station	34015	25/01/2021	0
SILO -Wentworth station	34015	26/01/2021	0
SILO -Wentworth station	34015	27/01/2021	0
SILO -Wentworth station	34015	28/01/2021	0
SILO -Wentworth station	34015	29/01/2021	0
SILO -Wentworth station	34015	30/01/2021	0
SILO -Wentworth station	34015	31/01/2021	0
SILO -Wentworth station	34015	1/02/2021	0
SILO -Wentworth station	34015	2/02/2021	0
SILO -Wentworth station	34015	3/02/2021	3
SILO -Wentworth station	34015	4/02/2021	0
SILO -Wentworth station	34015	5/02/2021	0
SILO -Wentworth station	34015	6/02/2021	0
SILO -Wentworth station	34015	7/02/2021	0
SILO -Wentworth station	34015	8/02/2021	1.3
SILO -Wentworth station	34015	9/02/2021	16.5
SILO -Wentworth station	34015	10/02/2021	0
SILO -Wentworth station	34015	11/02/2021	0
SILO -Wentworth station	34015	12/02/2021	0
SILO -Wentworth station	34015	13/02/2021	0
SILO -Wentworth station	34015	14/02/2021	0
SILO -Wentworth station	34015	15/02/2021	0
SILO -Wentworth station	34015	16/02/2021	0
SILO -Wentworth station	34015	17/02/2021	0
SILO -Wentworth station	34015	18/02/2021	0

SILO -Wentworth station	34015	19/02/2021	0
SILO -Wentworth station	34015	20/02/2021	0
SILO -Wentworth station	34015	21/02/2021	0
SILO -Wentworth station	34015	22/02/2021	0
SILO -Wentworth station	34015	23/02/2021	9
SILO -Wentworth station	34015	24/02/2021	0
SILO -Wentworth station	34015	25/02/2021	0
SILO -Wentworth station	34015	26/02/2021	0
SILO -Wentworth station	34015	27/02/2021	0
SILO -Wentworth station	34015	28/02/2021	0
SILO -Wentworth station	34015	1/03/2021	0
SILO -Wentworth station	34015	2/03/2021	0
SILO -Wentworth station	34015	3/03/2021	0
SILO -Wentworth station	34015	4/03/2021	0
SILO -Wentworth station	34015	5/03/2021	0
SILO -Wentworth station	34015	6/03/2021	0
SILO -Wentworth station	34015	7/03/2021	0
SILO -Wentworth station	34015	8/03/2021	0
SILO -Wentworth station	34015	9/03/2021	0
SILO -Wentworth station	34015	10/03/2021	0
SILO -Wentworth station	34015	11/03/2021	0
SILO -Wentworth station	34015	12/03/2021	0
SILO -Wentworth station	34015	13/03/2021	0
SILO -Wentworth station	34015	14/03/2021	0
SILO -Wentworth station	34015	15/03/2021	0
SILO -Wentworth station	34015	16/03/2021	0
SILO -Wentworth station	34015	17/03/2021	0
SILO -Wentworth station	34015	18/03/2021	0
SILO -Wentworth station	34015	19/03/2021	0
SILO -Wentworth station	34015	20/03/2021	0
SILO -Wentworth station	34015	21/03/2021	0
SILO -Wentworth station	34015	22/03/2021	0
SILO -Wentworth station	34015	23/03/2021	0
SILO -Wentworth station	34015	24/03/2021	0
SILO -Wentworth station	34015	25/03/2021	0
SILO -Wentworth station	34015	26/03/2021	0
SILO -Wentworth station	34015	27/03/2021	0
SILO -Wentworth station	34015	28/03/2021	0
SILO -Wentworth station	34015	29/03/2021	0
SILO -Wentworth station	34015	30/03/2021	0
SILO -Wentworth station	34015	31/03/2021	0
SILO -Wentworth station	34015	1/04/2021	0
SILO -Wentworth station	34015	2/04/2021	0
SILO -Wentworth station	34015	3/04/2021	0
SILO -Wentworth station	34015	4/04/2021	0
SILO -Wentworth station	34015	5/04/2021	0
SILO -Wentworth station	34015	6/04/2021	0
SILO -Wentworth station	34015	7/04/2021	4
SILO -Wentworth station	34015	8/04/2021	10
SILO -Wentworth station	34015	9/04/2021	0

SILO -Wentworth station	34015	10/04/2021	0
SILO -Wentworth station	34015	11/04/2021	0
SILO -Wentworth station	34015	12/04/2021	0
SILO -Wentworth station	34015	13/04/2021	0
SILO -Wentworth station	34015	14/04/2021	0
SILO -Wentworth station	34015	15/04/2021	0
SILO -Wentworth station	34015	16/04/2021	0
SILO -Wentworth station	34015	17/04/2021	0
SILO -Wentworth station	34015	18/04/2021	0
SILO -Wentworth station	34015	19/04/2021	0
SILO -Wentworth station	34015	20/04/2021	0
SILO -Wentworth station	34015	21/04/2021	8.4
SILO -Wentworth station	34015	22/04/2021	3.6
SILO -Wentworth station	34015	23/04/2021	4
SILO -Wentworth station	34015	24/04/2021	3.9
SILO -Wentworth station	34015	25/04/2021	0
SILO -Wentworth station	34015	26/04/2021	0
SILO -Wentworth station	34015	27/04/2021	0
SILO -Wentworth station	34015	28/04/2021	0
SILO -Wentworth station	34015	29/04/2021	0
SILO -Wentworth station	34015	30/04/2021	0
SILO -Wentworth station	34015	1/05/2021	0
SILO -Wentworth station	34015	2/05/2021	0
SILO -Wentworth station	34015	3/05/2021	0
SILO -Wentworth station	34015	4/05/2021	0
SILO -Wentworth station	34015	5/05/2021	0
SILO -Wentworth station	34015	6/05/2021	0
SILO -Wentworth station	34015	7/05/2021	0
SILO -Wentworth station	34015	8/05/2021	0
SILO -Wentworth station	34015	9/05/2021	0
SILO -Wentworth station	34015	10/05/2021	0
SILO -Wentworth station	34015	11/05/2021	0
SILO -Wentworth station	34015	12/05/2021	0
SILO -Wentworth station	34015	13/05/2021	0
SILO -Wentworth station	34015	14/05/2021	0
SILO -Wentworth station	34015	15/05/2021	0
SILO -Wentworth station	34015	16/05/2021	0
SILO -Wentworth station	34015	17/05/2021	0
SILO -Wentworth station	34015	18/05/2021	0
SILO -Wentworth station	34015	19/05/2021	0
SILO -Wentworth station	34015	20/05/2021	0
SILO -Wentworth station	34015	21/05/2021	0
SILO -Wentworth station	34015	22/05/2021	0
SILO -Wentworth station	34015	23/05/2021	0
SILO -Wentworth station	34015	24/05/2021	0
SILO -Wentworth station	34015	25/05/2021	0
SILO -Wentworth station	34015	26/05/2021	0
SILO -Wentworth station	34015	27/05/2021	0
SILO -Wentworth station	34015	28/05/2021	0
SILO -Wentworth station	34015	29/05/2021	0

SILO -Wentworth station	34015	30/05/2021	0
SILO -Wentworth station	34015	31/05/2021	0
SILO -Wentworth station	34015	1/06/2021	0
SILO -Wentworth station	34015	2/06/2021	0
SILO -Wentworth station	34015	3/06/2021	0
SILO -Wentworth station	34015	4/06/2021	0
SILO -Wentworth station	34015	5/06/2021	0
SILO -Wentworth station	34015	6/06/2021	0
SILO -Wentworth station	34015	7/06/2021	0
SILO -Wentworth station	34015	8/06/2021	0
SILO -Wentworth station	34015	9/06/2021	0
SILO -Wentworth station	34015	10/06/2021	0
SILO -Wentworth station	34015	11/06/2021	0
SILO -Wentworth station	34015	12/06/2021	0
SILO -Wentworth station	34015	13/06/2021	0
SILO -Wentworth station	34015	14/06/2021	0
SILO -Wentworth station	34015	15/06/2021	0
SILO -Wentworth station	34015	16/06/2021	0
SILO -Wentworth station	34015	17/06/2021	47
SILO -Wentworth station	34015	18/06/2021	0
SILO -Wentworth station	34015	19/06/2021	0
SILO -Wentworth station	34015	20/06/2021	0
SILO -Wentworth station	34015	21/06/2021	0
SILO -Wentworth station	34015	22/06/2021	0
SILO -Wentworth station	34015	23/06/2021	0
SILO -Wentworth station	34015	24/06/2021	0.1
SILO -Wentworth station	34015	25/06/2021	0
SILO -Wentworth station	34015	26/06/2021	0
SILO -Wentworth station	34015	27/06/2021	0
SILO -Wentworth station	34015	28/06/2021	0.1
SILO -Wentworth station	34015	29/06/2021	0.1
SILO -Wentworth station	34015	30/06/2021	0.1
SILO -Wentworth station	34015	1/07/2021	0
SILO -Wentworth station	34015	2/07/2021	6.1
SILO -Wentworth station	34015	3/07/2021	19.9
SILO -Wentworth station	34015	4/07/2021	1.1
SILO -Wentworth station	34015	5/07/2021	0
SILO -Wentworth station	34015	6/07/2021	0
SILO -Wentworth station	34015	7/07/2021	0
SILO -Wentworth station	34015	8/07/2021	0
SILO -Wentworth station	34015	9/07/2021	0.1
SILO -Wentworth station	34015	10/07/2021	0
SILO -Wentworth station	34015	11/07/2021	0.1
SILO -Wentworth station	34015	12/07/2021	0
SILO -Wentworth station	34015	13/07/2021	0
SILO -Wentworth station	34015	14/07/2021	0
SILO -Wentworth station	34015	15/07/2021	0
SILO -Wentworth station	34015	16/07/2021	0
SILO -Wentworth station	34015	17/07/2021	0
SILO -Wentworth station	34015	18/07/2021	0

SILO -Wentworth station	34015	19/07/2021	0
SILO -Wentworth station	34015	20/07/2021	0
SILO -Wentworth station	34015	21/07/2021	0
SILO -Wentworth station	34015	22/07/2021	0
SILO -Wentworth station	34015	23/07/2021	0
SILO -Wentworth station	34015	24/07/2021	0
SILO -Wentworth station	34015	25/07/2021	0
SILO -Wentworth station	34015	26/07/2021	0
SILO -Wentworth station	34015	27/07/2021	0
SILO -Wentworth station	34015	28/07/2021	5.9
SILO -Wentworth station	34015	29/07/2021	7.2
SILO -Wentworth station	34015	30/07/2021	0
SILO -Wentworth station	34015	31/07/2021	0
SILO -Wentworth station	34015	1/08/2021	0
SILO -Wentworth station	34015	2/08/2021	0
SILO -Wentworth station	34015	3/08/2021	0
SILO -Wentworth station	34015	4/08/2021	0
SILO -Wentworth station	34015	5/08/2021	0
SILO -Wentworth station	34015	6/08/2021	0
SILO -Wentworth station	34015	7/08/2021	0
SILO -Wentworth station	34015	8/08/2021	0
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SILO -Wentworth station	34015	10/08/2021	0
SILO -Wentworth station	34015	11/08/2021	0
SILO -Wentworth station	34015	12/08/2021	0
SILO -Wentworth station	34015	13/08/2021	0
SILO -Wentworth station	34015	14/08/2021	0
SILO -Wentworth station	34015	15/08/2021	0
SILO -Wentworth station	34015	16/08/2021	0
SILO -Wentworth station	34015	17/08/2021	0
SILO -Wentworth station	34015	18/08/2021	0
SILO -Wentworth station	34015	19/08/2021	0
SILO -Wentworth station	34015	20/08/2021	0
SILO -Wentworth station	34015	21/08/2021	0
SILO -Wentworth station	34015	22/08/2021	0
SILO -Wentworth station	34015	23/08/2021	0
SILO -Wentworth station	34015	24/08/2021	0
SILO -Wentworth station	34015	25/08/2021	0
SILO -Wentworth station	34015	26/08/2021	0
SILO -Wentworth station	34015	27/08/2021	0
SILO -Wentworth station	34015	28/08/2021	0
SILO -Wentworth station	34015	29/08/2021	0
SILO -Wentworth station	34015	30/08/2021	4.6
SILO -Wentworth station	34015	31/08/2021	61.3
SILO -Wentworth station	34015	1/09/2021	0
SILO -Wentworth station	34015	2/09/2021	0
SILO -Wentworth station	34015	3/09/2021	66.8
SILO -Wentworth station	34015	4/09/2021	0
SILO -Wentworth station	34015	5/09/2021	0
SILO -Wentworth station	34015	6/09/2021	0

SILO -Wentworth station	34015	7/09/2021	0
SILO -Wentworth station	34015	8/09/2021	0
SILO -Wentworth station	34015	9/09/2021	0
SILO -Wentworth station	34015	10/09/2021	0
SILO -Wentworth station	34015	11/09/2021	0
SILO -Wentworth station	34015	12/09/2021	0
SILO -Wentworth station	34015	13/09/2021	0
SILO -Wentworth station	34015	14/09/2021	0
SILO -Wentworth station	34015	15/09/2021	0
SILO -Wentworth station	34015	16/09/2021	0
SILO -Wentworth station	34015	17/09/2021	0
SILO -Wentworth station	34015	18/09/2021	0
SILO -Wentworth station	34015	19/09/2021	0
SILO -Wentworth station	34015	20/09/2021	0
SILO -Wentworth station	34015	21/09/2021	0
SILO -Wentworth station	34015	22/09/2021	0
SILO -Wentworth station	34015	23/09/2021	0
SILO -Wentworth station	34015	24/09/2021	0
SILO -Wentworth station	34015	25/09/2021	0
SILO -Wentworth station	34015	26/09/2021	0
SILO -Wentworth station	34015	27/09/2021	0
SILO -Wentworth station	34015	28/09/2021	0
SILO -Wentworth station	34015	29/09/2021	0
SILO -Wentworth station	34015	30/09/2021	2.8
SILO -Wentworth station	34015	1/10/2021	0
SILO -Wentworth station	34015	2/10/2021	0
SILO -Wentworth station	34015	3/10/2021	0
SILO -Wentworth station	34015	4/10/2021	0
SILO -Wentworth station	34015	5/10/2021	0
SILO -Wentworth station	34015	6/10/2021	0
SILO -Wentworth station	34015	7/10/2021	0
SILO -Wentworth station	34015	8/10/2021	0
SILO -Wentworth station	34015	9/10/2021	0
SILO -Wentworth station	34015	10/10/2021	0
SILO -Wentworth station	34015	11/10/2021	0
SILO -Wentworth station	34015	12/10/2021	0
SILO -Wentworth station	34015	13/10/2021	0
SILO -Wentworth station	34015	14/10/2021	0
SILO -Wentworth station	34015	15/10/2021	0
SILO -Wentworth station	34015	16/10/2021	0
SILO -Wentworth station	34015	17/10/2021	0
SILO -Wentworth station	34015	18/10/2021	0
SILO -Wentworth station	34015	19/10/2021	0
SILO -Wentworth station	34015	20/10/2021	0
SILO -Wentworth station	34015	21/10/2021	0
SILO -Wentworth station	34015	22/10/2021	0
SILO -Wentworth station	34015	23/10/2021	0
SILO -Wentworth station	34015	24/10/2021	0
SILO -Wentworth station	34015	25/10/2021	0
SILO -Wentworth station	34015	26/10/2021	0

SILO -Wentworth station	34015	27/10/2021	0
SILO -Wentworth station	34015	28/10/2021	0
SILO -Wentworth station	34015	29/10/2021	0
SILO -Wentworth station	34015	30/10/2021	0
SILO -Wentworth station	34015	44500	0
SILO -Wentworth station	34015	44501	0
SILO -Wentworth station	34015	44502	0
SILO -Wentworth station	34015	44503	0
SILO -Wentworth station	34015	44504	0
SILO -Wentworth station	34015	44505	0
SILO -Wentworth station	34015	44506	0
SILO -Wentworth station	34015	44507	0
SILO -Wentworth station	34015	44508	0
SILO -Wentworth station	34015	44509	29.6
SILO -Wentworth station	34015	44510	31.2
SILO -Wentworth station	34015	44511	42
SILO -Wentworth station	34015	44512	0
SILO -Wentworth station	34015	44513	0
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SILO -Wentworth station	34015	44516	0
SILO -Wentworth station	34015	44517	0
SILO -Wentworth station	34015	44518	0
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SILO -Wentworth station	34015	44520	0
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SILO -Wentworth station	34015	44523	0
SILO -Wentworth station	34015	44524	0
SILO -Wentworth station	34015	44525	0
SILO -Wentworth station	34015	44526	70
SILO -Wentworth station	34015	44527	0
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SILO -Wentworth station	34015	44529	29.9
SILO -Wentworth station	34015	44530	15
SILO -Wentworth station	34015	44531	0
SILO -Wentworth station	34015	44532	0
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SILO -Wentworth station	34015	44542	0
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SILO -Wentworth station	34015	44548	0
SILO -Wentworth station	34015	44549	0
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SILO -Wentworth station	34015	44554	0
SILO -Wentworth station	34015	44555	58
SILO -Wentworth station	34015	44556	83
SILO -Wentworth station	34015	44557	36.8
SILO -Wentworth station	34015	44558	0
SILO -Wentworth station	34015	44559	0
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SILO -Wentworth station	34015	44561	0
SILO -Wentworth station	34015	44562	0
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SILO -Wentworth station	34015	44564	0
SILO -Wentworth station	34015	44565	0
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SILO -Wentworth station	34015	44568	1.8
SILO -Wentworth station	34015	44569	3.3
SILO -Wentworth station	34015	44570	2
SILO -Wentworth station	34015	44571	0
SILO -Wentworth station	34015	44572	0
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SILO -Wentworth station	34015	44574	0
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SILO -Wentworth station	34015	44577	0
SILO -Wentworth station	34015	44578	0
SILO -Wentworth station	34015	44579	0
SILO -Wentworth station	34015	44580	0
SILO -Wentworth station	34015	44581	0
SILO -Wentworth station	34015	44582	0
SILO -Wentworth station	34015	44583	0
SILO -Wentworth station	34015	44584	0
SILO -Wentworth station	34015	44585	0
SILO -Wentworth station	34015	44586	0
SILO -Wentworth station	34015	44587	5.3
SILO -Wentworth station	34015	44588	41
SILO -Wentworth station	34015	44589	0
SILO -Wentworth station	34015	44590	0
SILO -Wentworth station	34015	44591	0
SILO -Wentworth station	34015	44592	0
SILO -Wentworth station	34015	44593	0
SILO -Wentworth station	34015	44594	0
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SILO -Wentworth station	34015	44607	0
SILO -Wentworth station	34015	44608	0
SILO -Wentworth station	34015	44609	0
SILO -Wentworth station	34015	44610	0
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SILO -Wentworth station	34015	44619	0
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SILO -Wentworth station	34015	44627	0
SILO -Wentworth station	34015	44628	0
SILO -Wentworth station	34015	44629	0
SILO -Wentworth station	34015	44630	0
SILO -Wentworth station	34015	44631	17.4
SILO -Wentworth station	34015	44632	0
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SILO -Wentworth station	34015	44673	0
SILO -Wentworth station	34015	44674	0
SILO -Wentworth station	34015	44675	0
SILO -Wentworth station	34015	44676	0
SILO -Wentworth station	34015	44677	3.6
SILO -Wentworth station	34015	44678	0.6
SILO -Wentworth station	34015	44679	0
SILO -Wentworth station	34015	44680	0
SILO -Wentworth station	34015	44681	0
SILO -Wentworth station	34015	44682	0
SILO -Wentworth station	34015	44683	0
SILO -Wentworth station	34015	44684	0
SILO -Wentworth station	34015	44685	0
SILO -Wentworth station	34015	44686	0
SILO -Wentworth station	34015	44687	0
SILO -Wentworth station	34015	44688	0
SILO -Wentworth station	34015	44689	7.3
SILO -Wentworth station	34015	44690	20
SILO -Wentworth station	34015	44691	13.2
SILO -Wentworth station	34015	44692	62.6
SILO -Wentworth station	34015	44693	0.8
SILO -Wentworth station	34015	44694	0
SILO -Wentworth station	34015	44695	0.3

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SILO -Wentworth station	34015	44701	0
SILO -Wentworth station	34015	44702	2.4
SILO -Wentworth station	34015	44703	0
SILO -Wentworth station	34015	44704	0
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SILO -Wentworth station	34015	44712	0
SILO -Wentworth station	34015	44713	0
SILO -Wentworth station	34015	44714	0
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SILO -Wentworth station	34015	44740	0
SILO -Wentworth station	34015	44741	0
SILO -Wentworth station	34015	44742	0
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SILO -Wentworth station	34015	44744	41.6
SILO -Wentworth station	34015	44745	15

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SILO -Wentworth station	34015	44747	33.9
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SILO -Wentworth station	34015	44750	0
SILO -Wentworth station	34015	44751	0
SILO -Wentworth station	34015	44752	0
SILO -Wentworth station	34015	44753	0
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SILO -Wentworth station	34015	44762	0
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SILO -Wentworth station	34015	44764	0.4
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SILO -Wentworth station	34015	44766	0
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SILO -Wentworth station	34015	44768	0.1
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SILO -Wentworth station	34015	44771	0
SILO -Wentworth station	34015	44772	0
SILO -Wentworth station	34015	44773	0
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SILO -Wentworth station	34015	44802	0
SILO -Wentworth station	34015	44803	0.6
SILO -Wentworth station	34015	44804	0.7
SILO -Wentworth station	34015	44805	0
SILO -Wentworth station	34015	44806	1.5
SILO -Wentworth station	34015	44807	31.4
SILO -Wentworth station	34015	44808	0
SILO -Wentworth station	34015	44809	0.1
SILO -Wentworth station	34015	44810	0
SILO -Wentworth station	34015	44811	0
SILO -Wentworth station	34015	44812	0
SILO -Wentworth station	34015	44813	7.8
SILO -Wentworth station	34015	44814	0.7
SILO -Wentworth station	34015	44815	0
SILO -Wentworth station	34015	44816	0
SILO -Wentworth station	34015	44817	0
SILO -Wentworth station	34015	44818	0
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SILO -Wentworth station	34015	44820	0
SILO -Wentworth station	34015	44821	0
SILO -Wentworth station	34015	44822	0
SILO -Wentworth station	34015	44823	0
SILO -Wentworth station	34015	44824	0
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SILO -Wentworth station	34015	44826	0
SILO -Wentworth station	34015	44827	0
SILO -Wentworth station	34015	44828	0
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SILO -Wentworth station	34015	44831	3
SILO -Wentworth station	34015	44832	2.4
SILO -Wentworth station	34015	44833	12.4
SILO -Wentworth station	34015	44834	0
SILO -Wentworth station	34015	44835	0
SILO -Wentworth station	34015	44836	0
SILO -Wentworth station	34015	44837	0
SILO -Wentworth station	34015	44838	0
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SILO -Wentworth station	34015	44840	0
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SILO -Wentworth station	34015	44842	0
SILO -Wentworth station	34015	44843	0
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SILO -Wentworth station	34015	44845	0

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SILO -Wentworth station	34015	44847	0
SILO -Wentworth station	34015	44848	0
SILO -Wentworth station	34015	44849	0
SILO -Wentworth station	34015	44850	0
SILO -Wentworth station	34015	44851	1.5
SILO -Wentworth station	34015	44852	0
SILO -Wentworth station	34015	44853	1
SILO -Wentworth station	34015	44854	30.5
SILO -Wentworth station	34015	44855	14.4
SILO -Wentworth station	34015	44856	15.2
SILO -Wentworth station	34015	44857	0
SILO -Wentworth station	34015	44858	0
SILO -Wentworth station	34015	44859	0
SILO -Wentworth station	34015	44860	0
SILO -Wentworth station	34015	44861	0
SILO -Wentworth station	34015	44862	0
SILO -Wentworth station	34015	44863	0
SILO -Wentworth station	34015	44864	0
SILO -Wentworth station	34015	44865	0
SILO -Wentworth station	34015	44866	1.5
SILO -Wentworth station	34015	44867	0
SILO -Wentworth station	34015	44868	0
SILO -Wentworth station	34015	44869	0
SILO -Wentworth station	34015	44870	0
SILO -Wentworth station	34015	44871	0.1
SILO -Wentworth station	34015	44872	0
SILO -Wentworth station	34015	44873	0
SILO -Wentworth station	34015	44874	0
SILO -Wentworth station	34015	44875	0
SILO -Wentworth station	34015	44876	0
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SILO -Wentworth station	34015	44881	0
SILO -Wentworth station	34015	44882	0
SILO -Wentworth station	34015	44883	0
SILO -Wentworth station	34015	44884	0
SILO -Wentworth station	34015	44885	0
SILO -Wentworth station	34015	44886	12.7
SILO -Wentworth station	34015	44887	0
SILO -Wentworth station	34015	44888	0
SILO -Wentworth station	34015	44889	1.7
SILO -Wentworth station	34015	44890	11.2
SILO -Wentworth station	34015	44891	0
SILO -Wentworth station	34015	44892	0
SILO -Wentworth station	34015	44893	26.7
SILO -Wentworth station	34015	44894	2.7
SILO -Wentworth station	34015	44895	85.3

SILO -Wentworth station	34015	44896	4.2
SILO -Wentworth station	34015	44897	0
SILO -Wentworth station	34015	44898	2.1
SILO -Wentworth station	34015	44899	2.1
SILO -Wentworth station	34015	44900	0
SILO -Wentworth station	34015	44901	0
SILO -Wentworth station	34015	44902	0
SILO -Wentworth station	34015	44903	0
SILO -Wentworth station	34015	44904	0
SILO -Wentworth station	34015	44905	0
SILO -Wentworth station	34015	44906	0
SILO -Wentworth station	34015	44907	0
SILO -Wentworth station	34015	44908	1.2
SILO -Wentworth station	34015	44909	0
SILO -Wentworth station	34015	44910	0
SILO -Wentworth station	34015	44911	0
SILO -Wentworth station	34015	44912	0
SILO -Wentworth station	34015	44913	0
SILO -Wentworth station	34015	44914	0
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SILO -Wentworth station	34015	44917	0
SILO -Wentworth station	34015	44918	0
SILO -Wentworth station	34015	44919	0
SILO -Wentworth station	34015	44920	22.5
SILO -Wentworth station	34015	44921	0
SILO -Wentworth station	34015	44922	0
SILO -Wentworth station	34015	44923	16.4
SILO -Wentworth station	34015	44924	0.9
SILO -Wentworth station	34015	44925	0
SILO -Wentworth station	34015	44926	0
SILO -Wentworth station	34015	44927	0
SILO -Wentworth station	34015	44928	0
SILO -Wentworth station	34015	44929	0
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SILO -Wentworth station	34015	44933	0
SILO -Wentworth station	34015	44934	0
SILO -Wentworth station	34015	44935	0
SILO -Wentworth station	34015	44936	0
SILO -Wentworth station	34015	44937	8.6
SILO -Wentworth station	34015	44938	23
SILO -Wentworth station	34015	44939	48
SILO -Wentworth station	34015	44940	47
SILO -Wentworth station	34015	44941	17
SILO -Wentworth station	34015	44942	4.2
SILO -Wentworth station	34015	44943	12.5
SILO -Wentworth station	34015	44944	2.1
SILO -Wentworth station	34015	44945	0.2

