BLACKWATER MINE

BHP Mitsubishi Alliance

Blackwater Mine – North Extension Project

Environmental Authority Amendment Supporting Information Document

Status: Submission
Version: 1.0

Document Control

Reference	Date	Prepared	Checked	Authorised
BWM EA Amendment Supporting Document	14/12/2023	SLR and BMA		

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Abbreviations

Key terms, abbreviations and associated definitions used in this report are listed below.

List of Acronyms	
Acronyms	**Definitions**
ABA	acid-base accounting
ACARP	Australian Coal Association Research Program
ACH Act	*Aboriginal Cultural Heritage Act 2003* (Qld)
AD	acid/acidic drainage
ADR	Accepted Development Requirements
AEP	Annual Exceedance Probability
ALD	Assessment Level Decision
AMD	acid and metalliferous drainage
ANC	acid neutralising capacity
ANFO	ammonium nitrate/fuel oil
AR&R	Australian Rainfall and Runoff
ARI	Average Recurrence Interval
AS	Australian Standards
ASC	Australian Soil Classification
ATP	Authority to Prospect
BAU	Business as Usual
BHP	BHP Group Limited
BMA	BM Alliance Coal Operations Pty Ltd (BMA) (entity)

List of Acronyms	
BoM	Bureau of Meteorology
BWM	Blackwater Mine
CALMET	California Meteorological Model
CALPUFF	California Plume Dispersion Model
CEC	cation exchange capacity
CEEVNT	Critically Endangered, Endangered, Vulnerable or Near Threatened
CFC	chemical refrigerants and fire extinguishers
CHMA	Cultural Heritage Management Agreement
CHPP	Coal Handling and Preparation Plant
CONCAWE	*Conservation of Clean Air and Water Europe*
CQCA JV	Central Queensland Coal Associates Joint Venture
CQCAA Act	*Central Queensland Coal Associates Agreement Act 1968* (Qld)
CRD	cumulative rainfall departure
CSG	coal seam gas
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DGVs	default guideline values
DIN	Dissolved Inorganic Nitrogen
E	Endangered
EA	Environmental Authority
EA Amendment Guideline	Major and minor amendments – ESR/2015/1684 (formerly EM959), Version 6.02, Effective: 07 March 2017

List of Acronyms	
EA Approval Guideline	Approval processes for environmental authorities—ESR/2015/1743 (formerly EM966), Version 7.00, Effective: 8 January 2021
EETM	Emission Estimation Technique Manual
EIS	Environmental Impact Statement
EMM	EMM Consulting Pty Ltd
EMS	Environmental Management System
EP Act	*Environmental Protection Act 1994* (Qld)
EP Regulation	*Environmental Protection Regulation 2019* (Qld)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EPBC Act EO Policy	*EPBC Act environmental offsets policy (Commonwealth)*
EPP (Air)	*Environmental Protection (Air) Policy 2019* (Qld)
EPP (Noise)	*Environmental Protection (Noise) Policy 2019* (Qld)
EPP (Water and Wetland Biodiversity)	*Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (Qld)
ERAs	Environmentally Relevant Activities
ERC	Estimated Rehabilitation Cost
ESA	Environmentally Sensitive Areas
ESC	Erosion and Sediment Control
ESCP	Erosion and Sediment Control Plan
ESD	Ecologically Sustainable Development
ESP	Ecological Service Professionals Pty Ltd

List of Acronyms	
EV	Environmental Value
Fisheries Act	*Fisheries Act 1994* (Qld)
FPL	Flood Protection Location
FPRH	Fitzroy Partnership for River Health
FRREMP	Fitzroy Regional Receiving Environmental Monitoring Program
FTE	full time equivalent
FY	Financial Year
GDEs	Groundwater Dependent Ecosystems
GHG	Greenhouse Gases
GMA	Groundwater Management Area
GPS	Global Positioning System
GSDM	Generalised Short Duration Method
GTSMR	Revised Generalised Tropical Storm Method
GWDB	registered bore database
HCFC	chemical refrigerants and fire extinguishers
HES	High Ecological Significance
HEV	High Ecological Value
HS	Homestead
HSE	Health, Safety and Environment
HSEC	Health, Safety, Environment and Community

List of Acronyms	
IESC	Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development
IFD	Intensity-Frequency-Duration
ILUA	Indigenous Land Use Agreement
K	potassium
Land Act	*Land Act 1994* (Qld)
LC	Least concern
LGCs	large-scale generation certifications
MAW	Mine affected water
MERFP Act	*Mineral and Energy Resources (Financial Provisioning) Act 2018*
MIA	Mine Infrastructure Area
MICs	Maximum Instantaneous Charges
ML	Mining Lease
MNES	Matters of National Environmental Significance
Model Mining Conditions	Model Mining Conditions – ESR/2016/1936, Version 6.02, Effective: 07 March 2017
MPA	maximum potential acidity
MR Act	*Mineral Resources Act 1989* (Qld)
MSES	Matters of State Environmental Significance
Mtpa	Million tonnes per annum
NA	Not Applicable

List of Acronyms	
NAF	non-acid forming
NC Act	*Nature Conservation Act 1992* (Qld)
NEPC Act	*National Environment Protection Council (Queensland) Act 1994*
NMD	neutral and metalliferous drainage
NPI	National Pollutant Inventory
NT Act	*Native Title Act 1993* (Cth)
NUMA	non-use management areas
OAMP	Offset Area Management Plan
OC	Of Concern
ODS	Ozone depleting substances
Offsets Act	*Environmental Offsets Act 2014* (Qld)
Offsets Regulation	*Environmental Offsets Regulation 2014* (Qld)
PAF	potentially acid forming
PAF-LC	low capacity PAF
PCA	Potential Commercial Area
PCB	Polychlorinated biphenyls
PET	Plecoptera, Ephemeroptera and Trichoptera
Planning Act	*Planning Act 2016* (Qld)
PMF	probable maximum flood
PMLU	post-mining land uses

List of Acronyms	
PMP	probable maximum precipitation
PMPF	Probable Maximum Precipitation Flood
PMST	Protected Matters Search Tool
PNC	*“Planning for Noise Control’*
PPV	peak particle velocity
PRC Plan	Progressive Rehabilitation and Closure Plan
QEOP	Queensland Environmental Offsets Policy
QLD	Queensland
Qld EO Policy	*Queensland Environmental Offsets Policy*
Queensland Heritage Act	*Heritage Act 1992* (Qld)
RBL	Rating Background Levels
RE	Regional Ecosystem
REMP	Receiving Environment Monitoring Program
RoM	Run-of-Mine
RPI Act	*Regional Planning Interests Act 2014* (Qld)
SA	Surface Area
SD	saline drainage
SDS	Safety Data Sheet
SEA	Strategic Environmental Area
SIGNAL	Stream Invertebrate Grade Number – Average Level

List of Acronyms	
SILO	Scientific Information for Landowners
SLC	Special Least Concern
SMU	Soil Map Units
SRI	Significant Residual Impact
T&S	Truck and Shovel
TAPM	The Air Pollution Model
TARP	Trigger Action Response Plan
TCP	Thermal Coal Plant
TDS	total dissolved solids
TEC	Threatened Ecological Community
TEP	Transitional Environmental Programs
TGDE	Terrestrial Groundwater Dependent Ecosystems
The Water Plan	*Water Plan (Fitzroy Basin) 2011*
TSF	tailings storage facility
TSP	total suspended particulates
TSS	Total Suspended Solids
UWIR	Underground Water Impact Report
VM Act	*Vegetation Management Act 1999* (Qld)
VWPs	vibrating wire piezometers
Water Act	*Water Act 2000* (Qld)

List of Acronyms	
Water Regulation	*Water Regulation 2016* (Qld)
WMP	Water Management Plan
WoNS	Weeds of National Significance
WPA	wetland protection area
WQOs	water quality objectives
WRAC	Workplace Risk Assessment Control
WROLA Act	*Water Reform and Other Legislation Amendment Act 2014*
WstMP	Waste Management Plan
Departments and Organisations	
DAF	Department of Agriculture and Fisheries
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DES	Department of Environment and Science
DEHP	Department of Environment and Heritage Protection
DoR	Department of Resources
DSDILGP	Department of State Development, Infrastructure, Local Government and Planning
DRDMW	Department of Regional Development, Manufacturing and Water
DTMR	Department of Transport and Main Roads

1 Introduction

1.1 The Application for Amendment

The Blackwater Mine (BWM) is located approximately 20 kilometres (km) south-west of Blackwater in the Bowen Basin, Queensland (**Figure 1-1**). BWM's Mining Leases (MLs) include ML1759, ML1760, ML1761, ML1762, ML1767, ML1771, ML1772, ML1773, ML1792, ML1800, ML1812, ML1829, ML1860, ML1862, ML1907, ML70091, ML70103, ML70104, ML70139, ML70167 and ML70329 (**Figure 1-1**).

BM Alliance Coal Operations Pty Ltd (BMA) seek approval to extend the current mining operation through the BWM – North Extension Project (the Project). The Project would extend the mining area of the existing BWM to within Surface Area (SA)10 on ML1759 and SA7 on ML1762 (**Figure 1-1** and Figure **1-2)**.

This document is referred to as the "Supporting documentation to the Amendment Application for Environmental Authority No. EPML00717813" (the EA Amendment Application) and has been prepared to support BMA's application to amend Environmental Authority (EA) EPML00717813 (the EA) under Section 226 the *Environmental Protection Act 1994* (EP Act).

1.2 The Proponent

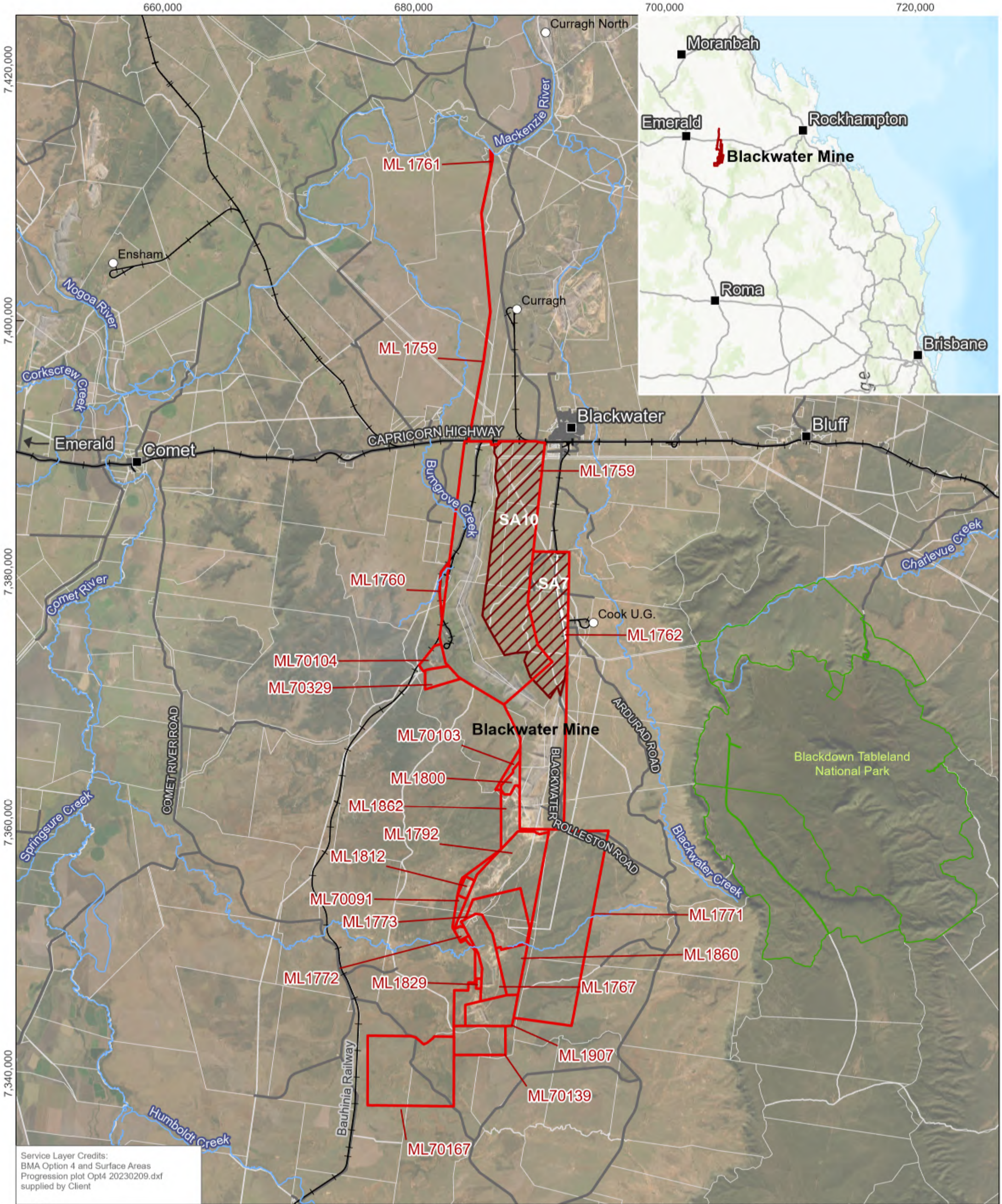
The Project proponent is BMA, as manager and agent on behalf of the Central Queensland Coal Associates Joint Venture (CQCA JV) and South Blackwater Coal Pty Limited.

BMA is owned by BHP Group Limited (BHP) (50 per cent) and Mitsubishi Development Pty Ltd (Mitsubishi Development) (50 per cent). BMA is Australia's largest supplier of seaborne metallurgical coal. BMA operates seven Bowen Basin mines - Blackwater, Broadmeadow, Goonyella Riverside, Peak Downs, Saraji, Caval Ridge and Daunia, and owns and operates the Hay Point Coal Terminal near Mackay.

BMA's operations provide significant benefits to the local communities in which it operates, to the broader Central Queensland region and to the Queensland economy as a whole. BMA is the largest employer in the Central Queensland region and plays a key role in its economic development.

BHP and BMA make a substantial contribution to Queensland's economy through royalties, taxes, wages, local suppliers, and social investment, as demonstrated by the contributions made during the 2022 financial year (FY) (FY2022 BHP and BMA's Community Contribution Report, Queensland, BHP and BMA, 2023):

- A$6,800M spent by BMA on payments to suppliers.
- A$16.5M spent on goods and services from Indigenous businesses.
- A$3,100M paid in coal royalties to the Queensland Government.
- A$38M paid to Regional Councils in rates, fees and charges.
- A$1,534M in wages and salaries to Queensland employees and contractors.
- A$13.72M in voluntary social investments (health, education and environmental) in the Bowen Basin.



0 5 10 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:400,000 at A4
Project Number:	620.014601
Date Drawn:	28-Nov-2023
Drawn by:	NT

LEGEND

- City/Town
- Coal Mine
- Railway
- Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Cadastre

BLACKWATER MINE - NORTH EXTENSION PROJECT

PROJECT LOCATION

BMA
BHP Mitsubishi Alliance

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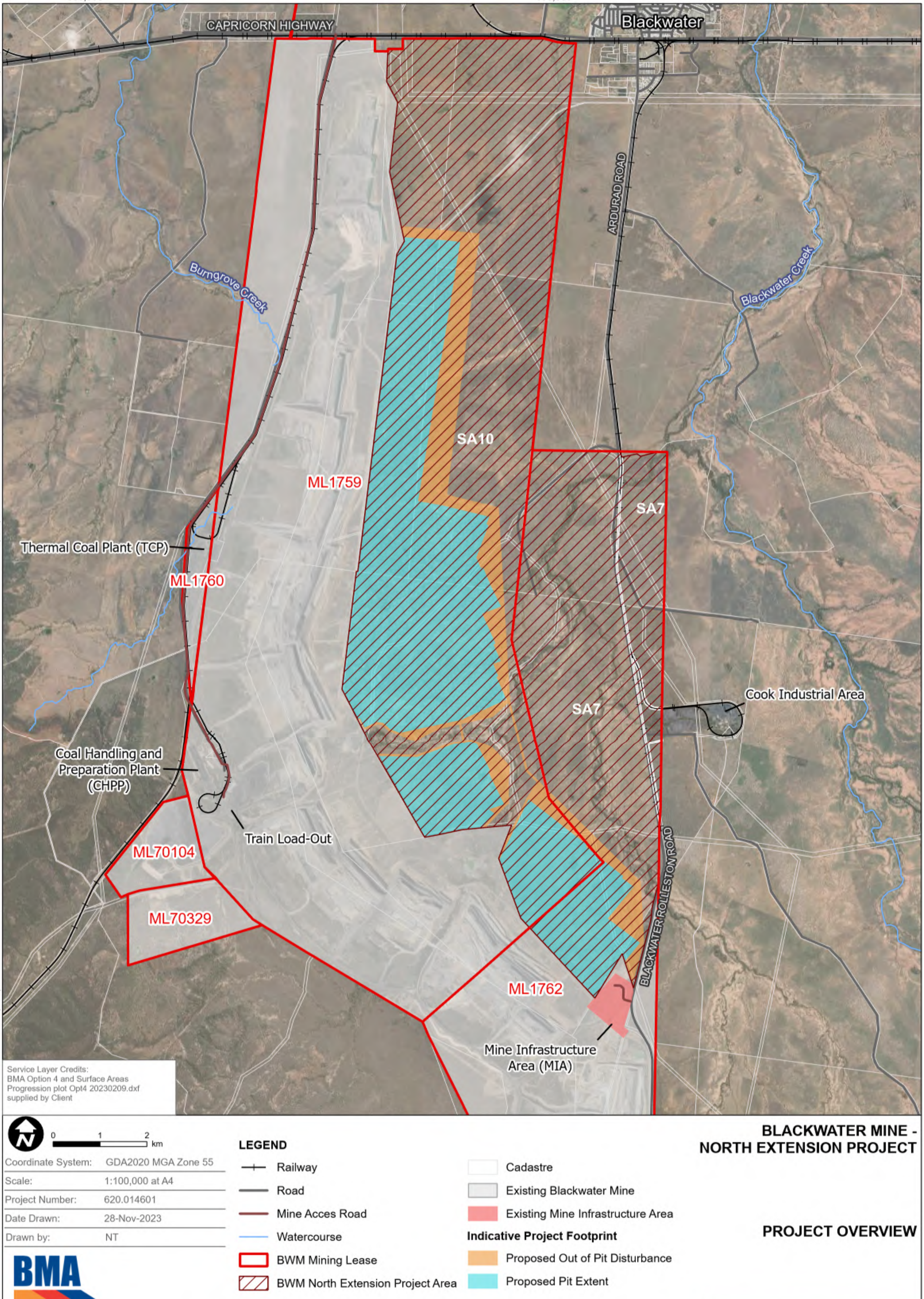
FIGURE 1-1

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro.aprx\620014601_IN_F01_1_Site_Location



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BMA
BHP Mitsubishi Alliance

BLACKWATER MINE - NORTH EXTENSION PROJECT

PROJECT OVERVIEW

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FIGURE 1-2

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro.aprx\620014601_IN_F01_2_Project Overview

In addition, BMA employs approximately 10,000 full-time equivalent employees and contractors (BHP and BMA, 2023). BMA is committed to the communities and the environments in which it operates.

BMA regularly reviews environmental performance and publicly reports on progress. BMA has a record of responsible environmental management and a strong commitment to continual improvement of environmental performance.

BHP's long-term and ongoing commitment to sustainability is defined by 'Our Charter' and realised through 'Our Requirements' standards. These standards describe BHP's mandatory minimum performance requirements and include sustainability, integrity, respect, performance, simplicity and accountability values. They provide the foundation for the management systems at BHP operated assets and are designed to help ensure BHP maintain and promote the long-term health of society and the natural environment.

BMA is committed to the principles of sustainable development, including the wellbeing of its employees and communities. BMA is also committed to developing, implementing and maintaining management systems for health, safety, environment and the community that are consistent with best practices. This commitment is given practical effect by BHP's Health, Safety, Environment and Community (HSEC) Management Standards, and the systems, procedures, and operational protocols through which these standards are applied at a site level. Through these standards, BMA drives an overriding commitment to health, safety, environmental responsibility, and sustainable development. The BMA Environmental Management System is aligned to ISO14001.

The Climate Change Report 2020 (BHP, 2020) details BHP's approach to climate change and the role BHP will play in addressing it. BHP is committed to reducing operational greenhouse gas emissions (Scope 1 and Scope 2) by at least 30 per cent from FY2020 levels by FY2030 and has set a goal to achieve Net Zero operational emissions by 2050. BHP has also set goals and targets to reduce value chain Scope 3 emissions.

Similarly, Mitsubishi Development (a wholly owned subsidiary of Mitsubishi Corporation) operates under three corporate principles: corporate responsibility to society; integrity and fairness; and global understanding through business. Mitsubishi Development are committed to reducing greenhouse gases by implementing new operational efficiencies and sustainable technologies, as well as actively pursuing business partnerships that facilitate the transition to a low carbon society. Mitsubishi Corporation, Mitsubishi Development's parent company, aims to reduce greenhouse gas emissions by 50 per cent by 2030 per total assets, compared to FY2020 levels and Net Zero by 2050.

1.3 Existing BWM Operations

Operating since 1967, BWM is an open cut strip mine utilising draglines and supporting pre-strip and coal mining fleets to produce up to 16 million tonnes per annum (Mtpa) of product coal. The current BWM strike extends for approximately 45 km and produces predominantly coking coals.

A Coal Handling and Preparation Plant (CHPP), Thermal Coal Plant (TCP), train load-out facilities, Mine Infrastructure Area (MIA) and other mine infrastructure service the existing mining operations.

The existing BWM operations are authorised under the existing EA.

In the northernmost MLs, mining at BWM is scheduled to approach the western boundaries of SA10 on ML1759 and SA7 on ML1962 during FY2025, requiring the relocation of supporting infrastructure in advance of mining.

1.4 Project Overview

The Project is an extension of mining into SA7 on ML1762 and SA10 on ML1759 utilising the current BWM mining methods, mining fleet, mine infrastructure and facilities (**Figure 1-2**).

Importantly, the Project should be viewed in the context that it is an extension and continuation of ongoing mining operations on a portion of the significantly larger BWM mining operation (as shown on **Figure 1-1**).

SA7 on ML1762 and SA10 on ML1759 cover a total area of approximately 9,010 hectares (ha). The extent of the proposed Project open cut mining area and out of pit disturbance areas is approximately 3,761 ha.

If approved, and subject to customer demand, the extension is projected to extend mining at the BWM to within SA7 on ML1762 and SA10 on ML1759 from 2025 to 2085.

A detailed description of the Project is provided in **Chapter 3**.

1.5 Project Objectives

The key objectives of the Project are to:

- Secure the necessary external approvals to:
  - Extract approximately 220 million tonnes (Mt) of Run-of-Mine (RoM) coal from within SA7 on ML1762 and SA10 on ML1759 at BWM using existing open cut mining methods.
  - Increase BWM's production from up to 16 Mtpa to up to 17.6 Mtpa (product coal).
- Make efficient use of existing BWM infrastructure for the Project.
- Avoid, minimise and/or mitigate potential impacts to environmental values.
- Continue to contribute to the local communities in which it operates, to the broader Central Queensland region and to the Queensland economy as a whole.
- Continue to operate the BWM in compliance with all relevant statutory obligations and to improve operations to ensure best practice environmental management and sustainability.
- Provide a sustained and profitable Project to provide high-quality hard coking coal and semi hard coking coal to the export market, as a component of the overall BWM operation.

1.6 Structure of this Document

The structure and contents of the supporting information document is summarised as follows:

- **Chapter 1** Introduction - provides information about the Proponent, a brief overview of the Project and its objectives, and outlines the structure of the document.
- **Chapter 2** Regulatory Considerations - provides confirmation that this EA Amendment Application has been prepared in accordance with regulatory requirements.
- **Chapter 3** Project Description - includes a detailed description of the Project activities, providing context for the EA Amendment Application and associated technical assessments.
- **Chapter 4** Rehabilitation - describes how the Project land will be progressively rehabilitated.

- **Chapter 5** Project Justification and Alternatives - provides justification for the Project and describes the Project alternatives considered. An assessment addressing the 'standard criteria' is also provided in this Chapter.

Chapters 6 to 14 provide a description of the existing environmental values within and surrounding the Project, the potential impacts of the Project on those values and the mitigation and management measures proposed to prevent or minimise adverse environmental effects. These chapters are:

- **Chapter 6** Land Resources.
- **Chapter 7** Geochemistry.
- **Chapter 8** Air Quality.
- **Chapter 9** Noise and Vibration.
- **Chapter 10** Surface Water.
- **Chapter 11** Groundwater.
- **Chapter 12** Terrestrial Ecology.
- **Chapter 13** Aquatic Ecology and Stygofauna.
- **Chapter 14** Waste Management.
- **Chapter 15** Environmental Authority Amendments - describes proposed amendments to the relevant conditions of the current EA.

The **Appendices** contain the Technical Reports for each relevant environmental discipline supporting the EA Amendment Application and include:

- **Appendix A** Land Resources Assessment.
- **Appendix B** Geochemistry Assessment.
- **Appendix C** Air Quality Assessment.
- **Appendix D** Noise and Vibration Assessment.
- **Appendix E** Surface Water Resources Assessment.
- **Appendix F** Groundwater Impact Assessment.
- **Appendix G** Terrestrial Ecology Matters of National Environmental Significance Assessment.
- **Appendix H** Terrestrial Ecology Matters of State Environmental Significance Assessment.
- **Appendix I** Aquatic Ecology Impact Assessment.
- **Appendix J** Groundwater Modelling and Impact Assessment Peer Review Letter.

2 Regulatory Considerations

2.1 Primary State Legislation

2.1.1 Mining and Environmental Legislation

There are two primary pieces of State legislation which are relevant to the EA Amendment for the Project. They are:

- *Mineral Resources Act 1989* (MR Act).
- EP Act.

The Proponent holds ML1759 and ML1762 and SA rights, granted under the MR Act, which provide rights to access minerals in the Project area.

While the existing EA covers the Project areas (SA10 on ML1759 and SA7 on ML1762). EA Condition E23 currently prohibits coal mining (other than certain prescribed activities) within SA10 on ML1759 and SA7 on ML1762.

Hence, no further approval or grant of mining tenure is required under the MR Act and an EA Amendment is required to authorise the Project under the EP Act.

2.1.2 Mineral Resources Act 1989

The MR Act is administered by the Department of Resources and provides for “the assessment, development and utilisation of mineral resources to the maximum extent practicable consistent with sound economic and land use management”. The principal objectives of the MR Act are to:

- Encourage and facilitate prospecting and exploring for and mining of minerals.
- Enhance knowledge of the mineral resources of the State.
- Minimise land use conflict with respect to prospecting, exploring and mining.
- Encourage environmental responsibility in prospecting, exploring and mining.
- Ensure an appropriate financial return to the State from mining.
- Provide an administrative framework to expedite and regulate prospecting and exploring for and mining of minerals.
- Encourage responsible land care management in prospecting, exploring and mining.

The MR Act provides for the granting, conditioning and management of mining tenements, being prospecting permits, exploration permits, mineral development licences, MLs and mining claims.

A ML (with surface rights) under the MR Act is required to authorise mining and associated activities within the ML. The Project footprint is wholly located within two approved ML’s (with surface rights granted)[1], namely ML1759 and ML1762, and therefore there is no requirement to apply for additional MLs or SA rights as part of this Project.

[1] Note that Nil SAs occur within the wider Project area (i.e. within ML 1762 and adjacent to SA7) associated with the South Blackwater Mine Railway, Cook Mine Railway Loop and Cook CHPP Access Road.

2.1.3 Environmental Protection Act 1994

2.1.3.1 Overview of the EA Amendment procedure

The EP Act was established "to protect 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".

Resource activities carried out on mining tenure are approved via the grant of an EA under Chapter 5 of the EP Act. When deciding whether to grant or refuse an application for an EA or an amendment to an EA or deciding on the conditions of the EA, the Department of Environment and Science (DES), the administering authority, must consider certain matters set out in the EP Act.

The EP Act utilises several mechanisms to achieve its objectives. These include:

- Major and minor EA amendment application processes, including where applicable, an Environmental Impact Statement (EIS) process for resource projects.
- Licensing or approving all Environmentally Relevant Activities (ERAs).
- Allowing for improvement through Transitional Environmental Programs (TEPs).
- Provision of Environmental Protection Policies (EPPs).
- Regulating contaminated land.
- Creating a general environmental duty.

In particular, the EP Act authorises the holder of an EA to apply to DES for amendment to an EA under Section 224 at any time. The EA amendment application process is described below:

- EA Amendment Application.
- Assessment Level Decision.
- Information stage (if requested by DES).
- Notification stage (if required).
- Decision Stage (including Notice of Decision).
- Draft EA issued.
- Objections and Referral to the Land Court (if objections received).
- Land Court Process (if required).
- EA Approved with Conditions.

An EA amendment is required where there is a proposed change to the nature and extent of authorised activities on an associated ML(s) and/or the conditions of the EA need to be amended.

Operations at BWM are carried out under the conditions of the EA (EPML00717813). The current EA for the BWM is dated 29 June 2023. The EA includes authorisations for impacts to environmental values and management measures for these impacts.

Condition E23 of the EA prohibits open cut coal mining within SA10 on ML1759 and SA7 on ML1762. As such, BMA's proposal to extend open cut mining at BWM into SA10 on ML1759 and SA7 on ML1762 requires an EA Amendment Application to be submitted to amend Condition E23. The proposed amendments to EA Condition E23 are set out in **Chapter 15.**

2.1.3.2 Assessment Level Decision

Within 10 business days after receiving an EA Amendment Application, DES must make an Assessment Level Decision. The Assessment Level Decision process will determine whether the EA Amendment Application is a minor or major amendment (with or without an EIS).

A major amendment for an EA under Section 223 of the EP Act "*means an amendment that is not a minor amendment*". An assessment of the proposed EA Amendment for the Project against the minor amendment (threshold) criteria (as outlined in Section 223 of the EP Act) is presented in **Table 2-1**. This assessment demonstrates that the proposed EA Amendment is not a minor amendment and is therefore considered a major amendment for the purposes of the EP Act.

Table 2-1: Minor EA Amendment Threshold Criteria

Minor EA Amendment Threshold Criteria	This EA Amendment application
The proposed 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. (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.	The proposed amendment is not a change to a standard condition.
(b) does not significantly increase the level of environmental harm caused by the relevant activity.	The proposed amendment will extend open cut mining at BWM to within SA10 on ML1759 and SA7 on ML1762.
(c) does not change any rehabilitation objectives stated in the authority in a way likely result in significantly different impacts on environmental values than the impacts previously permitted under the authority.	The proposed EA Amendment does not change any rehabilitation objectives stated in the EA.
(d) does not significantly increase the scale or intensity of the relevant activity.	The Project will not significantly increase the scale or intensity of the relevant activity.
(e) does not relate to a new relevant resource tenure for the authority that is – (i) a new ML; or (ii) a new petroleum lease; or (iii) a new geothermal lease under the Geothermal Energy Act 2010; or (iv) a new GHG injection and storage lease under the *Greenhouse Gas Storage Act 2009* (GHG Storage Act).	The proposed amendment does not relate to a new relevant resource tenure for the EA.
(f) involves an addition to the SA for the relevant activity of no more than 10% of the existing area.	SA rights for SA10 on ML1759 and SA7 on ML1762 have been granted in accordance with the MR Act. The current EA prohibits open cut coal mining within those SAs. The Project seeks authorisation for a change in activity within SA10 on ML1759 and SA7 on ML1762 from the current limited level of activity to include the activity of coal mining.

Minor EA Amendment Threshold Criteria	This EA Amendment application
	The increase in area for the relevant activity (coal mining) for the BWM will be by more than 10%. It is noted that the Project area was intended for coal mining purposes since the original grant of the MLs.
(g) for an EA for a petroleum activity – (i) if the amendment involves constructing a new pipeline – the new pipeline exceeds 150 km; and (ii) if the amendment involves extending an existing pipeline – the extension will exceed 10% of the existing length of the pipeline.	Not Applicable (NA).
(h) if the amendment relates to a new relevant resource tenure for the authority that is an exploration permit or GHG permit – the amendment application under section 224 seeks an amended EA that is not subject to the standard condition for the relevant activity or authority, to the extent it relates to the permit.	NA.

2.1.3.3 EIS Trigger Criteria Assessment

DES must determine whether an EIS is required when considering an EA Amendment Application for a resource activity. Section 143 of the EP Act describes the circumstances under which a resource activity may be assessed by an EIS process. The criteria that inform the decision-making process under Section 143 of the EP Act are outlined in the DES Guideline: "*Criteria for environmental impact statements for resource projects under the Environmental Protection Act 1994".*

Assessment of the Project against the EIS triggers for the Project under Appendix B of the guideline is set out in **Table 2-2**. The assessment concludes that the Project would not trigger the need for an EIS.

The relative magnitude (scale and risk) of impacts (e.g., impacts on matters of state environmental significance, water quality and resources, environmentally sensitive areas (Category A, B and/or C), air, noise) are discussed in **Chapters 6-14** (environmental assessments) and **Appendices A-I**. The assessment concludes that the Project would not trigger the need for an EIS.

BMA considers that the Project is not a project that would require an EIS for the purposes of addressing public interest. The Project involves the continuation of existing operations on granted MLs and does not introduce any significant new activities or operations.

There is sufficient certainty about the potential impacts of the Project, as described in **Chapters 6-14** (environmental assessments) and the detailed environmental impact assessments provided in **Appendices A-I**. Hence, this matter should not trigger the requirement for an EIS.

Additional approvals are anticipated to be required for the Project from the Queensland Government and the Australian Government. Of particular relevance is the likely requirement for approval of the Project under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). However, the Project, like all large coal mines and other projects that could potentially impact on Threatened Ecological Communities (TECs), threatened and/or migratory species, water resources and other MNES can be assessed under the EPBC Act without necessarily requiring an EIS process. Hence, while other approvals will be required, BMA considers that this is not a Project that will result in significant issues with the Queensland or Australian Governments and would not trigger the need for an EIS.

BMA considers that the Project is not a project that would require an EIS to address the potential for social and economic impacts. The Project involves the continuation of operations at an existing mine and provides for the continued economic development of Queensland's mineral resources, in accordance with current Queensland Government policy and the existing regulatory framework.

Cumulative impacts, where relevant, have been considered in the environmental assessments presented in **Chapters 6-14** and **Appendices A-I**. The assessments, where relevant, have considered the potential impacts of the Project in the context of the BWM as well as the potential impacts from other operations and land uses in the surrounding area. The assessments conclude that the Project would not trigger the need for an EIS on the basis of potential cumulative impacts.

Table 2-2: EIS Trigger Assessment for the Project

DES EIS Trigger	Trigger (Yes/No)	Justification
For proposals to amend/alter an existing mine		
For mines already removing 2–10 million tonnes per year RoM ore or coal, would the application increase the current annual removal rate by more than 100% or 5 million tonnes per year (whichever is the lesser)?	NA	NA
For mines already removing over 10 million tonnes per year RoM ore or coal, would the application increase the current annual removal rate by more than 50% or 10 million tonnes per year (whichever is the lesser)?	No	The existing product coal tonnage for BWM is up to 16 Mtpa, which equates to a RoM tonnage rate of up to 19 Mtpa. The proposed Project product coal tonnage of up to 17.6 Mtpa equates to approximately 22 Mtpa of RoM coal. The Project will not result in an increase in the annual removal rate by more than 50% or 10 Mtpa.
For mines already removing more than 20 million tonnes per year RoM ore or coal, would the application increase the current annual removal rate by more than 25%?	NA	NA
Would the application involve an extension into and significant impact on a Category A or B environmentally sensitive area, which is not already authorised by the State?	No	The Project would not result in a significant impact on Category A or B Environmentally Sensitive Areas. This is discussed in further detail in Section 2.1.3.2.
Would the application involve a substantial change in mining operations—such as from underground to open cut, or (for underground mining) a change in operations from one causing little subsidence to one likely to cause substantial subsidence?	No	The Project is an extension of the existing operation at BWM into SA10 on ML1759 and SA7 on ML1762. The Project will utilise the existing mining techniques and infrastructure and remain as an open cut mine.
Would the application introduce a novel or unproven resource removal process, technology or activity?	No	The Project will continue to utilise the existing extraction process and as such no novel or unproven resource extraction process will be introduced.

2.1.3.4 Category A, B and C Environmentally Sensitive Areas

The Project area is not located within or proximal to any Category A Environmentally Sensitive Areas (ESAs), however does contain Category B Environmentally Sensitive Areas. This is discussed below.

Regional Ecosystems (REs) with a biodiversity status of endangered comprise a Category B ESA under the *Environmental Protection Regulation 2019* (EP Regulation).

Endangered (biodiversity status) REs were identified by DES on the certified RE mapping within SA10 and SA7 (**Figure 2-1**). Ecological field surveys were conducted by EMM Consulting Pty Ltd (EMM) to ground-truth the REs and confirm the patches of remnant or regrowth vegetation that contain an endangered RE (biodiversity status) within the Project area. The ground-truthed RE mapping is shown in **Figure 2-2**.

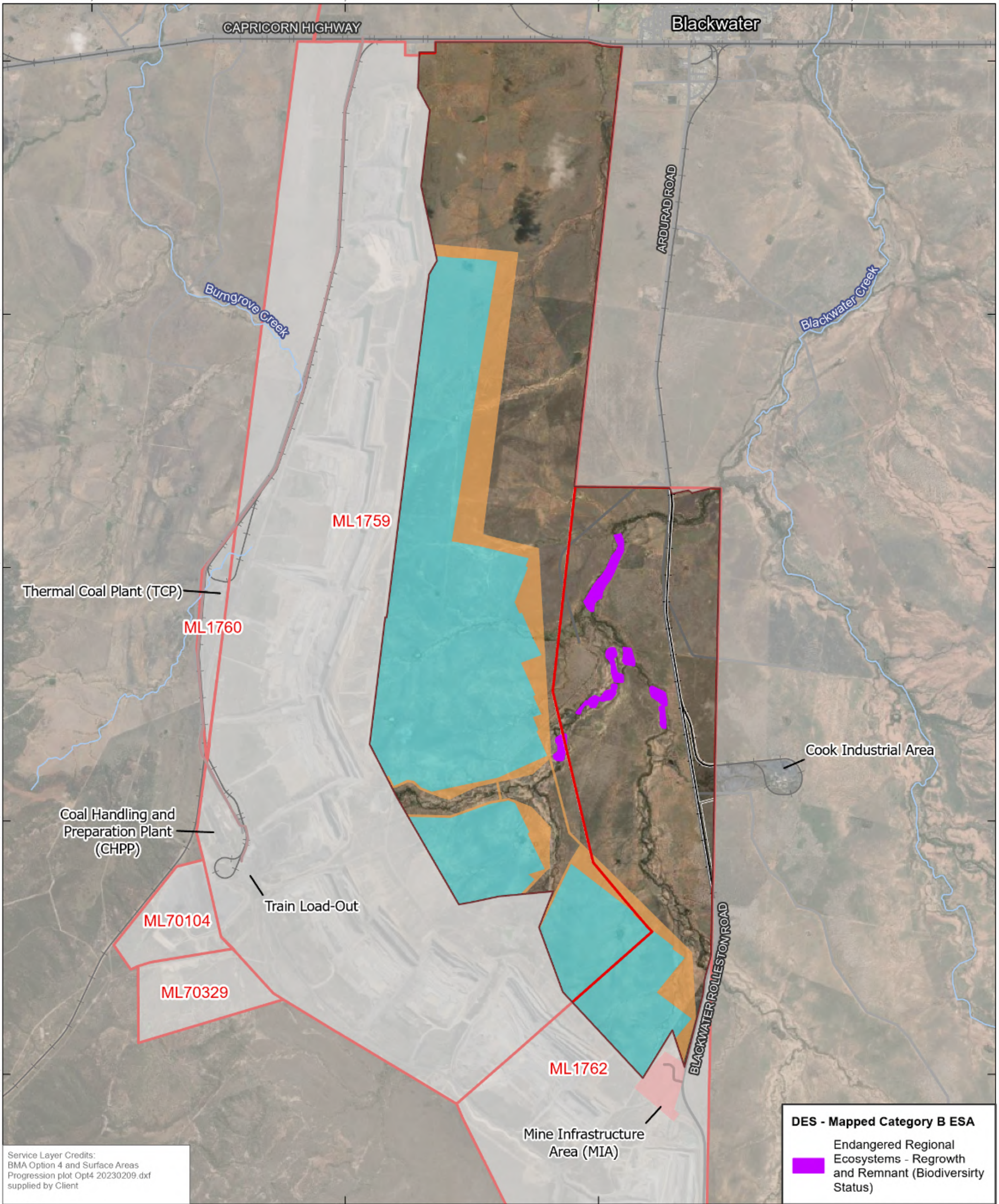
As described in **Section 5.2**, BMA refined the original Project footprint to minimise impacts to the mapped patches of endangered RE (biodiversity status) through the exclusion of sections of Deep Creek (a tributary of Taurus Creek) and Taurus Creek from the mining footprint, as well as areas mapped as Category B ESA further to the east (**Figure 2-2**).

The remaining area of endangered REs (biodiversity status) that would be directly impacted by the Project is approximately 14.32 ha, comprising 10.53 ha of remnant vegetation and 3.79 ha of high-value regrowth vegetation (**Figure 2-2**), noting that one of these RE's is a mixed polygon containing an RE of least concern.

Impacted vegetation includes:

- A narrow band of RE 11.3.1 (*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains) along a tributary of Taurus Creek.
- High value regrowth RE 11.3.2/11.4.9 (50/50) (Mixed polygons of *Eucalyptus populnea* woodland on alluvial plains and *Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains), where the infrastructure corridor crosses Taurus Creek (noting only RE11.4.9 is an endangered biodiversity status RE).
- High value regrowth RE 11.3.1/11.3.6 (90/10) (Mixed polygons of *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains and *Eucalyptus melanophloia* woodland on alluvial plains) situated on a tributary of Two Mile Gully.

Ground-truthed mapping indicated that the patches of RE 11.3.1/RE11.4.9 vegetation within the Project footprint are narrow, linear patches fringing creek lines. These patches are predominantly in poor condition due to the high abundance of exotic vegetation, sparse nature of vegetation due to historical clearing and grazing, and edge effects as these patches are adjacent to large, cleared grazing paddocks. Groundcover within these communities was largely dominated by Buffel Grass. While a number of patches are dominated by Brigalow, other species are present such as the occasional Bottle Tree (*Brachychiton* spp) and scattered emergent eucalypts including Poplar Box, Silver-leaved Ironbark, and in some sections, Coolibah.



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	06-Dec-2023
Drawn by:	NT

BMA
BHP Mitsubishi Alliance

LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

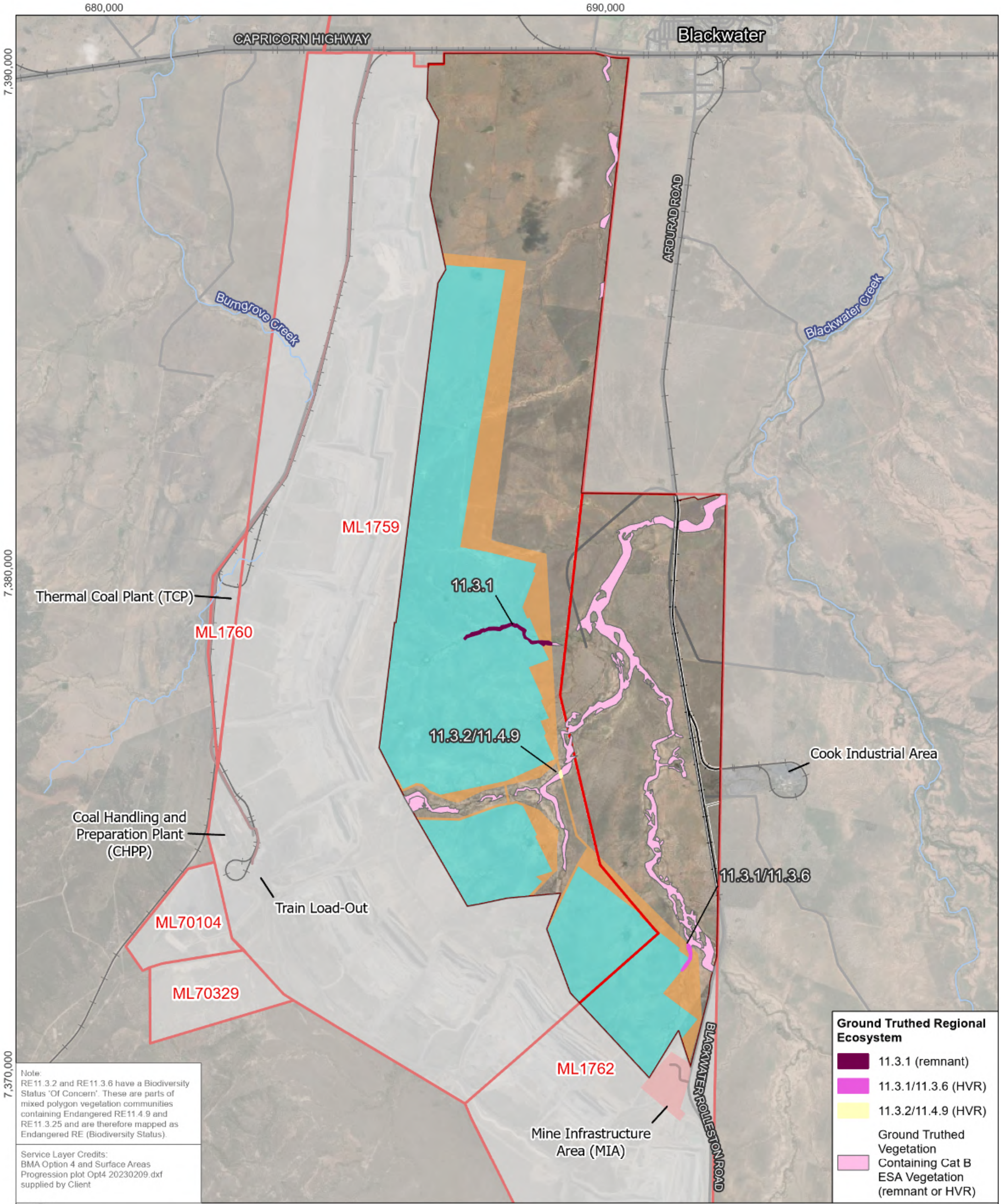
- Propsoed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

CATEGORY B ESA, DES MAPPING WITHIN PROJECT AREA

FIGURE 2-1

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_REG_F02_01_ESA_CategoryB



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
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BMA
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LEGEND

- Railway
- Road
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- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Propsoed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

CATEGORY B ESA, GROUND-TRUTHED VEGETATION MAPPING WITHIN PROJECT AREA

FIGURE 2-2

The patches of RE11.3.1 and RE11.4.9 in the Project footprint were assessed against key diagnostic characteristics and condition thresholds to determine whether these patches constituted a TEC under the EPBC Act (as RE 11.3.1 and RE 11.4.9 are analogous with the EPBC Act listed Brigalow TEC). The diagnostic characteristics (Commonwealth Department of Environment 2013) include dominant tree species, patch size, and structural composition, but more relevantly, the condition threshold which prescribes that exotic species must comprise less than 50 per cent of the total vegetation cover of the patch. Therefore, where exotic vegetation cover is high, the patch of vegetation does not constitute a TEC under the EPBC Act. Brigalow patches surveyed in the Project area (and in the Project footprint) generally suffered from high levels of weed encroachment (Buffel Grass, Parthenium and Green Panic Grass), and therefore did not meet TEC criteria. One patch of Brigalow outside the Project footprint in the northern stretch of Taurus Creek met TEC criteria where weed encroachment was less severe. Hence, it is noted that the condition of the patches located within the Project footprint do not qualify as a TEC under the EPBC Act.

In view of the narrow, linear nature and poor condition of the RE 11.3.1 remnant patches and regrowth mixed RE patches (RE 11.3.1 and RE 11.4.9), the removal of the stands of vegetation within the Project footprint is not considered to result in a significant impact on this particular Category B ESA. There will be large areas of RE 11.3.1 that remain that will not be impacted as a result of the Project, including areas of higher ecological condition in northern stretches of Taurus Creek.

When describing the likely impacts to Category A, B and C ESAs from the proposed activities in an EA application, an applicant is required to provide details of:

- Any emissions or releases likely to be generated by the activities.
- Descriptions of the risk and likely magnitude of the impacts.
- Details of the management practices proposed to be implemented to prevent or minimise adverse impacts.
- Details of how the impacted land will be rehabilitated after the activities cease.

Accordingly, this EA Amendment Application presents substantial information addressing each of these requirements. Of particular relevance are the detailed assessments of impacts to terrestrial ecology, proposed mitigation measures (such as weed management), and progressive rehabilitation that will be implemented for the Project.

In summary, the assessment concludes that there are no EIS triggers applicable to the Project that would, in isolation or cumulatively, trigger the need for an EIS. Further, BMA is not proposing to undertake any additional ERAs for the Project other than those which are currently authorised under the BWM EA.

2.1.3.5 Progressive Rehabilitation and Closure Plan

The *Mineral and Energy Resources (Financial Provisioning) Act 2018* (MERFP Act), passed by Parliament on 30 November 2018, amends the EP Act to require a Progressive Rehabilitation and Closure Plan (PRC Plan). The MERFP Act requires the holder of an EA to plan for how, where and when activities will be carried out on land in a way that maximises the progressive rehabilitation of the land to a stable condition and provide for the condition to which the holder must rehabilitate the land before the EA may be surrendered.

The PRC Plan is required to be prepared in accordance with the PRC Plan guideline (*Guideline - Progressive rehabilitation and closure plans (PRC plans)* (DES, ESR/2019/4964, Version 3.00, 04 April 2023)).

The PRC Plan consists of two components:

1. Rehabilitation planning.
2. PRC Plan schedule.

The rehabilitation milestone criteria sets out the requirements that must be met to achieve the agreed post-mining land uses (PMLU) and non-use management areas (NUMA). The PRC Plan schedule details the locations of PMLUs and NUMAs, rehabilitation and management milestones, milestone criteria and a rehabilitation schedule, which are legally binding.

Under Part 27 of the EP Act (transitional provisions for the *Mineral and Energy Resources (Financial Provisioning) Act 2018*), holders of EAs are required to submit a PRC Plan to DES that complies with Section 126C and Section 126D of the EP Act, pertaining to the activities authorised by the EA. The BWM transitional PRC Plan is scheduled to be submitted to the DES in November 2024.

2.2 Other State Legislation

2.2.1 Water Act 2000

The *Water Act 2000* (Water Act) provides for the management of waters and watercourses and the construction, control and management of works that affect watercourses. The purpose of the Water Act is to advance sustainable management and efficient use of water resources by establishing a system for planning, allocation and use of water.

2.2.1.1 Surface water

The Mackenzie River, into which Blackwater Creek flows, is a declared watercourse under the Water Act. Queensland Globe spatial data identifies Blackwater Creek and the lower section of Taurus Creek (downstream of the Two Mile Gully confluence) as watercourses while the remaining local waterways are currently either unmapped or mapped as a drainage feature under the Water Act. There is one mapped drainage feature within the Project area.

No watercourse diversions or modifications to existing or approved watercourse diversions are proposed for the Project. There are existing and/or approved diversions at BWM associated with Deep Creek and Taurus Creek.

The *Water Plan (Fitzroy Basin) 2011* (the Water Plan) outlines the use of water within the basin under the Water Act. The Water Plan defines the availability of water and provides a framework for sustainable management such as targets for environmental flow objectives and regulating the taking of overland flow. The Project falls within the Upper Mackenzie Sub Basin area of the Water Plan, with no specific objectives set for this sub basin area in the vicinity of the Project.

The *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (EPP (Water and Wetland Biodiversity)) outlines the objectives of the EP Act with regards to water. In particular, the EPP (Water and Wetland Biodiversity) Upper Mackenzie River Sub Basin Plan outlines the Environmental Values and Water Quality Objectives for the region. In 2019, the EP Act was amended to include Section 41AA of the *Environmental Protection Regulation 2019*. The aim of Section 41AA is to achieve no net decline in water quality in the surface water basins that feed into the Great Barrier Reef. Since June 2021, all new or expanding projects that potentially impact the waters for the Great Barrier Reef are required to provide information about their Dissolved Inorganic Nitrogen and Total Suspended Solids load.

This Project has been assessed against the *"Guideline – Environmental Protection Act 1994: Reef discharge standards for industrial activities"* (DES, 2022) based on relevant information required for this EA amendment application to address Section 41AA of the *Environmental Protection Regulation 2019*. The assessment is provided in **Chapter 10**.

2.2.1.2 Groundwater

The Project will potentially affect groundwater within the Highlands Groundwater Management Area, Chemistry Zone 36 of the Fitzroy Basin under the Water Plan. Water resources within the Project area are captured under the Water Plan. The plan covers surface water (zone WQ1304) associated with Mackenzie River, and groundwaters (zone WQ1310 – Fitzroy Basin groundwaters).

The Water Act, supported by the subordinate *Water Regulation 2016*, is the primary legislation regulating groundwater resources in Queensland. The purpose of the Water Act is to advance sustainable management and efficient use of water resources by establishing a system for planning, allocation and use of water.

The statutory right of a tenure holder to take or interfere with underground water is granted as part of the ML approval under the MR Act, if the taking or interference with that water is necessarily and unavoidably obtained in the process of extracting the mineral resource. This water is termed 'associated water'.

In developing the Project, BMA is proposing to exercise its underground water rights as part of planned mining activities. Chapter 3 of the Water Act then deals with the management of water related impacts resulting from such an exercise of underground water rights, through the development of an UWIR. Based on ML1759 and ML1762 being granted before 6 December 2016 and holding associated water rights under the MR Act, a UWIR will not be required.

2.2.2 Environmental Offsets Act 2014

The *Environmental Offsets Act 2014* (Offsets Act) provides the framework for environmental offsets in Queensland. The Offsets Act is supported by the *Environmental Offsets Regulation 2014* (Offsets Regulation) and the Queensland *Environmental Offsets Policy 2017.* The 'Significant Residual Impact Guideline' (SRI Guideline) is also relevant to determining when an impact will be a significant residual impact for the purposes of the Offsets Act.

Under the Offsets Act, an administering agency, being the entity that may grant or has granted an authority under another Act for a prescribed activity, may impose an offset condition on that authority only if:

- A prescribed activity will, or is likely to have, a significant residual impact on a prescribed environmental matter.
- All reasonable on-site mitigation measures for the prescribed activity have been, or will be undertaken.

Ecological offsets will be required for the Project to comply with the requirements of the Offsets Act. A "prescribed environmental matter" is any of the following matters prescribed under the Offsets Regulation:

- MNES.
- MSES.
- Matters of Local Environmental Significance.

Biodiversity offset matters are considered in detail in **Chapter 12** and **Chapter 13**.

2.2.3 Planning Act 2016

The *Planning Act 2016* (Planning Act) provides the framework for Queensland's planning and development assessment system. Under the Planning Act, development approvals are required for assessable development, unless an exemption applies. Development approvals under the Planning Act are not required for works on a ML. No Project activities are located outside of the existing MLs and therefore the Planning Act does not apply to the Project.

2.2.4 Regional Planning Interests Act 2014

The *Regional Planning Interests Act 2014* (RPI Act) identifies and protects areas of regional interest throughout Queensland and aims to strike an appropriate balance between protecting priority land uses and delivering a diverse and prosperous economic future for our regions. The four areas of regional interest identified under the RPI Act include:

- Priority Agricultural Areas.
- Priority Living Areas.
- Strategic Environmental Areas.
- Strategic Cropping Areas.

A Priority Living Area is mapped around the township of Blackwater and extends into ML1759. However, the Project footprint does not encroach into the Priority Living Area.

A Strategic Cropping Area is mapped to the west of the existing BWM. However, this is outside of the Project area and the Project footprint.

In summary, the Project is located outside of zones mapped as Priority Agricultural Areas, Priority Living Areas, Strategic Environmental Areas and Strategic Cropping Areas under the RPI Act.

2.2.5 Fisheries Act 1994

The main purpose of the *Fisheries Act 1994* is to provide for the use, conservation and enhancement of the community's fisheries resources and fish habitats in a way that seeks to apply and balance the principles of ecologically sustainable development and promote ecologically sustainable development.

The Project has the potential to impact on fisheries resources and fish habitats. A number of ephemeral waterways traverse the Project area including Two Mile Gully, Deep Creek, Taurus Creek and Sagittarius Creek. The *Fisheries Act 1994* regulates waterway barrier works within waterways. Mapping for waterway barrier works classifies waterways based on their risk of impact to fish passage. The classification of the waterway barrier works changes along the creeks. In the Project area the classification is typically low to moderate with high or major classification for the main channels of Sagittarius, Taurus and Two Mile Creeks.

The Project's potential impacts on fishery resources and habitats are described in **Chapter 13** and **Appendix I**. The assessments concluded that the Project would not significantly impact on fisheries resources and fish habitats, such as fish passage (**Appendix I**).

Activities associated with the Project will be assessed and conditioned through the EA Amendment process, with no separate, stand-alone approval required under the *Fisheries Act 1994*. Waterway works within the Project area will be undertaken within the existing MLs under the conditions of the EA.

2.2.6 Nature Conservation Act 1992

The object of the *Nature Conservation Act 1992* (NC Act) is the conservation of nature, while allowing for the involvement of indigenous people in the management of protected areas in which they have an interest under Aboriginal tradition or Island custom.

The NC Act provides for the dedication and declaration of protected areas, protection of native wildlife and its habitat amongst other provisions.

The NC Act prescribes classes of wildlife and sets out restrictions on the taking or harm to native wildlife without a valid permit. Under the NC Act permits and licences can be required to authorise interference with native wildlife. This includes for clearing native plants, tampering with animal breeding places and catching and relocating wildlife. There are, however, certain exemptions that may be applicable.

Pre-clearance fauna surveys will be undertaken by suitably experienced and qualified persons to identify individual fauna at direct risk from clearing in accordance with existing BWM Permit to Disturb procedures. A suitably qualified fauna spotter catcher will be present during vegetation clearing in MNES and MSES habitat areas to minimise risk of injury to native fauna. Spotter catchers will hold appropriate permits under the NC Act.

2.2.7 Vegetation Management Act 1999

The *Vegetation Management Act 1999* (VM Act) regulates the clearing of vegetation in Queensland in a way that (DES, 2020):

- Conserves remnant vegetation that is an endangered, of concern or a least concern regional ecosystem.
- Conserves vegetation in declared areas.
- Ensures the clearing does not cause land degradation.
- Prevents the loss of biodiversity.
- Maintains ecological processes.
- Manages the environmental effects of the clearing to achieve the above matters.
- Reduces greenhouse gas emissions.
- Allows for sustainable land use.

Under the VM Act, clearing of remnant vegetation (Category B), high value regrowth (Category C), and reef catchment regrowth (Category R) vegetation requires development approval under the Planning Act, unless an exemption applies. For example, if the clearing is carried out in the course of a mining activity on a ML. Accordingly, any clearing of remnant vegetation conducted on a ML as part of the Project~~,~~ will not require development approval. Authorisation for clearing of vegetation in the Project area will be sought via the EA Amendment Application.

The VM Act does not apply to the Project, however the framework established under the VM Act for the description of mapping of regulated vegetation including remnant and high value regrowth applies. Under the VM Act, REs are classified to three classes which are: Endangered RE, Of Concern RE, or Least Concern RE. These classifications are taken from the RE description database and respective definitions in the VM Act.

Chapter 12, **Appendix G and Appendix H** provide details of the RE's identified within the Project area.

2.2.8 Biosecurity Act 2014

The purposes of *Biosecurity Act 2014* are:

- To provide a framework for an effective biosecurity system for Queensland that helps to minimise biosecurity risks, facilitates responding to impacts on a biosecurity consideration, including responding to biosecurity events, in a timely and effective way.
- To ensure the safety and quality of animal feed, fertilisers and other agricultural inputs.
- To help align responses to biosecurity risks in the State with national and international obligations and requirements for accessing markets for animal and plant produce, including live animals and plants.

The *Biosecurity Act 2014* provides a regulatory framework to safeguard the economy, agriculture, tourism, and the environment from pests, diseases, and contaminants.

All people in Queensland, including the BWM, have a general biosecurity obligation under the *Biosecurity Act 2014* to ensure they do not spread a pest, disease or a contaminant. No approvals or permits are anticipated to be required for the Project. All biosecurity obligations relevant to the Project will be managed appropriately and in compliance with the *Biosecurity Act 2014*.

BWM has a Weed and Feral Animal Management procedure that provides a framework for site management of weeds and pest species. This procedure, amongst other measures, provides a framework for addressing the requirements of the *Biosecurity Act 2014.*

2.3 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth EPBC Act provides a legal framework to protect and manage MNES. The nine MNES categories protected under the EPBC Act are:

- World heritage properties.
- National heritage places.
- Wetlands of international importance (listed under the Ramsar Convention).
- Listed threatened species and ecological communities.
- Migratory species protected under international agreements.
- Commonwealth marine areas.
- The Great Barrier Reef Marine Park.
- Nuclear actions (including uranium mines).
- A water resource, in relation to coal seam gas development and large coal mining development.

An assessment and approval under the EPBC Act is required for any activity that has, or is likely to have, a significant impact on an MNES. Such an activity is deemed to be a 'controlled action'. It is an offence to undertake a 'controlled action' without the approval of the Commonwealth Environment Minister.

The EPBC Act approval process for a controlled action is summarised below:

- A referral is submitted to the Commonwealth Department for Climate Change, Energy, the Environment and Water (DCCEEW).
- The referral is published for public comment.
- The Commonwealth Environment Minister decides if the action is a controlled action, and the method of assessment (for example, a 'controlled action', requiring assessment via Preliminary Documentation).
- The Commonwealth Environment Minister may request further information for the completion of their assessment of the controlled action.
- Information is published for public comment.
- Revision of documentation based on public comment and information published.
- The Independent Expert Scientific Committee (IESC) advises the Commonwealth Environment Minister on water resources.
- The Commonwealth Environment Minister decides whether to approve the controlled action, with or without conditions.

The IESC's role in the EPBC Act approval process is to assess impacts to water resources and provide advice to the Minister.

A referral for the Project was submitted to the Commonwealth Environment Minister in November 2023.

2.4 Cultural Heritage and Native Title

2.4.1 Queensland Heritage Act 1992

The Qu*eensland Heritage Act 1992* is the primary legislation by which Queensland's historic heritage places are identified and protected.

Searches of the Queensland Heritage Register (https://apps.des.qld.gov.au/heritage-register/map/, accessed 24 August 2023) did not identify any sites within or in close proximity to the Project area.

2.4.2 Queensland Aboriginal Cultural Heritage Act 1993

The Gaangalu Nation People are the statutory Aboriginal Party for the Project area in accordance with the Queensland *Aboriginal Cultural Heritage Act 1993*. BMA Blackwater and the Gaangalu Nation People have entered into two cultural heritage management agreements to satisfy the Duty of Care provisions in accordance with the Queensland *Aboriginal Cultural Heritage Act 1993*. BWM currently operates in accordance with the provisions set out in the 'BMA Blackwater Mine Aboriginal Cultural Heritage Management Agreement' (CHMA) to identify, protect, manage, and conserve Aboriginal cultural heritage.

2.4.3 Native Title Act 1993

The Project area is located within the traditional lands of the Gaangalu Nation People (QC2012/009) who have just received a judgement on their Native Title claim asserting native title rights and interests across parts of the broader region. The recent judgement found that Native title has been extinguished over the Project area; however, at the time of drafting, there is uncertainty as to the orders that will be issued by the Court in relation to this hearing. The Project area, and the existing BWM, are located within the extent of the Blackwater and South BWMs Indigenous Land Use Agreement (ILUA) (QI2001/035), between the Ghungalu and Kangoulu People, the Gurang Land Council, BHP Coal, and South Blackwater Coal Ltd.

2.5 Assessment Methodology

2.5.1 Overview of assessment methodology

The assessment methodology comprised the following key stages:

- Identification of environmental assessments to be conducted for the specific technical disciplines.
- Baseline assessments including conceptual modelling and surveys.
- Assessment of pre-mitigation impacts to identify where there was the potential for impacts that required the development of routine, or Project-specific environmental management strategies (in accordance with the mitigation hierarchy).
- Identification of environmental management strategies and measures, including consideration of the efficacy and reliability of those measures.
- Assessment of post-mitigation impacts to determine the residual environmental impacts of the Project, and specifically, determine if there are any SRIs that require the provision of an environmental offset.

Further details on technical assessment methodologies are provided in summary in **Chapters 6-14** and in detail in **Appendices A-I**.

2.5.2 Environmental Assessments

Environmental assessments have been undertaken for the following critical matters:

- Land Resources.
- Geochemistry.
- Air Quality.
- Noise and Vibration.
- Surface Water.
- Groundwater.
- Terrestrial Ecology.
- Aquatic Ecology (including Stygofauna).
- Waste Management.

These assessments were completed with reference to relevant legislation, standards and guidelines.

2.6 Community Engagement and Project Consultation Activities

BMA currently engages with the Blackwater community and other stakeholders through:

- Bi-annual meetings with the Central Highlands Regional Council.
- Central Highlands Resources Roundtable.
- Central Highlands Development Corporation.
- Community Reference Group Meetings.
- Regional Interagency Meetings.
- Social investment partnerships which include:
  - Benefiting My Community program.
  - Capricorn Rescue Helicopters.
  - Queensland Indigenous Land Conversation Project.
  - Woorabinda Arts and Cultural Centre.
  - Selectability (Mental Health).
  - Central Queensland University Chair for Indigenous Engagement.
  - Queensland Minerals and Energy Academy.
  - National Indigenous Business Support Program.
  - Pathway to Nature Positive CSIRO.
  - Restoration of degraded Woodlands on agricultural land.
  - Fitzroy Partnership for River Health (Fitzroy Basin Association).
- CSIRO Local Voices Surveys.

Project-specific consultation and engagement has been undertaken with State and Commonwealth Government regulatory authorities, local Council, local landowners, Gaangalu Nation People, the existing BWM workforce, neighbouring mine owners and operators, and relevant infrastructure and service providers and will continue through the EA Amendment application process.

The key consultation activities undertaken with DES and DCCEEW for the Project are summarised in **Table 2-3.**

Table 2-3: DES and DCCEEW Consultation Activities

Date	Consultation Purpose	Attendees	Location
5 September 2023	DES – Introduction to the Project	DES, BMA	Virtual meeting
19 September 2023	DCCEEW – Introduction to the Project	DCCEEW, BMA	Virtual meeting
7 November 2023	DCCEEW Pre-lodgement meeting	DCCEEW, BMA	Virtual meeting
30 November 2023	DES Pre-lodgement meeting	DES, BMA	Virtual meeting

3 Project Description

3.1 Overview of Existing Operations

3.1.1 Mining Tenure

BWM is located on 21 granted Mining Leases including (ML)1759, ML1760, ML1761, ML1762, ML1767, ML1771, ML1772, ML1773, ML1792, ML1800, ML1812, ML1829, ML1860, ML1862, ML1907, ML70091, ML70103, ML70104, ML70139, ML70167 and ML70329 (**Figure 1-1**).

Surface Area (SA) rights to mine within SA10 (ML1759) and SA7 (ML1762) (**Figure 1-1** and **Figure 1-2**) have been granted, as described further in **Section 3.2.2**.

3.1.2 Mine Method, Run of Mine and Product Coal Tonnages

BWM has been operating since 1967 as an open cut mining operation that uses conventional open cut strip mining techniques. Mining has been progressing to the east.

The mining process involves land clearing, the removal and stockpiling of topsoil material, drilling and blasting of overburden and interburden as required, stripping of overburden and interburden material utilising a combination of draglines and/or truck/shovel/excavator operations.

Overburden and interburden is removed to uncover coal from the pit and is relocated to backfill the mined-out pits (known as ‘in-pit spoil dumps’) as mining advances. Coal is excavated from the pit via shovel / excavator and trucked via mine haul truck to the CHPP or the TCP.

Figure 3-1 shows a schematic of the open cut mining methodology employed at BWM. Typical pit design criteria at BWM are summarised in **Table 3-1**.

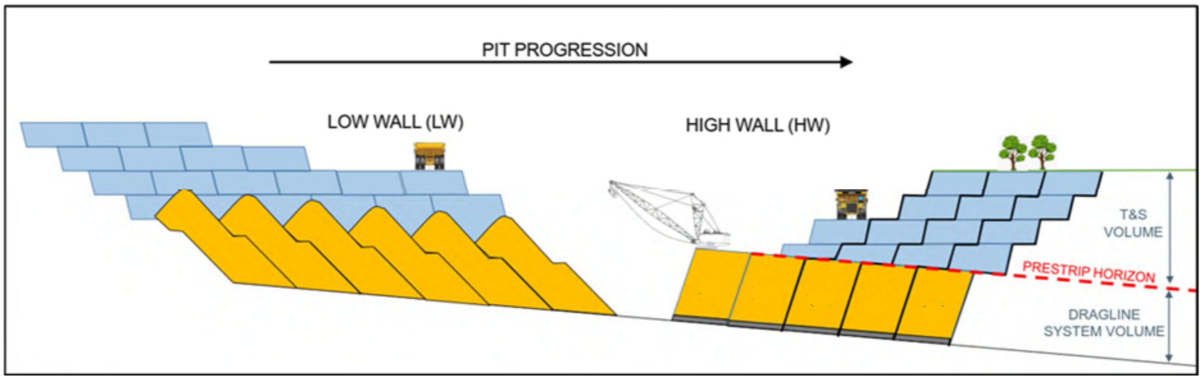


Figure 3-1: Blackwater Mine – Typical Mining Sequence

Table 3-1: Blackwater Mine – Typical Pit Design Criteria

	Units	Design Criteria
Strip Width	m	60 - 70
Highwall Bench Angle*	degrees	45 -70
Highwall Berm	m	25 - 30
Low wall Angle*	degrees	37

Note. *Overall wall angles are lower slope.

RoM coal is processed at the CHPP to produce a predominantly hard coking coal product (BWC (Blackwater Coke) and BWW (Blackwater Weak)) for the export market. Product coal is loaded on to coal trains via an existing train load out facility located adjacent to the CHPP and product stockpiles. Product coal is transported to Gladstone Port for loading to bulk carrier ships.

Currently, BWM produces up to 19 million tonnes per annum of (Mtpa) of RoM coal equating to approximately 16 Mtpa of product coal. Mining operations, mining rates and RoM and product tonnages vary from year to year, due to a number of operational factors, such as the amount of overburden to be removed and coal seam thickness.

3.1.3 Coal Handling and Preparation

The existing BWM includes RoM coal stockpile and crushing facilities, CHPP, product stockpiles and train load-out facilities. A schematic of the mining process at the BWM is shown in **Figure 3-2**.