SILO -Wentworth station	34015	44946	0
SILO -Wentworth station	34015	44947	0
SILO -Wentworth station	34015	44948	0
SILO -Wentworth station	34015	44949	0.1
SILO -Wentworth station	34015	44950	0
SILO -Wentworth station	34015	44951	0
SILO -Wentworth station	34015	44952	0
SILO -Wentworth station	34015	44953	0
SILO -Wentworth station	34015	44954	0.9
SILO -Wentworth station	34015	44955	1.1
SILO -Wentworth station	34015	44956	0.1
SILO -Wentworth station	34015	44957	4.1
SILO -Wentworth station	34015	44958	0
SILO -Wentworth station	34015	44959	0
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SILO -Wentworth station	34015	44962	0
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SILO -Wentworth station	34015	44964	0
SILO -Wentworth station	34015	44965	0
SILO -Wentworth station	34015	44966	0
SILO -Wentworth station	34015	44967	0
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SILO -Wentworth station	34015	45023	0
SILO -Wentworth station	34015	45024	0
SILO -Wentworth station	34015	45025	0
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SILO -Wentworth station	34015	45027	0
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SILO -Wentworth station	34015	45030	0
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SILO -Wentworth station	34015	45078	0
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SILO -Wentworth station	34015	45125	0
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SILO -Wentworth station	34015	45127	20
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SILO -Wentworth station	34015	45132	0
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SILO -Wentworth station	34015	45183	0
SILO -Wentworth station	34015	45184	0
SILO -Wentworth station	34015	45185	0
SILO -Wentworth station	34015	45186	0
SILO -Wentworth station	34015	45187	0
SILO -Wentworth station	34015	45188	0
SILO -Wentworth station	34015	45189	0
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SILO -Wentworth station	34015	45238	0
SILO -Wentworth station	34015	45239	0
SILO -Wentworth station	34015	45240	0
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SILO -Wentworth station	34015	45252	0
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SILO -Wentworth station	34015	45257	1
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SILO -Wentworth station	34015	45259	0
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SILO -Wentworth station	34015	45261	4.9
SILO -Wentworth station	34015	45262	5.1
SILO -Wentworth station	34015	45263	8
SILO -Wentworth station	34015	45264	0
SILO -Wentworth station	34015	45265	0
SILO -Wentworth station	34015	45266	0
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SILO -Wentworth station	34015	45268	0
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SILO -Wentworth station	34015	45272	0
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SILO -Wentworth station	34015	45275	0
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SILO -Wentworth station	34015	45277	0
SILO -Wentworth station	34015	45278	0
SILO -Wentworth station	34015	45279	0
SILO -Wentworth station	34015	45280	0
SILO -Wentworth station	34015	45281	28.2
SILO -Wentworth station	34015	45282	18.1
SILO -Wentworth station	34015	45283	0
SILO -Wentworth station	34015	45284	0
SILO -Wentworth station	34015	45285	3.5
SILO -Wentworth station	34015	45286	55.3
SILO -Wentworth station	34015	45287	2.1
SILO -Wentworth station	34015	45288	0
SILO -Wentworth station	34015	45289	0
SILO -Wentworth station	34015	45290	0
SILO -Wentworth station	34015	45291	0

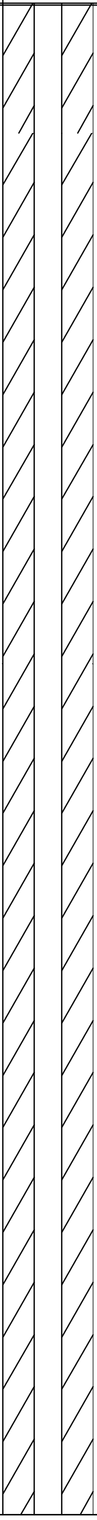
BORE LOG: MBBE0001

PROJECT NUMBER DX70025A01
PROJECT NAME Broadmeadows East Groundwater Investigation
LOCATION Moranbah, Queensland
DRILLING METHOD Air Rotary
SAMPLING METHOD Drill Cuttings
LOGGED BY H. Marais
TOTAL DEPTH (mbGL) 67.6
BOREHOLE SIZE (mm) 152,4
STATIC WATER LEVEL (mbGL) 15.3, 29/01/2021
COMMENTS Surveyed by mine surveyor

CLIENT NitroSolutions
COMPLETION DATE 27/01/2021
DRILL CONTRACTOR Wizard Drilling
COORDINATES 7585224mE, 619739mN (AGD 84; Zone 55)
GROUND ELEVATION (mAHD) 304.50
STICK UP (m) 0.71
BLANK Class 18 uPVC 50mmID
SCREEN Class 18 uPVC 50mmID; 1mm slots; (63-66m)

DEPTH (mbGL)	ELEVATION (mAHD)	LITHOLOGIC DESCRIPTION	STATIC WATER LEVEL (mbGL)
	304	GRAVELLY SAND, (SW), very loose, light brown and light grey, red, dry	
		SAND, (SP), very loose, brown and grey, red	
2	302	GRAVEL, (GP), very loose, light brown and light grey, red	
4	300	SILTSTONE AND SANDSTONE, extremely weathered, very low strength, dark brown and grey, medium sand sized grains to coarse sand sized grains, highly altered, dry	
6		SILTSTONE, extremely weathered, extremely low strength, light grey with red, silt/clay sized grains, highly altered, dry, Water from rig	
8	298 296	SILTSTONE, extremely weathered, very low strength, brown with grey, medium sand sized grains to coarse sand sized grains, highly altered, dry	
10 12	294 292	SILTSTONE, highly weathered, low strength, light grey with red-brown, medium sand sized grains to coarse sand sized grains, highly altered, dry	
14 16	290 288	SILTSTONE, highly weathered, very low strength, pale grey and red-brown, medium sand sized grains to fine sand sized grains, highly altered, dry	▼
18 20	286	SANDSTONE, moderately weathered, medium strength, light grey to pale grey, fine sand sized grains, moderately altered, dry	
22	284	SANDSTONE, highly weathered, low strength, pale grey with light brown, fine sand sized grains to medium gravel sized grains, highly altered, dry	
24 26 28	282 280 278	SANDSTONE, moderately weathered, low strength, light grey with pale yellow-brown, fine sand sized grains to coarse sand sized grains, moderately altered, dry	
30 32 34	276 274 272 270	SILTSTONE, moderately weathered, low strength, light grey to pale grey, silt/clay sized grains to fine sand sized grains, moderately altered, dry	

MONITORING BORE DIAGRAM



Cemented to surface; Lockable monument installed

Static water level

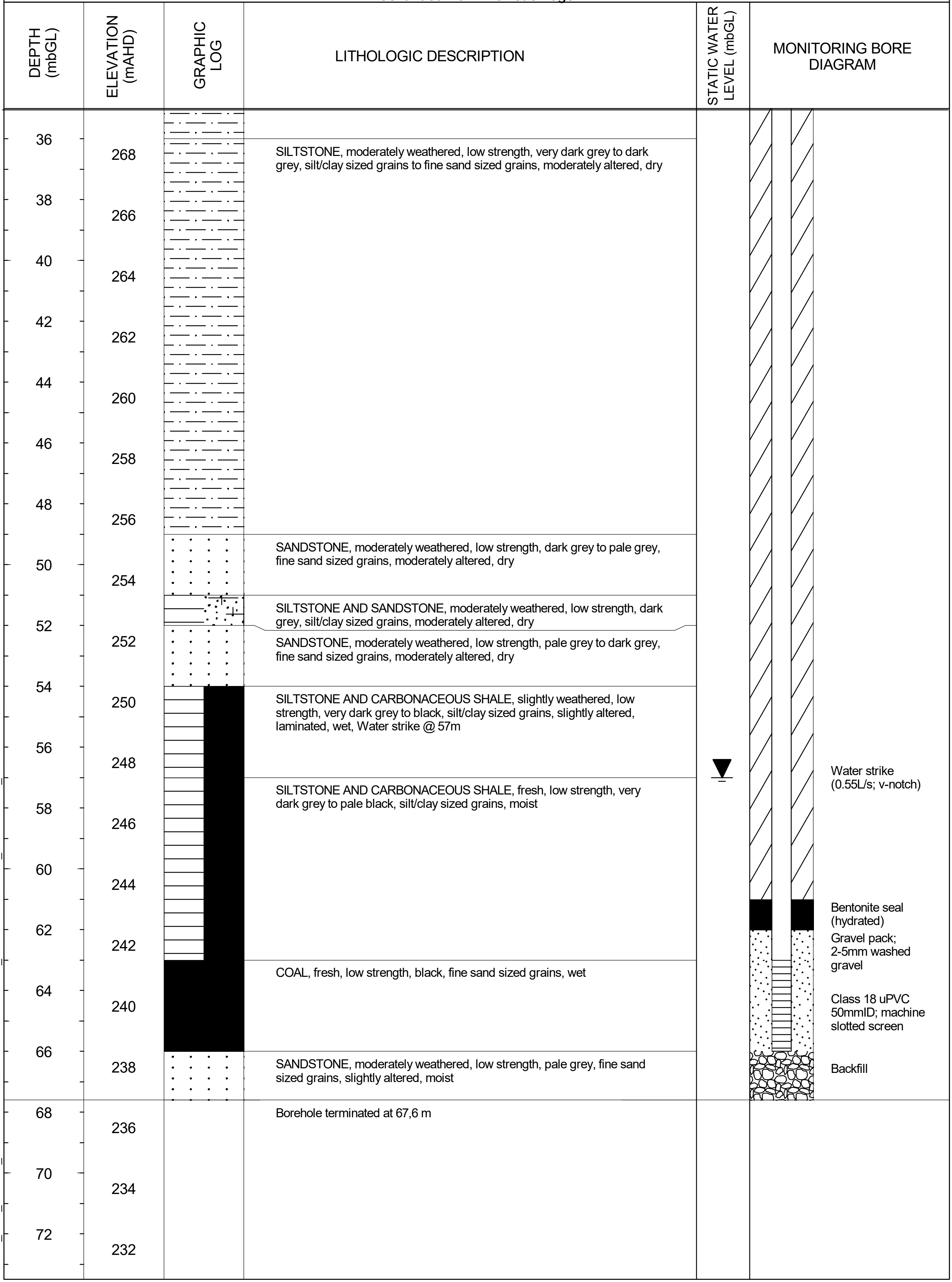
Class 18 uPVC 50mmID; Cemented casing

▼ Static Water Level

BORE LOG: MBBE0001

PROJECT NUMBER DX70025A01
CLIENT NitroSolutions
PROJECT NAME Broadmeadows East Groundwater Investigation
COMPLETION DATE 27/01/2021
LOCATION Moranbah, Queensland

- Continued from Previous Page -



SILTSTONE, moderately weathered, low strength, very dark grey to dark grey, silt/clay sized grains to fine sand sized grains, moderately altered, dry

SANDSTONE, moderately weathered, low strength, dark grey to pale grey, fine sand sized grains, moderately altered, dry

SILTSTONE AND SANDSTONE, moderately weathered, low strength, dark grey, silt/clay sized grains, moderately altered, dry

SANDSTONE, moderately weathered, low strength, pale grey to dark grey, fine sand sized grains, moderately altered, dry

SILTSTONE AND CARBONACEOUS SHALE, slightly weathered, low strength, very dark grey to black, silt/clay sized grains, slightly altered, laminated, wet, Water strike @ 57m

SILTSTONE AND CARBONACEOUS SHALE, fresh, low strength, very dark grey to pale black, silt/clay sized grains, moist

COAL, fresh, low strength, black, fine sand sized grains, wet

SANDSTONE, moderately weathered, low strength, pale grey, fine sand sized grains, slightly altered, moist

Borehole terminated at 67,6 m

▼ Static Water Level

BORE LOG: MBBE0007

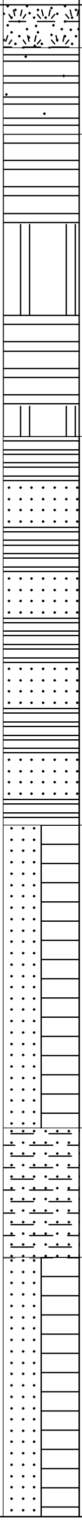
Klohn Crippen Berger

PROJECT NUMBER DX70025A01
PROJECT NAME Broadmeadows East Groundwater Investigation
LOCATION Moranbah, Queensland
DRILLING METHOD Air Rotary
SAMPLING METHOD Drill Cuttings
LOGGED BY N.Coetzee
TOTAL DEPTH (mbGL) 52
BOREHOLE SIZE (mm) 152,4
CLIENT NitroSolutions
COMPLETION DATE 16/04/2021
DRILL CONTRACTOR Wizard Drilling
COORDINATES 7586212mE, 620535mN (AGD 84; Zone 55)
GROUND ELEVATION (mAHD) 297.10
STICK UP (m) 0.72
BLANK Class 18 uPVC 50mmID
SCREEN Class 18 uPVC 50mmID; 1mm slots; (40-46m)
STATIC WATER LEVEL (mbGL) 18.05, 19/04/2021,
COMMENTS GPS coordinate

DEPTH (mbGL): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34

ELEVATION (mAHD): 296, 294, 292, 290, 288, 286, 284, 282, 280, 278, 276, 274, 272, 270, 268, 266, 264

GRAPHIC LOG

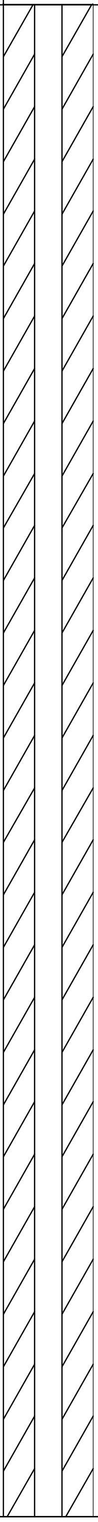


LITHOLOGIC DESCRIPTION	CONTACT DEPTH
TOPSOIL, residual soil/completely weathered, extremely low strength, red-brown, dry	1.00
SILTY CLAY, dense, highly weathered, low strength, red-brown	3.00
SILTSTONE & MUDSTONE, highly weathered, low strength, altered, purple and grey	10.00
SANDSTONE & MUDSTONE, moderately weathered, low strength, fine to medium grained, purple and grey	19.00
SANDSTONE & SILTSTONE, moderately weathered, low strength, fine to medium grained, dark grey and grey	26.00
SILTSTONE, sligthly weathered, low strength, dark grey	29.00
SANDSTONE & SILTSTONE, sligthly weathered, low strength, fine to medium grained, dark grey and grey	

WATER STRIKE

STATIC WATER LEVEL (mbGL): ▼ 19/04/2021

MONITORING BORE DIAGRAM



Klohn Crippen Berger

BORE LOG: MBBE0007

PROJECT NUMBER DX70025A01

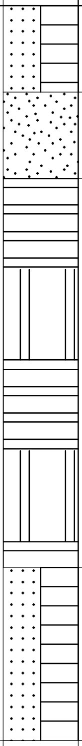
PROJECT NAME Broadmeadows East Groundwater Investigation

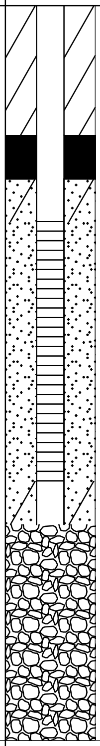
LOCATION Moranbah, Queensland

CLIENT NitroSolutions

COMPLETION DATE 16/04/2021

- Continued from Previous Page -





DEPTH (mbGL)	ELEVATION (mAHD)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH	WATER STRIKE	STATIC WATER LEVEL (mbGL)	MONITORING BORE DIAGRAM
36	260		SANDSTONE & SILTSTONE, sligthly weathered, low strength, fine to medium grained, dark grey and grey	37.00			
38	258		SANDSTONE, fresh, low strength, fine to medium grained, greenish grey	39.00			
40 42 44 46	256 254 252 250		SILTSTONE & MUDSTONE, fresh, low strength, altered, purple/green and grey	48.00	Water strike (0.284 L/s; v-notch) Water strike (0.61 L/s; v-notch)		
48 50 52	248 246		SANDSTONE & SILTSTONE, fresh, low strength, fine to medium grained, dark grey and greenish grey	52.00			
54 56 58 60 62 64 66 68 70 72			Borehole terminated at 52.0 m				

Klohn Crippen Berger

BORE LOG: MBBE0008

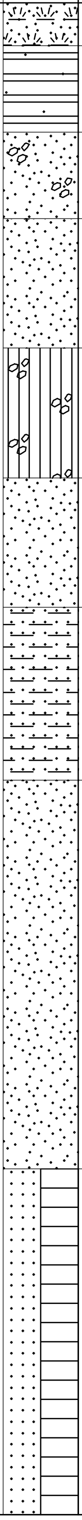
PROJECT NUMBER DX70025A01
PROJECT NAME Broadmeadows East Groundwater Investigation
LOCATION Moranbah, Queensland
DRILLING METHOD Air Rotary
SAMPLING METHOD Drill Cuttings
LOGGED BY N.Coetzee
TOTAL DEPTH (mbGL) 135
BOREHOLE SIZE (mm) 152,4

CLIENT NitroSolutions
COMPLETION DATE 19/04/2021
DRILL CONTRACTOR Wizard Drilling
COORDINATES 7584916mE, 620181mN (AGD 84; Zone 55)
GROUND ELEVATION (mAHD) 304.50
STICK UP (m) 0.71
BLANK Class 18 uPVC 50mmID
SCREEN Class 18 uPVC 50mmID; 1mm slots; (131.5-133.5m)

STATIC WATER LEVEL (mbGL) 16.73, 19/04/2024,
COMMENTS GPS coordinate

DEPTH (mbGL)	ELEVATION (mAHD)
	304
2	302
4	300
6	298
8	296
10	294
12	292
14	290
16	288
18	286
20	284
22	282
24	280
26	278
28	276
30	274
32	272
34	270

GRAPHIC LOG



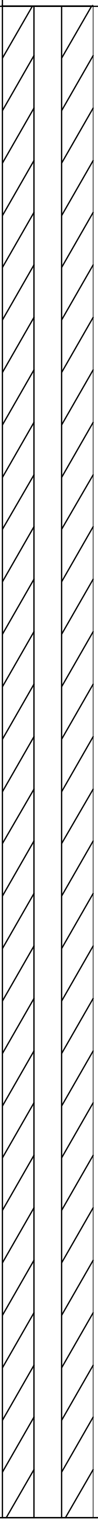
LITHOLOGIC DESCRIPTION	CONTACT DEPTH
TOPSOIL, residual soil/completely weathered, extremely low strength, brown, sand grains, dry	1.00
SILTY CLAY, low plasticity, red-brown, moist at 3 m	3.00
GRAVELLY SAND, fine to medium grained, subrounded to subangular, red-brown and grey, dry	5.00
SAND, fine to medium grained, rounded to subrounded, light brown, moist	8.00
SANDY CLAY, low plasticity, fine grained, rounded to subrounded, light brown, moist	11.00
SANDSTONE, fine to medium grained, completey weathered/altered to clay, extremely low strength, greenish grey	14.00
SILTSTONE, highly weathered, partially altered to clay, extremely low strength, dark grey	18.00
SANDSTONE, highly weathered, fine to medium grained, extremely low strength, altered, light grey	27.00
SILTSTONE AND SANDSTONE, completely weathered, extremely low strength, highly altered, dark and light grey	

WATER STRIKE

STATIC WATER LEVEL (mbGL)

▼ 19/04/2024

MONITORING BORE DIAGRAM



Klohn Crippen Berger

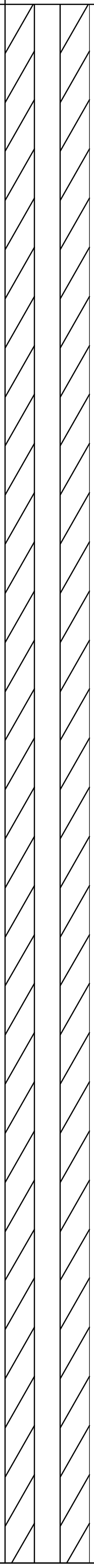
BORE LOG: MBBE0008

PROJECT NUMBER DX70025A01
PROJECT NAME Broadmeadows East Groundwater Investigation
LOCATION Moranbah, Queensland
CLIENT NitroSolutions
COMPLETION DATE 19/04/2021

- Continued from Previous Page -

DEPTH (mbGL)	ELEVATION (mAHD)	LITHOLOGIC DESCRIPTION	CONTACT DEPTH	WATER STRIKE	STATIC WATER LEVEL (mbGL)
36	268	SILTSTONE AND SANDSTONE, completely weathered, extremely low strength, highly altered, dark and light grey			
38	266			Water strike (0.33 L/s; v-notch)	
40	264				
42	262			Water strike (1.84 L/s; v-notch)	
44	260				
46	258				
48	256	SILTSTONE & MUDSTONE, distinctly weathered, low rock strength, dark grey and purple	48.00		
50	254	SILTSTONE, fresh, low rock strength, dark grey	50.00		
52	252				
54	250	SANDSTONE, fresh, fine to medium grained, low to medium rock strength, grey	55.00		
56	248				
58	246				
60	244	SILTSTONE, fresh, low strength rock, dark grey	61.00		
62	242				
64	240				
66	238				
68	236				
70	234	SANDSTONE, fresh, fine to medium grained, low rock strength, grey	70.00	Water strike (1.25 L/s; v-notch)	
72	232		73.00		

MONITORING BORE DIAGRAM



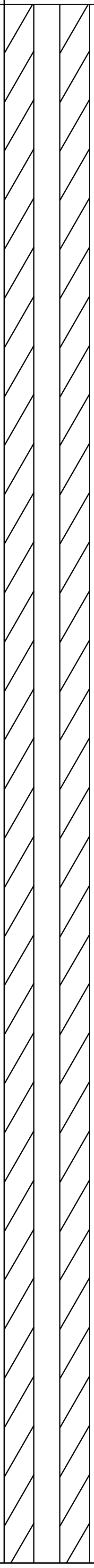
BORE LOG: MBBE0008

PROJECT NUMBER DX70025A01
PROJECT NAME Broadmeadows East Groundwater Investigation
LOCATION Moranbah, Queensland
CLIENT NitroSolutions
COMPLETION DATE 19/04/2021

- Continued from Previous Page -

DEPTH (mbGL)	ELEVATION (mAHD)	LITHOLOGIC DESCRIPTION	CONTACT DEPTH	WATER STRIKE	STATIC WATER LEVEL (mbGL)
74	230	SILTSTONE & MUDSTONE, fresh, low rock strength, grey	76.00		
76 78 80 82 84 86	228 226 224 222 220 218	SILTSTONE AND SANDSTONE, low rock strength, minor chlorite, dark and light grey	88.00	Water strike (5.63 L/s; v-notch)	
88 90 92 94	216 214 212 210	SANDSTONE, fresh, coarse grained, medium rock strength, minor chlorite, light grey	96.00		
96 98 100 102 104 106 108 110	208 206 204 202 200 198 196 194	SILTSTONE AND SANDSTONE, low rock strength, minor chlorite, dark and light grey	112.00		

MONITORING BORE DIAGRAM

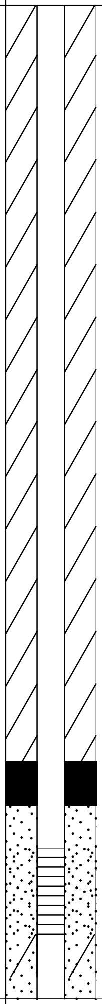


BORE LOG: MBBE0008

PROJECT NUMBER DX70025A01
PROJECT NAME Broadmeadows East Groundwater Investigation
LOCATION Moranbah, Queensland
CLIENT NitroSolutions
COMPLETION DATE 19/04/2021

- Continued from Previous Page -

DEPTH (mbGL)	ELEVATION (mAHD)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH	WATER STRIKE	STATIC WATER LEVEL (mbGL)	MONITORING BORE DIAGRAM
	192		CARB SILTSTONE, fresh, high rock strength, dark grey to black	113.00			
114 116	190 188		SILTSTONE AND SANDSTONE, low rock strength, minor chlorite, dark and light grey	117.00			
118 120	186 184		CARB SILTSTONE, fresh, high rock strength, dark grey to black	121.00			
122 124	182 180		SILTSTONE, hard rock strength, minor chlorite, dark grey	125.00			
126 128	178 176		CARB SILTSTONE, fresh, high rock strength, minor coal, dark grey to black	130.00			
130 132	174 172		COAL, fresh, low rock strength, black	133.00			
134			SILTSTONE & COAL, fresh, medium rock strength, grey and black	134.00			
	170		SANDSTONE & SILTSTONE, fresh, hard rock strength, dark and light grey	135.00			
136 138 140 142 144 146 148 150			Borehole terminated at 135.0 m				



Appendix C

Final Void Water Balance Assessment

ENGENY

BOWEN COKING COAL

Broadmeadow East Mine PRCP

Final Void Water Balance Assessment

QC1015_004-REP-001-2

26 FEBRUARY 2024

DISCLAIMER

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Rev	Date	Description	Author	Reviewer	Project Mgr.	Approver
A	18/08/2023	Client Issue	Chris Harris	Samantha Breslin	Chris Harris	Samantha Breslin
1	19/09/2023	Client Issue	Chris Harris	Samantha Breslin	Chris Harris	Samantha Breslin
2	26/02/2024	Table 3.7 Update	Chris Harris	Samantha Breslin	Chris Harris	Samantha Breslin
Signatures:						

CONTENTS

Appendices

Tables

Figures

1. INTRODUCTION

Engeny Australia Pty Ltd (Engeny) has been engaged by Bowen Coking Coal (BCC) to undertake a final void water balance assessment for the Broadmeadow East (BME) Mine.

BME is an open cut coal mine located entirely within Mining Lease (ML) 70257. BCC purchased the 845-hectare (ha) ML 70257 from Peabody (Burton Coal) Pty Ltd, which led to the de-amalgamation from nearby tenures and associated Environmental Authority (EA) on 24 August 2020. BME is authorised under EA0002465, last issued on 2 February 2023.

BCC are preparing the transitional Progressive Rehabilitation and Closure Plan (PRCP) for BME. This report details the void hydrology water balance assessment for the final landform configuration of the site. It has been prepared to address relevant requirements of Section 3.6.3 'Voids' of the Department of Environment and Science (DES) PRCP Guideline (DES, April 2023) and to support development of the void closure plan for the site.

1.1 PRCP Guideline Section 3.6.3 Voids

This report addresses the following information requirements from the DES PRCP Guideline Section 3.6.3 'Voids':

- Void hydrology, addressing the long-term water balance and water level in the void, stratification and potential for overflow.
- Surface water elements of a water balance study including:
  - water storage and long-term water balance.
  - the sources of surface water within the mine catchment that are likely to influence the water quality in the void.
  - predicted water quality in the long-term including potential stratification.

2. SITE INFORMATION

BME is located 22 km north-east of Moranbah township and 120 km southwest of Mackay in the Queensland Bowen Basin (Figure 2.1).

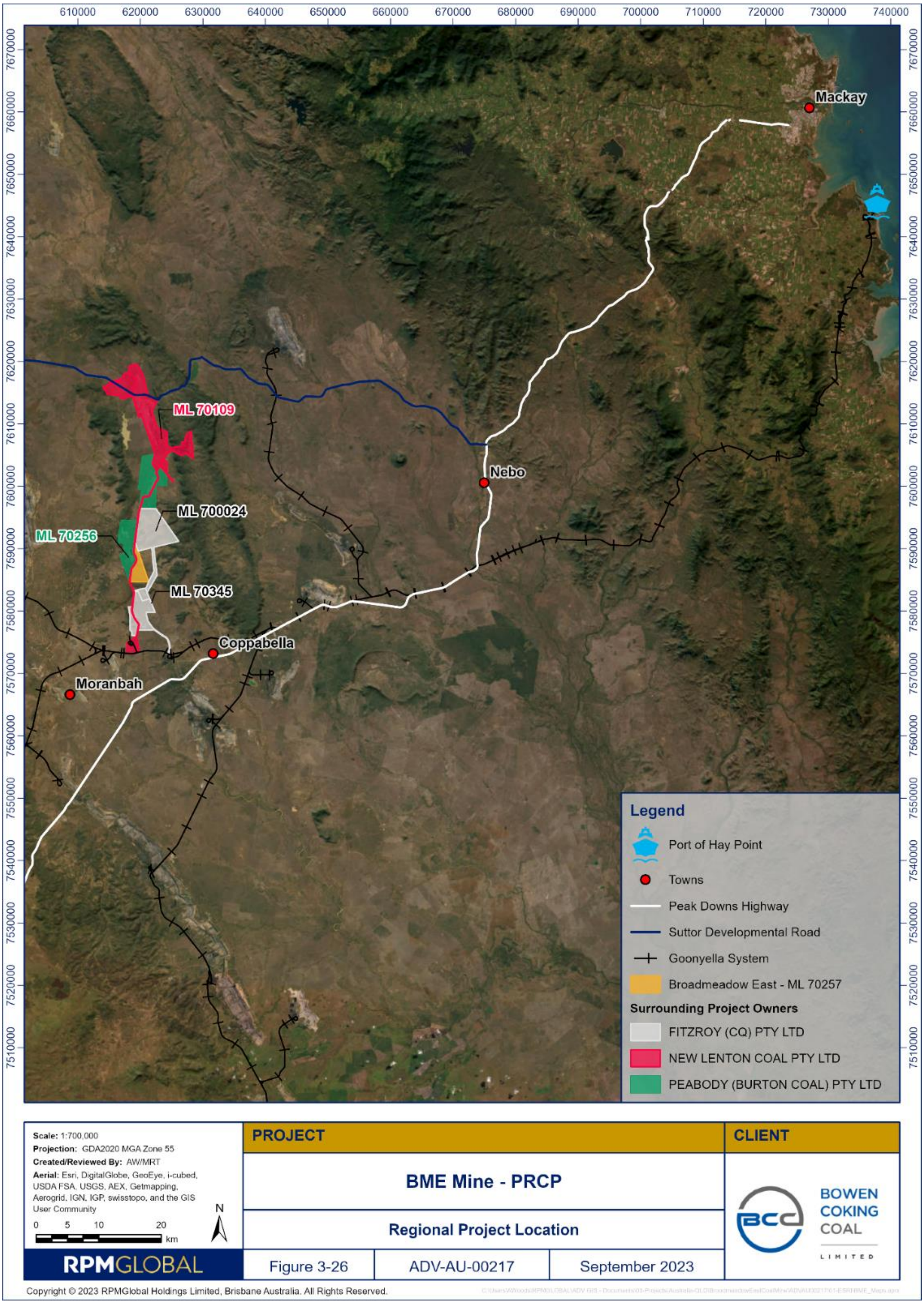

Figure 2.1: Site Location

2.1 Existing Site Topography and Water Features

Topographic data for BME includes detailed 5m Digital Terrain Model (DTM) within the ML boundary, and 25m Shuttle Radar Topography Mission (SRTM) DEM for the topography outside of the ML. The existing topography consists of several unnamed and named waterways, ranging from minor to non-perennial waterways. All waterways are ephemeral in nature. The largest of the waterways that traverse the ML is Hat Creek, which flows directly adjacent of the northern extent of the mine footprint. Hat Creek is a minor tributary of Teviot Brook, which it joins with downstream of the site boundary. Refer to Figure 2.2 for further information.

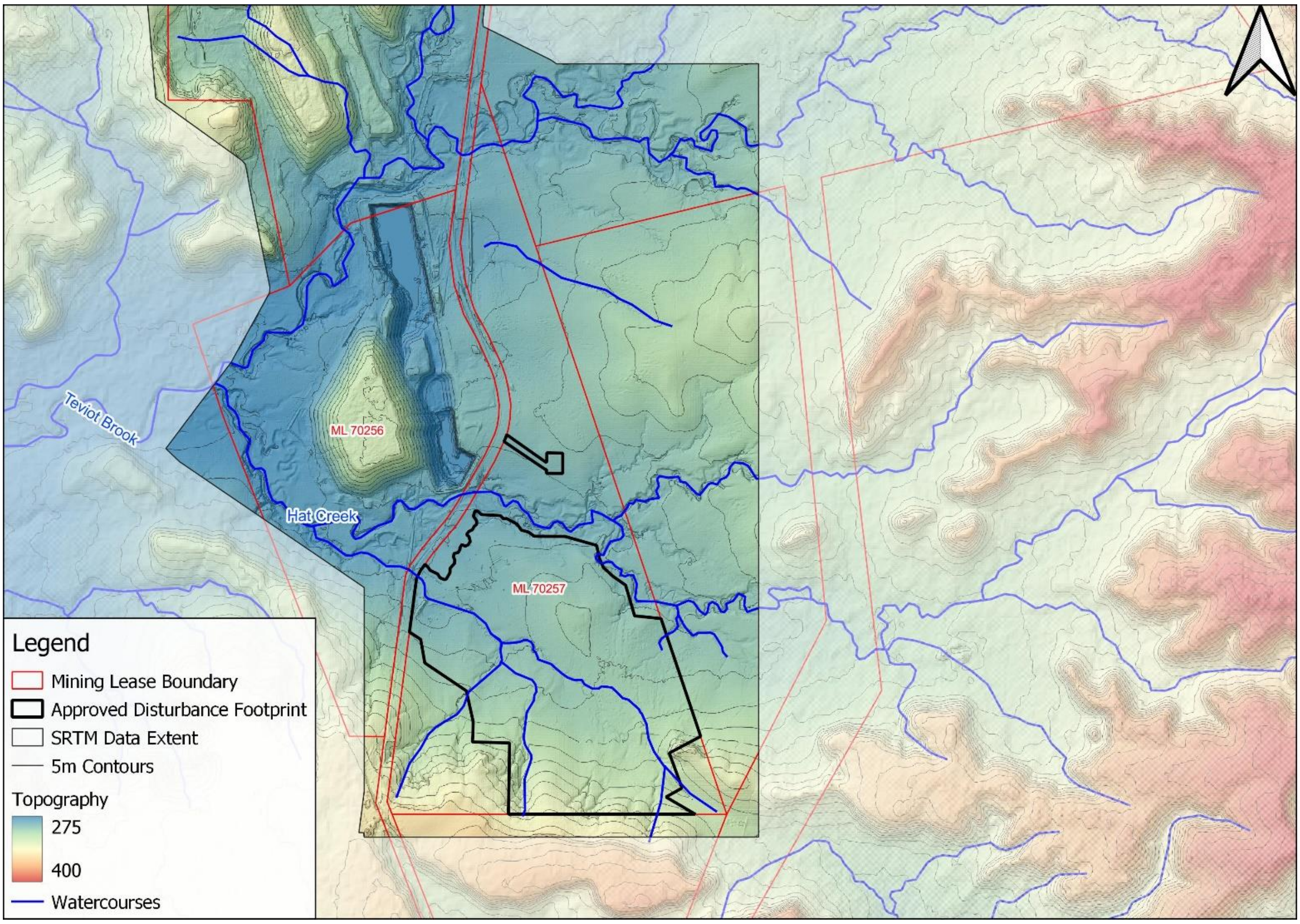

Figure 2.2: Existing Site Topography

2.2 Final Landform

Mining at BME has begun at the northern portion of the proposed pit area and is progressively occurring along the resource in a southerly direction. The northern portion of the pit will be partially backfilled and kept available for use as bulk water storage during operation. Prior to closure, the bulk water storage will be filled to the surrounding topography at the end of mine life when no longer required.

The initial overburden has been placed in the two Out of Pit Dumps that will be constructed over the operational period prior to rehabilitation works. Overburden will also be placed within the pit as mining progressively moves south, leaving one final void in the southern extent of the pit (South Pit). For the purposes of this assessment, all disturbed areas are assumed to be rehabilitated at closure excluding the area below the elevation of 250 RL (mAHD) to the base of pit at 225 RL (mAHD) within South Pit, due to this area being modelled below the longer-term water level based on WBM results (Refer to Appendix A). Drainage and pit protection infrastructure (e.g. bund/road) along the South pit highwall is proposed to remain post-closure after rehabilitation as a small access track for post closure monitoring and maintenance and will continue to direct clean surface water around South Pit towards Hat Creek to the North. This ensures that clean water runoff from the natural catchment area (~35ha) that would otherwise report into the pit, is directed towards Hat Creek and retained in the receiving environment catchment. The final landform for BME is shown in Figure 2.3.

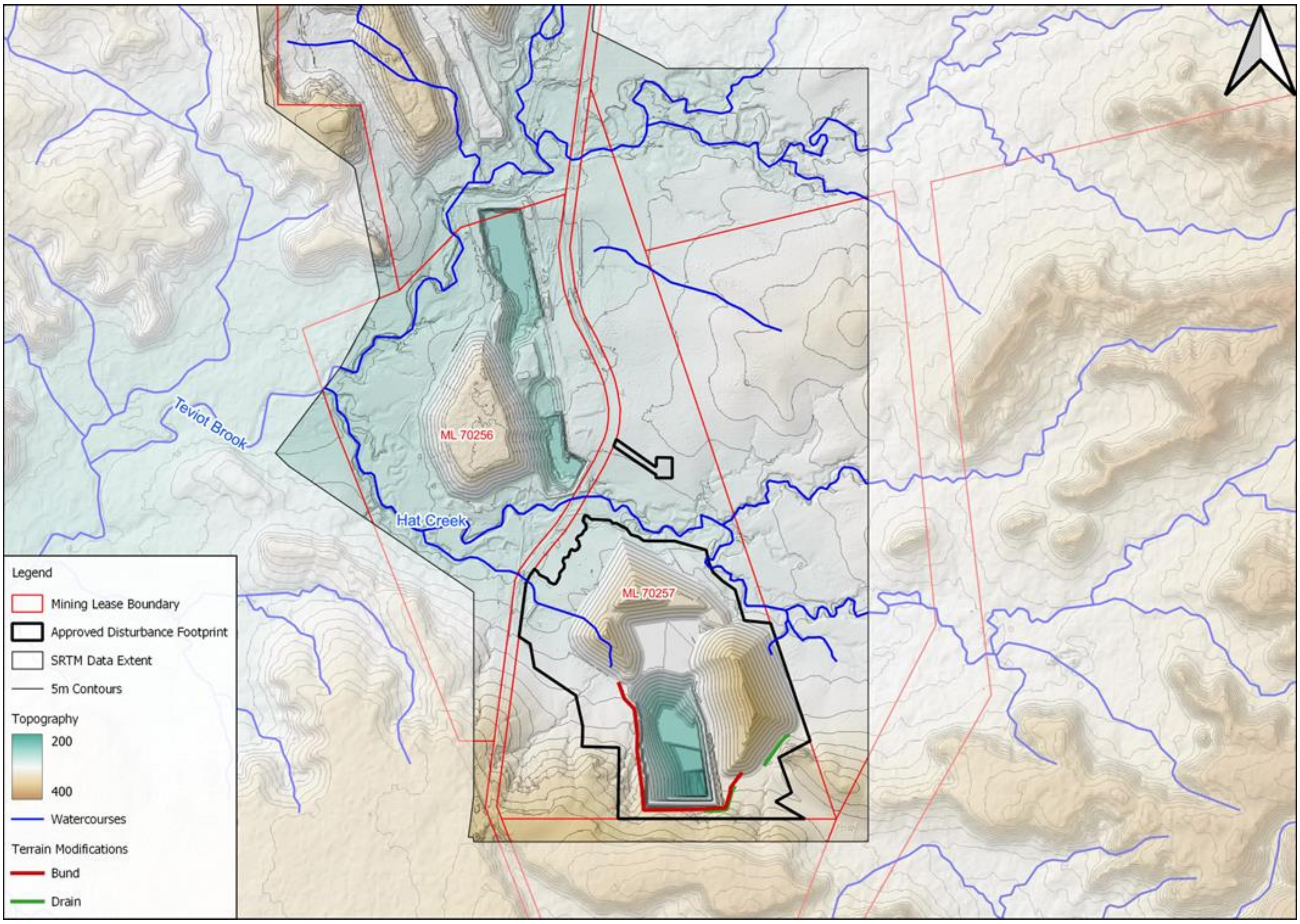

Figure 2.3: Final Landform

3. FINAL VOID HYDROLOGY ASSESSMENT

As discussed in Section 2, BME's final landform includes one open pit void in closure (South Pit). BME spoil stockpiles and the southern void low wall will be rehabilitated and regraded such that where practicable surface water drains away from South Pit. Based on the existing natural topography and proposed final landform, the southern void will have a surface water catchment of 167Ha. For the purpose of this hydrology assessment, all spoil dumps and disturbed areas are assumed to be successfully rehabilitated in the closure scenario and the southern void rehabilitated down to 250 RL (mAHD). No other water retaining pits/voids are proposed at closure of BME.

A void water balance model (WBM) has been developed using GoldSim modelling software. This model has been designed to represent the final landform configuration for the site to assess the behaviour of South Pit in the long-term post-closure. The void water balance model is used to calculate water volume and levels as well as quality (salinity) using a mass balance approach. The model uses the Australian Water Balance Model (AWBM) to estimate rainfall runoff from local climate data inputs.

The water balance model is based on local rainfall runoff modelling and does not incorporate flood interactions. As assessment of rehabilitation flood susceptibility is documented separately in the following study, QC1015_005-REP-0 "*Broadmeadow East Final Landform Flood Assessment"*.

The key indicators of the hydrological behaviour of the void for this assessment include:

- Void lake equilibrium level - The equilibrium level is defined as the forecast median level (50th percentile) after the initial filling period. This is considered to be the level at which the void lake is most likely to sit with periodic fluctuations above and below. Equilibrium level is relatively stable in the long-term following the initial filling period.
- Void lake equilibrium volume – The equilibrium volume is defined as the volume corresponding to equilibrium level.
- Void lake maximum level – The maximum level is defined as the highest void lake level forecast during the simulation.
- Void lake filling time – The void filling time is defined as the initial period of filling of the void after cessation of mining until the lake reaches its equilibrium volume.
- Ponded area at equilibrium – Equilibrium level is determined by the balance between lake inflows (primarily catchment runoff) and outflows (primarily evaporation). The evaporation is governed by the ponded area of the lake based on the adopted storage curve.
- Void lake water quality (Electrical Conductivity (EC)) 300 years after cessation of operations – Void lake salinity has been reported at the end of the simulation to indicate the general trend of EC over time. The concentration of salts is forecast to increase beyond the simulation period as there are negligible outflows of the salts from the residual void.
- Residual void outcome - The void equilibrium and maximum level results have been compared with the regional groundwater levels supplied by the groundwater technical consultants to determine whether the void is likely to act as a groundwater 'sink' or a 'source'.
  - Sink - A groundwater 'sink' refers to a void which has modelled equilibrium and/or maximum levels lower than the regional groundwater level. The hydraulic gradient generated by this change in levels would result in groundwater ingress to the pit.
  - Source - A groundwater 'source' refers to a void which has a net outflow of water from the void lake into the surrounding geology (generally identified by a water level above the regional groundwater level) where such outflow is not into the low-wall backfill material. In these cases, the hydraulic gradient could result in water within the pit seeping into groundwater systems.

3.1 Final Void Water Balance Model Development

The model development is summarised in Table 3.1 and the final void storage characteristics are shown in Figure 3.1

TABLE 3.1: FINAL VOID WATER BALANCE MODEL DEVELOPMENT

Input	Description
Final Void Inflows	
Catchment Runoff	Catchment runoff inflow to South Pit void is estimated as 167 ha (31ha final void surface area and 136 ha rehabilitated land). The associated AWBM and water quality parameters are provided in Table 3.4 and Table 3.5 .
Direct Rainfall	Direct rainfall on the final void surface area is calculated from daily rainfall applied to the surface area of the final void which is dynamically calculated each daily timestep using the stage storage relationship for South Pit as shown in Figure 3.1
Groundwater Inflows	Groundwater inflows calculated based on the final void level groundwater inflow relationship shown in Figure 3.2. The adopted groundwater inflow salinity is discussed in Section 3.1.4.
Final Void Outflows	
Evaporation	Evaporation from the final void lake surface area is calculated from daily Moreton's Lake Evaporation time series extracted from the SILO Data Drill at the BME location. Average annual Moreton's Lake evaporation at the final void waterbody is 1,806 mm/year (refer to Figure 3.3). For the purpose of modelling long term void lake behaviour, it is noted that evaporation rates from water bodies reduce with increasing water salinity. This reduction relationship varies depending upon the specific chemical composition of the water body. A site-specific relationship is not currently available for the BCM and consequently, Morton's method for adjusting evaporation rates has been adopted as presented in Hydrological Recipes: Estimation Technique in Australian Hydrology (1996). Evaporation reduction factor = $\frac{1}{\left[1+\frac{Salinity\ (ppm)}{10^\wedge 6}\right]}$ where, salinity (ppm) = Total Dissolved Solids (TDS) (mg/L).

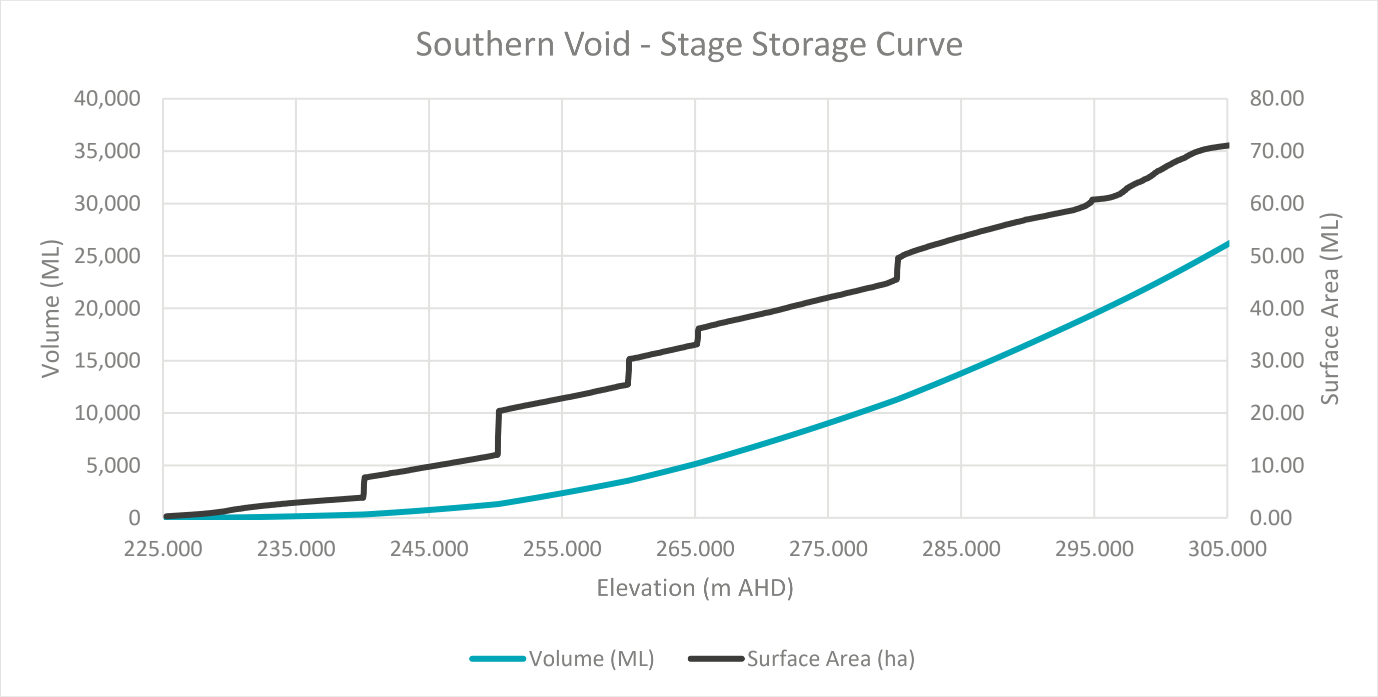

Figure 3.1: South Pit - Final Void Storage Characteristics

3.1.1 Model Key Assumptions

A number of key assumptions were made during the model development process and are summarized in Table 3.2.

TABLE 3.2: KEY WBM ASSUMPTIONS

Input Parameter	Assumption, Justification and Data Source
Groundwater Inflow to Pits	Groundwater ingress rate delineated in Figure 3.2. Based on updated numerical groundwater assessment undertaken by KCB in 2023.
Groundwater Quality	1000 mg/L (1500 µS/cm). Based on groundwater quality sampling data of Rangal Coal Measures (Bowen Coking Coal, 2021).
Southern Void Closure Starting Water Level	It is assumed that to allow for the removal / backfilling and rehabilitation of operational water retaining structures (i.e. Mine Water Dam and North Bulk Water Storage), total stored water at start of closure will be pumped to the Southern void. The Southern Void starting water level is therefore assumed to conservatively start at 380ML based on potential maximum storage on-site.

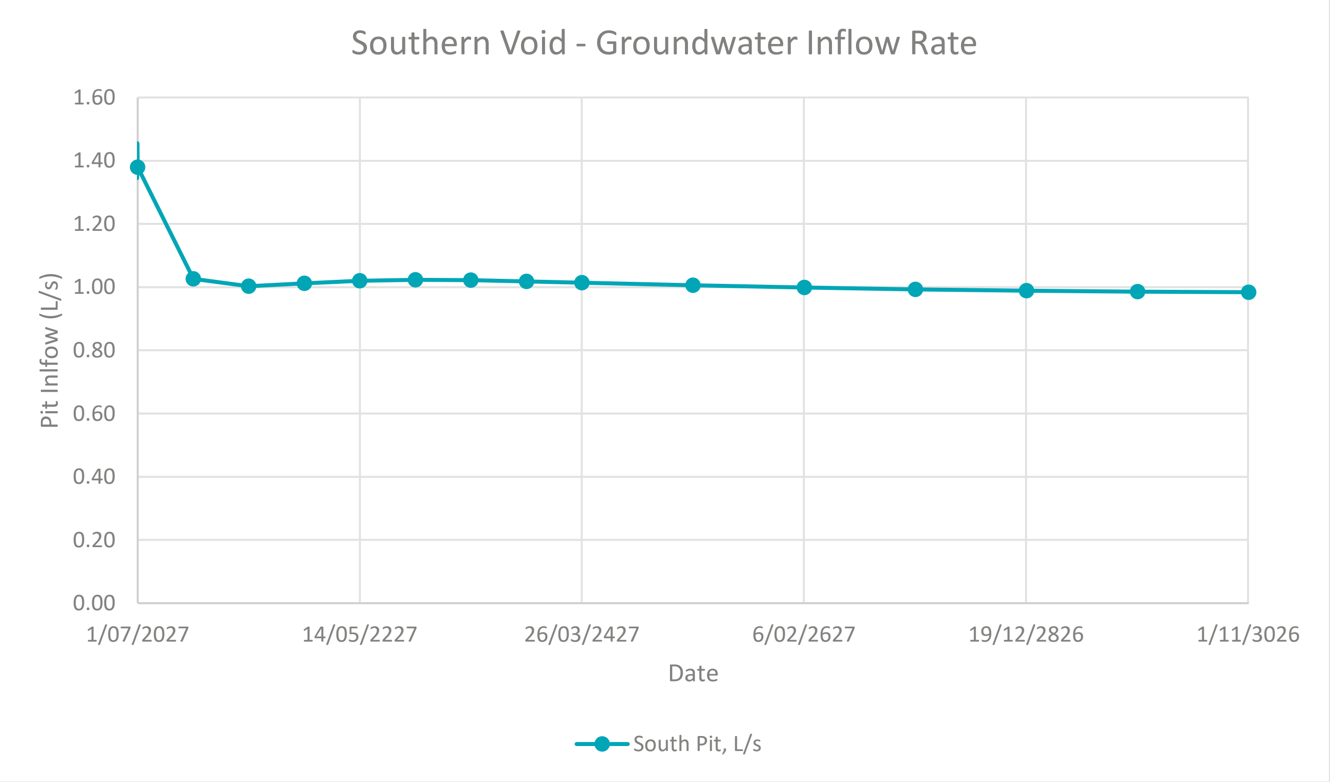

Figure 3.2: Southern Void Groundwater Ingress Curve (KCB, 2023)

3.1.2 Climate Inputs

Climate data for the system was derived from the SILO rainfall database facility hosted by the Department of Science, Information Technology and Innovation (DSITI). An approximate 300-year dataset was used to allow a continuous simulation of scenarios. Monthly average rainfall, evapotranspiration (Morton's Potential Evapotranspiration) and lake evaporation (Morton's Lake Evaporation) from the SILO climate dataset for BME are summarised in Table 3.3.

TABLE 3.3: MONTHLY AVERAGE CLIMATE DATA USED FOR WBM

Month	Rainfall (mm)	Lake Evaporation (mm)	Evapotranspiration (mm)
January	114	196	234
February	102	165	193
March	70	165	197
April	31	131	165
May	26	102	137
June	30	82	114
July	21	93	128
August	19	121	159
September	15	154	197
October	30	190	240
November	51	200	247
December	84	209	254
Total	**592**	**1,806**	**2,265**

3.1.3 Catchment Runoff

Catchment runoff has been simulated using the AWBM. The model represents the catchment using three surface stores to simulate partial areas of runoff. The water balance of each surface store is calculated independently of the others. The model calculates the water balance of each partial area at daily time steps. At each time step, rainfall is added to each of the three surface stores and evapotranspiration is subtracted from each store. If the value of water in the store exceeds the capacity of the store, the excess water becomes runoff. Part of this runoff becomes recharge of the base flow store if there is a base flow component to the stream flow. A schematic representation of the AWBM model is provided in Figure 3.3 .

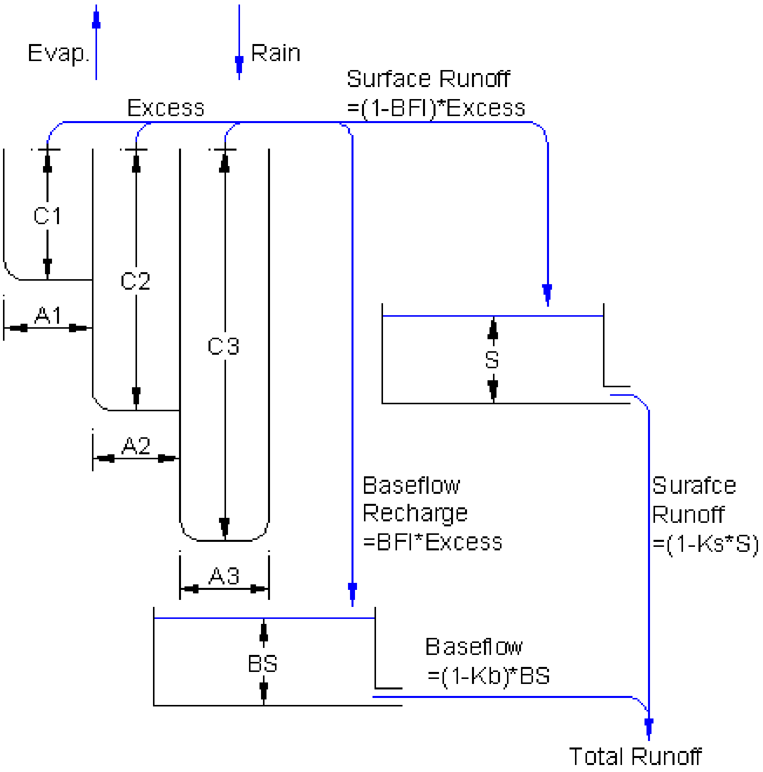

Figure 3.3: AWBM Schematic

The adopted AWBM parameters are shown in Table 3.4. In the absence of calibrated AWBM parameters for BME the adopted AWBM parameters are consistent with the parameters used and developed as part of a calibrated water balance model for the Bowen Basin which was calibrated to the Isaac River. The inability to calibrate project specific AWBM parameters is due to insufficient local stream flow gauging (the mine only commenced operations in 2022). Therefore, the adopted parameters are consequently considered the most representative for water balance modelling for the site.