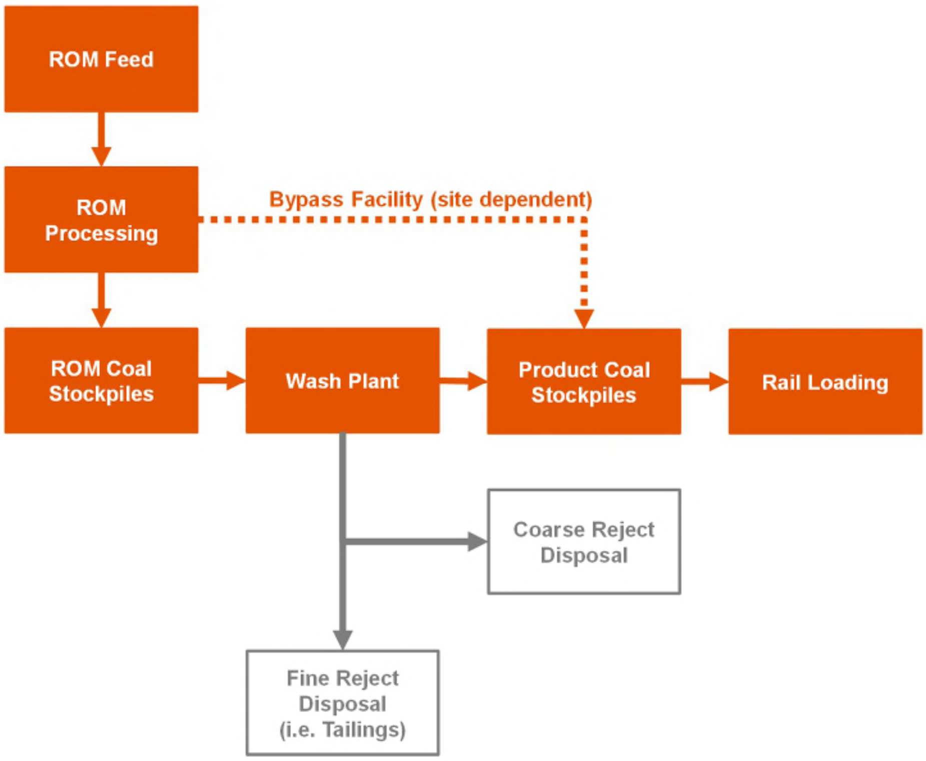


Figure 3-2: BWM Operation Process Schematic

The CHPP employs conventional dense medium and microcell froth flotation circuits and operates on a 24/7 routine, shutting down only for maintenance periods. BWM also hosts a small Thermal Coal Plant (TCP), which does not 'wash' the coal; but rather crushes and sizes the raw coal for sale.

Product coal is railed to the Gladstone Port from the existing BWM train load-out facilities and the existing export rail network operated by Aurizon connecting Blackwater to Gladstone. Customers for BWM product coal are predominantly located in Japan and India.

3.1.4 Production and Supporting Infrastructure

The existing MIA is located on ML1762 and outside of the Project area.

The existing RoM coal stockpiles, CHPP, TCP, product coal stockpiles and train load-out facility are located on ML1759 and outside the Project area.

Water management infrastructure and supporting infrastructure (i.e., mine haul roads, light vehicle access roads, powerlines, laydown areas, workshops) extend across the BWM mining leases, and are periodically relocated to service ongoing mining operations as mining progresses to the east.

3.1.5 Rejects and Tailings Management

BWM rejects and tailings are disposed of in accordance with the EA according to the specified features for the waste type. Rejects will be disposed of:

- in spoil emplacements;
- in regulated structures in accordance with Schedule G: Structures, of the EA;
- in pits or voids; and / or
- in dedicated rejects emplacements.

Tailings will be disposed of:

- in regulated structures in accordance with Schedule G: Structures, of the EA; and / or
- in pits or voids that are not regulated structures, provided a consequence category assessment in accordance with EA Condition G1, has been completed.

BMA will continue to investigate options for tailings disposal at BWM in consideration of developments in technology.

3.1.6 Electricity Supply

Electricity supply to the BWM is via the existing connection to the Queensland electricity grid at the combined Powerlink/Ergon Energy 132/66 kV Rangal Substation situated on the Capricorn Highway and adjacent to the BWM mining lease boundary. BMA own and operate the overhead power line from the Rangal substation to and throughout the existing BWM leases. The BWM connection is via a 66kV transmission line. The BWM internal electricity network comprises a main line and stub lines to the mining areas.

BMA's electricity sourcing strategy is seeking to explore low emission electricity from the Queensland Government's CleanCo renewable generation scheme or through other Power Purchase Agreements. A portion of BMA's power supply is already provided under a Power Purchase Agreements which delivers electricity with a lower carbon footprint.

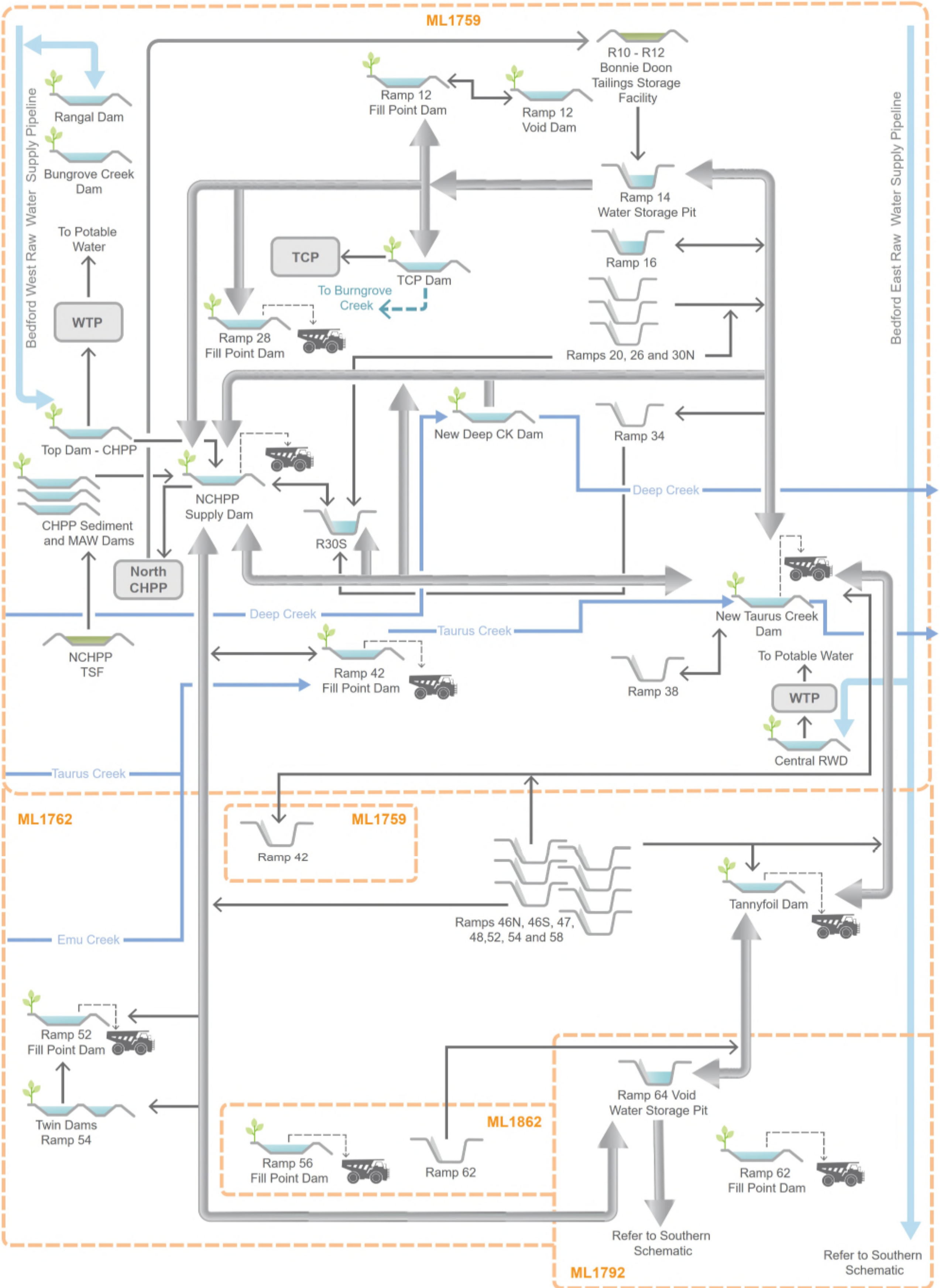
3.1.7 Mine Water Management, Water Supply and Demand

Key water management activities and associated infrastructure are summarised in **Table 3-2**.

Table 3-2: BWM – Existing Mine Water Management Overview

Activity	Infrastructure	Description
Pit dewatering	Highwall pumps and pipelines	Pumps exist in all major operational pits to dewater pit floors of water accumulated from groundwater ingress and rainfall events. Water is transferred via backbone pipelines to designated water storages. These pipelines are relocated as the pits progress. A backbone pipeline refers to a pipeline that receives inflow from multiple smaller pipelines and delivers this to key storages in the site's mine water management system for use, management and release in accordance with the EA.
Water transfer to storages/release point	Backbone pipelines, transfer pumps and staging dams	Cross-site transfers occur via backbone pipelines and are staged across various dams including Tannyfoil Dam and New Taurus Creek Dam.
Water storage	Dedicated dams, and water storage pits	Mine affected water (MAW) is currently sent to inactive pits for storage where it is called on to meet the various site demands as required. MAW is also stored across the site in dust suppression fill point dams, environmental dams, and release dams.
Release to environment	Release gates, release dam storage capacity	Controlled mine water releases are made from the existing release points as per the current EA.
Flood management	Diversion drains and levees	A number of waterways intersect the existing mining area, notably Deep Creek and Taurus Creek. These watercourses are part of the Fitzroy catchment. There are existing and/or approved diversions at BWM associated with Deep Creek and Taurus Creek. Water is conveyed downstream, from upstream undisturbed areas, along existing watercourses and/or diversions between mining areas. The potential for flood ingress from clean catchments into mining areas is managed through flood levees. Small diversion drains and bunding also divert clean catchments from minor tributaries around mining areas.
Groundwater management	Groundwater bores	A network of groundwater monitoring bores exists at BWM.
Water quality management	Environmental dams, erosion and sediment control (ESC) structures	The current operations utilise environmental dams and ESC devices to progressively manage water which comes in contact with disturbed areas of the BWM.

A schematic representation of the existing mine water management system is shown in **Figure 3-3**.



BLACKWATER MINE -
NORTH EXTENSION PROJECT

BWM MINE WATER MANAGEMENT
SYSTEM SCHEMATIC

FIGURE 3-3

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro.aprx\620014601_PD_F03_3_BWM Mine Water Management System Schematic

Water is supplied/produced for the existing BWM operations from the following sources:

- Rainfall runoff captured in onsite water storage facilities.
- Incidental groundwater in mining pits.
- External pipeline water supply.

External pipeline water supply is provided via the existing external pipeline water network supplying BWM supplemented by the capture of rainfall runoff which forms part of the sites MAW inventory. External pipeline water is supplied from the Fitzroy River catchment via Fairbairn Dam and the Bedford Weir on the Mackenzie River. MAW is prioritised over external pipeline water to meet the operational demands of the BWM. External pipeline water allocation for the current BWM operation is 2,281 ML/year.

The BWM primary water demands include:

- Coal processing at the CHPP.
- Dust suppression.
- Potable water for drinking, fire suppression, workshops and related employee facilities.

3.1.8 Sewage Treatment

Sewage treatment comprises three existing plants, one located at the MIA, one at the CHPP and another at the decommissioned South Blackwater CHPP. Effluent from the sewage treatment plants is managed as part of the overall existing BWM water management system in accordance with the BWM EA.

3.1.9 Fuel and Lubricant Storage and Dispensing

Fuel storage and dispensing occurs at both the MIA and the CHPP. Self-bunded storage tanks, bunded delivery areas and electronic process controls are in place at these locations.

In-field servicing and fuelling of equipment such as bulldozers, excavators, loaders, lighting plants and pumps is provided by service trucks.

3.1.10 Environmental Authority

The latest revision of the EA (EPML00717813) for BWM took effect on 29 June 2023 and covers the following ERAs:

- Schedule 3: 13 Mining black coal.
- Ancillary 08 – Chemical storage.
- Ancillary 63 – Sewage Treatment 1.
- Ancillary 31 – Mineral processing 2.
- Ancillary 60 – Waste disposal 2.
- Ancillary 62 – Resource recovery and transfer facility operation 1.

Prior to the Project commencing, BWM will continue to carry out authorised activities on SA10 (ML1759) and SA7 (ML1762) in accordance with existing or future State and Commonwealth government approvals.

3.2 Proposed Project

3.2.1 Introduction

The following sections describe the various components and activities that comprise the Project.

The Project specifically describes components and activities that are to be implemented in addition to the existing operations, as described above.

3.2.2 Mining Tenure

The Project is located on existing mining tenure that is held by the CQCA JV or South Blackwater Coal Limited. Surface area rights for the Project area have been granted. No new mining tenure or surface areas are required for the Project.

The mining and associated activities that are the subject of this EA Amendment will occur on SA10 on ML1759 and SA7 on ML1762. Details of relevant mining tenure associated with the Project is provided in **Table 3-3** and shown on **Figure 1-2.**

Table 3-3: Project Area Mining Tenements

Mining tenement	Size (ha)	Status	Purpose	Effective until	Development associated with the Project
ML1759	Total: 13,525 SA10: 6,154	Granted	Coal and Gaseous Hydrocarbons	31/12/2029	Open cut coal mining
ML1762	Total: 7,247.52 SA7: 2,856	Granted	Coal and Gaseous Hydrocarbons	31/07/2032	Open cut coal mining

Petroleum and Gas tenements held by BOW CSG Pty Ltd (Potential Commercial Area (PCA) permit number 264 and Authority to Prospect (ATP) number 1025) occur in the north of the Project area. The Project footprint approaches but does not overlap the petroleum and gas tenements.

3.2.3 Land Ownership within SA10 and SA7

Details of relevant land ownership is outlined in **Table 3-4** and shown on **Figure 3-4**.

The land underlying SA10 and SA7 is predominantly Freehold Land and Lands Lease (Grazing Homestead Perpetual Lease).

Table 3-4: Land Ownership within SA10 and SA7

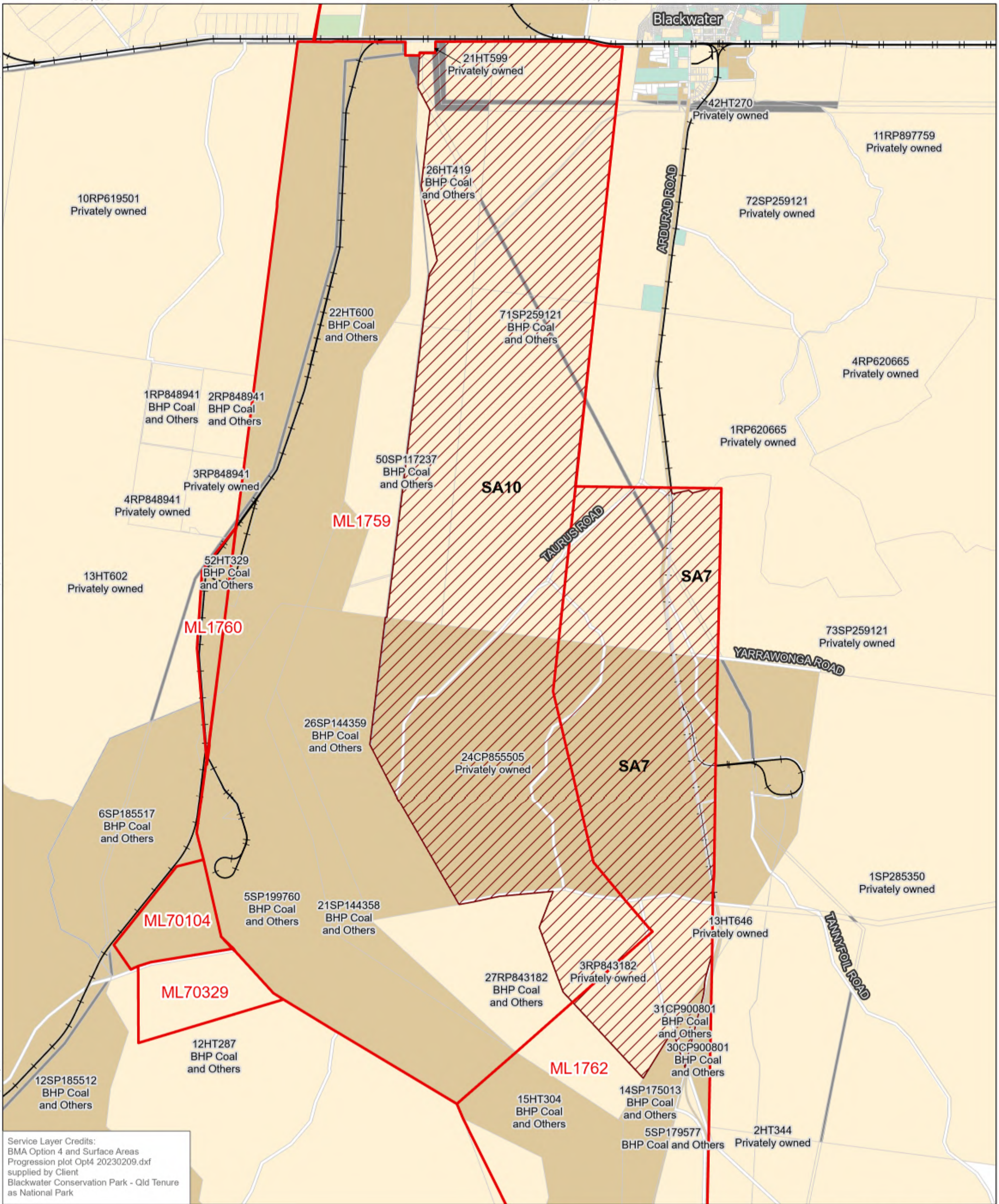
Landowner	Land Title	Tenure Type
BHP Coal Pty Ltd & Others[2]	26HT419 50SP117237 71SP259121 31CP900801	Freehold Freehold Freehold Lands Lease
Private landowner	24CP855505 3RP843182	Lands Lease (Grazing Homestead Perpetual Lease) Freehold
Central Highlands Regional Council	Taurus Road Ardurad Road Yarrowonga Road Tannyfoil Road	Road Reserve Road Reserve Road Reserve Road Reserve

The following easements and associated infrastructure traverse the Project:

- Powerlink 132 kV powerlines.
- BMA 66 kV powerlines.
- Ergon 66kV powerlines.
- Ergon 22kV powerlines.
- BMA Bedford East External Water Pipeline.
- Sunwater Blackwater Water Pipeline.
- Various roads.
- A stock route.

The land associated with the Project area is predominantly used for cattle grazing, with infrastructure as listed above, and coal mining/exploration activities.

[2] BHP Coal Pty Ltd (ABN 83 010 595 721), Umal Consolidated Pty Ltd (ABN 29 000 767 386), BHP Queensland Coal Investments Pty Ltd (ABN 56 098 876 825), Mitsubishi Development Pty Ltd (ABN 17 009 779 873), QCT Investment Pty Ltd (ABN 45 010 487 831), QCT Mining Pty Ltd (ABN 47 010 487 840), QCT Resources Pty Ltd (ABN 74 010 808 705).



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Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	28-Nov-2023
Drawn by:	NT

BMA
BHP Mitsubishi Alliance

LEGEND

- Railway
- BWM Mining Lease
- BWM North Extension Project Area
- Cadastre

Tenure

- Easement
- Freehold
- Lands Lease
- Consevation Area
- Reserve

BLACKWATER MINE - NORTH EXTENSION PROJECT

LAND OWNERSHIP SA7 AND SA10

FIGURE 3-4

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro.aprx\620014601_PD_F03_04_Tenure

3.2.4 Resource Characterisation

3.2.4.1 Regional Geological Setting

The Project is located in the Bowen Basin, which is one of five major foreland sedimentary basins formed along the eastern side of Australia during the Permian period. The Bowen Basin is the largest productive coal basin in the country. The Bowen Basin stretches from Townsville to south of the Queensland-New South Wales border in a north to south direction. In the southern parts, the extent of the Bowen Basin and the hydrogeological Great Artesian Basin overlap.

The post-depositional structure of the Bowen Basin is dominated by compressional tectonics which has formed at a regional scale with north to northwest striking's and easterly dipping thrust faults which are the major structural elements in the Bowen Basin. The fault system forms platforms/shelves that are separated by sedimentary troughs. The BWM is located in the northern region of the Bowen Basin.

3.2.4.2 Local Geology

The structural geology of the region is characterised by gently folded sediments and a major north to north-west striking fault system which forms the Jellinbah thrust fault (AGE, 2013). The strata in the vicinity of the BWM is heavily influenced by the series of easterly dipping thrust faults that occur parallel to the Jellinbah thrust.

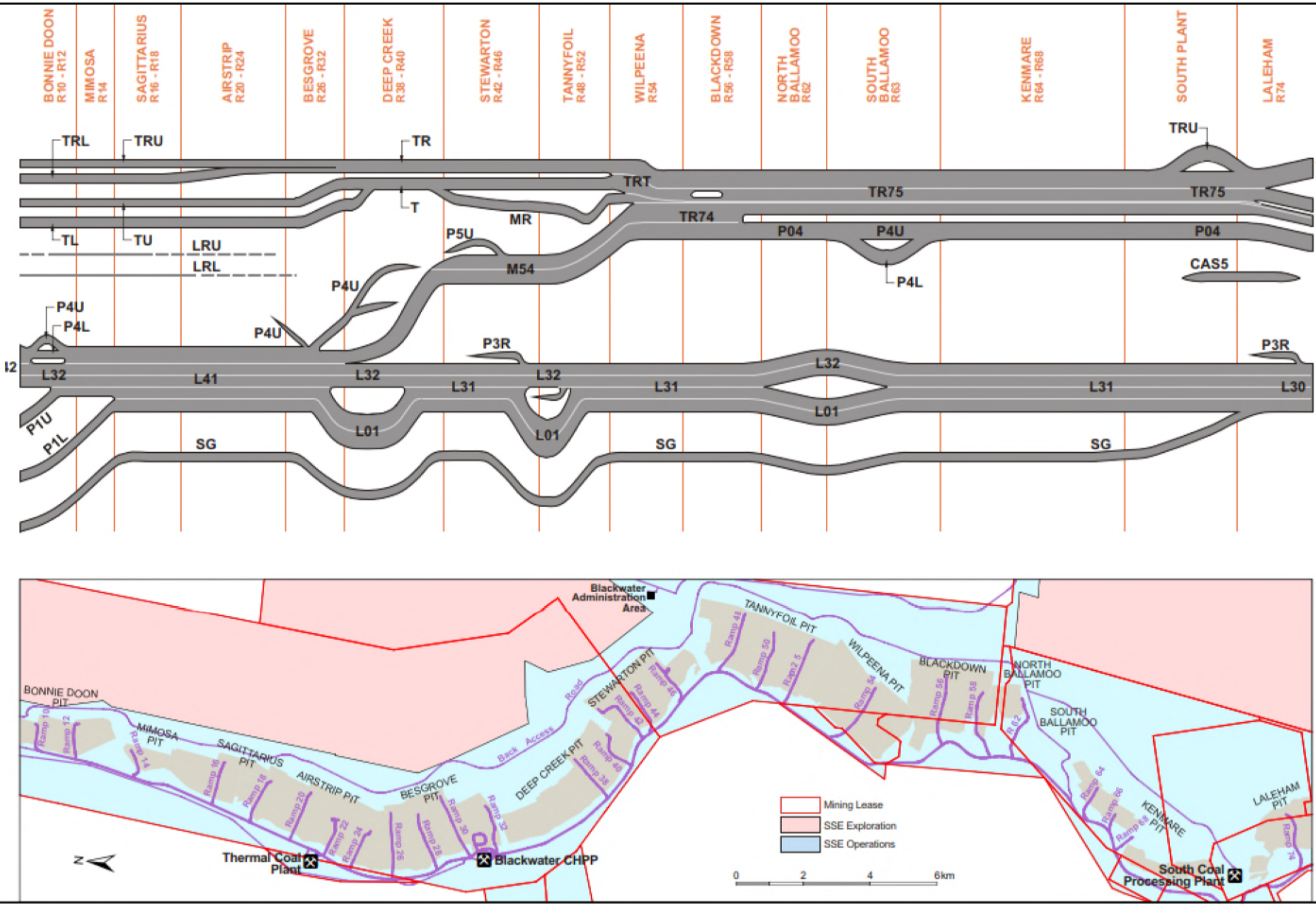
The coal deposits mined at BWM are found within the Rangal Coal Measures, which is the uppermost Permian unit. In the Project area the Rangal Coal Measures consist of up to 100 m of interbedded sandstone, siltstone, mudstone, and coal with tuff. The Rangal Coal Measures lie conformably on the coal bearing Burngrove Formation.

The stratigraphic sequence overlying the Rangal Coal Measures across the BWM comprises (from shallow to deep):

- The consolidated Quaternary aged sediments, a thin (0.5 m to 12 m) layer of unconsolidated clays, silts and sands and gravels that is associated with floodplains of the major drainage channel.
- The Tertiary sediments and basalts that unconformably overly the Triassic aged Rewan Group. The Tertiary unit consists primarily of variable thicknesses (5 m to 115 m) of claystone, siltstone, sandstones and weathered basalts.
- The Rewan Group unconformably overlies the Permian coal measures and is comprised of 50 m to 300 m of siltstone and mudstone, with interbeds of lithic and volcanic sandstones.
- The Clematis group conformably overlies the Rewan group to the east of the Project where it outcrops and forms an elevated plateau. The unit is comprised of medium to coarse grained quartzose to sublabile and micaceous sandstone, siltstone, mudstone and conglomerate.

3.2.4.3 Seam Stratigraphy

The principal coal seams in the BWM area in descending order are the Top Seam (also known as TFULL), Middle Seam (MFULL) and Middle split (MB), Lower Seam (LFULL) and Lower Split (L01). Minor Seams include the Upper Top (UT), Top Rider (TR), Middle Rider (MR), and Lower and Upper Rider (LUR) seams. The seam correlation diagram (from north to south) is presented in **Figure 3-5**.



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BLACKWATER MINE - NORTH EXTENSION PROJECT

SCHEMATIC SEAM STRATIGRAPHY AND SPLIT DIAGRAM

FIGURE 3-5

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro.aprx\620014601_PD_F03_05_Schematic Seam Stratigraphy and split diagram

The Aries and Castro seam join to form the Mammoth Seam in the Wilpeena Pit area. However, the two seams can be considered separately with thin parting able to be removed. The Aries and Castor also divide into upper and lower seams in some areas. These are the Aries Upper and Middle, and Castor Upper and Middle seams. The Pollux and Orion seams create the thick Argo seam (CD) in the southern areas of the BWM. With respect to the Northern areas of the BWM, the Orion and Pollux Seams coalesce into the LFULL seam. This seam splits into the lower split (L01) and the Middle Seam (MFULL). Between the Deep Creek/Wilpeena and Blackwater Pit areas the middle seam coalesces with the Aries and Castor Seams.

3.2.4.4 Mineral Resources and Ore Reserves

Coal resources and reserves estimates for the BWM were reported in the BHP Annual Report 2023 in accordance with the reporting guidelines of the 2012 Joint Ore Reserves Committee of The Australasian Institute of Mining and Metallurgy, Australasian Institute of Geoscientists, and Minerals Council of Australia (JORC Code 2012). The JORC classified Mineral Resources identified for BWM are summarised in **Table 3-5**.

Table 3-5: JORC Classified Resources for BWM (30 June 2023)

Mining Method	Resources (Millions of wet metric tonnes)			
	Measured	Indicated	Inferred	Total
Open cut	308	528	779	1,615

The JORC classified Coal Reserves for BWM are presented in **Table 3-6**.

Table 3-6: JORC Classified Reserves for BWM (30 June 2023)

Mining Method	Reserves (Millions of wet metric tonnes)			
	Proved Coal Reserves	Probable Coal Reserves	Total Coal Reserves [3]	Proved and Probable Marketable Coal Reserves [4]
Open cut	91	121	212	183

3.2.5 Mining Methods and Sequence

3.2.5.1 Mining Method

The mining method utilised for the Project will be consistent with the current operations at BWM, using open cut mining methods utilising dragline and truck/shovel/excavator equipment. This is a proven mining method at BWM that operates efficiently with resource geometry and offers operational flexibility.

[3] Total Coal Reserves (tonnes) is the sum of the Proved and Probable Coal Reserves estimates which includes allowances for diluting materials and for losses that occur when the coal is mined and reported at 4% moisture (BMA standard RoM moisture used for reporting as opposed to actual RoM moisture.

[4] Marketable Coal Reserve (tonnes) are the tonnages of coal available at product specification % moisture (Blackwater, 7.5-11.5%)

Mining activities commence with vegetation clearing and topsoil stripping. All topsoil is stripped using earthmoving equipment and handled using dozers, front end loaders, trucks and/or scraper fleet, and will be stockpiled (or direct placed) in preparation for progressive rehabilitation of areas available for rehabilitation.

Drilling and blasting operations will continue as per current methods to support the Project for overburden, interburden and coal removal to enable the shovels/excavators and draglines to work effectively. The removal of overburden and interburden will continue as per current methods by utilising a combination of truck/shovel/excavator fleets and draglines.

The strip-mining technique currently in practice at the BWM will continue for the Project. Conventional open cut strip mining techniques are applied at BWM, with mining progressing to the east. The overall angle of the high wall will be dependent on the nature of the high wall materials and geotechnical conditions. Coal ramps will extend into the active pits with the surface haul roads connecting them to the RoM stockpiles.

The Project does not propose any changes to the existing mining methods. Mining methods across the BWM may change over time with replacement of mine equipment, introduction of new technologies and innovation in mining methods; these changes will be implemented independently from the Project.

3.2.5.2 Mine Sequence

The Project's mine plan is an extension of mining of the open cut pits in the north of the BWM to within SA10 and SA7. Mining at BWM is scheduled to approach the western boundaries of SA10 and SA7 during FY2025, requiring the relocation of supporting infrastructure in advance of mining. Mining will progress to the east and completed spoil dump areas to the west of the active pits will be progressively rehabilitated as the mine advances.

The mining sequence for the Project will entail the following:

- Progressive land clearing and topsoil removal.
- Stockpiling topsoil from disturbed areas for storage and use in future rehabilitation of the site.
- Drill and blasting of overburden/interburden material (including through seam blasting).
- Pre-stripping/excavation of overburden material using excavators/shovels and trucks, draglines and dozers.
- Side casting of lower overburden into the previously mined strip using a dragline.
- Removal of overburden/interburden and placement in the in-pit spoil dumps.
- Loading and hauling of RoM coal using a combination of excavators, loaders and trucks.
- Progressive rehabilitation of completed spoil dump areas, including reshaping dumps, topsoiling/alternate growth media and revegetation in accordance with EA requirements and PRC Plan.

Final voids will remain at the conclusion of mining with final rehabilitation and closure activities commencing at the end of mining.

The indicative mine progression plan to FY2085 is shown in **Figure 3-7**.

The indicative mining progression of the Project area for every 10 years from FY2025 until FY2085 is presented in **Figure 3-8** to **Figure 3-14**. The conceptual final landform of the Project is presented in **Figure 3-15**.

There will also be continuing activities that are authorised by existing approvals in the Project area prior to FY2025 (and the granting of this application), in accordance with Condition E23 of the EA.

3.2.6 Waste Rock Management

Project overburden/interburden (waste rock) management will be consistent with BWM existing practice. Over the life of the Project, approximately 4,500 Mbcm of overburden/interburden material will be mined. Overburden/interburden will be backfilled into the mined-out pits and rehabilitated as part of the BWM ongoing progressive rehabilitation and closure planning processes. Indicative yearly estimates of waste production for the total BWM are outlined in **Figure 3-6**. The objective of the mine waste management strategy for the Project is to backfill the mined-out pits (as there is sufficient capacity) and reduce the final void area remaining at end of the Project life.

3.2.7 Run of Mine and Product Coal Production Schedule

The indicative mine materials schedule for BWM from FY2025 to FY2085 is shown in **Figure 3-6** presenting RoM coal (Mt/year), product coal (Mt/year), and waste (overburden/interburden) volumes (Million bank cubic metres per year: the *in-situ* volume (Mbcm/year)). RoM coal production will be up to 22 Mtpa and product coal output will be up to 17.6 Mtpa (based on an average yield of approximately 80 per cent). The final production sequence will depend on economic, scheduling and infrastructure constraints.

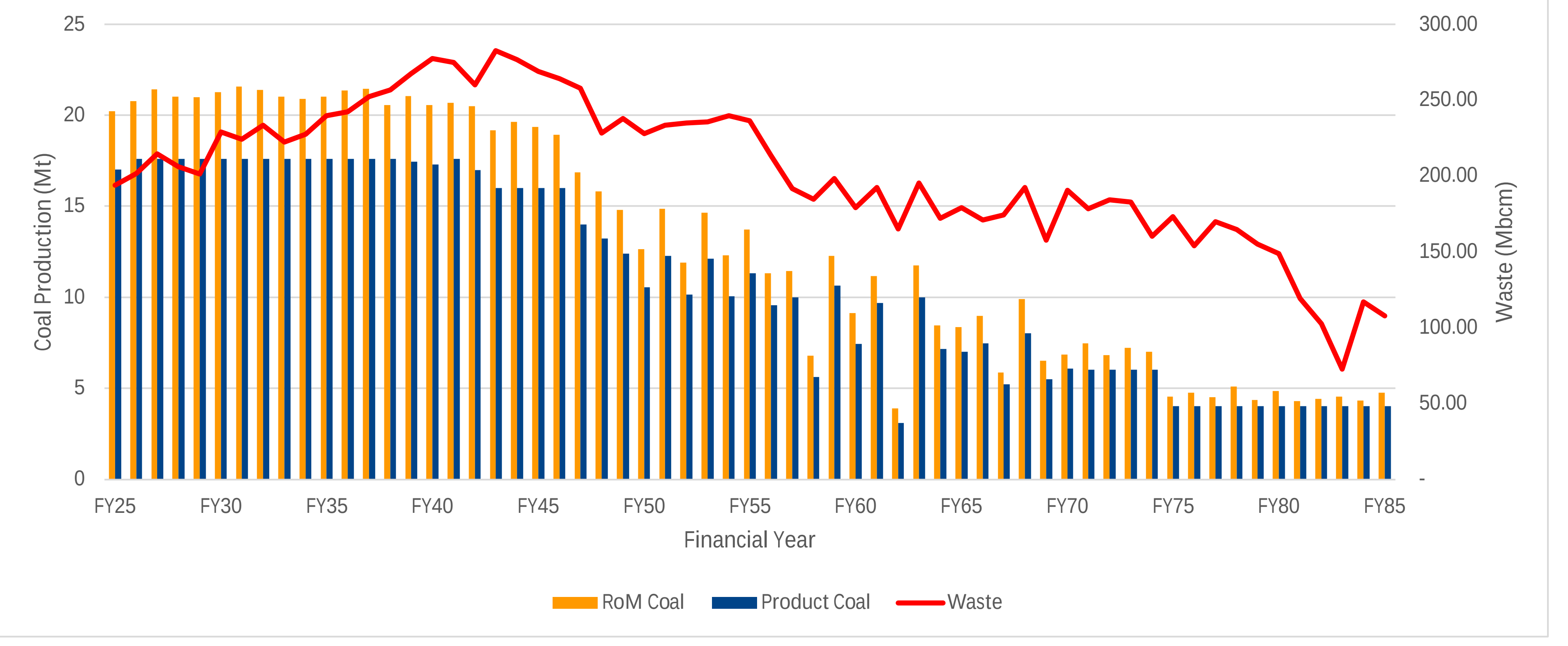
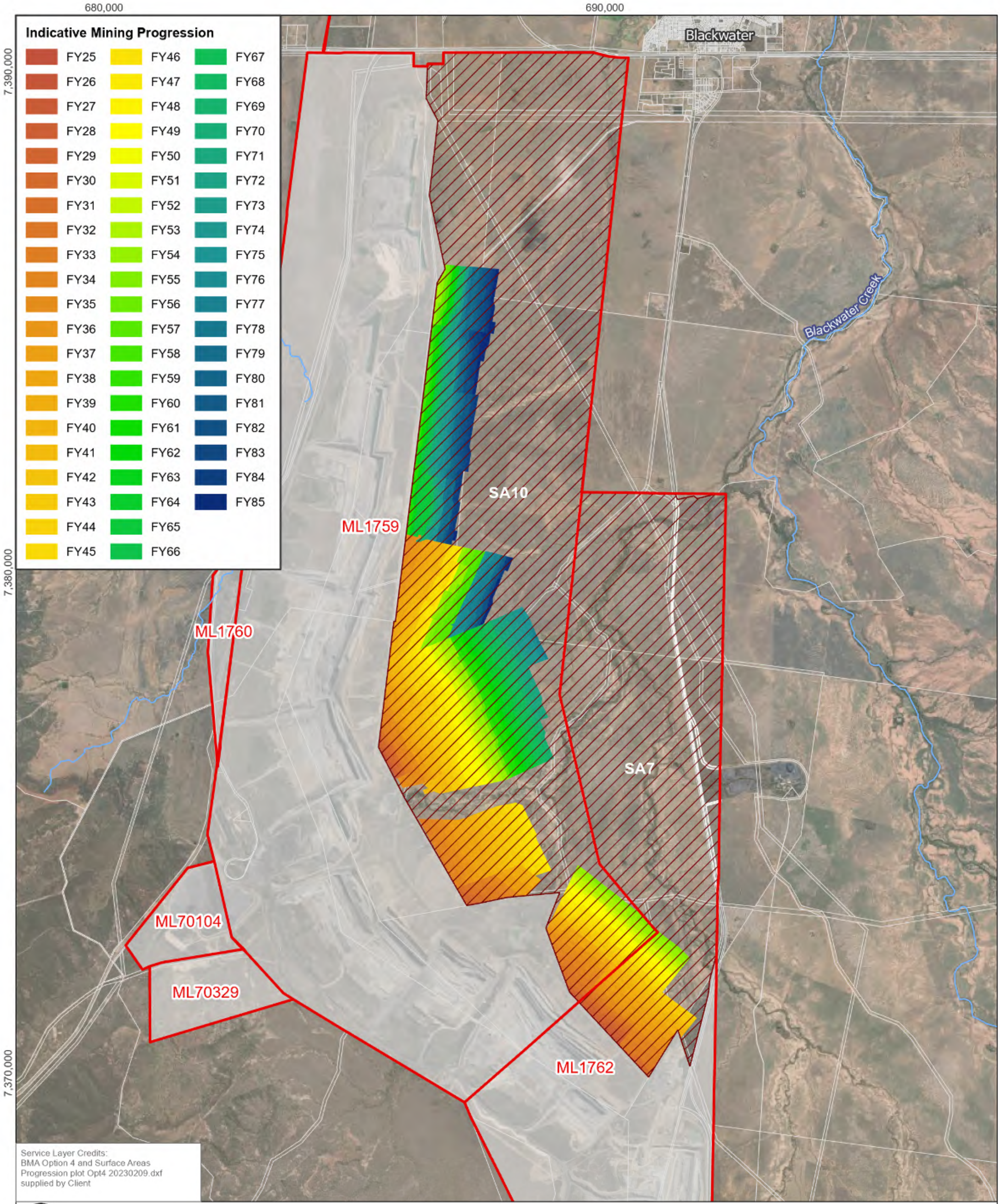


Figure 3-6: Indicative BWM Materials Schedule – FY2025 to FY2085



0 1 2 km

Coordinate System: GDA2020 MGA Zone 55

Scale: 1:100,000 at A4

Project Number: 620.014601

Date Drawn: 05-Dec-2023

Drawn by: NT

BMA

BHP Mitsubishi Alliance

LEGEND

- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Existing Blackwater Mine
- Cadastre

BLACKWATER MINE - NORTH EXTENSION PROJECT

INDICATIVE PROJECT MINING PROGRESSION

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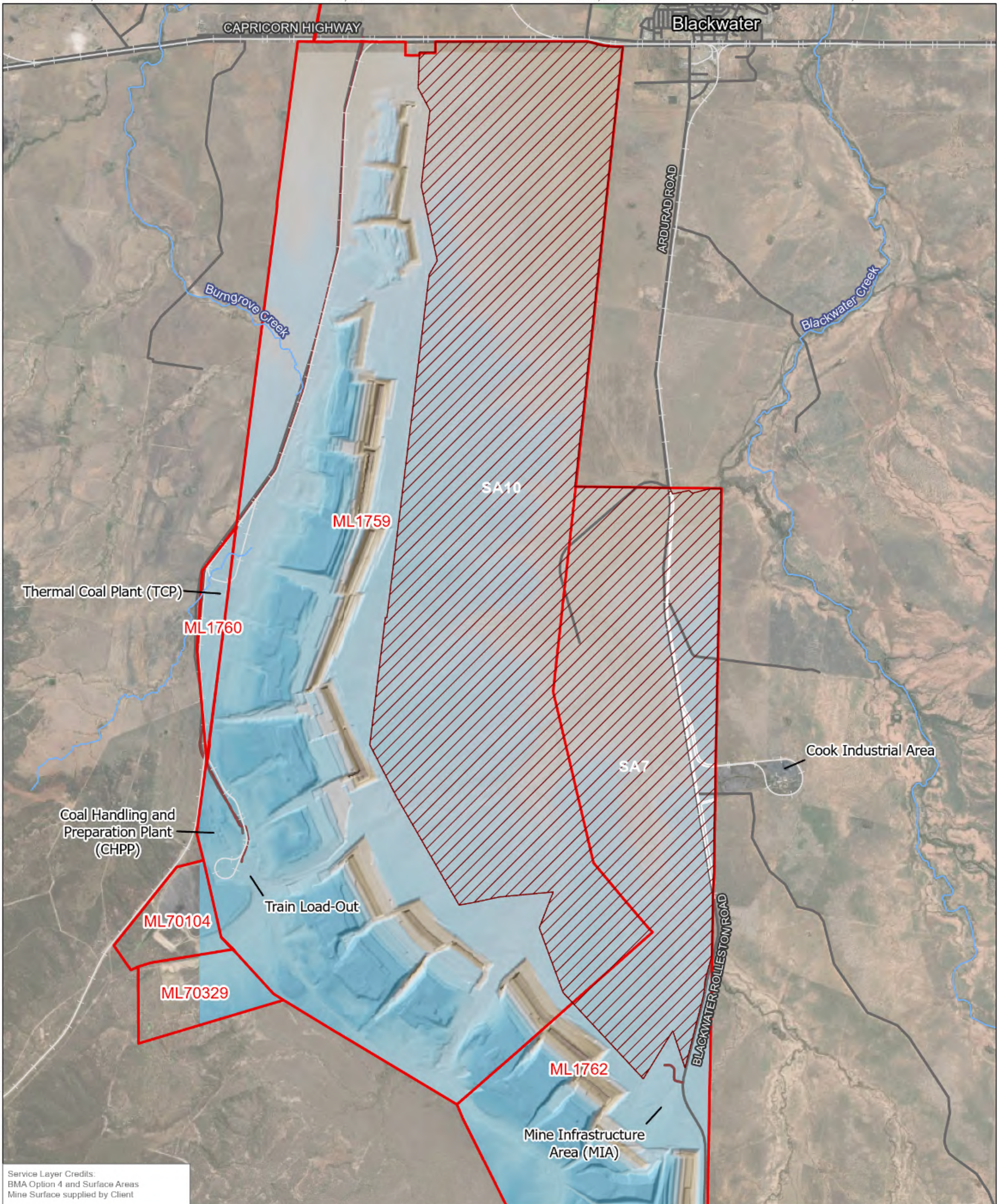
FIGURE 3-7

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_PD_F03_07_Mine Progression



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	05-Dec-2023
Drawn by:	AS

BMA
BHP Mitsubishi Alliance

LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area

Indicative Elevation (mAHD)

340

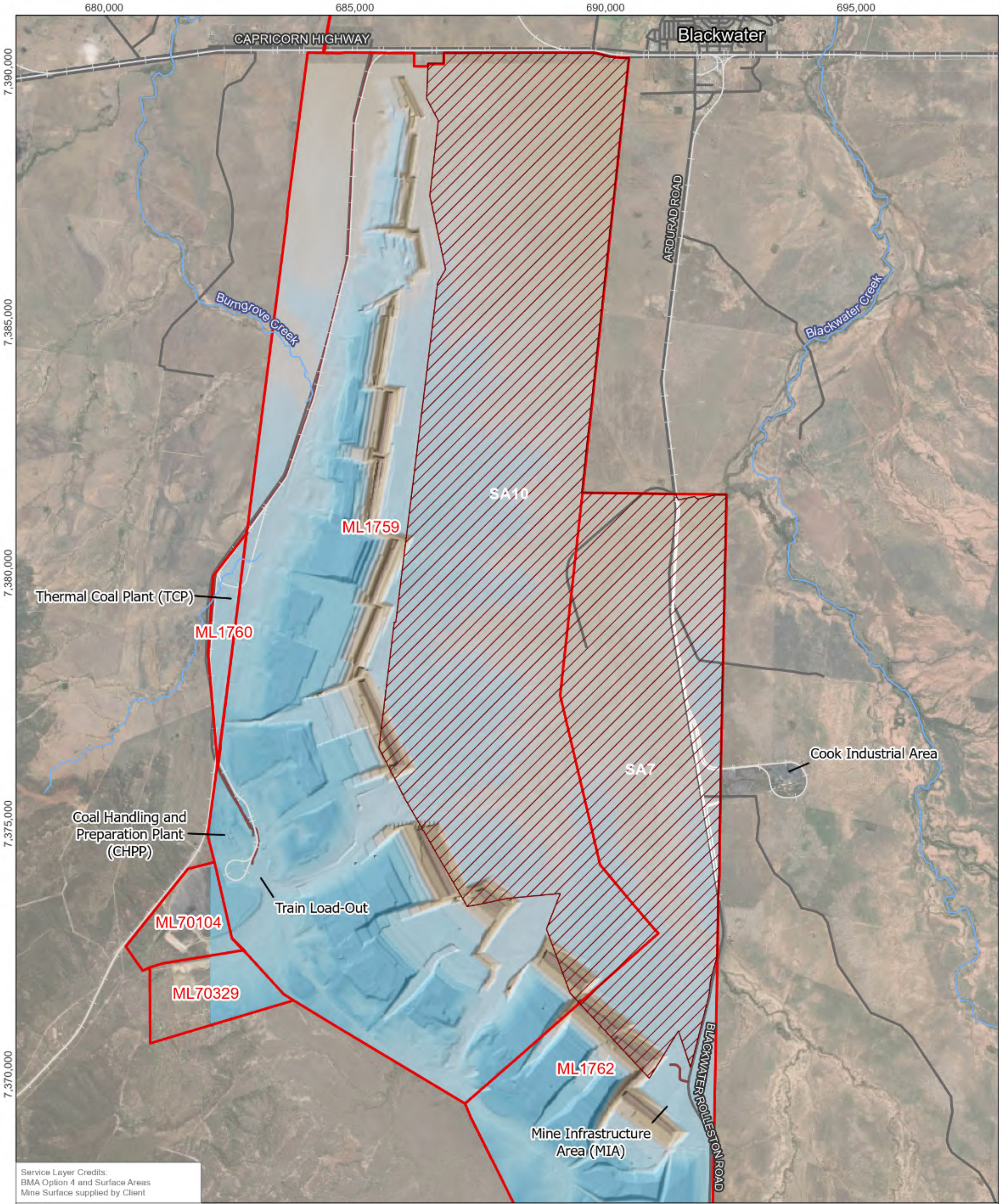
82

BLACKWATER MINE - NORTH EXTENSION PROJECT

INDICATIVE MINING PROGRESSION AT FY2025

FIGURE 3-8

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_PD_F03_08_BWM Option4 Year 2025



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	05-Dec-2023
Drawn by:	NT

BMA
BHP Mitsubishi Alliance

LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area

Indicative Elevation (mAHD)

340

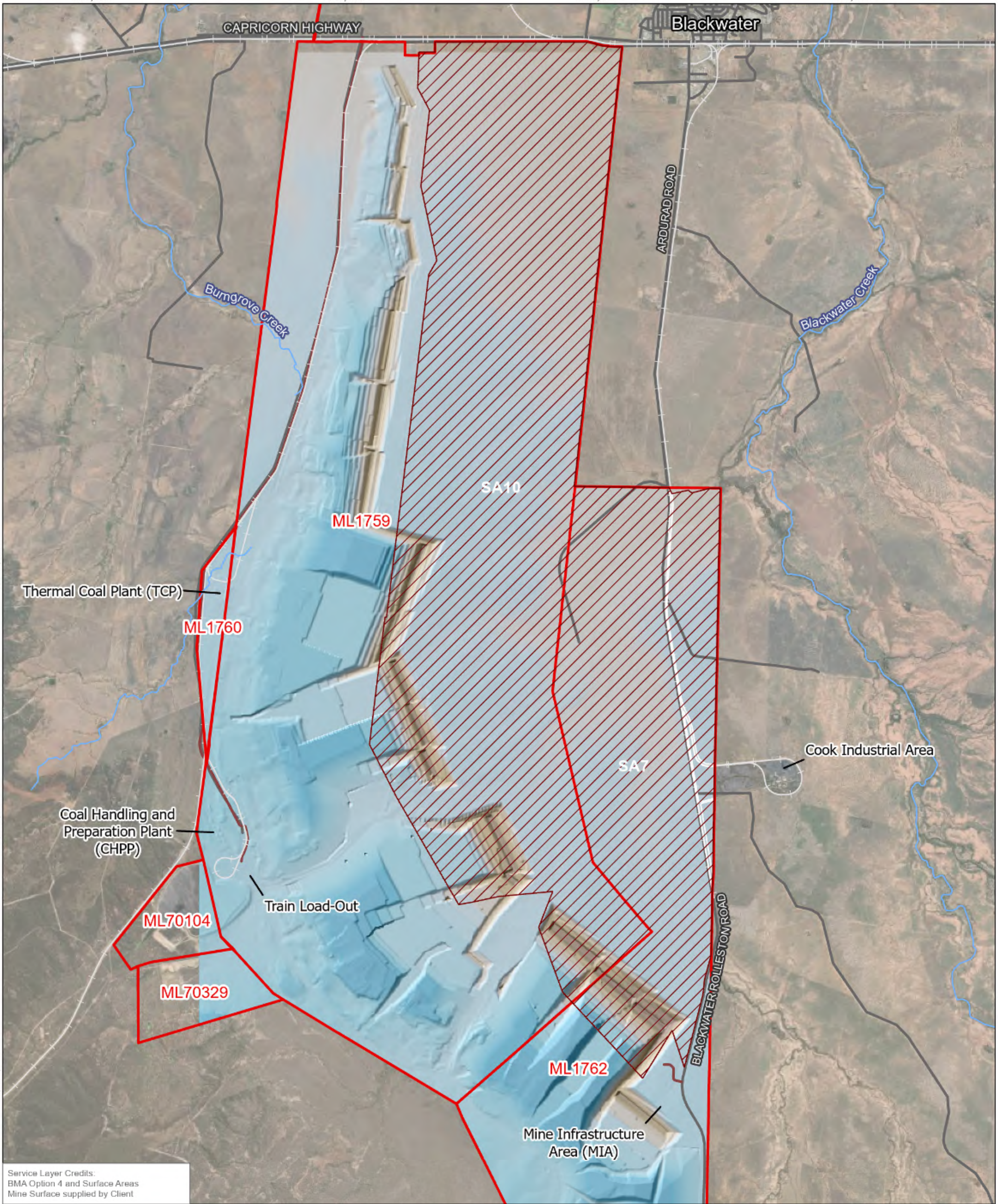
55

BLACKWATER MINE - NORTH EXTENSION PROJECT

INDICATIVE MINING PROGRESSION AT FY2035

FIGURE 3-9

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_PD_F03_09_BWM Option4 Year 2035



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	05-Dec-2023
Drawn by:	AS

BMA
BHP Mitsubishi Alliance

LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area

Indicative Elevation (mAHD)

500

4

BLACKWATER MINE - NORTH EXTENSION PROJECT

INDICATIVE MINING PROGRESSION AT FY2045

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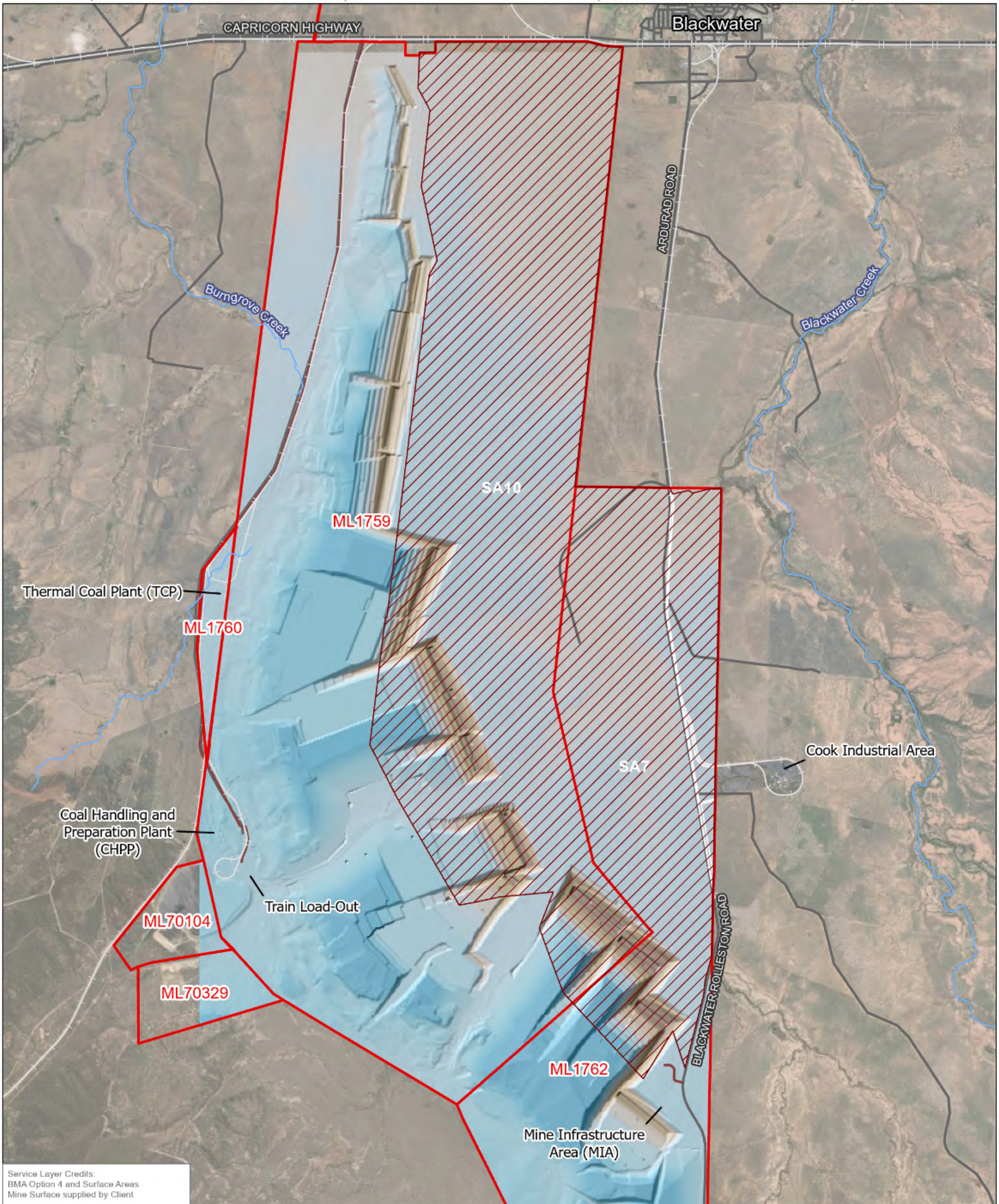
FIGURE 3-10

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_PD_F03_10_BWM Option4 Year 2045



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Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	05-Dec-2023
Drawn by:	AS

BMA
BHP Mitsubishi Alliance

LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area

Indicative Elevation (mAHD)

500

-8

BLACKWATER MINE - NORTH EXTENSION PROJECT

INDICATIVE MINING PROGRESSION AT FY2055

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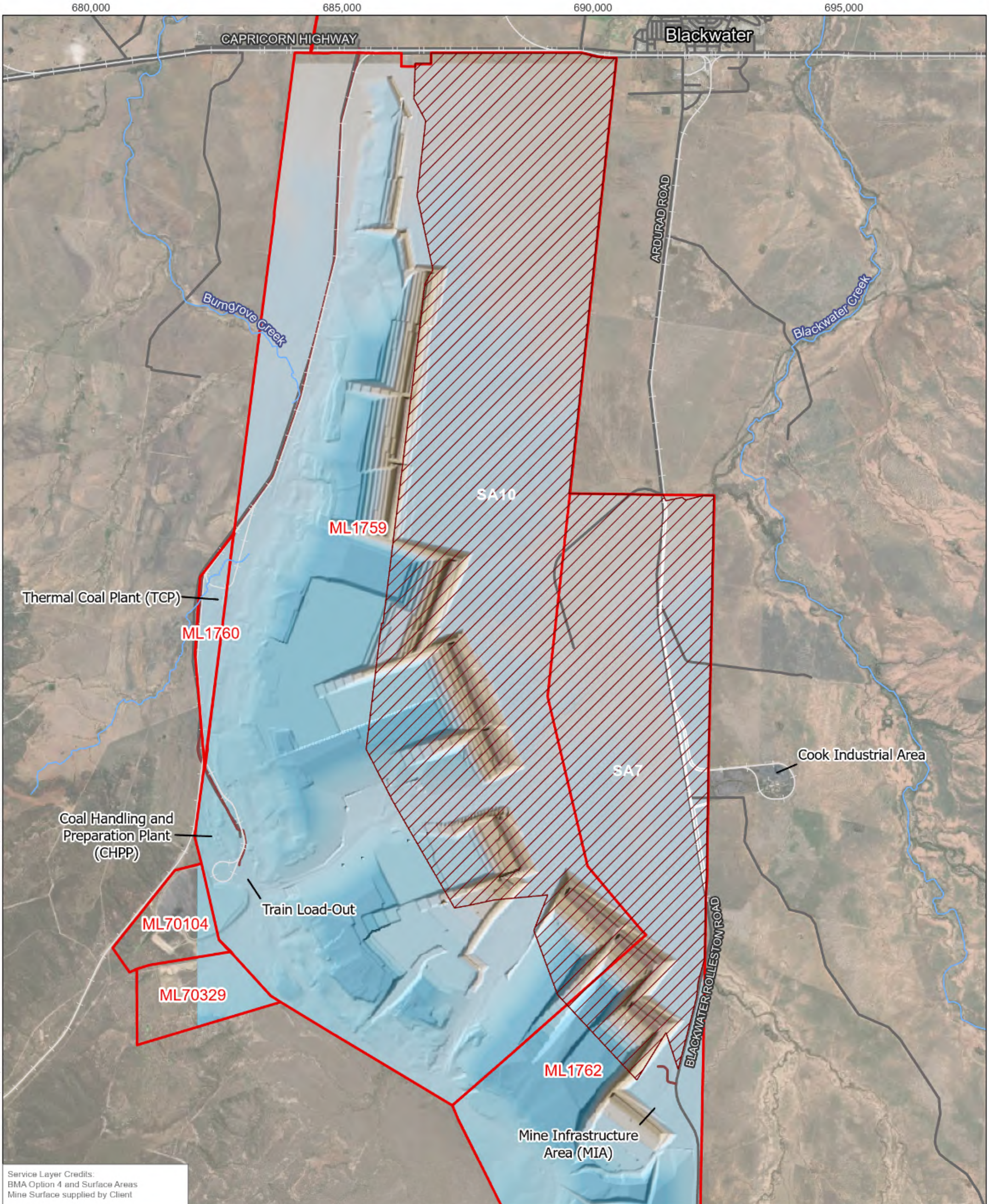
FIGURE 3-11

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_PD_F03_11_BWM Option4 Year 2055



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Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	05-Dec-2023
Drawn by:	NT

BMA
BHP Mitsubishi Alliance

LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area

Indicative Elevation (mAHD)

500

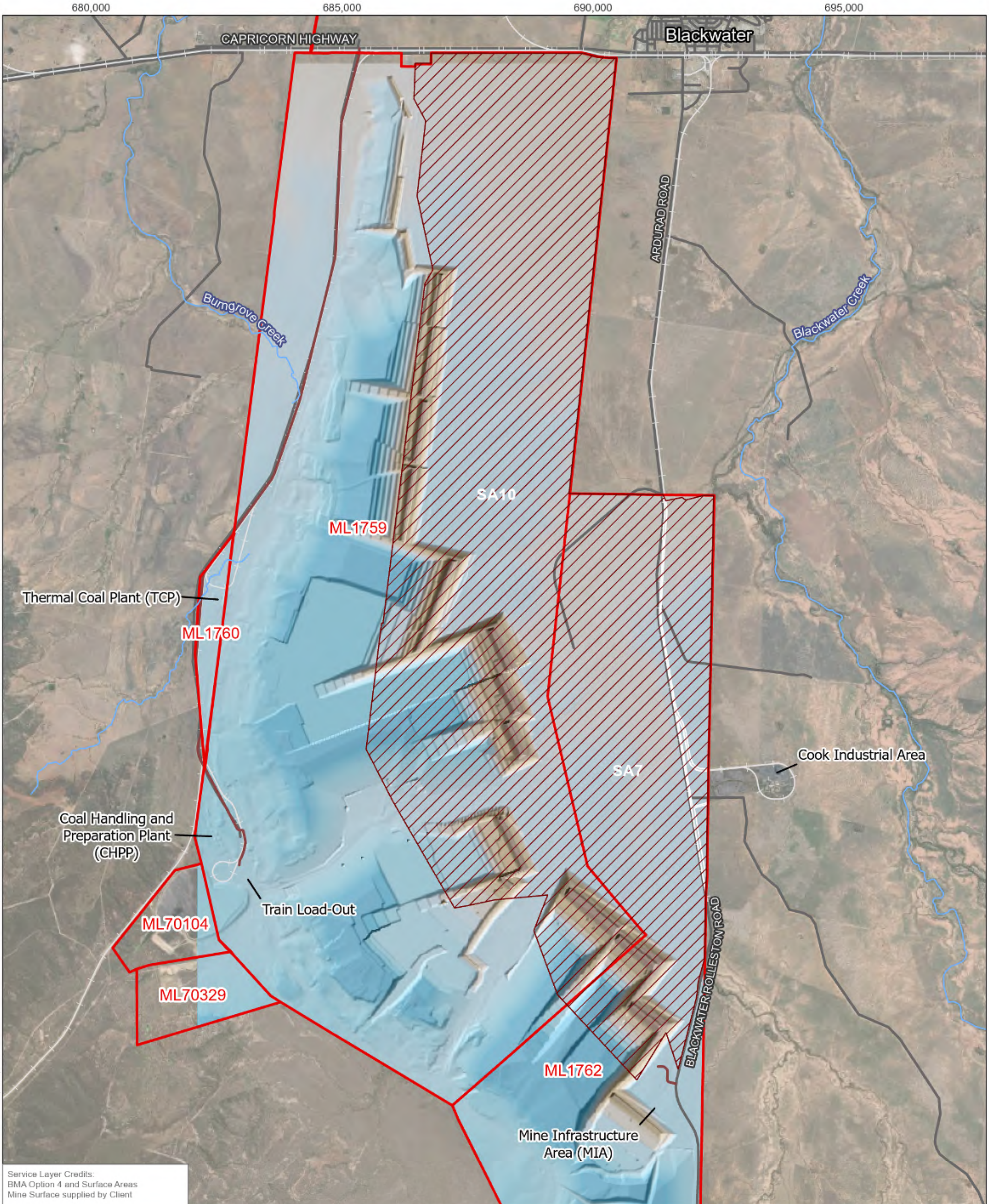
-13

BLACKWATER MINE - NORTH EXTENSION PROJECT

INDICATIVE MINING PROGRESSION AT FY2065

FIGURE 3-12

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_PD_F03_12_BWM Option4 Year 2065



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	05-Dec-2023
Drawn by:	AS

BMA
BHP Mitsubishi Alliance

BLACKWATER MINE - NORTH EXTENSION PROJECT

INDICATIVE MINING PROGRESSION AT FY2075

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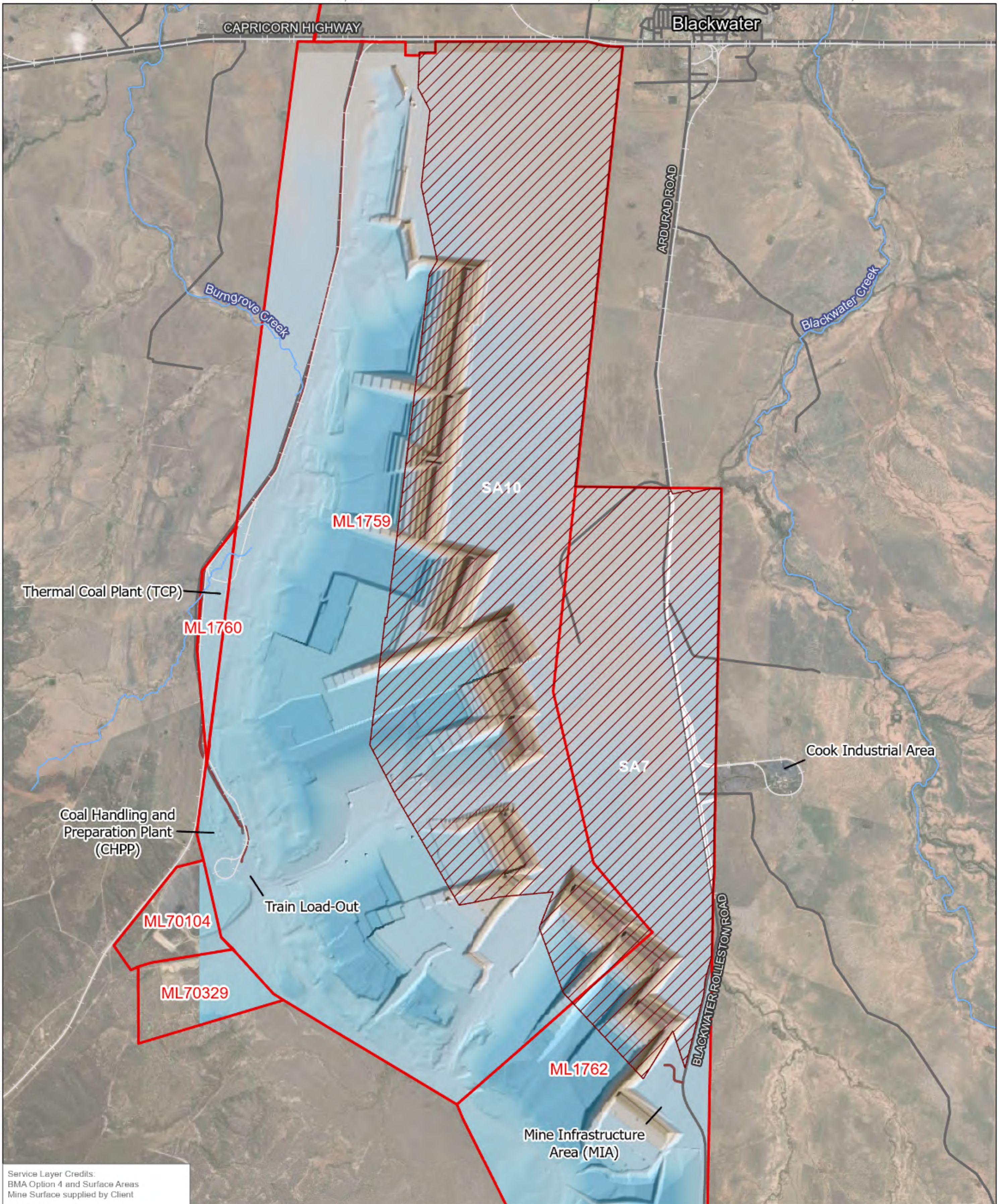
FIGURE 3-13

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_PD_F03_13_BWM Option4 Year 2075



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	05-Dec-2023
Drawn by:	AS

LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area

Indicative Elevation (mAHD)

500

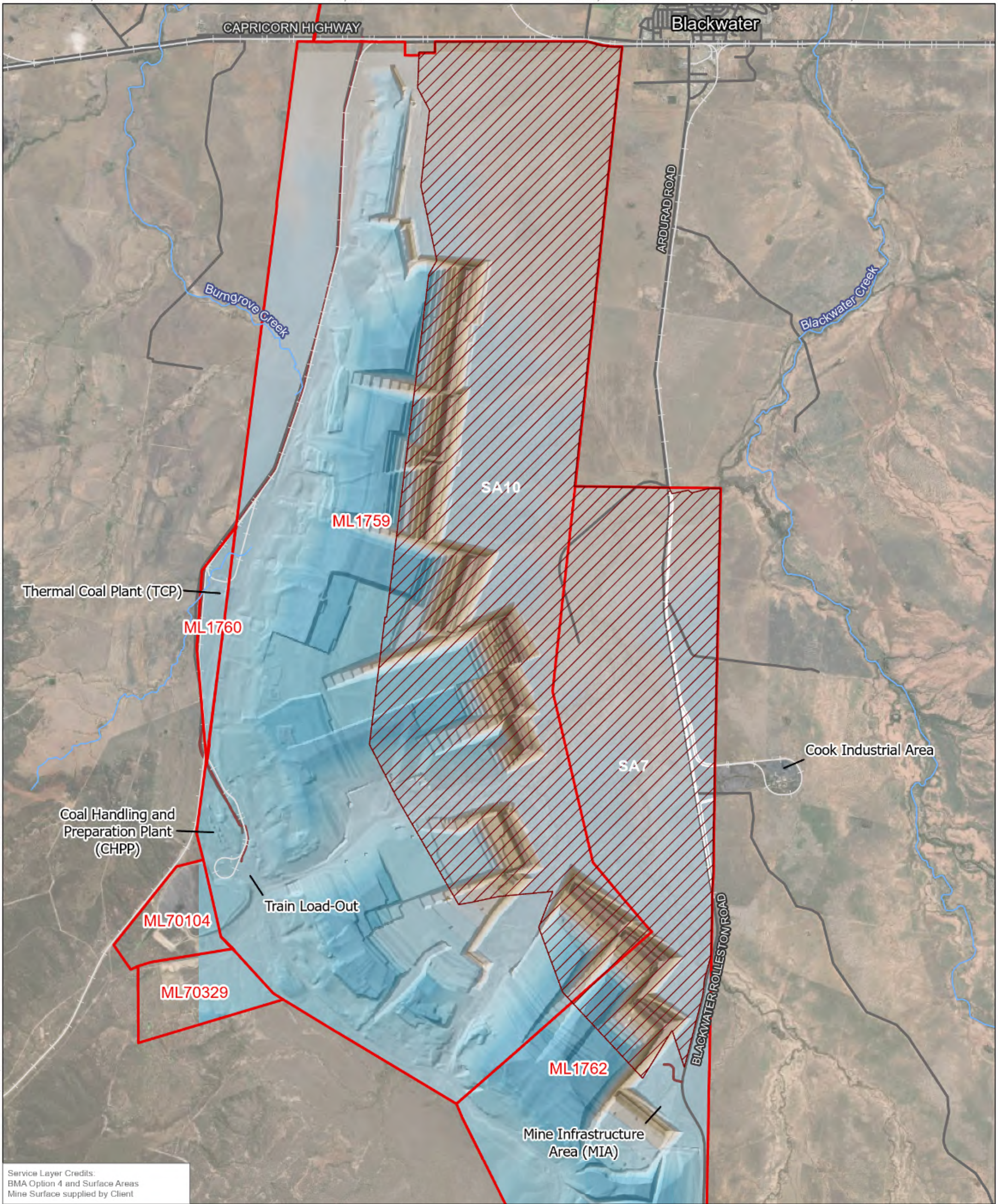
-13

BLACKWATER MINE - NORTH EXTENSION PROJECT

INDICATIVE MINING PROGRESSION AT FY2085

FIGURE 3-14

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_PD_F03_14_BWM Option4 Year 2085



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	05-Dec-2023
Drawn by:	AS

BMA
BHP Mitsubishi Alliance

LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area

Indicative Elevtion (mAHD)

500

-13

BLACKWATER MINE - NORTH EXTENSION PROJECT

INDICATIVE CONCEPTUAL FINAL LANDFORM

FIGURE 3-15

3.2.8 Coal Handling and Preparation

RoM coal reclaim and preparation will follow existing processes at the BWM.