In accordance with the EA permit, streamflow and water quality monitoring of Hat Creek will be conducted during operations upstream and downstream of site release points. This site-specific streamflow data will allow for future calibration and refinement of the adopted AWBM parameters as part of future water balance model updates under the BME Water Management Plan during operations.

TABLE 3.4: AWBM PARAMETERS

Parameter	Natural	Waste Dump/Active Rehabilitation	Mining Pit/Hardstand	Rehabilitated Spoil
A1	0.134	0.134	0.134	0.134
A2	0.433	0.433	0.433	0.433
A3	0.433	0.433	0.433	0.433
C1 (mm)	10	10	5	12
C2 (mm)	55	50	20	71
C3 (mm)	115	120	40	141
BFI	0.45	0.35	0	0.35
Kb	0.6	0.6	0.6	0.6
Ks	0.2	0.1	0.1	0.1
Average annual runoff coefficient	13.49%	13.88%	25.62%	11.27%

3.1.4 Catchment Runoff Water Quality

The WBM includes a contaminant transport model to simulate water quality (salinity) within site storages. Salinity generation rates for the assigned land use types are summarised in Table 3.5.

Runoff entering South Pit final void is assumed to be completely mixed with any current storage. This does not account for the potential stratification of water quality within the void where partial mixing with different layers may occur. Assuming complete mixing of the void lake provides an average salinity in the final void over the simulation period (Refer also to Section 3.2 below).

TABLE 3.5: SALINITY GENERATION RATES FOR LAND USE TYPES

Land Use Type	Salinity (µS/cm)	Source of Data
Natural	178	80th percentile water quality results of the tributaries of Burton Gorge Dam (Teviot Creek and Sandy Creek) were averaged and were adopted for the purpose of the WBM (Peabody, February 2019)
Mining Pit Floor	1,370	BME geochemical testing undertaken in February 2021
Rehabilitation Spoil	425	In absence of project specific water quality data for rehabilitated landuse, the parameter has been sourced from the regional model that has been calibrated to the Isaac River

3.2 Final Void Stratification

Stratification involves multiple layers of differing water quality based on density differences in the final void. The likelihood of stratification is mainly attributed to the depth of the final void water body. Some stratification is likely to occur in South Pit due to the average water depth within the pit of 29.1m, however stratification is likely to be negligible in terms of risk due to the average salinity level results from the water balance observed as already potentially hyper saline without further considering the likelihood of stratification turn over.

3.3 Final Void Water Balance Model Outcomes

The final void water balance model was simulated for 300 years based on historical climate data with 131 realizations. The key model outputs for the South Pit are summarised below and in Table 3.7. A graphical representation of the forecast void lake level, volume and salinity for South Pit is provided in Appendix A, B and C respectively.

- South Pit - Void Lake Levels.
  - The modelling results show no modelled overflows from the residual South void.
  - The void lake levels are forecast to fluctuate over time as a result of prevailing climate conditions. The approximate South Pit equilibrium level of 249 m AHD is 39.8 m below the pre-mining groundwater level of 288.8 m AHD.
  - The maximum South void lake level 254.1 m AHD is 45.9 m below the pre-mining groundwater level, and therefore, based on the modelled results it is expected the South Pit Void will have no potential net outflows to the local geology and regional groundwater and is considered a "groundwater sink".
  - The void lake level generally rises over the initial 25 years following the cessation of mining.
- South Pit - Void Lake Quality.
  - The salinity of South Pit void is forecast to continue to increase over time due to the ongoing concentration of salt due to evaporation with no outflows of salt from the system. WBM Southern void water quality results forecast pit water salinity over 10,000µS/cm within 70 years of closure.

TABLE 3.7: SOUTH PIT WBM RESULTS SUMMARY

Residual Void	Catchment Area (ha)	Void Equilibrium Level (m AHD)	Maximum Water Level (m AHD)	Void Spilling Elevation Level (m AHD)	Pre-mining Groundwater Level (m AHD)[1.]	Void Equilibrium Volume (ML)	Ponded area at Equilibrium (ha)	Average Void EC at 300 years (µS/cm)	Maximum Void EC at 300 years (µS/cm)[2.]	Initial Void Filling Period (Years)
South Pit	167	249.0	254.1	300	288.8	1,130	10.7	36,254	131,306	25

1. Pre-mining ground water level for South Void from MBBE0001

2 The maximum EC represents the fluctuations in water quality due to evaporation resulting in concentration of salt in the pit lake during dry periods.

4. QUALIFICATIONS

(a) In preparing this document, including all relevant calculation and modelling, Engeny Australia Pty Ltd (Engeny) has exercised the degree of skill, care and diligence normally exercised by members of the engineering profession and has acted in accordance with accepted practices of engineering principles.

(b) Engeny has used reasonable endeavours to inform itself of the parameters and requirements of the project and has taken reasonable steps to ensure that the works and document is as accurate and comprehensive as possible given the information upon which it has been based including information that may have been provided or obtained by any third party or external sources which has not been independently verified.

(c) Engeny reserves the right to review and amend any aspect of the works performed including any opinions and recommendations from the works included or referred to in the works if:

  (i) Additional sources of information not presently available (for whatever reason) are provided or become known to Engeny; or

  (ii) Engeny considers it prudent to revise any aspect of the works in light of any information which becomes known to it after the date of submission.

(d) Engeny does not give any warranty nor accept any liability in relation to the completeness or accuracy of the works, which may be inherently reliant upon the completeness and accuracy of the input data and the agreed scope of works. All limitations of liability shall apply for the benefit of the employees, agents and representatives of Engeny to the same extent that they apply for the benefit of Engeny.

(e) This document is for the use of the party to whom it is addressed and for no other persons. No responsibility is accepted to any third party for the whole or part of the contents of this Report.

(f) If any claim or demand is made by any person against Engeny on the basis of detriment sustained or alleged to have been sustained as a result of reliance upon the Report or information therein, Engeny will rely upon this provision as a defence to any such claim or demand.

(g) This Report does not provide legal advice.

5. REFERENCES

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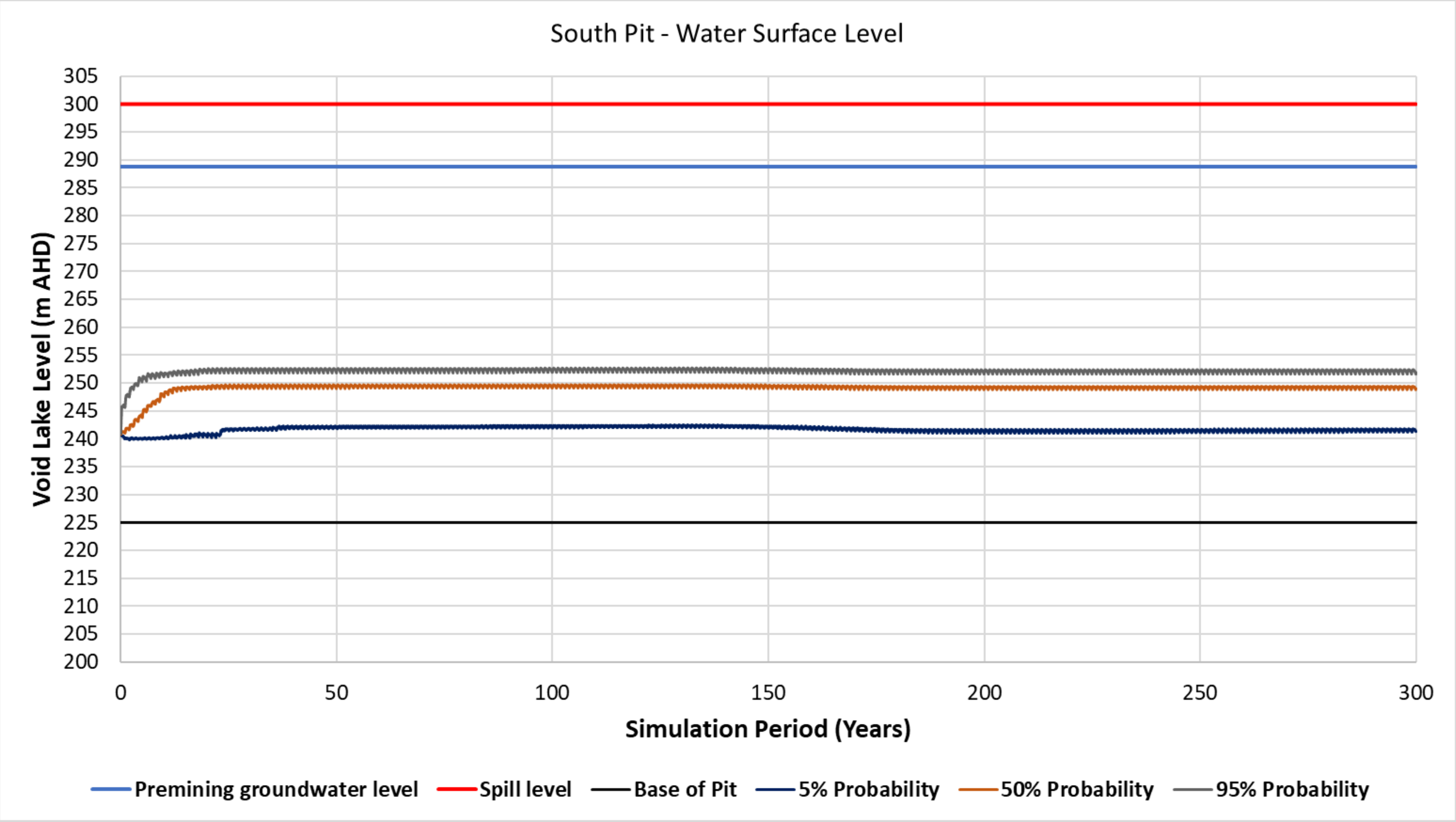
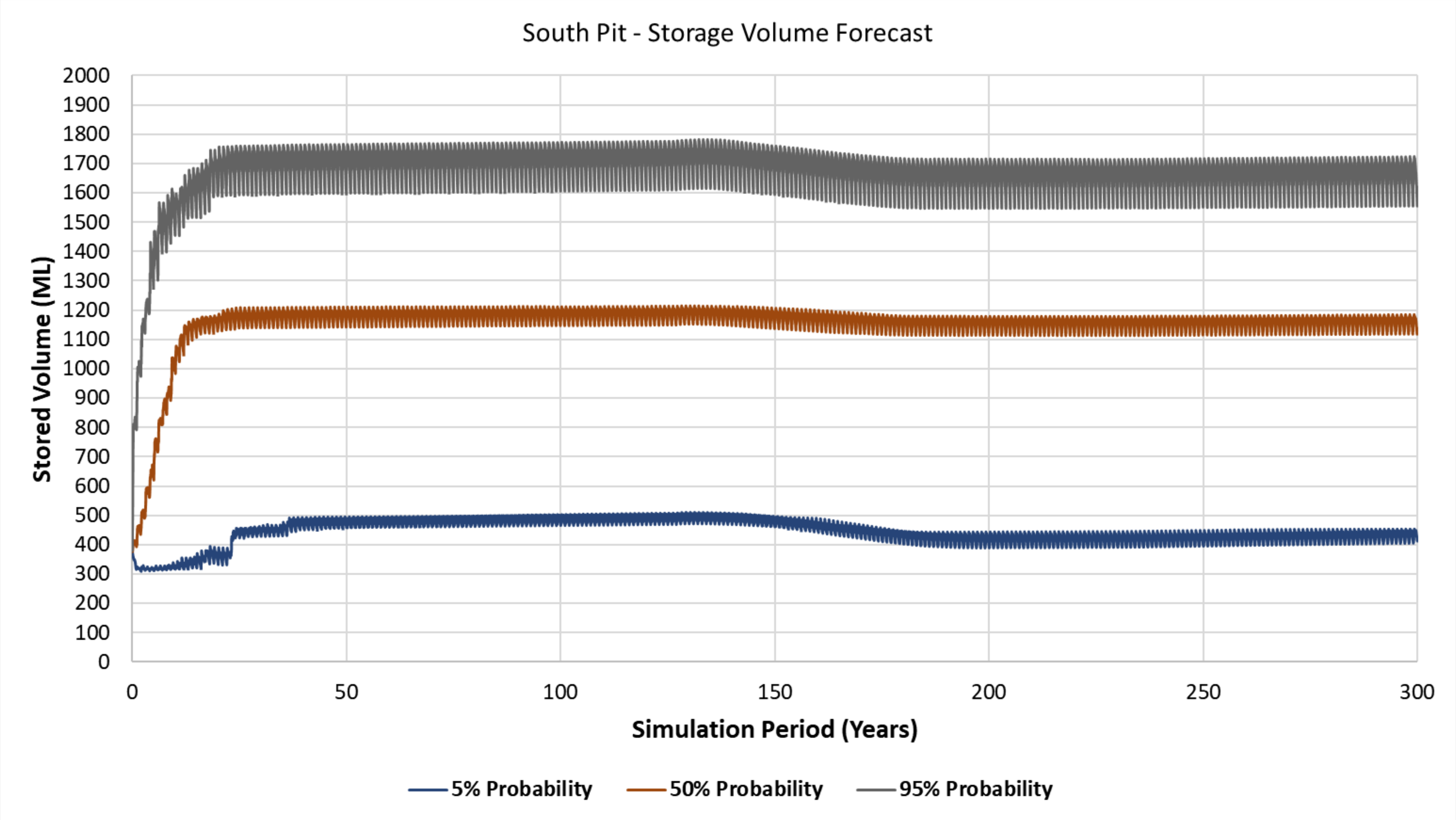
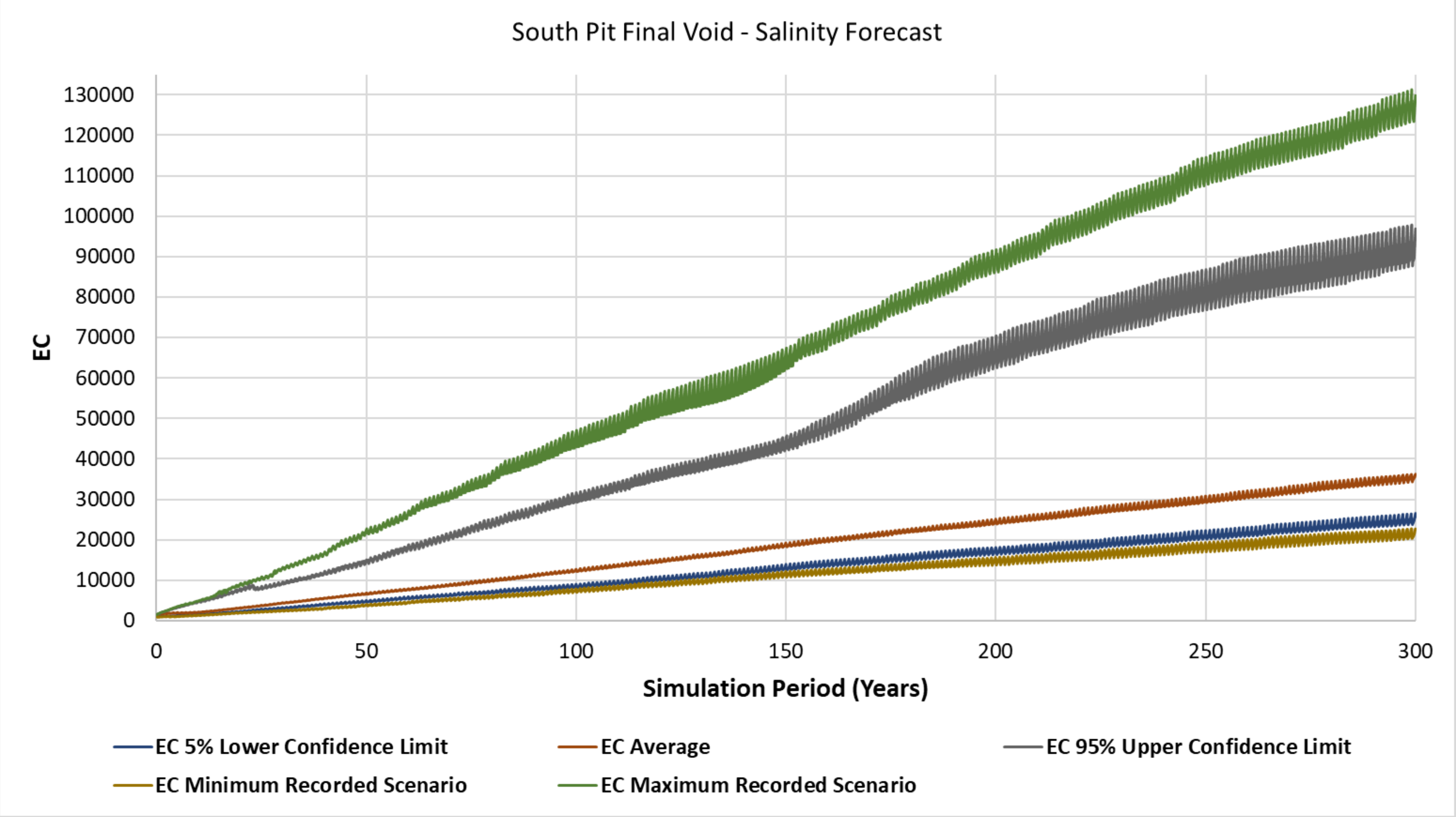
APPENDIX A: SOUTH PIT – WBM WATER SURFACE LEVEL RESULTS


South Pit - Water Surface Level
Void Lake Level (m AHD)
305
300
295
290
285
280
275
270
265
260
255
250
245
240
235
230
225
220
215
210
205
200
0
50
100
150
200
250
300
Simulation Period (Years)
Premining groundwater level
Spill level
Base of Pit
5% Probability
50% Probability
95% Probability

APPENDIX B: SOUTH PIT – WBM STORAGE VOLUME RESULTS


South Pit - Storage Volume Forecast
Stored Volume (ML)
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0
50
100
150
200
250
300
Simulation Period (Years)
5% Probability
50% Probability
95% Probability

APPENDIX C: SOUTH PIT – WBM SALINTY RESULTS


South Pit Final Void - Salinity Forecast
EC
130000
120000
110000
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
0
50
100
150
200
250
300
Simulation Period (Years)
EC 5% Lower Confidence Limit
EC Average
EC 95% Upper Confidence Limit
EC Minimum Recorded Scenario
EC Maximum Recorded Scenario

Appendix D

Update to Groundwater Quality Triggers Memorandum

TECHNICAL MEMORANDUM

TO: Richard Oldham
Bianca Voges-Haug
Aislinn Macintyre

DATE: 21 June 2024

FROM: Marlese Nel

FILE NO: DX70025A07

SUBJECT: Final Revision and Update of Groundwater Triggers for BME to support EA Amendment in response to Request for Information

1 INTRODUCTION

KCB Australia Pty Ltd (KCB) has been requested by Bowen Coking Coal (BCC) to assist with the revision and update of some of the groundwater triggers in support of an Environmental Authority (EA) Amendment application.

This document provides a brief background, an overview of the revision approach, calculation of proposed groundwater triggers, and recommendations are made for assigning trigger limits to new replacement bores drilled in October 2023.

2 BACKGROUND

BCC operates the Broadmeadows East (BME) Project under EA EA0002465 (February 2, 2023). Conditions D1 to D18 of the EA relate to groundwater.

Table D1 and Table D2 of the EA presents the current groundwater water level and quality triggers. These triggers were calculated in February 2022 based on data available at the time.

Condition D2 of the EA refers to the baseline groundwater monitoring program and in terms of triggers specifically states:

> *"h) identify groundwater quality limits and triggers to update Table D2 – Groundwater quality limits and submit to the administering authority by 1 April 2024 if required;"*

The purpose of this memorandum is to comply with condition D2 in support of an EA Amendment to update the groundwater level and quality triggers for the BME monitoring bores and to make recommendations regarding triggers for newly drilled replacement monitoring bores. It also provides support to the exceedance investigation for MBBE0001.

During the 2023 groundwater monitoring reporting period an exceedance was recorded as per definition in Condition D7:

> *"If the contaminant limits specified in Table D2 - Groundwater Quality limits are exceeded at the same monitoring bore on three (3) consecutive sampling occasions the holder of the environmental authority must notify the administering authority via WaTERS within twenty-four (24) hours of receiving the results".*

Compliance bore MBBE0001 recorded an exceedance for Electrical Conductivity (EC) and as per EA requirements a notification was made vis WaTERS and a subsequent investigation performed and submitted to DES within the required timeframe.

3 HYDROGEOLOGICAL CONCEPTUAL SUMMARY

3.1 Climate

The climate of the Project area is classified as sub-tropical continental, characterised by high variability in rainfall, temperature and evaporation, typical of the Central Queensland region, based on the modified Köppen classification system (BOM 2005).

Long-term rainfall data was sourced from the Scientific Information for Landowners database (SILO) at the Wentworth Station, located close to the Project area.

The rainfall data was analysed to produce a cumulative rainfall departure (CRD) trend (Figure 3.1). CRD trends present a running deviation of long-term actual rainfall against the average. This provides seasonal-scale identification of trends (wet/dry) and longer term (e.g., decadal) deviation from average conditions.

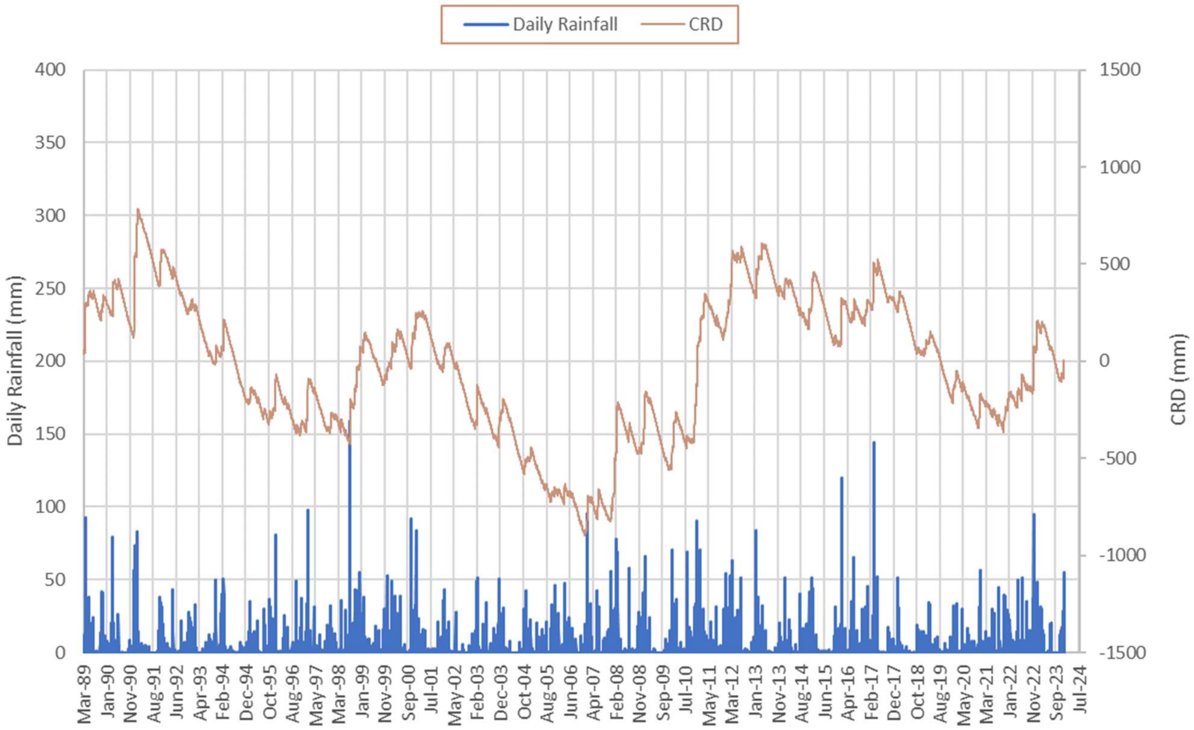


Figure 3.1 Daily rainfall and CRD, January 1989 to December 2023, Wentworth Station (SILO)

Key climatic trends observed in the period from the CRD trend are:

- 2002 to 2007: A 6-year decreasing trend, where below average rainfall occurred.
- 2007 to 2010: A 4-year increasing trend, but rainfall still below average.

- 2010 to 2019: A 10-year above average rainfall period, including some large rainfall events.
- 2019 to 2022: A 4-year below average rainfall period.
- 2023 to present: A short period of above average rainfall.

The impact of seasonality, long term climatic trends and above average rainfall events could manifest in changes in groundwater quality and should be taken into consideration when evaluating the groundwater chemistry.

3.2 Hydrostratigraphy

The following hydrostratigraphic units have been identified at BME:

- ***Quaternary Alluvium:*** a unit associated with the ephemeral watercourses in the Project area. The regional water table is typically located several metres below the base of the alluvium, which has a thickness ranging from 3 m to 4 m and is typically dry and unsaturated.
- ***Tertiary Sediments:*** a unit with a heterogenous profile of semi-consolidated quartz sandstone, clayey sandstone, mudstone and conglomerate, fluvial lacustrine sediments, and minor interbedded basalt. This unit is predominantly located to the south of the Project area and has a thickness of up to 15 m. As with the alluvium, these are typically located above the regional groundwater table and are therefore generally dry.
- ***Tertiary Basalt:*** a unit typically occurring as a single composite unit comprising massive and vesicular lava, tuff, and ash flows. The upper basalt profile mapped to the south of the Project area is highly weathered and comprises a basaltic clay. The hydraulic properties of the basalt can vary considerably as groundwater is primarily stored within highly compartmentalised fractures and vesicular zones. Tertiary basalt was identified only in one bore in the southwest corner of the mining lease, where it is 15 m thick and dry.
- ***Triassic Rewan Group:*** a unit that is recognised as a regional aquitard and acts as a confining unit overlying the Permian sediments. The Rewan is a thin interbedded sequence of siltstone, claystone and minor fine-grained sandstone that overlies the Permian coal measures. This unit outcrops across majority of the eastern portion of the Project area and sub-crops beneath the alluvium, Tertiary sediments and basalt where present.
- ***Permian Coal Measures:*** a unit that comprises of alternating layers of fine to medium grained sandstone, siltstone and coal, including the target Leichhardt seam of the Rangal Coal Measures. Permian strata occur across the Project area as a regular layered sedimentary sequence dipping to the east, with outcrops of these units observed within the Project area and sub-cropping beneath the Rewan Group towards the east. Individual coal seams form the principal water bearing strata within the coal measures and are therefore typically saturated and the majority of the monitoring bores are screened within this unit.

The geology encountered, groundwater qualities and dissolved metal concentrations are not unexpected based on the geology of the site and dissolved metal concentrations in the groundwater are reflective of local geology and local pH.

3.3 Potential sources of groundwater quality impact

Processing and associated management of rejects from processing activities will be handled offsite at an existing facility. Therefore, the potential for contamination of the groundwater will be in relation to spills associated with hydrocarbon and chemical usage at the Project site. However, the storage of hydrocarbons and chemicals will be managed in accordance with standard management practices, including the use of bunding and the immediate clean-up of spill, which are typically legislated requirements at mine sites.

OOPD's (stockpiles and dumps) could impact the groundwater quality when leachate from the OOPDs' reaches the groundwater level. The hydrogeological environment on the site will determine how fast (based on hydraulic conductivity) and how far (extent of potential impact) this potential impact could occur.

4 GROUNDWATER MONITORING PROGRAM

4.1 Current EA monitoring bores

Condition D3 states that 'groundwater quality and levels must be monitored at the locations and frequencies defined in Table D1 – Groundwater monitoring locations and frequency'. Further requirements for groundwater quality monitoring and groundwater level monitoring are provided in Condition D4 and D5 respectively.

The current monitoring network as presented in Table D1 of the EA is summarised in Table 4.1.

Table 4.1 Groundwater Monitoring Locations and Frequency (Adapted from Table D1 of the EA February 2, 2023)

Monitoring ID	Easting (GDA20)	Northing (GDA20)	Monitoring Frequency
Compliance Bore			
MBBE0001	619884	7585428	▪ Quarterly measurements of SWL[a] ▪ Quarterly EC and pH ▪ Six-monthly for remaining analytes
MBBE0007	620615	7586415	
EA Monitoring Bore			
MBBE0002	618436	7585329	▪ Quarterly measurements of SWL ▪ Quarterly EC and pH ▪ Six-monthly for remaining analytes
MBBE0003	618431	7584664	
MBBE0004	620205	7586976	
MBBE0006	619173	7587205	
MBBE0008	620294	7585092	
BDW5C	619687	7586758	
BDW8C	619782	7585651	
BDW172(32)	619376	7586650	
BDW172(54)	619376	7586650	

a. SWL = Standing Water Level

Baseline monitoring data at BME is available for the EA monitoring bores for the time periods as summarised in Table 4.2.

Table 4.2 Baseline monitoring data time periods for EA bores

Monitoring ID	Monitoring period	
	From	To
BDW172(32)*	Aug-99	Feb-22
BDW172(54)*	Aug-99	Feb-22
BDW5C*	Jan-06	Sep-22
BDW8C*	Jan-06	Aug-23
MBBE0001**	Feb-21	2024
MBBE0002b	Feb-21	Current
MBBE0003	Feb-21	Current
MBBE0004	Feb-21	Current
MBBE0006*	Feb-21	Sep-23
MBBE0007	Apr-21	Current
MBE00008	Aug-21	Current

*mined through
**planned to be mined through

Some data gaps exist for BDW172(32), BDW172(54), BDW5C and BWD8C; before BCC took ownership of the mine in January 2021. Since then, monitoring has been recorded and reported as per the EA requirements.

Due to progression of mining operations, some of the existing EA monitoring bores have been mined through. Four (4) new replacement monitoring bores were therefore drilled in October 2023 to update the groundwater monitoring network.

The updated monitoring network locations are shown in Figure 4.5.

4.1.1 Groundwater Monitoring Results

MBBE0001

Groundwater quality data from February 2021 to February 2024 for compliance bore MBBE0001 indicates a slight increase in electrical conductivity (EC). The minimum and maximum over this period are 801 µS/cm and 947 µS/cm respectively.

The EC concentrations and the current water quality trigger limit are shown in Figure 4.1 and a summary of the results for analytes as listed in Table D2 of the EA for this bore is shown in Table 4.3 (values in exceedance of water quality trigger limit as stipulated in EA highlighted in **red**).

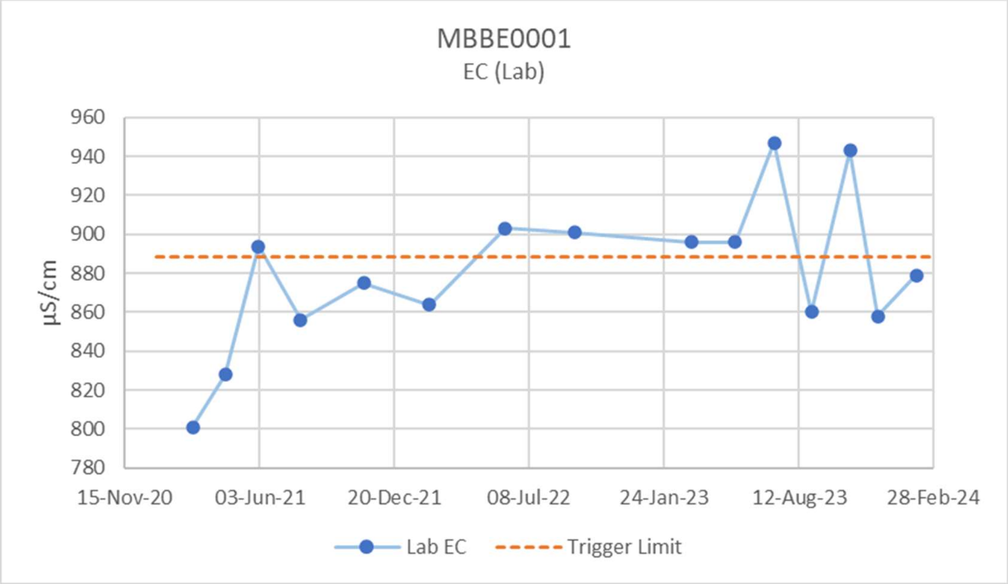


Figure 4.1 **Electrical conductivity (EC) for compliance bore MBBE0001 for total monitoring period**

Table 4.3 Laboratory results for water quality triggers (as per Table D2 EA0002465) for MBBE0001 over monitoring period

Trigger Parameter	Unit	MBBE0001														
		Feb 2021	April 2021	June 2021	Aug 2021	Nov 2021	Feb 2022	June 2022	Sept 2022	March 2023	May 2023	July 2023	Aug 2023	Oct 2023	Dec 2023	Feb 2024
pH	pH units	8.3	7.78	8.26	8.03	8.26	8.11	8.09	8.34	8.22	8.29	8.2	8.01	8.13	7.99	8.09
Electrical Conductivity	µs/cm	801	828	**894**	856	875	864	**903**	**901**	**896**	**896**	**947**	860	**943**	858	879
Sulfate	mg/L	<1[1]	<1[1]	<1[1]	<1[1]	<1[1]	<1[1]	<1[1]	<1[1]	<1[1]	<1[1]	<1[1]	<1[1]	<1[1]	<1[1]	<1[1]
Arsenic	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Aluminium	mg/L	0.07	0.08	0.08	0.06	0.04	0.03	0.03	0.01	<0.01	0.02	0.02	<0.01	0.02	<0.01	<0.01
Molybdenum	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	mg/L	<0.01[1]	<0.01[1]	<0.01[1]	<0.01[1]	<0.01[1]	<0.01[1]	<0.01[1]	<0.01[1]	<0.01[1]	<0.01[1]	<0.01[1]	<0.01[1]	<0.01[1]	<0.01[1]	NR

1. Note: where exceedances are at the limit of reporting of the lab, halving of the value results in less than or equal to the trigger value.

NR = No Resul

Figure 4.2 Groundwater Quality Monitoring Results and Compliance Triggers

MBBE0007

Groundwater quality data from February 2021 to February 2024 for compliance bore MBBE0007 indicates a slight increase in sulfate (SO_4). The minimum and maximum over this period are 850 mg/L and 1,060 mg/L respectively.

The sulfate concentrations and the current water quality trigger limit are shown in Figure 4.3 and a summary of the results for analytes as listed in Table D2 of the EA for this bore is shown in Table 4.4 (values in exceedance of water quality trigger limit as stipulated in EA highlighted in **red**).

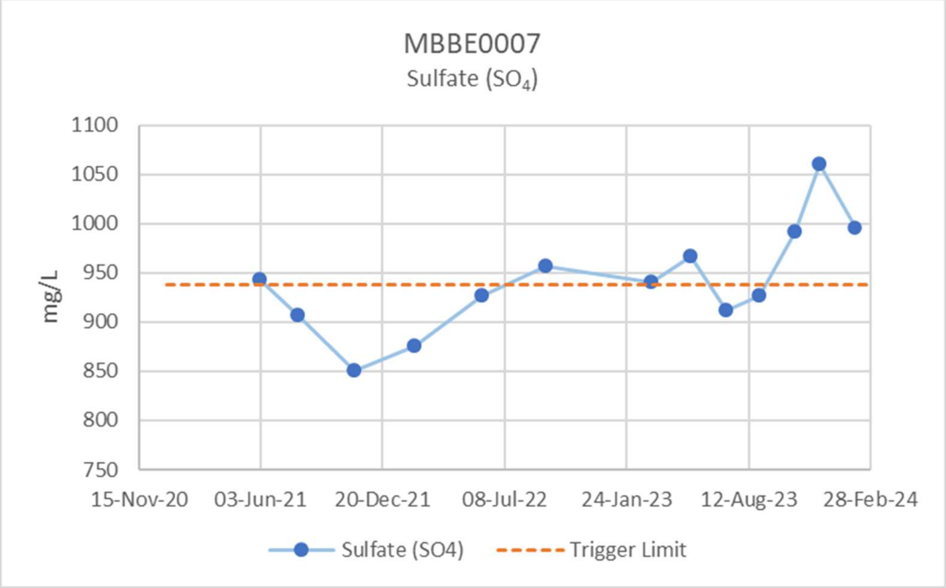


Figure 4.3 Sulfate for compliance bore MBBE0007 for total monitoring period

Table 4.4 Laboratory results for water quality triggers (as per Table D2 EA0002465) for MBBE0007 over monitoring period

Trigger Parameter	Unit	MBBE0007												
		June 2021	Aug 2021	Nov 2021	Feb 2022	June 2022	Sept 2022	March 2023	May 2023	July 2023	Aug 2023	Oct 2023	Dec 2023	Feb 2024
pH	pH units	7.53	7.34	7.79	7.51	7.34	7.63	7.52	7.66	7.47	7.45	7.58	7.4	7.22
Electrical Conductivity	µs/cm	48,200	47,600	40,200	**48,600**	47,900	**56,400**	45,200	43,000	47,900	45,400	46,300	**48,600**	47,400
Sulfate	mg/L	**943**	907	850	876	926	**956**	**940**	**966**	912	927	**991**	**1060**	**996**
Arsenic	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Aluminium	mg/L	0.37	<0.05	<0.05	<0.05	0.64	<0.05	<0.05	<0.05	<0.05	<0.05	0.07	<0.05	<0.05
Molybdenum	mg/L	0.021	0.02	0.026	0.02	0.022	0.015	0.015	0.015	0.027	0.01	0.012	0.009	0.005
Selenium	mg/L	<0.10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.002	<2

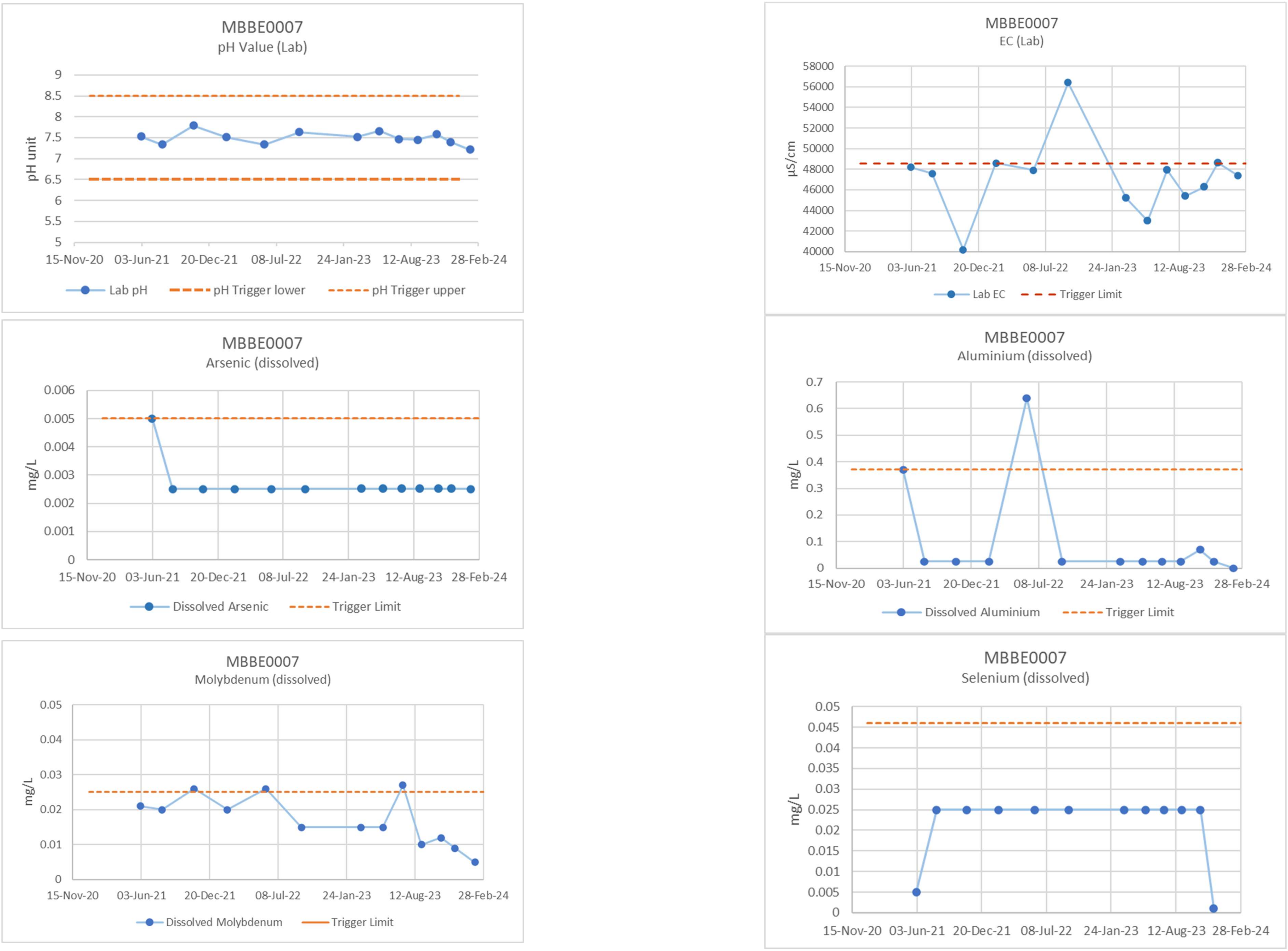


Figure 4.4 **Groundwater Quality Monitoring Results and Compliance Trigger**

4.2 Updated Groundwater Monitoring Network

The current network as stipulated in Table D1 of EA includes 11 monitoring bores screened in five hydrostratigraphic units at varying depths.

Recent changes were made to the network:

- Various monitoring bores were mined through due to the progression of mining activities.
- Drilling of four (4) replacement bores in Q4 2023.

The updated BME monitoring network now consists of 10 monitoring bores screened in five hydrostratigraphic units at varying depths. The updated network is presented in Figure 4.5 and summarised in Table 4.5.

One of the current compliance bores, MBBE0001, is planned to be decommissioned in 2024 and replaced by bore MBBE0009 at that time. From December 2023, until monitoring is stopped at MBBE0001, these two bores are monitored concurrently to ensure continuous records for EA compliance.

Table 4.5 Updated Monitoring Bore Network Details and Monitoring Requirements Q1 2024

Monitoring Point	Easting	Northing	Screened Interval (mbgL*)	Aquifer / Monitored Interval	TOC[3] elevation (mAHD)[4]	Monitoring Frequency		Comments
	(GDA20)					Quarterly	Six monthly	
Updated EA Monitoring Bores								
MBBE0002b[1]	618436	7585329	10.0 to 13.0	Tertiary Sediments	323.7	pH and EC	All other analytes	Ongoing
MBBE0003[1]	618431	7584664	4.0 to 7.0	Basalt	345.7	pH and EC	All other analytes	Ongoing
MBBE0004[1]	620205	7586976	2.0 to 5.0	Alluvium	290.8	pH and EC	All other analytes	Ongoing
MBBE0008	620294	7585092	130.0 to 133.0	Rangal Coal Measures	305.2	pH and EC	All other analytes	Ongoing
MBBE0010[5]	620362	7586723	52.0 to 58.0	Rewan Group	292.39	pH and EC	All other analytes	Monitoring started Oct 2023
MBBE0011[5]	619058	7587386	3.0 to 6.0	Alluvium	285.13	pH and EC	All other analytes	Monitoring started Oct 2023
MBBE0012[5]	619797	7584702	51.0 to 57.0	Rangal Coal Measures	336.42	pH and EC	All other analytes	Monitoring started Oct 2023
Compliance Bores								
MBBE0001[2]	619884	7585428	63.0 to 66.0	Rangal Coal Measures	305.2	pH and EC	All other analytes	Ongoing until mined through
MBBE0009[5]	620376	7586716	104.0 to 110	Rangal Coal Measures	292.46	pH and EC	All other analytes	Monitoring started Oct 2023.
MBBE0007	620615	7586415	40.0 to 46.0	Rewan Group	297.9	pH and EC	All other analytes	Ongoing
Surrounding Bores								
MBBE0005[1]	620519	7586210	4.0 to 7.0	Rewan Group	297.1	Not sampled		Ongoing

1. Some bores are often dry and unavailable for water levels.
2. MBBE0001 to be replaced by MBBE0009, already drilled in Oct 2023. Continue monitoring of both until MBBE0001 is mined out (2024).
3. TOC – top of casing.
4. mAHD – meters above Australian Height Datum
5. Replacement monitoring bores (Drilled October 2023)

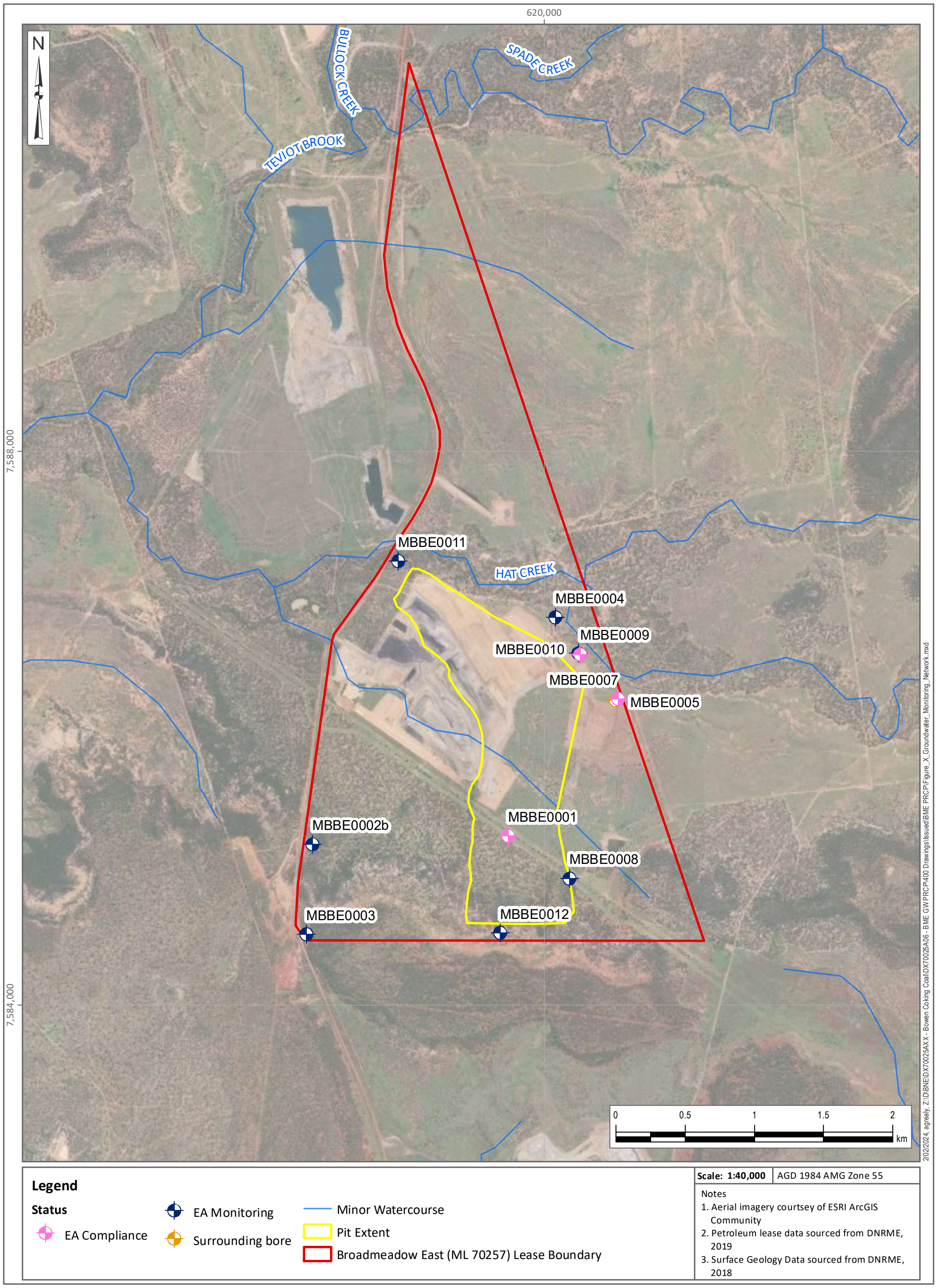


Figure 4.5 Updated Groundwater Monitoring Network (as in Q1 2024)

5 INVESTIGATION TRIGGER VALUES

5.1 Overview

The DES 2021 Guideline explains that *‘trigger values are typically the numerical criteria that, if exceeded, provide an alert of a change that warrants further investigation for the contaminant being measured’.*

The Guideline offers two alternative methods: ‘default values’ or ‘site-specific’. Where sufficient data is available, the site-specific approach is preferred, and this is the approach adopted for BME. The Guideline explains that groundwater quality can be highly variable. The variability can be influenced by local geology, residence time in the aquifer and groundwater-rock interactions, which can result in naturally elevated concentrations (e.g. salinity), dissolved nutrients and metals. As groundwater quality can be variable, the Guideline states that the use of ‘default’ values, such as those derived from the Queensland Water Quality Guidelines (DEHP 2013), and Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018) for the protection of freshwater aquatic ecosystems or stock drinking water and the Australian Drinking Water Quality Guidelines (NHMRC 2018) ‘may not always be appropriate’ (page 1). In these cases, site-specific values should be calculated which are aquifer-based and operational area-defined, as these are considered more representative.

The DES guidance document (2021) identifies that:

> *“Trigger values should be fit for purpose and conservative enough such that, when applied, they provide an early warning of emerging potential impacts to groundwater. Applying triggers that are set too high may not be sensitive enough to identify current or emerging contamination issues. Conversely, if triggers and limits are set too low, natural variability may be mistaken for contamination events and result in unnecessary reporting and investigation.”*

5.2 Methodology

This assessment was undertaken in a manner that is consistent with the DES guidance document (2021). An approach has been adopted that considers the site-specific conditions and is targeted towards understanding trends, providing BME with appropriate triggers to initiate actions.

DES (2021) recommends that groundwater quality assessment be based on comparing a number of consecutive sample tests at investigation trigger bores to a limit based on percentile calculations. This approach is aimed at reducing the probability of a false positive whilst ensuring that the approach is sufficiently sensitive to detect potential impacts.

5.2.1 Adoption of Percentiles

The approach is based on combining the ANZECC 2000 methodology, adapted control charting approaches, and statistics. The approach includes the calculation of the following:

- Limit - maximum (95th percentile) of existing time series monitoring data.
- pH limits based on ANZECC freshwater aquatic ecosystem trigger value (ANZG 2018).

5.2.2 Data Used to Develop Trigger Levels

The following approach was used to develop the trigger levels:

- All monitoring data from January 2021 to February 2024 was compiled into one data set for consideration.
- Anomalous values or outliers were removed for individual bores prior to calculation of the trigger value (consistent with guidance provided by DSITI 2017).
- If <50% of the dataset were non-detects (under the Limit of Recognition (LoR)) the non-detect values were set at half of the detection concentrations.
- If >50% of the dataset were non-detects (under the LoR), these values were removed from the dataset before site-specific triggers were calculated on the remaining data.
- If there are less than eight (<8) data points available that are greater than LoR, the guidelines recommend using the default or WQO until sufficient data is collected to calculate a site-specific value.
- If there are no default guidelines for a given analyte or if the default guideline is less than the LoR, KCB recommends the LoR to be used as the trigger limit until sufficient data is collected to calculate a site-specific value.
- If more than one species (e.g. As(III) and AS(V)) and we don’t know which one the laboratory will analyse, then the more stringent of the default values is set as trigger value.

5.3 Groundwater Contaminant Triggers

The ‘source-pathway-receptor’ approach has been adopted to assess the need for trigger values in accordance with the guidelines wherein site activities, the hydrogeological environment and identified environmental receptors are considered. This approach reviews environmental values, available data and existing groundwater quality changes to choose appropriate groundwater quality trigger levels.

The primary source of potential contaminants associated with the Project may include spoil dumps and surface water management facilities. However, throughout the duration of Project operation, and during mine closure, groundwater flow will be towards the proposed pit / post-closure pit voids (KCB 2023). This is due to dewatering activities associated with the pit development causing a drawdown in the local groundwater regime; and the final post-closure groundwater equilibrium level resulting in the development of a localised groundwater sinks in vicinity of the Project area. Therefore, throughout operation of the Project, and into mine closure, there will be no groundwater flow pathway from the Project area to downstream receptors.

The parameters chosen for trigger development (pH, EC, SO_4, Al, As, Fe) are appropriate for the contaminants of concern for coal mining operations.

Table 5.2 provides a summary of all the data points used in the calculation of the trigger limits for compliance bores MBBE0001 and MBBE0007.

The initial calculated groundwater quality trigger values for the indicator parameters for the monitoring bores are shown in Table 5.3 and are based on the monitoring data collected at the specific bores between January 2021 to February 2022. This has been taken up in the EA of 3 February 2023.

Since February 2022, additional water quality data has become available. These results have been evaluated and trigger values updated where applicable according to the DES 2021 guideline document. These updated triggers are summarised in Table 5.4.

The WQOs for the Isaac River Groundwaters (Zone 34) have been identified for both the shallow (<30 m) and deep systems (>30 m) (DEHP, 2011).

The ANZG default water quality guidelines for the groundwater quality parameters have been identified for aluminium, silver, arsenic, mercury, antimony, molybdenum, and selenium based on a moderately disturbed system. These are presented in Table 5.1.

There are no default water quality guidelines or objectives for potassium, carbonate, and total petroleum hydrocarbons (TPH).

Table 5.1 Default Guidelines and WQOs for Key Analytes

Indicator	Default Guidelines and WQOs						
	ANZG Default (mg/L) (Slightly to Moderately Disturbed – 80th percentile)	Isaac River Groundwaters (Zone 34)					
		Shallow (<30m)			Deep (>30m)		
		20th	50th	80th	20th	50th	80th
pH		7.10	7.75	8.10	7.40	7.80	8.03
Electrical Conductivity (uS/cm)		498	2150	8910	3419	6100	16000
Calcium (mg/L)		18	84	215	46	145	442
Magnesium (mg/L)		27	108	389	35	115	491
Sodium (mg/L)		135	747	1500	480	1100	2565
Potassium (mg/L)		-	-	-	-	-	-
Chloride (mg/L)		171	1309	3185	753	1900	5905
Sulphate (mg/L)		12	140	318	25	138	398
Carbonate (mg/L)		-	-	-	-	-	-
Bicarbonate (mg/L)		187	536	878	188	330	650
Iron (mg/L)		0.000	0.030	0.140	0.000	0.050	0.246
Aluminium (mg/L)	0.055*	-	-	-	-	-	-
Silver (mg/L)	0.00005*	-	-	-	-	-	-
Arsenic (mg/L)	0.013*^	-	-	-	-	-	-
Mercury (inorganic) (mg/L)	0.00006#	-	-	-	-	-	-
Antimony (mg/L)	0.009	-	-	-	-	-	-
Molybdenum (mg/L)	0.034	-	-	-	-	-	-
Selenium (mg/L)	0.005#	-	-	-	-	-	-
Total Petroleum Hydrocarbons (ug/L)	-	-	-	-	-	-	-

* 95% level of species protection recommended for slightly to moderately disturbed ecosystems.