The existing CHPP and TCP together, have existing capacity to process RoM coal to produce a total of 17.6 Mtpa product coal and can accommodate the peak RoM coal production rates for the Project. As such, there is no proposed upgrade to the CHPP as part of this Project.

Coal products will continue to be conveyed to the product coal stockpiles for transport to port from the train load-out facilities. No additional infrastructure or modifications to the existing product coal handling, preparation or transport processes are required for the Project.

3.2.9 Rejects and Tailings Management

The results of the geochemical test work conducted for the Project by Terrenus Earth Sciences (2022; Appendix B – Geochemistry Assessment) indicate that the characteristics of potential coal reject material and tailings will be consistent with the characteristics of these materials at the existing BWM (refer **Chapter 7**, for further information).

Coarse rejects from the CHPP will continue to be disposed of in accordance with the EA (e.g. placed into disused mine ramps and in-pit spoil dumps and progressively buried consistent with existing operations).

Tailings will continue to be disposed into an approved tailings storage facility (TSF), in-pit void or other disposal options in accordance with the EA. Should dry stacking of dewatered tailings be pursued in the long-term, coarse rejects would also likely be placed with the dry stacked tailings to assist in achieving geotechnical stability.

3.2.10 Final Voids

As per the current practice at BWM, mining for the Project will continue to the east and the mined-out pit areas to the west will be progressively back-filled and rehabilitated.

Final voids will remain at the conclusion of mining in some of the pits. The conceptual final landform including indicative extents of the final void is presented in **Figure 3-15**. BWM plans to explore additional opportunities to reduce the extent of the residual voids through further backfilling operations over the life of the Project. Further information on Project progressive rehabilitation and closure is presented in **Chapter 4**.

3.2.11 Mining Equipment

The mobile equipment used for the Project would vary according to the requirements of the mining operations. It would include draglines, a combination of excavators and/or shovels and haul trucks, with a support fleet that includes dozers, graders, front end loaders, drill rigs and water trucks. **Table 3-7** provides the indicative list of major mobile equipment that has been used for Project impact assessment purposes.

Initially, the Project would utilise the existing mining fleet and equipment at BWM, noting that mine equipment is replaced at end of life, as part of the overall BWM operation.

Future mining equipment would be selected in consideration of technological advancements and company policies (e.g., decarbonisation strategy).

Table 3-7: Indicative Mining Fleet and Equipment

Type	Model (or equivalent)	Quantity
Draglines	Marion 8050	3
	BucyrusErie (BE) 1370W	2
	Marion 8200	2
	Any additional units needed will be Marion 8050	
Shovel / Excavators - Waste	CAT 7495 HD	1
	P&H 4100XPC-AC (BMA)	1
	CAT 6060 (BMA)	3
	CAT 6040 (BMA)	1
	Liebherr 9800 (Contract)	1
	Terex RH340B (Contract)	2
	Hitachi EX3600 (Contract)	1
FEL/EXD – Excavators & Coal Loaders	Terex RH170B (BMA)	1
	Hitachi EX3600 (Contract)	1
	Komatsu WA1200-6SL	1
	Komatsu WA1200-6HL	1
Shovel CHPP Reject	CAT 988K-HDAL	1
Shovel TCP Reject	CAT 988G	1
Wheel loaders on coal	Komatsu WA1200-3	1
Waste Dozers Fleet	CAT D11	14
Dozers with DRE/EXC/SHE	CAT D10	10
	1 Dozer per DRE, 1.5 per SHE remainders to be CAT D11	11
Dozers with Coal Loaders	CAT D11	4
Dozer on waste dumps	CAT D11	5
Dozer on rejects	CAT D11	2
Dozer on topsoil	CAT D11	2
Wheel Dozer	CAT 854	3
Haul Trucks	CAT 795F_AC	4
	CAT 789	11
	Komatsu 930E	61
	Kress	8
	CAT 793	7
	Komatsu 830E	5
Drill	Sandvik D90K	2
	Epiroc DM-M3	2
	Epiroc PV275	2

Type	Model (or equivalent)	Quantity
Water Truck	CAT 789D-W-HDAL	15
Graders	CAT 24M	6
	CAT 18M	2
	CAT 16M	2

3.2.12 Blasting

Blasting for the Project will continue as currently employed at the BWM.

Blasting typically occurs across the BWM site at approximately one to three times per week. Blasting is utilised for overburden and interburden, including through seam blasting, as necessary at depths typically ranging from 6 m to 65 m. Subject to operational requirements, blasting occurs on any day of the week during daylight hours.

The predominant explosive used in blasting activities at the BWM is ammonium nitrate/fuel oil (known as ANFO), which is the most common explosive used in the mining industry in Queensland.

The storage, transportation and use of explosives will be in accordance with Australian Standard *AS 2187.2-2006 Explosives - Storage and use - Use of explosives, the Explosives Act 1999*, BMA's policies and procedures, and all other relevant legislation. Blasting activities at BWM are undertaken by a specialist blasting contractor.

3.2.13 Workforce Requirements and Accommodation Arrangements

The Project is not anticipated to require a significant change in the existing BWM workforce or workforce accommodation arrangements. The Project will utilise the existing BWM workforce as a continuation of existing operations. The current operational workforce at BWM (2023) is approximately 1,422 full time equivalent (FTE) employees and contractors. Over the life of the Project, the workforce numbers are expected to continue to change from year to year in response to the forward production profiles. Other factors such as development and implementation of future technologies (e.g., autonomous haulage) may also influence workforce numbers over the life of the mine.

Construction of infrastructure required to support the Project is not expected to increase the workforce. The current workforce arrangements at the BWM will remain in place for the Project. The BWM workforce utilise local housing, including in Blackwater and Emerald, and the workforce accommodation village in Blackwater.

3.2.14 Hours of Operation

Mine operation hours will continue as per current operations at BWM, i.e., 24 hours per day, seven days per week, 365 days per year.

3.2.15 Project-Specific Mine Infrastructure

3.2.15.1 Utilisation of Existing BWM Mine Infrastructure

The Project will predominantly use existing BWM mine infrastructure, as the Project is an extension and continuation of existing mining operations on ML1759 and ML1762, however, the Project will require some additional and supplementary infrastructure. The Project will require the relocation of some existing mine support infrastructure in advance of mining operations (as part of routine mine progression).

The key mine infrastructure elements of the Project are summarised below:

- Installation and / or relocation of existing ancillary support infrastructure such as back access roads, access tracks, mine pit pumps and pipelines, mine pit powerlines (including stub-lines substations), fences and explosives magazines.
- Installation and / or relocation of existing mine water management infrastructure, including:
  - clean water diversion drains, MAW drains and sediment dams.
  - Pumps and pipes, for dewatering pits and conveying water to storages.

3.2.15.2 Site Access

The Project will not require changes to current site access arrangements at BWM. Access to BWM will continue to be via the existing Blackwater CHPP access road and Ardurad Road access route to the MIA.

3.2.15.3 Back Access Roads

Back access roads will continue to be relocated to the east, such that they always remain within a certain distance (>2 km) of the mining front. Back access roads are relocated periodically on a ramp-by-ramp basis depending on the mine plan for individual ramps.

3.2.15.4 Haul Roads

Existing light vehicle access roads and haul roads will be extended to the east broadly in west-east alignments as the ramps and pits extend eastwards into and through the Project area.

3.2.15.5 Corridor Access Roads

Corridor access roads run west east, extending from haul roads on the western side of BWM. Existing corridor access roads will continue to be periodically extended to the east. As with back access roads, the corridor access roads are extended on a ramp-by-ramp basis depending on the mine plan for individual ramps.

3.2.15.6 Dragline Crossing

A dragline crossing of Deep Creek will be required for the Project. The crossing will be up to 50 m wide and is designed to allow the machine to walk down into, across and out of the creek bed. The crossing is at creek bed level and will not restrict flow. No culvert pipes will be installed, and the upstream and downstream edges of the crossings will be protected by rock. Dragline crossing events do not occur on a frequent basis and when they do, they are not scheduled to occur during wet weather or stream flow. The dragline crossing across the waterway is not permanent, however the route created on the approaches to and from the creek may last several years.

3.2.15.7 Power Supply and Transmission Line Relocation

Power supply will be provided via the existing electricity supply infrastructure to the BWM and existing transmission lines within the BWM.

The existing BMA owned ‘Rangal 66 kV Feeder’ transmission line and associated stub lines, runs north-south along the western SA7/SA10 boundary. It is the main source of power for the northern part of BWM. This transmission line and stub lines will be progressively relocated as required to allow mining to progress within the Project area.

3.2.15.8 Project Water Demand and Supply

The Project’s water requirements and the source of supply will be similar to existing operations. The Project’s primary water demands will include:

- Coal processing at the CHPP.
- Dust suppression.
- Maintenance (e.g., washing of heavy mobile equipment).
- Potable water for drinking, fire suppression, bathhouse and incidental use (e.g., cleaning) for the existing operations.

Water will continue to be supplied/produced from the following sources:

- Rainfall runoff (MAW inventory) captured in onsite water storage facilities.
- Incidental groundwater in mining pits.
- External pipeline water supply.

Water supply for the Project will be provided via rainfall runoff which forms part of the sites MAW inventory, supplemented by the existing external pipeline water network supplying BWM. External pipeline water is supplied from the Fitzroy River catchment via Fairbairn Dam and the Bedford Weir on the Mackenzie River.

The Project will increase the maximum production resulting in an increase in the average CHPP water demand. This is predicted to increase from its current rate of 3.4 GL/year to a peak of 4 GL/year in approximately 2032 (increase of ~0.6 GL/year), before declining again. To meet this demand, water is planned to be supplied by the existing onsite MAW inventory, rainfall runoff and external pipeline water delivered from Bedford Weir.

Each pipeline has an associated water supply allocation with Sunwater, which BWM is currently operating at the limit for. BWM is seeking an additional water supply option which will consist of an additional 1,000 ML on 1 July 2026 and a further 1,000 ML on 1 July 2027. This will bring the total water supply option for the Project to 4,281 ML /year by 2027.

The water supply strategy proposed is consistent with the existing operations onsite. It is expected that incremental capacity upgrades of the existing external pipeline water supply pipelines will be needed to meet the forecast increasing demands. However, the water supply requirements are based on a maximum rate of production of 17.6 Mtpa. When the production rate is lower, the water consumption requirements would also be lower.

3.2.15.9 Project Mine Water Management Infrastructure

The Project will not require any significant new mine water management infrastructure or major changes to the existing water supply system at BWM.

The existing Bedford East and Bedford West pipelines currently supply BWM. The supply delivery is managed internally by BWM.

MAW is currently sent to inactive pits for storage where it is called on to meet the various site demands as required. MAW is also stored across the site in dust suppression fill point dams, environmental dams and release dams. No change to this strategy is proposed.

MAW pump and pipeline networks will continue to be used to dewater operational pits and transfer water between storages. “Backbone” pipelines, which receive MAW from operational pits and facilitate bulk transfers of water between Tannyfoil Dam, New Taurus Creek Dam, New Deep Creek Dam and the Ramp 14 water storage pit, generally run north-to-south along the western SA7/SA10 boundary. The Project will involve ongoing relocations of backbone pipelines in association with back access roads, consistent with current mining operations.

A number of waterways intersect the Project footprint, notably Sagittarius Creek and its tributaries, tributaries of Deep Creek, tributaries of Taurus Creek and tributaries of Two Mile Gully. Water will continue to be conveyed downstream, from upstream undisturbed areas, along existing watercourses and/or diversions. Small diversion drains and bunding will continue to be used to divert clean catchments from minor tributaries around mining areas.

3.2.16 Flood Protection

To prevent the inundation of the proposed pits from Two Mile Gully, Deep Creek and Taurus Creek the following protection measures have been proposed.

- Flood protection at six locations during operations which will consist of either flood levees or flood protection landforms.
- Where flood protection is required post-mining, the final landform design will be shaped to provide an appropriate level of flood protection.
- Delineation and management of areas where minimum ground levels need to be maintained to prevent ingress of the flood events into mine pits and infrastructure areas.

Flood protection in both operations and closure will prevent inundation up to a 0.1% AEP flood event plus 0.5 m freeboard for operation. Further details for closure phase flood protection will be provided in the PRC Plan for the BWM.

4 Rehabilitation

This chapter describes the proposed approach to rehabilitation of the Project and includes:

- A description of the Progressive Rehabilitation and Closure Plan that will be developed for the Project (**Section 4.1**).
- A summary of the key information relevant to rehabilitation planning (**Section 4.2**).
- An overview of the main features of the conceptual final landform (**Section 4.3**).
- A summary of the options assessed for the final landform (**Section 4.4**).
- A description of the proposed land outcomes for the Project post-mining landform (**Section 4.5**).
- An outline of rehabilitation activities including topsoil management, surface preparation and revegetation activities (**Section 4.6**).
- An indication of the rehabilitation schedule and how it will be developed (**Section 4.7**).
- An overview of the Project rehabilitation goals, milestones and completion criteria (**Section 4.8**).
- A description of the rehabilitation of exploration areas (**Section 4.9**).

4.1 Progressive Rehabilitation and Closure Plan

A Progressive and Rehabilitation Closure Plan (PRC Plan) is being prepared for all of BWM including the proposed extension of open cut mining within SA7/SA10 (the Project) and the resultant landform. The PRC Plan will be prepared in accordance with the requirements of the MERFP Act and to meet the requirements of the EP Act and the *Guideline - Progressive rehabilitation and closure plans (PRC plans)* (the PRC Plan Guideline).

The main purposes of the PRC plan are to:

- Require the holder of an EA to plan for how, where and when activities will be carried out on land in a way that maximises the progressive rehabilitation of the land to a stable condition; and
- Provide for the condition to which the holder must rehabilitate the land before the EA may be surrendered.

The BWM transitional PRC Plan is due to be submitted to the DES on the 15 November 2024. The submission of a PRC Plan including the SA7/SA10 approval will be dependent on the approvals timeframes of the current SA7/SA10 EA Amendment. At the time of submission, the PRC Plan including the SA7/SA10 approval will be based on the latest information available regarding the BWM rehabilitation and closure strategy.

The EP Act requires that all areas disturbed within the relevant mining tenure must be rehabilitated to a post-mining land use (PMLU) or managed as a non-use management area (NUMA).

4.2 Key Information

Key information relevant to rehabilitation planning at BWM is outlined in **Table 4-1**.

Table 4-1: Key Information Considered in Rehabilitation Planning

Key Aspect	Overview	Chapter/Appendix for Further Information
Site topography	The topographic elevations in and around the Project area range from approximately 180 metres Australian Height Datum (mAHD) (northeast of the Project area) to 230 mAHD (in the south of the Project area). Most of the Project area is situated on gently undulating lowlands and plains with slopes of 0% to 5%,	• Chapter 6 (Land Resources) and Appendix A (Land Resources Assessment)
Climate	The Project area is characterised by a long-term average annual rainfall of approximately 549 mm, wetter conditions during the summer months of December, January and February (average rainfall of 83 mm, 87 mm and 77 mm respectively) and relatively dry conditions during the remainder of the year, with evaporation and evapotranspiration exceeding rainfall throughout the year. Throughout the year, evaporation is approximately two to three times greater than rainfall.	• Chapter 10 (Surface Water Resources) and Appendix E (Surface Water Resources Assessment)
Geological setting	The Project area is situated in the northern region of the Bowen Basin, which is a north-south trending basin divided into broad morphotectonic zones. The Bowen Basin is characterised by gentle easterly dips and minor to moderate deformation on a relatively thin accumulation of sediments. The sediments and stratigraphic sequence were formed by the Permo-Triassic sediments of the Bowen Basin, which are overlain by a range of Tertiary and Quaternary sediments and alluvium.	• Chapter 6 (Land Resources), Chapter 7 (Geochemistry), Chapter 11 (Groundwater) and associated Appendices
Site hydrology and fluvial networks	The Project area lies within the Fitzroy Basin and Mackenzie River sub-basin. Watercourses are ephemeral and include Sagittarius Creek and Taurus Creek, with tributaries including Two Mile Gully and Deep Creek. Taurus Creek intersects with Blackwater Creek east of the Project area. Downstream of the Project area, Blackwater Creek joins with the Mackenzie River.	• Chapter 10 (Surface Water Resources) and Appendix E (Surface Water Resources Assessment)
Groundwater	The two major aquifers in the Project area are: • The Rangal Coal Measures, which contains brackish water, and is not accessed by landholder bores within a 10 km buffer area. • The Burngrove Formation which contains brackish water and is accessed by landholder bores within a 10 km buffer area. Locally, the alluvium was found either absent or dry and it is not considered a major aquifer in the Project area.	• Chapter 11 (Groundwater) and Appendix F (Groundwater Impact Assessment)
Soil types, properties and productivity	Dominated by lowlands with brigalow and cracking clay soils on weathered and fresh Permian shales and lithic sandstone.	• Chapter 6 (Land Resources) and Appendix A (Land Resources Assessment)

Key Aspect	Overview	Chapter/Appendix for Further Information
Land stability	The Agricultural Land Assessment indicates the Project area, consisting of SMU 1, 2A, 2B & 3, is rated as Agricultural Land Class C1, pastureland, suitable for grazing improved and native pastures. PMLUs have been determined based on the post mining landscape and stability, not pre-mining land classes	• Chapter 6 (Land Resources), Chapter 7 (Geochemistry), Appendix A (Land Resources Assessment), Appendix B (Geochemistry)
Vegetation communities and ecology	The vegetation within the Project area is largely regrowth brigalow and eucalypt woodland communities. The areas of non-remnant vegetation are now largely dominated by introduced Buffel Grass and have been raked of woody debris and rocks and continue to be grazed by livestock	• Chapter 12 (Terrestrial Ecology), Chapter 13 (Aquatic Ecology), MNES Assessment (Appendix G), Aquatic Ecology Impact Assessment (Appendix I).
Pre-mining land use	Cattle grazing	• Most Chapters and Appendices.

4.3 Conceptual Final Landform

The conceptual final landform design is based on the mine plan and outcomes from supporting studies to ensure the landform is stable and minimises the risk of environmental harm. Whilst the conceptual final landform design is based on the information available at the time of preparation of the EA Amendment application, the PRC Plan will provide further updates when submitted.

The main features of the Project final landform will be reshaped and rehabilitated elevated spoil dumps and residual voids:

- The pit voids will be progressively backfilled during operations. As mining continues to the east, strip voids in the west will be progressively filled with dragline spoil, and truck dumps constructed in lifts (or benches) above. As dump areas reach maximum capacity, the spoil dumps will be regraded and reshaped to suitable slopes prior to growth media application and revegetation activities.
- As mining progresses, the BWM voids will migrate to the east. Residual voids will remain for the last strip of each pit, along the eastern extent of the planned mining area.

The Project conceptual landform once mining is complete is shown in **Figure 3-15** (**Chapter 3**). It should be noted that recontouring and shaping activities are not necessarily reflected.

The proposed final landform design parameters include:

- Spoil dumps:
  - Slope angles up to 15% or up to 30% with rock on the final landform.
- Residual voids (below ground level):
  - High-wall and end-wall profiles as-mined, with numerous mining benches of varying face angles, heights and offsets.
  - Low-wall profile as-dumped, with dragline spoil and truck dump lifts remaining at angle of repose with varying bench offsets.

Set-back from the high-wall and end-wall crests to achieve structural stability of factor of safety ≥1.5 within the NUMA extents.

Table 4-2 provides further detail on the proposed final landform design criteria for residual voids. Note that EA amendment only relates to SA7/SA10. Hence the final landform design criteria for the mining areas (and voids) outside of the SA7/SA10 area remain as per current EA commitments.

Table 4-2: Residual Void Landform Criteria

Void	Highwall criteria	Low wall criteria
SA7/SA10 voids	• Maximum overall slope is 45 degrees (measured from highwall crest to toe). • Must be safe, stable and non-polluting.	• Maximum 30% slopes above natural ground level. • Must be safe, stable, non-polluting and achieve a post mining land use above natural ground level. • Maximum overall slope is 37 degrees below ground level (measured from low wall at natural ground level to low wall toe). • Must be safe and stable below ground level to 10 m above long-term water level.
Other BWM voids (outside of SA7/SA10 area)	• Must be safe, stable and non-polluting.	• Must be safe, stable, non-polluting and achieve a post mining land use above natural ground level.

A conceptual cross section of the proposed residual voids for the Project is shown in **Figure 4-1**.

4.4 Rehabilitated Landform Options Assessment

BMA's preferred conceptual final landform and the basis of the EA Amendment is as described in **Section 4.3** and will be updated upon submission of the PRC Plan in November 2024. Geotechnical and landform erosion modelling will be conducted as a component of the PRC Plan studies to further inform the final design criteria for the Project landform. In addition, the final landform will be optimised further in the PRC Plan, based on the outcomes of the additional studies to be conducted for the PRC Plan. Modifications may include consideration of:

- partial void backfill on end-walls for flood mitigation;
- placement of landforms along sections of the high wall for flood mitigation;
- change to residual void configuration or size to ensure the residual void acts as a long-term groundwater sink;
- reduction to residual void catchments to prevent overtopping; and/or
- increased set back of the voids from watercourses or boundaries to achieve structural stability of factor of safety ≥1.5.

Noting the future PRC Plan development and in preparation for the EA Amendment, alternate landform options were considered as described in **Sections 4.4.1** to **4.4.2** below. The options described below are not being taken forward by BMA at this time, but as listed above, the PRC Plan development will further appraise viable, sustainable options to inform the final closure strategy.

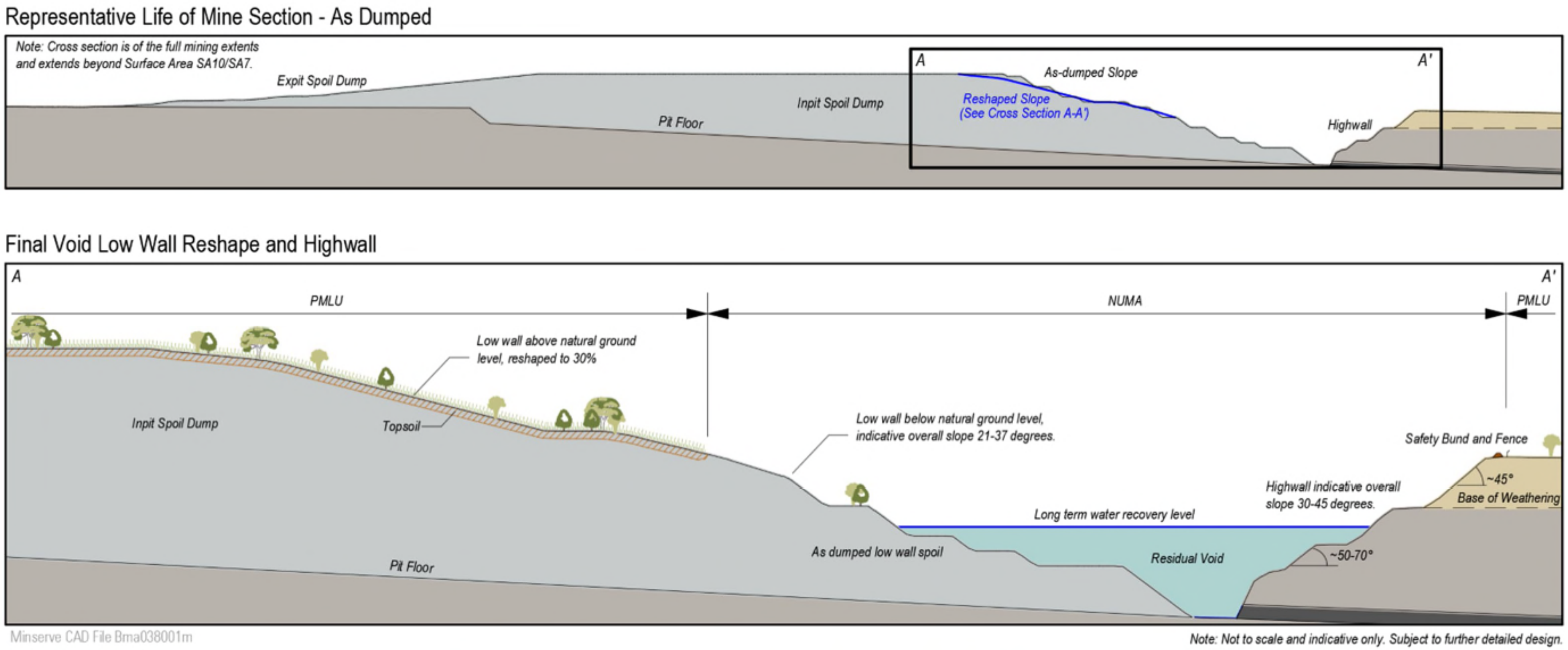


Figure 4-1: Indicative Residual Void Cross Section

4.4.1 Final Void – Endwall Backfill for Flood Mitigation

To assess the option of partially backfilling the endwalls to provide flood protection to final voids, an assessment was completed that considered endwall backfill around the southern wall of Besgrove Pit, the north and southern walls of Deep Creek Pit and the northern wall of Stewarton Pit. The concept considers creating a landform from backfill where endwalls are adjacent to a watercourse to provide a permanent flood barrier. The design was then compared against the rehabilitation surfaces determined for the preferred final landform as described in **Section 4.3**.

It was found that neither Stewarton Pit nor Deep Creek Pits would be able to be dumped into as part of the current dumping strategy, which incorporates keeping the waste material contained to the same ramp. For these reasons, this option is considered infeasible at this time but may be evaluated again as part of the PRC Plan studies.

4.4.2 Progressive Backfilling of Void

Progressive backfilling of pits occurs as mining advances, with waste moved by draglines and the truck and shovel fleets placed into the void areas behind the working pits.

Haulage options were assessed to understand the potential advantages and disadvantages of prioritising dumps with an elevation at or below the current topography and the potential to backfill additional void area. This was then compared to the preferred final landforms described in Section 4.3. Success of this approach is also dependent upon the staggering of mining activities in across the strip sequence to facilitate more in-pit backfilling at end of mine life.

It was assessed that such changes from the preferred strategy would result in additional equipment requirements, additional fuel and carbon emissions and additional costs to the operation for marginal gain.

The proposed land outcomes for the final landform are described in **Section 4.5**.

4.5 Proposed Land Outcomes

The proposed land outcomes for the Project post-mining landform include a number of post-mining land uses and non-use management areas, as described in **Sections 4.5.1** and **4.5.2.**

4.5.1 Post-Mining Land Use

A number of PMLUs are permitted for BWM under the EA (EA Table E1) and were developed in consideration of the site characteristics, local and regional land uses, and surrounding landscape.

Of the PMLUs detailed in EA Table E1, the following PMLUs are proposed in the SA7/SA10 area at BWM:

- Cattle grazing.
- Woodland habitat.
- Watercourse.

Land within the Project area has largely been cleared through past agricultural and mining-related activities and is predominantly used for cattle grazing. The largest tracts of remnant or regrowth vegetation in the Project area occur along the riparian corridors of Taurus Creek and Two Mile Gully.

The proposed PMLUs have been developed in consideration of the post-mining landform, growth media, pre-mining land uses, existing vegetation, ecological values and watercourses, and include:

- Woodland habitat is proposed for elevated landforms (e.g. spoil dumps) and areas near existing vegetation communities.
- Cattle grazing is predominantly proposed for lower gradient areas proposed to be disturbed by mining activities, as well as areas that require shallow rooted species and/or areas on the lease undisturbed by mining where significant clearing occurred prior to BMA's establishment of the mine.
- The watercourses that traverse through SA7/SA10 (e.g. Deep Creek and Two Mile Gully) are proposed to be assigned a watercourse PMLU.

Indicative locations of the proposed PMLUs for the Project disturbance areas are shown in **Figure 4-2**. The proposed PMLUs and their locations will be reviewed as part of the preparation of the PRC Plan and will be based on the outcomes of the additional rehabilitation and closure studies conducted in support of the PRC Plan.

The EA objectives, indicators, and acceptance criteria for the proposed PMLUs are discussed in **Section 4.6**.

4.5.2 Non-Use Management Areas

As outlined in Section 754(3) of the EP Act and Section 6.3.2 of the PRC Plan Guideline 'a NUMA will be taken to be pre-approved if a land outcome, the same or substantially similar to a NUMA, is contained in a 'land outcome document' (DES, 2023a). The BWM EA is an approved land outcome document for the transitional BWM PRC Plan and residual voids are authorised under Schedule E (Condition E10 and E11) of the EA. BMA has transitional arrangements for residual voids as pre-approved NUMAs in the PRC Plan.

The post-mining landform includes the residual voids in the Project area (**Figure 4-2**). Due to the pit progression down dip, the residual voids are located at the eastern extent of the Project area within ML1759 and ML1762. The final NUMA location and extents will be finalised as part of the PRC Plan.

The NUMAs will be designed to achieve an area that is safe and structurally stable. Structural stability is achieved through geotechnical assessments to include wall set-backs at natural ground level to achieve a factor of safety of 1.5, therefore no geotechnical instability is expected beyond the set-back.

Safety features are incorporated to prevent unrestricted access by humans and livestock and will include a safety bund constructed at the set-back distance to achieve a factor of safety of 1.5, as well as fencing and signage. The indicative locations of the NUMAs are shown in **Figure 4-2**. Further geotechnical assessment will be undertaken as part of the PRC Plan process.

Long-term residual void water levels have been modelled as part of the Groundwater Impact Assessment (**Appendix F** and **Chapter 11**) and Surface Water Resources Assessment (**Appendix E** and **Chapter 10**). After mining, groundwater will flow into and accumulate within the residual voids. The final landform will be designed to minimise the surface water catchment area of the residual voids.

The NUMAs will not present an unacceptable risk of environmental harm outside of the tenure boundary given:

- The residual voids will act as long-term groundwater sinks, containing potential contaminant migration via groundwater within the mining tenements.

- The potential for interconnectivity between the deeper Permian and shallower aquifers will be minimised.
- The residual voids will be protected from flooding up to the 0.1% AEP flood level.
- The long-term pit water levels will remain below the spill point, and therefore, minimise the risk of residual voids overtopping and releasing void water to surface waters and/or the receiving environment.
- The extent of the NUMA has been designed to achieve structural stability, resulting in no geotechnical damage beyond the NUMA.

4.6 Rehabilitation Activities

4.6.1 Topsoil Management and Surface Preparation

A Land Resources Assessment (**Appendix A**) has been undertaken for the Project and the outcomes are described in **Chapter 6**. Soil stripping, handling and stockpiling will be undertaken in accordance with the BMA Topsoil Management Procedure.

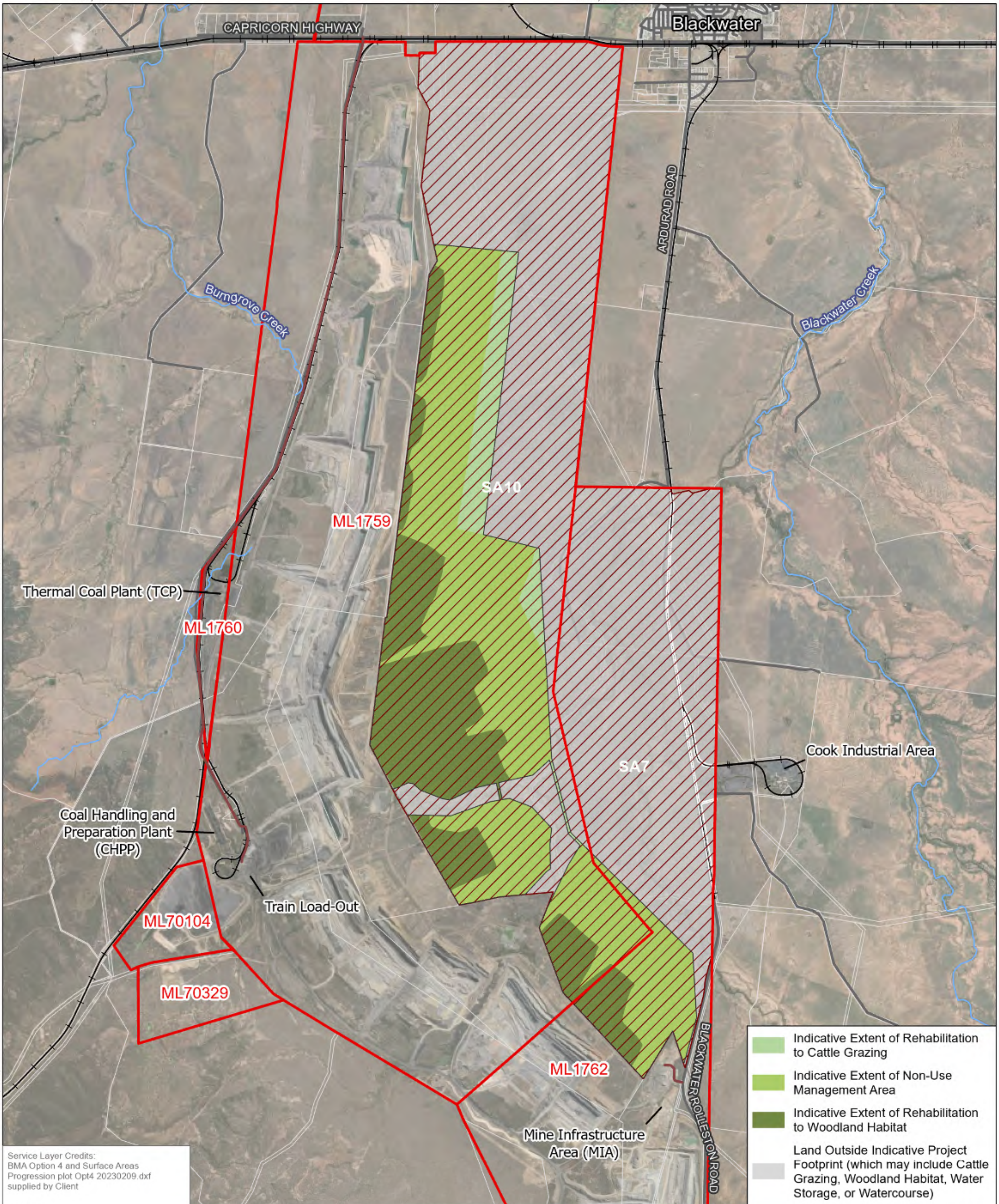
During mining operations, topsoil will be stripped according to the recommended depths from the pre-mining soil surveys. The topsoil will either be used direct on rehabilitation areas or stockpiled progressively for later use in rehabilitation. Topsoil stockpiles will be located throughout the BWM mining leases. Stockpile locations and volumes will vary throughout the life of the operation as stockpiled topsoil is used on rehabilitation and new stockpiles are created as mining advances. The spatial location of stockpiles will be recorded in a geographic information system and a volume inventory will be maintained.

An assessment of the growth media characteristics will be completed by an appropriately qualified person to determine the amelioration requirements to suit the revegetation plan for the PMLUs. The required growth media depth, amelioration options and the surface treatment requirements to support the establishment of vegetation for each PMLU, are outlined in **Table 4-3**.

BWM growth media may also consist of ameliorated mine waste materials or a topsoil/mine waste mix, that are determined suitable by an appropriately qualified person. Methods to ameliorate growth media include (but are not limited to):

- Integrated organic materials (compost, biosolids, straw, cane tops, biochar, fertilisers).
- Surface mulching (straw, canetops).
- Blending suitable benign materials (Permian sandstones, rejects, tailings, stockpiled topsoil).

The post mining landscape of BWM will involve slopes that differ from the pre mining landscape. The landscape requires a growth media with appropriate qualities to support the PMLU's of cattle grazing and woodland habitat on the planned landform. BWM has the materials available onsite for a suitable growth media to support appropriate vegetation.



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	05-Dec-2023
Drawn by:	NT

LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Cadastre
- Indicative Project Footprint

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BLACKWATER MINE - NORTH EXTENSION PROJECT

CONCEPTUAL POST-MINING LAND USE

FIGURE 4-2

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_PRCP_F04_2_Draft PRCP Land Use

Table 4-3: Growth media ameliorant options and surface treatments for the Project PMLUs

PMLU	Growth Media	Ameliorant Options	Surface Treatments
Cattle grazing	Topsoil – minimum depth of 150 mm is sufficient to store moisture and nutrients to initiate and sustain pasture growth.	• Elemental Sulphur. • Manures. • Urea. • Diammonium phosphate. • Superphosphate. • Fertiliser. • Gypsum. • Incorporated organic. • Matter. • Surface mulching (e.g. hay mulch).	• Ameliorate growth media as recommended by an appropriately qualified person (if required). • Rip on contour. • Direct seed as per seed mixes and rates for cattle grazing revegetation.
Woodland habitat	Topsoil –depth of 100 mm to 150 mm to limit the effects of competition on woodland species due to the potential loads of exotic pasture species.	• Elemental Sulphur. • Manures. • Superphosphate. • Fertiliser. • Gypsum. • Incorporated organic matter. • Surface mulching (e.g. hay mulch).	• Ameliorate growth media as recommended by an appropriately qualified person (if required). • Deep rip on contour to incorporate rock. • Direct seed as per seed mixes and rates for woodland habitat revegetation.
Watercourse	Topsoil – minimum depth of 150 mm on banks to encourage a vegetative cover to provide erosion resistance.	• Elemental Sulphur. • Manures. • Superphosphate. • Gypsum. • Incorporated organic matter. • Surface mulching (i.e. hay mulch).	• Ameliorate growth media as recommended by an appropriately qualified person (if required). • Rip on contour as required. • Direct seed as per seed mixes and rates for watercourse revegetation.

4.6.2 Revegetation

Rehabilitation areas will be revegetated once final land reshaping, growth media and ameliorants are applied to support the PMLU, and surface preparation has been completed. Seed mixes containing appropriate species to support the nominated post mining land use will be used to establish a sustainable vegetation cover. Provisional revegetation species lists will be developed as part of the PRC Plan.

The provenance (where the seed comes from) is considered important for all species. Seeds will be sourced as locally as possible from natural populations. Although the local provenance boundary locations may differ between species, seed would ideally be obtained from the Brigalow Belt North bioregion.

Woodland habitat and watercourse revegetation are anticipated to provide longer term connectivity values for native flora and fauna species.

4.6.2.1 Cattle Grazing PMLU

As shown on the indicative **Figure 4-2**, the flatter areas within the disturbance areas of the Project area would be revegetated to support the cattle grazing PMLU. The proposed revegetation species mix for the cattle grazing PMLU will be developed as part of the PRC Plan and will be based on seeding preferred, palatable and productive (3P) native and exotic pasture species and legumes cognisant of grazing best management practice (DES, 2022; Future Beef, 2022). Example 3P pasture species include Rhodes grass (*Chloris gayana*), bambatsi (*Panicum coloratum* var*. makarikariense*), green panic (*Megathyrsus maximus* var. *pubiglumis*), Queensland blue grass (*Dichanthium sericeum*) and Mitchell grasses (*Astrebla* spp.). The PRC Plan development will further define the optimal seed mix proposed at BWM. Where practicable, direct seeding of pasture seed mixes will be undertaken in the warmer months of the year from September to March.

4.6.2.2 Woodland Habitat PMLU

Regional ecosystems (REs) within the Project area were ground-truthed and mapped as part of the ecological assessments undertaken by EMM (2023a, 2023b). The ground-truthed REs are described in **Chapter 12**, Terrestrial Ecology (refer **Table 12-3** and **Figure 12-2**). The remnant vegetation cover within SA7/SA10 has been largely altered over time by clearing for agricultural land use purposes and for mining-related activities. Remaining remnant and/or high value regrowth vegetation occurs in narrow strips, predominantly along watercourses.

Areas of woodland habitat PMLU are planned on elevated reshaped mine spoil (**Figure 4-2**). The spoil dumps are elevated, sloped anthropogenic landforms comprised of mudstones, claystones, siltstones and sandstones. These landforms vary from pre-mining landforms and do not align with any specific land zone under the regional ecosystem framework (Wilson & Taylor, 2012).

The approach to woodland habitat revegetation will consider the selection of key framework tree, shrub and grass species that are adapted to the growth media and rehabilitation landforms from representative regional ecosystems surrounding the Project area. The species selection for the woodland habitat revegetation areas will be developed as part of the PRC Plan and will consider key ecological functional groupings including framework trees, woody understory species and native grasses according to the role or function they perform in both rehabilitation and non-mined environments (Emmerton et al., 2016a and 2016b) (**Table 4-4**).

The preferred seeding timing for woodland habitat is expected to be in September/early October or April/May when there is sufficient soil moisture in the profile. Sowing in cooler months can offer longer periods of surface moisture resulting from rain events, as well as reduced grass competition.

4.6.2.3 Watercourse PMLU

Watercourse revegetation activities will be implemented to establish riparian vegetation associated with a watercourse PMLU. The watercourse revegetation species will be developed as part of the PRC Plan and will be based on selecting framework trees, woody understorey and groundcover species associated with the natural watercourses occurring within the Project area. Competitive pasture species and short-lived wattle species would be excluded from the seed mix.

Revegetation activities would be scheduled most likely in August to October, when there is low chance of frost and less likelihood of significant rainfall.

Table 4-4: Life form and functional groups assigned to species based on their structural form or ecological function (Emmerton et al., 2016a and 2016b)

Life form and functional group	Code	Explanatory notes
Framework trees		
Eucalypt/ Bloodwood (Corymbia) species	E/C	*Eucalyptus, Corymbia,* and occasionally *Angophora* species (of any height) which can form an upper storey and often form recognisable vegetation communities but may exist within other communities
Non-eucalypt, non-acacia species	NE/NA	Non-eucalypt, non-wattle species (of any height) which can form recognisable communities, or which may exist in isolation and can become part of the upper storey
Long lived acacias	LLA	Wattle species which may form recognisable communities or exist as part of the upper storey in other communities (e.g. *Acacia shirleyi, Acacia rhodoxylon*)
Woody understory components		
Shrubby understorey	SU	A shrub is defined as: a woody plant that is multi-stemmed from the base (or within 200mm from ground level) up to 8m in height or if single stemmed, less than 2m tall (Eyre, et al, 2015). Therefore, an understorey shrub may include species that are sometimes regarded as small trees
Groundcover shrubs	GCS	Shrubs which form a groundcover
Vines/creepers	V/C	Vines or creepers that are perennial and have a woody component
Intermediate lifespan acacias	ILA	Sub-dominant wattles (*Acacia* spp.) which do not form a community in undisturbed natural ecosystems but can become dominant in rehabilitation areas
Short lifespan wattles	SLA	Wattles prevalent as an understorey in eucalypt communities with some level of disturbance and relatively short lived (≤10-years)
Introduced woody perennials	IWP	Introduced woody species potentially becoming weeds in some circumstances
Groundcover components		
Competitive pasture grasses	CPG	Aggressive introduced pasture grass species (considered to detract from ecosystem values)
Introduced grasses	IG	Less competitive naturalised species (less aggressive than the CPG group)
Native grasses	NG	Perennial and annual native grasses. Includes grass like plants (e.g. genera include: *Cyperus, Dianella* and *Lomandra*)

4.7 Rehabilitation Schedule

Land disturbed by mining activities will be rehabilitated progressively as it becomes available.

BWM is an operating mine site that will continue mining coal until 2085, subject to approvals, economics and market conditions. As mining progresses down-dip and the pits get deeper, the spoil dumps increase in height to accommodate all the spoil material. This process facilitates dumping as much material in-pit as possible and eliminates the requirement for out-of-pit dumping as part of the SA7/SA10 project. (Note, there is no out of pit dumping proposed.) Due to the large size of the BWM spoil dumps, the outside spoil dump areas (the areas to be rehabilitated) are only a small proportion of the operational dump surface as the dumps advance. Areas become available for rehabilitation as spoil dumps reach the final spoil dump extents and no further placement of material is scheduled.

For deep mines such as BWM, the amount of area available for rehabilitation progressively throughout the mine life is constrained by:

- *Mining rate:* If the mine plan is modified due to strategic or operational issues, the rate of mining can fluctuate accordingly. If mining rate slows, it follows that the timing of when areas become available for rehabilitation also slows. For the current mine plan, which is based on a production rate of 17.6 Mtpa, that is the maximum rate and will not be produced year on year. Hence the rehabilitation rates will also vary.
- *Access Ramps:* Dumping occurs over multiple dump faces at various heights, with multiple dump access ramps required for access. The dump access ramps can change location over time as the dumps progress, these access ramps, plus the coal access ramps, restrict the dump footprint available and results in the separate dump areas progressing at different rates. The access ramps also limit the area available for progressive rehabilitation until they are no longer required. Numerous coal access ramp voids are planned to be backfilled towards the end of mining. Once backfilled, these areas are also available for rehabilitation.
- *Geotechnical stability*: Dumps can only increase in height once mining has progressed sufficiently to ensure the lower dump benches have advanced sufficient distance for geotechnical stability of the spoil. This limits progressive rehabilitation to the outside of the lower dump benches as more spoil is dumped above. Significant areas become available for rehabilitation as the final bench is dumped.
- *Pit activity*: The spoil dump low walls continually advance and increase in height with the strip-mining operation. The low wall of each pit becomes available for rehabilitation once mining in the pit is complete.

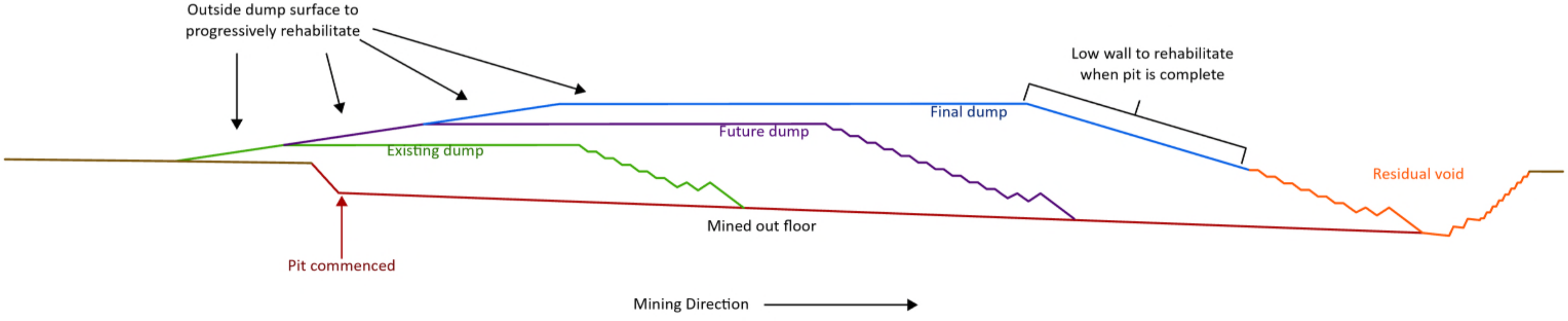
Therefore, in considering the constraints listed above, the external spoil dump areas do not become available for rehabilitation at a linear rate due to the mining and dumping sequence, configuration of spoil dumps and ramp access, and height and stability requirements to balance the required dump capacity. The majority of spoil dump areas become available later in the schedule as dumps reach their maximum extents at a faster rate, and the low wall areas become available once mining in each pit is complete. **Figure 4-3** illustrates the spoil dump progression and how areas available for rehabilitation are determined.

Other non-mining areas are typically required to support mining operations, such as infrastructure areas, and are therefore unavailable for rehabilitation until mining is complete. Areas associated with individual pits become available as mining finishes in each pit.

The residual voids/NUMAs are available for improvement once the PMLU low wall spoil rehabilitation is complete for each pit and any partial backfill for flood mitigation is complete.

The PRC Plan to be developed for the Project will include a detailed schedule for mine rehabilitation consistent with the PRC Plan Guideline.

As described above, the rate of rehabilitation is driven by the rate of mining. The mining rate of 17.6 Mtpa is the maximum rate sought for approval, but production rates will be variable over the life of the asset and potentially may be materially lower for some periods. This impacts the spoil dump area available for rehabilitation. Depending on the mine plan, rate of mining it is expected that across the whole site, not just SA7 and SA10, that BWM will be able to achieve approximately 80 hectares of rehabilitation (seeded) per annum. Further details on the rehabilitation schedule and milestones will be presented in the PRC Plan.



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BLACKWATER MINE - NORTH EXTENSION PROJECT

SCHEMATIC OF MINE AND SPOIL DUMP PROGRESSION

FIGURE 4-3

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro.aprx\620014601_PRCP_F4_03_Schematic of Mine and Spoil Dump Progression

4.8 Rehabilitation Goals, Milestones and Completion Criteria

4.8.1 Rehabilitation Goals

The rehabilitation goals for the Project are to establish a post-mining landform that is:

- Safe.
- Stable.
- Non-polluting.
- Able to sustain an agreed post-mining land use (PMLU areas) or achieved sufficient improvement (NUMA areas).

4.8.2 Rehabilitation Objectives, Indicators and Acceptance Criteria

In accordance with EA Condition E3, all areas significantly disturbed by mining activities will be rehabilitated in accordance with Table E1 (Rehabilitation Requirements), which outlines the rehabilitation objectives, indicators and acceptance criteria for each post mining land use. The BWM EA objectives, indicators and acceptance criteria for the cattle grazing, woodland habitat and watercourse PMLUs are outlined in **Table 4-5**.

4.8.3 Rehabilitation Areas, Improvement Areas and Milestones

Rehabilitation areas and rehabilitation milestones will be included in the PRC Plan. A 'Rehabilitation Area' is defined in the PRC Plan Guideline (DES, 2023a) as an area of land in the post-mine land use to which a rehabilitation milestone for the post-mining use relates. A 'Rehabilitation Milestone' is each significant event or step necessary to rehabilitate the land to a stable condition (section 112 of the EP Act). The proposed rehabilitation milestones for the Project may include:

- Infrastructure decommissioning and removal.
- Remediation and/or management of contaminated land.
- Landform development and reshaping.
- Surface preparation.
- Revegetation.
- Achievement of surface requirements.
- Achievement of post-mining land use to a stable condition.

Improvement areas and management milestones will be included in the PRC Plan. An 'Improvement Area' is defined in the PRC Plan Guideline (DES, 2023a) as an area of land in the NUMA to which a management milestone for the NUMA relates. A 'Management milestone' means each significant event or step necessary to achieve best practice management of the area and to minimise risks to the environment (section 112 of the EP Act).

The proposed management milestones for the Project may include:

- Achievement of structural stability.
- Achievement of surface requirements.
- Achievement of sufficient improvement.

Table 4-5: BWM Rehabilitation Objectives, Indicators and Acceptance Criteria

PMLU	Goal	Objective	Indicator	Acceptance Criteria
Cattle grazing	Safe to humans and wildlife	Safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use	Hazard assessment	No significant difference
	Stable	Rehabilitation is geotechnically stable	Factor of safety	≥1.5
		Rehabilitation is erosionally stable	Extent, slope gradient and groundcover	Groundcover >50% 70% of slopes ≤20%
	Non polluting	Rainfall runoff from rehabilitation achieves relevant water quality objectives for receiving waters	pH EC Turbidity	Not significantly different to upstream values
		Deep drainage from rehabilitation achieves relevant water quality objectives for groundwater	EC	Not significantly different to: the EPP (Water) schedule documents water quality objectives for relevant groundwater chemistry zones; or, local water quality objectives developed in accordance with the Queensland Water Quality Guidelines.
	Able to sustain the agreed post mining land use	Rehabilitation is suitable for sustainable cattle grazing	Land suitability assessment for cattle grazing	Land suitability class ≤3 or not different from pre-mining class if ≥4. Assessment completed in accordance with *LSA Framework for Open-Cut Coal Mine Rehabilitation 2018 (A ruleset for land suitability assessment of sustainable beef cattle grazing on land rehabilitated after open-cut coal mining in the Bowen Basin Queensland*) unless otherwise agreed in writing between the administering authority and the environmental authority holder.
			Leucaena stem density	<250 stems >2m height per ha (1 per 40m^2), mean total area

PMLU	Goal	Objective	Indicator	Acceptance Criteria
Woodland habitat	Safe to humans and wildlife	Safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use	Hazard assessment	No significant difference
	Stable	Rehabilitation is geotechnically stable	Factor of safety	≥1.5 unless an alternative is justified by an appropriately qualified person
		Rehabilitation is erosionally stable	Groundcover (steep slopes, >15%)	80%
			Groundcover (lesser slopes, ≤15%)	50%
	Non-polluting	Rainfall runoff from rehabilitation achieves relevant water quality objectives for receiving waters	pH EC Turbidity	Not significantly different to upstream values
		Deep drainage from rehabilitation achieves relevant water quality objectives for groundwater	EC	Not significantly different to: the EPP (Water) schedule documents water quality objectives for relevant groundwater chemistry zones; or, local water quality objectives developed in accordance with the Queensland Water Quality Guidelines.
	Able to sustain the agreed post-mining land use	Native bushland characteristics	Species richness	
			Trees Shrubs Grasses	≥2 ≥3 ≥4
			Tree canopy cover	≥16%

PMLU	Goal	Objective	Indicator	Acceptance Criteria
Watercourse	Safe to humans and wildlife	Safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use	Hazard assessment	No significant difference
	Stable	Rehabilitation is erosionally stable	Geomorphic index (IDC method)	Greater or equal to upstream or downstream values
	Non-polluting	Rainfall runoff from rehabilitation achieves relevant water quality objectives for receiving waters	pH EC Turbidity	Not significantly different to upstream values
	Able to sustain the agreed post-mining land use	Riparian vegetation	Riparian vegetation index (IDC method)	Greater or equal to upstream or downstream values

4.8.4 Monitoring, Maintenance and Reporting

Rehabilitation milestone monitoring will be undertaken to demonstrate achievement of the rehabilitation milestones, as they relate to achieving the PMLUs of cattle grazing, woodland habitat or watercourse. A combination of monitoring, reporting and data analysis approaches will be utilised to demonstrate the rehabilitation milestone has been met. Rehabilitation monitoring information collected will include, but not necessarily be limited to, species richness, regeneration, and vegetation structure/cover, photographic monitoring, erosion, topsoil parameters, surface water and groundwater parameters.

Rehabilitation monitoring data will be collected and analysed by an appropriately qualified person and assessed against the milestone criteria. The data will be analysed to identify changes and trends, as well as map the trajectory of rehabilitation to identify whether it is on track to achieve the milestone criteria or requires corrective actions or maintenance. The rehabilitation data will be stored and processed within internal geospatial and document management systems.

Maintenance will be implemented when monitoring identifies issues with the rehabilitation (e.g. erosion or inadequate vegetation cover), or when milestone criteria are not being met. Maintenance measures may include repairing areas of excessive soil erosion or additional seeding or planting to increase floristic diversity.

Management milestone monitoring will be undertaken to demonstrate achievement of the management milestones, as they relate to achieving sufficient improvement. A combination of monitoring and reporting approaches will be utilised to demonstrate the achievement of the management milestones.

Further details of the specific monitoring, maintenance and reporting will be provided in the PRC Plan.

4.9 Exploration Areas

Locations within SA7/SA10 that are disturbed for exploration activities will be rehabilitated in accordance with the *Eligibility Criteria and Standard Conditions for Exploration and Mineral Development Projects* (DEHP, 2016).

5 Project Justification and Alternatives

5.1 Justification

BMA is Australia's largest seaborne exporter of metallurgical (steelmaking) coal mined from its seven Bowen Basin coal mines. BHP's operations in Queensland make a significant contribution to the Queensland and Australian economy. Assets in the Bowen Basin have been progressively developed by BMA to meet long-term global demand for high quality metallurgical coals since the 1960s.

The BWM has been in operation since 1967 and has been subject to regular review of its feasibility in consideration of market demand. The long-term future of BWM and associated approvals for long-term access to BWM's resources including in SA7 on ML1762 and SA10 on ML1759 assist to secure the future of BWM, its customers, workforce and the surrounding community. The Project facilitates an opportunity to further contribute to Australia's position as a primary global producer of high-quality coking coal products.

If approved, the Project will contribute to BWM's mine life by mining within SA7 on ML1762 and SA10 on ML1759 to FY2085, sustaining jobs and royalties for years to come. The Project will utilise existing infrastructure at BWM for activities such as coal processing, tailings management, train load-out of product coal and water management.

The Project will maximise extraction and use of metallurgical coal reserves in an area largely disturbed by previous and existing land uses. As described in **Section 5.2**, the Project has been designed to avoid or minimise native vegetation clearance. Mitigation and management measures will be implemented to avoid or minimise impacts on environmental values.

The existing operations at BWM play a fundamental role in creating employment opportunities within the local and regional communities, which in turn, increases regional prosperity and domestic productivity. The local and regional community has established itself to service the existing mining complex, and is therefore accustomed to the benefits, costs and demands associated with the mining operations undertaken at BWM.

Development of SA7 on ML1762 and SA10 on ML1759 will, as part of the BWM operation, provide ongoing significant direct employment opportunities to the regional communities, and long-term flow-on social and economic benefits. The Project will also provide continued economic benefits to local and regional communities. The Project will also contribute to economic growth through sustained employment at the local and regional levels, primarily through local employment and business opportunities.

The benefits arising from ongoing operations facilitated by the Project will be greatest in areas where direct activity will occur, such as the nearby major population and service centres, i.e., Blackwater and Emerald. The Project will continue to:

- Support economic activity in the region and Queensland through direct and flow-on activity, and thus contribute to local, regional and State economic growth.
- Provide local businesses with opportunities to continue to secure new contracts and increase sales to service the Project and workforce needs.
- Enable the local sourcing of goods and services as well as labour from the local region, preferentially to elsewhere in Queensland and Australia.

- Employ local, regional then State-based employees as an order of preference. Benefits may be further enhanced through skills transfer and on-the-job skills development. Over 1,422 direct jobs are anticipated to be sustained as a result of the Project and the ongoing BWM operations.
- Directly contribute to infrastructure development in the region.

BMA has a long history with the Blackwater and Emerald communities and takes great pride in the delivery of social value for the community over 50 years. Some examples of BMA's economic contributions to the Blackwater and Emerald communities include the Blackwater International Coal Centre, Blackwater Swimming Pool, Blackwater State High School, Emerald State High School, Emerald Police-Citizens Youth Club, Central Highlands Science Centre, Central Highlands Mining Trail partnership with Central Highlands Development Corporation, Childcare Assessment Review, Capricorn Rescue Helicopters and Local Buying Program.

In addition, BMA funds environmental research through donations to the Reef Catchments, Fitzroy Basin Association and other organisations. Overall, the Project will contribute to economic growth through sustained employment at the Local, Regional and State levels, primarily through employment, local business opportunities and taxation revenues.

5.2 Alternatives

Alternatives to the Project have been considered and include alternative mining and infrastructure footprints. These are described below.

5.2.1 Project Location

The Project location is defined by the nature and scale of the deposit. The Project is located in the Bowen Basin and the geological strata in the vicinity of the BWM is heavily influenced by the series of easterly dipping thrust faults. The coal deposits mined at BWM are found within the Rangal Coal Measures. In the Project area the Rangal Coal Measures consist of up to 100 m of interbedded sandstone, siltstone, mudstone, and coal with tuff. The coal seams to be mined by the Project are within coal tenements held by BMA.

5.2.2 Full Footprint Development

The coal reserves within ML1759 and ML1762 at BWM extend further east than the proposed Project footprint. As described in **Chapter 1**, the BWM is currently scheduled to approach the western boundaries of SA10 on ML1759 and SA7 on ML1962 during FY2025. To facilitate the continuation of BWM it was considered appropriate to seek approval for an extension to the mine. Any progression of mining further to the east than that proposed by the Project would be subject to future environmental assessments and applications.

5.2.3 Non-Constrained Mine Plan – Sensitive Vegetation

The initial mine footprint for the Project was designed to maximise resource recovery within SA10 on ML1759 and SA7 on ML1762. While the majority of the Project footprint has been disturbed by agricultural activities (i.e., grazing), some Eucalypt woodland and Brigalow vegetation remains. The initial Project footprint would have resulted in substantially greater impacts to remnant vegetation that comprise Category B Ecologically Sensitive Areas.

The Project mine plan and footprint were revised to retain riparian vegetation associated with Deep Creek, Taurus Creek and Two Mile Gully. A buffer zone to the riparian vegetation from open cut mining activities has also been incorporated into the Project. Adjustments were also made in relation to the out of pit disturbance areas required for Project infrastructure (such as powerlines and back access roads), particularly where the alignments are required to traverse waterways to minimise the clearing of vegetation.

5.2.4 No Project

The Project is constrained by the characteristics of the coal resource, local geographic features, the environmental setting, existing infrastructure, and economic and technical feasibility considerations. As such, one alternative is to not proceed with the Project.

The direct consequences of not proceeding with the Project include the loss of sustained positive economic opportunities for the locality and the region. The potential positive impact of not proceeding with the Project is avoiding the potential environmental impacts. In this case, potential impacts to land, water, noise and air (including carbon dioxide emissions [CO_2-e]) (and associated physical, biological and social impacts) arising from the Project, would not occur.

Should the Project not proceed, the following high-level impacts are highly likely to be realised:

- A reduction in the overall life of the existing BWM.
- Curtailment of production and potential for earlier mine closure.
- The full benefits of the State's mineral resources would not be realised.
- A reduction in State and Federal tax revenues.
- An earlier reduction in the workforce, with the earlier ramping down from the existing 1,422 direct jobs provided by BWM, in regional Queensland.
- Negative economic impacts on local businesses in Blackwater and Emerald.
- Flow-on impacts to the local communities of Blackwater and Emerald.

5.3 Standard Criteria Assessment

The EP Act requires ERAs to be authorised by DES. When considering an application to amend an EA or when deciding on the conditions of an EA, DES must consider certain matters set out under the EP Act. One of those matters is the 'Standard Criteria'. The purpose of this assessment is to address each of these criteria to demonstrate how they will be met by BMA for the Project.

Schedule 4 of the EP Act defines the 'Standard Criteria' as:

a. *the following principles of environmental policy as set out in the Intergovernmental Agreement on the Environment—*
   i. *the precautionary principle;*
   ii. *intergenerational equity;*
   iii. *conservation of biological diversity and ecological integrity; and*

b. *any Commonwealth or State government plans, standards, agreements or requirements about environmental protection or ecologically sustainable development; and*

d. *any relevant environmental impact study, assessment or report; and*

e. *the character, resilience and values of the receiving environment; and*

f. *all submissions made by the applicant and submitters; and*

g. *the best practice environmental management for activities under any relevant instrument, or proposed instrument, as follows—*

    i. *an environmental authority;*

    ii. *a transitional environmental program;*

    iii. *an environmental protection order;*

    iv. *a disposal permit;*

    v. *a development approval; and*

h. *the financial implications of the requirements under an instrument, or proposed instrument, mentioned in paragraph (g) as they would relate to the type of activity or industry carried out, or proposed to be carried out, under the instrument; and*

i. *the public interest; and*

j. *any relevant site management plan; and*

k. *any relevant integrated environmental management system or proposed integrated environmental management system; and*

l. *any other matter prescribed under a regulation.*

Note criterion (c) omitted from the list above, has been repealed.

5.3.1 Criterion (a) – Ecologically Sustainable Development

This section outlines the Project's compatibility with the objectives and principles defined in Australia's National Strategy for Ecologically Sustainable Development (Commonwealth of Australia, 1992). The key Ecologically Sustainable Development (ESD) objectives and principles defined in the National Strategy for ESD are:

- To enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations.
- To provide for equity within and between generations (the Intergenerational Equity Principle).
- To protect biological diversity and maintain essential ecological processes and life-support systems.

The National ESD Strategy also identifies three specific objectives for the mining sector:

- To ensure mine sites are rehabilitated to sound environmental and safety standards, and to a level at least consistent with the condition of surrounding land.
- To provide appropriate community returns for using mineral resources and achieve better environmental protection and management in the mining sector.
- To improve community consultation and information, improve performance in occupational health and safety and achieve social equity objectives.

5.3.1.1 Individual and Community Well-being and Welfare

The Project will provide significant benefits, particularly to local and regional communities in terms of sustained contributions to household employment and income, training, business opportunities (Local and Regional) and increased Government revenues and reinvestment. BMA also makes significant donations to a variety of local organisations in the areas of education, health, indigenous groups, environment, sporting groups, and social community groups. More than A$13 M in social investment funding was contributed during the FY22 financial year to Queensland community organisations.

5.3.1.2 The Intergenerational Equity Principle

The Project addresses the welfare of future generations while realising economic benefits. The welfare of future generations has been considered through minimising disturbance, building beneficial infrastructure and a post-mining landform. The majority of mine infrastructure will be removed during closure and the majority of the post-mining landform will provide for post-mining land uses.

The Project has been designed to retain, where practicable, areas of ecological value and to minimise impacts on environmental values. Biodiversity offsets will be provided for the Project. The use of existing BWM and regional infrastructure improves the overall Project efficiency and resource utilisation and minimises the Project footprint.

Building intergenerational equity requires that the Project consider the long-term use of the land and community impacts. The Project seeks to safeguard the welfare of future generations and achieve intergenerational equity by achieving a post-mining landform consistent with the former landscape, where practical, recognising that mining has been undertaken in and around Blackwater since the early 1960's. This will continue to be achieved through the Project design, operational management, rehabilitation practices and environmental monitoring and reporting. A detailed PRC Plan will be prepared for the BWM incorporating the Project.

The principles of intergenerational equity have been addressed for the Project through assessment of the Project's contribution to climate change and greenhouse gas emissions, assessment of the impacts on climate change to potential Project impacts, consideration of potential short-term, long-term and cumulative impacts on environmental values and the development of monitoring programs, avoidance actions, mitigation measures and biodiversity offsets to adequately address the potential impacts.

In summary, through the continued use of sound management practices (currently in practice) and monitoring of the impacts of the Project, the Project will not significantly reduce, or fail to maintain, the health, diversity and productivity of the regional environment or affect future generations.

5.3.1.3 Protection of Biological Diversity and Essential Ecological Processes

While the majority of the Project footprint has been disturbed by previous and existing land uses (e.g., agriculture, exploration and mining-related activities), key decisions for the Project support the protection of biological diversity and ecological processes. Specifically, BMA has limited the overall footprint of the Project (to the extent that is reasonable and practicable) by retaining areas of remnant vegetation and utilising existing BWM infrastructure to avoid or minimise further vegetation clearing. Disturbance areas will be progressively rehabilitated and monitored to measure the success of the rehabilitation in line with the post-mine land use strategy.

The Project terrestrial and aquatic ecology assessments have assessed the ecological values of the Project area. Despite the Project area being highly modified, it supports a diversity of wildlife species, habitat features, vegetation communities and habitat for threatened species and communities.

Avoidance, mitigation and management measures will be implemented. These include, but are not limited to:

- The retention of native riparian vegetation associated with Deep Creek, Taurus Creek and Two Mile Gully, and the incorporation of a buffer zone to the riparian vegetation from open cut mining activities.
- Clearing of vegetation to be avoided or minimised where practical.
- The implementation of weed management practices to prevent the introduction and / or spread of weeds.
- Rehabilitation of mined land to include the use of native endemic species where appropriate to the proposed post-mining land use.

Further information on the assessment and protection of biological diversity is provided in the Terrestrial Ecology MNES Assessment (**Appendix G**), Terrestrial Ecology MSES Assessment (**Appendix H**) and Aquatic Ecology Impact Assessment (**Appendix I**).

5.3.1.4 Mine Site Rehabilitation

The rehabilitation schedule and milestones for the Project are described in **Chapter 4** and will be defined in further detail in the PRC Plan. Where the rehabilitation milestones are being met or are on-track to being met (as indicated by monitoring results), this will demonstrate that the rehabilitated landscape has reached a stable and sustainable condition and is able to be certified and relinquished.

5.3.1.5 Provide Appropriate Returns for Mineral Resources and Achieve Better Environmental Protection and Management in the Mining Sector

The Project will produce a product that is subject to international demand for the foreseeable future and will provide significant revenues to the Local, State and Commonwealth governments. The resource has been subject to detailed investigations to define the feasibility of its extraction and processing as reported in publicly available mineral resource and ore reserve statements, prepared in accordance with the JORC Code 2012.

The Project will not impact upon other resources, such as other mineral deposits and/or gas in the region. The northern end of the Project area overlaps a Petroleum and Gas tenement held by BOW CSG Pty Ltd (Potential Commercial Area permit number 264). However, the Project footprint does not overlap this Petroleum and Gas tenement.

5.3.1.6 ESD Guiding Principles

The guiding ESD principles, defined in the National Strategy for ESD, are:

- Decision-making processes should effectively integrate both long and short-term economic, environmental, social and equity considerations.
- Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation (the Precautionary Principle).
- The global dimension of environmental impacts of actions and policies should be recognised and considered.
- The need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised.

- The need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised.
- Cost-effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentives mechanisms.
- Decisions and actions should provide for broad community involvement on issues which affect them.

Each of these ESD guiding principles are addressed below.

<u>Decision-Making Based on Long and Short-Term Considerations</u>

The Project will provide immediate and long-term benefits to the economic and social fabric of Queensland and in particular to the community located in and around the Central Highlands Regional Council local government area. The Project will contribute to the Local, State and Commonwealth economies as described in **Section 5.1**.

<u>The Precautionary Principle</u>

The EP Act does not define the ‘precautionary principle’ but rather requires DES to consider it in the decision-making process under Schedule 4 of the Standard Criteria definition. Hence, it is considered appropriate to refer to the definition of the ‘precautionary principle’ as stated in Section 391 (2) of the *EPBC Act*, that being:

> *The precautionary principle is* that *lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage.*

To address this principle, BMA has undertaken an assessment of the risk of unacceptable environmental harm consistent with the precautionary principle. These findings have been incorporated into the development of appropriate environmental control strategies/mitigation strategies as outlined in the Technical Assessments for each relevant environmental discipline. Further, BMA has the technical and financial support and resources to establish and maintain the proposed environmental protection controls/mitigation measures proposed for the Project.

<u>Global Environmental Impact</u>

Reducing GHG emissions is a key component of BHP’s climate change policy. BHP’s medium-term target is to reduce operational GHG emissions (scope 1 and 2 from operated assets) by 30 per cent from FY2020 levels by FY2030 and in the long-term maintain net-zero operational emissions by 2050. For value chain (Scope 3) emissions, BMA’s goals are to:

- Support industry to develop technologies and pathways capable of 30 per cent emissions intensity reduction in integrated steelmaking, with widespread adoption expected post 2030.
- Support 40 per cent emissions intensity reduction of BHP-chartered shipping of its products.

BMA recognises that use of the coal products mined from BWM and consumed by customers generates carbon emissions. Hence working with customers (e.g., steelmakers) to develop technologies that reduce emissions intensity is an important part of BHP's approach to climate action.

<u>Development of a Strong, Growing and Diversified Economy which can enhance the Capacity for Environmental Protection</u>

The Project will contribute to extending the life of the BWM (to FY2085) and therefore benefits to Local, Regional and State economies. There will also be flow-on effects to other areas of the

Queensland economy as a result of the Project. BMA will continue to encourage the use of Local and Regional suppliers and contractors through the existing Local Buying Program. BMA adds further social value, by contributing to the BMA's Local Buying Foundation for transactions approved through the Local Buying Program.

Enhancing International Competitiveness in an Environmentally Sound Manner

The Project will continue to enhance Australia's international competitiveness by adopting the latest technology in mining and processing, while minimising environmental impacts. The Project will continue to operate under an EA and manage environmental impacts in accordance with regulatory requirements.

BMA is the largest seaborne metallurgical coal producer in Australia, with a global presence in export markets. In addition, BMA's high quality metallurgical coal products are expected to remain in demand for longer than other producers with lower quality coal products, particularly as international decarbonisation plans progress.

Cost-Effective and Flexible Policy Instruments

The Project will be managed in accordance with relevant State and Commonwealth Government legislation, policies, and standards.

Community Involvement in Decisions and Actions

BMA will continue to consult with stakeholders including but not limited to the Commonwealth, State and Local government, local community, business associations, surrounding landholders, agistment licence holders and Traditional Owners. The Project will continue to utilise the existing formal complaint procedure.

5.3.2 Criterion (b) – Applicable Commonwealth, State or Local plans, Standards, Agreements or Requirements

Commonwealth, State and Local plans, agreements, standards, and requirements have been considered in the environmental assessments for the Project.

5.3.2.1 Plans/Schemes

It is expected that the operation of the Project will be consistent with the Central Highlands Regional Council Planning Scheme 2016.

5.3.2.2 Agreements

The Commonwealth Government remains as a signatory to agreements on climate change, migratory birds, world heritage and biodiversity. There are four main principles of these conventions:

- The precautionary principle.
- Intergenerational equity.
- Conservation of biological diversity.
- Improved valuation, pricing and incentive mechanisms.

These principles, in relation to the Project, have been discussed in **Section 5.3.1**.

5.3.2.3 Standards and Requirements

Relevant standards include those set out under the *National Environment Protection Council (Queensland) Act 1994* (NEPC Act). This reflects the Commonwealth legislation, which provides for standards that will have effect nationally. National Environment Protection Measures (NEPMs) outline national objectives for protecting and managing aspects of the environment.

The NEPMs relevant to the Project are:

- Ambient Air Quality.
- Diesel Vehicle Emissions.
- Movement of Controlled Waste.
- National Pollutant Inventory.

These NEPMs have been considered during the environmental assessment stage for the Project.

5.3.2.4 Environmental Protection Policies

The following Environmental Protection Policies (EPPs) relevant to the Project provide a framework to manage development in an ecologically sustainable manner, in relation to air, acoustic, and water and wetlands environmental values:

- Environmental Protection (Water and Wetland Biodiversity) Policy 2019.
- Environmental Protection (Air) Policy 2019.
- Environmental Protection (Noise) Policy 2019.

<u>Environmental Protection (Water and Wetland Biodiversity) Policy 2019</u>

Assessment of potential impacts on the environmental values of water and wetlands in the Project area and surrounds has been undertaken for the Project by the Surface Water Resources Assessment (**Appendix E**), Groundwater Impact Assessment (**Appendix F**) and Aquatic Ecology Impact Assessment (**Appendix I**).

BMA will update the existing BWM Water Management Plan, as required, to incorporate relevant aspects of the Project based on the existing practices at the BWM. Mine affected water will be managed in accordance with the EA conditions for BWM. A comprehensive water balance model for the Project has been developed and is presented in **Appendix E**.

<u>Environmental Protection (Air) Policy 2019</u>

The EPP (Air) establishes guidelines for ambient air quality. Schedule 1 of the EPP (Air) provides air quality objectives for a range of airborne contaminants. The Project will generate greenhouse gas emissions and other air pollutants which have the potential to impact on the air quality in the vicinity of the Project. An air quality assessment has been undertaken to assess the potential for impacts from the Project's emission sources on air quality as informed by BWM's EA conditions. The results of the assessment are presented in **Chapter 8** and **Appendix C**. Dust management practices and controls will be implemented to mitigate air emissions from the Project.

Environmental Protection (Noise) Policy 2008

The EPP (Noise) covers environmental values and acoustic quality objectives. The Project will generate noise and contribute to the acoustic values in the surrounding area. Potential impacts from the Project and management of those impacts are described in **Chapter 9** and **Appendix D**.

5.3.3 Criterion (d) – Environmental Impact Study

BMA has prepared environmental assessments commensurate to a major EA Amendment Application (not requiring an EIS) subject to the provisions of the EP Act. These environmental assessments have focused on the critical matters of air quality, noise and vibration, surface water resources, groundwater resources, terrestrial ecology, aquatic ecology, groundwater dependent ecosystems and waste. The environmental assessments conducted have considered the existing environmental values, the potential impacts of the Project, and the avoidance, management, mitigation, rehabilitation and offset measures to be implemented.

5.3.4 Criterion (e) – Character, Resilience and Values of Receiving Environment

The BWM is situated amongst a coal mining region in the central Bowen Basin where resource extraction, agriculture and livestock grazing are the predominant, co-existent land uses. As a result, the landscape has been highly modified.

Chapters 6 to 14 provide a description of the character, resilience and values of the receiving environment.

5.3.5 Criterion (f) – Submissions made by Applicant and Submitters

The EA Amendment and associated environmental studies will constitute BMAs submission in support of the Project's EA Amendment Application. BMA will undertake an appropriate level of formal and non-formal key stakeholder consultation during the EA Amendment process. Further to any formal public notification process, BMA will respond to complaints and concerns from the public during all phases of the Project should they arise.

5.3.6 Criterion (g) – Best Practice Environmental Management

Best practice environmental management is defined in the EP Act, Section 21 as: The management of the activity to achieve an ongoing minimisation of the activity's environmental harm through cost-effective measures assessed against the measures currently used nationally and internationally for the activity.

BHP's environmental management processes are set out in the '*Our Requirements – Environment and Climate Change*' and other *Our Requirements* standards. At every stage in the life cycle of our operated assets, BMA seeks to avoid, minimise and mitigate adverse environmental impacts and have frameworks, policies and processes to achieve the environmental objectives. To support continual improvement in environmental performance, each of BMA's operated assets has an Environmental Management System (EMS) that aligns with ISO14001 standards. BWM's existing management plans will be updated to incorporate the Project.

5.3.7 Criterion (h) – Financial Implications

The Project will financially benefit the local and regional communities directly, not only in value adding but also in providing the local community with sustained employment and opportunity. The Project has the technical and financial support to establish and maintain commitments associated with infrastructure requirements and environmental management controls.

5.3.8 Criterion (i) – Public Interest

The Project will provide sustained employment and wealth for the region. Issues of community interest and concern will be addressed during the EA Amendment process. BMA will continue to engage with the relevant key stakeholders in relation to the Project as an extension of its existing key stakeholder engagement program.

5.3.9 Criterion (j) – Site Management Plan

An Environmental Management Framework exists at BWM. The existing environmental management plans will be updated accordingly stating the management strategies to prevent or minimise the potential for environmental harm from the Project and will also set out a framework to manage environmental obligations set out in the EA.

5.3.10 Criterion (k) – Proposed integrated environmental management system

The Project will operate in accordance with the existing Environmental Management Framework and other related documentation.

5.3.11 Criterion (l) – Other matters

An EA under the EP Act is required for undertaking a resource activity, which includes a mining activity authorised under a ML. A single EA is required for all resource activities that are carried out as a single integrated operation. In this regard, an application to amend EPML00717813 has been prepared for the Project.

The EA includes authorisations for impacts to environmental values and management measures for these impacts. An EA Amendment is required for the Project to authorise open cut mining at BWM within SA10 on ML1759 and SA7 on ML1762.

6 Land Resources

6.1 Introduction

A Land Resources Assessment Report been completed by SLR (2023a) for the Project and is provided in **Appendix A**.

6.2 Environmental Values

6.2.1 Climate

The Bureau of Meteorology (BoM) operates the rainfall gauges for the nearest meteorological station at Blackwater Water Treatment Plant (BoM Station 035290, 1995-2010), located approximately 20 km north of the BWM. The annual average rainfall for this station is 542.0 mm with most rain occurring between October and February. More recent information has been obtained from Blackwater Airport (BoM Station 035134. 2022-2023). The annual average rainfall for this station is 671.4 mm with most rain occurring between October and February.

6.2.2 Topography

The topographic elevations in and around the Project range from approximately 180 meters Australian Height Datum (mAHD) (in the north-east) to 230 mAHD (in the south). Most of the Project is situated on gently undulating lowlands and plains with slopes of 0 per cent to 5 per cent.

6.2.3 Vegetation and Land-Use

The Project is highly modified from historic vegetation clearing, cattle grazing, weed encroachment and fragmentation and subject to direct and indirect effects of the operation of BWM. The vegetation within the Project is largely regrowth brigalow and eucalypt woodland communities. The areas of non-remnant vegetation are now largely dominated by introduced Buffel Grass and have been raked of woody debris and rocks and continue to be grazed by livestock.

Vegetation within the Project area is described further in **Chapter 12** and detailed in the terrestrial ecology reports provided in **Appendix G** and **Appendix H**.

6.2.4 Land Systems

Three land systems occur within the Project: Daunia, Blackwater and Comet. These are dominated by lowlands with brigalow and cracking clay soils on weathered and fresh Permian shales and lithic sandstone.

The Project covered by each Land System and a brief description of attributes is presented in **Table 6-1**. The Land System mapping indicates Vertosols comprise the major soil type within the Project.

Table 6-1: Land Systems in the Project

Land System	Land System Description	Project (hectares)	Project (per cent)
Blackwater	Brigalow plains and cracking clay soils on weathered Tertiary clay and older rocks along the central axis of the Project.	5,706	63
Daunia	Lowlands with brigalow and cracking clay soils on weathered and fresh Permian shales and lithic sandstone in the north and centre.	2,276	25
Comet	Alluvial plains with brigalow and cracking clay soils, often flooded, along major streams.	1,028	11
	Total	**9,010**	**100**

6.2.5 Soil Classification and Description

6.2.5.1 Dominant soil types

The soils assessment and subsequent laboratory analysis indicated a total of three dominant and four sub-dominant soil orders within the Project according to the Revised Australian Soil Classification (Isbell, 2021). The dominant soil types within the Project are Self-Mulching Black-Brown Vertosols, Eutrophic Red Dermosols and Eutrophic Black-Brown Dermosols.

6.2.5.2 Vertosols

Vertosols are soils with the following:

- A clay field texture of 35 per cent or more clay throughout the solum except for a thin, surface crusty horizons 0.03 m or less thick.
- When dry, open cracks occur at some time in most years. These are at least 5 mm wide and extend upward to the surface or to the base of any plough layer, peaty horizon, self-mulching horizon, or thin, surface crusty horizon.
- Slickensides and/or lenticular peds occur at some depth in the solum.

Self-Mulching Black-Brown Vertosols were identified as the dominant soil type.

The Vertosols within the Project generally consisted of brown to black light to heavy clay A horizons (topsoil) with moderate structure, overlying a medium to heavy medium clay B2 horizon with strong subangular blocky structure. The topsoil showed moderately alkaline, non-sodic and non-saline properties. The B2 horizon generally showed strongly alkaline, sodic to strongly sodic and slightly to moderately saline properties.

6.2.5.3 Dermosols

Dermosols are soils other than Vertosols, Hydrosols, Calcarosols and Ferrosols which:

- Have B2 horizons with a moderate or strong structure throughout the major part of the horizon.
- Do not have clear or abrupt textural B horizons.

The Dermosols were further classified into the following dominant soil types:

- Eutrophic Black-Brown Dermosols.
- Eutrophic Red Dermosols.

The Dermosols within the Project generally consisted of very dark brown to dark reddish-brown clay loam to light clay A horizons (topsoil) with moderate structure, overlying a typically light clay B2 horizon with strong subangular blocky structure. The topsoil showed neutral, non-sodic and non-saline properties, whilst the B2 horizon generally showed strongly alkaline, strongly sodic and moderately saline properties.

6.2.5.4 Soil Map Units

Within the Project, a total of four Soil Map Units (SMU) were identified based on the dominant Australian Soil Classification (ASC) soil types. The dominant and sub-dominant soil types per SMU are shown in **Table 6-2**. A summary of the SMUs is provided in the Land Resources Assessment (**Appendix A**).

Table 6-2: SMU Soil Types and Areas

Soil Map Unit	Dominant Soil Type	Sub-Dominant Soil Types	Area (hectares)	Percentage (per cent)
1	Self-Mulching Black-Brown Vertosols	Dermosols, Sodosols	8,275	92
2A	Eutrophic Red Dermosols	Nil	167	2
2B			168	2
3	Eutrophic Black-Brown Dermosols	Chromosols	400	4
		Total	**9,010**	**100**

6.2.5.5 Soil Resources

Based on the soil survey results, topsoil resources available in the Project are summarised in **Table 6-3**. It is noted that these soil resources are presented for informative purposes as not all areas within the Project area are planned to be stripped.

Table 6-3: Available Soil Resource Summary

Topsoil Map Unit	ASC Soil Type	Area (hectares)	Topsoil Depth (m)	Topsoil Volume (m^3)
1	Self-Mulching Black-Brown Vertosol	8,275	0.1	8,275,000
2A	Eutrophic Red Dermosol	167	0.1	167,000
2B	Eutrophic Red Dermosol	168	0.2	336,000
3	Eutrophic Black-Brown Dermosol	400	0.1	400,000
			Topsoil Volume Available	**9,178,000**

6.3 Potential Impacts to Land Resources

6.3.1 Land Suitability

6.3.1.1 Pre-Mining

The land suitability assessment has rated SMU 1, which covers the majority of the Project, as Class 4 for cropping and Class 3 for grazing, with the main limitations being soil wetness (W) and soil water availability (M). SMUs 2A, 2B and 3 are rated as Class 5 for cropping and Class 4 for grazing, with the same limitations as SMU 1.

6.3.1.2 Post-Mining

Land suitability (cropping and grazing) classes for areas not scheduled for the proposed mining activity disturbances are likely to remain the same. This includes some Class 4 and 5 cropping and Class 3 and 4 grazing areas located in the east of the Project.

Areas scheduled for the proposed mining activity disturbances that are outside of the boundary of the final void area, will be managed and rehabilitated. The approaches described in **Section 6.4** aim to result in successful rehabilitation to the proposed Post Mining Land Use (PMLU). The PMLU within the disturbance areas will have the following implications to the pre-mining land suitability classes:

- The PMLU areas to be rehabilitated to cattle grazing will likely retain the pre-mining land suitability classes.
- The PMLU areas to be rehabilitated to woodland habitat will present additional limitations to the land which will reduce the land suitability to marginal land with severe limitations (Class 4) or unsuitable land (Class 5).

6.3.2 Agricultural Land

6.3.2.1 Pre-Mining

The agricultural land assessment indicates the Project, consisting of SMU 1, 2A, 2B and 3, is rated as Class C1, pastureland, suitable for grazing improved and native pastures.

6.3.2.2 Post-Mining

Agricultural land classes for areas not scheduled for the proposed mining activity disturbances are likely to remain the same. This includes some Class C1 located in the eastern portion of the study area. Areas scheduled for the proposed mining activity disturbances will be managed and rehabilitated to meet their assigned PMLU. The PMLU within the disturbance areas will have the following implications to the pre-mining agricultural land classes:

- The PMLU areas to be rehabilitated to cattle grazing will likely retain the pre-mining agricultural land classes.
- The PMLU areas to be rehabilitated to woodland habitat will present additional limitations to that land, which will result in a Class C3 or Class D agricultural land class classification.

6.3.3 Land Capability

6.3.3.1 Pre-Mining

The Land capability assessment indicates SMU 1, is rated as Class III land suitable for all agricultural uses but with moderate restrictions for cultivation. The main limitations of the Class III area are wetness, soil salinity/sodicity and landscape complexity. The balance of the Project is rated as Class IV, which is land primarily suited to pastoral use but may be safely used for occasional cultivation with careful management. The main limitations of the Class IV area are soil water availability, soil salinity/sodicity and landscape complexity. Results for the pre-mining land capability assessment and the detailed Land capability assessment are provided in the Land Resources Assessment **(Appendix A)**.

6.3.3.2 Post-Mining

Land capability classes for areas not scheduled for the proposed mining activity disturbances are likely to remain the same. This includes some Class III and Class IV areas located in the eastern portion of the Project. Areas scheduled for the proposed mining activity disturbances will be managed and rehabilitated to their assigned PMLU. The PMLU within the disturbance areas will have the following implications to the post-mining land capability classes:

- The PMLU areas to be rehabilitated to cattle grazing will likely retain the pre-mining land capability classes.
- The PMLU areas to be rehabilitated to woodland habitat will present additional limitations to that land, which will result in a Class VII or Class VIII land capability classification.

6.3.4 Grazing Suitability

6.3.4.1 Pre-Mining

The grazing suitability assessment indicates SMU 1 within the Project is rated as Class 4, with the main limitations being soil water availability (m), nutrient supply (Nr), soil physical factors and subsoil erosion (Es). SMU2A, is rated as Class 3 with the main limitations of soil water availability and salinity. The balance of the Project made up of SMU2B and SMU3 are rated as Class 4, with the main limitations of soil water availability (m) and soil physical factors (p). Results for the grazing suitability are provided in the Land Resources Assessment (**Appendix A)**.

6.3.4.2 Post-Mining

Grazing suitability classes for areas not scheduled for the proposed mining activity disturbances are likely to remain the same. This includes the Class 3 and some Class 4 areas located in the eastern portion of the Project. Areas scheduled for the proposed mining activity disturbances will be managed and rehabilitated to meet their assigned PMLU. The PMLU within the disturbance areas will have the following implications to the pre-mining grazing suitability classes:

- The PMLU areas to be rehabilitated to cattle grazing will likely retain the pre-mining grazing suitability.
- The PMLU area to be rehabilitated to woodland habitat will present additional limitations (e.g., steeper slopes and increased rockiness), which will result in unsuitable (Class 4 or 5) grazing suitability.

6.4 Mitigation and Management Measures

The mitigation measures and approach to management of impacts to land resources will be provided through the development and implementation of progressive rehabilitation and closure plans. Further information on the proposed approach to progressive rehabilitation and closure planning for the Project is provided in **Chapter 4**.

6.4.1 Rehabilitation

6.4.1.1 Rehabilitation Goals

The BWM PRC Plan is yet to be developed. BWM has a transitional notice for the PRC Plan and once developed, submitted, and approved, the PRC Plan will guide the long-term rehabilitation and closure strategy for BWM. The BWM PRC Plan is due to be submitted in November 2024.

In accordance with the conditions of the BWM EA, all areas significantly disturbed by mining activities will be rehabilitated in accordance with Table E1 of the EA. Table E1 outlines objectives, indicators and acceptance criteria for rehabilitation relating to goals for creating land that is:

- Safe to humans and wildlife.
- Non-polluting.
- Stable.
- Able to sustain an agreed post-mining land use.

The stability of the post-mine landform will be achieved by applying sound rehabilitation practices. Landforms will be established following mining, using soils capable of supporting vegetation communities adapted to the local environment. The rehabilitation practices are designed to stabilise the landform, protect downstream water quality, and aid a sustainable outcome for the Project area.

6.4.1.2 Rehabilitation Methodology

Rehabilitation of the Project will be in accordance with the BWM rehabilitation commitments as per the upcoming PRC Plan and the EA.

6.4.1.3 Soil and Material Balances

Soils for rehabilitation are salvaged and made available for reuse in establishing a soil profile on the post-mining landform. Volume calculations and soil balance will be determined to inform post-mining requirements for soil depths.

The estimated volume of suitable soil throughout the study area is summarised in **Section 6.3.1** and an includes 9,178,000 m^3 of topsoil (as shown in **Table 6-3**).

The soil survey and laboratory results were used to determine depth of soil material suitable for recovery and reuse as material in rehabilitation. Factors requiring management considerations include sodicity, salinity and alkalinity.

6.4.1.4 Soil Sourcing and Substitution

Suitable topsoil will be stripped for use in later rehabilitation. The topsoil will either be stockpiled until suitable re-contoured areas are available, or directly returned across areas to be rehabilitated. The results of the land resources assessment identified that the topsoil resources are adequate for the rehabilitation of the disturbed areas.

Where practicable soil will be stripped in a slightly moist condition and not stripped in either an excessively dry or wet condition to prevent pulverisation of the natural soil aggregates or damage of the resource through compaction by equipment.

To reduce soil degradation during stripping operations preference will be given to using equipment which can grade or push soil into windrows such as graders or dozers for later collection by conventional truck and shovel techniques. This will minimise compaction impacts of heavy equipment that is often necessary for economical transport of soil material. These techniques are examples of preferential, less aggressive soil handling systems which may be adopted.

6.4.1.5 Soil Placement and Management

All soils removed will be placed in designated stockpile areas or returned to areas available for immediate rehabilitation. Freshly stripped and placed topsoil retains more viable seed micro-organisms and nutrients than stockpiled soil, and vegetation establishment is generally improved by the direct return of topsoil and is considered 'best practice' topsoil management. Where long term storage stockpiles be proposed, accurate records are required indicating stockpile volumes and locations. Soil stockpiles within work areas could be used as long term batters or bunds to facilitate noise amelioration, visual screening and surface water diversion where required.

The following management and mitigation strategies and/or the BWM Topsoil Management Procedure (where applicable) is to be implemented to reduce degradation during stockpiling operations.

- Locations of stockpiles will be recorded using GPS along with data relating to the soil type and volume. An inventory of available soil is maintained and updated regularly to ensure adequate topsoil will be available for planned rehabilitation activities.
- The surface of soil stockpiles will be left in as coarsely structured condition where practicable to promote rainfall infiltration and minimise erosion prior to cover vegetation becoming established.
- Soil types with significantly different properties will be stockpiled separately.
- Storage time will be minimised, where possible. If long term stockpiling is planned, stockpiles may be seeded with an annual cover crop.
- Growth media including topsoil will be spread to depths according to target requirements.
- Where possible, suitable growth media will be re-spread directly onto rehabilitation areas. Growth media will be treated with fertiliser and seeded in one consecutive operation, reducing the potential for compaction and topsoil loss to wind and water erosion.

Stockpiles are not disturbed until required for rehabilitation, weed management, erosion control or for seeding and fertilising purposes. Ameliorants are applied post-spreading of soil resources on rehabilitation areas.

6.4.1.6 Vegetation Establishment

Timing

Revegetation operations will consider both the season and timing of potential germination during the drier months. The preferred seeding timing for woodland habitat is expected to be in September/early October or April/May when there is sufficient soil moisture in the profile.

Revegetation

Revegetation methods for all types of disturbed land within the study area will normally consist of the following:

- Respreading of freshly stripped or stockpiled topsoil.
- Contour ripping.
- Application of appropriate fertiliser and ameliorants for plant establishment, after soil chemical analysis, if required.
- Seeding with the appropriate seed mix.

Contour ripping is used as an erosion control measure immediately after surface preparation and before revegetation. A seed mix containing pasture grass and/or local native shrub and tree species is used to establish a sustainable vegetation cover suitable for the post mining land use. Further information is included in **Chapter 4**.

Erosion and Sediment Control

The principal objectives of erosion and sediment control for rehabilitation areas are to:

- Minimise erosion and sedimentation from all active and rehabilitated areas, thereby minimising sediment ingress into surrounding surface waters.
- Segregate contact water (surface run-off from disturbed catchments e.g., active areas of disturbance, stockpiles and rehabilitated areas until stabilised) from clean water (surface run-off from catchments that are undisturbed or relatively undisturbed by Project-related activities and rehabilitated catchments) and maximise the retention time of contact water so that any discharge from the disturbance area is in line with the EA.
- Avoid the potential for runoff and incorporate suitable erosion and sediment control measures in accordance with the BWM ESC Plan.
- Manage surface flows upstream of any surface disturbance during Project works so that rehabilitation activities are not affected by excessive run-on water.
- Establish sustainable long-term surface water management features following rehabilitation of the site, including implementation of an effective revegetation and maintenance program.
- Monitor the effectiveness of erosion and sediment controls and maintain, in accordance with the requirements of the BWM ESC Plan.
- Land disturbance will be restricted to that necessary for the Project.
- Disturbance will be controlled using the BWM Permit to Disturb process and in accordance with the EA.
- All available topsoil will be salvaged for use in rehabilitation, where practicable.
- Erosion from topsoil stockpiles will be managed in accordance with the BWM ESC Plan which requires stockpile sites to be located outside the limits of drainage lines, with controls to prevent mobilising stockpiled material and capture sediment.
- Topsoil stockpiles will be managed in accordance with the BWM Topsoil Management Procedure.
- Stormwater and runoff from catchments directly upstream of the study area will be diverted away from the site during Project works.
- Vehicles to utilise maintained tracks and roads.

Table 6-4 summarises the risks associated with surface disturbance and the associated erosion and sediment control measures which can be applied.

Table 6-4: Erosion Causes and Control – Soil Disturbance Activities

Area	Control Measure
Cleared Land	• Restrict clearing to areas essential for the Project works. • Windrow vegetation debris along the contour. • Minimise length of time soil is exposed. • Divert run-off from undisturbed areas away from the Project works. • Direct run-off from cleared areas to be dealt with as outlined in the BWM ESC Plan.
Rehabilitation	• Install drainage control works as outlined in the BWM ESC Plan. • Spread topsoil or appropriate growth media, rip on the contour and seed with appropriate seed mix.
Infrastructure	• Vehicles to utilise maintained tracks and roads. • Sediment will be controlled as outlined in the BWM ESC Plan. • Rehabilitate disturbed areas around work sites as soon as practicable after becoming available.

6.4.2 Land Resources Mitigation Measures

The following general mitigation strategies will be implemented by the Project to minimise the extent and severity of land disturbance and constraints on rehabilitation, thus mitigating risks that could result in environmental impacts:

- Clearing will occur within the area approved via the BWM's Permit to Disturb process.
- Appropriate storage and management of hydrocarbons and hazardous materials within the MIA to prevent contamination of land e.g., bunding.
- Disturbance to be undertaken in consideration of water flows that could affect land resources during early mining activities.
- Topsoil will be stripped prior to mining and direct re-spread is the preferred method to minimise topsoil handling and reduce damage to soil structure and propagules.
- Topsoil that is not directly re-spread will be stockpiled for re-use in rehabilitation.
- Appropriate surface water management measures are to be implemented including clean water diversions, and use of in-pit sumps and sediment dams to capture mine affected runoff and stormwater as outlined in the Water Management Plan.
- Monitoring and maintenance of rehabilitation until post-mining land use criteria and relinquishment have been achieved.

7 Geochemistry

7.1 Introduction

A Geochemical Assessment of mineral waste that may be produced by the Project was completed by Terrenus Earth Sciences (Terrenus, 2022). The assessment report is provided in **Appendix B** and summarised in the following sections.

7.2 Assessment Methodology

Mineral waste is the broad term for 'geologic' (soil and rock) materials disturbed during mining and processing of coal and comprises overburden and interburden (collectively called spoil) and coal reject materials produced from the CHPP (all grain sizes, including dewatered tailings).

Terrenus has geochemically assessed potential overburden and interburden and coal from drill-hole samples, and coal reject samples obtained from the CHPP. All geochemical data has been sourced from BHP (primarily from the BHP coal geochemical database).

Geochemical samples were obtained from two sources:

- Drill-core samples collected and analysed during 2019-2020 by BWM and BHP Minerals Australia Closure Planning team.
- Tailings (fine reject) samples collected from the CHPP since 2010 by BWM and the BHP Minerals Australia Closure Planning team. A small number of coarse reject sample results were available from samples collected from coarse reject disposal areas at BWM.

The number of drill-hole samples of each key mineral waste group/type are approximately proportional to the drill-hole meterage of the mineral waste type in the assessment drill-holes. Tailings and coarse reject samples are representative of fine and coarse reject expected to be produced from the CHPP from processing RoM coal from the Project.

All samples were assessed with respect to their ability to generate acid and metalliferous drainage (AMD) and salinity. AMD includes acid/acidic drainage (AD), neutral and metalliferous drainage (NMD) and saline drainage from sulfide oxidation (SD). Samples representing materials likely to report to final landform surfaces (i.e., spoil samples) also underwent assessment for sodicity and dispersion potential.

The geochemical characteristics associated with mineral waste materials are discussed by type:

- Non-carbonaceous spoil (n=638 samples) – estimated to represent about 92 per cent of the total mineral waste and about 98 per cent of spoil. About 15 per cent of non-carbonaceous spoil will be weathered material.
- Carbonaceous spoil (excluding coal reject) (n=63 samples) – estimated to represent about two to three per cent of the total mineral waste and about two per cent of spoil. Of this, essentially all will be unweathered (fresh). This material type comprises materials described as carbonaceous and/or coaly (excluding coal from target seams).
- Tailings (n=180 samples) – fine-grained mineral waste from the CHPP. Estimated to represent about two per cent of the total mineral waste.
- Coarse reject (n=15 samples) – coarse-grained gravel to cobble-sized mineral wastes from the CHPP. Estimated to represent about 3 per cent of the total mineral waste.

- Coal (n=87 samples) – will predominantly report as RoM coal that is stored temporarily on a RoM pad pending processing. A small proportion of coal from non-target seams/plys will report as waste and may also remain exposed on the highwall.

7.3 Environmental Values

7.3.1 Geochemical Characteristics of Non-Carbonaceous Mineral Waste

7.3.1.1 AMD Potential of Non-Carbonaceous Spoil

Non-carbonaceous spoil, as a bulk material, is expected to generate pH-alkaline to highly alkaline contact water (run-off and seepage).

The total sulfur (total S) concentration of this material is very low, with a 90th percentile total S concentration of 0.06 per cent. As such and combined with acid neutralising capacity (ANC) values (median 44 kilograms of sulfuric acid per tonne of rock [kg H_2SO_4/t]), which is significantly higher than the maximum potential acidity (MPA) (median 0.9 kg H_2SO_4/t), greater than 99 per cent of samples (634 out of 638 samples) were classified as non-acid forming (NAF). Due to the very low total S concentration, this material has a negligible potential to generate saline drainage (SD) due to sulfide oxidation.

ANC is expected to be about 50-60 per cent available under field conditions, with dolomite (ankerite) and iron-dolomite being the main carbonate minerals contributing to the acid buffering potential of the spoil. Siderite, present in minor quantity, does not provide any net ANC. Overall, non-carbonaceous waste has excess acid neutralising capacity.

Total metal and metalloid concentrations from 122 samples are very low compared to average element abundance in soil in the earth's crust. That is to say, non carbonaceous spoil has low enrichment in total metals and metalloids compared to unmineralised rocks. Soluble multi-element results indicate that leachate from non-carbonaceous spoil is expected to contain low concentrations of soluble metals and metalloids.

In summary, non-carbonaceous spoil – which is expected to represent about 92 per cent of the total mineral waste at the Project – has a negligible potential to generate AMD as either AD and/or NMD and/or SD.

7.3.1.2 Salinity Potential of Non-Carbonaceous Spoil

Non-carbonaceous spoil has electrical conductivity (EC) values ranging from 137 to 1,670 µS/cm with 90th percentile values of 387 and 502 µS/cm.

In summary, contact water (run-off and seepage) from non-carbonaceous spoil is expected to be non-saline, either as a result of dissolution of geogenic salts and/or from sulfide oxidation (sulfate salinity).

7.3.1.3 Sodicity and Dispersion Potential of Non-Carbonaceous Spoil

Non-carbonaceous spoil samples (n=117) had modest cation exchange capacity (CEC) values and high exchangeable sodium percentage (ESP) values, resulting in all except two samples being classified as 'strongly sodic'. The CEC and ESP values suggest that this material type would be subject to some degree of dispersion. Emerson Class testing on all samples found that all samples displayed 'some dispersion'.

In summary, non-carbonaceous spoil is expected to be strongly sodic with potential for dispersion.

7.3.2 Geochemical Characteristics of Carbonaceous Spoil

7.3.2.1 AMD Potential of Carbonaceous Spoil

Carbonaceous spoil, as a bulk material, is expected to generate pH-alkaline to highly alkaline contact water (run-off and seepage).

The total S concentration of this material is generally low, with a 90th percentile value of 0.57 per cent and similarly low 90th percentile sulfide (Scr) concentration of 0.35 per cent. A small number of samples had moderate to high total S (and Scr) concentrations. Due to the generally low total S concentration, this material has a low potential to generate SD due to sulfide oxidation.

Combined with generally moderate ANC values (median 22 kg H_2SO_4/t) and relatively low MPA values (median 5.5 kg H_2SO_4/t), and net acid generation pH (NAGpH) values generally greater than pH 4.5, 86 per cent of carbonaceous samples were classified as NAF, with a further nine per cent classified as NAF-S [i.e., NAF with total S greater than 1 per cent] or Uncertain (UC)(NAF) [i.e. uncertain, but expected to be NAF]. Three (out of 63 samples) were classified as potentially acid forming (PAF), low capacity PAF (PAF-LC) or UC(PAF) [i.e., uncertain, but expected to be PAF].

ANC is expected to be about 20-30 per cent available under field conditions, with iron-dolomite and dolomite (ankerite) being the main carbonate minerals contributing to the acid buffering potential of carbonaceous spoil. Siderite, present in minor quantity, does not provide any net ANC.

Total metal and metalloid concentrations are generally very low compared to average element abundance in soil in the earth's crust. Soluble multi-element results indicate that leachate from carbonaceous spoil is expected to contain low concentrations of soluble metals and metalloids – similar to non-carbonaceous spoil.

In summary, carbonaceous spoil has a generally low potential to generate AD and/or NMD and/or SD. A very small proportion of this material type has some potential to generate low-level AD and/or NMD and/or SD.

7.3.2.2 Salinity Potential of Carbonaceous Spoil

Carbonaceous spoil has similar EC values to non-carbonaceous spoil – ranging from 110 to 1,260 µS/cm, with median and 90th percentile values of 367 and 509 µS/cm.

In summary, and consistent with non-carbonaceous spoil, contact water (run-off and seepage) from carbonaceous spoil is expected to be non-saline, either as a result of dissolution of geogenic salts and/or from sulfide oxidation (sulfate salinity).

7.3.2.3 Sodicity and Dispersion Potential of Carbonaceous Spoil

Carbonaceous spoil samples (n=63) had low CEC and high ESP values comparable to non-carbonaceous samples, resulting in all samples being classified as 'strongly sodic'. The CEC and ESP values suggest that this material type would be subject to some degree of dispersion. Emerson Class testing on all samples found that all samples displayed 'some dispersion'.

In summary, and consistent with non-carbonaceous spoil, carbonaceous spoil is expected to be strongly sodic with potential for dispersion.

7.3.3 Geochemical Characteristics of Tailings

7.3.3.1 AMD Potential of Tailings

Tailings is expected to generate pH-alkaline contact water (run-off and seepage).

The total S concentration of this material ranges from low to high, but is generally low-moderate to high, with 75th and 90th percentile total S values of 1.44 per cent and 4.92 per cent, respectively. The proportion of total S as sulfide was highly varied in the tailings samples, ranging from four per cent to 100 per cent of total S. The generally low-moderate to high total S concentration of tailings suggests some tailings may have some potential to generate SD due to sulfide oxidation.

The ANC of samples spanned a wide range, from less than one to 129 kg H_2SO_4/t, with the median ANC (33 kg H_2SO_4/t) being only slightly higher than the median MPA (26 kg H_2SO_4/t). These results, combined with half of the tailings samples having NAGpH values below pH4.5, resulted in 31 per cent of tailings samples being classified as PAF or PAF-LC and 17 per cent classified as UC(PAF). That is, about half of 180 tailings samples were classified as PAF, PAF-LC or UC(PAF). Of the remaining samples, 31 per cent were classified as NAF and 19 per cent as UC(NAF).

Kinetic geochemical test-work conducted on low-moisture tailings samples suggests relatively moderate to rapid pyrite oxidation rates of PAF tailings, with lag times until potential acidification (under oxidising conditions) ranging from less than one month to several years.

Some 36 per cent of the tailings samples had an uncertain classification and have been tentatively classified as UC(NAF) or UC(PAF) based on comparing the data available for these samples with the results from tailings samples where extensive geochemical test-work has been undertaken. In view of the potential limitations of the results, the classification of the samples is conservative and classifying approximately half of the tailings samples as PAF is likely an upper limit.

ANC is expected to be about 55-65 per cent available under field conditions, with ANC availability expected to range from about 20-75 per cent, with iron-dolomite and dolomite (ankerite) as the main neutralising minerals contributing to the acid buffering of carbonaceous spoil. Siderite, present in minor quantity, does not provide any net ANC.

With some exceptions, the total metal and metalloid concentrations from 34 samples tested are generally low compared to average element abundance in soil in the earth's crust. Soluble multi-element results indicate that leachate from tailings is expected to contain low concentrations of soluble metals and metalloids. Leachate from PAF tailings after oxidation has the potential to generate low pH leachate (AD) or NMD with elevated sulfate and soluble metal and metalloid concentrations. Under brackish and saline leaching conditions mobilisation of soluble metals and metalloids is also expected to be low.

In summary, a significant proportion (up to half) of tailings currently reporting to the tailings storage facility (TSF) (and also expected to be representative of tailings to be produced by the Project) have a moderate to high potential to generate AMD as either AD and/or NMD and/or SD.

7.3.3.2 Salinity Potential of Tailings

Tailings has EC values ranging from 274 to 4,980 µS/cm, with median and 90th percentile values of 659 and 1,135 µS/cm, respectively.

In summary, contact water (run-off and seepage) for most current tailings is expected to be slightly to moderately saline, either as a result of dissolution of geogenic salts and/or from sulfide oxidation (sulfate salinity). A small proportion of current tailings are saline to strongly saline, with moderate potential for SD (from sulfide oxidation). The salinity characteristics of future tailings from the Project are expected to be comparable to existing tailings.

7.3.3.3 Geochemical Characteristics of Coarse Reject

Limited coarse reject sampling and analysis has been undertaken and, as such, the data is not statistically valid. Two thirds of the reject samples (10 samples) were clearly NAF, with relatively high ANC and low total S values, producing moderate to strongly negative net acid producing potential (NAPP) values. The remaining reject samples (5 samples) had varying AMD classifications of PAF, PAF-LC and UC(PAF).

The available data suggests that coarse reject is expected to have environmental geochemical characteristics potentially more similar to coal and carbonaceous spoil than to tailings – a finding that is consistent with the geochemical characteristics of coarse reject – generally – from similar Permian coal mining operations with the Bowen Basin (Terrenus 2022; **Appendix B**).

Coarse reject has EC values (from 15 samples) ranging from 451 to 2,020 µS/cm, with median and 90th percentile values of 1,120 and 1,806 µS/cm, respectively, and has generally low total S concentrations similar to coal. On this basis – and acknowledging the small dataset – contact water (run-off and seepage) is expected to be slightly to moderately saline, either as a result of dissolution of geogenic salts and/or from sulfide oxidation (sulfate salinity).

7.3.4 Geochemical Characteristics of RoM Coal

7.3.4.1 AMD Potential of RoM Coal

RoM coal, as a bulk material, is expected to generate pH-alkaline to highly alkaline contact water (run-off and seepage).

The total S concentration of this material is generally low, with 90th percentile total S and Scr values of 0.51 per cent and 0.25 per cent, respectively.

Coal samples have a wide range of ANC values from less than 0.5 to 166 kg H_2SO_4/t however the median ANC is low (12 kg H_2SO_4/t) and, as such, 47 per cent of samples were classified as NAF with a further 21 per cent classified as UC(NAF) – with the remaining 32 per cent classified as PAF, PAF-LC or UC(PAF).

Some 27 per cent of the coal samples had an uncertain classification and have been tentatively classified as UC(NAF) or UC(PAF) based on comparing the data available for these samples with the results from coal samples where extensive geochemical test-work has been undertaken. In view of the potential limitations of this extrapolation of the results, the classification of the samples is conservative and classifying approximately one-third of coal samples as PAF (to some degree) is likely an upper limit. The generally low sulfur concentrations in coal samples indicate that the sulfate loads from sulfide oxidation would likely be low.

Total metal and metalloid concentrations from 23 samples tested are generally low compared to average element abundance in soil in the earth's crust. Soluble multi-element results from 23 samples tested indicate that contact water (run-off and seepage) from coal is expected to contain low concentrations of soluble metals and metalloids.

In summary, RoM coal has a low potential to generate AMD as either AD, NMD or SD.

7.3.4.2 Salinity Potential of RoM Coal

Coal has lower EC values from 31 to 623 µS/cm, with low median and 90th percentile values of 107 and 259 µS/cm, respectively.

On a RoM pad, coal is expected to generate low-salinity contact water (run-off and seepage). Due to the relatively low total S concentrations and the short exposure (temporary storage) of RoM coal, the potential for salinity release, either by dissolution of geogenic salts and/or from sulfide oxidation (sulfate salinity), is low.

7.4 Potential Impacts

The assessment considered geological and geochemical data within the existing BWM (northern pits) and the Project footprint. The geological environment is consistent between the existing (northern) mining area and the Project footprint.

The assessment has demonstrated that the environmental geochemical characteristics of new mineral waste materials expected to be generated by the Project are consistent with current mineral waste materials being generated at BWM.

The ongoing implementation of the management and mitigation measures for spoil and tailings is anticipated to continue to manage geochemical risks as posing a low risk of environmental harm.

The management of soil and tailings generated by the Project will be consistent with the current EA approved management strategies.

7.5 Mitigation and Management Measures

7.5.1 Management and Mitigation of Spoil

The management of overburden and interburden (spoil) materials generated by the Project will be consistent with the current approved mine waste management strategy – comprising the disposal of overburden and interburden into in-pit spoil dumps, then progressively rehabilitated – with run-off and seepage captured by the mine water management system.

Spoil is overwhelmingly NAF with excess ANC and has a negligible risk of developing AMD, including AD, NMD or SD. Furthermore, surface water run-off and seepage from spoil is expected to be non-saline with relatively low soluble metal/metalloid concentrations. However, some spoil is expected to be strongly sodic with potential for dispersion and erosion.

Where highly sodic and/or dispersive spoil is present it will not, wherever practicable, report to final landform surfaces and will not be used in construction activities. Tertiary spoil has generally been found to be unsuitable for construction use or on final landform surfaces (Australian Coal Association Research Program [ACARP], 2004 and 2019). It is unlikely that sodic and potentially dispersive spoil will be able to be selectively handled and emplaced during operation of the Project. Therefore, in the absence of such selective handling, spoil landforms will be constructed with short and low (shallow) slopes and progressively rehabilitated to minimise erosion. Where practical, and where competent rock is available, armouring of slopes may also be completed.

If rock is used for construction activities, this will be limited to unweathered Permian sandstone, as this material has been generally found to be more suitable for construction and for use as embankment covering on final landform surfaces.

Surface water run-off and seepage from spoil, including any rehabilitated areas, will be monitored for ‘standard’ water quality parameters including, but not limited to, pH, EC, major anions (sulfate [SO_4], chloride [Cl] and alkalinity), major cations (sodium [Na], calcium [Ca], magnesium [Mg] and potassium [K]), total dissolved solids (TDS) and a broad suite of soluble metals/metalloids.

With the implementation of the proposed management and mitigation measures spoil is regarded as posing a low risk of environmental harm.

7.5.2 Management and Mitigation of Tailings

Based on the current assessment, tailings are a mix of NAF and PAF materials, with geochemical properties controlled by the blend of coal seams being processed on the day. Potentially half of all tailings pose a moderate (to potentially high) AMD hazard with respect to generation of AD and/or NMD and/or SD, with lag times until potential AMD generation under relatively dry conditions of months to years. Under very moist or saturated conditions these lag times would be extended considerably (potentially indefinitely). Mineralogical analysis shows tailings to have a high clay content, comprising hydrophilic swelling clays (typical for Bowen Basin Permian coal tailings).

The management of tailings generated by the Project will be consistent with the current EA approved management strategies for tailings – comprising their disposal as a slurry into the TSF (or similar approved tailings disposal area).

7.5.3 Management and Mitigation of Coarse Reject

Based on the current assessment, coarse reject materials are regarded as posing a generally low AMD hazard with respect to generation of acidity and/or sulfate, however some coarse reject materials are expected to have some potential to generate low-level AMD.

The management of coarse reject generated by the Project will be consistent with the current approved management strategies for coarse reject – comprising their disposal within in-pit spoil dumps at designated disposal areas. Seepage would be confined within the footprint of the open cut pit and would drain into/towards open cut pit areas (and therefore be captured by the mine water management system). Surface water run-off would drain into mine dams/drains and also be captured by the mine water system. Therefore, when buried deeply amongst alkaline NAF spoil the risk of environmental harm and health-risk that emplaced coarse reject poses is very low.

7.5.4 Validation of Tailings and Coal Reject Characteristics

BMA will undertake geochemical test-work of tailings and coarse reject samples. Test-work would, at minimum, comprise a broad suite of environmental geochemical parameters, such as pH, EC (salinity), acid-base accounting (ABA) parameters, sulfur speciation, and total and soluble metals/metalloids analysis.

7.5.5 Management of RoM Coal and RoM Stockpiles

RoM coal is not mining waste, and surface water run-off and seepage from RoM stockpiles will not report off-site and will be managed as part of the mine water management system. RoM coal generated by the Project is expected to have a low risk associated with potential acid, salt and soluble metals generation. Surface water run-off from RoM coal and product coal stockpiles will also be assessed on a periodic basis.

RoM coal will be stored at BWM for a relatively short period of time (days to weeks) compared to mineral waste materials, which will be stored at BWM in perpetuity. Management practices are therefore different for RoM coal (compared to spoil) and will largely be based around the operational (day-to-day) management of surface water run-off from RoM coal stockpiles, as is currently accepted practice at coal mines in Australia.

The mine water management system will be monitored for 'standard' water quality parameters including, but not limited to, pH, EC, major anions (sulphate, chloride and alkalinity/acidity), major cations (calcium, potassium, magnesium and sodium), TDS, and a broad suite of soluble metals/metalloids.

8 Air Quality

8.1 Introduction

An Air Quality Assessment has been prepared by Advanced Environmental Dynamics (AED, 2023) for the Project and is included as **Appendix C**. The Air Quality Assessment assesses the potential Project impacts on environmental values of air and proposed mitigation and management measures. The Air Quality Assessment is summarised in the sections below.

8.2 Environmental Values

8.2.1 Existing Receptors

The BWM EA provides definitions for sensitive and commercial places. Based on the EA definition, receptors surrounding the Project are listed in **Table 8-1** and identified on **Figure 8-1**. Highlighted rows within the table indicate that the receptor is not considered 'sensitive' as defined in the EA.

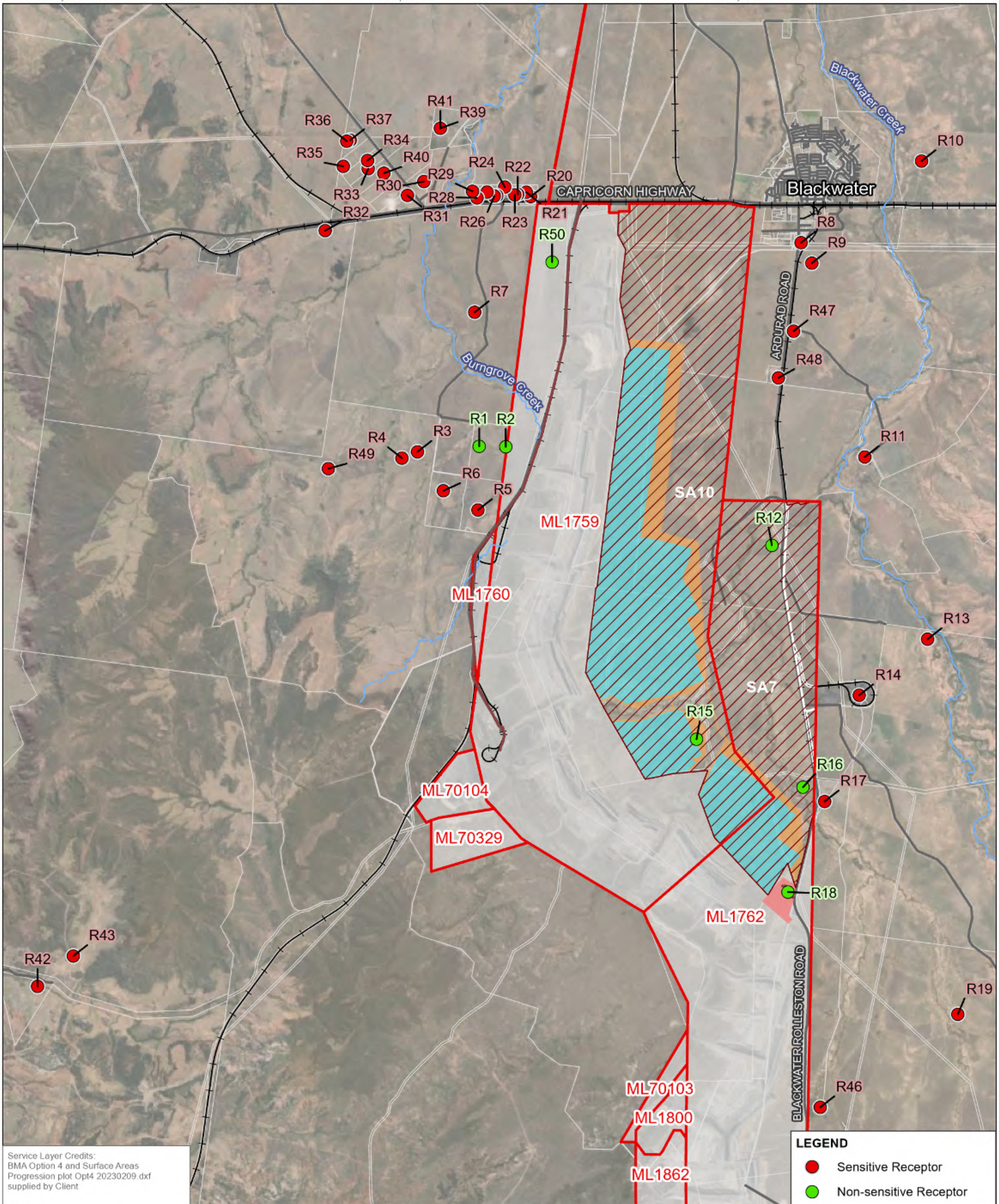
Table 8-1: Receptor Locations

ID	Easting (m) [A]	Northing (m) [A]	Description
R1	682,332	7,383,198	BMA
R2	683,118	7,383,184	BMA
R3	680,506	7,383,036	Private - Tolmies Creek Homestead (HS)
R4	680,046	7,382,848	Private - Tolmies Creek HS
R5	682,295	7,381,314	Private - Ausbute HS
R6	681,271	7,381,884	Private
R7	682,199	7,387,165	Private - Burngrove HS
R8	691,856	7,389,223	Private - (edge of Blackwater township)
R9	692,174	7,388,618	Private - Minyango HS
R10	695,420	7,391,637	Private - Cardona HS
R11	693,741	7,382,883	Private - Tantallon HS
R12	690,992	7,380,267	BMA
R13	695,598	7,377,492	Private - Yarrawonga HS
R14[B]	693,576	7,375,833	QCoal (Cook Colliery - north)
R15	688,762	7,374,534	Private - Taurus HS
R16	691,913	7,373,114	Private - Stewarton HS
R17	692,554	7,372,690	Private - Retreat HS
R18	691,468	7,370,011	BMA - BWM MIA & Administration
R19	696,492	7,366,393	Private - Tannyfoil HS
R20	683,854	7,390,585	Private
R21	683,725	7,390,717	Private
R22	683,471	7,390,656	Private

ID	Easting (m) [A]	Northing (m) [A]	Description
R23	683,386	7,390,637	Private
R24	683,088	7,390,869	Private
R25	682,852	7,390,613	Private
R26	682,776	7,390,604	Private
R27	682,564	7,390,721	Private
R28	682,268	7,390,548	Private
R29	682,136	7,390,744	Private
R30	680,696	7,391,034	Private - Tulloch Ard HS
R31	680,210	7,390,623	Private
R32	677,776	7,389,581	Private - Maryvale HS
R33	679,048	7,391,412	Private - Malamy HS
R34	679,029	7,391,655	Private - Malamy HS
R35	678,311	7,391,482	Private - Sherborne HS
R36	678,413	7,392,228	Private
R37	678,517	7,392,258	Private
R39	681,182	7,392,608	Private
R40	679,512	7,391,279	Private
R41	681,184	7,392,609	Private
R42	669,266	7,367,221	Private - Monash HS
R43	670,323	7,368,118	Private
R46[B]	692,423	7,363,643	QCoal (Cook Colliery - south)
R47	691,633	7,386,604	Blackwater Cemetery
R48	691,184	7,385,223	Resource Recovery Centre
R49	677,869	7,382,537	Quarry
R50	684,392	7,388,504	BWM Airport

A: Based on GDA 2020 MGA Zone 55 coordinate reference.

B: The Cook Colliery meets the definition of ‘commercial place’ in the current BWM EA, however, is an operating coal mine with its own EA.



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:150,000 at A4
Project Number:	620.014601
Date Drawn:	06-Dec-2023
Drawn by:	NT

LEGEND

- Railway
- Road
- Watercourse
- Mine Acces Road
- BWM Mining Lease
- BWM North Extension Project Area
- Cadastre
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BMA
BHP Mitsubishi Alliance

BLACKWATER MINE - NORTH EXTENSION PROJECT

PROJECT AREA AND RECEPTOR LOCATIONS

FIGURE 8-1

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_AQ_CH_F08_1_Project_Receptors

8.2.2 Existing Air Quality Environment

8.2.2.1 Meteorological Environment

Hourly averaged wind speed and direction data from the DES Blackwater monitoring station[5] indicates the predominance of easterly winds at this location. The data highlights the variation in wind conditions as a function of the time of day. Of particular note is the increased frequency of light winds during the night and an increased frequency of elevated winds during day time hours **(Appendix C).**

Rainfall data sourced from the BoM Blackwater Airport monitoring station[6] indicated that the average annual rainfall was 548 mm, whilst an annual total of 327 mm was recorded in 2019. With approximately 180 mm recorded in March 2019, the balance of the year experienced significantly less than average rainfall. Further details and discussion of the meteorological environment is provided in **Appendix C**.

Key findings of the data analysis that are relevant to the Air Quality Assessment include:

- Seasonal variability in wind speed and direction, with increased frequency of light winds during the night and an increased frequency of elevated winds during day time hours.
- Drier conditions (i.e., less rainfall) during the winter months.

A detailed analysis of the meteorological conditions was undertaken in order to identify conditions that lead to an increased risk of elevated levels of dust. In general, worst-case meteorological conditions for open-cut mining operations fall into two categories:

- **Temperature Inversions**: Characterised by calm conditions and the development of low level temperature inversions (typically in winter) that trap dust close to the Earth's surface. Dust levels under these conditions have been observed to increase rapidly over very short periods of time. Inhibiting the dispersion of dust away from the source, the strength and duration of a temperature inversion event can be very difficult to forecast. The collapse of the inversion layer (typically just after sunrise) is associated with a rapid rate of dispersion of the trapped dust and an associated reduction in ground level concentrations.
- **Wind Events**: Elevated wind conditions that lead to the generation of significant windblown dust, particularly from exposed areas. Wind events are typically associated with elevated levels of visible dust and an increase in dust deposition. Wind events in the Bowen Basin are likely associated with summer storms or a synoptic front associated with a regional weather system. The minimum wind speed required to initiate wind erosion will vary depending on the properties of the exposed material, however, in general a lift off velocity of approximately 5.4 m/s is suggested by the literature (e.g., NPI, 2012). Data from the DES Blackwater monitoring station, for the period 10 April 2019 through 09 April 2022, highlighted that winds above 5.4 m/s were recorded approximately 11.3 per cent of the time.

Data analysed from mid-2018 through 2019, which assessed the occurrence of both categories of worst-case meteorological conditions indicated:

- Infrequent elevated levels of dust associated with high wind speeds (i.e., wind events).
- Frequent elevated levels of dust associated with low wind speeds.

[5] 10 April 2019 to 09 April 2020

[6] January 2014 to December 2022

8.2.2.2 Background Air Quality

For the purposes of estimating background levels for the 24 hour average concentration of PM_{10}, hourly averaged data from the DES Blackwater monitoring station has been used. Commissioned on 10/04/2019, the 70th percentile 24 hour average concentration of PM_{10} for the period 10/04/2019 indicated in **Figure 8-2**, there were a total of 18 exceedances of the EPP(Air) objective of 50 µg/m^3 for the 24 hour average concentration of PM_{10}.

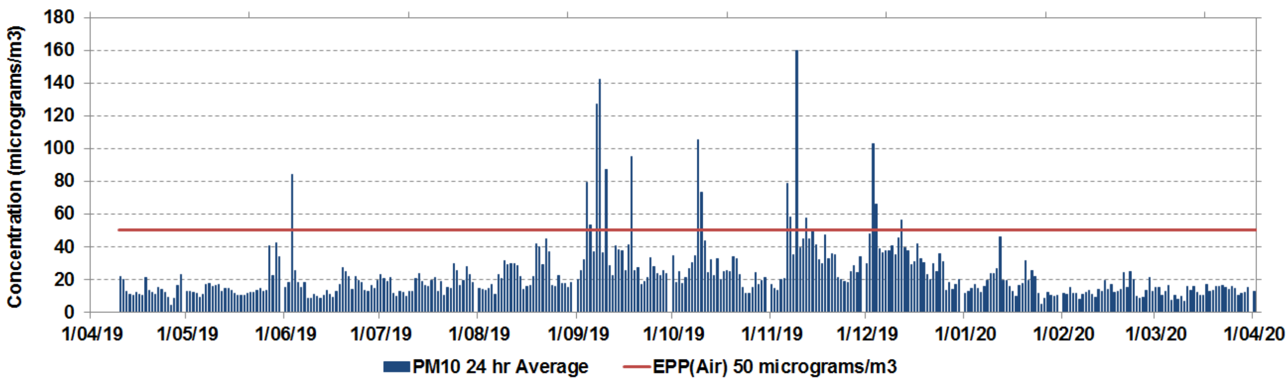


Figure 8-2: DES Blackwater monitoring station data – 24 hour average concentration of PM_{10}

An estimate for the annual average concentration of TSP has been developed based on an assumption that 50% of TSP is in the form of PM_{10}. Estimates of background levels are summarised in **Table 8-2**.

Table 8-2: Estimate of Background Levels

Pollutant	Averaging Period	Estimated Background Level	Source
Dust deposition	Monthly	36 mg/m^2/day	BWM Dust deposition gauge data.(1)
TSP	Annual	45.2 µg/m^3	Inferred from DES Blackwater monitoring station data.(3)
PM_{10}	24 hour	23.7 µg/m^3	DES Blackwater monitoring station.(2)
	Annual	22.6 µg/m^3	DES Blackwater monitoring station.(2)

Note: (1) Data collected over the period 06/2014 through 12/2021 has been used.

(2) Data collected over the period 04/2019 to 04/2022 has been used.

(3) Based on an assumption that 50 per cent of TSP is in the form of PM_{10}.

8.2.3 Assessment Criteria

8.2.3.1 Relevant EA Conditions

Under BWM's EA, the requirement to demonstrate compliance with air quality objectives specified in Schedule B of the EA is triggered by a request from the administering authority (Condition A14).

Specifically, Schedule B includes ambient air quality objectives for the monthly average of dust deposition (Condition B4(a)) and the 24 hour average concentration of PM_{10} (Condition B4(b)) (**Table 8-3**). To date, in relation to air quality, Condition A14 has not been triggered.

Additional pollutants and/or averaging periods of interest to the administering authority that have been considered in this assessment include the annual average of TSP and the annual average of PM_{10} (**Table 8-3**).

Table 8-3: Air Quality Assessment Objectives

Pollutant	Averaging Period	Assessment Objectives	Source
Dust deposition	Monthly	120 mg/m^2/day	EA condition B4(a) (1,2)
TSP	Annual	90 µg/m^3	QLD Environmental Protection (Air) Policy
PM_{10}	24 hour	50 µg/m^3	EA condition B4(b) (1,2)
	Annual	25 µg/m^3	QLD Environmental Protection (Air) Policy

Note: (1): Monitoring required *when triggered by EA Condition A14.*

(2): *Exceedances due to events that cannot be managed by the environmental authority holder, such as bush fires, fuel reduction burning for fire management purposes or dust storms, would not be considered to be in breach of condition B4 if the environmental authority holder can demonstrate that the exceedance was caused by such events.*

8.3 Air Quality Assessment Methodology

8.3.1 Dust Emission Sources

To assess potential impacts of the Project, a series of dust emission sources were modelled such that key drivers could be identified and dust levels could be predicted for various scenarios. Through understanding the contribution of various emission sources, predictions could be compared against the Air Quality Assessment air quality objectives and the extent to which mitigation measures may be required could be investigated.

Dust emission sources that have been explicitly modelled include (and are limited to):

- Coal mining, hauling and dumping.
- Waste removal by dragline.
- Waste removal by truck and shovel fleets including the loading of trucks, hauling and truck dumping.
- Reject haulage.
- Dozer dragline support.
- Dozer operations in support of in-pit coal operations.

- Dozer operations in support of waste handling.
- CHPP activities (crushing, stacking, reclaiming).
- TCP activities (crushing, stacking, reclaiming).
- Wind erosion of exposed areas.

8.3.2 Dust Emission Scenarios

Two mining scenarios for the Project based on business as usual (BAU) dust management practices (inclusive of all dust reduction measures in **Section 8.5.1**) were assessed:

- Project Without (BAU) Case: The mining of BWM as permitted under current mining approvals.
- Project With (BAU) Case: The mining of BWM that includes the Project.

Incremental changes in air quality outcomes that are attributed to the Project were calculated as the difference in the results for the Project With (BAU) Case compared with those of the Project Without (BAU) Case over the life of mine (LoM).

8.3.3 Dust Emissions Inventory

The National Pollutant Inventory (NPI) has produced a series of Emission Estimation Technique Manuals (EETM) that are intended to provide data on emissions of air pollutants from a wide variety of industries/activities. The NPI EETM for Mining V3.1 (NPI 2012) has been used to develop estimates of the amount of TSP and PM_{10} emitted from the various dust generating activities and incorporating site-specific information where available. Emission factors from the NPI EETM for Mining were supplemented with those from the US EPA's AP42 (USEPA, 1995) as required.

The TSP and PM_{10} emissions inventories for the Project Without (BAU) Case for selected years for mining is presented in **Table 8-4** with those for the Project With (BAU) Case presented in **Table 8-5**.

8.3.4 Overview of Dispersion Modelling

Regional, three-dimensional wind fields that are used as input into the dispersion model were prepared using a combination of The Air Pollution Model (TAPM) developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) (Hurley, 2008), CALMET, the meteorological pre-cursor for CALPUFF (Scirer, 2000). One year of hourly meteorology corresponding to 2019 was developed. The CALPUFF dust dispersion model was used for this assessment based on the CALMET meteorological data set for 2019.

A preliminary screening assessment of results for the 24 hour average concentration of PM_{10} for a total of 86 assessment locations[7] was undertaken (results not presented). The findings of this assessment were used to identify a sub-set of worst case representative receptor(s) for clusters of receptor locations and/or individual locations (**Table 8-6**). Results for receptors that were significantly less than those presented here have not been explicitly included. Tabulated results for the six representative locations in **Table 8-6** and shown in **Figure 8-3** are presented.

[7] The term assessment location refers to a location that is of potential interest that has been assessed as part of the Air Quality Assessment, but does not necessarily constitute a 'sensitive receptor'.

The management of dust by BWM in accordance with its EA Conditions at these locations is considered to be sufficient to ensure compliance with EA Conditions at locations for which results are not explicitly provided in this report. The dispersion modelling provides predictions of air quality outcomes, based on a number of assumptions, and the results should be interpreted with these limitations in mind. Assumptions and interpretation guidance is provided in **Appendix C**.

Table 8-4: Project Without (BAU) Case: Emissions Inventory for Selected Years of Mining

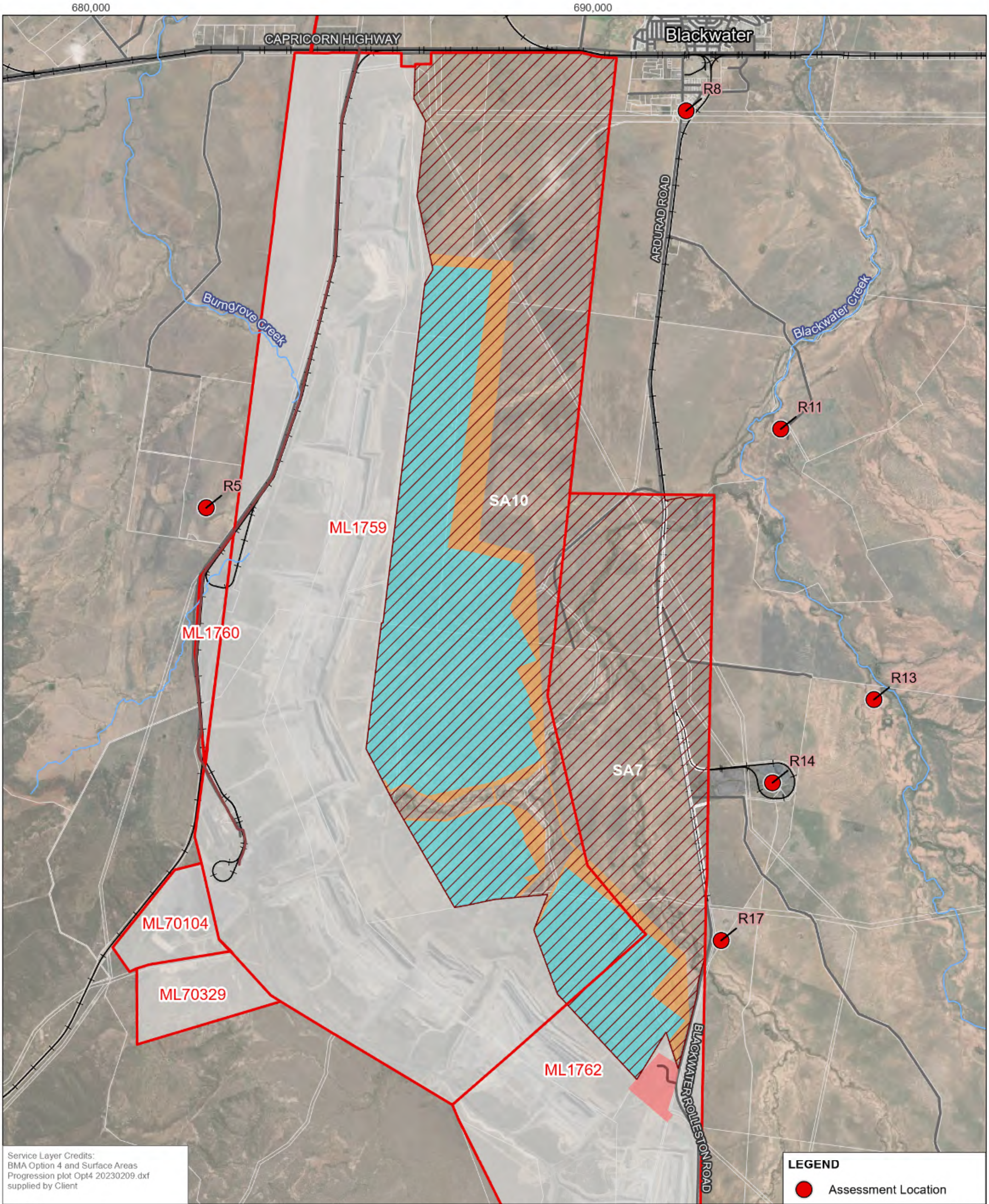
Activity	Units	FY30	FY50	FY70
TSP				
Dragline	tonnes/year	1,597	734	695
Coal handling	tonnes/year	1,455	1,037	708
Rejects handling	tonnes/year	13	17	15
Waste handling by truck and shovel	tonnes/year	13,424	16,289	13,529
Dozers	tonnes/year	816	497	567
CHPP	tonnes/year	233	233	233
TCP	tonnes/year	66	66	66
Subtotal		**17,604**	**18,872**	**15,813**
Wind erosion (disturbance)	tonnes/year	18,960	13,953	11,903
Total		**36,564**	**32,825**	**27,716**
PM_{10}				
Dragline	tonnes/year	487	224	212
Coal handling	tonnes/year	1,405	1,014	695
Rejects handling	tonnes/year	13	17	15
Waste handling by truck and shovel	tonnes/year	7,304	8,308	6,920
Dozers	tonnes/year	214	130	149
CHPP	tonnes/year	233	233	233
TCP	tonnes/year	66	66	66
Subtotal		**9,722**	**9,992**	**8,289**
Wind erosion (disturbance)	tonnes/year	9,480	6,976	5,952
Total		**19,202**	**16,969**	**14,241**

Table 8-5: Project With (BAU) Case: Emissions Inventory for Selected Years of Mining

Activity	Units	FY30	FY50	FY70
TSP				
Dragline	tonnes/year	1,833	1,110	844
Coal handling	tonnes/year	1,467	1,013	560
Rejects handling	tonnes/year	14	28	16
Waste handling by truck and shovel	tonnes/year	13,352	24,254	24,100
Dozers	tonnes/year	973	993	841
CHPP	tonnes/year	233	233	233
TCP	tonnes/year	66	66	66
Subtotal		**17,937**	**27,696**	**26,660**
Wind erosion (disturbance)	tonnes/year	21,868	23,004	21,066
Total		**39,805**	**50,700**	**47,726**
PM_{10}				
Dragline	tonnes/year	559	338	257
Coal handling	tonnes/year	1,412	980	542
Rejects handling	tonnes/year	14	28	16
Waste handling by truck and shovel	tonnes/year	7,646	12,322	11,846
Dozers	tonnes/year	255	260	221
CHPP	tonnes/year	233	233	233
TCP	tonnes/year	66	66	66
Subtotal		**10,184**	**14,228**	**13,180**
Wind erosion (disturbance)	tonnes/year	10,934	11,502	10,533
Total		**21,118**	**25,730**	**23,713**

Table 8-6: Dispersion Modelling Assessment Locations

ID	Easting (m) (1)	Northing (m) (1)	Assessment Location Type
R5	682,295	7,381,314	Private residence
R8	681,271	7,381,884	Private residence
R11	693,741	7,382,883	Private residence
R13	695,598	7,377,492	Private residence
R14	693,576	7,375,833	Industrial
R17	692,554	7,372,690	Private residence



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	13-Dec-2023
Drawn by:	NT

BHP Mitsubishi Alliance

LEGEND

- Railway
- Road
- Watercourse
- Mine Acces Road
- BWM Mining Lease
- BWM North Extension Project Area
- Cadastre
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

AIR QUALITY ASSESSMENT LOCATIONS (DETAILED RESULTS)

FIGURE 8-3

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_AQ_CH_F08_3_Air Quality Assessment Locations

8.4 Potential Impacts

Results for the dispersion model presented in this section include results for three specific years of mining (FY30, FY50, FY70) as well as an average over the 'Life of Mine' (LoM)(i.e., for 61 years, FY25 through FY85) for both the Project Without (BAU) Case and the Project With (BAU) Case.