^ The ANZG 2018 specify different toxicant trigger values for arsenic Arsenite As(III) and Arsenate As(V); when the speciation of arsenic is unknown, as in this case, the more conservative trigger value (Arsenate As(V)) should be used.

To account for the bioaccumulating nature of this toxicant, it is recommended that the 99% species protection level DGV is used for slightly to moderately disturbed systems.

Table 5.2 Summary of data point statistics for compliance bore trigger calculations

Compliance Parameter	pH	EC	Sulfate (SO4)	Aluminium (dissolved)	Arsenic (dissolved)	Molybdenum (dissolved)	Selenium (dissolved)
MBBE0001							
Amount of data points on 23 Feb 2024	16	16	16	16	16	15	14
Limit of Reporting	0.01	1	0.1*	0.01	0.001	0.001	0.01
% of dataset <LoR	0	0	100	25	56	73	100
Amount of data points usable	16	14	0	12	7	4	0
Other reason for exclusion of data point-/s		2 outliers					
Proposed Trigger	**6.5 - 8.5**	**901.7**	**Default***	**0.08**	**Default***	**Default***	**Default***
MBBE0007							
Amount of data points on 23 Feb 2024	13	13	13	13	13	13	13
Limit of Reporting	0.01	1	0.1*	0.01	0.001	0.001	0.01
% of dataset <LoR	0	0	0	76	92	7	84
Amount of data points used	13	12	10	3	1	12	1
Other reason for exclusion of data point-/s		Outlier	Outliers, rain dilution				Outlier
Proposed Trigger	**6.5 - 8.5**	**48,600**	**961.5**	**Default***	**Default***	**0.02**	**Default***

*If >50% of the dataset were non-detects (under the LoR), these values were removed from the dataset before site-specific triggers were calculated on the remaining data. If less than 8 points then available, the default or WQO is allocated as trigger until sufficient data (>8 points) are available.

Table 5.3 Current Groundwater Quality Trigger Values (Table D-2 from EA)

Monitoring Point	Parameter	pH	EC	Sulfate (SO_4)	Arsenic	Aluminium	Molybdenum	Selenium	Major ions
	Sample	Range	Max	Max	Max	Max	Max	Max	
	Unit	pH units	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	
MBBE0001		6.5 – 8.5	888.3	0.5	0.002	0.08	0.001	0.005	Interpretation Only
MBBE0007			48,540	937.6	0.005	0.37	0.025	0.046	

Table 5.4 Proposed Groundwater Quality Trigger Values

Monitoring Point	Parameter	pH	EC	Sulfate (SO_4)	Arsenic	Aluminium	Molybdenum	Selenium	Major ions
	Sample	Range	Max	Max	Max	Max	Max	Max	
	Unit	pH units	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	
MBBE0001		6.5 – 8.5	901.7	398*	0.013*	0.08	0.034*	0.013*	Interpretation Only
MBBE0007			48,600	961.5	0.013*	0.055*	0.02	0.013*	
MBBE0009			16,000*	398*	0.013**	0.055**	0.034**	0.005**	

*default WQO value
**default values ANZECC/ARMCANZ (2000)

5.4 Groundwater Level Triggers

KCB developed a numerical groundwater model for the BME project site in September 2023 as part of the Progressive Rehabilitation and Closure Plan (PRCP). After calibration of the model, groundwater level predictions were done for different times during mining operations, as well as post-closure. Maximum drawdown levels for each hydrostratigraphic unit are shown in Figure 5.1 to Figure 5.5.

These model results were used to determine maximum drawdown for the newly drilled bores, MBBE0009, MBBE0010, MBBE0011 and MBBE0012. Recommended groundwater level triggers are summarised in Table 5.5. Groundwater trigger levels for BME compliance bores have also been updated and these are presented in Table 5.6.

No pre-mining baseline standing water level can be allocated to MBBE0011 since the bore was dry after construction and subsequent monitoring rounds confirmed the absence of groundwater in the bore.

Table 5.5 Predicted Groundwater Levels with Proposed Trigger Levels

Purpose	Bore ID	Ground level elevation (mAHD)	Bore depth (meters below surface)	Baseline SWL (mbTOC)	Groundwater Trigger Elevation* (mAHD)
Investigation Trigger	MBBE0010	291.63	58	21.36	267.23
Investigation Trigger	MBBE0011	284.34	8	N/A	N/A
Investigation Trigger	MBBE0012	335.72	58	46.43	280.23

N/A – Not Applicable, bore dry
*based on numerical model predictions for maximum drawdown

Table 5.6 Proposed Groundwater Trigger Levels for Compliance Bores

Purpose	Bore ID	Ground level elevation (mAHD)	Bore depth (meters below surface)	Baseline Water Level (mbTOC)	Baseline Water Level (mAHD)	Groundwater Trigger Elevation* (mAHD)
Compliance Bore	MBBE0001	304.5	67.6	17.11	288.1	241
Compliance Bore	MBBE0007	297.10	52	18.22	279.6	273
Compliance Bore	MBBE0009#	291.65	166	24.74**	266.1	267.48

* Based on numerical model predictions for maximum drawdown
**Used first recorded manual dip water level after bore drilled and before mining commenced
to replace MBBE0001 as Compliance Bore in future

It is recommended that the EA be amended so that any exceedance of the predicted maximum groundwater drawdowns be used as trigger values to indicate excessive drawdown. The groundwater model is conservative, and therefore, the predicted maximum drawdown values should not be reached under currently anticipated conditions. To avoid false triggering, triggers for groundwater levels are defined to occur when average values exceed the groundwater trigger elevation for three or more consecutive monitoring rounds.

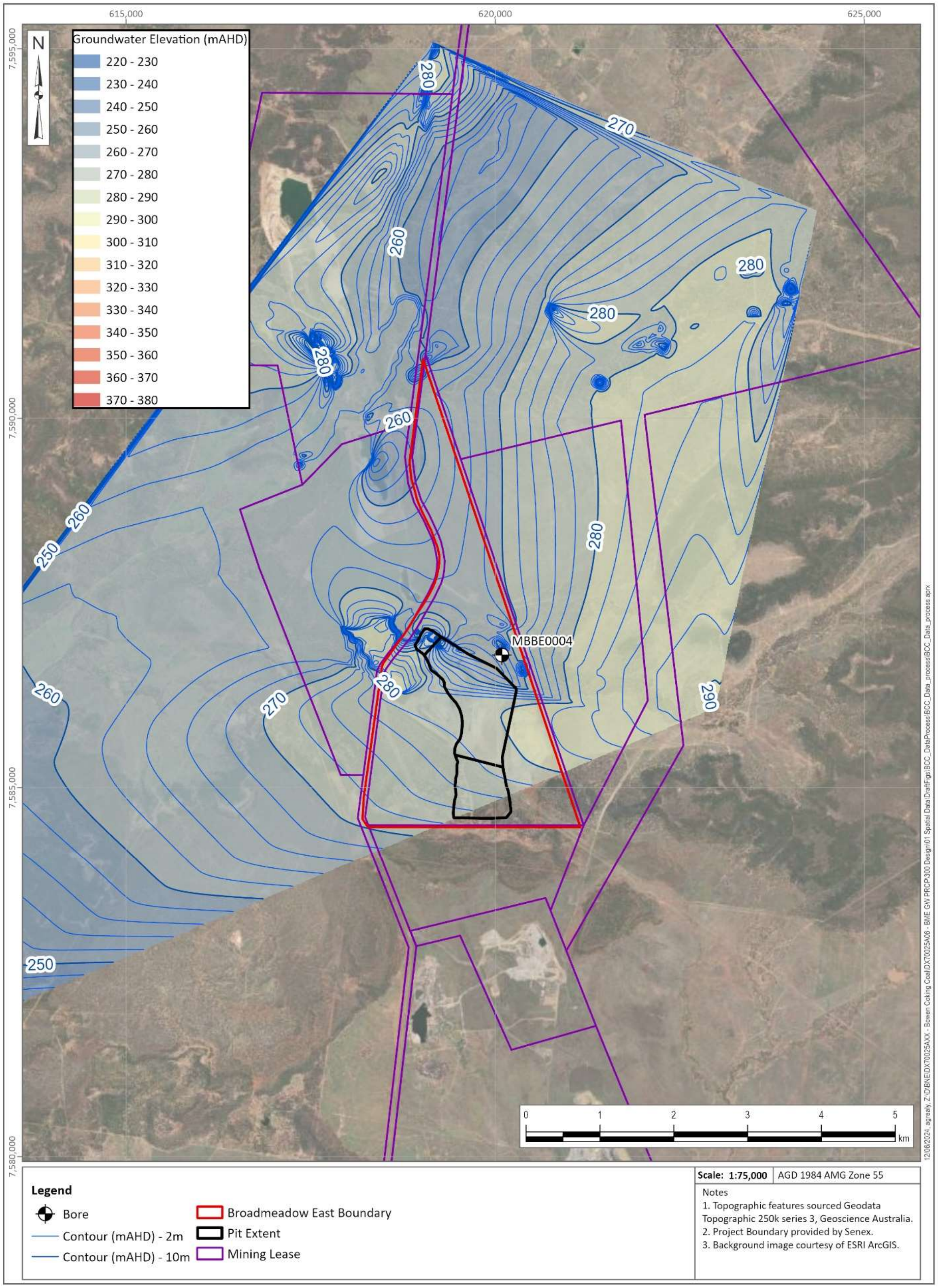


Figure 5.1 Predicted Maximum Drawdown Elevation in Layer 1 – Quaternary Alluvium

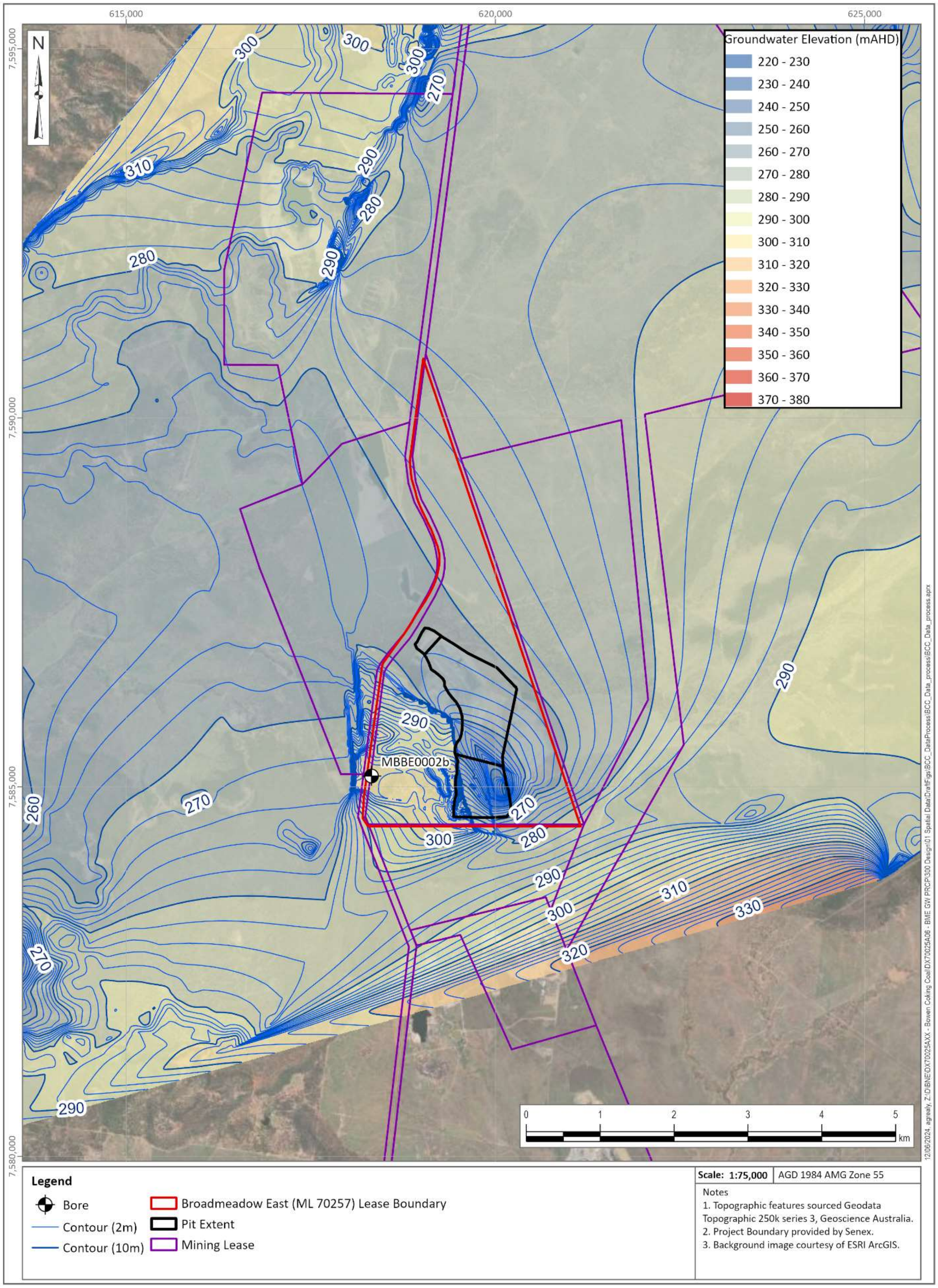


Figure 5.2 Predicted Maximum Drawdown Elevation in Layer 2 – Tertiary Sediments

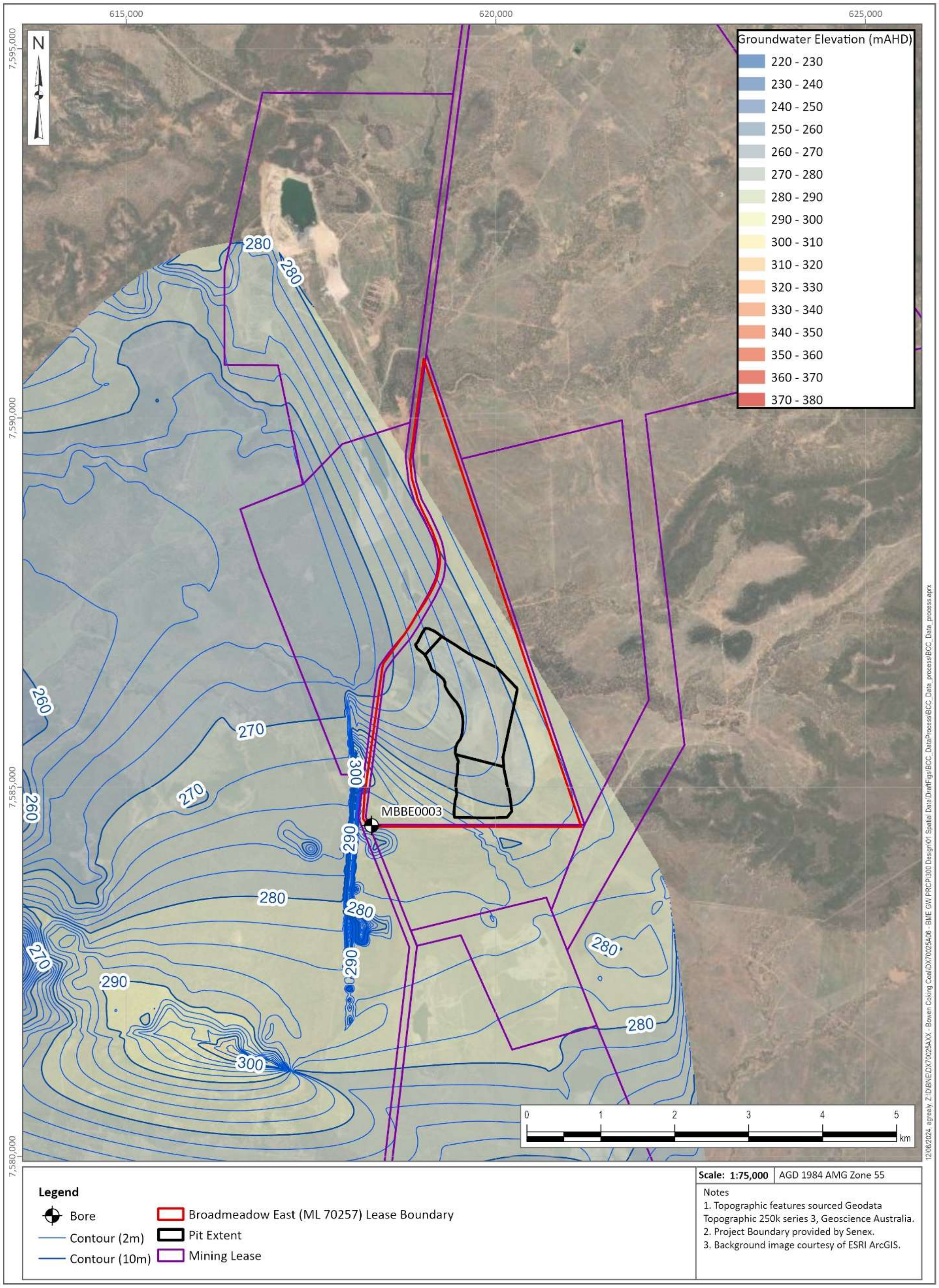


Figure 5.3 Predicted Maximum Drawdown Elevation in Layer 3 – Tertiary Basalt

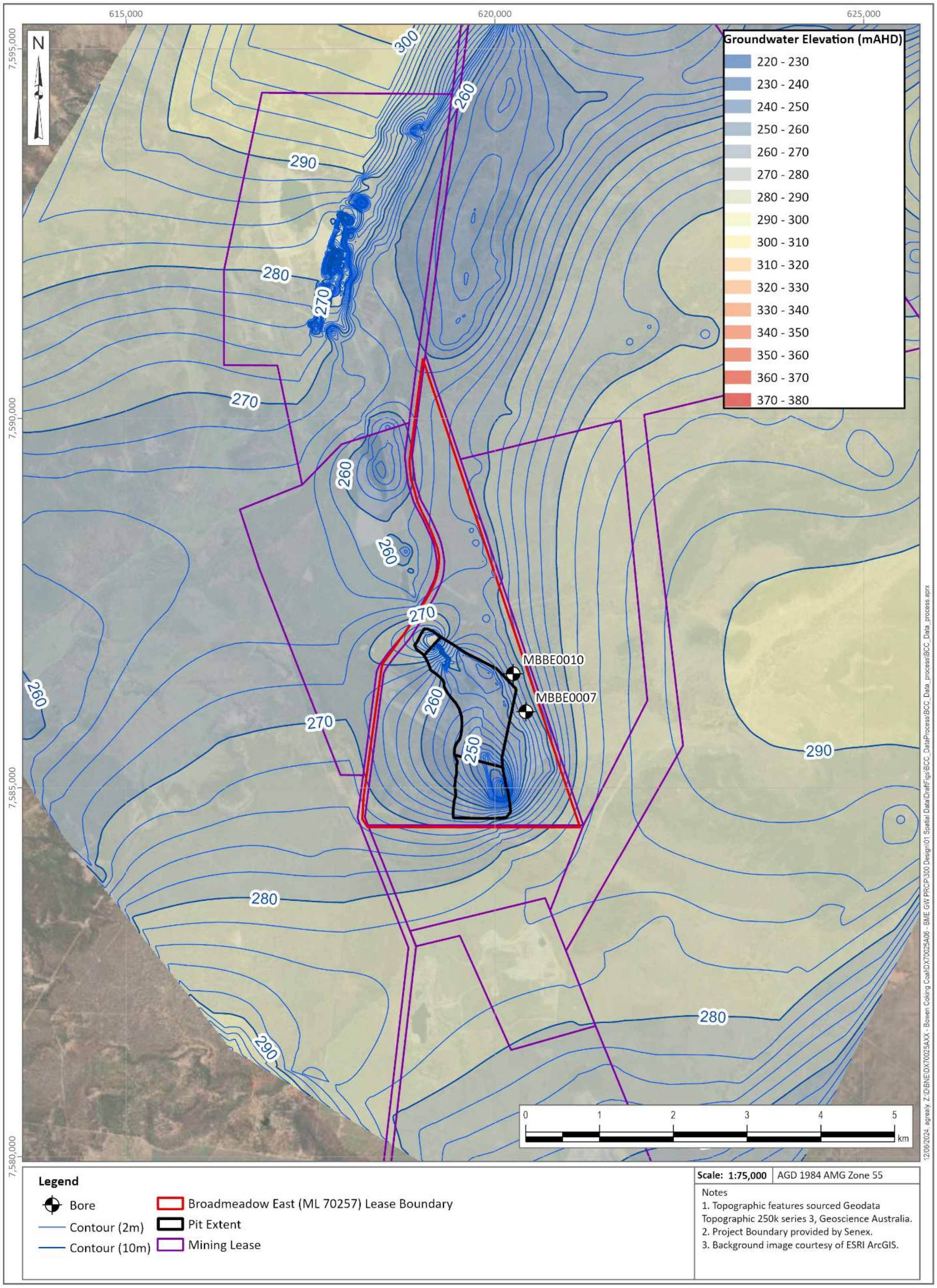


Figure 5.4 Predicted Maximum Drawdown Elevation in Layer 4 – Rewan Group

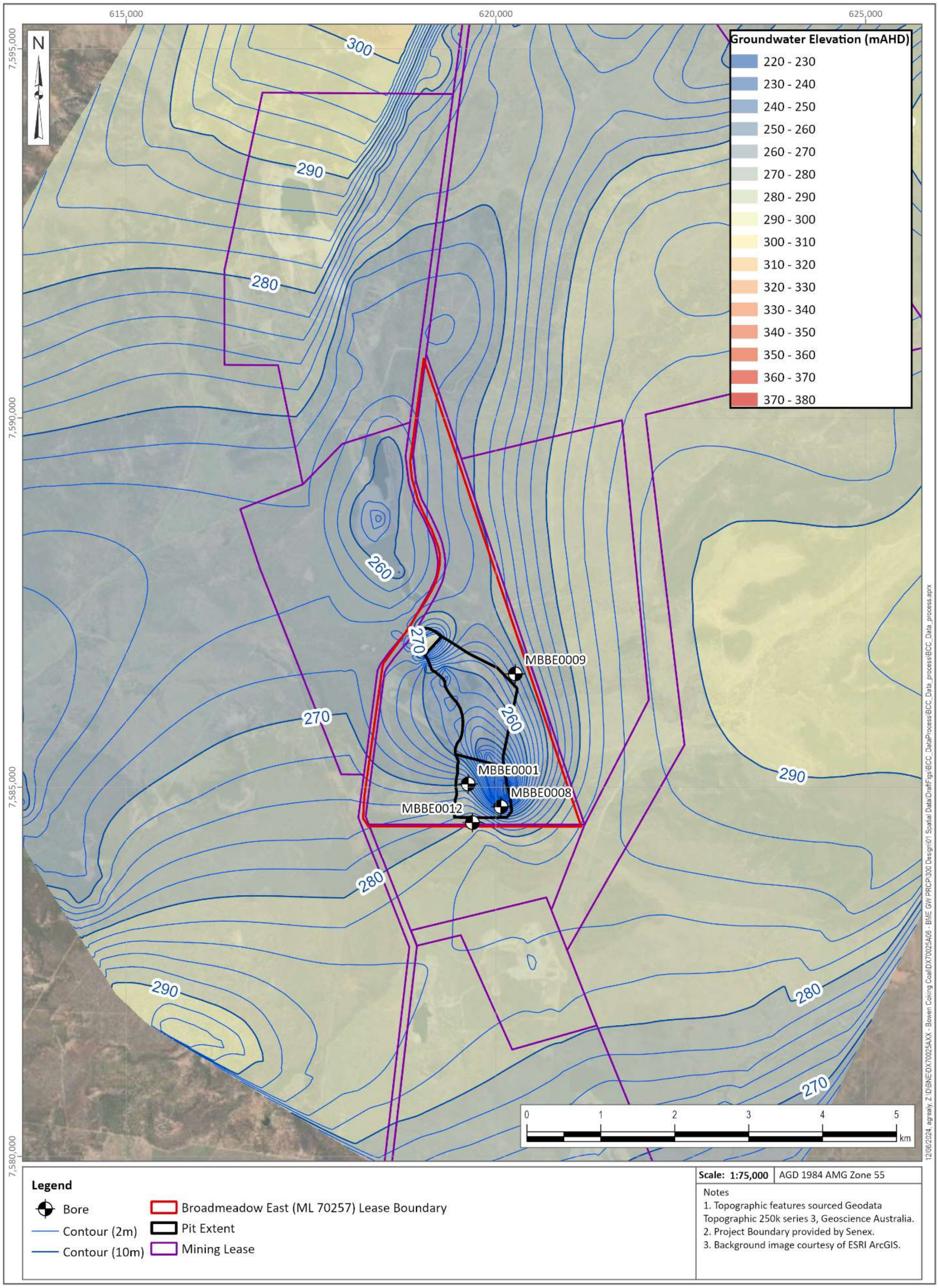


Figure 5.5 Predicted Maximum Drawdown Elevation in Layer 5 – Rangal Coal Measures

6 SUMMARY AND RECOMMENDATIONS

This technical memorandum was compiled to assist BCC in the compilation of an EA Amendment application.

The following triggers – with specific reference to compliance bores MBBE0001 and MBBE0007 - were evaluated and updated where applicable in this document:

- Groundwater quality (based on bore-specific water quality monitoring data); and
- Groundwater levels (based on model predictions of the expected changes).

MBBE0007 Summary

- The sulfate concentration shows an increasing trend from July 2023 to December 2023. The latest result shows a decline in the concentration, but the concentration still exceeds the trigger limit. The increasing trend could be due to impact from mining activities (spoil and overburden dump leachate).
- The 2021 DES guideline states "*The time series data should also be analysed for trends. If a trend, either upward or downward, is detected then the groundwater may be impacted. In general, data with values increasing over time should not be used to calculate site-specific groundwater guidelines"*.
- An increasing trend in the data may indicate contamination of the groundwater and should be investigated. The latest monitoring event in February 2024 shows a decline in the EC concentration.
- An update for the water quality trigger limit considered 10 of the 13 available data points; excluding two outliers and the most recent data result that seems to be influenced by high rainfall events.
- Arsenic, aluminium and selenium have less than 8 data points available for trigger calculation. All three analytes have a very large part (76 to 92%) of their dataset values reported as below Limit of Reporting.

MBBE0007 Recommendations

- Update the sulfate (SO_4) water quality trigger limit to 961.5 mg/L.
- Update the electrical conductivity (EC) water quality trigger limit to 48,600 µS/cm.
- Update aluminium, arsenic and selenium water quality triggers to reflect the default water quality guideline values.

MBBE0001 Summary

- The electrical conductivity concentrations have exceeded the trigger limit of the total monitoring period. These limits were originally calculated on only a few data points, but additional data points have since become available to include in the statistical calculations.
- Sulfate, arsenic, molybdenum and selenium have less than 8 data points available for trigger calculation. All three analytes have a very large part (56 to 10%) of their dataset values reported as below Limit of Reporting.

MBBE0001 Recommendations

- Adjust the electrical conductivity (EC) quality trigger to 901.7 µS/cm, based on the additional chemistry results that are available since previous trigger calculations.
- Update sulfate (SO_4), arsenic, molybdenum and selenium water quality triggers to reflect the default water quality guideline values.

New Monitoring Bores

Additional monitoring bores were drilled in October 2023 to update the existing network after some EA monitoring bores were decommissioned as a result of the progression of approved mining activities.