8.4.1 Dust Deposition

Presented in **Table 8-7** are the results from the dispersion modelling for the average over the life of the mine (LoM) of the maximum monthly averaged dust deposition for comparison with the assessment objective of 120 mg/m^2/day.

Results highlight assessment location R5 as being associated with the greatest increase in operational risk with the Project's contribution to the maximum monthly dust deposition predicted to exceed the assessment goal on average over the LoM.

The predicted number of exceedances of the assessment objective for dust deposition is presented in **Table 8-8**. A result of 1.4 (for example R5, Project Impacts) is interpreted as predicting fourteen exceedances of the assessment objective for dust deposition over a 10 year period (or 120 months).

Table 8-7: The Maximum Monthly Average Dust Deposition (mg/m^2/day)

Receptor	Project Without Case(1) (BAU)				Project With Case(1) (BAU)				Project Impacts
	FY30	FY50	FY70	Average LoM	FY30	FY50	FY70	Average LoM	Change in Average LoM
Mine years assessed	1	1	1	61	1	1	1	61	61
R5	431.6	13.5	9.8	55.5	78.7	167.8	238.4	204.9	+149.4
R8	15.2	11.4	6.9	9.1	14.4	20.1	16.7	17.7	+8.6
R11	17.0	12.5	7.3	9.7	18.9	22.7	17.7	18.4	+8.7
R13	15.0	21.0	11.4	14.5	21.2	25.3	18.9	20.9	+6.4
R14	2.9	30.5	13.9	21.1	41.6	46.0	30.4	36.8	+15.7
R17	47.9	51.8	21.2	34.3	43.2	64.8	66.7	56.2	+21.9

Note (1): Background levels are excluded from the results presented

Table 8-8: Annual Exceedances of the Monthly Average Dust Deposition

Receptor	Project Without Case(1) (BAU)				Project With Case(1) (BAU)				Project Impacts
	FY30	FY50	FY70	Average LoM	FY30	FY50	FY70	Average LoM	Change in Average LoM
Mine years assessed	1	1	1	61	1	1	1	61	61
R5	2	0	0	0.3	0	1	1	1.7	+1.4
R8	0	0	0	0	0	0	0	0	0
R11	0	0	0	0	0	0	0	0	0
R13	0	0	0	0	0	0	0	0	0
R14	0	0	0	0	0	0	0	0	0
R17	0	0	0	0	0	0	0	0	0

Note (1): Background levels are excluded from the results presented

8.4.2 Particulate Matter as TSP

Presented in **Table 8-9** are the results from the dispersion modelling for the annual average concentration of TSP for comparison against the assessment objective of 90 µg/m^3 (**Table 8-3**).

Results suggest that there will be an increase in operational risk associated with all assessment locations, with location R5 predicted to experience the largest increase in Project-related impacts of 45.5 µg/m^3 per year on average over the LoM.

Table 8-9: Annual Average Concentration of TSP (µg/m^3)

Location	Project Without Case[1] (BAU)				Project With Case[1] (BAU)				Project Impacts
	FY30	FY50	FY70	Average LoM	FY30	FY50	FY70	Average LoM	Change in Average LoM
Mine years assessed	1	1	1	61	1	1	1	61	61
R5	79.9	8.8	6.2	16.4	28.1	65.6	57.6	61.9	+45.5
R8	7.7	3.6	2.4	3.5	6.3	10.4	9.7	9.4	+5.9
R11	6.6	5.1	3.0	4.2	8.0	11.2	9.3	9.1	+4.9
R13	6.0	6.1	3.6	4.9	8.9	10.4	7.9	8.3	+3.4
R14	10.5	11.1	5.4	8.0	17.1	19.7	10.9	14.9	+6.9
R17	14.4	15.4	6.0	10.4	25.4	26.6	13.2	20.2	+9.8

Note (1): Background levels are excluded from the results presented

8.4.3 Particulate Matter as PM_{10}

Presented in **Table 8-10** are the results for the mine contribution to the maximum 24 hour average concentration of PM_{10} at the selected assessment locations for comparison against the assessment objective of 50 µg/m³ (**Table 8-3**).

Results from the dispersion modelling highlight R5 as the most affected assessment location with an increase in the maximum predicted 24 hour average concentration of PM_{10} on average over the LoM of 67.6 µg/m³.

A summary of the predicted number of exceedance days is presented in **Table 8-11**. Results of the assessment highlight location R5 located to the west of the Project, as the most affected assessment location with an additional 13.9 predicted PM_{10} exceedance days per year attributed to the Project on average over the LoM. It is noted that these results are based on the BAU cases.

Additional information highlighting the annual variability in the predicted number of exceedance days is provided in the Air Quality Assessment (**Appendix C**).

Table 8-10: Maximum 24 Hour Average Concentration of PM_{10} (µg/m³)

Location	Project Without(1) (BAU) Case				Project With(1) (BAU) Case				Project Impacts
	FY30	FY50	FY70	Average LoM	FY30	FY50	FY70	Average LoM	Change in Average LoM
Number of mine years	1	1	1	61	1	1	1	61	61
R5	184.4	18.7	11.9	34.2	95.3	78.4	106.0	101.8	+67.6
R8	53.2	79.4	52.1	59.8	84.0	104.3	64.2	72.1	+12.3
R11	34.3	22.9	14.5	20.5	35.9	38.7	34.6	35.0	+14.5
R13	27.6	43.8	26.5	32.3	43.6	52.3	36.9	41.2	+8.9
R14	34.4	40.9	23.4	33.3	60.3	63.3	42.4	50.2	+16.9
R17	51.3	53.3	28.1	45.1	81.5	102.5	53.1	70.5	+25.4

Note (1): Background levels are excluded from the results presented

Table 8-11: Number of PM_{10} Exceedance Days

Location	Project Without[1] (BAU) Case				Project With[1] (BAU) Case				Project Impacts
	FY30	FY50	FY70	Average LoM	FY30	FY50	FY70	Average LoM	Change in Average LoM
Number of mine years	1	1	1	61	1	1	1	61	61
R5	18	0	0	2.3	4	12	12	16.2	+13.9
R8	1	1	1	0.7	1	1	1	0.8	+0.1
R11	0	0	0	0	0	0	0	0	0.0
R13	0	0	0	0.1	0	1	0	0.4	+0.3
R14	0	0	0	0.1	1	4	0	1.8	+1.7
R17	1	1	0	0.7	5	12	1	5.5	+4.8

Note (1): Background levels are excluded from the results presented

8.5 Mitigation and Management Measures

8.5.1 Existing Dust Management

Dust management at BWM is supported by a real-time Dust Monitoring System and a Trigger Action Response Plan (TARP). The TARP outlines a suite of specific dust mitigation options that may be implemented in response to elevated levels of dust recorded by the BMA ambient air monitoring stations. Specific dust mitigation measures specified in the TARP include:

- Pre-Strip:
  - Prioritise water carts to areas impacting dust monitors.
  - Increase watercarts, hot seat water carts and reduce grading.
  - Drive to conditions to reduce dust.
  - Reduce quantity of active trucks hauling.
  - Change dig/dump method.
  - Stop circuit.
  - Shut down work area.
- Dragline:
  - Reduce dumping height.
  - Consider alternate dig/dump locations/methodology.
  - Lift bucket cleanly away from the face, and hoist up with minimum spillage.
  - Do not dump with swinging boom.
  - Slow cycle time down.

  - Shut down work area.
- Dozer Push/Grader:
  - Drive to conditions to reduce dust.
  - Attempt to spread work area out.
  - Relocate dozer.
  - Shut down work area.
- Drilling:
  - Identify specific drills with compromised dust controls.
  - Prioritise compromised controls.
  - Shut down work area.
- Blasting
  - Management of the pattern.
  - Shut down work area.
- Coal Mining:
  - Prioritise water carts.
  - Drive to conditions.
  - Divert trucks from pits.
  - Shut down work area.
- Coal Processing:
  - Visual inspection.
  - TCP turn on water sprays if not currently operating.
  - TCP turn off stacker.
  - TCP stockpile dozer to be relocated if required.
  - Shut down work area.

8.5.2 Key Drivers to Dust Risk

Presented in **Figure 8-4** is a summary of the identified key drivers at the location of R5 (as the most affected assessment location) for the Project With (BAU) case based on an average over the LoM.

Results suggest that waste handling by truck and shovel mining methods (including loading, hauling and dumping) will be the most significant contributor to dust risk.

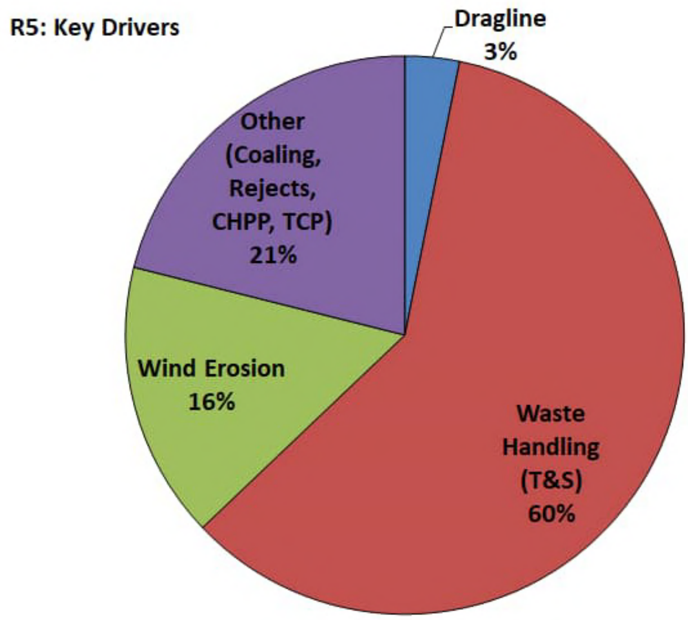


Figure 8-4: Project With (BAU) Case: Key Drivers based on an Average over the LoM

8.5.3 Modelled PM_{10} Mitigation Scenarios

Results from the dispersion modelling presented in **Section 8.5.2** highlighted waste material handling by truck and shovel mining methods as being the key driver to predicted impacts at the location of R5. Therefore, modelled dust reduction scenarios focused on additional mitigation measures that target dust emissions from waste handling by truck shovel mining methods. A summary of the mitigation scenarios that were investigated is provided in **Table 8-12**.

It is noted that the percentage reduction for the scenarios listed in **Table 8-12** may be achieved using one or more of a combination of dust mitigation options for example:

- Reducing haul distances where possible.
- Reducing vehicle speed and thus vehicle kilometres travelled per hour.
- Reducing the number of operating trucks.

Two additional mitigation scenarios have been included in **Table 8-12** that focus on dust mitigation strategies other than truck and shovel mining methods:

- Draglines only operation in key areas on high risk days.
- The cessation of all mining activities.

Table 8-12: Project With (BAU) Mitigation Scenarios

Scenario	Description	Comments
Dust 25 per cent Reduction (T&S).	• A reduction in dust emissions associated with Truck and Shovel activity (including loading, hauling and dumping of waste material) by 25 per cent in key source areas on high risk days.	• Assumes all other activities are operating as per BAU in key source areas on high risk days.
Dust 50 per cent Reduction (T&S).	• A reduction in dust emissions associated with Truck and Shovel activity (including loading, hauling and dumping of waste material) by 50 per cent in key source areas on high risk days.	• Assumes all other activities are operating as per BAU in key source areas on high risk days.
Dust 75 per cent Reduction (T&S).	• A reduction in dust emissions associated with Truck and Shovel activity (including loading, hauling and dumping of waste material) by 75 per cent in key source areas on high risk days.	• Assumes all other activities are operating as per BAU in key source areas on high risk days.
Dust 100 per cent Reduction (T&S).	• A reduction in Truck and Shovel activity by 100 per cent (i.e. stopped operating) in key source areas on high risk days.	• Assumes all other activities are operating as per BAU in key source areas on high risk days.
Dragline Only.	• Dragline operations as per BAU. • All other activities have ceased in key source areas on high risk days.	• Assumes all other activities are operating as per BAU in other areas of site on high risk days.
Shutdown.	• All mining activities have ceased.	• Assumes all activities in key source areas on high risk days have ceased operating.

Notes: T&S – Truck and Shovel operation.

Presented in **Table 8-13** are the results from the mitigation scenarios highlighting the extent to which additional dust control measures may be required to mitigate the predicted number of PM_{10} exceedance days (on average over the LoM).

When interpreting the results presented in the **Table 8-13** the following are noted:

- The number in the BAU column indicates the average number of exceedance days per year of the assessment objective of 50 µg/m^3 for the 24 hour average concentration of PM_{10} that are predicted to occur over the LoM.
- The value in the remaining columns highlight the number of exceedances days per year that are mitigated by implementing the noted mitigation measure when required.
- For example, 16.0 exceedance days per year are predicted to occur over the LoM at the location of R5. A total of 8.6 of these days are predicted to be mitigated by implementing a strategy that is associated with a 25 per cent reduction in dust associated with waste handling by truck and shovel mining methods. An additional 3.8 exceedance days are predicted to be mitigated through the implementation of a 50 per cent reduction in dust associated with waste handling by truck shovel mining methods. Note that due to the scale of the BWM disturbance footprint, a residual of 2.3 exceedance days on average per year are predicted to result due to wind erosion, even if mining operations shutdown on these days.

Results suggest that with the exception of significant wind events, the range of mitigation measures available to site will in general be sufficient to adequately manage operational dust risk.

Table 8-13 Results[(1)] from the Project With Case Mitigation Scenarios

Location	BAU	Dust 25 per cent Reduction (T&S)	Dust 50 per cent Reduction (T&S)	Dust 75 per cent Reduction (T&S)	Dust 100 per cent Reduction (T&S)	Dragline Only	Shutdown	Residual (BWM)[(2)]
R5	16.0	8.6	3.8	1.3	0.1	0.0	0.0	2.3
R8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.8
R11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R13	0.4	0.2	0.0	0.1	0.0	0.0	0.0	0.0
R14	1.8	1.1	0.3	0.0	0.0	0.0	0.0	0.3
R17	5.5	2.1	1.3	0.4	0.1	0.1	0.0	1.4

Note (1): Background levels are excluded from the results presented

(2): Residual exceedance days are attributed to significant wind events

8.5.4 Comparison of the Project With (BAU) and (Fully Mitigated) Cases

Presented in **Table 8-14** is a comparison of the predicted number of PM_{10} exceedance days for the Project With (BAU) Case and the Project With (Fully Mitigated) Cases presented in **Section 8.5.3**.

Results presented in the **Table 8-14** suggest that with the exception of significant wind events, the range of mitigation measures available to site will in general be sufficient to adequately manage operational dust risk.

Table 8-14: Comparison of Predicted PM_{10} Exceedance Days for the Project With BAU Case and Project With (Fully Mitigated) Case

Location	Project With (BAU) Case[(2)]				Project With (Fully Mitigated) Case[(2)]
	FY30	FY40	FY50	Average LoM	Average LoM[(1)]
Number of mine years	1	1	1	61	61
R5	4	12	12	16.2	2.3
R8	1	1	1	0.8	0.8
R11	0	0	0	0	0.0
R13	0	1	0	0.4	0.0
R14	1	4	0	1.8	0.3
R17	5	12	1	5.5	1.4

Note: (1) Residual exceedance days are attributed to significant wind events

(2) Background levels are excluded from the results presented

8.5.5 Project Dust Management

The following dust management measures will be implemented for the Project.

8.5.5.1 Implementation of an Ambient Air Monitoring Network

A network of ambient air monitoring stations will be established that measure dust and meteorological parameters on a continuous basis. The number of ground stations will be sufficient to monitor air quality outcomes at locations that are representative of, or surrogate for, sensitive receptor location(s) and/or are required for informing background dust estimates.

The ground stations will be complimented by temperature inversion towers.

The parameters that will be sampled are provided in **Table 8-15**.

Table 8-15: Air Quality Monitoring Parameters

Station	Parameters monitored	Monitoring Frequency	Monitoring Method	Comment
Ground station	TSP, PM10, Meteorology(1)	5 minute	Continuous	Representative of, or surrogate for, a sensitive receptor location and/or required for informing background estimates
BWM Tower	Meteorology(2)	5 minute	Continuous	Temperature Inversion Tower

Notes:

(1) Meteorology will include:

- *Wind speed, wind direction, standard deviation of wind direction using ultrasonic wind sensors sampled at a height of 10 m;*
- *Rainfall, solar radiation, relative humidity, pressure and temperature.*

(2) Meteorology will include:

- *The measurement of temperature at heights of 2 m, 10 m, 20 m, 30 m, 40 m, 50 m and 60 m.*
- *The measurement of wind speed and wind direction using ultrasonic wind sensors at heights of 2 m, 10 m, 20 m, 30 m, 40 m, 50 m and 60 m.*

8.5.5.2 Continual Improvement Plan for Dust Management

The features and functionality of the Dust Monitoring System that is currently used by BWM to inform dust management practices will be expanded. This may include, but not be limited to:

- Analysis of sensor data to provide estimates of background dust levels and mine contributions to dust.
- Alarms in response to trigger levels based on sensor data analysis.
- The development of alarms/notifications that inform the implementation of dust management practices (e.g. alarms/notifications informed by temperature inversion data or real-time dust forecast).
- Features that provide information on key dust emission sources and/or resource utilisation (e.g. equipment use).

8.5.5.3 Implementation of a Continual Improvement Plan for Dust Management

A Dust Management Continual Improvement Plan will be developed for the BWM that includes key triggers for review, auditing, and refinement of the plan to assist in minimising operational risk.

8.5.5.4 Mine Plan Optimisation

Opportunities to reduce operational risk will be sought by incorporating dust reduction strategies into mine planning practices (e.g. the incorporation of strategies into long term and short term mine plans).

8.6 Greenhouse Gas Emissions

Steps being taken by BHP to reduce, or support reduction of, greenhouse gas emissions BHP is taking steps to reduce operational (Scopes 1 and 2) greenhouse gas (GHG) emissions for its operated assets in accordance with its[8]:

- Medium-term target to reduce operational GHG emissions by at least 30 per cent from FY2020 levels by FY2030.
- Long-term goal to achieve net zero operational GHG emissions by 2050.

BMA, as part of the BHP portfolio to which the target and goal apply, is also taking steps to contribute to these outcomes.

BMA has contracted with CleanCo for the supply of almost 50% of BMA sites' estimated annual operational power requirements from renewable sources by FY2025[9]. Options to achieve 100% renewable power supply for BMA operations are being actively explored. In addition, BHP is working with original equipment manufacturers to develop and trial battery electric technology to replace diesel trucks, which could also be leveraged at BMA mine sites, and is also investigating methane abatement opportunities.

[8] These positions are expressed using terms that are defined in the Glossary to the BHP Annual Report 2022 available at bhp.com, including the terms 'target', 'goal' and 'net zero'. The FY2020 baseline year of the target will be adjusted for any material acquisitions and divestments, and to reflect progressive refinement of emissions reporting methodologies. The target's boundaries may in some cases differ from required reporting boundaries. The use of carbon offsets will be governed by BHP's approach to carbon offsetting described at bhp.com/climate.

[9] Based on forecasted electricity consumption (which is subject to change) and renewable energy supply from the Power Purchase Agreement as evidenced by Renewable Energy Certificates (RECs), retirement of large-scale generation certifications (LGCs) (both voluntary and for renewable energy target compliance in Australia) and/or supplier-provided documentation in line with the Greenhouse Gas Protocol Scope 2 Guidance.

9 Noise and Vibration

9.1 Introduction

The Noise and Vibration Impact Assessment (SLR, 2023b) has been prepared for the Project and is included as **Appendix D**. The assessment involved modelling of operational noise emission from the Project and total BWM noise as well as air blast overpressure and ground vibration modelling for the Project at the nearest receptors surrounding BWM. The noise and vibration impact assessment is summarised in the sections below.

9.2 Environmental Values

9.2.1 Existing Receptors

The BWM EA provides definitions for sensitive and non-sensitive places. Based on the EA definition, noise and vibration receptors surrounding and potentially impacted by the Project are listed in **Table 8-1** and identified on **Figure 8-1**.

9.2.2 Existing Acoustic Environment

9.2.2.1 Baseline Noise Measurement

In April and May 2020, EMM conducted a baseline noise monitoring survey primarily at four receptor locations surrounding the BWM to quantify and characterise the existing noise environment at the time of the measurements. Supplementary attended noise measurements were conducted in 2021 (EMM, 2021) at a further five locations to support the baseline noise monitoring data collected at the four primary receptor locations. The noise monitoring survey locations are listed in **Table 9-1** and shown on **Figure 9-1** (note locations NM7 and NM11 were used for noise model validation and do not represent receptor locations).

The baseline noise monitoring surveys were conducted in general accordance with:

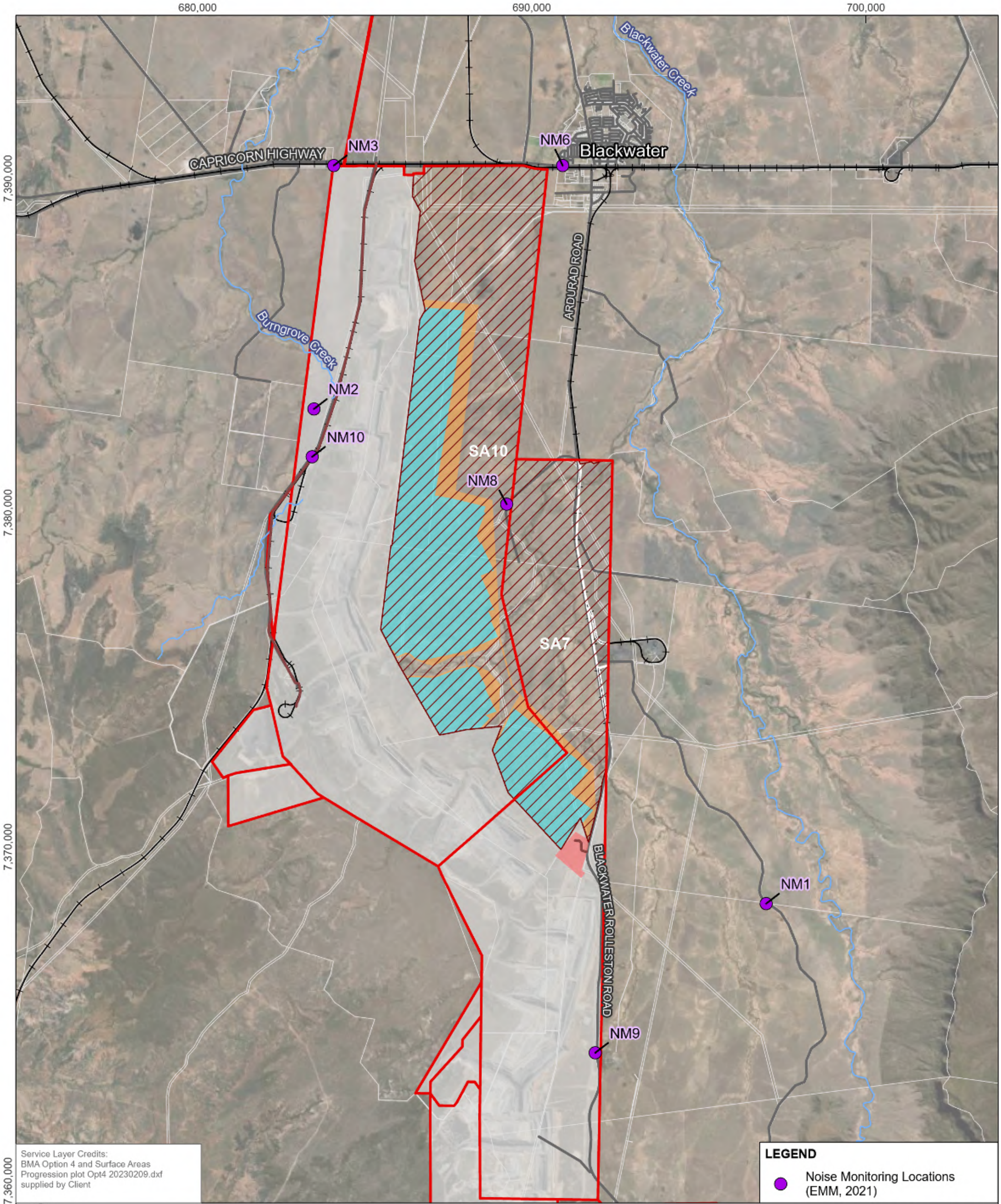
- The Department of Environment and Science's (DES) Noise Measurement Manual 2020.
- Australian Standards (AS) 1055-1997 Acoustics – Description and Measurement of Environmental Noise.

9.2.2.2 Attended Noise Measurement Results

The results of EMM's attended noise measurements are summarised in **Table 9-2**.

For monitoring locations NM1, NM2 and NM3, the measured attended noise levels and identified sources are representative of day time noise levels for a rural environment. At the time of the noise measurement at NM6 which is on the outskirts of the Blackwater township, BWM operations were inaudible at this location with the acoustic environment being dominated by road traffic noise from the Capricorn Highway as well as bird song.

EMM noted that at most long-term noise measurement locations, attended measurements showed that BWM was generally inaudible, and where mine noise was audible, other nearby environmental sources were noted as the dominant feature.



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:150,000 at A4
Project Number:	620.014601
Date Drawn:	14-Dec-2023
Drawn by:	NT

BMA
BHP Mitsubishi Alliance

LEGEND

- Railway
- Road
- Watercourse
- Mine Acces Road
- BWM Mining Lease
- BWM North Extension Project Area
- Cadastre
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

EMM NOISE MONITORING LOCATIONS (EMM, 2021)

FIGURE 9-1

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_NV_CH_F09_1_Noise Monitoring

Table 9-1: EMM Baseline Noise Monitoring Survey Locations

Location ID (SLR ID)	Monitoring Location [1]	Noise Monitoring Method	Coordinates (MGA 55)	
			Easting	Northing
NM1 (R19)	Tannyfoil Homestead	Unattended and attended	697,016	7,368,303
NM2 (R2)	'Besgrove' BMA and Others	Unattended and attended	683,482	7,383,106
NM3 (R20)	South of Homestead 1	Unattended and attended	684,074	7,390,392
NM6	Ausco Stayover Camp, Blackwater	Unattended and attended	690,925	7,390,392
NM8	Alternative location 2 (within ML1759, approx. 1.75 km west of Mountain View and Stewarton receptor, east of R16S)	Attended only	689,250	7,380,257
NM9	Alternative location 3 (at the edge of ML1762, approx. 0.5 km WNW of Cook Colliery, east of R52S)	Attended only	691,900	7,363,829
NM10	Alternative location 4 (within ML1759, approx.1.45 km SSE of NM2, west of R16S)	Attended only	683,428	7,381,676

Note 1: Details provided in brackets are supplementary information SLR has added for the purpose of this Report.

Table 9-2: Summary of Attended Noise Monitoring Results (EMM, 2021)

Location ID (SLR ID)	Start Date and Time	Measured Noise Levels (15min, dBA)				BWM Contribution (LAeq,15min dBA) *	Comments
		LA90	Laeq	LA10	LA1		
NM1 (R19)	17/04/20 09:53	21	27	28	37	Inaudible	BWM noise inaudible. Noise sources include occasional wind, birdsong and insects.
NM2 (R2)	17/04/20 14:02	34	35	37	38	<20	BWM noise occasionally audible. Mine noise includes distant engine revs (approx. 20 dBA) and horn blasts (approx. 22 dBA). Other noise sources include occasional wind, passing vehicles on Blackwater Airport Road, birdsong and insects.
NM3 (R20)	17/04/20 14:54	34	47	50	58	Inaudible	BWM noise inaudible. Noise sources include occasional wind, passing vehicles on Capricorn Highway, birdsong and insects.
NM6	20/04/20 06:30	58	70	74	80	Inaudible	BWM noise inaudible. Noise sources include vehicles passing on Capricorn Highway, birdsong and insects.
NM8	19/04/20 16:14	28	31	34	37	26	BWM noise audible. Mine noise includes distant engine revs (28 dBA) and horn blasts (32 dBA). Other noise sources include wind, birdsong and insects.
NM9	19/04/20 16:47	42	50	46	63	42[#]	BWM noise audible. Mine noise includes engine revs (45 dBA), light vehicles on mine (49 dBA), dozer tracks (43 dBA) and horn blasts (45 dBA). Other noise sources include vehicles passing on Blackwater Rolleston Road, birdsong and insects.
NM10	19/04/20 17:42	47	59	54	73	42[#]	BWM noise audible. Mine noise includes engine revs (50 dBA), bucket noise (50 dBA), haul trucks (59 dBA) and horn blasts (48 dBA). Other noise sources include vehicles passing on Blackwater Airport Road, birdsong and insects.

* BWM noise contribution was determined using in-field observations and post-analysis of data as required.

\# Although the stated BWM contribution noise level is above the applicable day-time noise limit (see Appendix D – Table 4-1, Section 4.1), this noise monitoring location does not represent a noise sensitive receptor.

9.2.2.3 Unattended Baseline Noise Measurement Results

A summary of the EMM unattended noise monitoring carried out between Friday 17 April and Sunday 26 April 2020 is provided in **Table 9-3**. The reported L_{A90} noise levels are interpreted to be Rating Background Levels (RBL).

Table 9-3: Summary of Unattended Noise Logging Results (EMM, 2021)

Monitoring Location	L_{A90} Noise Levels (dBA)[1]			L_{Aeq} Noise Levels (dBA)[1,2]			L_{A1} Noise Levels (dBA)[1]		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
NM1	25	32	28	40	47	46	57	55	58
NM2	27	27	24	47	46	43	57	55	57
NM3 [3]	30	33	27	63	59	59	79	77	82
NM6 [3]	43	42	38	68	65	64	81	79	85

Note 1: Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: 10 pm to 7 am.

Note 2: The energy averaged noise level over the measurement period and representative of general ambient noise.

Note 3: These locations are positioned near Capricorn Highway, hence the relatively higher noise levels compared to others.

Like the attended measurements, for monitoring locations NM1, NM2 and NM3, the unattended L_{A90} noise levels presented in **Table 9-3** are typical of a rural setting. The L_{Aeq} and L_{A1} noise levels for NM3 are higher than both NM1 and NM2, and higher than typically observed for a rural setting noting (from **Table 9-2**) that NM3 was influenced by road traffic noise from the Capricorn Highway.

9.2.3 Noise and Vibration Assessment Criteria

9.2.3.1 Relevant EA Conditions

BWM's EA (EPML00717813) Conditions C1 and C5 (noise and vibration nuisance) requires BWM not to cause an environmental nuisance at any sensitive place or commercial place. Condition C4 requires noise monitoring when requested by the Administering Authority (EA Condition A14). Conditions C2, C6 and C8 specify the noise levels and vibration/airblast overpressure nuisance levels that are not to be exceeded when monitored in accordance with Condition A14. Potential noise and vibration (blasting) impacts from the Project have been assessed against the noise and vibration limits prescribed in the EA.

9.2.3.2 Noise – BWM EA Noise Limits

Conditions relevant to noise are contained within Conditions C1 to C4, with numerical noise limits prescribed in Table C1 (Noise Limits) of the EA. Table C1 is reproduced in **Table 9-4** below.

Table 9-4: BWM EA Schedule C Table C1 (Noise Limits)

Noise Level (dBA)	Monday to Sunday (including public holidays)		
	Day time 7 am – 6 pm	Evening 6 pm – 10 pm	Night-time 10 pm – 7 am
$L_{Aeq, adj,15mins}$	40	40	40
$L_{A1, adj,15mins}$	N/A	N/A	45

9.2.3.3 Blasting – BWM EA Airblast and Vibration Limits

Conditions relevant to vibration and airblast overpressure (from blasting) are contained within Conditions C5 to C10 of the EA, with numerical blasting vibration and airblast overpressure limits stated in Tables C2 and C3 of the EA, respectively. The blasting limits are summarised in **Table 9-5**.

Table 9-5: BWM EA Schedule C Table C2 and C3 - Blasting Vibration and Airblast Overpressure Limits

Parameter	Sensitive or Commercial Place Blasting Limits
Ground vibration peak particle velocity	5 mm/s peak particle velocity for nine (9) out of ten (10) consecutive blasts and not greater than 10 mm/s peak particle velocity at any time.
Airblast overpressure level	115 dB (Linear peak) for nine (9) out of ten (10) consecutive blasts and not greater than 120 dB (Linear peak) at any time.

9.3 Noise and Vibration Assessment Methodology

9.3.1 Noise and Vibrating Project Activities

Existing mining operations with the potential to generate noise emissions are as follows:

- Progressive land clearing and topsoil removal.
- Stockpiling topsoil from disturbed areas for storage and use in future rehabilitation of the site.
- Drill and blasting of overburden/interburden material (including coal seam blasting).
- Pre-stripping/excavation of overburden material using excavators/shovels and trucks, and dozers.
- Side casting of lower overburden into the previously mined strip using draglines.
- Removal of overburden/interburden and placement in in-pit spoil dumps.
- Loading and hauling of RoM coal using a combination of excavators, loaders and trucks.
- Progressive rehabilitation by overburden placement, reshaping spoil dumps, topsoiling and revegetation.

9.3.2 Noise Modelling Scenarios

The selection of noise modelling/assessment scenarios for the Project was based on activities with the greatest potential to result in noise at the identified sensitive receptors. This included when plant and equipment (noise sources) would be at the closest proximity to receptors (i.e. due to active mining pits and in-pit spoil dumps) and where there would be limited screening of noise from on-site structures or topography.

The Noise and Vibration Assessment (**Appendix D**) has modelled the Project noise emission levels from three operational mining scenarios coinciding with FY2027, FY2039 and FY2044. These scenarios were selected to represent the years likely to produce the greatest noise impacts (i.e. worst-case scenarios with consideration of the following:

- Progressive mining within the Project footprint including the eastward progression of active BWM pits and adjacent in-pit spoil dumps.
- Consideration of peak extraction years for both coal and waste (which occur at different times), and peak mobile mining equipment numbers.

The scenarios selected are biased towards the initial 20 years of the Project life as equipment numbers and production rates are progressively reduced from approximately FY2045 and only one sensitive receptor east of BWM (i.e. R17) is close enough to potentially be impacted by the Project. When the Project is at its closest to R17 (i.e., approximately 1 km) all mining equipment would be within the pit operating behind the high wall and would be significantly shielded from receptor R17.

Specifically, Project FY2027 coincides with an increase in haul trucks and aligns with higher BWM (including Project) product and RoM coal rates. FY2039 coincides with further increases in haul trucks, increases in dozers, waste shovel and water trucks and is representative of worst-case mining in the southern extent of SA7 closest to sensitive receptor R17. The FY2044 mine plan coincides with a peak in the total mining fleet and aligns with the peak waste stripping volumes.

Further detail on the methodology and information regarding noise emission sources (i.e., plant and equipment), assigned noise emission levels, rates of production and key assumptions of the assessment are provided in **Appendix D.**

9.3.3 Noise Prediction Modelling

A SoundPLAN (version 8.2) computer noise model was developed to predict mine noise levels at the nominated noise sensitive receptors. SoundPLAN is a computer model software package enabling calculation of environmental noise by combining a digitised ground map (topography), the location and acoustic sound power levels of potentially critical noise sources on site and the location of receivers for assessment purposes.

The model can calculate noise levels, taking into account such factors as the sound power levels and locations of noise sources, distance attenuation, ground absorption, air absorption and shielding attenuation, as well as meteorological conditions, including wind effects.

The *Conservation of Clean Air and Water Europe* (CONCAWE 1981) prediction methodology was utilised within SoundPLAN. The CONCAWE prediction method is specifically designed for large industrial facilities and incorporates the influence of wind effects and the stability of the atmosphere.

In relation to the modelling of atmospheric conditions, DES's Ecoaccess Guideline '*Planning for Noise Control'* (PNC) provides guidance with respect to assessing the potential for noise enhancements due to prevailing atmospheric conditions. In accordance with PNC, meteorological data was analysed to:

- Confirm whether a 'prevailing' wind component was a feature of the area.
- For temperature inversion parameters, to confirm whether temperature inversions are a feature of the area.

The wind analysis concluded a prevailing (i.e. ≥30% occurrence) wind component was not a feature of the Project area. Analysis of temperature inversion parameters indicated temperature inversions are characteristic of the Project area, and as a result, were considered as part of the assessment.

Modelling has been undertaken to determine the potential impacts of the Project under neutral and adverse weather conditions. The noise prediction modelling approach, including weather parameters and equipment inputs, is described in detail in Section 5.2 of the Noise and Vibration Assessment (**Appendix D)**.

9.3.4 Cumulative Noise Impact Assessment

The noise and vibration assessment also considered the potential for cumulative mine noise impacts for the following:

- Sensitive receptors surrounding the Cook Colliery and potentially impacted by combined noise from the Cook Colliery and BWM.
- Sensitive receptors located between BWM and Curragh Mine.

The location of Curragh Mine and Cook Colliery in relation to BWM is shown in **Figure 1-1**.

9.3.5 Blasting

Blasting at BWM is utilised for overburden and interburden, including through seam blasting as necessary. Subject to operational requirements, blasting occurs on any day of the week during daylight hours. The predominate explosive used in blasting activities at the BWM is ammonium nitrate/fuel oil (ANFO), which is the most common explosive used in the mining industry in Queensland. Blasting will continue for the Project as currently employed at BWM.

An assessment of air blast overpressure and ground vibration (peak particle velocity [PPV] impacts from the Project has been undertaken in accordance with Australian Standard AS 2187.2 – 2006 *Explosives- Storage, Transport and Use – Part 2 Use of Explosives* (AS 2187).

9.4 Potential Impacts

9.4.1 Predicted Operational Noise Levels

The predicted noise levels from the modelled operational scenarios (i.e. FY2027, FY2039 and FY2044) are summarised in **Table 9-6** for neutral weather conditions and **Table 9-7** for adverse weather conditions, with noise level contour maps presented in **Appendix D**.

The assessment for the Project identified the following potential noise impacts:

- Under neutral weather conditions, only noise sensitive receptors R5 and R17 are predicted to experience BWM noise levels that exceed the EA noise limits. For sensitive receptor R5, exceedances of the 40 dBA LAeq and 45 dBA LA1 limits are predicted for the FY2039 and FY2044 scenarios (i.e. up to 43 dBA LAeq and 46 dBA LA1 for the FY2044 scenario only). The predicted exceedances are primarily attributed to:
  - Coal haulage trucks operating from ramp R20N and travelling along the main haul route to the CHPP for the FY2039 scenario.
  - Coal haulage trucks operating from ramp R14N and travelling along the main haul route to the CHPP for the FY2044 scenario.
  - Waste mining activities occurring between ramps R16N to R20N, haulage trucks operating between pits and waste dumps at ramps east of R5 between ramps R16S and R16N.
  - Noise levels at R5 associated with the plant and equipment operating at the TCP have been predicted in the order of 30 dBA under neutral weather conditions, which is likely to be audible at R5 particularly in the absence of other significant ambient noises.

    For sensitive receptor R17, a marginal 1 dBA exceedance of the 45 dBA LA1 noise limit is predicted for the FY2039 scenario. The predicted exceedance is attributed to Komatsu 930 waste haul trucks operating in R46S, R46N and R42S.

- Under adverse weather conditions (i.e. temperature inversion), noise limit exceedances have been predicted for the following sensitive receptors:
  - R5 under all three modelled scenarios with exceedances predicted against both the 40 dBA LAeq and 45 dBA LA1 noise limits. The highest predicted exceedance was 48 dBA LAeq (i.e. 8 dBA above the noise limit) and 56 dBA LA1 (i.e. 11 dBA exceedance) for the FY2044 scenario. As noted above, the exceedances are primarily attributed to coal and waste haulage from ramps to the east and north-east of R5.
  - R6 for the FY2027 scenario (i.e. 2 dBA exceedance of the 45 dBA LA1 limit) and for FY2039 and FY2044 scenarios exceedances were predicted against both the 40 dBA LAeq and 45 dBA LA1 noise limits (i.e. by up to 7 dBA). The highest predicted exceedance was 52 dBA LA1 for the FY2044 scenario. Consistent with R5, the exceedances are primarily attributed to coal and waste haulage from ramps to the east and north-east of R6.
  - R3 for the FY2044 modelled scenario by a marginal 1 dBA against the 40 dBA LAeq noise limit and 4 dBA against the 45 dBA LA1 noise limit. A marginal 1 dBA exceedance of the LA1 noise limit is also predicted for the FY2039 scenario. The predicted exceedances are primarily attributed to waste haulage from ramp R16N and R16S and coal haulage from ramp R14N (i.e. from Komatsu 830s travelling along the main haul road).
  - R17 under modelled scenario FY2039 by 4 dBA against the 40 dBA LAeq noise limit and 7 dBA against the 45 dBA LA1 noise limit, and by 3 dBA against the LA1 noise limit for the FY2044 scenario. As noted above with the neutral weather predictions, the predicted adverse weather exceedances are primarily attributed to waste haulage from ramps R46N, R46S and R42N.
  - For the FY2044 scenario, marginal 2 dBA exceedances of the 45 dBA LA1 noise limit has been predicted for R4 and R7. The exceedances are primarily attributed to coal haulage from the main haul road and waste haulage from the closest ramps.
  - For the FY2027 scenario, marginal 1 to 2 dBA exceedances have been predicted for sensitive receptors R20, R21, R22 and R23 (i.e. 46 to 47 dBA LA1), which are all located on the northern side of the Capricorn Highway. The predicted exceedances are attributed to Komatsu 930 waste haul trucks operating from ramp R08N. We note the following in relation to these predicted exceedances:
- The marginal 1 to 2 dBA exceedances have only been predicted for the FY2027 scenario and would be avoided when mining activities cease in the northern-most pits of BWM as reflected in the reduction in noise levels for the FY2039 and FY2044 scenarios compared to FY2027.
- The noise monitoring completed near R20 by EMM in 2020 (i.e. NM3 summarised in **Table 9-2** and **Table 9-3**) indicate that these sensitive receptors currently experience high LA1 noise levels (i.e. 77 to 82 dBA) from vehicle passbys on the Capricorn Highway. Given the significant difference in LA1 noise levels between BWM and the Capricorn Highway (i.e., ≥30 dBA), LA1 noise levels from BWM are not expected to adverse impact these sensitive receptors.
- BWM noise levels that exceed the EA noise limits have been predicted for receptors R1, R2, R15, R16, R18 (BWM Admin) and R50, however these receptors are not considered to be “sensitive” under the definition provided in the EA and summarised in **Appendix D** (Section 3.1).

Considering the above predicted noise limit exceedances, noise mitigation options have been investigated for the Project. The noise mitigation options are discussed in **Section 9.5** and consideration of the noise characteristics is provided in **Appendix D**.

Table 9-6: Predicted BWM Operational Noise Levels – Neutral Weather

ID	Description	Predicted BWM Noise Level (adj, 15 mins dBA)					
		FY2027		FY2039		FY2044	
		LAeq	LA1	LAeq	LA1	LAeq	LA1
	EPML00717813 noise limits	**40**	**45**	**40**	**45**	**40**	**45**
R1	BMA	33	41	36	44	41	49
R2	BMA	36	44	38	46	45	53
R3	Private - Tolmies Creek HS	28	36	31	39	34	42
R4	Private - Tolmies Creek HS	27	35	30	38	33	41
R5	Private - Ausbute HS	39	**47**	**42**	**50**	**43**	**51**
R6	Private	33	41	35	43	37	45
R7	Private - Burngrove HS	29	37	30	38	32	40
R8	Private - (edge Blackwater township)	22	30	24	32	23	31
R9	Private - Minyango HS	22	30	24	32	23	31
R10	Private - Cardona HS	17	25	17	25	18	26
R11	Private - Tantallon HS	23	31	25	33	25	33
R12	BMA	29	37	29	37	30	38
R13	Private - Yarrawonga HS	23	31	26	34	24	32
R14	QCoal (Cook Colliery - north) #	26	34	30	38	27	35
R15	Private - Taurus HS	36	44	42	50	40	48
R16	Private - Stewarton HS	30	38	38	46	34	42
R17	Private - Retreat HS	30	38	38	**46**	34	42
R18	BMA - BWM MIA Administration	42	50	47	55	45	53
R19	Private - Tannyfoil HS	27	35	27	35	24	32
R20	Private	34	42	27	35	29	37
R21	Private	33	41	27	35	28	36
R22	Private	32	40	26	34	28	36
R23	Private	32	40	26	34	27	35
R24	Private	30	38	25	33	26	34
R25	Private	30	38	25	33	26	34
R26	Private	29	37	25	33	26	34
R27	Private	28	36	24	32	26	34
R28	Private	28	36	25	33	25	33
R29	Private	27	35	25	33	25	33
R30	Private - Tulloch Ard HS	23	31	22	30	23	31
R31	Private	22	30	22	30	23	31
R32	Private - Maryvale HS	19	27	20	28	22	30
R33	Private - Malamy HS	19	27	20	28	21	29

ID	Description	Predicted BWM Noise Level (adj, 15 mins dBA)					
		FY2027		FY2039		FY2044	
		LAeq	LA1	LAeq	LA1	LAeq	LA1
	EPML00717813 noise limits	**40**	**45**	**40**	**45**	**40**	**45**
R34	Private - Malamy HS	19	27	20	28	21	29
R35	Private - Sherborne HS	19	27	19	27	21	29
R36	Private	18	26	19	27	20	28
R37	Private	18	26	19	27	20	28
R39	Private	22	30	20	28	21	29
R40	Private	20	28	20	28	22	30
R41	Private	22	30	20	28	21	29
R42	Private - Monash HS	15	23	18	26	16	24
R43	Private	17	25	19	27	18	26
R46	QCoal (Cook Colliery - south)#	46	54	32	40	27	35
R47	Blackwater Cemetery	24	32	26	34	25	33
R48	Resource recovery centre	25	33	27	35	27	35
R49	Quarry	23	31	26	34	28	36
R50	BWM Airport	43	51	38	46	38	46

Bold and highlighted noise levels represent an exceedance of the LAeq, adj, 15 min 40 dBA and/or LA1, adj, 15min 45 dBA noise limit for noise sensitive receptors only.
Greyed cells indicate that the receptor is not considered "sensitive" as defined in the EA.
A commercial receptor by definition of the EA however is an existing coal mine operating under its own EA and therefore very unlikely to be impacted by noise from BWM.

Table 9-7: Predicted BWM Operational Noise Levels – Adverse Weather

ID	Description	Predicted BWM Noise Level (adj, 15 mins dBA)					
		FY2027		FY2039		FY2044	
		LAeq	LA1	LAeq	LA1	LAeq	LA1
	EPML00717813 noise limits	**40**	**45**	**40**	**45**	**40**	**45**
R1	BMA	39	47	42	50	47	55
R2	BMA	42	50	43	51	50	58
R3	Private - Tolmies Creek HS	35	43	38	**46**	**41**	**49**
R4	Private - Tolmies Creek HS	34	42	37	45	39	**47**
R5	Private - Ausbute HS	**44**	**52**	**47**	**55**	**48**	**56**
R6	Private	39	**47**	**41**	**49**	**44**	**52**
R7	Private - Burngrove HS	35	43	36	44	39	**47**
R8	Private - (edge of Blackwater township)	30	38	32	40	31	39
R9	Private - Minyango HS	29	37	32	40	30	38
R10	Private - Cardona HS	25	33	25	33	26	34
R11	Private - Tantallon HS	30	38	32	40	32	40
R12	BMA	36	44	36	44	38	46
R13	Private - Yarrawonga HS	31	39	33	41	32	40
R14	QCoal (Cook Colliery – north) #	33	41	37	45	35	43
R15	Private - Taurus HS	42	50	48	56	46	54
R16	Private - Stewarton HS	37	45	45	53	41	49
R17	Private - Retreat HS	37	45	**44**	**52**	40	**48**
R18	BMA - BWM MIA Administration	47	55	52	60	50	58
R19	Private - Tannyfoil HS	34	42	34	42	32	40
R20	Private	39	**47**	34	42	35	43
R21	Private	38	**46**	33	41	35	43
R22	Private	38	**46**	33	41	34	42
R23	Private	38	**46**	32	40	34	42
R24	Private	36	44	32	40	33	41
R25	Private	36	44	32	40	33	41
R26	Private	36	44	32	40	33	41
R27	Private	35	43	31	39	33	41
R28	Private	34	42	32	40	32	40
R29	Private	34	42	32	40	32	40
R30	Private - Tulloch Ard HS	30	38	29	37	30	38
R31	Private	29	37	29	37	31	39
R32	Private - Maryvale HS	26	34	28	36	29	37
R33	Private - Malamy HS	27	35	27	35	28	36

ID	Description	Predicted BWM Noise Level (adj, 15 mins dBA)					
		FY2027		FY2039		FY2044	
		LAeq	LA1	LAeq	LA1	LAeq	LA1
	EPML00717813 noise limits	**40**	**45**	**40**	**45**	**40**	**45**
R34	Private - Malamy HS	27	35	27	35	28	36
R35	Private - Sherborne HS	26	34	26	34	28	36
R36	Private	26	34	26	34	27	35
R37	Private	26	34	26	34	27	35
R39	Private	29	37	28	36	28	36
R40	Private	28	36	28	36	29	37
R41	Private	29	37	28	36	28	36
R42	Private - Monash HS	23	31	25	33	24	32
R43	Private	24	32	26	34	26	34
R46	QCoal (Cook Colliery - south) #	51	59	38	46	34	42
R47	Blackwater Cemetery	31	39	33	41	33	41
R48	Resource recovery centre	33	41	34	42	34	42
R49	Quarry	30	38	34	42	35	43
R50	BWM Airport	47	55	43	51	43	51

Bold and highlighted noise levels represent an exceedance of the LAeq, adj, 15 min 40 dBA and/or LA1, adj, 15min 45 dBA noise limit for noise sensitive receptors only.
Greyed cells indicate that the receptor is not considered "sensitive" as defined in the EA.
A commercial receptor by definition of the EA however is an existing coal mine operating under its own EA and therefore very unlikely to be impacted by noise from BWM.

9.4.2 Cumulative Noise Levels

9.4.2.1 BWM and Cook Colliery

The cumulative noise impact assessment for noise sensitive receptors surrounding the Cook Colliery (and exposed to BWM noise) is detailed in

Table 9-8. Noting that the Cook Colliery is an underground mine and that surface operations are unlikely to change significantly over the life of the mine, the SoundPLAN predicted Cook Colliery noise levels have been compared against the highest predicted BWM noise level from the three modelled scenarios. The cumulative noise assessment has considered only adverse weather conditions, that is temperature inversion with negligible wind (i.e. the highest predicted noise level).

Based on the cumulative noise impact assessment detailed in **Table 9-8** cumulative mine noise levels from BWM and Cook Colliery have the potential to result in a combined noise level of 45 dBA LAeq at sensitive receptor R17. The predicted cumulative noise level is primarily attributed to BWM (i.e. 44 dBA), with the contribution from Cook Colliery increasing the cumulative noise level by a marginal 1 dBA.

As noted in **Section 9.4.1**, predicted BWM noise levels of up to 44 dBA represents an exceedance of the 40 dBA noise limit, and therefore noise mitigation measures are required to address this predicted exceedance. Noise mitigation measures are discussed in **Section 9.5**.

Table 9-8: Cook Colliery and BWM Cumulative Mine Noise Under Adverse Weather Conditions

Receptor	Predicted LAeq (dBA) Noise Level from:		Predicted Cumulative Noise Level (LAeq dBA)
	Cook Colliery	BWM	
R11	22	32	33
R13	36	33	38
R17	34	**44**	**45**

Bold and highlighted noise levels represent an exceedance of the LAeq, adj, 15 min 40 dBA

The highest noise level from Cook Colliery (i.e., 36 dBA) was predicted at R13, which is the closest sensitive receptor to Cook Colliery. With the addition of BWM noise, the cumulative noise level at R13 is predicted to be 38 dBA which complies with the 40 dBA BWM EA noise limit.

9.4.2.2 BWM and Curragh Mine

Noise sensitive receptors potentially impacted by cumulative noise from BWM and Curragh Mine include:

- Blackwater township.
- Homesteads located along the Capricorn Highway west of Blackwater.

To complete the assessment SLR has relied on publicly available information relevant to Curragh Mine, together with the findings from assessment of the Project to inform the potential for cumulative noise impacts.

With reference to the noise levels presented in **Table 9-7**, Blackwater township (R8) is predicted to experience BWM noise levels of up to 32 dBA, which is 8 dBA below the 40 dBA LAeq BWM EA noise limit. The current Curragh Mine EA (EPML00643713) prescribes a night-time (10 pm to 7am) noise limit of 41 dBA LA10, which is approximately equivalent to 38 dBA LAeq for a mine. Provided Curragh Mine achieves compliance with their EA noise limit, cumulative noise from Curragh Mine and BWM would not exceed 39 dBA LAeq and thereby comply with the 40 dBA BWM EA noise limit.

For sensitive receptors located west of Blackwater along the Capricorn Highway, there is potential for these receptors to be exposed to noise from both BWM and Curragh Mine, particularly when mining at Curragh Mine commences in ML700006, which is approximately 750 m north-east of the closest homestead (i.e. R20). Regarding BWM, the following is noted:

- Mining operations in the northernmost pit closest to these sensitive receptors (i.e. Pit 8, which is not part of the extension area in SA10 and SA7 but included for completeness) ceases from approximately FY2033, which is reflected in the predicted drop in noise levels from FY2027 to FY2039 for receptors R20 to R39 indicated in **Table 9-6** and **Table 9-7**.
- No mining operations are proposed for the Project in Pit 10 (i.e. which is also outside of the SA10 and SA7 extension area).

Based on the above, it is anticipated that cumulative noise impacts would be avoided if noise intensive Curragh Mine operations in the southern extent of ML700006 commence after BWM operations have ceased in Pit 8.

9.4.3 Blasting

9.4.3.1 Airblast Overpressure

The airblast overpressure limits prescribed in the EA cater for the inherent variation in emission levels from a given blast design by allowing a 10% (i.e. nine (9) out of ten (10) blasts) exceedance of the 115 dBL criterion up to a 120 dBL maximum (assumed at 1% exceedance to facilitate predictions through the below formula). Correspondingly, '1% exceedance' and '10% exceedance' airblast overpressure prediction formula was used for the assessment.

Maximum Instantaneous Charges (MICs) have been calculated to comply with the 115 dBL 10% exceedance criterion and 120 dBL maximum criterion. The calculated MICs are summarised in **Table 9-9**.

Table 9-9: Predicted Airblast Overpressure Levels at the Closest Sensitive Receptors and Blackwater Township

Sensitive Receptor	Closest Pit in Project Area	Distance to Receptor (m)	Calculated MIC (kg) to Comply With	
			115 dBL Criterion (with 10% Exceedance Allowance)	120 dBL Criterion (Maximum)
R5	16	2,900	3,050	2,795
R8	12	5,000	15,900	14,575
R17	46	1,000	120	110
R19	47	5,400	20,075	18,400

9.4.3.2 Ground Vibration

MICs have been calculated to comply with the 5 mm/s and 10 mm/s PPV vibration limits. The calculated MICs are summarised in **Table 9-10**.

Table 9-10: MICs Calculated to Comply with the 5 mm/s and 10 mm/s PPV Limits

Sensitive Receptor	Closest Pit in Project Area	Distance to Receptor (m)	Calculated MIC (kg) to Comply With	
			5 mm/s Criterion (with 10% Exceedance Allowance)	10 mm/s Criterion (Maximum)
R5	16	2,900	3,805	4,275
R8	12	5,000	11,315	12,715
R17	46	1,000	450	505
R19	47	5,400	13,195	14,835

9.4.3.3 Blasting Assessment Summary

Actual blast design parameters, predictive modelling and monitoring of impacts are regularly reviewed and completed for existing blasting activities at BWM and this will continue as part of the Project.

The calculated MICs presented in **Table 9-9** and **Table 9-10** indicate that blast control measures, such as limiting MICs and careful blast design parameters, would be required for BWM blasting occurring in proximity to sensitive receptor R17. The calculated MICs for the Blackwater township and other surrounding sensitive receptors are in the order of or above the advised production blast MICs of 1,000 to 4,500 kg and therefore specific controls would not be required.

Notwithstanding the above, based on the current and future site practices and the above conservative blasting assessment, it is anticipated that airblast overpressure and ground vibration from the Project can be controlled to acceptable levels at the sensitive receptor locations using current BWM blasting practices.

9.5 Mitigation and Management Measures

9.5.1 Operational Mine Noise

The assessment of predicted BWM noise levels presented in **Section 9.4.1** identified the potential for noise limit exceedances at sensitive receptors R3 and R4 (Tolmies Creek), R5 (Ausbute), R6, R7 (Burngrove) and R17 (Retreat). Marginal 1 to 2 dBA exceedances of the 45 dBA LA1 noise limit has been predicted for sensitive receptors R20, R21, R22 and R23, which it should be noted is not attributed to mining equipment operating in the extension areas of SA10 and SA7. Impacts are not expected at sensitive receptors R20, R21, R22 and R23 given the existing high ambient noise levels from the Capricorn Highway.

For noise sensitive receptors R3, R4, R5, R6 and R7 coal haulage trucks operating along the main haul road as well as waste haulage trucks operating from the closest ramps were found to be primarily responsible for the predicted exceedances. For noise sensitive receptor R17, the predicted exceedances are primarily attributed to waste haulage from ramps R46N and R46S.

In considering these predicted exceedances, the following good practice noise mitigation and management measures will be implemented in conjunction with the exceedance-specific potential noise mitigation measures summarised in **Table 9-11**:

- Clustering of mobile equipment on haul roads and other exposed/elevated areas, such as during shift changeovers to be avoided. Haul truck arrival and departures from go lines will be staggered where possible.
- Dumping of material may include engineering controls to minimise the distance the material falls and lining bins and chutes with rubber to dampen the impact.
- Equipment to be shut down when not in use.
- Equipment to be operated in accordance with the manufacturer’s instruction and in order to minimise noise impact events.
- BWM will seek to utilise broadband “buzzer”, not tonal “beeper”, reversing alarms on mobile plant.
- In the event of a complaint regarding potential impulsive noise disturbance such as dozer track slap, this has the potential to be minimised through idle wheel modification, use of track slides and grousers, and/or management controls such as gear limitation (forward and reverse in 1st gear only).

Additional to **Table 9-11**, whilst it represents the current leading mitigation options for sensitive receptors BWM will explore and potentially implement further alternatives (modelled) that achieve the noise limits (e.g. haul road placement/incline, speed restrictions, landholder agreements and/or land acquisitions).

Table 9-11: BWM Exceedance Specific Noise Mitigation Measures

Predicted Noise Level	Reason for Predicted Exceedance	Potential Noise Mitigation Options	Mitigated Noise Level
Receptor R5			
44-48 dBA LAeq,adj,15min 52-56 dBA LA1,adj,15min (adverse weather with temperature inversion)	Komatsu 930 haul trucks on R16S: up to 43 dBA LAeq (7 trucks) Komatsu 830 coal haul trucks on haul road: up to 42 dBA (2 trucks) Komatsu 930 haul trucks on R20N: up to 38 dBA (5 units) Komatsu 930 haul trucks on R16N: up to 36 dBA (5 trucks) CAT 854 wheeled dozer at TCP: up to 37 dBA Watercart on main haul road: up to 35 dBA BWM TCP: up to 34 dBA	Mitigating waste haul truck noise in Pits 16 and 20: • Komatsu 930 pre-strip (waste) haul trucks to remain shielded (i.e. no clear line of sight to R5) for the majority of operation whilst working between Pits 16 and 20 during temperature inversion conditions. Noise mitigation modelling has indicated reductions exceeding 20 dBA with shielded pre-strip activities. Mitigating coal haul truck noise on the main haul road: Option 1: • Use of quieter coal haul trucks such as the Kress haulers. Noise mitigation modelling completed by SLR indicated a reduction of up to 5 dB with CAT793 haul trucks and up to 9 dB with Kress haulers operating along the main haul road. • Limiting watercart movements on the main haul road (near R5) to one every 15-minutes. Option 2: • If limitations on equipment types, movements and/or after-market noise attenuation kits are not practicable, an acoustic bund/barrier adjacent the main haul road between the TCP and ramp 16 would be effective at reducing mine noise levels at R5 (and at R6 also). Modelling of bunds up to 10 m high indicated a 6 to 8 dB reduction in noise levels from mobile mining equipment operating on the haul road. It is also recommended that dozers operating on waste dumps in Pits 16 and 20 remain shielded (by the waste dump) during temperature inversions.	≤40 dBA LAeq,adj,15min ≤45 dBA LA1,adj,15min Based on shielded waste trucks and either coal haulage (near R5) with Kress haulers and/or noise attenuated trucks or the main haul road acoustic bund/barrier
Receptor R6			
41-44 dBA LAeq,adj,15min 47-52 dBA LA1,adj,15min	Komatsu 930 haul trucks on R16S: up to 37 dBA LAeq (7 trucks) Komatsu 830 haul trucks on haul road: up to	Given the location of R6 relative to R5 (i.e. similar line of sight/acoustic view of BWM, but a further 1 km away), applying the above mitigation measures for R5 would result in compliance with the noise limit at R6.	<40 dBA LAeq,adj,15min <45 dBA LA1,adj,15min (assuming noise mitigation measures

Predicted Noise Level	Reason for Predicted Exceedance	Potential Noise Mitigation Options	Mitigated Noise Level
(adverse weather with temperature inversion)	35 dBA (2 trucks) Komatsu 930 haul trucks on R16N: up to 34 dBA (5 trucks) Komatsu 930 haul trucks on R20N: up to 33 dBA (5 units) BWM TCP: up to 28 dBA		applied to achieve compliance for R5)
Receptor R17			
44 dBA LAeq,adj,15min 46-52 dBA LA1,adj,15min (FY2039 and FY2044 adverse weather with temperature inversion scenario)	Komatsu 930 haul trucks on R42N: up to 38 dBA LAeq (10 trucks) Komatsu 930 haul trucks on R46S: up to 37 dBA (10 trucks) Komatsu 930 haul trucks on R46N: up to 36 dBA	• Komatsu 930 waste haul trucks to remain shielded (i.e. no clear line of sight to R17) for the majority of operation whilst working between Pits 42 and 46 during temperature inversion conditions. • If options for shielding are limited due to work location, the alternative would be to restrict the numbers of Komatsu 930 waste haul trucks operating simultaneously from Pits 46 and 42 (note, noise attenuation kit options are able to reduce the restriction). This could potentially be achieved by avoiding the 800t and 600t shovels operating from the same pit during temperature inversion conditions, as was modelled in Pit 46 for the 2039 scenario.	<40 dBA LAeq,adj,15min <45 dBA LA1,adj,15min
Receptor R3 (measures also applicable to R4)			
41 dBA LAeq,adj,15min 46-49 dBA LA1,adj,15min (FY2039 and FY2044 adverse weather with temperature inversion scenario)	Komatsu 930 haul trucks on R16S: up to 34 dBA LAeq (7 trucks) Komatsu 930 haul trucks on R16N: up to 32 dBA (5 trucks) Komatsu 830 coal haul trucks on haul road: up to 31 dBA (2 trucks)	• Given the location of R3 relative to R5 and R6 and the exceedance being a marginal 1 dBA, applying the above mitigation measures for R5 and R6 would result in compliance with the noise limit at R3.	<40 dBA LAeq,adj,15min <45 dBA LA1,adj,15min (with mitigation measures applied for R5)
Receptor R7			
39 dBA LAeq,adj,15min	Komatsu 830 coal haul trucks on haul road: up to 35 dBA LAeq (2 trucks)	• The haul truck mitigation measures noted above for R5 would result in compliance with the LA1 noise limit for R7.	<45 dBA LA1,adj,15min

Predicted Noise Level	Reason for Predicted Exceedance	Potential Noise Mitigation Options	Mitigated Noise Level
47 dBA LA1,adj,15min (FY2044 adverse weather with temperature inversion scenario)	Komatsu 930 haul trucks on R16N: up to 31 dBA (5 trucks)		(with mitigation measures applied for R5)

9.5.2 Cumulative Noise

The cumulative noise assessment presented in Section 6.2 identified the potential for cumulative noise impacts at sensitive receptor R17 with combined BWM and Cook Colliery noise levels. In consideration of this predicted impact and noting the cumulative noise level of up to 45 dBA is primarily attributed to BWM (i.e. 44 dBA), the noise mitigation options detailed in **Table 9-11** have been developed to achieve cumulative noise levels at R17 compliant with the 40 dBA noise limit for BWM.

It is anticipated that cumulative noise impacts for sensitive receptors located along the Capricorn Highway would be avoided if noise intensive Curragh Mine operations in the southern extent of ML700006 commence after BWM operations have ceased in Pit 8.

9.5.3 Blasting

Future site blasting practices occurring within the Project area would be controlled to acceptable airblast overpressure and ground vibration levels at all sensitive receptor locations using current BWM blasting practices including detailed computational modelling and limited charges where necessary.

10 Surface Water

10.1 Introduction

A Surface Water Resources Assessment (SLR, 2023c) has been prepared for the Project and is provided in **Appendix E**.

10.2 Environmental Values

The *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (EPP Water and Wetland Biodiversity) aims to achieve the objectives set out by the EP Act and is applicable to all Queensland waters. Environmental values (EVs) and water quality objectives (WQOs) are determined for Queensland waters, in alignment with the EPP Water and Wetland Biodiversity.

EPP Water and Wetland Biodiversity provides a framework to achieve the water and wetland objectives that are set out by the EP Act through:

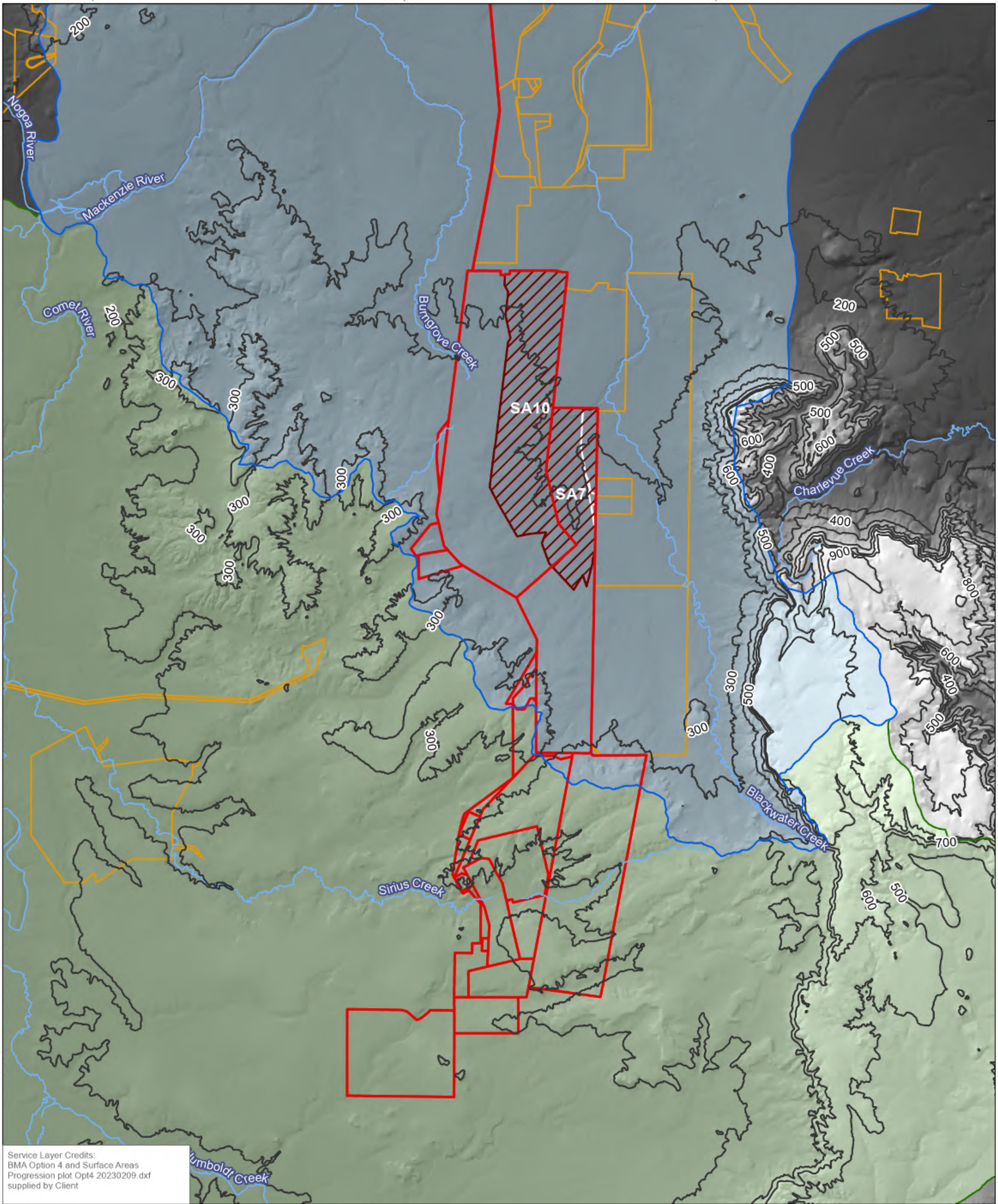
- Identifying EVs and management goals for Queensland waters.
- Providing state water quality guidelines and WQOs to enhance or protect the environmental values.
- Providing a framework for making consistent, equitable and informed decisions.
- Monitoring and reporting on the condition of Queensland waters.

EVs for surface water are defined as the qualities of water that make it suitable for supporting aquatic ecosystems and human water use (DES 2018). The Project is located within the Southern Tributaries of the Mackenzie River Sub-basin. The EVs for the Project are listed in *Environmental Protection (Water) Policy 2009 – Mackenzie River Sub-basin Environmental Values and Water Quality Objectives* (EPP Mackenzie River Sub-Basin EV and WQO) (DEHP, 2013). The purpose of this policy is to achieve ecological sustainable development in relation to Queensland waters. It sets a framework for managing environmental impacts on water, the identification of environmental values and the guidelines needed to protect the water environment.

Figure 10-1 shows the location of the Upper Mackenzie Sub-catchment of the Fitzroy Basin Water Plan area.

A review of the WQ1304 surface waters plan that accompanies the EPP Mackenzie River Sub-Basin EV and WQO indicates that Burngrove Creek, Taurus Creek, Deep Creek and Emu Creek are waters included in the Mackenzie River Southern Tributaries – Developed Areas.

All relevant EVs need to be considered when evaluating a water body. The level of environmental and water quality protection must be determined to maintain each of the EVs. Management goals that are established to protect the EVs should reflect the specific problems and/or threats to the values, desired levels of protection and key attributes that must be protected (ANZECC & ARMCANZ, 2000).



0 5 10 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:325,000 at A4
Project Number:	620.014601
Date Drawn:	08-Dec-2023
Drawn by:	NT

LEGEND

- Topographic Contour (mAHD)
- BWM Mining Lease
- BWM North Extension Project Area
- Mining Lease

Fitzroy Basin (2011) Water Plan Sub-catchment

- Comet
- Upper Mackenzie

Elevation (m)

925

28

BLACKWATER MINE - NORTH EXTENSION PROJECT

UPPER MACKENZIE SUB-CATCHMENT OF THE FITZROY BASIN

FIGURE 10-1

BMA
BHP Mitsubishi Alliance

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_SW_CH_F10_1_Upper Mackenize Sub Catchment

The EVs applicable to the Project are:

- Aquatic Ecosystems.
- Farm supply/use.
- Stock water.
- Human consumption of aquatic foods.
- Visual recreation.
- Cultural and spiritual values.

The EV for human consumption is noted for this area of the sub-basin, however, it is not considered relevant to the Project area due to the ephemeral nature of the creeks and lack of any water supply infrastructure in close proximity to the Project. The closest water supply location is Bingegang Weir which is located over 100 kilometres downstream of the Project. The Project represents less than 0.002% of the total catchment area to Bingegang Weir and drinking water is treated prior to its distribution for consumption. Similarly, due to the ephemeral nature of the watercourses and their location, it is considered unlikely they would be used for primary or secondary recreation.

Where more than one EV applies to receiving waters, the most stringent Water Quality Objective (WQO) is adopted to protect all identified EVs. Aquatic ecosystem WQOs therefore form the basis of the WQO for this Project.

Table 10-1 outlines the guideline WQOs identified for the Protection of Aquatic Ecosystems.

BWM has an annual Receiving Environment Monitoring Program (REMP) for the BWM. The REMP has been active for multiple years and the associated sampling has been used to derive local water quality guidelines for Blackwater, Taurus and Deep Creeks. The REMP notes the aquatic ecosystem protection guideline (2000 µS/cm) identified by Prasad et al. (2012) for the protection of 95% of species within the Fitzroy Basin. This limit is also the guideline upon which the current EA condition F21, Table F5 is based. Table F5 of the EA requires a salinity of 2,000 µS/cm for the 80th percentile of readings for the downstream receiving environment.

10.2.1 Regional and Local Hydrology

The Project is located within the catchment of Blackwater Creek, which is a tributary of the Mackenzie River. The Mackenzie River catchment drains to the Fitzroy River, which ultimately terminates at the Coral Sea south-east of Rockhampton, near Port Alma.

The Project area covers an area of approximately 90 km^2, which equates to approximately 0.7% of the 13,000 km^2 Mackenzie River catchment and 0.07% of the 140,000 km^2 Fitzroy River basin.

The waterways of the Project area are predominantly first and second order tributaries. There are sections of waterways ranging up to the fourth order including Two Mile Gully and Taurus Creek. Taurus Creek flows north into Blackwater Creek as a fifth order stream.

The waterways are ephemeral streams, which are dry for most of the year and flow for a short time following sustained or intense rainfall events that are more common in the wet season. Stream flows are highly variable, with most channels dry during winter to early spring when rainfall and runoff is historically low.

Table 10-1: Guideline Values for the Protection of Aquatic Ecosystems

Management Intent (Level of Protection)	Parameter	Water Quality Objectives (2013)	Water Quality Objectives 2017 DRAFT
Southern Tributaries Mackenzie River Sub-Basin Waters (refer plans WQ130, WQ1310)			
Aquatic Ecosystems, Moderately Disturbed	Ammonia N	<20 µg/L	<10-10-25 µg/L
	Oxidised N	<60 µg/L	<10-10-130 µg/L (base) 20-50-160 µg/L (event)
	Organic N	<420 µg/ L	-
	Total nitrogen	<775 µg/ L	<250-400-680 µg/L (base) 400-755-1300 µg/L (event)
	Filterable reactive phosphorus (FRP)	<20 µg/L	<11-20-44 µg/L[a]
	Total phosphorus	<160 µg/L	<50-75-150 µg/L (base) 210-230-350 µg/L (event)
	Chlorophyll a	<5.0 µg/L	As per 2013 WQO
	Dissolved oxygen	85%–110% saturation	As per 2013 WQO
	Turbidity	<50 NTU	15-70-688 NTU 90-190-450 NTU
	Suspended solids	<110 mg/L	11-75-1280 mg/L 30-90-315 mg/L
	pH	6.5–8.5	As per 2013 WQO
	Electrical conductivity (EC) baseflow	<310 µS/cm	430-620-870 µS/cm (low) 220-320-390 µS/cm (high)
	Electrical conductivity (EC) high flow	<210 µS/cm	
	Sulfate	<10 mg/L	<20-<20-25 mg/L (base) <20-<20-33 mg/L (event)
	Macroinvertebrates	Taxa richness (composite): 12–21 Taxa richness (edge habitat): 23–33 PET taxa richness (composite): 2–5 PET taxa richness (edge habitat): 2–5 SIGNAL index (composite): 3.33–3.85 SIGNAL index (edge habitat): 3.31–4.20 % tolerant taxa (composite): 25–50% % tolerant taxa (edge habitat): 44–56% % tolerant taxa (edge habitat): 44–56%	As per 2013 WQO

Notes N = nitrogen, EC = electrical conductivity (EC), ND = no data, µg/ L = micrograms per litre, mg/L = milligrams per litre, NTU = Nephelometric Turbidity Units, µS/cm = microSiemens per centimetre

WQGs for indicators are shown as a range of 20th, 50th and 80th percentiles to be achieved (e.g.3-4-5), lower and upper limits (e.g. pH: 7.2-8.2) or as a single value.

The waterways within the Project area and downstream are shown on **Figure 10-2**. These include:

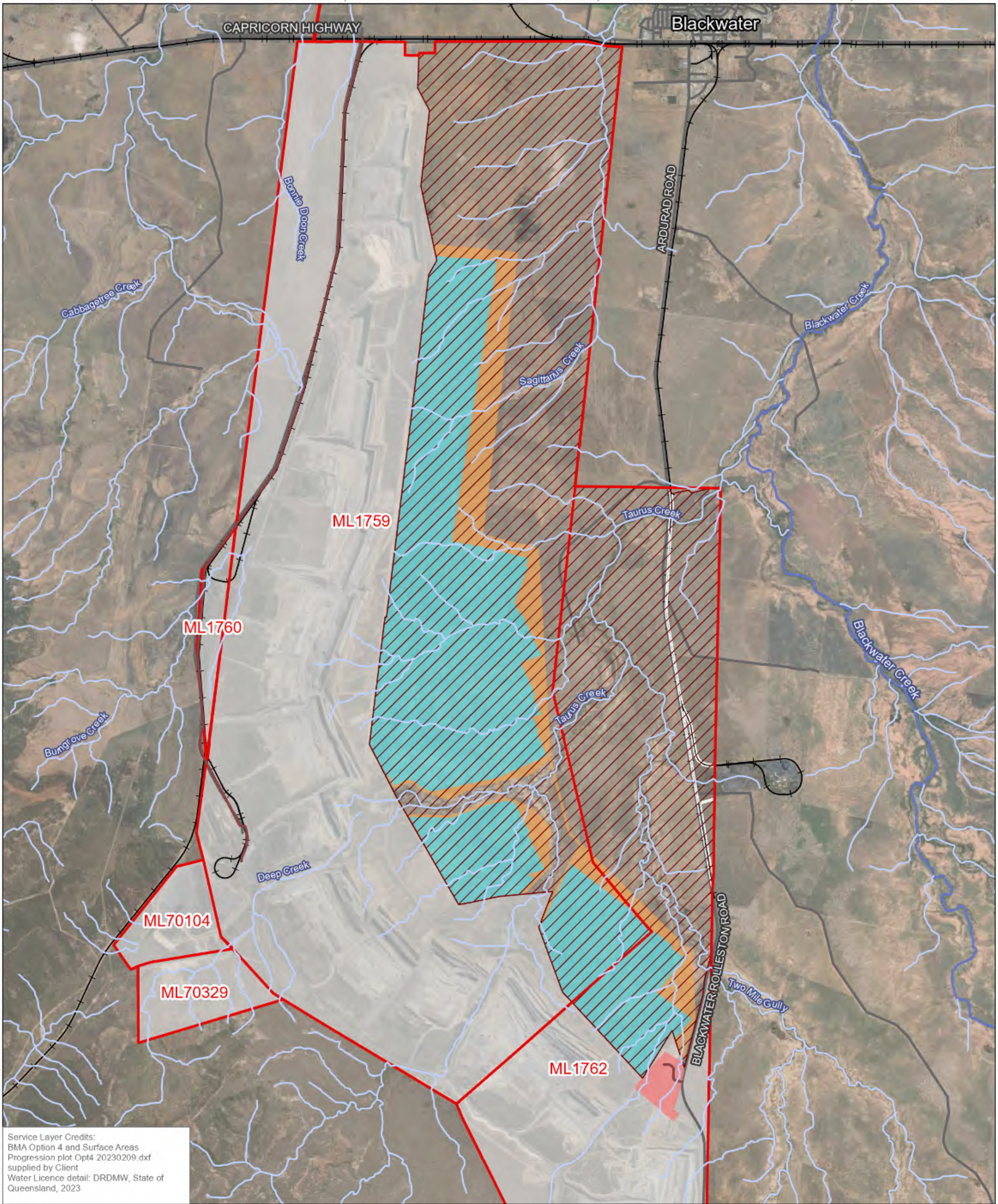
- **Two Mile Gully** and its associated tributaries, the headwaters of which are located to the south east and within the southern part of the Project area. These waterways flow in a north easterly direction, joining Taurus Creek approximately 6 km downstream of the Project disturbance footprint.
- **Deep Creek**, the tributaries of which originate to the west of BWM and flow in a north easterly direction between active mining areas of BWM (parallel with Taurus Creek) and joins Taurus Creek immediately downstream of Taurus Road. The Deep Creek watercourse traverses between active mining areas via the Deep Creek Diversion, which conveys flows to the New Deep Creek Dam. The New Deep Creek Dam is an on-line structure and flows discharging from the Dam continue in an easterly direction for approximately 3.5 km before joining at the confluence with Taurus Creek.
- **Taurus Creek**, the tributaries of which originate to the west of BWM and flow in a north easterly direction between active mining areas of BWM as well as immediately west of the Project disturbance footprint in a north easterly direction, where it joins with Blackwater Creek. Taurus Creek flows into Blackwater Creek approximately 15 km downstream of the New Taurus Creek Dam and approximately 4 km downstream of the Project disturbance footprint.
- **Sagittarius Creek**, the upstream tributaries of which originate in the Project area, flows off-site passing to the west of Blackwater, then joining Blackwater Creek, approximately 12 km downstream of the Project area.
- **Blackwater Creek**, which is located to the east of the Project area and flows in a northerly direction to the east of Blackwater, joining the Mackenzie River approximately 40 km downstream of the Project area, and ultimately joining the Fitzroy River and flowing to the Coral Sea at Rockhampton.

10.2.2 Water Quality Monitoring

Water quality sampling has been regularly undertaken at 11 locations upstream and downstream of the Project area as part of the BWM Receiving Environment Monitoring Program (REMP). The REMP has been undertaken in accordance with Condition F22 of the EA and includes water quality, sediment and macro invertebrate sampling. **Figure 10-3** shows the REMP sampling locations as relevant to surface water resources.

REMP (2020/21) water quality results indicated most analytes were within guidelines, and where concentrations were above the guideline, they mainly occurred both upstream and downstream of mining. With a few exceptions, downstream median concentrations for all analytes across the entire REMP study (since 2010) remained within the upstream 80th percentile which is considered acceptable for slightly-to-moderately disturbed ecosystems (Gauge, 2022). These exceptions were reported as mainly confined to creeks outside the Project area. The REMP also examined stream flow, habitat condition, sediment quality, and biological indicators. It was concluded the data indicates changes in water quality after mining are within acceptable limits and/or downstream medians were within guideline values, suggesting the current EA limits are protecting the environment (Gauge, 2022). The results of this monitoring are discussed further in the Aquatic Ecology Impact Assessment (**Appendix I**).

Water quality data for pH and Electrical Conductivity (EC) are regularly sampled during periods of flow at key upstream and downstream flow monitoring locations. This monitoring has been undertaken over ten years since 2013. The results indicate pH is generally within guideline values and EC is generally below the 80th percentile downstream requirements under the EA, which correspond to 2,000 µS/cm. With the exception of Taurus Creek upstream, the majority of the readings are within the WQO 2017 80th percentile guidelines. Further details of recent water quality results in relation to guideline values are provided in **Appendix E**.



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	08-Dec-2023
Drawn by:	NT

BMA
BHP Mitsubishi Alliance

LEGEND

- Railway
- Road
- Mine Acces Road
- Minor Watercourse
- Major Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

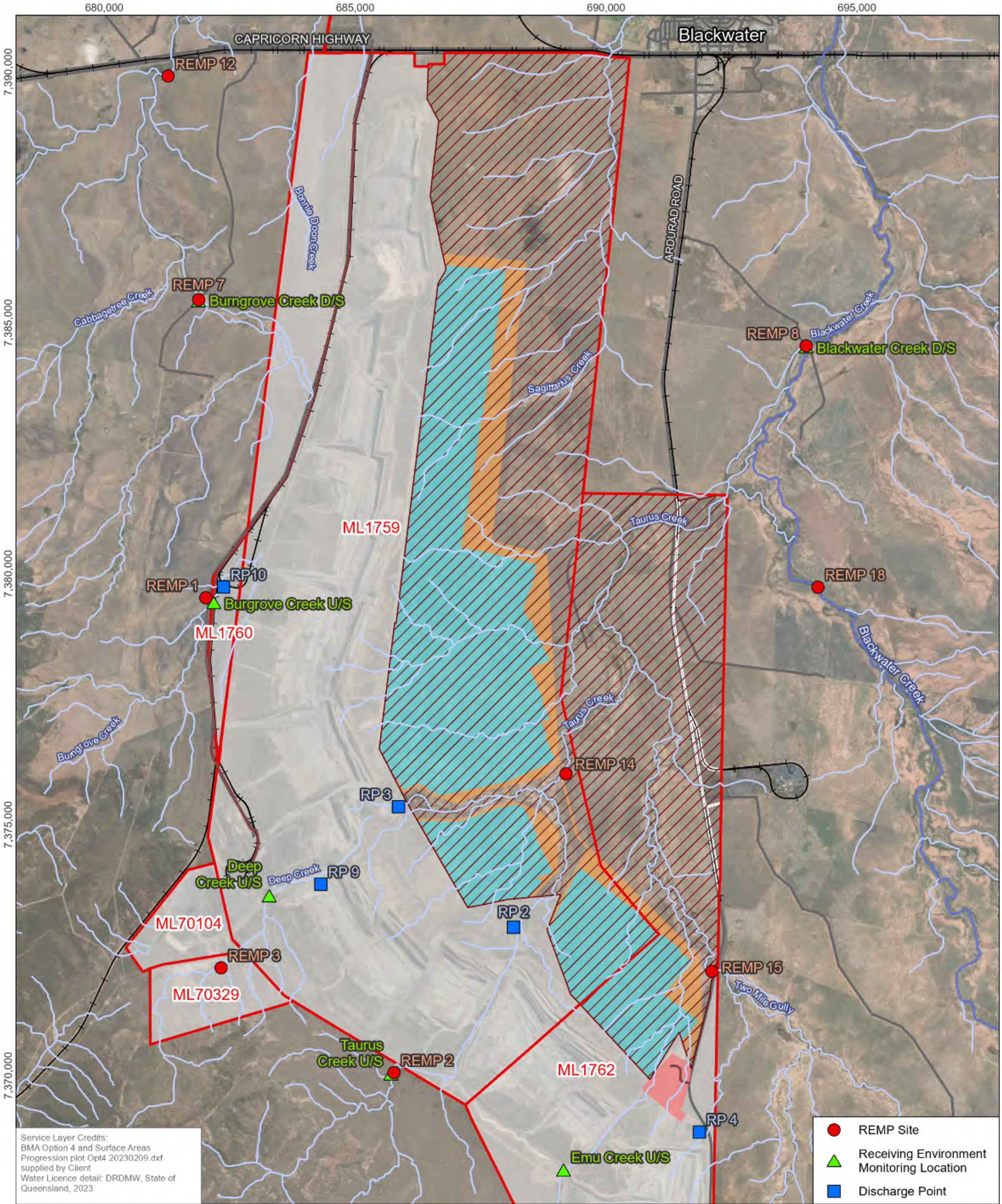
BLACKWATER MINE - NORTH EXTENSION PROJECT

LOCAL WATERWAYS

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 10-2

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_SW_CH_F10_2_Local_Waterways



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Coordinate System:	GDA2020 MGA Zone 55
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Date Drawn:	08-Dec-2023
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LEGEND

- Railway
- Road
- Mine Acces Road
- Minor Watercourse
- Major Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

WATER QUALITY MONITORING LOCATIONS

FIGURE 10-3

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_SW_CH_F10_3_WQ Monitoring

The BWM EA was amended on 29 June 2023 to authorise BWM to participate in the Fitzroy Regional Receiving Environmental Monitoring Plan (FRREMP). The EA amendments remove the application of EA Conditions F22 to F24 while BWM is a participant in the FRREMP. Condition F21 Table F5 is unaffected by this EA Amendment.

10.2.3 Water Quality in Mine Affected Water Storages

Water quality in key Mine Affected Water (MAW) storages on site is regularly monitored. The observed pH levels are within the pH limits for the 10th percentile in all storages, with some exceedances at 20th and 50th percentiles. Exceedances are observed in all storages for the 80th and 90th percentiles. The maximum pH level observed in the MAW storages range from pH 9.4 to 11.6 (**Appendix E**). EC concentrations for the MAW storages are within the release limit of 10,000 (µS/cm) for the 10th to 90th percentiles for the majority of the storages. Further details of water quality in MAW water storages are provided in the Surface Water Resources Assessment in **Appendix E**.

10.2.4 Existing Water Users

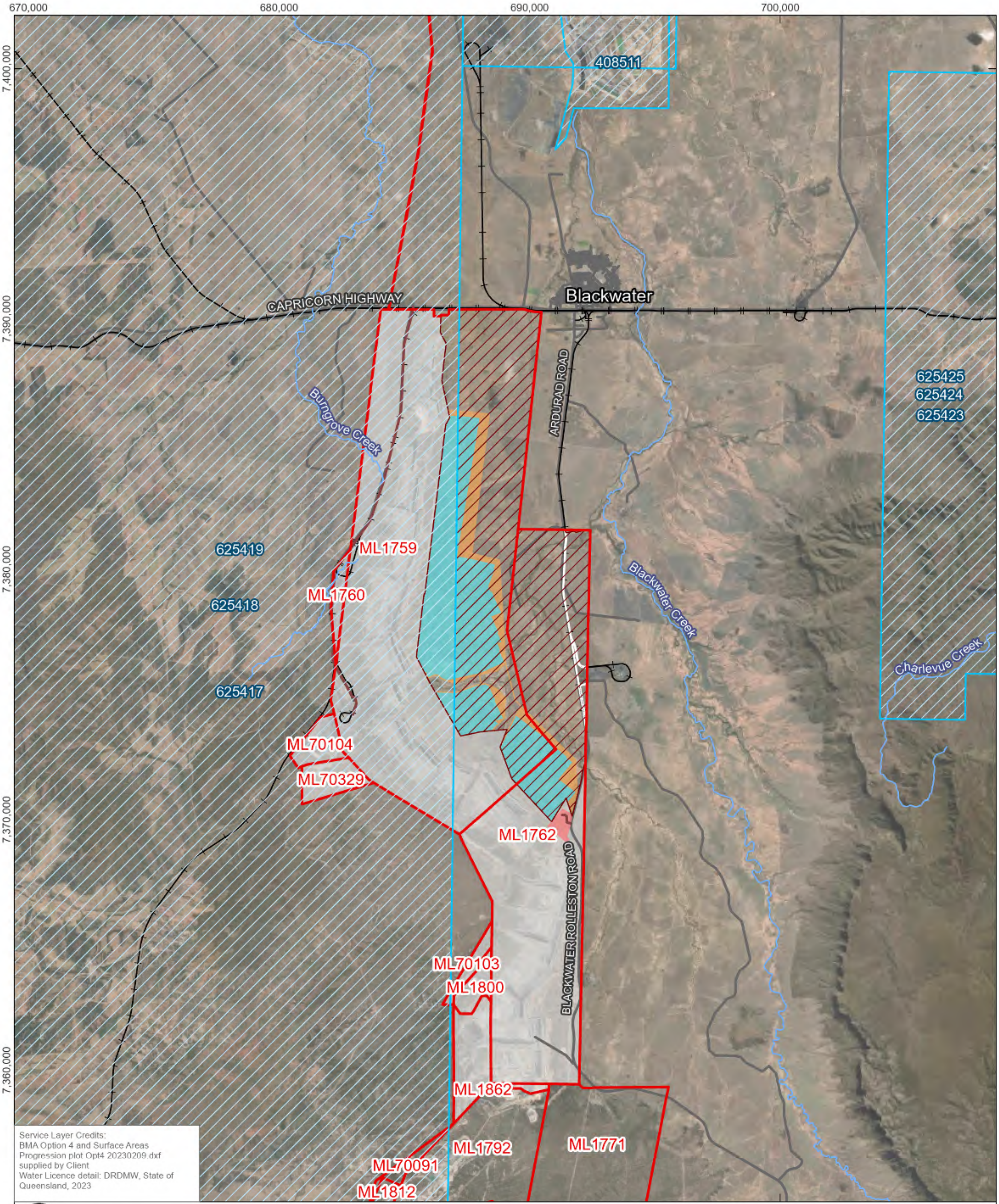
A search of the Queensland Government database for licenced water users was undertaken on 19 June 2023. Licenced surface water users downstream of the Project are presented in **Figure 10-4**. Three of the four licenses are associated with a license to take water for Petroleum and Gas; these licenses cover a large area around BWM. The only other license that overlaps the area is for Coronado's operations at Curragh Mine and is for diverting or interfering with the Blackwater Creek channel, not to take water from the watercourse. Any other licenses in the vicinity of the Project are not directly impacted by the Project.

10.2.5 Creek Geomorphology

The waterways in and around the Project area are ephemeral and are dry for prolonged periods throughout the year. A significant rainfall event is typically required in order for the streams to flow.

Typical cross-sections for two of the main ephemeral waterways, Sagittarius Creek and Taurus Creek, within the Project area have been prepared. The Sagittarius Creek cross-section shows a single confined channel, whereas the Taurus Creek cross-section shows confined low-flow channels and a broader high-flow channel.

The waterways traversing the Project area are prone to erosion, particularly as a result of grazing activities. The stream beds contain mostly sand and gravel on a clay base, except Deep Creek upstream which contains mainly silt and clay. Downstream of the active mining area, the substrate of Deep Creek shows little change in morphology, with small amounts of silt or sediment observed in areas of former remnant pools (BMA, 2020).



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:200,000 at A4
Project Number:	620.014601
Date Drawn:	08-Dec-2023
Drawn by:	NT

BMA
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LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- Water Licence
- BWM Mining Lease
- BWM North Extension Project Area
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

WATER USERS

FIGURE 10-4

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_SW_CH_F10_4_WaterLicence

10.3 Surface Water Management

10.3.1 Surface Water Management Strategy

The BWM water management strategy will be applied to the Project, which includes (but is not limited to) the following management actions:

- Where possible, runoff from undisturbed areas both on and surrounding the mine site is diverted away from disturbed areas into adjacent waterways.
- Disturbed area runoff is captured and treated in sediment/environmental dams and used preferentially for dust suppression and coal processing.
- Mine affected water is captured and treated in the BWM water management system where it is then transferred to be preferentially used for process water or dust suppression. If required, it is released off-site in compliance with the BWM EA release conditions.

Catchment planning and separation of water types is undertaken as part of the mine design, as illustrated in **Figure 10-5**. Water is classified as 'having the potential to be sediment-laden" (ESC), MAW or undisturbed and is directed through the water management structures accordingly.

The Project will utilise the same infrastructure and processes currently implemented at BWM. The system is supported through a number of management controls, many of which are required by the Project's EA. These include, but are not limited to:

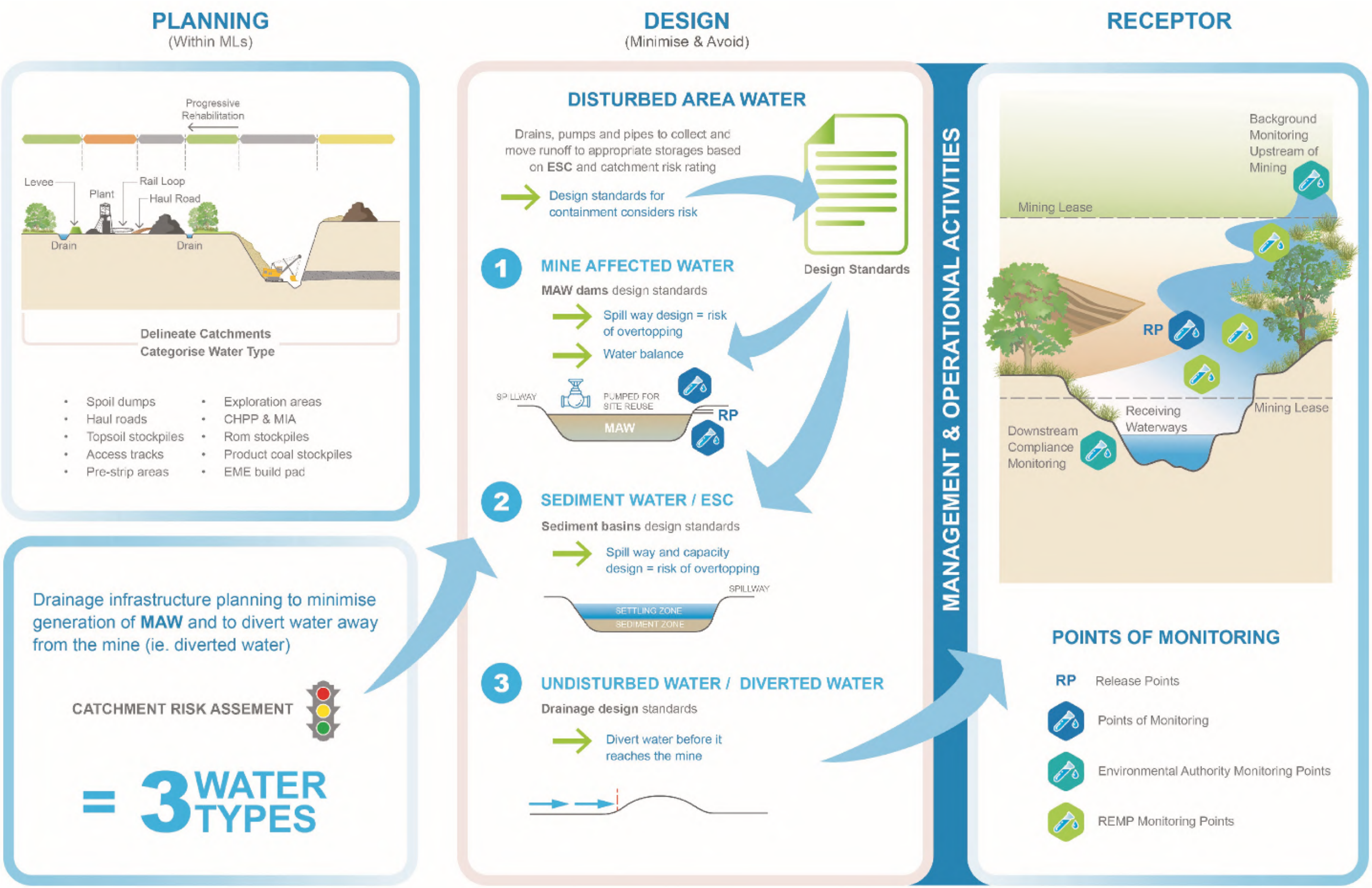
- A site-specific Erosion and Sediment Control Plan and Water Management Plan.
- Trigger Action Response Plan (TARP) for the system and key structures.
- Release rules, procedures and telemetry.
- Inspections and water level management.
- Maintenance procedures including dewatering, desilting, and inspections.
- Monitoring of water quality.
- Wet season preparedness, including predictive water balance modelling and subsequent planning.

The water management system has been designed in accordance with BMA and BWM Standards. These standards are based on industry standards formed by research and proposed by regulatory agencies such as DES. The system is designed on a risk basis with consideration for avoiding and minimising the risk of environmental harm.

10.3.2 Surface Water Storage

The Project will integrate with and utilise existing water management infrastructure. As the Project pit extent progresses, modifications to the locations of water management infrastructure will occur.

New erosion and sediment control (ESC) structures will be constructed and designed to capture sediment laden runoff from disturbed areas. ESC structures will be designed in accordance with the BWM Erosion and Sediment Control Plan and BWM Water Management Plan and managed in accordance with Schedule G of the BWM EA. The management plan specifies different types of ESC and the different requirements for each control type being Erosion, Drainage and Sediment. The regulated structures require a certified operational plan to be developed which will include management methods for high rainfall and flood events.



Project Number:	620.13593
Date:	14-Nov-2023
Drawn by:	NT

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BLACKWATER MINE - NORTH EXTENSION PROJECT

WATER MANAGEMENT DIAGRAM

FIGURE 10-5

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ESC structures will be placed at the natural low point within the disturbance footprint, with undisturbed surface water catchments diverted around and away from disturbed areas using bunds and gravity diversion drains. Some small diversion drains may be required to capture all disturbed catchment and discharge to the proposed sediment dams. Catchment risk assessments will be undertaken and used to define sediment control structure design, in particular the sizing. Sediment control measures will be designed and constructed in accordance with the Best Practice Erosion and Sediment Control Guideline (IECA, 2018).

There are no proposed changes to the MAW structures as part of the Project. MAW is proposed to be managed in the existing MAW system, with additional pumps and pipeline infrastructure utilised to manage transfer of this water from the expanded Project site. MAW structures will be relocated if required as the Project footprint extends to the east.

Structures will be assessed in accordance with the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (DEHP, 2016) (the Manual), which includes an assessment for: failure to contain overtopping, failure to contain seepage and failure to contain dam break. High or significant structures will be managed in accordance with Schedule G of the EA and designed, constructed and managed in accordance with the Manual and associated dam specific documents required therein.

ESC structures and MAW dams are inspected pre- and post-wet season (at a minimum), and operational controls require dewatering to reset to the desired operational level and provide the required settling storage for rainfall events. The spillway capacity of the dams is designed specific to the consequence category and catchment risk.

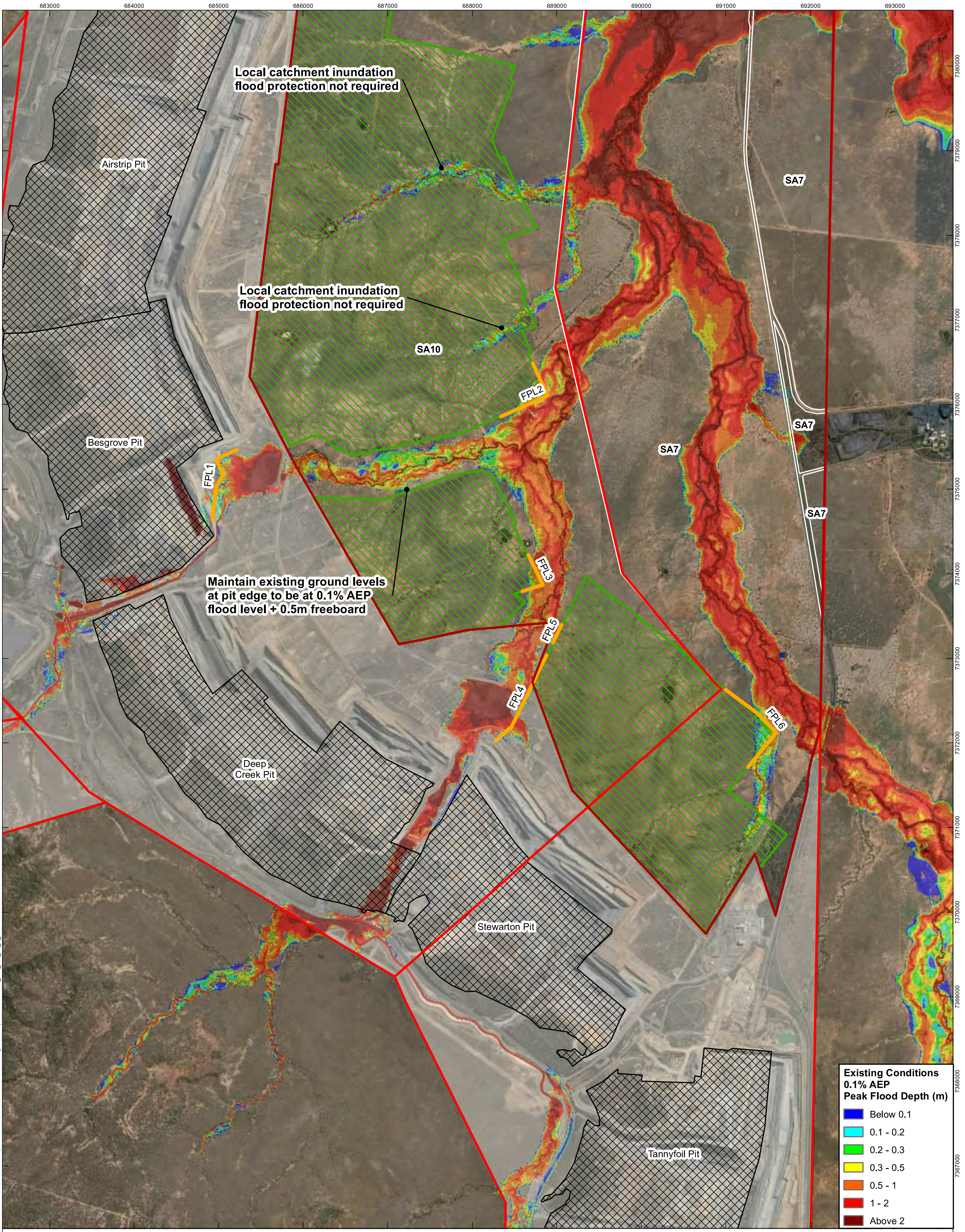
10.3.3 Flood Protection

Existing flood protection such as those associated with the Deep Creek Diversion and Taurus Creek Diversion will not be altered as part of the Project. To prevent inundation of the proposed open cut pits from Two Mile Gully, Deep Creek and Taurus Creek, additional flood protection measures are proposed for the Project including:

- Flood protection during operation. Operational flood protection will include levees and/or flood protection landforms.
- Where flood protection is required post-mining, the final landform design will provide an appropriate level of protection.
- Delineation and management of areas where minimum ground levels need to be maintained to prevent ingress of the flood events into mine pits and infrastructure areas.

The flood protection components and locations are shown in **Figure 10-6**, with further details provided in **Appendix E**.

A flood protection levee (located at Flood Protection Location 1 (FPL1) on **Figure 10-6**) is required to prevent flood waters from Deep Creek inundating Besgrove pit west of New Deep Creek Dam. The levee will extend on the existing flood pit protection and be approximately 1 km long with a crest level at or above the 0.1% Annual Exceedance Probability (AEP) flood level +0.5 m freeboard. The levee will have an average height of 1.5 m. This levee will only be required during operations.



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Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	07-Dec-2023
Drawn by:	SM

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LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE - NORTH EXTENSION PROJECT

PROPOSED FLOOD PROTECTION LOCATIONS

FIGURE 10-6

Flood protection at locations FPL2 to FPL6 will be required during both operations and closure to protect the extension of Stewarton Pit, Deep Creek Pit and Besgrove Pit. Flood protection at these five locations may take the form of a flood protection levee during operations and be recontoured in the final landform. Alternatively, the flood protection may be provided through a flood protection landform designed to function during both operations and closure. At all five locations the final landform will provide flood protection during closure. These landforms will be generally trapezoidal in shape, top soiled and grass covered to minimise the potential for erosion.

Any flood protection levees will be constructed with an appropriate width based on the levee height and designed and constructed in accordance with the DES *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams* and the Department of Environment and Heritage Protection (DEHP) guideline *Structures which are dams or levees constructed as part of environmentally relevant activities*.

10.4 Potential Impacts

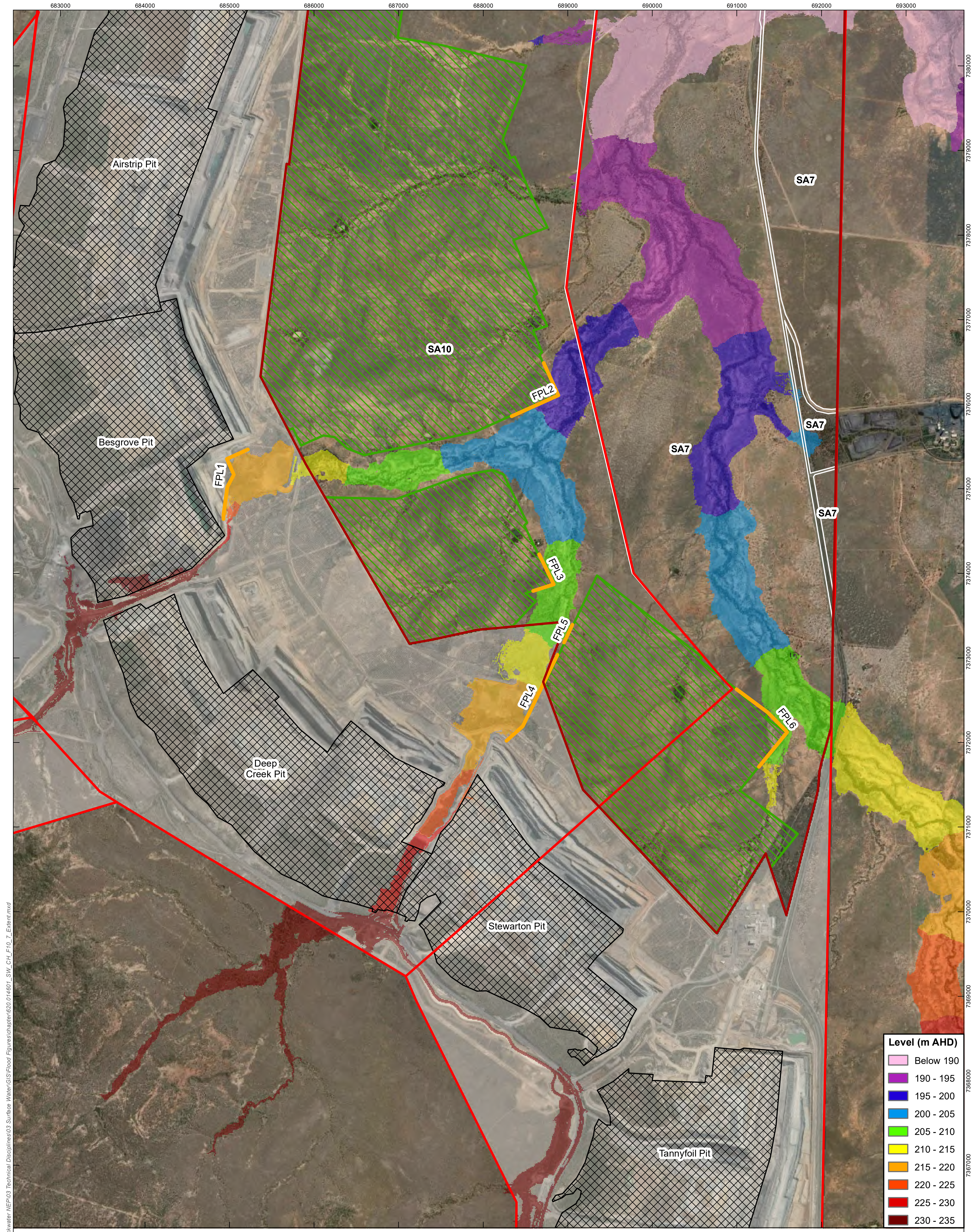
10.4.1 Flooding

Flood modelling was undertaken to examine the effectiveness and impact of the proposed flood protection levees/landforms. A flooding assessment of the Taurus Creek (including Deep Creek), Two Mile Creek and Blackwater Creek has been conducted for the 0.1%, 2%, 50% AEP and Probable Maximum Flood (PMF) events. Current industry standards (Australian Rainfall and Runoff (AR&R)) for hydrology and the most up-to-date topographical information from 2019 have been used. Details of the flood modelling are provided in **Appendix E**.

Modelled flood extent and peak flood levels for the 0.1% AEP following inclusion of the flood protection measures are illustrated in **Figure 10-7** and **Figure 10-8**, respectively. Modelling indicates that in the 0.1% AEP event, peak flood levels in Taurus Creek downstream of SA10 on ML1759 and SA7 on ML1762 are generally reduced in the future scenario in comparison to the existing scenario. In Blackwater Creek, downstream of the junction with Taurus Creek, peak flood levels are approximately 70 mm lower than in the existing scenario. The reduction in flood levels can be attributed to the reduction in catchment area caused by the proposed mining progression.

Local increases in peak flood levels occur within Deep Creek and Taurus Creek as a result of the flood protection, particularly FPL1, FPL2 and FPL3. These increases range from 10 mm to 500 mm, although are generally less than 100 mm. Isolated increases also occur at the junction of Deep Creek and Taurus Creek adjacent to FPL2. The increases are localised and wholly contained within ML1759 and ML1762.

The flood characteristics in comparison with the recommended industry standard ACARP design criteria for the design of stream diversions (ACARP, 2002) indicates little difference between the existing conditions and the Project during the 2% and 50% AEP events. This is a result of the proposed flood protection and the alterations to surface water catchments having minimal impacts to the flow/flood behaviour for these events. Therefore, the anticipated flow velocity, bed shear stress and stream power results are similar to that of the existing conditions.



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Coordinate System: AGD 1966 AMG Zone 55
Scale: 1:40,000 at A3
Project Number: 620.014601
Date: 07-Dec-2023
Drawn by: SM

BMA
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LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE - NORTH EXTENSION PROJECT

EXTENSION CONDITIONS PEAK FLOOD LEVELS - 0.1% AEP

FIGURE 10-7

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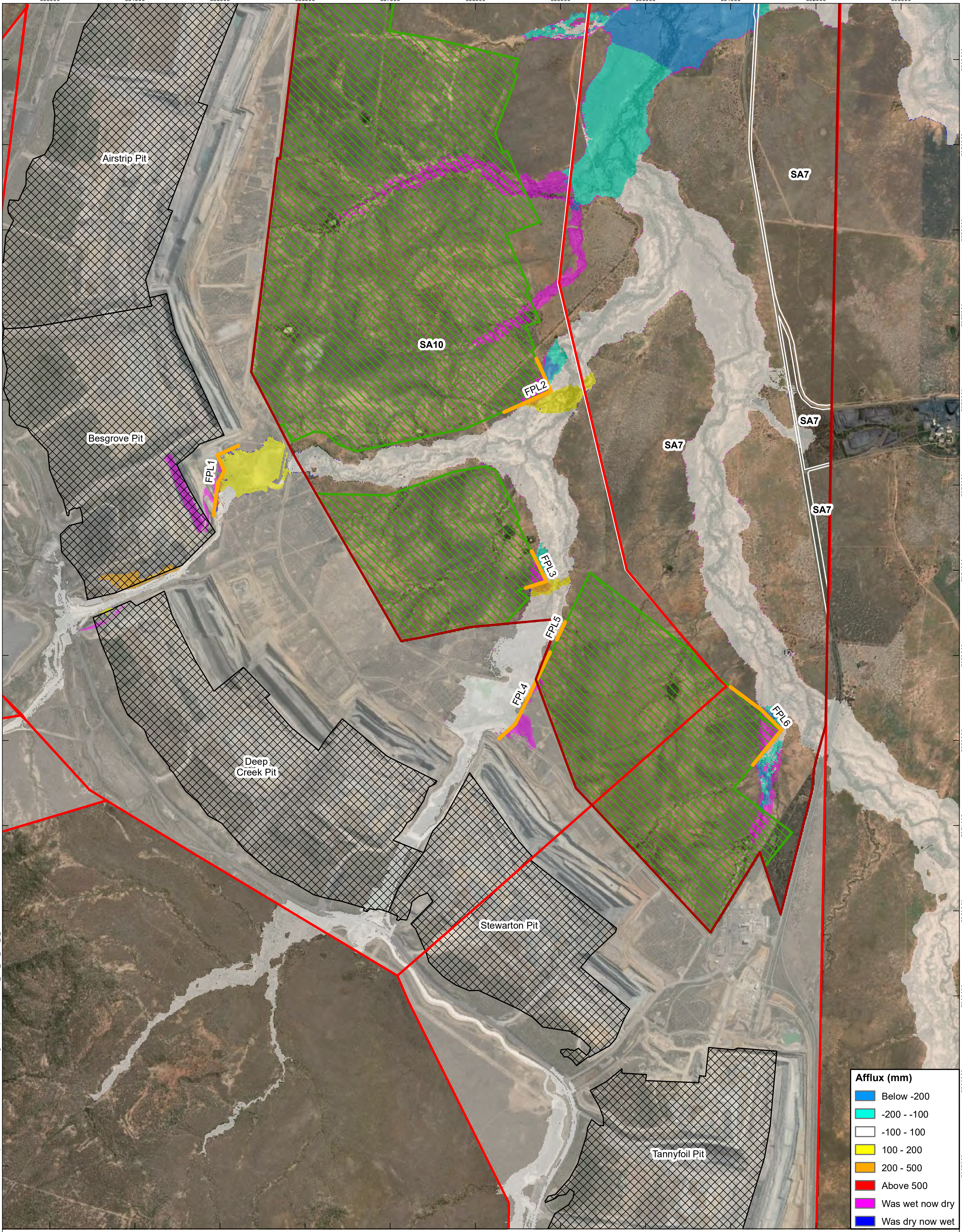

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Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	07-Dec-2023
Drawn by:	SM

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LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE - NORTH EXTENSION PROJECT

EXTENSION CONDITIONS PEAK FLOOD AFFLUX - 0.1% AEP

FIGURE 10-8

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A sensitivity assessment was undertaken to examine the potential impact of climate change on flood levels in the 0.1% AEP event (**Figure 10-9**). The results indicate that climate change may increase the 0.1% AEP flood level by up to 320 mm adjacent to the flood protection at FPL2 which is within the 500 mm freeboard of the final landform flood protection. Across the model domain, climate change results indicate an increase in 0.1% AEP flood levels of up to 900 mm, but are generally less than 250 mm. Further information, including the assumptions for the climate change analysis, are provided in the **Appendix E**.

There are no downstream water users and only isolated areas that are potentially sensitive environmental receptors. The magnitude and frequency of change to flood behaviour in these areas is predicted to be minimal. Therefore, any changes to the flood risk are unlikely to impact sensitive receptors in the vicinity of the Project.

Assessment of flood behaviour for the final landform was undertaken for the 0.1% AEP event and is illustrated in **Figure 10-10** (and in **Appendix E**). As shown, results of the modelling indicate that the proposed final landform will provide flood immunity for the final void up to the 0.1% AEP event.

The final landform shows the removal of any levees including the Deep Creek Levee (FPL1) and final stable landforms FPL2 through to FPL6. The final landform includes areas of raised ground which act as flood protect the final void from the 0.1% AEP event. The final landforms at the flood protection locations are less than 2.5 m in height (above the natural ground level) and provide flood mitigation for a length of up to 1.3 km. The landforms will be vegetated which will assist in preventing erosion and mitigate the potential for increased sediment load downstream.

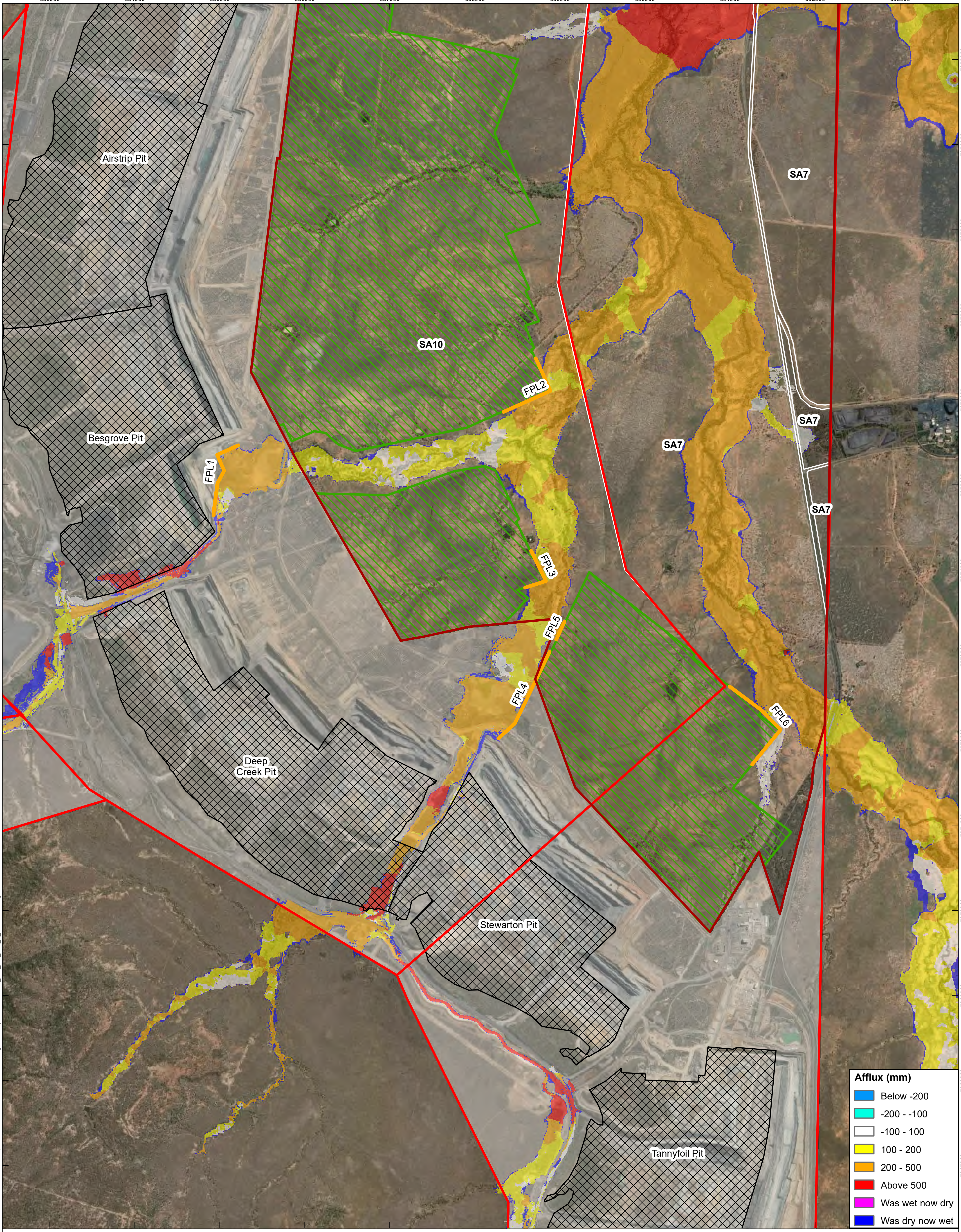
A sensitivity assessment was undertaken to examine the potential impact of climate change on flood levels in the 0.1% AEP. The final landform footprint is similar to that of the operational model at 2085 and similar impacts to flooding would be expected in the final landform. Flood level increases due to climate change could be up to 320 mm but this remains within the 500 mm freeboard of the final flood protection.

The final landform will be assessed further and redesigned as part of the detailed closure planning. This will include assessment of the structural integrity of the final landform and monitoring of erosion and water quality. The mining lease will not be relinquished until the final landform is deemed to be stable and suitable for relinquishment.

10.4.2 Changes to Stream Flows

The Project has the potential to impact on stream flow due to loss of catchment area draining to local waterways. Catchment area to these waterways is reduced through the Project's activities as disturbed catchment areas are directed to the MAW management or ESC system for capture, treatment, and reuse. The captured catchment will change as the mine develops and has the potential to influence flows in downstream sections of Sagittarius Creek, Taurus Creek, Deep Creek and Blackwater Creek. The greatest potential impact is at Sagittarius Creek where a greater proportion of the total catchment area ~11% is captured by the Project. The reduction in catchment area at Blackwater township is 2%.

The translation of this loss of catchment area to potential change in stream flow was estimated based on gauged flow data whereby the flow was estimated based on recorded flows in the catchment and scaled for any differences in catchment area between the gauge location and point of interest. For Sagittarius Creek, which is ungauged, flow was based on the Taurus Creek gauge scaled by relative catchment area at both locations.



0 500 1,000 Meters

Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	07-Dec-2023
Drawn by:	SM

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BHP Mitsubishi Alliance

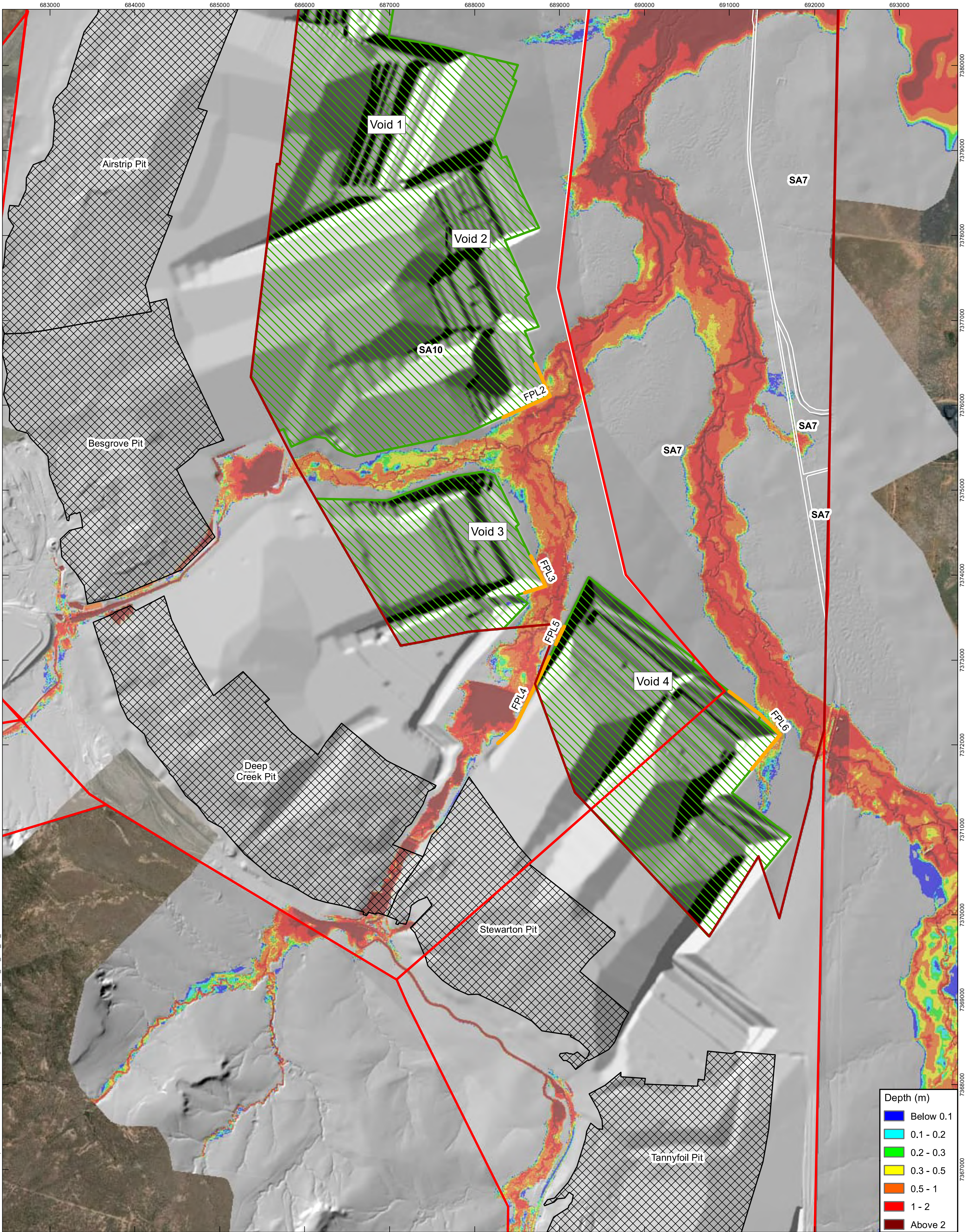
LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE - NORTH EXTENSION PROJECT

CLIMATE CHANGE PEAK FLOOD AFFLUX - 0.1% AEP

FIGURE 10-9



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Coordinate System: AGD 1966 AMG Zone 55
Scale: 1:40,000 at A3
Project Number: 620.014601
Date: 07-Dec-2023
Drawn by: SM

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BHP Mitsubishi Alliance

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE - NORTH EXTENSION PROJECT

FINAL LANDFORM PEAK FLOOD DEPTHS - 0.1% AEP

FIGURE 10-10

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Due to the ephemeral nature of the creeks, flows are minimal and infrequent. The change in flow is illustrated in **Figure 10-11** which shows the change in the flow exceedance curve due to the change in daily discharge exceedance. The change in stream flow due to the loss of catchment area is minimal, even in the case of Sagittarius Creek which as noted above has the greatest proportional reduction in catchment area. The potential impact on water quantity in Blackwater Creek at the confluence with Taurus Creek and further downstream at the town of Blackwater is likely to be undetectable.

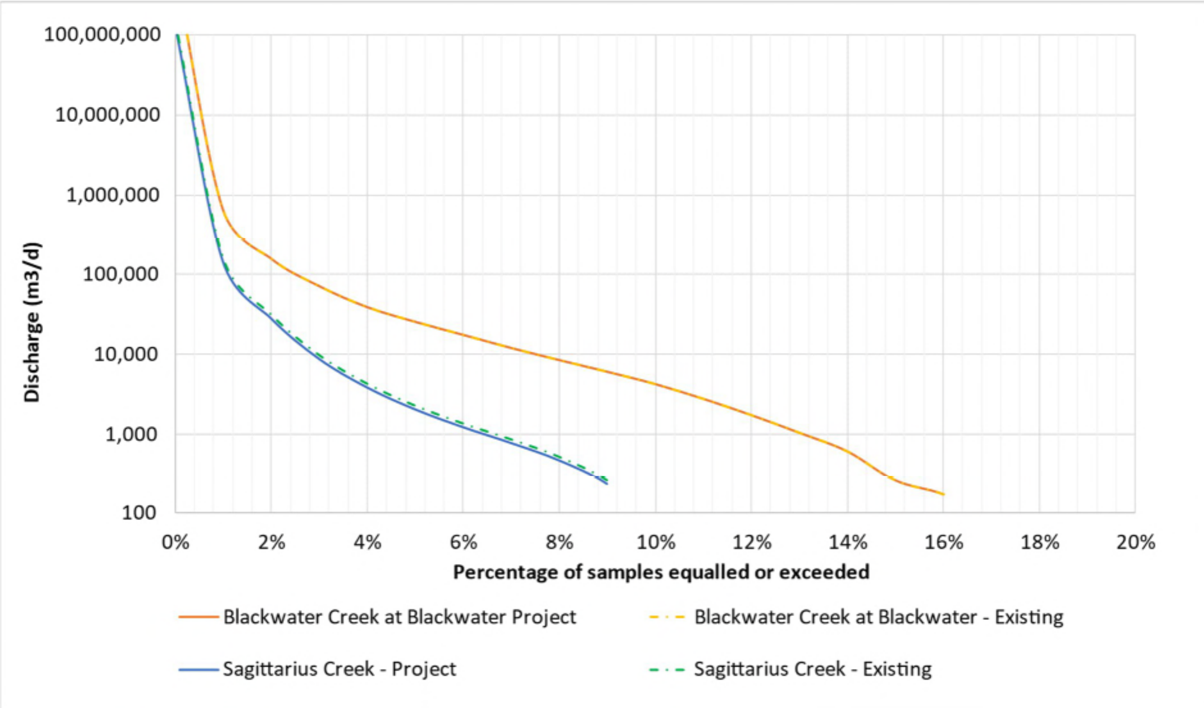


Figure 10-11: Potential Change in Stream Flow

10.4.3 Changes to Groundwater – Surface Water Interactions

The Project has the potential to impact on groundwater – surface water interactions and result in changes in baseflow. Potential impacts on groundwater - surface water interactions are discussed in **Section 11.3.4.1**, **Chapter 11** (Groundwater) and indicate that over the life of the mine, the change in baseline to Blackwater Creek from the Project is insignificant.

10.4.4 Mine Water Releases

Water balance modelling was undertaken to assess the performance of the existing water management system to manage Mine Affected Water (MAW) and the water supply needs of the Project. The modelling included consideration of climate change factors for six selected climate scenarios.

As part of the Project, the average water demand for BWM is predicted to increase from a current rate of 3.7 GL/year to 4.9 GL/year[10] (increase of ~3.3 ML/day). The water management strategy developed for the Project provides a continuation of existing water management practices albeit with various water supply upgrades.

The performance of the existing water management system for the Project has been examined through both flood modelling and water balance modelling for a range of scenarios including consideration of six climate change scenarios. The modelling indicated that the Project is able to satisfy the mine water demands in all but the very dry, P5 climate, through planned water supply allocations in 2023 and 2024 as well as use of the stored MAW inventory. In very dry conditions BMW will undertake water conservation measures in accordance with the sites Trigger Action Response Plan (TARP) to reduce and manage this risk. The performance of the system will be continuously reviewed as part of the BWM Water Management Plan.

The Project will also continue to comply with the BWMs existing EA including release conditions based on downstream water quality criteria.

Key findings from the water balance assessment include that release conditions have negligible impacts due to the storages being on-stream with large natural catchments. These storages would typically be overflowing or close to overflowing when the downstream flow gauges enable controlled release conditions to be triggered. The majority of water removed from the system via these storages is through uncontrolled releases rather than controlled releases, noting that on-stream storage overflows are largely from the undisturbed catchment flowing from upstream of the BWM.

The Project increases the water demands for dust suppression and CHPP, and these demands are predicted to be reliably met in the P50 scenario through the use of additional allocations as well as the on-site MAW inventory. The requirement and timings of the additional water supply options are reviewed annually to manage the risk of water shortfall.

In very wet climates the site will have a surplus of water. Pit inundation occurrences are more likely after approximately 2070 when the catchment area increases and production decreases, BWM will manage the risks as part of the site's plan for transitioning to closure and through prioritisation of pumping from the remaining active mine pits.

To prevent the inundation of proposed pits from Two Mile Gully, Deep Creek and Taurus Creek, of the following protection measures are proposed:

- Flood protection during operation. Operational flood protection will include levees and/or flood protection landforms.
- Where flood protection is required post-mining, the final landform design will provide an appropriate level of protection.
- Topographic / ground modification, delineation and management of areas where minimum ground levels need to be maintained to prevent ingress of flood into mine pits and infrastructure areas.

[10] Based on P50 climatic assumption.

10.4.5 Water Quality Impacts

Without adequate management and controls in place, the Project has the potential to impact on water quality and subsequently the downstream environment. The existing BWM surface water management measures are suitable to mitigate potential water quality impacts. Through the implementation of the surface water management strategies described in **Section 10.3** and **Section 10.5**, the risk of adverse impacts to the water quality of watercourses downstream of the Project is considered to be low (**Appendix E**).

10.4.6 Great Barrier Reef Considerations

In 2019, the EP Act was amended to include Section 41AA of the *Environmental Protection Regulation 2019*. The aim of Section 41AA is to achieve no net decline in water quality in the surface water basins that feed into the Great Barrier Reef. The Project is required to assess potential impacts on water quality in accordance with the *Guideline - Reef discharge standards for industrial activities* (DES, 2023b) as per section 41AA of the Environmental Protection Regulation 2019. The current release limits for the approved operations do not require consideration of total suspended solids and nitrogen for planned water releases. Therefore, neither suspended solids nor total nitrogen is currently measured as part of regular water quality monitoring data for water releases. Water quality monitoring data from site storages taken from March 2021 – January 2023 indicate an average Total Nitrogen (N) concentration of 2.44 mg/L with a maximum of 8.1 mg/L (**Appendix E**). This is below the environmental guidelines for Total Nitrogen in rivers and streams (100-750 mg/L) as per the ANZECC guidelines.

Water balance modelling results for the Project suggest that planned releases would be minimal, less than 100 ML/year across all site storages (refer Section 5 of **Appendix E**). This is less than current release volumes as the Project is predicted to utilise more of the site stored water inventory to satisfy mine demands as production increases and the climate dries under climate change projections (**Appendix E**). The results of the water balance modelling indicate downstream water quality is consistent with the requirements of the EA and generally below downstream water quality objectives for salinity.

BWM undertakes controlled releases in accordance with its EA conditions. The Project will utilise the same infrastructure and processes for water releases as is being used for the approved operations. The potential for increased Dissolved Inorganic Nitrogen and fine sediment resulting in impacts to the Great Barrier Reef as a result of the Project are considered to be minimal (**Appendix E**).

10.4.7 Final Void Assessment

The primary objective of the spoil dumping strategy for the Project is to backfill the mined-out pits where practical, to reduce the final void area remaining at end of the Project life. At the end of the Project life, four final voids will remain in perpetuity within the Project area.

A daily time step water balance model was developed for each void to predict the final void water quality and volume. The modelling involved an iterative process between ground and surface water modelling. Groundwater inflows to the GoldSim void water balance model were determined from the groundwater flux curve, provided from the Groundwater Impact Assessment (**Appendix F**). All four void areas will act as groundwater sinks, which means that groundwater will flow into the voids driven by ongoing evaporative discharge from the void lakes. As the final voids would act as a sink, evaporation from the final void water bodies would concentrate salts in the final void water bodies over time.

The model was simulated for six climate change sequences for a 100-year period with the resulting water levels calculated (**Appendix E**). The groundwater model was then simulated for the resulting pit lake levels. The equilibrated water levels change by 1 m to 3 m for the four voids. If drier or wetter conditions were to prevail, modelling indicates the voids would still remain groundwater sinks.

The salinity of the final voids was also modelled to examine the impacts of the effects of evaporation and groundwater inflows on void water quality. The salinity of the final voids is predicted to increase significantly post closure due to the constant inflow from highly saline groundwater ranging from 12,200 to 16,200 µS/cm. The predicted salinity values increase above 50,000 µS/cm and the resulting water quality is predicted to be hypersaline (**Appendix E**).

The BWM PRC Plan will incorporate management measures to reduce the impacts of the final void water quality on the environment and any potential water users.

10.4.8 EPBC Act Significant Impact Assessment

The Surface Water Resources Assessment (**Appendix E**) assesses the Project's impacts on surface water resources and includes assessment against the requirements of the *Significant Impact Guidelines 1.3: Coal seam gas and large coal mining developments—Impacts on water resources* (Commonwealth of Australia, 2013). The assessment indicates the Project will have a minimal impact on the hydrological characteristics of the surface water resources in the area. The flow regime is unlikely to change significantly, and the quantity of flow is unlikely to reduce the current or future utility of the resource for other users.

10.4.9 Cumulative Impacts

The existing BWM has been integrated into the surface water assessment for the Project and as a result the cumulative impacts due to the Project and the BWM have been accounted for (refer to **Appendix E)**.

The results indicate the Project is able to manage surface water impacts (such as flooding) and mine water management in accordance with DEHP standards and guidelines, refer to **Appendix E**. These guidelines set out conditions and thresholds such as downstream receiving water quality conditions which are based on research undertaken into species tolerance and the potential for cumulative impacts from multiple mining releases.

10.4.10 Climate Change

As the Project has a 60 year mine production plan, the Project's climate data used in water balance modelling incorporated climate change predictions. The climate change scenario estimates a lower amount of average annual rainfall and increased annual evaporation over the long term (**Appendix E**). Thus, the Project's proposed water management strategy recommended as a result of the water balance modelling inherently caters for potential influence of climate change.

10.5 Mitigation and Management Measures

The Surface Water Resources Assessment identified the following:

- The proposed infrastructure achieves the 0.1% AEP flood immunity as required by industry guidelines to protect the mine from ingress from Deep Creek, Taurus Creek, and Two Mile Gully. This flood immunity is able to be achieved with minimal impacts on flood behaviour. Impacts are limited to the immediate Project vicinity and flood behaviour is similar to existing conditions.

- The results of the water balance modelling demonstrate the ability of the Project's proposed water management infrastructure to manage mine water. The results indicate the water management system's ability to manage water in accordance with the current EA conditions as well as support the Project's water requirements.
- Post-closure, the final voids are immune to flood inundation in flood events of magnitude up to and including the 0.1% AEP event (considering climate change).
- The modelling of the final landform predicts that the final voids will be sinks and are not predicted to overflow into the environment. Water quality in these voids is predicted to be hypersaline.

The existing BWM surface water management measures are suitable to mitigate potential water quality impacts. To manage potential impacts on water quality from Project construction activities, the following mitigation measures will be implemented:

- Appropriate sediment control measures (e.g., sediment fences and sediment filters) will be established as required to reduce the amount of runoff from disturbed areas in accordance with the BWM Erosion and Sediment Control Plan and BWM Water Management Plan.
- Bunding and appropriate storage of fuels and other hazardous and flammable materials will be undertaken in accordance with AS1940:2004.
- Fuels and chemicals will not be stored or handled within 200 m of waterbodies.
- Personnel will receive appropriate spill clean-up training.
- Construction of any temporary waterway crossings will occur over the dry season to minimise soil disturbance on adjacent waterways.
- As soon as practical, disturbed areas will be rehabilitated to reduce the amount of exposed soils.

The following management strategies will be implemented by the Project to protect surface water quality and the downstream receiving environment from operations:

- The existing BWM Water Management Plan will be reviewed and updated, as required to incorporate the Project.
- Sediment dams, pit water storage and other water management structures (e.g. bunds and drains) will be used appropriately in accordance with the current framework specified in the BWM Water Management Plan.
- The Project's water management will be based on the separation and management of clean and MAW/sediment-laden water catchments.
  - Water captured within the Project's clean areas will be diverted around operational areas and where practical, allowed to discharge off site as part of normal overland flow.
  - Disturbed areas within the Project Footprint will be diverted to sediment and MAW dams for treatment and possible reuse for dust suppression and process water requirements. This will maximise their storage capacity to reduce the risk of off-site discharges.
- The current REMP or FRREMP and associated water quality monitoring program will continue for the Project in accordance with the EA. The program is designed to ensure the Water Management Plan is effective, to demonstrate compliance with the BWM's strict discharge limits, and to ensure the downstream water quality is not being adversely impacted.
- Progressive rehabilitation will be undertaken as the Project's operational areas become available to reduce the amount of disturbed area.
- Fuel, dangerous goods and hazardous chemicals will be managed as outlined by current standards, guidelines and in compliance with statutory requirements.

- The existing BWM spills and emergency response procedures will be implemented for the Project. Spill recovery and containment equipment will be available when working adjacent to sensitive drainage paths and within other areas, such as workshops.

New flood protection during operations will include levees and/or flood protection landforms. If assessed as regulated structures these will be and designed, constructed and operated in accordance with the relevant guidelines.

The management and mitigation measures are currently conditioned in the existing BWM EA or managed through elements such as the Water Management Plan, REMP/FRREMP, Erosion and Sediment Control Plan and Regulated Structures Design and Inspection Conditions. These plans will be updated to incorporate the Project.