The following are the main recommendations for these new replacement bores:

- Water Quality sampling at the newly drilled 2023 bores should initially be done at a bi- monthly frequency.
- Once sufficient water quality data is available (minimum 8 sampling events within one full calendar year of data), triggers should be set for the new 2023 bores.
- Default Water Quality Guideline values (ANZECC & ARMCANZ, 2000) should be used as temporary groundwater quality trigger parameters for MBBE0009. The parameters pH, EC, SO_4, Al, As, Se, Mo are recommended as appropriate triggers for the contaminants of concern for coal mining operations (see summary in Table 5.1). Data analysis results for two (2) sampling events at MBBE0009 differ substantially from MBBE0001 and therefore it is not recommended that trigger limits are inferred, even though the two bores are screened in the same aquifer.
- The groundwater model should be verified and potentially updated with the new bore drilling and data collection.
- Bore MBBE0011 cannot be assigned a pre-mining baseline standing water level, since no groundwater was encountered, and the bore is considered dry. This approach has also been followed in the previous Amendment of EA0002465.

New Monitoring Bore Recommendations

- Groundwater levels trigger values for all four replacement bores are recommended based on the maximum drawdown predicted from the numerical groundwater model (KCB 2023).
- Default WQO guideline values (ANZECC & ARMCANZ, 2000) should be assigned to MBBE0009 (future compliance bore) as temporary groundwater quality triggers, until at least eight (8) sampling event results are available. Then bore-specific triggers should be calculated for the four bores.

The recommended trigger values should be applicable through operation into post-closure. An update of the trigger levels for both quality and water level will be required once sufficient data points (minimum of 8) become available.

7 CLOSING

This memorandum is an instrument of service of Klohn Crippen Berger (KCB). The memorandum has been prepared for the use of Bowen Coking Coal (Client) for the specific application to the Broadmeadows East Project and may be published or disclosed by the Client to the Department of Environment, Science and Innovation.

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6. This memorandum is electronically signed and sealed, and its electronic form is considered the original. A printed version of the original can be relied upon as a true copy when supplied by the author or when printed from its original electronic file.

KCB AUSTRALIA PTY LTD.

Marlese Nel
Senior Hydrogeologist

MN:CW:JJ

8 REFERENCES

ANZECC & ARMCANZ. 2000. ‘Australian and New Zealand Guidelines for Fresh and Marine Water Quality’. Prepared by the Australian and New Zealand Conservation Council (ANZECC) and the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ).

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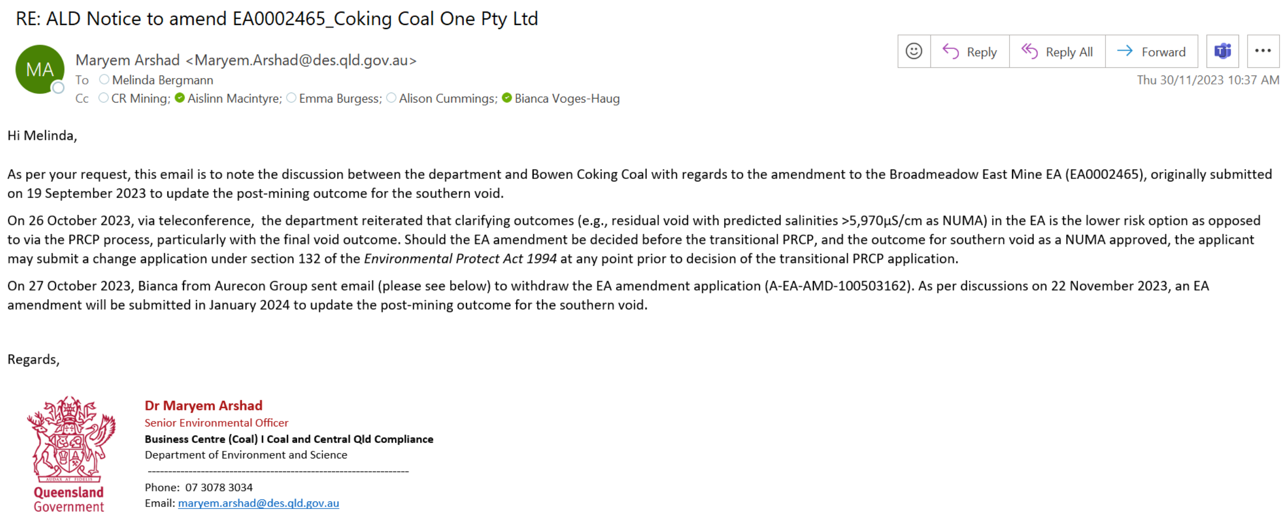
Appendix E

Administering Authority Correspondence



RE: ALD Notice to amend EA0002465_Coking Coal One Pty Ltd

MA

Maryem Arshad <Maryem.Arshad@des.qld.gov.au>
To ○ Melinda Bergmann
Cc ○ CR Mining; ● Aislinn Macintyre; ○ Emma Burgess; ○ Alison Cummings; ● Bianca Voges-Haug

Thu 30/11/2023 10:37 AM

Hi Melinda,

As per your request, this email is to note the discussion between the department and Bowen Coking Coal with regards to the amendment to the Broadmeadow East Mine EA (EA0002465), originally submitted on 19 September 2023 to update the post-mining outcome for the southern void.

On 26 October 2023, via teleconference, the department reiterated that clarifying outcomes (e.g., residual void with predicted salinities >5,970µS/cm as NUMA) in the EA is the lower risk option as opposed to via the PRCP process, particularly with the final void outcome. Should the EA amendment be decided before the transitional PRCP, and the outcome for southern void as a NUMA approved, the applicant may submit a change application under section 132 of the *Environmental Protect Act 1994* at any point prior to decision of the transitional PRCP application.

On 27 October 2023, Bianca from Aurecon Group sent email (please see below) to withdraw the EA amendment application (A-EA-AMD-100503162). As per discussions on 22 November 2023, an EA amendment will be submitted in January 2024 to update the post-mining outcome for the southern void.

Regards,

Queensland
Government

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DESI EA Amendment RFI Tracking Register (refer formal RFI dated 7 March 2024)

Application reference number is: A-EA-AMD-100609123

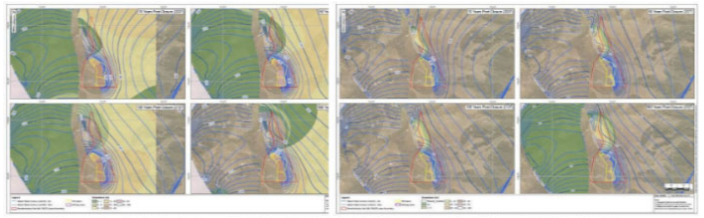
Item Number	Matters of Interest	DESI Comment	DESI Requested Action	External Response
1	**Current operations**	*Section 2.2 Current operations* (Supporting Document) states: *"The targeted coal resource within the ML is located within the Leichhardt seam of the **Rangal Coal Measures (RCM**) formation in the Bowen Basin. Other coal seams exist within the RCM, but these are not targeted because they are too thin or discontinuous to recover economically. The RCM is stratigraphically located above the high-ash, non-economic Girrah seam of the Fort Cooper Coal Measures".* This indicates that mining will target the Leichhardt coal seam only. Section 3.1 Final Void Water Balance Model Development (Appendix B Groundwater Report of the Supporting Document) states: *"The **Permian Rangal Coal Measures** comprises the target coal seams for this Project, which include the Leichhardt, Vermont and Girrah Seams*". There should be clarity and consistency in regard to what coal seam/s are being targeted and which formation they are located in. This is important in understanding pit depths and whether the modelling accurately simulates the mining that is to occur.	An updated supporting document that provides clear consistent advice as to which coal seams, in which geological formations will be targeted at Broadmeadow East.	Section 2.2 of the Supporting Document, as well as Appendix B and Appendix D, has been updated to clarify the below: Leichhardt is the only target coal seam, as Vermont and Girrah are too thin or discontinuous to recover economically. Regarding the difference in terminology between **Rangal Coal Measures (RCM)** in the Supporting Document and **Permian Rangal Coal Measures** in Section 3.1 Final Void Water Balance Model Development (Appendix B Groundwater Report of the Supporting Document): The relevant coal unit/formation is the Rangal Coal Measures (RCM). 'Permian' refers to the geological age of the unit. Therefore, the term Permian Rangal Coal Measures is referring to the same RCM as in the Supporting Document, with the addition of the word Permian referring to its geological age.
2	**Geologic unit thicknesses**	*Table 4.2 Summary of Stratigraphy in BME* This table identifies the local geological units. In relation to the Rangal Coal measures, it states: *Carbonaceous mudstone, siltstone, sandstone. Coal seams:* *• Burton Seam (splitting to the Leichhardt and Vermont Seam).* *• Girrah Seam.* However, there is no indication of the average thickness of the coal seams and the interburden layers. This information should be provided to support the numerical groundwater modelling.	Provide information on average geologic unit thicknesses at the project including seam and interburden thicknesses.	Thicknesses acquired from available logs, Xenith geology report, and numerical model geology setup. Refer to information now included in Table 4.2 of Groundwater Report (Appendix B).

Item Number	Matters of Interest	DESI Comment	DESI Requested Action	External Response
3	**Groundwater flow models**	*Section 4.2.5 Permian Coal Measures* (Appendix B Groundwater Report of the Supporting Document) states: *“Individual coal seams form the principal water bearing strata within the coal measures and are therefore typically saturated throughout their full thickness”.* And *“Groundwater storage and movement occurs within the coal seam cleats and fissures and within open fractures that intersect the seams”.* *Section 3.2 Model Domain and Hydrogeological Study Area* (Appendix B Groundwater Report Appendix IV – Numerical Groundwater Modelling) states: *The development of the groundwater flow model was based on the conceptualisation of the hydrogeological system.* And *The closer the numerical model represents the conceptual understanding, and the site conditions, the better the performance of the model in making predictions.* However, *Section 3.6 Model Layers* (Appendix B Groundwater Report Appendix IV – Numerical Groundwater Modelling) identifies that only one model layer is used to represent the Rangal Coal Measures when typically, there would be multiple layers in the model to represent the coal seams and interburden separately in line with the conceptualisation of the coal seams being the principal water bearing strata within the Rangal Coal Measures. There is no discussion as to why the model layering has been structured this way. There is concern that the adoption of such model layers limits the model predictive capacity.	Provide advice – (a) as to the reasoning for using only one layer in the model to represent the Rangal Coal Measures. (b) as to the limitations caused by this approach and how the predictive ability of the model may be impacted.	Refer to Groundwater Report (Appendix B) at Section IV-3.6 (Appendix IV-Numerical Modelling Report) for updated information on model layers to address queries.

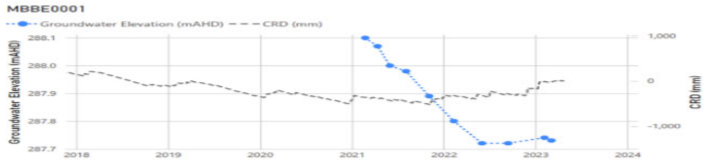
Item Number	Matters of Interest	DESI Comment	DESI Requested Action	External Response
4	**Groundwater level and flow.**	*Section 4.3.5 Rangal Coal Measures* (Appendix B Groundwater Report of the Supporting Document) *"Conceptually, the interpreted groundwater flow direction in the Permian coal measures is towards west-southwest, which is a subdue reflection of the surface topography. However, historical coal mining activities in the vicinity of the Project area has resulted in zones of depressurisation in the groundwater, particular in the vicinity of adjacent residual open pit voids where pit lakes, in connection with the groundwater system, are present. These pit lakes have caused a reduction in the potentiometric surface creating a hydraulic gradient towards the pit lake. Therefore, the current groundwater flow direction in the vicinity of the Project area is a reflection of this hydraulic gradient, with groundwater flowing towards these pit lakes (i.e., towards the northwest)".* Evidence/conceptual model/figures to support the above statement is not clearly demonstrated.	Provide evidence including conceptual models and figures that clearly demonstrate the groundwater flow direction.	Refer to Section 4.3 of Groundwater Report (Appendix B) which references flow direction and new figures demonstrating groundwater contours (Figure 4.11 and Figure 4.13).
		Section 4.3 Groundwater levels and flows There are hydrographs in section 4.3 showing historical groundwater trends in the monitoring bores. There is also some discussion in this section of the direction of groundwater flow in some formations. However, there are no groundwater contours using observed groundwater levels. Where data exists, as in the Rewan Formation and the Rangal Coal Measures groundwater contours based on observed data should be presented to demonstrate groundwater flow direction and to provide a basis for the numerical groundwater model.	Provide separate groundwater elevation contours for the Rewan Formation and the Rangal Coal Measures based on observed groundwater levels.	Refer to Section 4.3 of Groundwater Report (Appendix B) and new figures demonstrating groundwater contours in Figure 4.11 and Figure 4.13 (Rewan Group and Rangal Coal Measures, respectively).

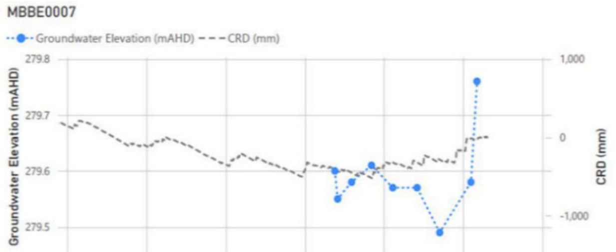
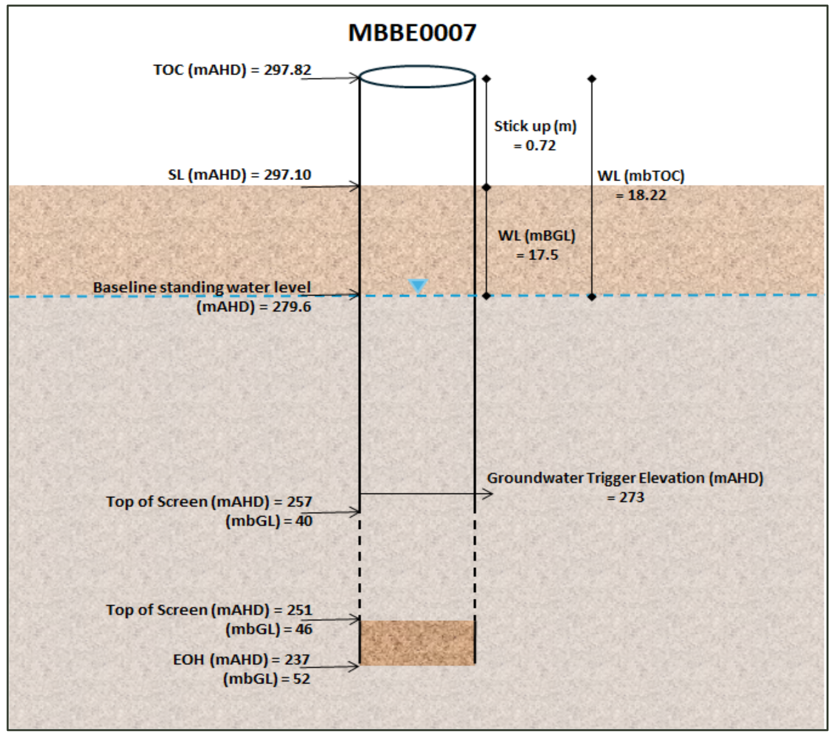
Item Number	Matters of Interest	DESI Comment	DESI Requested Action	External Response
5	**Groundwater Quality**	*Section 4.4 Groundwater Quality* (Appendix B Groundwater Report of the Supporting Document) of the supporting document states: *"A review of groundwater quality data from the current Project groundwater monitoring network (as per EA0002465) indicates that the water quality in the Project area remains relatively stable, and the key parameters noted in the EA are within baseline levels".* Piper and Durov plots and time series plots for pH, EC and sulfate show stable trends and are discussed. Time series plots of the other key parameters noted in Table D2 – Groundwater quality limits of the current EA are presented in Appendix III Groundwater Chemistry Graphs (Appendix B Groundwater Report Groundwater Report of the Supporting Document). To further validate the groundwater chemistry graphs, raw chemical data of groundwater monitoring needs to be provided for validation. Additionally, Figures 4.12, 4.13 and 4.14 in section 4.4 Groundwater Quality (Appendix B Groundwater Report of the Supporting Document) provides graphs of water quality data for multiple formations. These graphs should be for individual formations to allow an understanding of water quality from each formation.	Provide – (a) raw groundwater monitoring data in excel templates provided (attached in email). (b) updated graphs to replace Figures 4.12, 4.13 and 4.14 where water quality data for individual formations are plotted.	Refer Section 4.4 figures updated (Figure 4.15 to Figure 4.23) in Groundwater Report (Appendix B), which now have separate water quality results into hydrostratigraphic units (Rewan Group, Rangal Coal Measures and Tertiary Sediments).
6	**Cross section diagrams**	Whilst *Figure 4.5 Cross-section of Project area* in section 4.2 Hydrostratigraphic Units demonstrates the cross-section area of the project, there are no detailed cross sections that show the relationship between the full proposed pit depth, backfill level and adjacent coal seams. Cross sections should be provided (North, Central and South) which show the relationship between full proposed pit depth, backfill level and adjacent coal seams.	Provide cross sections for North void, Central backfilled pit, and South void which show the relationship between full proposed pit depth, backfill level and adjacent coal seams.	Refer to Section 4.2.6 of Groundwater Report (Appendix B) and North-South cross section across mining area provided in new Figure 4.6.

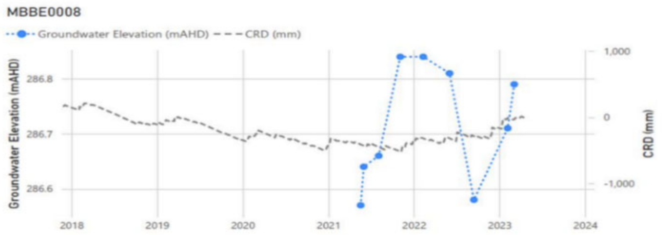
Item Number	Matters of Interest	DESI Comment	DESI Requested Action	External Response
7	**Groundwater level triggers**	*Section 5.4 Groundwater Level Triggers* (Appendix B Groundwater Report of the Supporting Document) The supporting document lacks detail as to how the numerical groundwater model was used to determine predicted drawdown levels for both the existing bores in the EA and the newly proposed bores to go in the EA. For example, the predicted drawdown levels for those older bores in the EA, proposed to go in the amended EA, don't seem to have changed. No predicted drawdown contours, with monitoring bores marked on, are presented to demonstrate how these drawdown contours compare with the drawdown triggers determined for the individual EA bores. The 4 new bores in *Table 5-5 Predicted groundwater levels with proposed trigger levels* (Appendix D Update to Groundwater Quality Triggers Memorandum (KCB March 2024)) memo that states, in relation to trigger elevation levels, 'within 5 m of model predictions'. An explanation is required as to what this means and how it has been applied.	Provide – (a) more information about how the updated numerical groundwater model was used to determine predicted drawdown triggers in all bores in the proposed EA. (b) predicted maximum drawdown contours in those geologic units relevant to the proposed EA bores with the EA bores marked on those contour maps. (c) explanation as to how the comment in Table 5.5 '*within 5 m of model prediction*' applies to the predicted drawdown triggers.	a) Model output predictions at end of mining (which represents maximum drawdown) were used to determine drawdown triggers. b) In Section 5.4, Tables 5.5 and 5.6 have been updated in Technical Memorandum - Groundwater Triggers (Appendix D). Maps for each geology unit are also provided in Section 5.4 (refer Figures 5.1 - 5.5). c) Comment removed, see updated approach relating to maximum drawdown in notes for Table 5.5 and 5.6 in Technical Memorandum - Groundwater Triggers (Appendix D).
8	**Maximum extent of drawdown**	The bore groundwater and drawdown levels reported in the supporting documents refer to EA conditions previously approved for 5m and 2m per annum and this was based on the Water Act. However, the department has moved away from this approach to conditioning groundwater level triggers given it is not fit for purpose and does not reflect the approved level of drawdown for the project. To ensure that the drawdown authorised in the EA for each hydrogeological unit is not exceeded, in order to protect groundwater values associated with each hydrogeological unit it is best practice to include bore specific groundwater level trigger thresholds. Most commonly, the groundwater level trigger thresholds are based on the 'maximum extent of drawdown' modelled and approved for the project.	Provide groundwater level trigger thresholds for each compliance bore; and baseline water level for each bore against which the drawdown is measured. The Level Trigger Threshold may be set based on yearly drawdowns or modelling on mounding, point in time drawdown or maximum drawdown.	Refer to updated Table 5.5 and Table 5.6 (for compliance bores) in Section 5 of Technical Memorandum - Groundwater Triggers (Appendix D).

Item Number	Matters of Interest	DESI Comment	DESI Requested Action	External Response
9	**Additional drawdown contours**	*Figure 5.1 Post-Closure Drawdown and Elevation for Rangal coal measures – 10-, 50-, 100- and 500-Years Post-Closure and Figure 5.2 Post-Closure Drawdown and Elevation for Rewan – 10- , 50-, 100- and 500-Years Post-Closure* (Appendix B Groundwater Report of the Supporting Document) provide predicted Post – Closure drawdown and elevation for the Rangal Coal Measures for 10, 50, 100 and 500 years post closure.  Figure 5.1 Post-Closure Drawdown and Elevation for Rangal coal measures – 10-, 50-, 100- and 500-Years Post-C Figure 5.2 Post-Closure Drawdown and Elevation for Rewan – 10-, 50-, 100- and 500-Years Post-Closure The colour coding for the drawdown is difficult to interpret. It would be more informative if separate drawdown contour maps were provided with contour lines marked and labelled. It is also noted that this document is to support the determination and validation of water level triggers. Predicted drawdown contours at the end of mining should be provided and for any other time period, where maximum drawdown is predicted to occur at the location of water level trigger bores. The predicted drawdown contours should be for the layers which the trigger water level bores are monitoring and have the location of the water level trigger bores marked clearly on the drawdown contour figures. Additionally, it is noted in Figures 5.1 and 5.2 that the groundwater levels in the area of the Central and Northern pit are very slow to recover post mining. Discussion of the processes assumed to be occurring that result in this outcome of slow post mining recovery of the Central and Northern Pits is required.	Provide – (a) separate predicted drawdown contours for the Rangal Coal Measures for 10, 50, 100 and 500 years post closure with contour lines marked and labelled. (b) predicted drawdown contours for the end of mining and for any other time period, where maximum drawdown is predicted to occur at the location of groundwater level trigger bores. The predicted drawdown contours should be for the layers which the groundwater trigger level bores are monitoring and have the location of the groundwater level trigger bores marked clearly on the drawdown contour figures. (c) discussion of the processes assumed to be occurring that result in this outcome of slow post mining recovery of the Central and Northern Pits.	a) Added separate predicted drawdown contour maps for Rangal Coal Measures for 10, 50, 100 and 500 years post closure in Figures 5.1 to 5.4 in Section 5.2 of Groundwater Report (Appendix B). b) Maps with predicted maximum drawdown for each layer are provided in Section 5.2 (refer Figures 5.5 to 5.9) of Groundwater Report (Appendix B). c) Discussion of process of slow post mining recovery at Central and North pits discussed in Section 5.2 of Groundwater Report (Appendix B).

Item Number	Matters of Interest	DESI Comment	DESI Requested Action	External Response
10	**Recharge zone description**	*Section 3.7 Model boundary conditions – Recharge* (Appendix B Groundwater Report of the Supporting Document) states: *"The four recharge zones defined for this model are the extents/outcrop of: Quaternary alluvium, Tertiary sediments, Tertiary basalt, and Permian units".* It appears that the Triassic (Rewan) have been omitted from this description. In contrast *Figure 3.6 Recharge Zones* (Appendix IV – Numerical Groundwater Modelling) is a map of the recharge zones used in the model. It shows alluvium, Tertiary Sediments, Tertiary Basalt and Rewan Group. Therefore, Figure 3.6 includes the Rewan Group, but it does not mention the Permian's. Alternatively, *Table 3.4 Summary calibrated recharge rates* (Appendix IV – Numerical Groundwater Modelling) provides calibrated recharge rates for Quaternary alluvium, Tertiary Sediments, Tertiary Basalt and Triassic and Permian units. As such, there are three descriptions of the recharge zones all of which are different.	Review the references to the various recharge zones and update to reflect an accurate consistent description of what geologic units the recharge zones represent.	Refer to Groundwater Report (Appendix B) at Section IV-3.7 (Appendix IV-Numerical Modelling Report) for updated Figure 3.6 showing recharge zones.
11	**Comments on individual Bores**	**MBBE0001** This bore is screened between 63m and 66m below ground level (mbgl) (Table 4.5 Updated Monitoring Bore Network Details and Monitoring Requirements Q1 2024 in Appendix D Update to Groundwater Quality Triggers Memorandum, KCB March 2024). Based on a ground level elevation of 305m AHD (Appendix B Groundwater Report Table 3.2 Groundwater Monitoring Network (KCB, Sept 2023)) the bottom of the screened interval is 239m AHD. However, the trigger level in the existing EA Table D1 Groundwater Monitoring Locations and Frequency and the proposed Table D1 in Section 8.1.1 of the supporting document (Table 8-1 Proposed new wording of Table D1) is 206.01m AHD. The trigger level is therefore 33m below the bottom of the screened section of the bore and 32m below the bottom of the hole. Additionally, there is an issue with the baseline standing water level. A water plot for this bore was provided in Appendix B Groundwater Report, Appendix II Groundwater Elevations Hydrographs (page 205). A copy is provided below.	For bore MBBE0001, review and update were relevant: (a) the baseline standing water level. (b) the trigger water level.	a) Baseline standing level = 288.1mAHD b) Trigger water level = 241mAHD Refer to Table 5.6 in Section 5.4 of the Technical Memorandum - Groundwater Triggers (Appendix D). Also updated Table I-1 in Groundwater Report (Appendix B). Please note, MBBE0001 will be mined through and not part of network, and replaced by MBBE0009.

Item Number	Matters of Interest	DESI Comment	DESI Requested Action	External Response
		 The baseline water level in Appendix B Groundwater Report, Appendix I Monitoring Program, Table I-1 Groundwater Monitoring Bores at BME is 42.2m below top of casing (mbtoc). Based on top of casing (TOC) elevation (EL) of 305.2m AHD (Appendix D Update to Groundwater Quality Triggers Memorandum (KCB March 2024)) this converts to a baseline water level elevation of 263m AHD. This does not seem to agree with the data above. It is unclear how the baseline water level of 42.2m was determined.		
		MBBE0004 This bore is screened between 2 and 5 mbgl AHD (Appendix D Update to Groundwater Quality Triggers Memorandum (KCB March 2024)) and reported to be mostly dry. A water level plot (hydrograph) is not provided for this bore in Appendix B Groundwater Report, *Appendix II Groundwater Elevations Hydrographs* , presumably because it is always dry. The existing EA has a drawdown trigger level of 2m for this bore. It is proposed to have a 2m drawdown trigger level in the updated EA Table D1 (Section 8.1.1 of the supporting document, *Table 8-1 Proposed new wording of Table D1*). No baseline water level or groundwater trigger elevation is provided for this bore in either the existing EA Table D1 *Groundwater Monitoring Locations and Frequency* or the proposed *Table D1.* It appears inappropriate to indicate a 2m drawdown level in the EA for a bore which is apparently predominantly dry.	Provide further justification for the appropriateness of the proposed 2m drawdown level to a dry bore.	Please note, MBBE0004 is dry to date therefore no hydrograph available. However, recommend that bore continues to be monitored to inform conceptual understanding of site and remains in EA. No groundwater level trigger proposed for this bore as it is dry. Drawdown Trigger Level removed for MBBE0004 in Table D1 of the EA (refer Section 8.1.1 in the Supporting Document, and the draft EA (Appendix A)). Please note this approach has also been applied to MBBE0003.