The Project does not require amendments to the EA conditions outlined in Schedule F – Water and Schedule G – Structures.

11 Groundwater

11.1 Introduction

A Groundwater Impact Assessment, including the development of a numerical groundwater model has been completed for this Project (SLR, 2023d; 2023e), and is provided in **Appendix F**.

The conceptual hydrogeological model of the groundwater regime was developed by SLR (2023e) based on the review of the hydrogeological data for the Project and surrounds and has built on previous conceptualisation presented by AGE (2013). The Groundwater Modelling Technical Report is provided in Appendix B of the Groundwater Impact Assessment (**Appendix F**).

The groundwater 'study area' is shown on **Figure 11-1** and is defined as the extent of the groundwater model domain.

An independent peer review of the Groundwater Modelling Technical Report and Groundwater Impact Assessment has been completed by Dr. Noel Merrick and is provided in **Appendix J**.

11.2 Environmental Values

11.2.1 Environmental Values and Water Quality Objectives

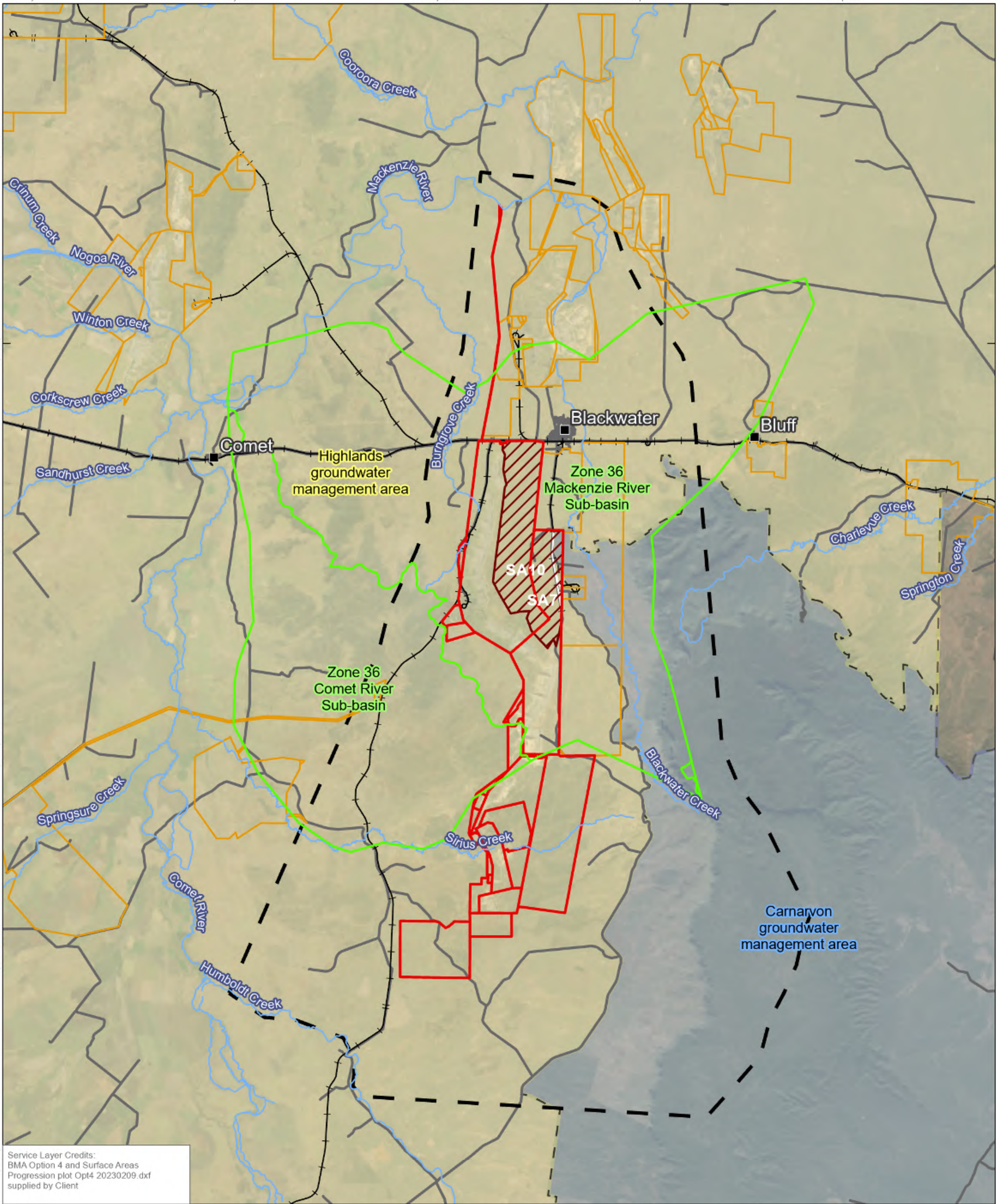
The groundwater study area lies within the Highlands Groundwater Management Area and Carnarvon Groundwater Management Area (**Figure 11-1**) under the Water Plan.

The groundwater study area covers zone 36 of the groundwater chemistry zone of WQ1310 of the EPP Water and Wetland Biodiversity. The EVs for these groundwaters listed in DEHP (2011) are:

- Aquatic ecosystems.
- Irrigation.
- Farm supply/use.
- Stock water.
- Primary recreation (Comet Groundwaters only).
- Drinking water.
- Industrial use.
- Cultural and spiritual values.

The EPP Water and Wetland Biodiversity also provides limited Water Quality Objectives (WQOs) for underground aquatic ecosystem protection in Fitzroy Basin groundwaters. These WQOs provided in the EPP Water and Wetland Biodiversity are classified by groundwater depth and regional chemistry zone.

Surface water resources in the vicinity of the Project are scheduled under the EPP Water and Wetland Biodiversity and EPP Mackenzie River Sub-Basin EV and WQO as 'Waters of the Mackenzie southern tributaries of the Upper Mackenzie Sub-basin of the Fitzroy Basin Water Plan' (WQ1304) (as described in Chapter 10). The surface water WQOs are relevant to the groundwater assessment for the Project if there is a component of surface water-groundwater interaction associated with them.



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Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:500,000 at A4
Project Number:	620.014601
Date Drawn:	08-Dec-2023
Drawn by:	NT

BMA
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LEGEND

- City/Town
- Railway
- Road
- Watercourse
- Mining Lease
- Study Area
- EPP Water and Biodiversity, WQ1310 Zones
- Carnarvon Groundwater Management Area
- Highlands Groundwater Management Area
- BWM Mining Lease
- BWM North Extension Project Area

BLACKWATER MINE - NORTH EXTENSION PROJECT

GROUNDWATER MANAGEMENT AREAS AND CHEMISTRY ZONES

FIGURE 11-1

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_GW_CH_F11_1_GMA_Chem Zones1

11.2.2 Geology

The Project is located in the Bowen Basin, which is one of five major foreland sedimentary basins which were formed along the eastern side of Australia during the Permian geologic period. The Bowen Basin is the largest productive coal basin in Australia.

The stratigraphic sequence of the Project area and surrounds is summarised in **Table 11-1**. From youngest to oldest, the stratigraphic sequence is comprised of unconsolidated Quaternary aged sediments unconformably overlying consolidated Permian and Triassic aged sequences (**Figure 11-2**). The Permian and Triassic strata form regular layered fluvio-deltaic sedimentary sequences, while the Quaternary sediments are more complex and irregular. The coal deposits extracted from BWM are found within the Rangal Coal Measures, which is the uppermost Permian unit (**Figure 11-3)**.

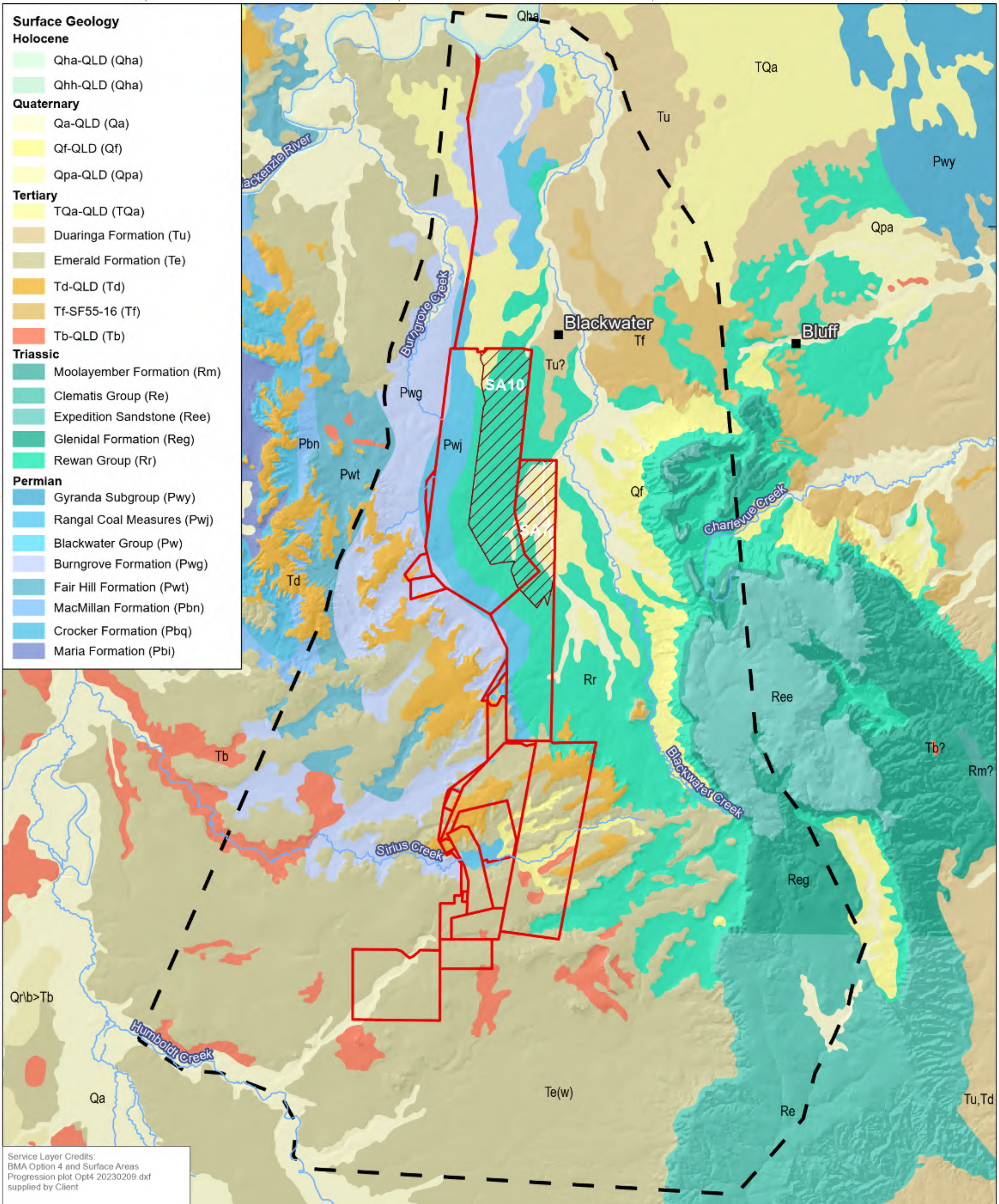
The Rangal Coal Measures at BWM outcrop in the west of the pits and dip down to the east of the pits. In the Project area, the strike is in a north-south direction. West of the pits is an anticline structure, which means that further west, the coal seams dip to the west (**Figure 11-3**).

Table 11-1: Summary of Stratigraphy in the Groundwater Study Area

Age	Unit	Thickness[1] (m)	Description
Quaternary	Alluvium	0.5–12	Alluvium - silt, clay, sand and gravel.
Tertiary	Basalt	30	Weathered basalt soils, residual basalt. Moderately weathered and fresh basalt. Does not outcrop.
	Sediments	30	Clays, sandstones, sands, gravels, often poorly consolidated (Tu, Te(w), Tf and TQa). Regional mapping shows highly weathered Tertiary Sediments display some areas of duricrust (Td) and partially cemented fanglomerate (Tf).
Triassic	Clematis Sandstone	100–800	Weathering resistant medium to coarse grained quartzose to sublabile and micaceous sandstone, siltstone, mudstone and conglomerate.
	Rewan Group	50–300	Lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanilithic pebble conglomerate (at base); deposited in a fluvial-lacustrine environment. Occur 2 m to 6 m above the Aries seam.
Permian	Rangal Coal Measures	100	Feldspathic and lithic sandstone, carbonaceous mudstone, siltstone, tuff and coal seams. Coal seams include the Aries, Castor, Pollux and Orion and Pisces seams. The Pollux and Orion seams commonly coalesce into a single seam, which is referred as the Argo seam.
	Burngrove Formation	170	Sandstones, siltstones and mudstones, and banded coal seams frequently interbedded with tuff and tuffaceous mudstones - coal seams include the Virgo and Leo seams.

Note: Source AGE (2008), AGE (2013) and EMM (2019) in SLR (2023d)

The surface geology of the groundwater study area is dominated by the outcropping Permian Coal Measures to the west of BWM and the overlying Rewan Group in the east of the BWM (**Figure 11-2**). Overlying these basal units, Tertiary Sediments and Quaternary alluvium are present as cover. At the eastern extents of the groundwater model domain (i.e. the Groundwater 'Study Area' shown on **Figure 11-3**), the Clematis Group outcrops with a dramatic change in topography.



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Project Number:	620.014601
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Drawn by:	NT

BMA
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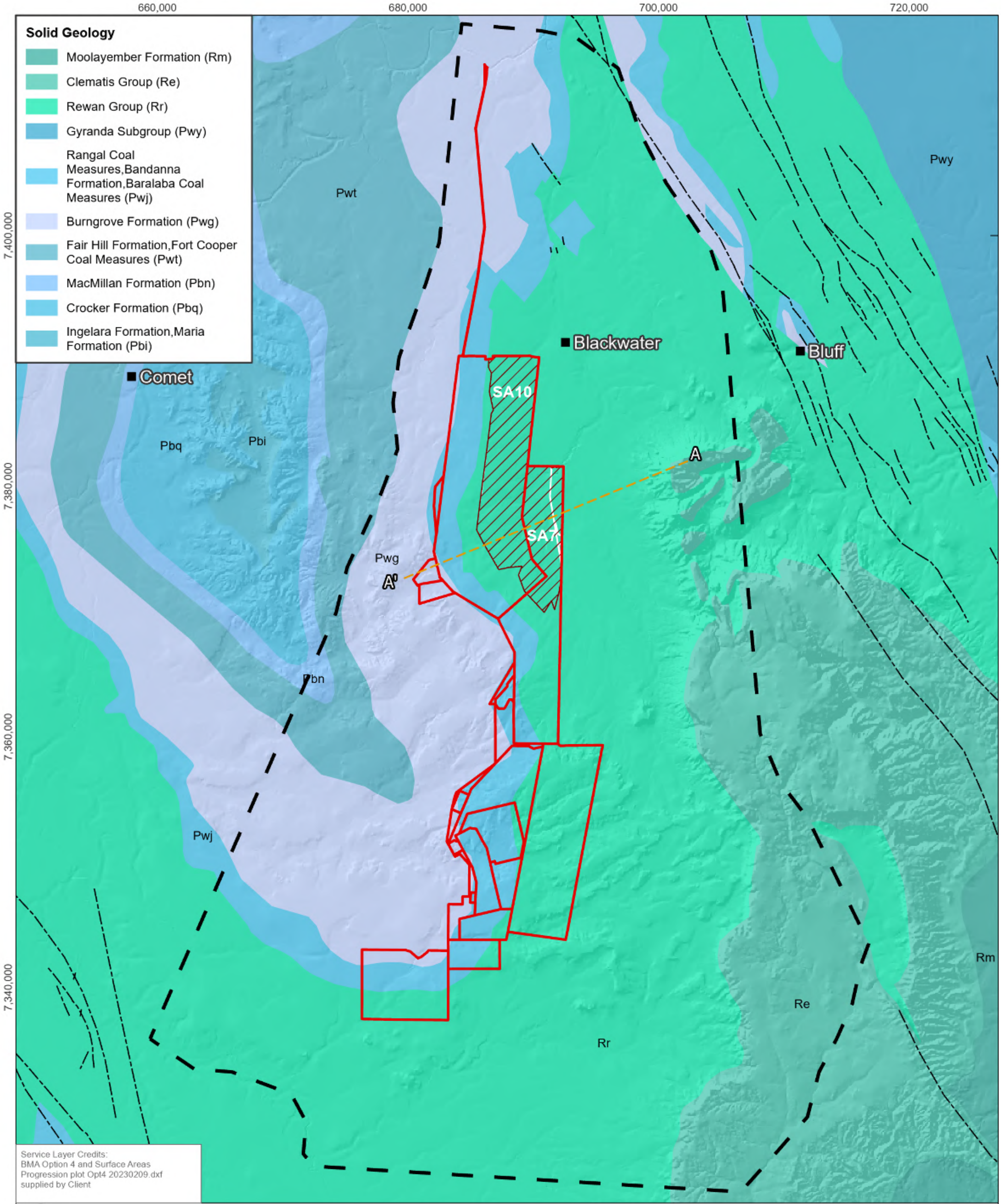
LEGEND

- City/Town
- Watercourse
- Study Area
- BWM Mining Lease
- BWM North Extension Project Area

BLACKWATER MINE - NORTH EXTENSION PROJECT

SURFACE GEOLOGY

FIGURE 11-2



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Coordinate System:	GDA2020 MGA Zone 55
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Project Number:	620.014601
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Drawn by:	NT

BMA
BHP Mitsubishi Alliance

LEGEND

- City/Town
- East-West Cross Section
- Basin Scale Fault
- BWM Mining Lease
- BWM North Extension Project Area

BLACKWATER MINE - NORTH EXTENSION PROJECT

SOLID GEOLOGY

FIGURE 11-3

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_GW_CH_F11_3_Solid Geology

Figure 11-4 shows an east to west geological cross section through the Project area. The location of the cross section (Cross Section A'-A) is shown on **Figure 11-3**.

The strata in the vicinity of the BWM are heavily influenced by a series of easterly dipping north to northwest striking faults (AGE, 2008), of which the Shotover Fault is of major importance due to a displacement of up to 3,000 m (AGE, 2013). Locally, thrust faulting that occurs within the BWM may be attributed to thrusts in the Shotover Fault's footwall. Local structure is influenced by strike slip movement of basement rocks, with local fault displacements less than 5m on average, but can reach up to 20 m (AGE, 2008).

11.2.2.1 Quaternary Sediments (Alluvium)

The Quaternary age alluvial sediments unconformably overlie the Triassic age Rewan Group and Permian age coal measures. The unit consists of a thin surficial cover of generally unconsolidated clays, silts, sands and gravels associated with floodplains of the major drainage channels, primarily Blackwater Creek. The alluvial sequence varies in thickness from 0.5 to 12 m according to drilling data.

Recent drilling at BWM has shown that alluvium associated with the creeks is not always present or the areal extent is limited and / or dry conditions. In 2020, four bores were attempted to be installed into the alluvium, however only one bore intersected alluvial sediments (AGE, 2020). In 2021 another bore targeted the alluvium, however upon drilling, the alluvial sediments were not extensive at the site, so the bore was installed into the Tertiary instead (HydroFS, 2021).

11.2.2.2 Tertiary Sediments and Basalt

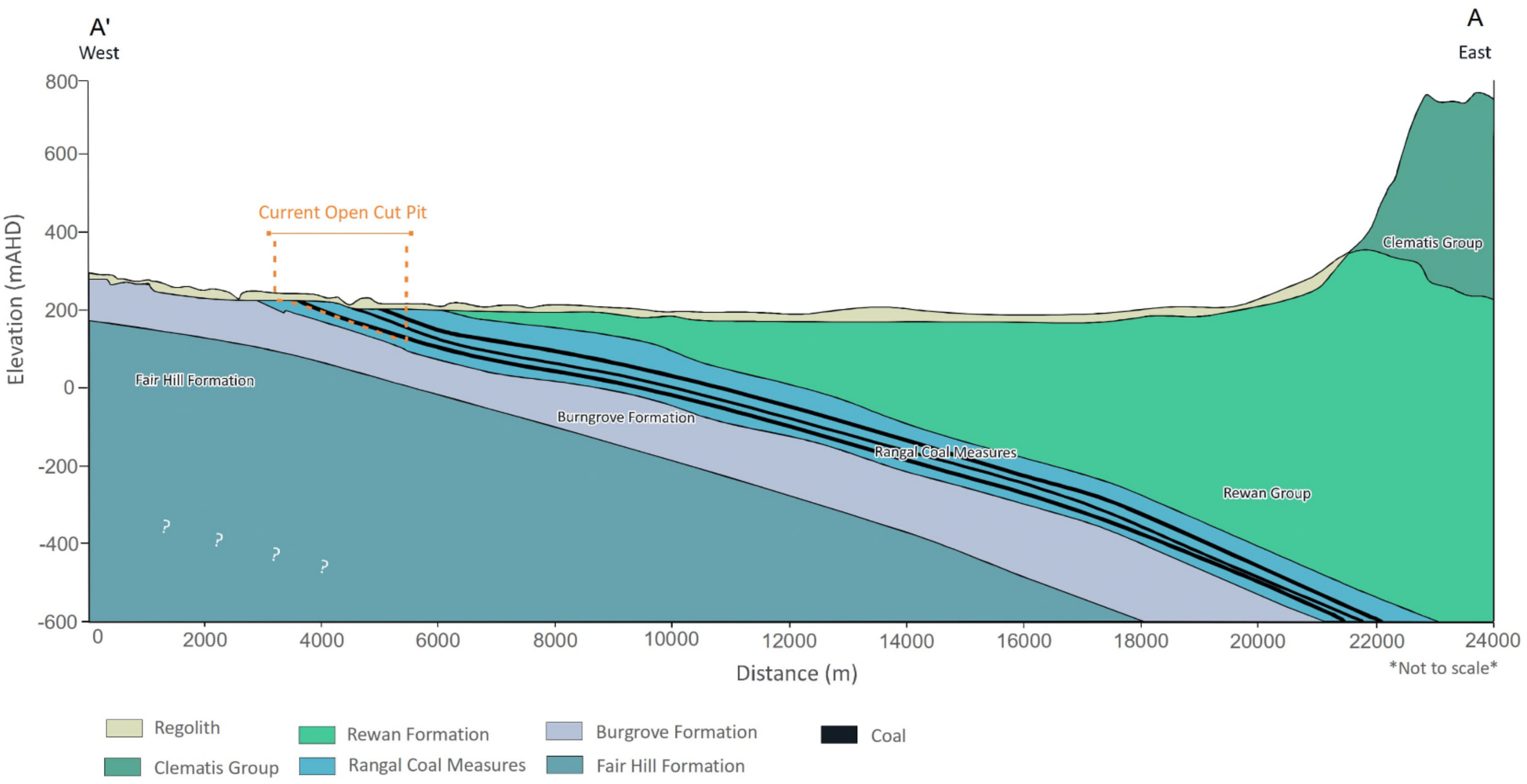
Tertiary sediments and basalts unconformably overlay the Triassic and Permian units. The sedimentary unit consists primarily of claystone, siltstone and sandstones. The unit varies in thickness, typically ranging from 5 to 50 m with a maximum thickness of 115 m. To the south and southwest of the study area, basalt flows are present (**Figure 11-2**). The basalts have been described as having varying degrees of weathering and thickness, from moderately weathered thin flows (intersected in the Humboldt area) to thicker and more fresh flows (South Marshmead area). The basalt flows vary in thickness ranging from 10 to 42 m (AGE, 2003). The basalt occurs in the study area (groundwater model domain), but not in the Project area.

11.2.2.3 Triassic Clematis Group

The Clematis Group unconformably overlies the Rewan Group and outcrops on the eastern margins of the study area (**Figure 11-4**), where it forms an elevated plateau. The unit is comprised of weathering resistant medium to coarse grained quartzose to sublabile and micaceous sandstone, siltstone, mudstone and conglomerate. In the study area, the Clematis Group is made up of the Glenidal Formation and Expedition Sandstone members which are estimated to form an average thickness in the range of 100 to 800 m (Geoscience Australia, 2021).

11.2.2.4 Triassic Rewan Group

The Rewan Group overlies the Permian coal measures and occurs as in-fill material, thickening to the east with the dip of the coal measures and thin to the west where the coal measures occur at outcrop (**Figure 11-4**). Where present, the Rewan Group has a distinct greenish tint (non-marine deposits containing glauconite) in colour and is composed of siltstone and mudstone, with interbeds of lithic and volcanic sandstones. Based on exploration drill holes and groundwater bore holes in the study area, the Rewan Group is comprised of siltstone and mudstone, with interbeds of lithic and volcanic sandstones and is of variable thickness ranging between 50 and 300 m.



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BLACKWATER MINE - NORTH EXTENSION PROJECT

GEOLOGICAL CROSS SECTION ACROSS THE GROUNDWATER STUDY AREA

FIGURE 11-4

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11.2.2.5 Permian Rangal Coal Measures

The Rangal Coal Measures underlie the Rewan Group and outcrop to the west of the mine (**Figure 11-4**). This unit consists of interbedded sandstone, siltstone, mudstone, and coal with tuff (towards the base) and has a thickness of up to 100 m in the study area. The three main economic coal seams are the Aries Seam, Castor Seam and Pollux Seam. At BWM, these measures are referred to as the Top Seam, Middle Seam and Lower Seam, respectively. A schematic of the seam stratigraphy and further details on the seams and their occurrence at BWM are presented in **Figure 3-5**.

11.2.2.6 Burngrove Formation

The Burngrove Formation is comprised of mudstone, siltstone, sandstone, coal and tuff. The Rangal Coal Measures conformably overlie the coal bearing Burngrove Formation. The Burngrove Formation is considered the basement formation for the Groundwater Impact Assessment (**Appendix F**).

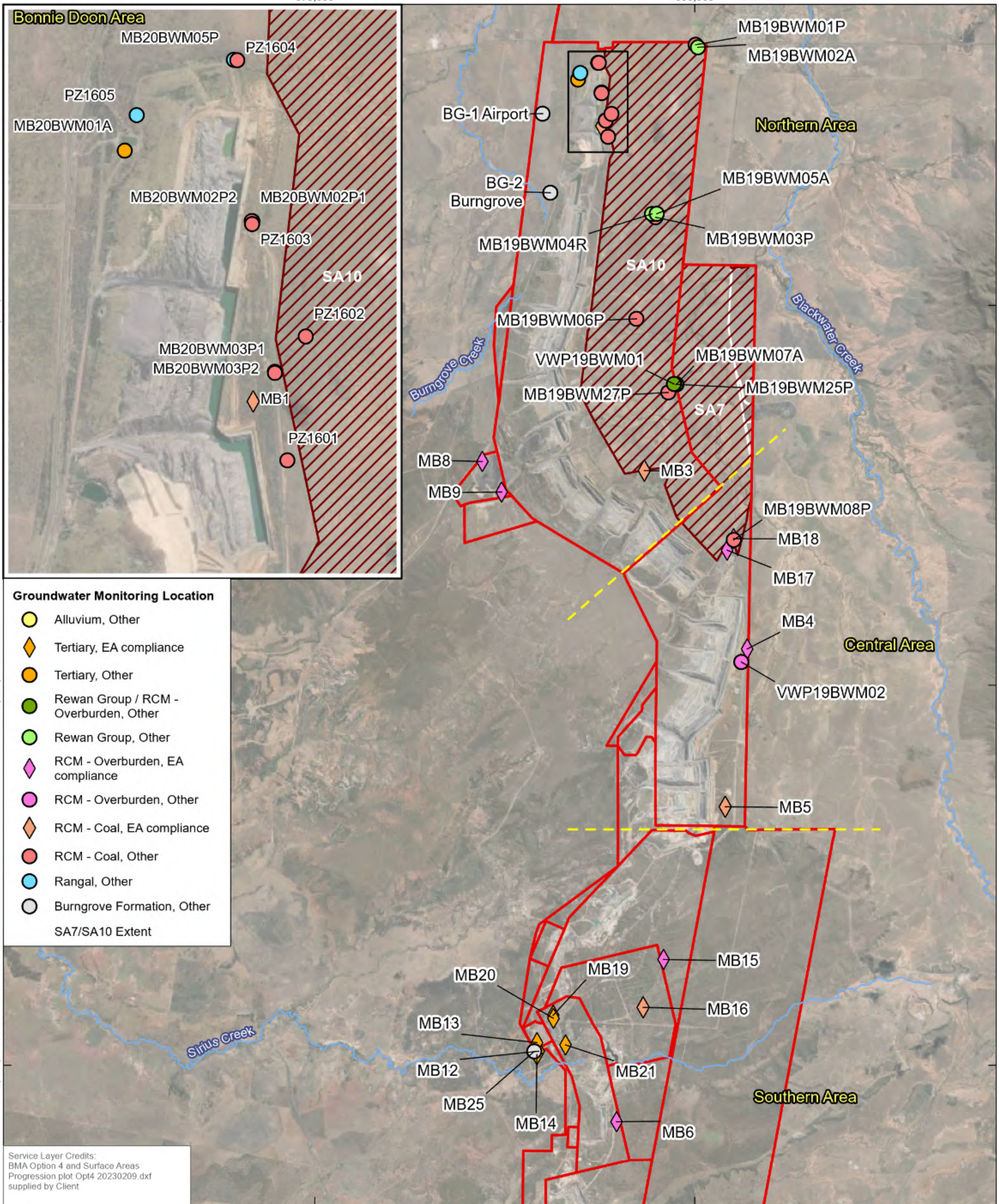
11.2.3 Local Hydrostratigraphic Units

The local hydrostratigraphic units are described below, from the shallowest (Alluvium) to the deepest (Burngrove Formation):

- **Alluvium** - Alluvial deposits are associated with local creeks. In recent years, the alluvium local to the study area has been found dry.
- **Tertiary Sediments** - unconsolidated surface layer of weathered rock which may provide a preferential flow pathway for groundwater if levels exceed the base of weathering.
- **Clematis Group** - outcrops on the eastern margins of the study area, where it forms an elevated plateau. The unit is comprised of weathering resistant medium to coarse grained quartzose to sublabile and micaceous sandstone, siltstone, mudstone and conglomerate.
- **Rewan Group** - a regional scale aquitard comprising mudstones interbedded with siltstone and fine to medium grained labile sandstone. However, permeability testing indicates hydraulic conductivity values may be higher in the upper weathered zone of the unit.
- **Rangal Coal Measures** - previous investigations (EMM, 2020) identified this formation as a regional aquifer. Groundwater flow is primarily within the coal seams (via interconnected cleats and fractures), which are confined by low permeability overburden and interburden that essentially form aquitards. The coal measures are highly faulted resulting in “compartmentalisation” with coal seams juxtaposed against lower permeability interburden. Recharge to this unit occurs via direct infiltration where the unit outcrops or sub-crops.
- **Burngrove Formation** - outcrops to the west of BWM and dips east below the Rangal Coal Measures. It is largely regarded an aquitard comprising interbedded siltstone, carbonaceous and tuffaceous shales, mudstone, and thin coal seams. However, several landholder bores are apparently screened within this formation locally (assuming the registered bore database aquifer attribution is correct) suggesting it includes permeable horizons that can support low yields. This formation is considered the basement for the purposes of the Groundwater Impact Assessment (**Appendix F**).

11.2.4 Groundwater Levels and Flow Directions

The groundwater levels across the Project area have been assessed in the Groundwater Impact Assessment (**Appendix F**) from data collected at the BWM groundwater monitoring bore network presented in **Figure 11-5**. **Figure 11-5** shows that the bores were geographically grouped (Northern Area, Bonnie Doon Area [a sub-set of the Northern Area], Central Area and Southern Area) for the purpose of data analysis and shows the target formation of each monitoring bore.



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Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:200,000 at A4
Project Number:	620.014601
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Drawn by:	NT

LEGEND

- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- SA7/SA10 Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

GROUNDWATER MONITORING NETWORK

BHP Mitsubishi Alliance

FIGURE 11-5

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_GW_CH_F11_5_Monitoring Bore

Groundwater level data within the alluvium is limited. The alluvium is often found to be limited in extent and thickness, and unsaturated, but may become saturated following rainfall recharge and occasional inflow from ephemeral creeks. Groundwater levels in the unconfined alluvium, where saturated, are expected to be a subdued reflection of topography, with flow toward the north of the Project in the Northern Area and towards the southwest in the Southern Area. If there are times when the alluvium is saturated, flow would still be restricted as the coarser grained alluvium (that could transmit water) is separated by clay lenses and outcropping bedrock, with limited connectivity between areas of saturated alluvium. Recharge to the alluvium is considered to be mostly from occasional ephemeral stream flow or flooding (i.e. losing streams), with direct infiltration of rainfall also occurring rapidly where there are no substantial clay barriers in the shallow subsurface. However, recharge is expected to be low due to the presence of surficial clays. On a regional scale, discharge occurs via evapotranspiration from vegetation growing along creek beds.

Within the Tertiary sediments the strata is typically unsaturated in the Northern Area, but saturated in the Southern Area. In the Southern Area groundwater levels in the Tertiary sediments are variable, ranging from 2 to 32 m below ground level, and groundwater flow is towards the south.

The Triassic Rewan Group is known as a regional scale aquitard, though still may contain low yielding groundwater. There is limited hydraulic connection between the Rewan Group and underlying Permian Coal Measures due to the low vertical hydraulic conductivity nature of the strata and the overlying Triassic units confine the underlying Permian sediments. In the Permian Coal Measures, the lower permeability interbedded claystone and shale horizons (interburden) significantly reduce vertical leakage causing most groundwater flow within the Coal Measures to be along the coal seams themselves. In the Project area, groundwater flow within Permian coal seams was inferred to be towards the north for pre-mining conditions. However, with many open-cut pits in the area, groundwater within the Coal Measures now generally flows towards these pits. Groundwater level contours for the Aries seam, based on groundwater level measurements from bores screened in the Aries seam and on surveyed pit void water levels for March 2023, are shown in **Figure 11-6**. The groundwater level contours in **Figure 11-6** show that the flow direction within the Aries seam is predominantly towards the mine, consistent with discharge to the active mine pits, as expected.

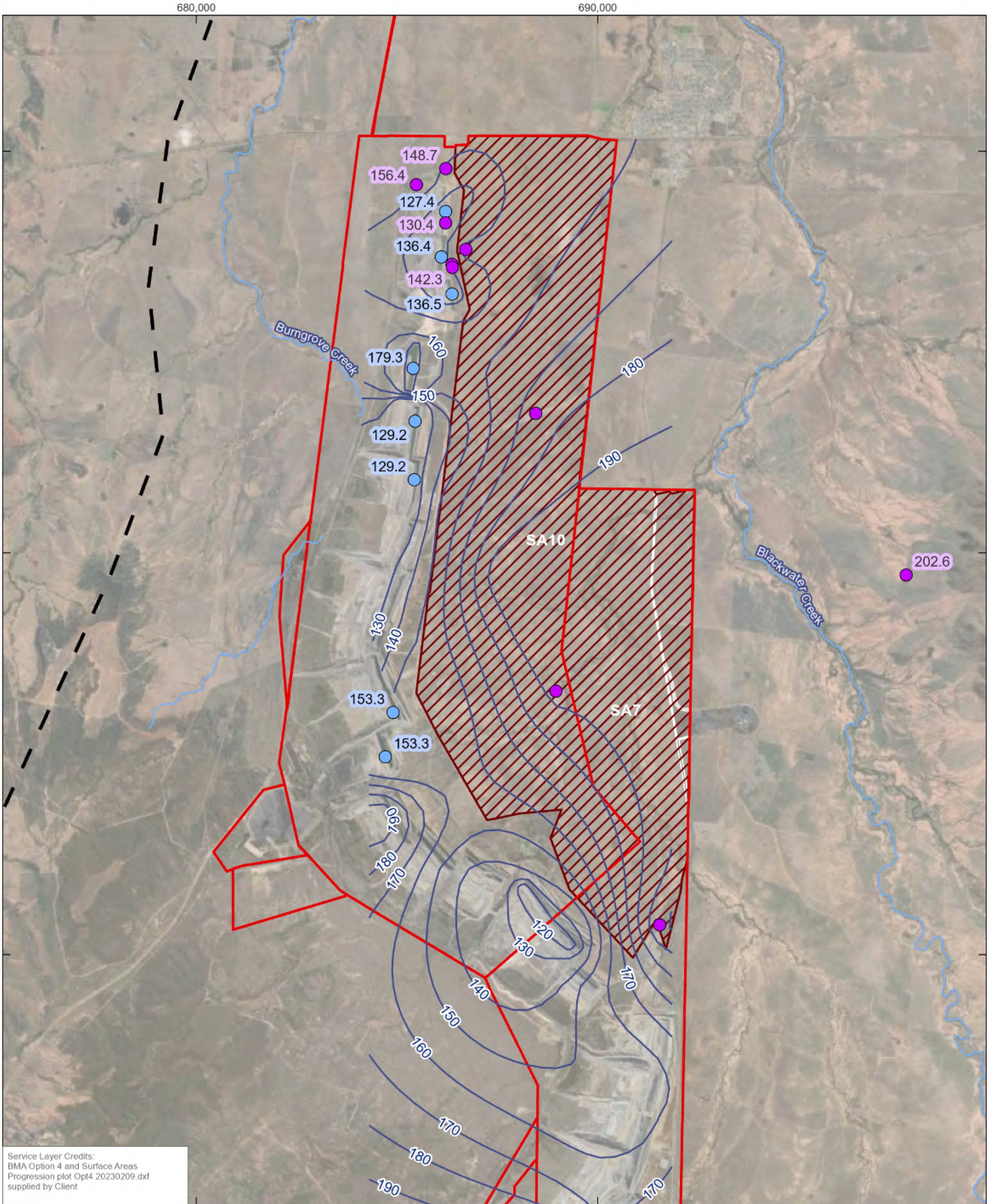
Recharge is limited to areas with relatively higher hydraulic conductivity units (e.g. coarse grained sandstone and coal seams) and in areas of outcrop. Coal seam recharge is expected to occur primarily via leakage from the overlying Quaternary and Tertiary units, where the Triassic formation is not present or significantly thinned. As such, the areas with greatest control of Permian formation recharge are proximal to seam outcrops. Some recharge to the coal measures also occurs through mine surface water storages where the seams are hydraulically connected to the storages such as mining pits and waste spoil.

11.2.5 Hydraulic Properties

Hydraulic conductivity and storativity have been measured using falling head/slug testing and packer testing (**Appendix F**). Within the groundwater study area, the coal seams are the main groundwater bearing units within the Permian sequences, with low hydraulic conductivity interburden generally confining the individual seams. Hydraulic conductivity of the coal decreases with depth due to increasing overburden pressure reducing the aperture of fractures.

11.2.6 Groundwater-Surface Water Interactions

Based on the water level data collected to date, and conceptualisations of groundwater flow within the Project area, groundwater interaction with ephemeral creeks is considered limited (**Appendix F**).



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:125,000 at A4
Project Number:	620.014601
Date Drawn:	08-Dec-2023
Drawn by:	NT

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LEGEND

- Groundwater Level
- Pit Water Level
- Groundwater Contour (mAHD)
- Watercourse
- Study Area
- BWM Mining Lease
- BWM North Extension Project Area

BLACKWATER MINE - NORTH EXTENSION PROJECT

GROUNDWATER LEVEL CONTOURS IN THE ARIES SEAM AND AVAILABLE PIT LAKE ELEVATIONS (MARCH 2023)

FIGURE 11-6

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_GW_CH_F11_6_GWL Levels Aries Seam

The extent of alluvium is limited, both horizontally and vertically, suggesting dry conditions for most of that unit and water tables significantly below the creek beds. Interaction is likely in terms of stream flow leakage to the underlying geology during sporadic creek flow events. The weathered Tertiary sediments and weathered Rewan Group are also unlikely to host significant groundwater (**Appendix F**). Where saturated, water levels in the Tertiary sediments appear to be several meters below the base of the creek bed and there would be no groundwater discharge to the creeks (the exception being Blackwater Creek as described in **Section 11.3.4.1**).

11.2.7 Groundwater Quality

Recent groundwater quality data (June 2020 to December 2022) are available for 17 Project bores (MB19BMW-series and MB20BMW-series). In addition, historical data are available for 25 bores across the BWM and surrounds between 2010 and 2020 (or shorter, where bores were damaged or lost) (**Appendix F**).

An analysis of water quality attributes of groundwater is provided in the Groundwater Impact Assessment (**Appendix F**). **Appendix A-2** of the Groundwater Impact Assessment (**Appendix F**) provides summary statistics for each parameter per-bore and per-formation. Box-and-Whisker plots for select bores are also provided in **Appendix A-2** of **Appendix F**.

11.2.7.1 Physicochemical Parameters

<u>Alluvium</u>

There is one groundwater monitoring bore, MB19BWM07A (**Figure 11-5**) screened in alluvium within the Project area, however it has been found dry since installation. Recent drilling campaigns in the alluvium in the Northern Area (2020 and 2021) revealed either an absence of alluvium, and/or dry conditions. In 2020, four bores were planned to be installed into the alluvium, however only one of the four locations (bore MB19BWM07A) intersected alluvium, which was unsaturated (AGE, 2020). Two of the planned bores were installed in the Rewan instead (MB19BWM02A and MB19BWM05A) and one was abandoned (drilling attempt near the creek line between MB19BWM06P and MB19BWM08P). In 2021, during an additional drilling campaign, bore MB20BWM01A initially targeted alluvium but due to the lack of alluvial sediments at the site, the bore was installed into the deeper Rewan Group (HydroFS, 2021).

Groundwater quality data is available from one bore that is part of the Minyango groundwater monitoring network (Minyango-MB9) located to the north-east of the Project (**Appendix F**). Sufficient data for statistical analysis for this bore is not available, although AGE (2013) notes the following:

- TDS is around 1,120 to 2,640 mg/L, indicating brackish water quality.
- Field pH is around pH 5, indicating acidic conditions consistent with recent rainfall recharge.
- The water type from this bore is Na-Ca-Cl-HCO_3 dominant.

Groundwater quality within the Rewan Group and Permian coal measures is variable ranging from brackish to saline. Groundwater within the coal measures of the Project area is not considered suitable for some livestock.

<u>Tertiary Sediments</u>

In the Northern Area (**Figure 11-5**), the Tertiary Sediments are expected to be mostly dry, as indicated by recent drilling (AGE, 2020 and HydroFS, 2021) as well as historical observations at Minyango (AGE, 2013).

Chemical analysis in the Southern Area indicate groundwater is sodium chloride type water dominated by sodium (Na), potassium (K) and chloride (Cl) ions. Groundwater in the Tertiary Sediments is generally saline (median EC of 7,280 µS/cm), though is highly variable and can range from fresh to saline (range of 303 to 18,932 µS/cm). The pH of most bores was relatively stable, varying from around pH 5.2 to pH 6.5, indicating conditions are generally acidic consistent with receiving rainfall recharge contribution.

Rewan Group

Chemical analysis of groundwater for bores targeting the Rewan Group indicate that groundwater in the Rewan Group is defined as sodium chloride type water dominated by sodium, potassium and chloride ions. The results suggest groundwater in the Rewan Group has a distinct water chemistry - being dominated by chloride ions (i.e. strong acid, fully ionised in water) rather than bicarbonate ions (weak acid).

Groundwater in the Rewan Group is generally saline (median EC of 33,864 µS/cm), ranging from brackish to saline (EC range of 4,253 to 37,915 µS/cm). Field pH results indicate the groundwater is mildly acidic to neutral (median value of pH 6.7, with a range of pH 5.9 to pH 8.1).

Rangal Coal Measures

Chemical analysis of groundwater for bores targeting the Rangal Coal Measures indicate that groundwater within the Boonie Doon Area, Southern Area and Northern Area (**Figure 11-5**) is defined as sodium chloride type water dominated by sodium, potassium and chloride ions, and driven by chloride ions.

Groundwater in the Rangal Coal Measures is generally saline (median EC of 13,188 µS/cm) but ranges from brackish to saline (range from 1,203 to 40,000 µS/cm). Field pH was near neutral, ranging from pH 4.5 to pH 10.2, with a median value of pH 7.0 in bores targeting coal and pH 6.9 in bores targeting the interburden.

Burngrove Formation

Chemical analysis of groundwater for bores targeting the Burngrove Formation is defined as sodium chloride type water dominated by sodium, potassium and chloride ions. The groundwater is saline (median EC of 11,045 µS/cm, ranging from 5,390 to 19,317 µS/cm). Field pH ranged from pH 6.3 to pH 8.4, with a median value of pH 7.2 indicating the groundwater pH is generally neutral.

11.2.7.2 Metals

Eight metals and metalloids are routinely monitored in accordance with the EA - iron, aluminium, silver, arsenic, mercury, antimony, molybdenum and selenium. The results were assessed against the ANZECC (2018) guidelines for aquatic ecosystem protection (95% limit of protection) and stock watering where available (ANZG, 2018). The 80th percentile for metal and metalloid EA analytes were mostly below guideline values in the Tertiary Sediments, except for Aluminium (Total) (11.9 mg/L, which exceeds the recommended ANZECC stock watering guideline of 5 mg/L). The laboratory Limit of Reporting for silver and selenium are currently too high to assess values against the ANZECC guidelines.

11.2.8 Groundwater Use

11.2.8.1 Springs and Wetlands

Desktop searches for springs and wetlands were conducted with the QSpatial Database and data downloaded from the QSpatial Catalogue (showing High Ecological Significance (HES) wetlands), respectively. There were no springs or wetlands located within a 10 km buffer of the Project area. The closest registered spring is located approximately 14.8 km southeast from the Project area and the closest wetland is located approximately 19.7 km southeast from the Project area. The distance of the closest spring and wetland is considered significant in the context of the Project's potential groundwater related impacts. As such, both spring and wetlands were not considered relevant to the Projects groundwater impact assessment.

11.2.8.2 Anthropogenic Groundwater Users

An assessment of the Queensland Department of Regional Development, Manufacturing and Water (DRDMW) registered bore database (GWDB) indicated that there are several private bores which extract groundwater within a 10 km radius from the Project area (**Figure 11-7**). According to GWDB records the groundwater is used for farm supply or stock water.

A field bore census was completed in 2019 (EMM, 2019) where some of the bores were subject to survey (further details are provided in Appendix A-3 of the Groundwater Impact Assessment, **Appendix F**). The bores located within 10 km of the Project area are listed in **Table 11-2**. Overall, anthropogenic groundwater usage is limited to the west of the Project area, mostly intersecting the Burngrove Formation. The eleven bores have been considered for drawdown impacts as part of the Groundwater Impact Assessment (**Appendix F**) and the results are summarised in **Section 11.3.5.1**.

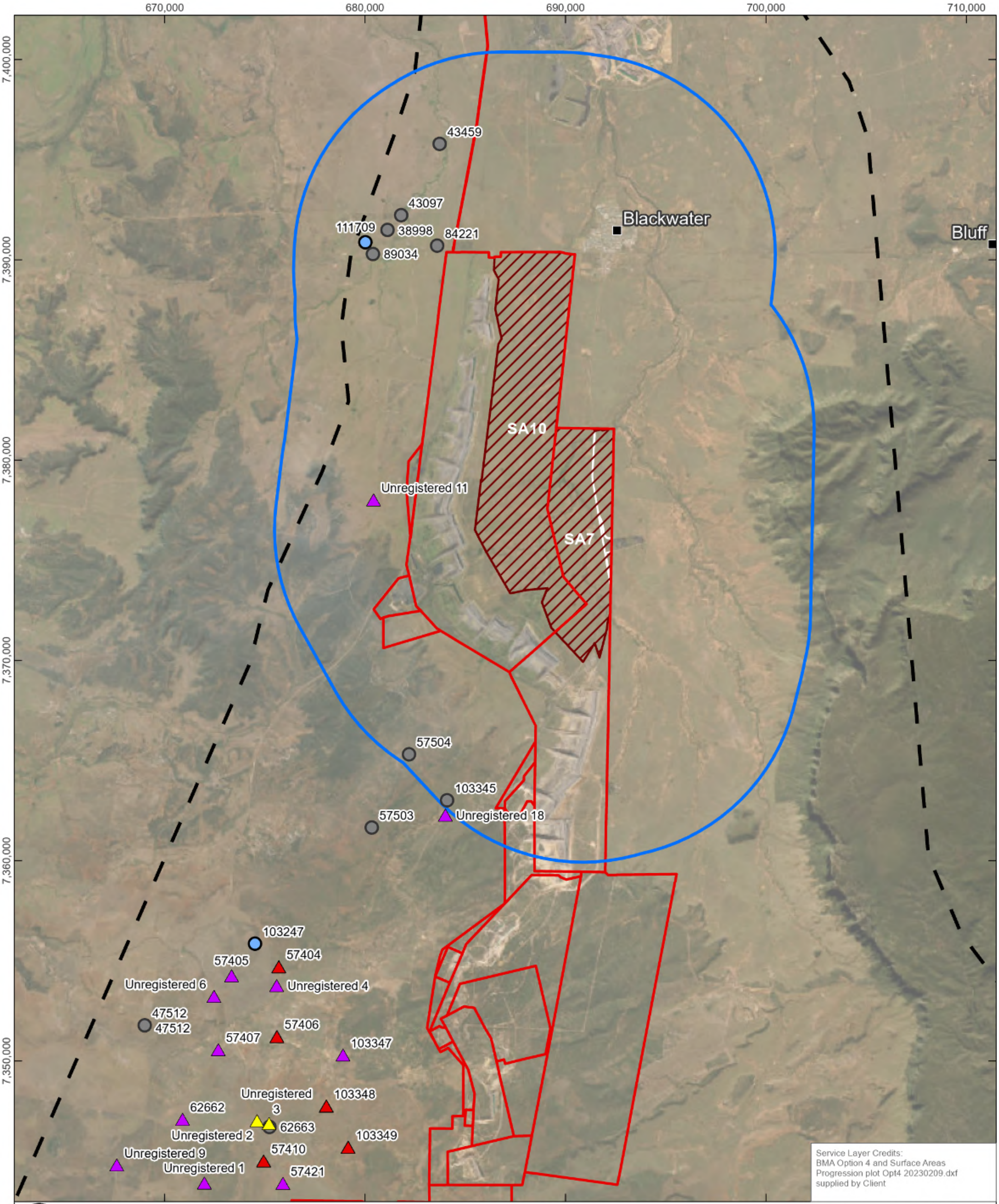
11.2.8.3 Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (GDEs) are ecosystems that require access to groundwater to meet all or some of their water requirements on a permanent or intermittent basis for maintenance of the ecosystem (Richardson et al 2011). GDEs are classified by Doody et.al. (2019) into three broad types:

- Terrestrial GDEs - ecosystems dependent on the subsurface presence of groundwater.
- Aquatic GDEs – ecosystems dependent on the surface-expression of groundwater.
- Subterranean GDEs - aquifer and cave ecosystems.

Further information on the three broad GDEs is provided in **Chapter 12** and **Chapter 13**.

Mapping of known or derived GDEs is available from the BoM GDE Atlas (BoM, 2023a) and *WetlandMaps* (DES, 2023c) and is shown on **Figure 11-8** for terrestrial GDEs and **Figure 11-9** for aquatic GDEs. No potential subterranean GDEs are mapped within the Project area or surrounds.



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:250,000 at A4
Project Number:	620.014601
Date Drawn:	08-Dec-2023
Drawn by:	NT

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LEGEND

- City/Town
- Project Area 10km Buffer
- Study Area
- BWM Mining Lease
- BWM North Extension Project Area

Private Bores in Model Boundary

- Unknown
- Water Supply
- Stock (Baseline Assessment)
- Stock & Domestic (Baseline Assessment)
- Not in use

BLACKWATER MINE - NORTH EXTENSION PROJECT

PRIVATE BORES

FIGURE 11-7

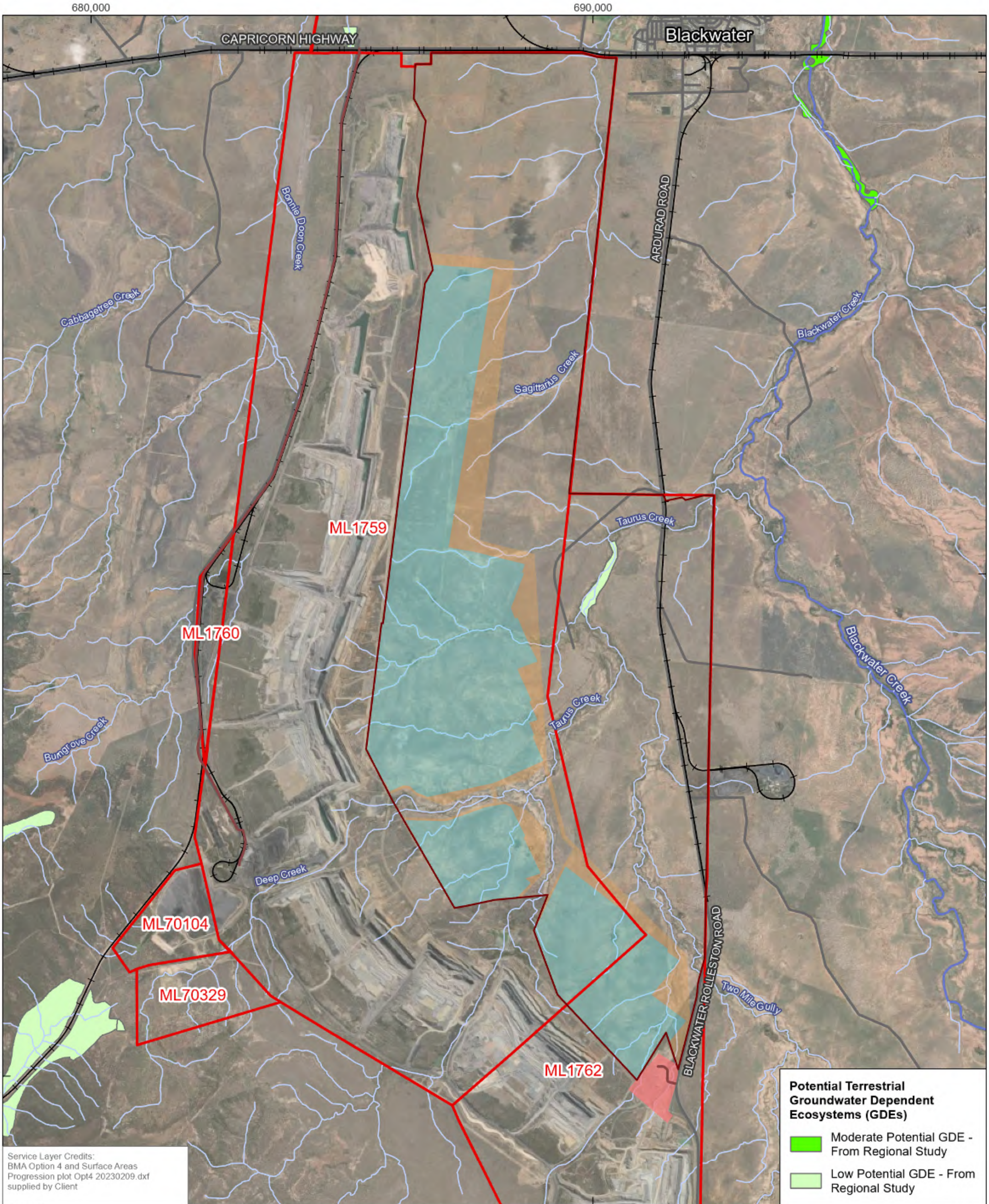
Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_GW_CH_F11_7_Private Bores

Table 11-2: Private Groundwater Bores within 10 km of the Project area (DRDMW GWDB)

Registered RN (ID)	Part of Bore Census[1]	Easting (GDA94 z55)	Northing (GDA94 z55)	Geology	Bore Depth (m)	Use	Salinity (µS/cm)	Yield (L/s)
38998	No	681119	7391492	Burngrove Formation	36.6	Unknown	6,920	0.69
43097	No	681800	7392230	Burngrove Formation	22.9	Unknown	Brackish	0.75
43459	No	683719	7395787	Unknown	54.9	Unknown	2,260	0.76
57503	Yes	680333	7361655	Burngrove Formation	Unknown	Stock watering	1,930	
57504	Yes	682192	7365312	Burngrove Formation	Unknown	Stock watering	1,613	-
84221	No	683596	7390708	Burngrove Formation	24	Unknown	'Salty'	0.12
89034	No	680391	7390291	Unknown	Unknown	Unknown	7,200	
103345	Yes	684091	7363016	Burngrove Formation	47	Not In use	-	-
111709	No	680013	7390877	Burngrove Formation	72	Water Supply	6,150	0.2
Unregistered 11	Yes	680420	7378058	Burngrove Formation	Unknown	Stock watering	7,719	-
Unregistered 18	Yes	684004	7362319	Burngrove Formation	Unknown	Stock watering	1,715	-

[1] Visited by EMM in December 2018, documented in EMM (2019)

All other data publicly available from Queensland Government Bore Reports



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	08-Dec-2023
Drawn by:	NT

LEGEND

- Railway
- Mine Acces Road
- Road
- Minor Watercourse
- Major Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

PREDICTED TERRESTRIAL GROUNDWATER DEPENDENT ECOSYSTEMS (BoM AND DES PREDICTICE MAPPING)

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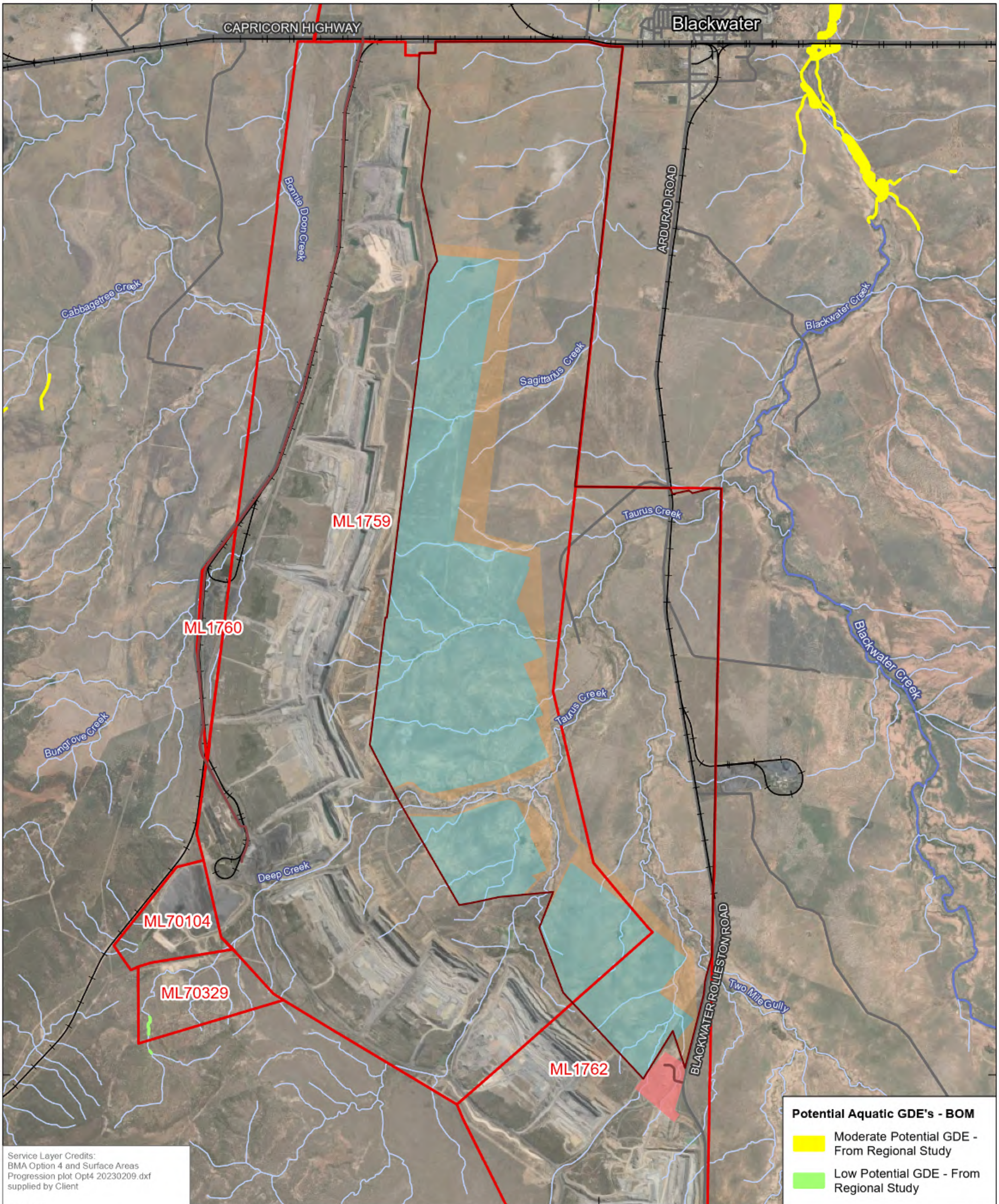
FIGURE 11-8

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_GW_CH_11_8_GDE Terrestrial



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	12-Dec-2023
Drawn by:	NT

LEGEND

- Railway
- Road
- Mine Acces Road
- Minor Watercourse
- Minor Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

MAPPED POTENTIAL AQUATIC GDEs IN THE VICINITY OF THE PROJECT

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FIGURE 11-9

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_GW_CH_F11_9_Potential GDE

Potential terrestrial GDEs identified within the Project area and surrounds by government mapping are shown in **Figure 11-8** and summarised as follows:

- No known terrestrial GDEs are mapped within the Project area or surrounds.
- Potential terrestrial GDE areas derived with low and moderate confidence, including:
  - In the Project area: a low confidence terrestrial GDE along Taurus Creek.
  - Downstream of the Project area: a moderate confidence terrestrial GDE along Blackwater Creek.

Potential aquatic (i.e. surface expression) GDEs identified within the Project area or surrounds by government mapping are shown in **Figure 11-9** and summarised as follows:

- No known aquatic GDEs are mapped within the Project area or surrounds.
- Potential aquatic GDE areas derived with moderate confidence (downstream of the Project area on Blackwater Creek).
- Surface expression GDE derived with low and moderate confidence.

The terrestrial GDEs are discussed further in **Chapter 12** and the aquatic GDEs in **Chapter 13**.

11.3 Potential Impacts

11.3.1 Groundwater Numerical Model

Numerical groundwater modelling was undertaken to assess the impact of the Project on the groundwater regime. Details of the modelling are presented in **Appendix F** (Appendix B - Groundwater Modelling Technical Report). The objectives of the modelling were to:

- Prepare a calibrated numerical groundwater model to simulate the hydrogeological conditions across the Project area.
- Estimate the groundwater inflow to the mine workings as a function of mine position and timing.
- Simulate and predict the extent and area of influence of dewatering and the level and rate of drawdown at specific locations.
- Simulate the post-mining recovery.
- Identify areas, where groundwater impact mitigation / control measures may be necessary.

The numerical model was developed using MODFLOW-USG as the model code (Panday *et al.*, 2013). MODFLOW-USG is a recent version of industry standard MODFLOW code and was chosen as the most suitable modelling code for accomplishing the model objectives.

The model domain is shown on **Figure 11-1** (labelled 'Study Area') and is large enough to allow the adjacent mines/projects to be assessed for potential cumulative impacts. At its widest extents, the model measures approximately 50 km by 90 km.

Model calibration, sensitivity and uncertainty analysis is detailed in the Groundwater Modelling Technical Report (SLR, 2023e), which is provided in Appendix B of the Groundwater Impact Assessment (**Appendix F**).

Transient predictive modelling was undertaken to simulate both the proposed mining at the Project and surrounding mines. The model timing used annual stress period durations as mining progressed into the future. Transient predictive models were developed for three model scenarios:

- Cumulative Scenario– all approved and foreseeable mining in the model area and at BWM plus the Project.
- Approved Scenario– all approved and foreseeable mining in the model area and at BWM without the Project.
- Null Run – no mining within in the model area.

The Project effects (i.e. the incremental changes) are determined by the difference between the Cumulative and Approved scenarios.

11.3.2 Groundwater Inflows to Open Cut Pits

The incremental inflows into the mine pits on SA7 and SA10 are predicted to reach a maximum in year 2038, with a peak just below 800 ML/year (2.2 ML/day). The average inflow rate for the Project (2025 to 2085) is 470 ML/year (1.3 ML/day).

The Water Plan (Fitzroy Basin) 2011 groundwater area consists of the following:

- Groundwater Unit 1 (containing aquifers of the Quaternary alluvium).
- Groundwater Unit 2 (sub-artesian aquifers).

The Project will not intercept Quaternary alluvium at any of the proposed pits. As such, all direct groundwater take predicted by the model is from Groundwater Unit 2.

The predicted cumulative groundwater take (i.e. groundwater inflow into the pits directly associated with mining for both the approved mining and the Project) would be in the order of up to 1,400 ML/year (average 735 ML/year) from Groundwater Unit 2.

11.3.3 Groundwater Drawdown

The maximum predicted drawdowns associated with the Project were assessed for incremental and cumulative drawdown impacts. Predicted drawdown figures (incremental and cumulative) are presented in **Figure 11-10** to **Figure 11-14**.

11.3.3.1 Incremental Drawdown

The numerical modelling indicates no incremental drawdown impacts are predicted for the alluvium and Tertiary in model layer 1 (**Figure 11-10a**) due to the Project, whilst the predicted incremental drawdown within the weathered zone (model layer 2) (**Figure 11-11a**) is largely confined to near the pit and is influenced by the distribution of predicted saturated zones in the weathered zone.

The groundwater model predicts that there is no incremental drawdown in the Clematis Sandstone.

The Permian coal seams (primary aquifers targeted by the Project) will experience drawdowns as a direct result of mining at the Project. The model showed that groundwater level drawdown within the mined coal seams is influenced by unit structure and are confined to unit extents. The extent of maximum predicted incremental drawdown of the Permian coal measures is limited to near the pit due to the structural geology (i.e., coal seams subcrop) and the extent of maximum predicted incremental drawdown in coal seams toward the east reaches the vicinity of Blackwater Creek (laterally at depth, not vertically into the shallow formations, such as alluvium or tertiary).

The maximum predicted incremental drawdown at Aries and Pollux Seams in the Rangal Coal Measures are shown in **Figure 11-12a** and **Figure 11-13a**, respectively. The maximum predicted incremental drawdown for the Burngrove Formation (**Figure 11-14a**) is similar to the drawdown in the coal seams and is limited to the area of outcrop.

11.3.3.2 Cumulative Drawdown

Maximum Cumulative drawdown predicted impacts are shown in panel (b) of **Figure 11-10** to **Figure 11-14**.

Cumulative drawdown impacts for the Alluvium and Tertiary Sediments (**Figure 11-10b**) show that maximum predicted cumulative drawdown impacts are in the north near Blackwater Creek. The cumulative drawdown impacts within the weathered zone (**Figure 11-11b**) is more widespread.

The groundwater model predicted that there is no cumulative drawdown in the Clematis Group.

Figure 11-12b and **Figure 11-13b** show the maximum predicted cumulative drawdown in the Aries and Pollux seams, respectively. The maximum cumulative drawdown is bounded on the western side by the coal seam outcrop and predicted to extend generally a distance of approximately 5-7 km east of the mining areas. The cumulative drawdown reached the model boundary in the northeast, which coincides with a major fault. An extension of the model in that area would still result in the same drawdown, as the fault is likely to act as a barrier to flow.

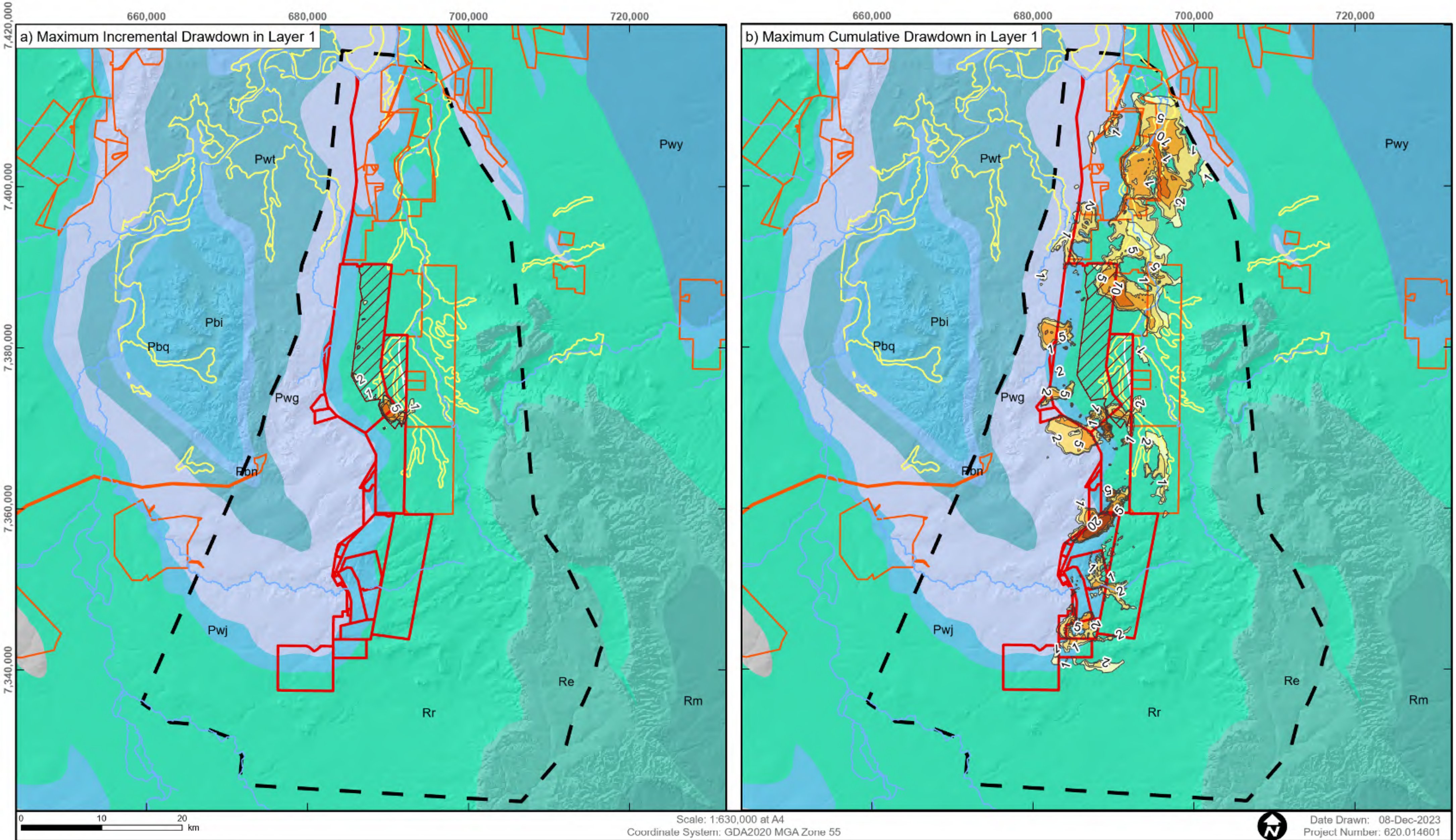
Figure 11-14b shows the maximum predicted cumulative drawdown in the Burngrove Formation. As shown in the figure, the maximum cumulative drawdown for this unit is similar to the predicted drawdowns in the Permian Coal Measures and predicted to extend approximately 5-7 km east of the mining areas.