Item Number	Matters of Interest	DESI Comment	DESI Requested Action	External Response
		MBBE0007 A water plot for this bore was provided in *Appendix B Groundwater Report, Appendix II Groundwater Elevations Hydrographs* (page 205). A copy is provided below.  There appears to be a problem with the baseline water level used for this bore. The baseline water level in *Table I-1 Groundwater Monitoring Bores at BME* (*Appendix B Groundwater Report, Appendix I Monitoring Program*, page 203) and in proposed *Table D1 Groundwater Monitoring Locations and Frequency* (Section 8.1.1 of the supporting document, *Table 8-1 Proposed new wording of Table D1*), is 24.9 mbtoc. Based on TOC EL of 297.9 m AHD (*Table 4.5 Updated Monitoring Bore Network Details and Monitoring Requirements Q1 2024 in Appendix D Update to Groundwater Quality Triggers Memorandum* (KCB March 2024)) this converts to a baseline water level elevation of 273m AHD. This does not seem to agree with the data above, with the lowest water level at about 279.5m AHD. It is unclear how the baseline water level of 24.9m was determined. It is also noted that there is no drilling log available for this bore on the groundwater database. A drilling log is required for this bore.	(a) Review how the baseline water level of 24.9m below top of casing was determined. (b) Provide a drilling log for bore MBBE00007. Where required, provide an updated supporting document based on the above reviews.	a) Baseline water level determined incorrectly. Updated level = 18.22mbTOC b) Log attached Refer to Table 5.6 in Section 5.4 of the Technical Memorandum - Groundwater Triggers (Appendix D). Also updated Table I-1 in Groundwater Report (Appendix B). Groundwater trigger elevation (mAHD) updated for MBBE0007 in Table D1 of the EA (refer Section 8.1.1 in the Supporting Document, and the draft EA (Appendix A)). 

Item Number	Matters of Interest	DESI Comment	DESI Requested Action	External Response
		MBBE0008 A water level plot for this bore was provided in *Appendix B Groundwater Report, Appendix II Groundwater Elevations Hydrographs* (page 205). A copy is provided below.  There appears to be an inconsistency with the baseline water level in this bore. *Table I-1 Groundwater Monitoring Bores at BME* provides a baseline water level of 19.59 mbtoc. Based on TOC EL of 305.2 m AHD (Table 4.5), this converts to a baseline water level elevation of 285.61 m AHD. Additionally, the drawdown trigger level for this bore in the existing EA and Section 8.1.1 of the supporting document, *Table 8-1 Proposed new wording of Table D1*, is 5 m. It is assumed that the groundwater trigger elevation level should equal: TOC elevation – baseline standing water level – drawdown trigger level. In this case that would be: 305.2 – 19.59 – 5 = **280.61 m AHD** However, the groundwater trigger elevation level in the existing EA and in section 8.1.1 of the supporting document *Table 8-1 Proposed new wording of Table D1* is **282.62 m AHD.** This issue requires further investigation. It is also noted that there is no drilling log available for this bore on the groundwater database. A drilling log is required for MBBE0008. It is noted that the ground level elevation and TOC EL for bore MBBE0008 and MBBE0001 are identical in the reports. Perhaps there may be a problem with one of these.	(a) Review the baseline water level and trigger elevation level for bore MBBE0008. (b) Provide a drilling log for bore MBBE0008. (c) Review the ground level and top of casing elevations for both MBBE0008 and MBBE0001. Where required, provide an updated supporting document based on the above reviews.	a) Revised baseline water level = 18.64mbTOC b) Log provided c) Ground level and TOC for MBBE0008 and MBBE0001 confirmed as correct with BCC Environmental Team. Also updated Table I-1 in Groundwater Report (Appendix B). Pre-mining baseline standing water level (mbTOC) updated for MBBE0008 in Table D1 of the EA (refer Section 8.1.1 in the Supporting Document, and the draft EA (Appendix A)).

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MBBE0009

Table 5.5 Predicted groundwater levels with proposed trigger levels (Appendix D Update to Groundwater Quality Triggers Memorandum (KCB March 2024)) provides a baseline standing water level of 22.3 mbtoc for this bore.

No water level plot is provided to support this baseline standing water level. A water level plot should be provided.

Additionally, a groundwater trigger level elevation of 267.48 m is provided in *Table 5.5 Predicted groundwater levels with proposed trigger levels*, with a comment that drawdown trigger levels are within 5 m of model predictions. It is not clear what this comment means.

Section 8.1.1 of the supporting document, *Table 8-1 Proposed new wording of Table D1* provides a groundwater trigger elevation of 291.65 m which is also the ground level elevation provided for this bore in the supporting document, Table 4-1 Replacement Groundwater Bore Locations. The groundwater trigger elevation in *Table 8-1 Proposed new wording of Table D1* for this bore therefore appears to be an error.

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Provide –

(a) a water level plot for MBBE0009 to support the identified baseline standing water level in Table 5.5.

(b) an explanation of the comment '*within 5 m of model predictions*' in the KCB Table 5-5 as to what it refers to and how it is applied.

(c) a review of the groundwater trigger elevation in supporting document Section 8.1.1, Table 8-1 for MBBE0009.

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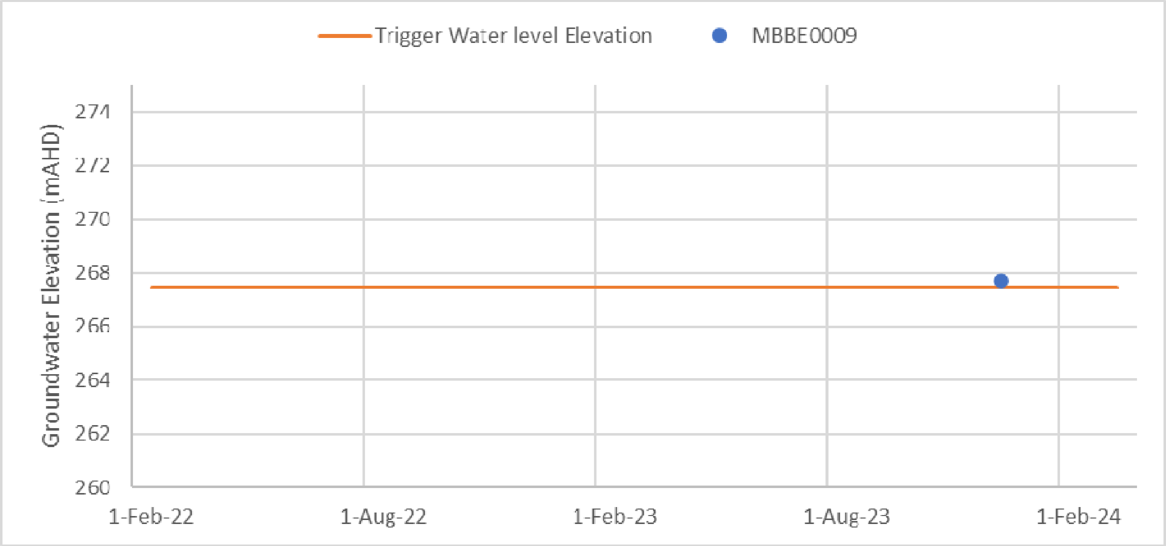
a) Plot provided below



b) Comment removed and trigger specified as maximum drawdown in Table 5-5 of Technical Memorandum - Groundwater Triggers (Appendix D).

c) Trigger level based on available data. Once more data available a review can be done.

Pre-mining baseline standing water level (mbTOC) and Groundwater Trigger Elevation (mAHD) updated for MBBE0009 in Table D1 of the EA (refer Section 8.1.1 in the Supporting Document, and the draft EA (Appendix A)).

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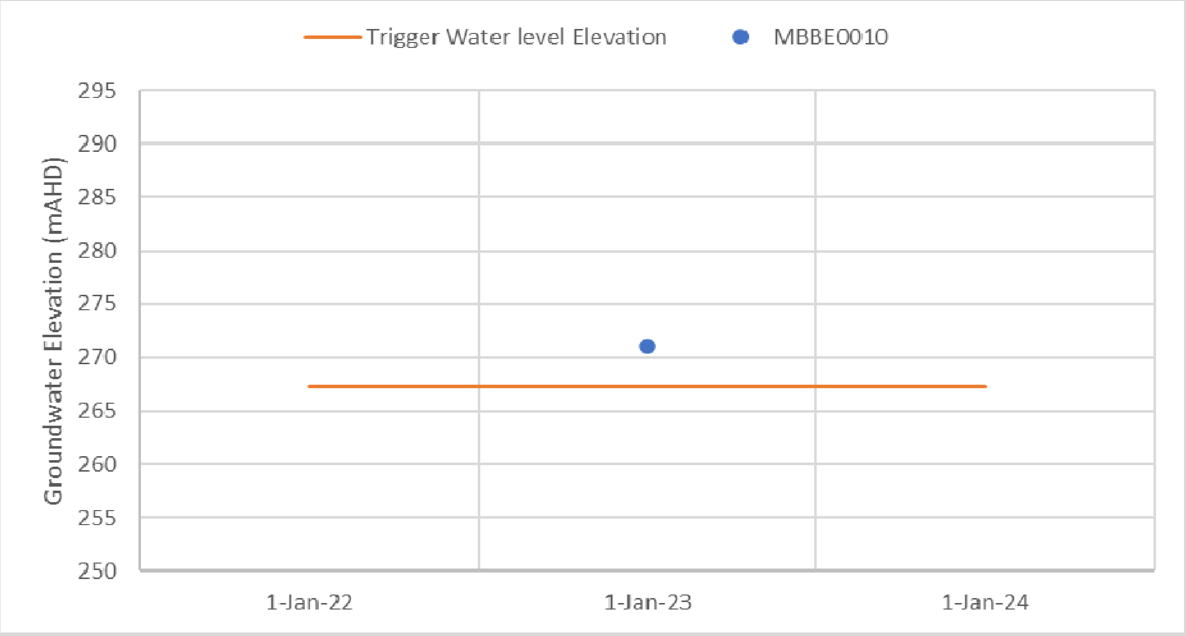
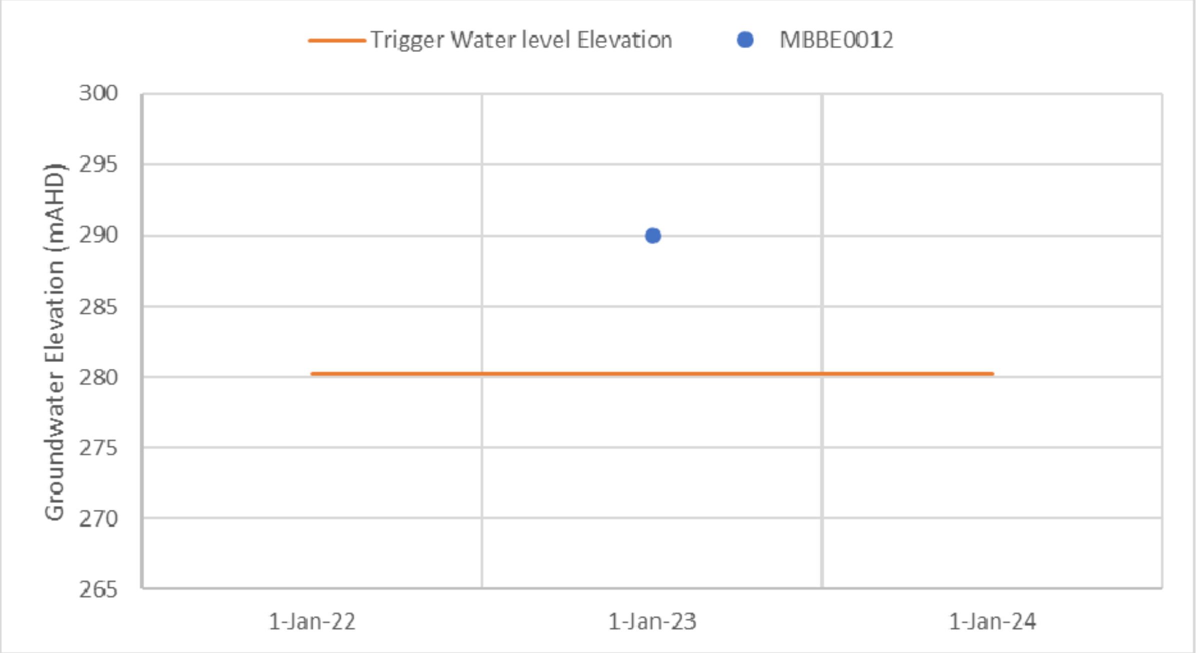
Item Number	Matters of Interest	DESI Comment	DESI Requested Action	External Response
		MBBE0010 *Table 5.5 Predicted groundwater levels with proposed trigger levels (Appendix D Update to Groundwater Quality Triggers Memorandum* (KCB March 2024)) provides a baseline standing water level of 22.3 mbtoc for this bore. No water level plot is provided to support this baseline standing water level. A water level plot should be provided. Additionally, a groundwater trigger level of 267.23 m is provided in *Table 5.5 Predicted groundwater levels with proposed trigger levels,* with a comment that drawdown trigger levels are within 5 m of model predictions. It is not clear what this comment means. The supporting document, Section 8.1.1, *Table 8-1 Proposed new wording of Table D1* provides a groundwater trigger elevation of 291.63 m which is also the ground level elevation provided for this bore in the supporting document Table 4-1. The groundwater trigger elevation in *Table 8-1 Proposed new wording of Table D1* for this bore therefore appears to be an error.	Provide: (a) a water level plot for MBBE0010 to support the identified baseline standing water level in Table 5.5. (b) an explanation of the comment 'within 5 m of model predictions' in KCB Table 5-5, as to what it refers to and how it is applied. (c) a review of the groundwater trigger elevation in supporting document Section 8.1.1, Table 8-1 for MBBE0010.	a) Plot provided below  b) Comment removed and trigger specified as maximum drawdown in Table 5-5 of Technical Memorandum - Groundwater Triggers (Appendix D). c) Trigger level based on available data. Once more data available a review can be done. Pre-mining baseline standing water level (mbTOC) and Groundwater Trigger Elevation (mAHD) updated for MBBE0010 in Table D1 of the EA (refer Section 8.1.1 in the Supporting Document, and the draft EA (Appendix A)).

Item Number	Matters of Interest	DESI Comment	DESI Requested Action	External Response
		MBBE0011 *Section 5.4 Groundwater Level Triggers (Appendix D Update to Groundwater Quality Triggers Memorandum* (KCB March 2024)) states: *“No pre-mining baseline standing water level can be allocated to MBBE0011 since the bore was dry after construction and subsequent monitoring rounds confirmed that bore is dry”.* However, a groundwater trigger elevation of 271.13 m AHD has been assigned to this bore in Table 5-5 Predicted groundwater levels with proposed trigger levels in section 5.4. This appears inappropriate for two reasons: 1. The bore is only 6 m deep. The ground level elevation (supporting document *Table 4-1 Replacement Groundwater Bore Locations*) is 284.34 m AHD. The bottom of the bore is therefore at 278.34 m AHD which is about 7 m above the trigger level provided in *Table 5-5 Predicted groundwater levels with proposed trigger levels.* 2. The bore is reported as always dry, and a trigger level may be inappropriate to apply to a dry bore. Additionally, the supporting document, Section 8.1.1, *Table 8-1 Proposed new wording of Table D1* provides a groundwater trigger elevation of 284.34 m which is also the ground level elevation provided for this bore in the supporting document *Table 4-1 Replacement Groundwater Bore Locations.* The groundwater trigger elevation in *Table 8-1 Proposed new wording of Table D1* for this bore therefore appears incorrect and any trigger level appears inappropriate given it is a dry bore.	Provide further justification of the appropriateness of assigning a groundwater trigger elevation to bore MBBE0011.	Please note, MBBE0011 is dry to date. However, recommend that bore continues to be monitored to inform conceptual understanding of site and remains in EA. Refer to Section 5.4 and Table 5.5 of Technical Memorandum - Groundwater Triggers (Appendix D). Groundwater Trigger Elevation (mAHD) removed for MBBE0011 in Table D1 of the EA (refer Section 8.1.1 in the Supporting Document, and the draft EA (Appendix A)).

Item Number	Matters of Interest	DESI Comment	DESI Requested Action	External Response
		MBBE0012 *Table 5.5 Predicted groundwater levels with proposed trigger levels (Appendix D Update to Groundwater Quality Triggers Memorandum* (KCB March 2024)) provides a baseline standing water level of 46.91 mbtoc for this bore. No water level plot is provided to support this baseline standing water level. A water level plot should be provided. Additionally, a groundwater trigger level of 280.23 m is provided in *Table 5.5 Predicted groundwater levels with proposed trigger levels*, with a comment that drawdown trigger levels are within 5 m of model predictions. It is not clear what this comment means. The supporting document, Section 8.1.1, *Table 8-1 Proposed new wording of Table D1* provides a groundwater trigger elevation of 336.49 m which is also the ground level elevation provided for this bore in the supporting document *Table 4-1 Replacement Groundwater Bore Locations.* The groundwater trigger elevation in *Table 8-1 Proposed new wording of Table D1* for this bore therefore appears to be an error.	Provide – (a) a water level plot for MBBE0012 to support the identified baseline standing water level in Table 5.5. (b) explanation of the comment *'within 5 m of model predictions'* in KCB Table 5-5, as to what it refers to and how it is applied. (c) Review of the groundwater trigger elevation in supporting document Section 8.1.1, Table 8-1 for this bore.	a) Plot provided below  b) Comment removed and trigger specified as maximum drawdown in Table 5-5 of Technical Memorandum - Groundwater Triggers (Appendix D). c) Trigger level based on available data. Once more data available a review can be done. Refer to Section 5.4 and Table 5.5 of Technical Memorandum - Groundwater Triggers (Appendix D). Pre-mining baseline standing water level (mbTOC) and Groundwater Trigger Elevation (mAHD) updated for MBBE0012 in Table D1 of the EA (refer Section 8.1.1 in the Supporting Document, and the draft EA (Appendix A)).
12	**Calibration and numerical groundwater modelling**	*Section 3.9.1 Calibration approach* (Appendix B *Groundwater Report* – Appendix IV – Numerical Groundwater Modelling) states: *Without an understanding of the historical mining activities and associated schedules, it is difficult to match modelled results with certain monitoring bores as part of the calibration process. Therefore, a review of the available monitoring bore network was undertaken to identify monitoring bores, and associated groundwater level records, that could be incorporated into the calibration process. Calibration focused on the more recent system conditions over the period March 2019 to January 2023.* *Section 3.1 Current and Planned Operations* (Appendix B Groundwater Report) states: *Mining commenced on the northern extent of the deposit in the last quarter of 2022 after sufficient overburden was removed.* Mining therefore was occurring at the end of the calibration period and through to 2028 in the predictive model period.	Provide details of the mining plan used in the calibration and predictive numerical groundwater modelling.	Refer to Groundwater Report (Appendix B) at Addendum IV-A for a Yearly Mine Progression Schedule, now included to address queries.

Item Number	Matters of Interest	DESI Comment	DESI Requested Action	External Response
		There however appears to be no mining plan provided showing the details of the mining plan used in the numerical groundwater modelling. This information should be provided to provide confidence in what has been modelled.		
13	**Nearby mines**	*Section 4 Model Predictions* (Appendix B Groundwater Report – Appendix IV – Numerical Groundwater Modelling). There appears to be no discussion of the assumptions in the numerical model as to the operations at nearby mines and how that might impact predictions in this model. These assumptions should be clearly stated so that it is understood what mining impacts the modelling relates to. For example, Appendix B Appendix IV Figures 4.1 and 4.3 appear to show significant groundwater recovery in the area around Broadmeadow West but there is little discussion of this.	Provide discussions as to what assumptions were made regarding the operation of nearby mines in the modelling for this project.	Refer to Groundwater Report (Appendix B) at Section IV-3.7 (Appendix IV-Numerical Modelling Report) for discussion around general head boundary cells. General head boundary (GHB) cells have also been applied to simulate current mining activities in the vicinity of the proposed mining area. Information of existing mining in adjacent area can be found in DBM for model. Existing mining GHB is switched off in 1000-Year post-closure stage to obtain water recovery.
14	**Evapotranspiration**	*Table 3.5 Summary Water Balance at the End of Calibration* Period (Appendix B Groundwater Report – Appendix IV – Numerical Groundwater Modelling) indicates evapotranspiration in the calibration period of 0. There should be some discussion as to whether this is considered a realistic representation of the groundwater system in the model domain.	Provide discussion on the water balance summary for the calibration period and in particular the assessment of evapotranspiration being equal to 0.	Refer to Groundwater Report (Appendix B) at Section IV-3.13 (Appendix IV-Numerical Modelling Report) for discussion on evapotranspiration which now addresses raised queries.
15	**Backfill and spoils**	*Section 4.2.1 Model Set-Up* (Appendix B Groundwater Report – Appendix IV – Numerical Groundwater Modelling) There is no indication in the report as to how backfill or spoil has been dealt with in the modelling. Much of the mined area will be backfilled. It is known that spoil typically receives higher recharge and has a higher hydraulic conductivity and specific yield than the natural geology it replaces. It is therefore important that it is represented in the modelling for those periods where it is in place. If separate parameters have not been applied to the spoil areas, how has this impacted predicted groundwater levels and predicted groundwater inflows provided to the water balance model.	(a) Provide advice as to how spoil has been dealt with in the numerical groundwater modelling. (b) If separate parameters have not been applied to the spoil, provide details on how this has impacted predicted groundwater levels and void water levels.	Refer to Groundwater Report (Appendix B) at Section IV-3.11 (Appendix IV-Numerical Modelling Report) for different parameters for spoils in North Pit and South Void.

Item Number	Matters of Interest	DESI Comment	DESI Requested Action	External Response
16	**Post Mining Land Use**	*Table G1 Post Mine Land Use (PMLU) and Rehabilitation Methods* (Appendix A Draft Environmental Authority with Proposed Changes – Appendix 5) states the Post-Mining Land Suitability Class for the PMLU disturbance areas are Class 4. Please confirm whether this is referencing the previous land suitability class definitions from Regional Land Suitability Frameworks for Queensland which defines Class 4 as 'Marginal land'. *"Marginal land, which is presently considered unsuitable due to severe limitations. The long term significance of these limitations on the proposed land use is unknown or not quantified. The use of this land is dependent upon undertaking additional studies to determine whether the effect of the limitation(s) can be reduced to achieve sustained economic production".* Or Whether this is referencing the current Guidelines for Agricultural Land Evaluation in Queensland which defines Class 4 as 'Unsuitable with severe limitations'. *"Currently unsuitable land. The limitations are so severe that the sustainable use of the land in the proposed manner is precluded. In some circumstances, the limitations may be surmountable with changes to knowledge, economics or technology".* If the draft EA follows the latter definition, this land suitability will not be suitable to support a stable grazing PMLU without severe limitations and management requirements.	(a) Please confirm which land suitability class definition is being followed. (b) Pending response to item 16(a), provide justification that the PMLU of land class suitability 4 will support a grazing outcome without severe limitations and management requirements.	Refer to Section 5.7.4 which has been added to the supporting document to respond to both queries.

<table>
<tr><th>Item Number</th><th>Matters of Interest</th><th>DESI Comment</th><th>DESI Requested Action</th><th>External Response</th></tr>
<tr>
<td>17</td>
<td>Southern Void NUMA</td>
<td>Section 5.3.7 Southern Void NUMA.
Although <i>Table 5-4 Final Southern Void</i> dimensions and criteria is provided (refer to screenshot below), it is not reflected in the draft EA Appendix 5 <i>Table G1 PMLU and Rehabilitation Methods</i> (Appendix 2 of the supporting document and included below for reference).
The proposed completion criteria in the EA lack sufficient geotechnical safety criterion for the residual voids (NUMAs) in the ‘long-term safety’ rehabilitation goals (e.g. factor of safety).

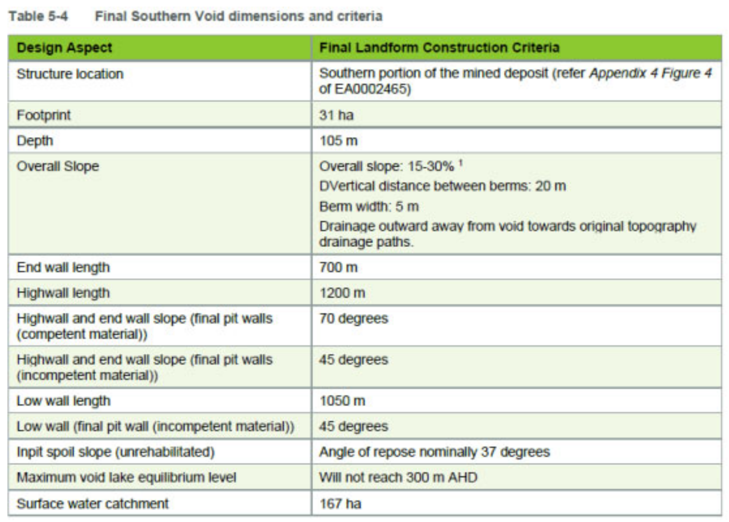



Table 5-4 Final Southern Void dimensions and criteria
<table>
<tr><th>Design Aspect</th><th>Final Landform Construction Criteria</th></tr>
<tr><td>Structure location</td><td>Southern portion of the mined deposit (refer <i>Appendix 4 Figure 4</i> of EA0002465)</td></tr>
<tr><td>Footprint</td><td>31 ha</td></tr>
<tr><td>Depth</td><td>105 m</td></tr>
<tr><td>Overall Slope</td><td>Overall slope: 15-30% [1]
DVertical distance between berms: 20 m
Berm width: 5 m
Drainage outward away from void towards original topography drainage paths.</td></tr>
<tr><td>End wall length</td><td>700 m</td></tr>
<tr><td>Highwall length</td><td>1200 m</td></tr>
<tr><td>Highwall and end wall slope (final pit walls (competent material))</td><td>70 degrees</td></tr>
<tr><td>Highwall and end wall slope (final pit walls (incompetent material))</td><td>45 degrees</td></tr>
<tr><td>Low wall length</td><td>1050 m</td></tr>
<tr><td>Low wall (final pit wall (incompetent material))</td><td>45 degrees</td></tr>
<tr><td>Inpit spoil slope (unrehabilitated)</td><td>Angle of repose nominally 37 degrees</td></tr>
<tr><td>Maximum void lake equilibrium level</td><td>Will not reach 300 m AHD</td></tr>
<tr><td>Surface water catchment</td><td>167 ha</td></tr>
</table>
</td>
<td>Provide updated SMART criteria for inclusion in the EA for the Southern Void as a NUMA demonstrating geotechnical stability, factor of safety that can be achieved, minimum set back distance if required and other specific criteria that can be transitioned to the PRCP as SMART management milestone criteria.</td>
<td>It is acknowledged that a Factor of Safety (FoS) is not identified in either Tables G1 or G2 of the EA in relation to the Southern Void; however, a FoS of 1.5 has been allocated against Out of Pit Dumps, Central Pit and the Northern Void. Additionally the PRCP application (RPM, 2021) does not identify a factor of safety for the Southern Void.

In response to an RFI for the major EA amendment in 2021, which also requested a Factor of Safety be identified for all mining domains, it was stated that ‘The Proponent proposed a 1.5 factor of safety for all mining domains. A review of approved coal mining EAs in the local region with similar geologic profiles have also adopted the factor of safety’.

As such, a Factor of Safety of ≥1.5 can be included in Table G2 of the EA (similar to the other structures), which states: ‘Geotechnical adequacy with a ≥1.5 Factor of Safety’ for the Southern Void. Refer to Section 8.1.6 of the supporting document which has been updated to address this point.

Sections 4.1.2, 5.7.3 and 6.3 have been updated to further describe the geotechnical safety mechanisms proposed for the Southern Void.</td>
</tr>
</table>