11.3.4 Influence on Alluvium

The change in alluvial water resources was estimated by comparing water budgets for alluvial zones using the Approved and Cumulative scenarios of the predictive model. Interference of the alluvial groundwater can occur due to reduced upward leakage from Permian Coal Measures that are depressurised because of mining activities. Over the extent of Quaternary alluvium of Blackwater Creek, there is a maximum flow reduction of 0.23 ML/day from the underlying formation into alluvium as a result of the Project. The data shows that the water levels in the Rangal Coal Measures are currently higher than in the overlying Rewan Group at the two locations that had grouped bores and there is no data confirming this upward gradient for alluvial bores. While the model results cannot be verified, the scale of the change in the alluvium is very minor.

11.3.4.1 Influence on Blackwater Creek

The change in groundwater flow to rivers and creeks due to the Project was calculated by comparing the river flow budgets for Blackwater Creek in the Cumulative scenario against the Approved scenario. The net groundwater flow to Blackwater Creek is 0.27 ML/day for the Approved scenario and 0.26 ML/day for the Cumulative scenario. This calculation showed that over the life of mine, the change of baseflow is 0.01 ML/day. Given the Blackwater Creek is highly ephemeral, the alluvium is not contributing large amounts of water and this reduction due to the Project is deemed insignificant.



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Coordinate System: GDA2020 MGA Zone 55

Date Drawn: 08-Dec-2023
Project Number: 620.014601

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Service Layer Credits:

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LEGEND

- Drawdown Contour (m)
- Watercourse
- Alluvium Extent
- Model Boundary
- BWM Mining Lease
- BWM North Extension Project Area
- Mining Lease

Maximum Drawdown (m)

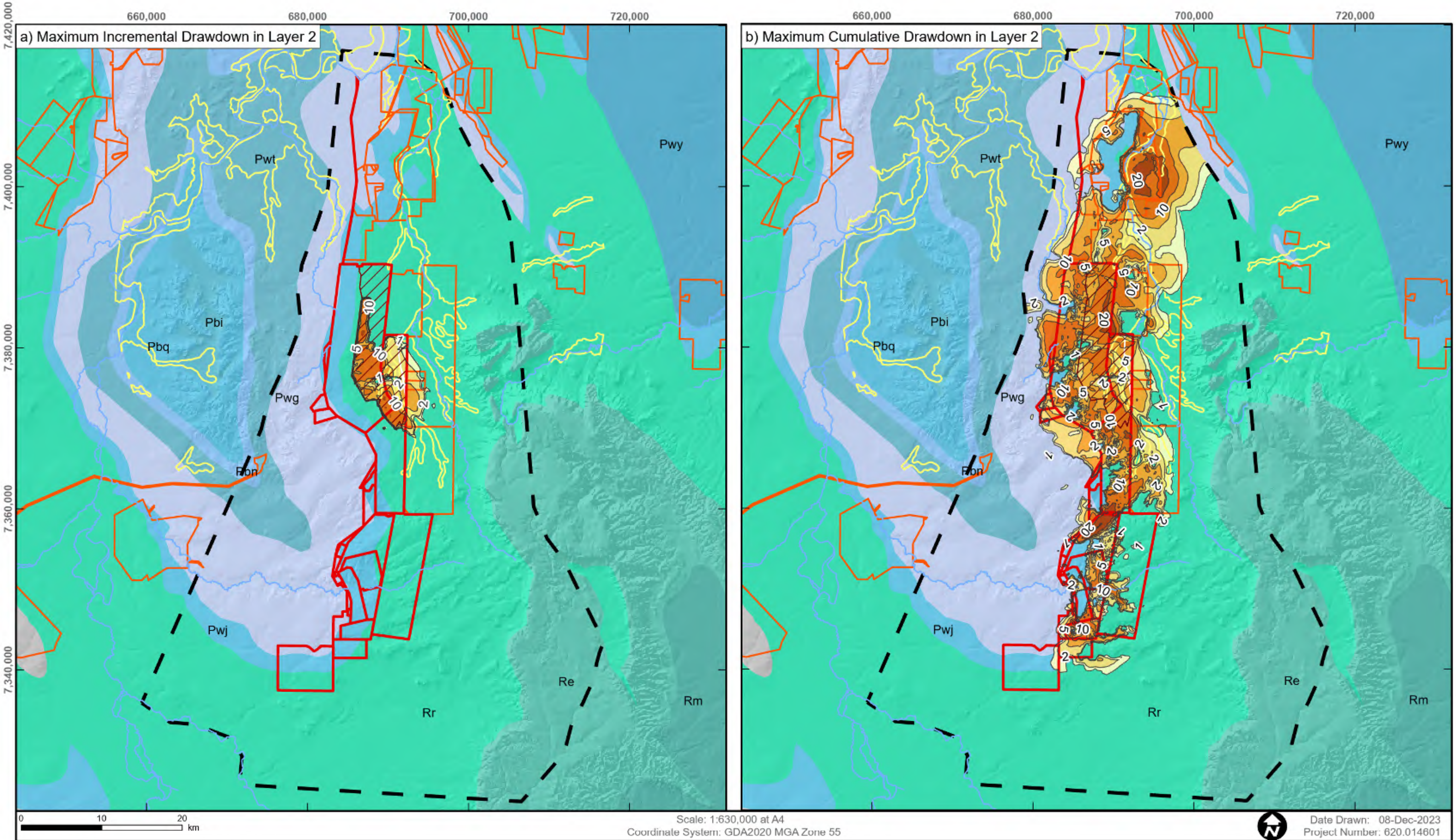
- 1 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 50
- 50 - 100

BLACKWATER MINE - NORTH EXTENSION PROJECT

MAXIMUM INCREMENTAL (A) AND CUMULATIVE (B) DRAWDOWN IN THE ALLUVIUM AND TERTIARY (LAYER 1)

FIGURE 11-10

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_GW_CH_F11_10_Incremental_Cumulative DD Layer1



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Coordinate System: GDA2020 MGA Zone 55

Date Drawn: 08-Dec-2023
Project Number: 620.014601

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LEGEND

- Drawdown Contour (m)
- Watercourse
- Alluvium Extent
- Model Boundary
- BWM Mining Lease
- BWM North Extension Project Area
- Mining Lease

Maximum Drawdown (m)

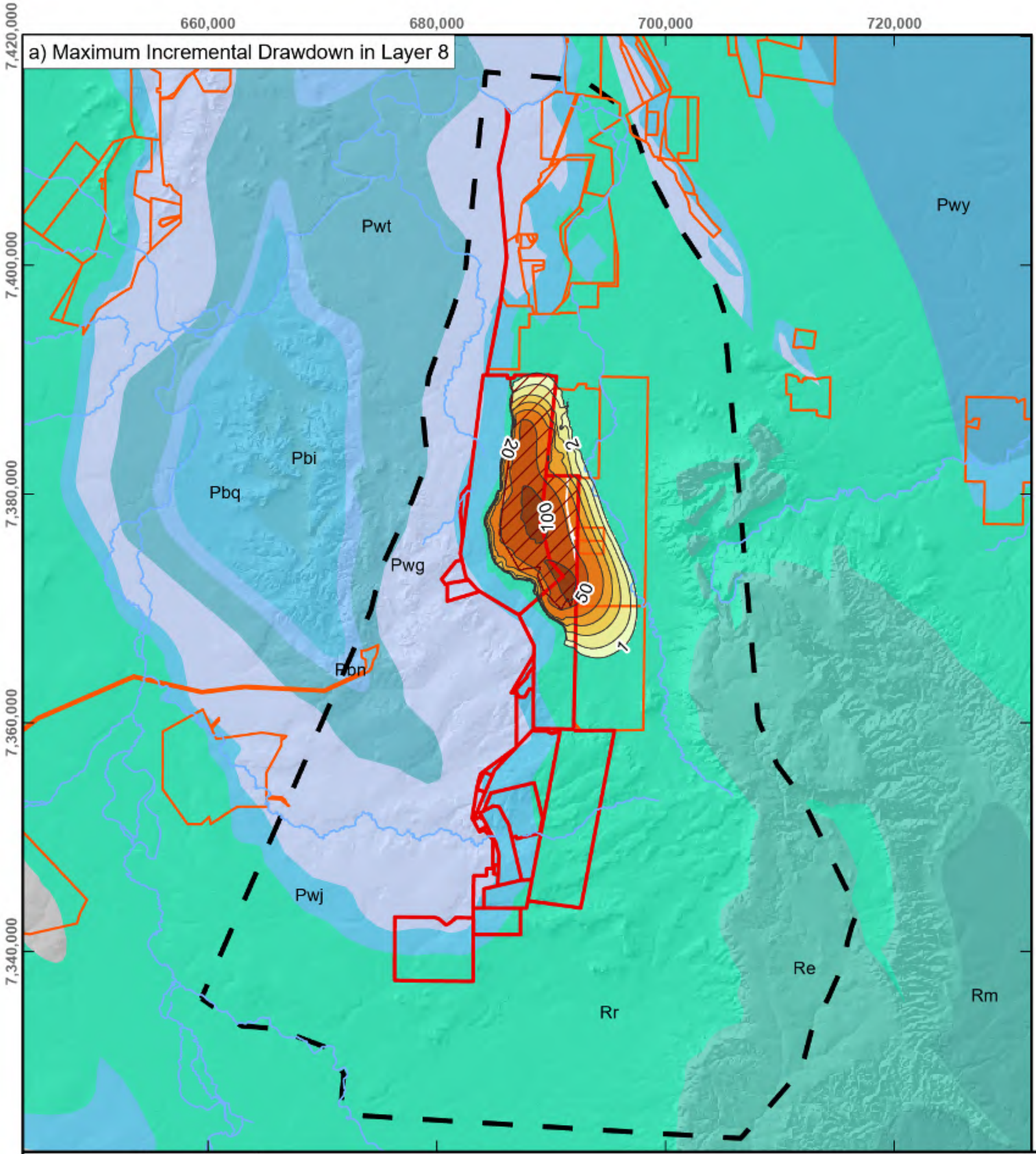
- 1 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 50
- 50 - 100

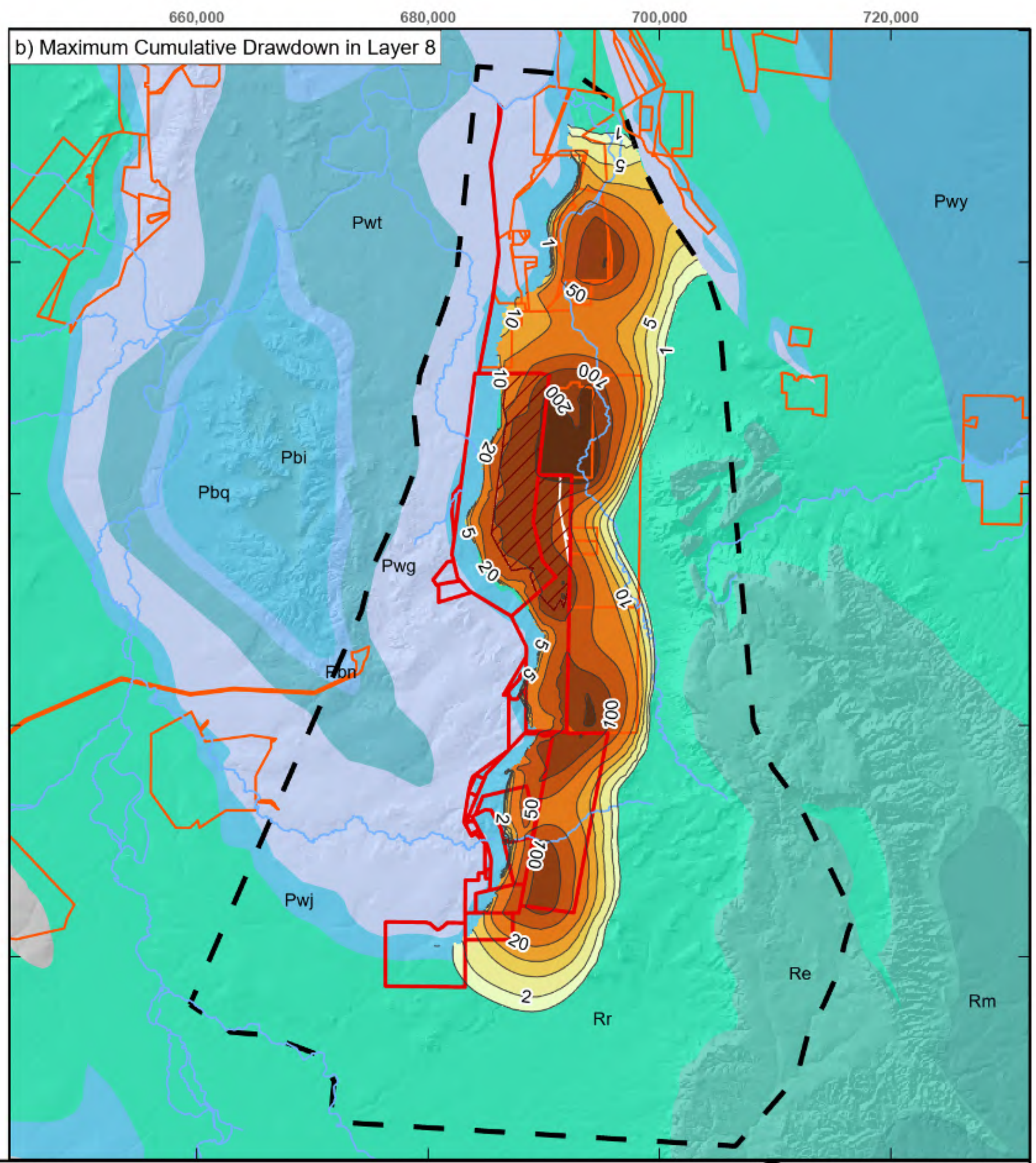
BLACKWATER MINE - NORTH EXTENSION PROJECT

MAXIMUM INCREMENTAL (A) AND CUMULATIVE (B) DRAWDOWN IN THE ALLUVIUM AND WEATHERED ZONE (LAYER 2)

FIGURE 11-11

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_GW_CH_F11_11_Incremental_Cumulative DD Layer 2





0 10 20 km

Scale: 1:630,000 at A4
Coordinate System: GDA2020 MGA Zone 55

Date Drawn: 08-Dec-2023
Project Number: 620.014601

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LEGEND

- Drawdown Contour (m)
- Watercourse
- Model Boundary
- BWM Mining Lease
- BWM North Extension Project Area
- Mining Lease

Maximum Drawdown (m)

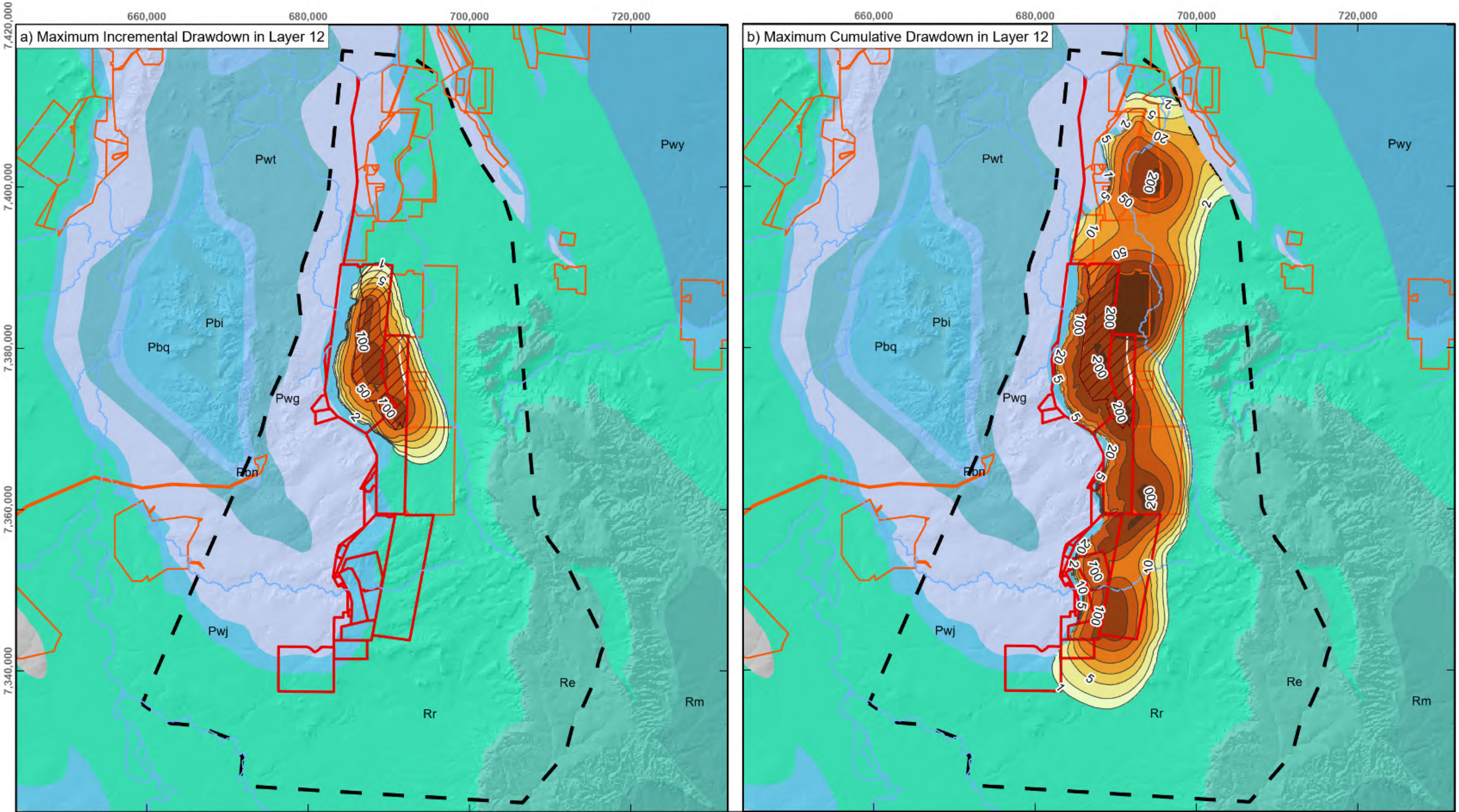
- 1 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- 100 - 200
- 200 - 500

BLACKWATER MINE - NORTH EXTENSION PROJECT

MAXIMUM INCREMENTAL (A) AND CUMULATIVE (B) DRAWDOWN IN THE ARIES SEAM (LAYER 8)

FIGURE 11-12

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_GW_CH_F11_12_Incremental_Cumulative DD Layer 8



0 10 20 km

Scale: 1:630,000 at A4
Coordinate System: GDA2020 MGA Zone 55

Date Drawn: 08-Dec-2023
Project Number: 620.014601

BMA
BHP Mitsubishi Alliance

Service Layer Credits:

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LEGEND

- Drawdown Contour (m)
- Watercourse
- Model Boundary
- BWM Mining Lease
- BWM North Extension Project Area
- Mining Lease

Maximum Drawdown (m)

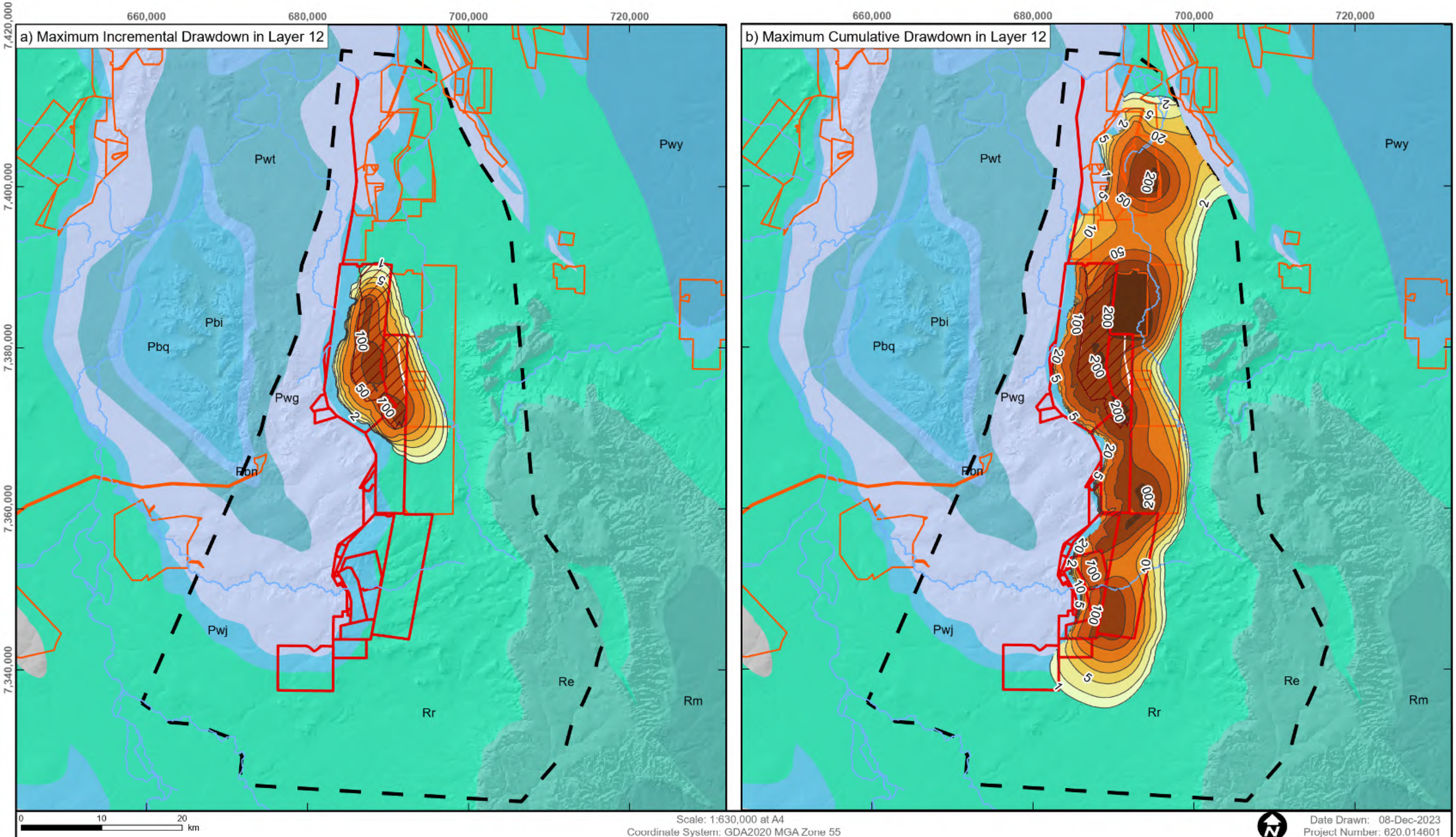
- 1 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- 100 - 200
- 200 - 500

BLACKWATER MINE - NORTH EXTENSION PROJECT

MAXIMUM INCREMENTAL (A) AND CUMULATIVE (B) DRAWDOWN IN THE POLLUX SEAM (LAYER 12)

FIGURE 11-13

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_GW_CH_F11_13_Incremental_Cumulative DD Layer 12



Scale: 1:630,000 at A4
Coordinate System: GDA2020 MGA Zone 55

Date Drawn: 08-Dec-2023
Project Number: 620.014601

BMA
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Service Layer Credits:

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LEGEND

- Drawdown Contour (m)
- Watercourse
- Model Boundary
- BWM Mining Lease
- BWM North Extension Project Area
- Mining Lease

Maximum Drawdown (m)

- 1 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- 100 - 200
- 200 - 500

BLACKWATER MINE - NORTH EXTENSION PROJECT

MAXIMUM INCREMENTAL (A) AND CUMULATIVE (B) DRAWDOWN IN THE POLLUX SEAM (LAYER 12)

FIGURE 11-13

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_GW_CH_F11_13_Incremental_Cumulative DD Layer 12

11.3.4.2 Final Voids and Post-mining Recovery

The Project open cut pits will be partially backfilled as the mining operations progress. Four final voids are proposed to remain post-closure and their indicative locations is provided in **Figure 11-15**.

The potential post mining impacts of the Project were investigated with a recovery model, commencing at the end of mining at the Project with a run time of 200 years.

All four voids have reached equilibrium in the modelled time period. The predicted final groundwater water levels are presented in **Figure 11-16**. All four voids will act as a groundwater sink, which means that groundwater will flow into the voids. As the final voids would act as a sink, evaporation from the final void water bodies would overtime concentrate salts in the final void water bodies (refer to Chapter 10, Surface Water). However, the gradual increase in salinity of the final void water bodies is unlikely to pose a risk to the surrounding groundwater regime, as the final voids would remain as a groundwater sink in perpetuity. Future climate change effects were also considered by the post-mining recovery modelling and indicated that if drier or wetter conditions should prevail, the voids would remain sinks to the groundwater.

11.3.4.3 Groundwater Quality

The impacts on groundwater quality is assessed in the Groundwater Impact Assessment (**Appendix F**). The potential sources and pathways of groundwater contamination associated with the Project include in pit waste emplacement areas, final voids and workshops and chemical storage areas.

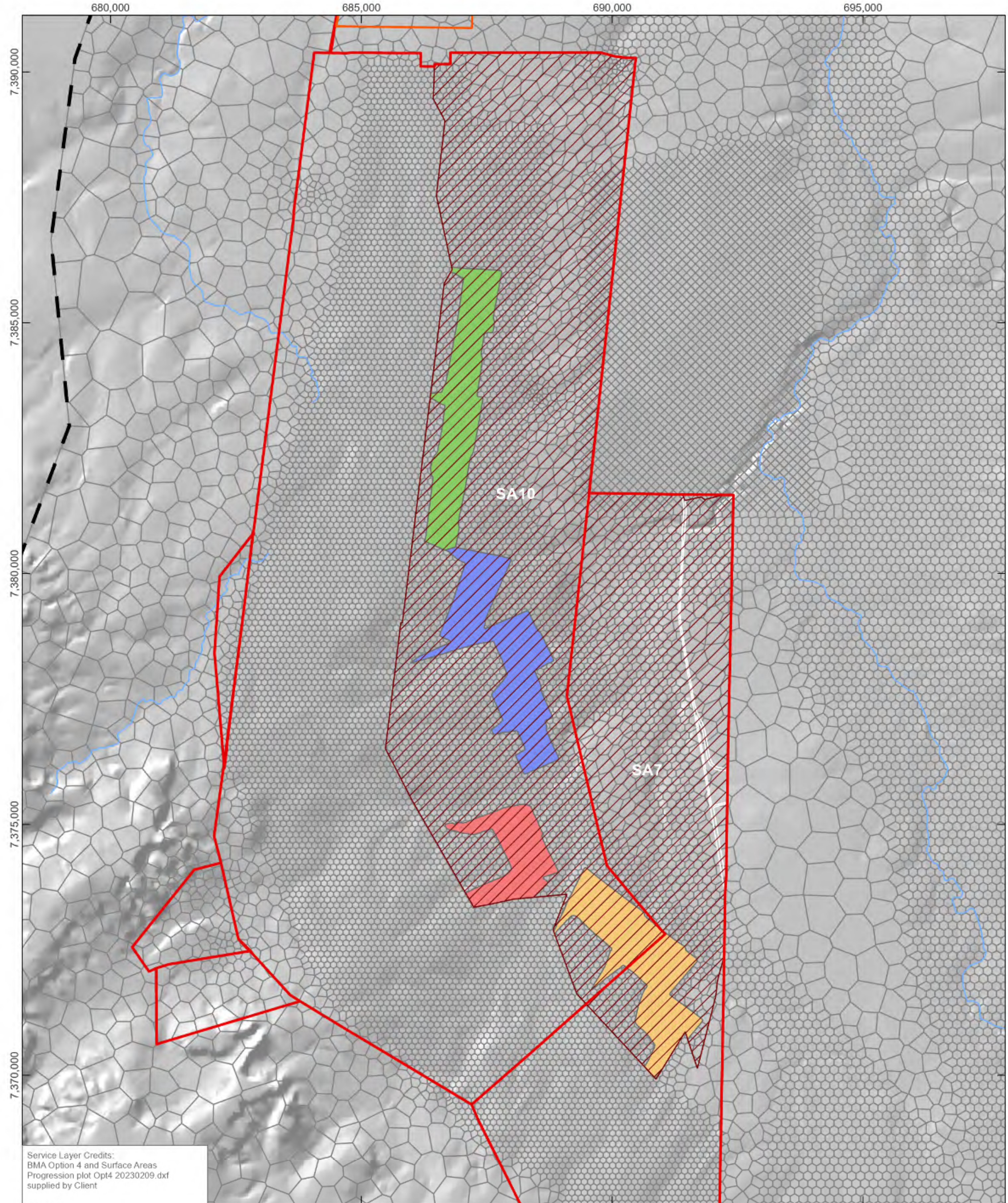
As described above, the Project open cut pits will be partially backfilled as the mining operations progress Water levels within these areas are predicted to recover back towards pre-mining levels. **Section 11.3.4.2** indicates the gradual increase in salinity of the final void water bodies is unlikely to pose a risk to the surrounding groundwater regime, as the final voids would remain as a groundwater sink in perpetuity.

The potential for groundwater contamination from workshops and fuel/chemical storage at BWM is minimal, due to the standard practices and legislative compliance measures in place to protect the groundwater regime from contamination. Additionally, the workshop, fuel, and chemical storage areas at BWM are constructed in accordance with the latest Australian Standards, which includes well-designed refuelling and chemical storage areas, which are designed with adequate bunding and equipped for immediate spill clean-up.

11.3.5 Impacts on Groundwater Users

11.3.5.1 Privately-Owned Supply Bores

The Groundwater Impact Assessment (**Appendix F**) evaluated the maximum incremental and cumulative drawdown at each of the eleven landholder bores identified within a 10 km radius of the Project area (**Table 11-3**). The bore drawdown threshold triggers (2 m for unconsolidated aquifers, and 5 m for consolidated aquifers) provided in Chapter 3 of the Water Act were adopted to assess impacts to third party bore users.



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	08-Dec-2023
Drawn by:	NT

BMA
BHP Mitsubishi Alliance

LEGEND

- Watercourse
- Model Boundary
- Model Grid
- BWM Mining Lease
- BWM North Extension Project Area
- Mining Lease

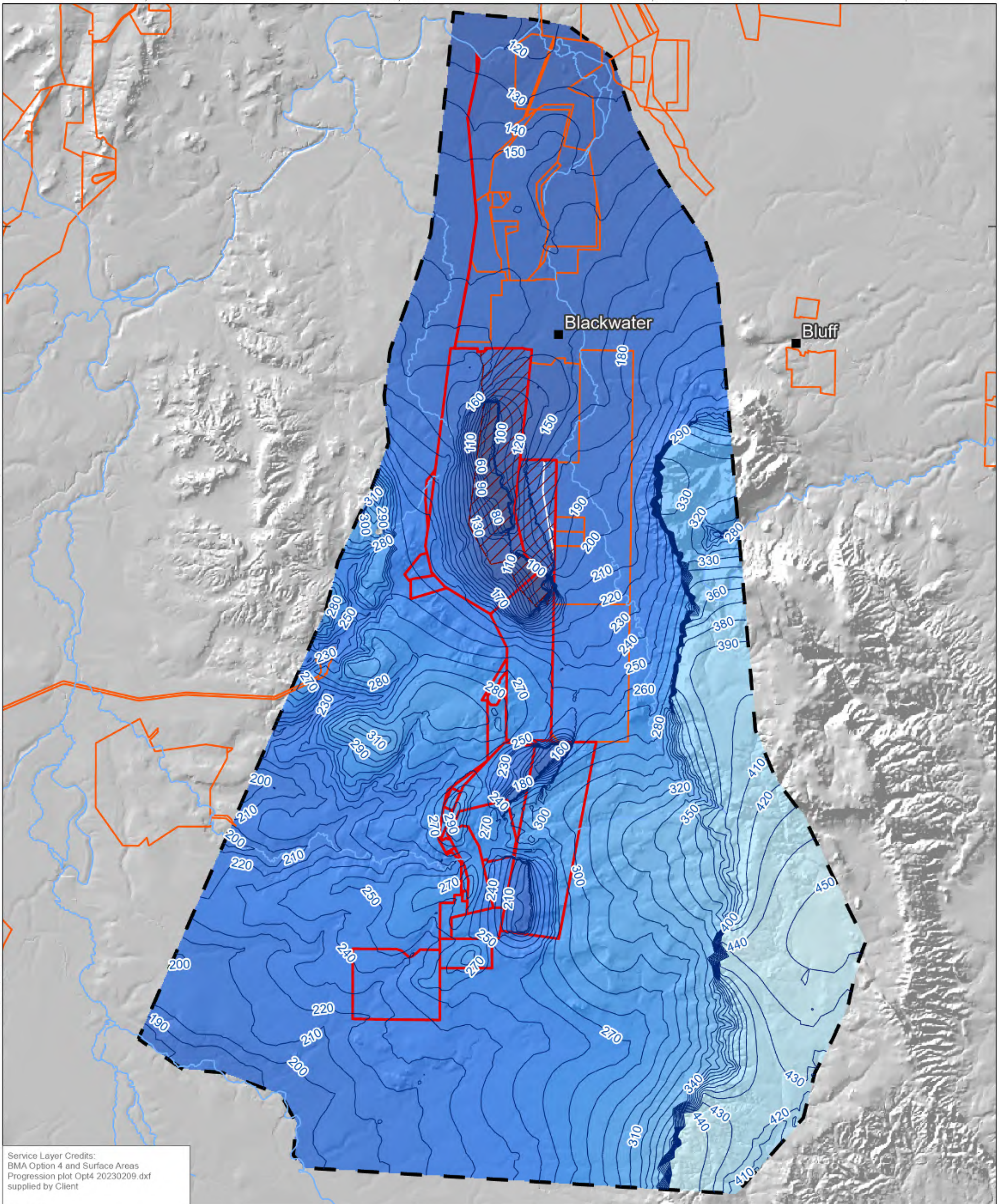
Final Void

- Void 1
- Void 2
- Void 3
- Void 4

BLACKWATER MINE - NORTH EXTENSION PROJECT

INDICATIVE FINAL VOID LOCATIONS

FIGURE 11-15



0 5 10 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:400,000 at A4
Project Number:	620.014601
Date Drawn:	08-Dec-2023
Drawn by:	NT

BMA
BHP Mitsubishi Alliance

LEGEND

- City/Town
- Groundwater Level Contour (mAHD)
- Watercourse
- Model Boundary
- BWM Mining Lease
- BWM North Extension Project Area
- Mining Lease

Groundwater Level (mAHD)

454

58

BLACKWATER MINE - NORTH EXTENSION PROJECT

GROUNDWATER TABLE RECOVERY (200 YEARS POST-MINING)

FIGURE 11-16

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_GW_CH_F11_16_Recovered GW Table

Table 11-3: Drawdown Impact on Landholder Bores (Base case scenario)

Registered RN (ID)	Bore Name	Easting (GDA94 z55)	Northing (GDA94 z55)	Geology	Bore Depth (m)	Use	Maximum Incremental Drawdown (m)	Maximum Cumulative Drawdown (m)
38998	No 2 Bore	681119	7391492	Burngrove Formation	36.6	Unknown	0.00	0.09
43097	-	681800	7392230	Burngrove Formation	22.9	Unknown	0.00	0.08
43459	Top Bore	683719	7395787	Unknown	54.9	Unknown	0.00	0.06
57503	Stake Bore	680333	7361655	Burngrove Formation[1]	Unknown	Stock Watering	0.00	0.10
57504	Eighteen Mile Bore	682192	7365312	Unknown	Unknown	Stock watering	0.00	0.11
84221	-	683596	7390708	Burngrove Formation	24	Unknown	0.07	9.38
89034	-	680391	7390291	Unknown	Unknown	Unknown	0.00	0.00
103345	JWS Bore	684091	7363016	Burngrove Formation	47	Not In Use	0.00	2.23
111709	-	680013	7390877	Burngrove Formation	72	Water Supply	0.00	0.02
Unregistered 11	-	680420	7378058	Burngrove Formation	Unknown	Stock Watering	0.010	3.66
Unregistered 18	-	684004	7362319	Burngrove Formation	Unknown	Stock Watering	0.00	1.69

There are no predicted incremental drawdowns at any of the identified bores that exceed the Water Act bore trigger thresholds as a result of the Project. Incremental drawdown from the Project is only expected at two bores. The maximum predicted incremental drawdown is 0.07 m at bore “RN84221” and 0.01 m at Bore ‘Unregistered 11’ (**Table 11-3**). The largest maximum cumulative drawdown of 9.38 m is predicted at Bore RN84221 to the north of the mine, followed by bores RN103345, “Unregistered 11” and “Unregistered 18”, all of which have predicted cumulative drawdowns of approximately 2–4 m. Seven bores are predicted to experience a maximum cumulative drawdown of 15 cm or less, which is considered insignificant.

The uncertainty analysis showed that the 95th percentile maximum cumulative drawdown is predicted to be greater than 5 m at six water supply bores. As per Table 2 of the IESC (2020), in terms of likelihood of exceedance, a percentile greater than 95% means that it is very unlikely that the maximum cumulative drawdown will be greater than 5 m at these bores. Further detail on the uncertainty analysis is provided in the Groundwater Impact Assessment (**Appendix F**).

11.3.5.2 Groundwater Dependent Ecosystems

Potential terrestrial GDEs have been mapped by EMM (2023a) within the Project area and within the 90^{th} percentile of the 1 m water table drawdown curve from the groundwater model uncertainty analysis (refer Groundwater Impact Assessment, **Appendix F**). The 90^{th} percentile adds confidence that all potential TGDEs are captured in the assessment. Potential impacts on potential terrestrial GDEs are discussed in **Chapter 12**.

Potential impacts on Aquatic GDEs and Subterranean GDEs are discussed in **Chapter 13**.

11.4 Mitigation and Management Measures

11.4.1 Groundwater Quality

The mine plan for the Project includes strategies to manage MAW for the life of the Project.

Groundwater inflows to the open cut pits during mining operations would be pumped out (along with any surface water) via in-pit sumps if the groundwater doesn’t passively evaporate on the pit face or from the pit floor. The groundwater inflows would be collected and contained within the mine water management system.

Waste rock material would be emplaced in-pit as the space becomes available and will in some areas form the walls of the final voids. As outlined in **Section 11.3.4.3**, groundwater within each of the four final voids is predicted to remain below pre-mining levels. Therefore, the final voids would act as a groundwater sink.

11.4.2 Groundwater Use

The potential impacts on groundwater users (privately-owned bores) indicate that the incremental drawdown at privately-owned bores is not predicted to exceed relevant bore trigger thresholds stipulated in Chapter 3 of the Water Act. As such, there are no existing privately-owned bores that would be impacted by the Project to a degree that may require mitigation.

11.4.3 Groundwater Monitoring Program

A groundwater monitoring program is conducted at BWM in accordance with Schedule I (Groundwater) of the EA. Recording of groundwater levels will continue in accordance with the EA and will allow natural groundwater level fluctuations (such as responses to rainfall) to be distinguished from potential groundwater level impacts due to depressurisation resulting from mining activities. Groundwater quality sampling will also continue in accordance with the EA to provide longer term baseline groundwater quality and to detect any changes in groundwater quality during and post mining.

The EA groundwater monitoring locations (Table I1, Schedule I Groundwater) are in the process of being revised in consultation with DES. The proposed monitoring locations and frequency are provided in **Table 11-4**.

Groundwater quality trigger levels for the BWM are being developed by BMA in consultation with DES and in consideration of the DES guideline on *Using monitoring data to assess groundwater quality and potential environmental impacts* (DES, 2021). The BWM Groundwater Monitoring and Management Program will be reviewed every two years by an appropriately qualified person.

Table 11-4: Groundwater Monitoring Locations and Frequency

Monitoring Location	Aquifer type	Easting (GDA94)	Northing (GDA94)	Monitoring Frequency
Compliance Bores				
MB1	Permian coal (TU seam)	686331	7387080	Quarterly
MB21	Tertiary Sediments	684900	7350805	Quarterly
MB18	Permian Sandstone	691537	7370787	Quarterly
BWM_MB02_01[1]	Permian Interburden	691748	7362713	Quarterly
BWM_MB02_02[1]	Permian Coal (M54 seam)	691736	7362715	Quarterly
BWM_MB03_01[1]	Alluvium	692229	7381516	Quarterly
BWM_MB03_02[1]	Rewan Group	692232	7381521	Quarterly
BWM_MB12_01[1]	Tertiary Sediments	687874	7355898	Quarterly
BWM_MB12_02[1]	Permian Coal (P04 seam)	687874	7355898	Quarterly
BWM_MB14_01[1]	Permian Interburden	683649	7350258	Quarterly
BWM_MB14_02[1]	Permian Interburden	683649	7350258	Quarterly
BWM_MB15_01[1]	Tertiary sediments	686662	7347631	Quarterly
BWM_MB17_01[1]	Basalt	684014	7343177	Quarterly
BWM_MB17_02[1]	Tertiary (BUTE)	684014	7343177	Quarterly
MB19BWM01P	Permian Coal (Aries Seam)	690037	7390281	Quarterly
MB19BWM02A	Permian Interburden (siltstone)	690127	7370182	Quarterly

Monitoring Location	Aquifer type	Easting (GDA94)	Northing (GDA94)	Monitoring Frequency
MB19BWM08P	Permian Coal (Aries Seam) & Siltstone	691542	7370739	Quarterly
MB19BWM27P	Permian Coal (Aries Seam) & Siltstone	688958	7376559	Quarterly
MB20BWM03P2	Permian (L41 seam)	686499	7387292	Quarterly
BG-1	Burngrove Formation	683994	7387561	Quarterly
BG-2	Burngrove Formation	684300	7384441	Quarterly

[1] Trigger levels have not yet been developed for these bores due to the limited available monitoring dataset. Monthly monitoring will occur until a suitable dataset is available to set trigger levels.

11.4.4 Data Management and Reporting

Routine groundwater monitoring would be conducted in accordance with any updated EA. Data will be stored within a consolidated groundwater database. Quality assurance and quality control procedures are in place to help ensure the accuracy of data entered within the database. Notification to DES and investigation into the cause of any exceedance would be undertaken in accordance with the requirements of the EA.

12 Terrestrial Ecology

12.1 Introduction

EMM was commissioned to undertake baseline terrestrial ecological studies across the Project area to support environmental impact assessments. The surveys consisted of extensive seasonal surveys applying methods consistent with survey guidelines across the Project area. A Terrestrial Ecology Matters of National Environmental Significance Assessment (EMM, 2023a) and Terrestrial Ecology Matters of State Environmental Significance Assessment (EMM, 2023b) have been prepared for the Project and are provided in **Appendix G** and **Appendix H**, respectively.

This chapter describes the terrestrial ecology values within the Project area, the potential impacts of the Project on terrestrial ecology and proposed mitigation and management measures.

12.2 Regional and Local Setting

The Project is located in the Brigalow Belt Bioregion and the Isaac-Comet Downs subregion and the Blackdown Tableland National Park is located approximately 10 km to the east of the Project area (**Figure 12-1**). The natural topography in the Project area is generally flat to gently undulating and slopes gently from west to east. The Project area is drained by a number of ephemeral first, second, and third order waterways.

The Project area is located in the Bowen Basin, where coal mining is a primary land use. Land within the Project area is predominantly used for cattle grazing, with large areas that have been cleared of native vegetation. Riparian vegetation comprises the entirety of the remnant vegetation within the Project area. Vegetation along watercourses such as Taurus Creek and Two Mile Gully consist of narrow linear patches that fringe the creeks.

Connectivity is very limited in the Project area due to the cleared and fragmented nature of native vegetation. Connectivity predominantly occurs along creek lines. A State significant biodiversity corridor is mapped to the east of the Project area, following the higher altitude range of Blackdown Tableland in a north-south direction. At its closest point the State significant biodiversity corridor is approximately 15 km from the Project. Regionally significant biodiversity corridors associated with the riparian corridor of Taurus Creek are mapped within the Project area.

12.3 Methodology

12.3.1 Desktop Assessment

A desktop assessment was undertaken to provide an understanding of the broader environmental values, landscape features and biodiversity attributes that are known, likely or have the potential to occur in the Project area and wider surrounds. The desktop assessment included a review of Commonwealth and State databases and mapping, literature reviews, ecology assessments previously conducted for the BWM and ecological assessments from surrounding projects.

The ‘desktop search area’ consisted of a 50 km buffer zone from a central point in the Project area (**Figure 12-1**). Desktop searches were undertaken of the Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool, DES Wildlife Online database, Queensland Department of Natural Resources, Mines and Energy (DNRME) RE mapping, Atlas of Living Australia, WildNet Wildlife Records and a range of other databases. The references sourced as part of the desktop assessment are detailed in **Appendices G** and **H**. The results of the desktop assessment informed field survey design and methodology.

12.3.2 Field Survey

12.3.2.1 Survey Timing and Guidelines

Extensive baseline terrestrial flora and fauna surveys have been undertaken by suitably qualified ecologists in the Project area from 2019 to 2023. The field survey programs (**Table 12-1**) were conducted to verify the findings of the desktop and likelihood of occurrence assessments, as well as identify and characterise the presence, extent and condition of terrestrial ecological values within the Project area.

Table 12-1: Survey Programs

Date	Survey type	Flora	Fauna
December 2018	Pre-wet season	✓	
March - April 2019	Post-wet season	✓	✓
September - October 2019	Pre-wet season	✓	✓
March 2020	Targeted survey for Ornamental Snake (*Denisonia maculata*) and Australian Painted Snipe (*Rostratula australis*)		✓
June 2023	Supplementary terrestrial ecology habitat assessments		✓

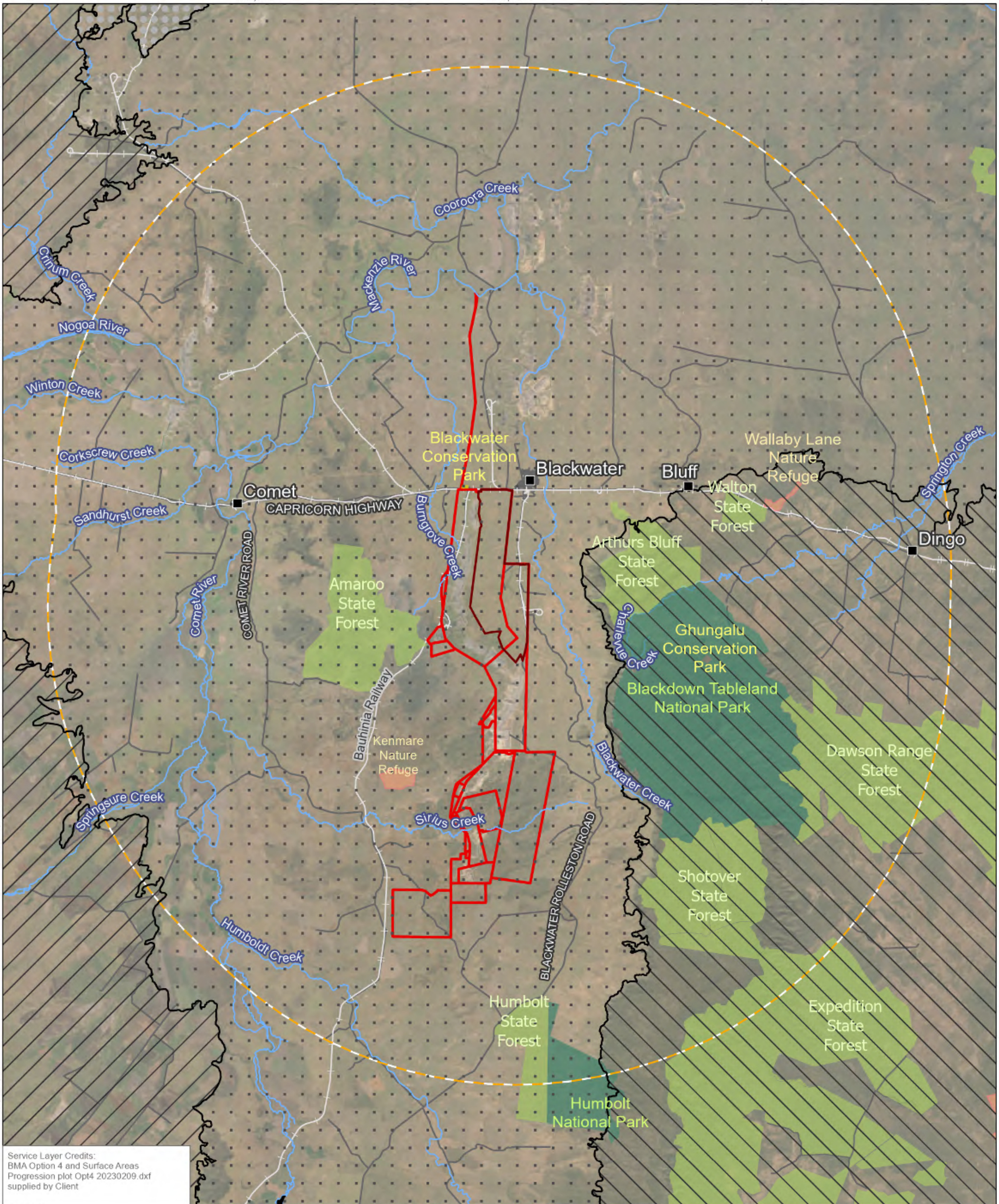
The timing and survey methods adopted for flora and fauna surveys were guided by State and Federal survey guidelines. Targeted fauna surveys were designed and implemented in accordance with the following guidelines:

- Terrestrial Vertebrate Fauna Survey Guidelines for Queensland – Version 3.0 (Eyre et al. 2018).
- Survey guidelines for Australia's threatened mammals (DSEWPC 2011).
- Survey guidelines for Australia's threatened birds (DEWHA 2010).
- Survey guidelines for Australia's threatened reptiles (DSEWPC 2011a).
- Survey guidelines for Australia's threatened bats (DEWHA 2010a).
- Referral guidelines for the vulnerable Koala (DoEE 2014) (now superseded but current at time of survey).
- Referral guidance for the endangered Koala (DCCEEW 2022).
- Draft referral guidelines for the nationally listed Brigalow Belt reptiles (DSEWPC 2011b).

Vegetation community surveys to validate the presence of REs were consistent with the *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland, Version 5.1* (Neldner et al. 2020).

12.3.2.2 Flora Surveys

Flora surveys were conducted to describe the contemporary composition, condition, state and extent of vegetation communities within the Project area as well as detect the presence and/or likelihood of occurrence of threatened flora species listed under the EPBC Act and critically endangered, endangered, vulnerable and near threatened (CEEVNT) species listed under the NC Act.



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Project Number:	620.014601
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Drawn by:	NT

0 5 10 km

LEGEND

- City/Town
- Railway
- Road
- Watercourse
- BWM North Extension Project Area
- BWM Mining Lease
- National Park
- State Forest
- Consevation Area
- Nature Refuge
- Desktop Seach Area

Brigalow Belt North Bioregion

- Basalt Downs Sub Region
- Isaac - Comet Downs Sub Region
- Northern Bowen Basin Sub Region

Brigalow Belt South Bioregion

- Woorabinda Sub Region

BLACKWATER MINE - NORTH EXTENSION PROJECT

DESKTOP SEARCH AREA AND BIOREGIONS

FIGURE 12-1

BMA
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To ensure adequate representation of all vegetation community types and ecological conditions, areas targeted included both remnant and regrowth native vegetation as well as representative non-remnant areas with potential to support associated threatened ecological communities (TECs) and threatened and CEEVNT flora species.

The flora survey methods employed included:

- Tertiary sites – for classification and detailed descriptions of REs and vegetation communities.
- Quaternary sites – for rapid assessment of REs and vegetation communities.
- BioCondition sites – for assessment of vegetation community condition.
- Targeted survey for threatened and CEEVNT species.

Vegetation assessments were completed at 68 sites consisting of five tertiary assessments and 63 quaternary assessments. Additional TEC assessments were carried out at nine sites and BioCondition assessments were conducted at four sites.

An objective of the flora surveys was to validate the presence of REs and confirm whether they met remnant or high value regrowth (HVR) status, and their extent. Where appropriate, criteria thresholds for threatened ecological communities were also evaluated to confirm if the vegetation meets the EPBC Act requirements for that community.

Where a CEEVNT plant or possible CEEVNT plant was recorded, the population extent was recorded and a specimen was taken for submission to the Queensland Herbarium to confirm species identification.

Details of the flora survey methods are provided in detail in **Appendices G** and **H**.

12.3.2.3 Fauna Surveys

Fauna survey sites were selected by targeting areas of remnant and regrowth vegetation, as well as different habitat types across the Project area.

The terrestrial fauna survey methods employed included:

- Pitfall traps.
- Funnel traps.
- Elliott traps.
- Camera traps.
- Passive auditory recording.
- Diurnal bird surveys.
- Spotlighting.
- Active searches.
- Scat/scratch/secondary sign search.

Based on the results of desktop assessments, a field survey program was developed that incorporated targeted methods for MNES and MSES species which were assessed as having potential to occur on site.

At several sites, specialised survey methods were also used to target specific species in accordance with relevant State and Commonwealth survey guidelines, including harp trapping for microchiropteran bat fauna and Spot Assessment Technique (SAT)/transects for the Koala (*Phascolarctos cinereus*).

General habitat assessments were completed in conjunction with vegetation community assessments to assess the availability and suitability of CEEVNT fauna habitat across the Project area. Habitat assessments included the recording of the following micro-habitat attributes:

- the presence of fallen logs, leaf litter, rocks;
- vegetation groundcover;
- presence of cracking soils;
- presence rocky overhangs, caves, decorticating bark;
- foraging resources such as native grasses, preferred food trees for Koalas etc;
- available water sources;
- animal breeding places such as hollow-bearing trees, dens, nests;
- presence and abundance of weeds; and
- signs of pest animals.

12.4 Environmental Values

12.4.1 Terrestrial Flora

12.4.1.1 Vegetation Communities

Vegetation assessments across the Project area identified a dominance of heavily degraded, non-remnant vegetation with few to no native plant species. Most non-remnant sites are active grazing land and have been altered by both recent and long preceding vegetation clearance and raking of woody debris and rocks. These areas are now largely dominated by introduced Buffel Grass and continue to be grazed by livestock.

Ground-truthing surveys of vegetation communities in the Project area identified six Regional Ecosystems (REs):

- RE11.3.1 *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains.
- RE11.3.2 *Eucalyptus populnea* woodland on alluvial plains.
- RE11.3.3 *Eucalyptus coolabah* woodland on alluvial plains.
- RE11.3.6 *Eucalyptus melanophloia* woodland on alluvial plains.
- RE11.3.25 *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines.
- RE11.4.9 *Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains.

Table 12-2 presents the ground-truthed REs identified within the Project area, the relevant VM Act and Biodiversity status (BD status) and potentially associated TEC where applicable. The ground-truthed REs are shown on **Figure 12-2a, Figure 12-2b** and **Figure 12-2c**.

Table 12-2: Biodiversity Status and VM Act Class of Ground-truthed Regional Ecosystems Identified

RE	RE descriptions	Potentially associated TEC	Biodiversity status[1]	VM Act class[2]
11.3.1	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains	Brigalow dominant and co-dominant	E	E
11.3.2	*Eucalyptus populnea* woodland on alluvial plains	Poplar Box Grassy Woodland on alluvial plains	OC	OC
11.3.3	*Eucalyptus coolabah woodland on alluvial plains*	-	OC	OC
11.3.6	*Eucalyptus melanophloia* woodland on alluvial plains	-	OC	LC
11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	-	OC	LC
11.4.9	*Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains	Brigalow dominant and co-dominant	E	E

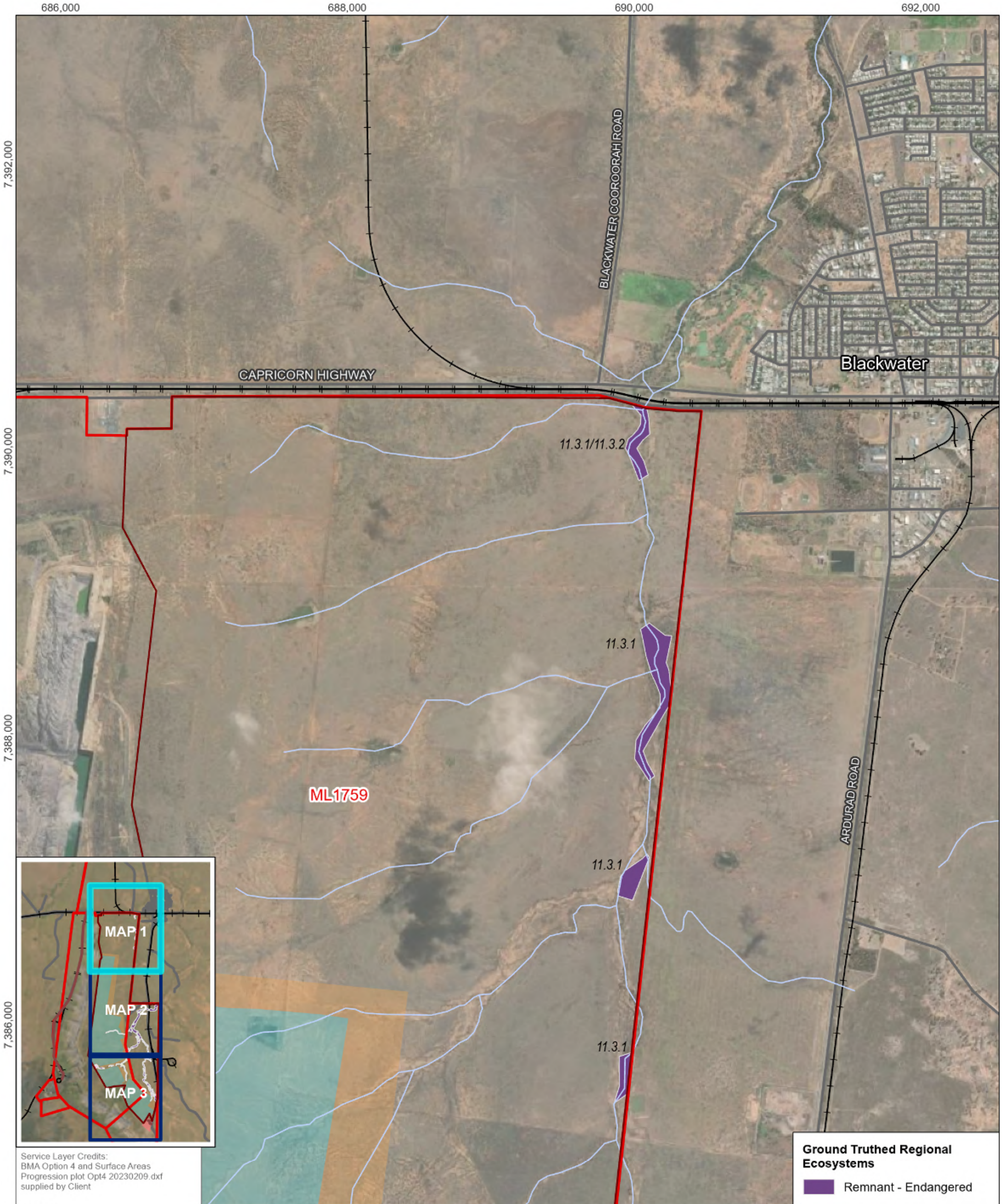
[1] *Biodiversity status: E – Endangered, OC – Of concern*

[2] *Vegetation Management Act class: E – Endangered, OC – Of concern, LC – Least concern*

Within the Project area, remnant and high value regrowth vegetation frequently occurs as narrow bands of RE11.3.1 or as mixed polygons with REs 11.3.2, 11.3.25, 11.3.3, 11.3.6 and 11.4.9 including some that are regrowth vegetation with sparse to no woody vegetation (**Table 12-3)**.

Table 12-3: Ground-truthed Regional Ecosystems within the Project area and Status

RE code	RE occurrence and community percentage	Area (ha)		
		HVR	Remnant	Total
11.3.1	11.3.1	19.69	64.07	83.76
	11.3.1/11.3.2 (50/50)	0.0	4.04	4.04
	11.3.1/11.3.25 (80/20)	0.0	133.2	133.2
	11.3.1/11.3.3 (50/50)	0.0	7.42	7.42
	11.3.1/11.3.6 (90/10)	8.31	67.11	75.43
			Subtotal:	303.84
11.3.2	11.3.2	1.25	7.23	8.47
	11.3.2/11.4.9 (50/50)	17.53	0.0	17.53
			Subtotal:	26
11.3.25	11.3.25	0.0	2.82	2.82
			Subtotal:	2.82
			Total:	**332.67**



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Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:35,000 at A4
Project Number:	620.014601
Date Drawn:	11-Dec-2023
Drawn by:	NT

LEGEND

- Railway
- Road
- Minor Watercourse
- BWM Mining Lease
- BWM North Extension Project Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

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BLACKWATER MINE - NORTH EXTENSION PROJECT

GROUND TRUTHED REGIONAL ECOSYSTEMS MAP 1 OF 3

FIGURE 12-2a

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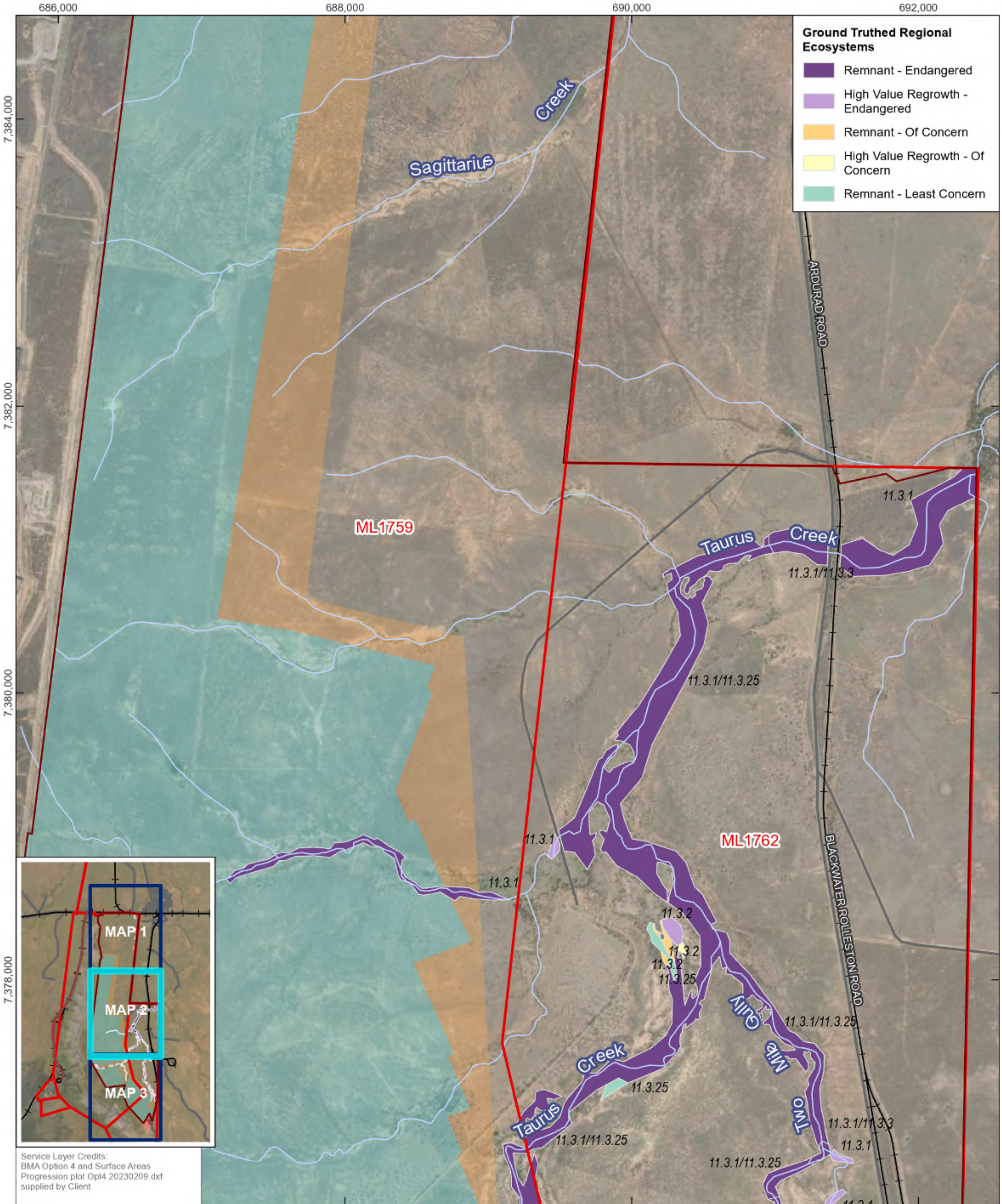

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0 0.5 1 km

Coordinate System:	GDA2020 MGA Zone 55
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LEGEND

- Railway
- Road
- Minor Watercourse
- BWM Mining Lease
- BWM North Extension Project Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

GROUND TRUTHED REGIONAL ECOSYSTEMS MAP 2 OF 3

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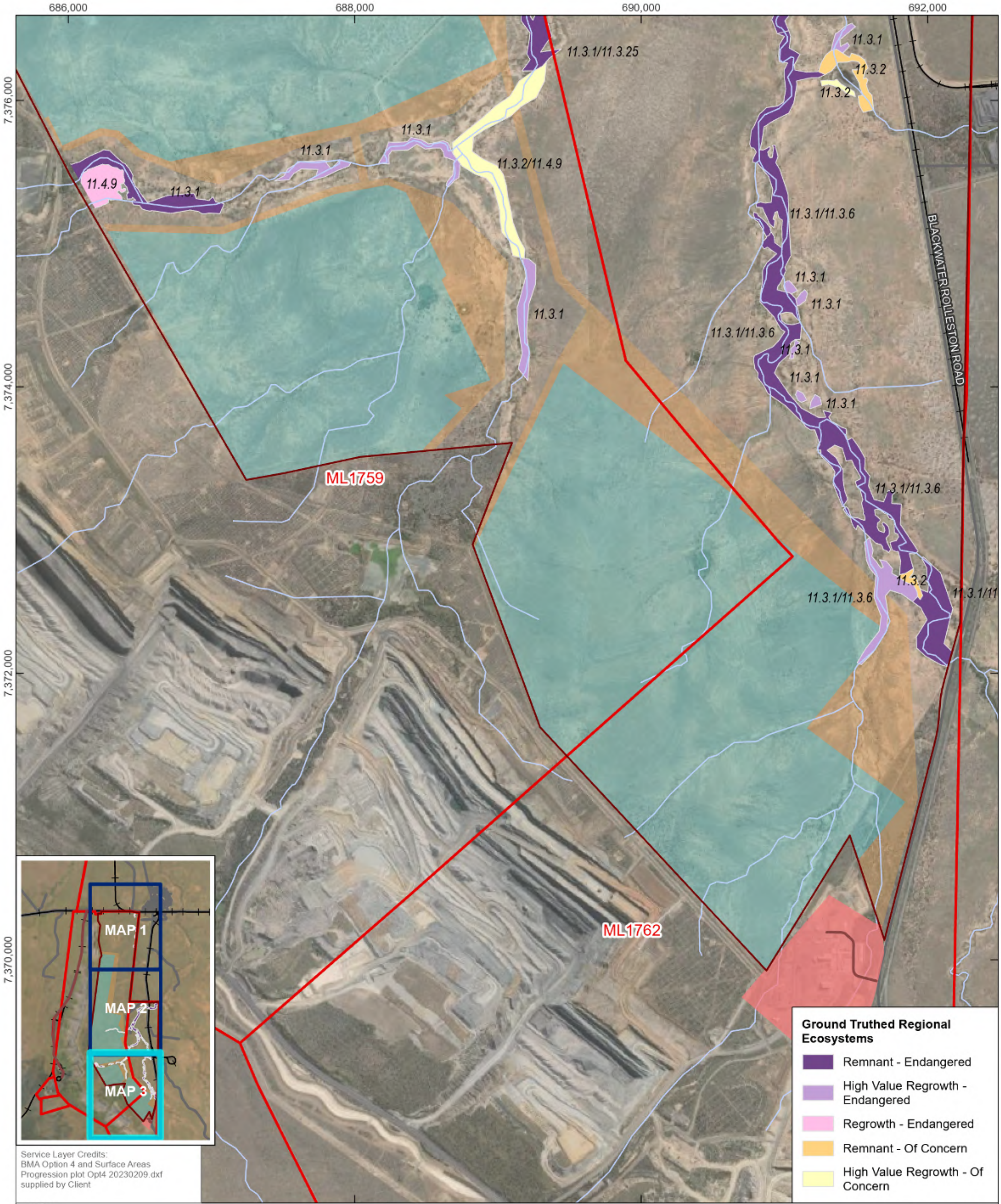
FIGURE 12-2b

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_TE_CH_F12_02b_GTRE 2 of 3



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Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:35,000 at A4
Project Number:	620.014601
Date Drawn:	11-Dec-2023
Drawn by:	NT

LEGEND

- Railway
- Road
- Mine Acces Road
- Minor Watercourse
- BWM Mining Lease
- Existing Mine Infrastructure Area
- BWM North Extension Project Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

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BLACKWATER MINE - NORTH EXTENSION PROJECT

GROUND TRUTHED REGIONAL ECOSYSTEMS MAP 3 OF 3

FIGURE 12-2c

Riparian vegetation comprises the entirety of the remnant vegetation within the Project area. Vegetation along watercourses such as Taurus Creek and Two Mile Gully consist of narrow linear patches that fringe the creeks. Vegetation types in riparian zones consisted primarily of Brigalow dominated communities such as RE 11.3.1 and 11.4.9, with some patches supporting large eucalypt species such as Coolibah (*Eucalyptus coolabah*), Queensland Blue Gum and Silver-leaved Ironbark (*E. melanophloia*). Other riparian vegetation includes RE11.3.2 dominated by *Eucalyptus populnea*. Vegetation is most extensive and with most complex structure around the downstream limit of Taurus Creek and Two Mile Gully.

12.4.1.2 Threatened Ecological Communities

Vegetation polygons confirmed as REs that were potentially associated with a TEC were assessed against applicable TEC diagnostic condition thresholds. The assessments indicated one vegetation patch of RE 11.3.1 *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains met thresholds for Brigalow TEC. This TEC patch was previously mapped as non-remnant vegetation in Queensland Government certified mapping prior to ground-truthing.

This area of Brigalow TEC (**Figure 12-3**) exists as riparian vegetation along Taurus Creek on ML1762 covering an area of 6.3 ha. Although the site meets TEC criteria, it exhibits elements of disturbance such as weed encroachment (within TEC thresholds of <50% exotic cover), predominantly from Buffel Grass and/or Rubber Vine.

Areas of ground-truthed RE 11.3.2 were recorded in the Project area, where Poplar Box (*Eucalyptus populnea*) was dominant in the canopy (**Figure 12-2a, Figure 12-2b** and **Figure 12-2c**). All areas failed to meet Poplar Box TEC thresholds through excessive weed cover. These areas often had a ground cover dominated by Buffel Grass or other non-native species.

The TEC assessment results are provided in **Appendix G**. No other TECs occur within the Project area.

12.4.1.3 Threatened and CEEVNT Flora Species

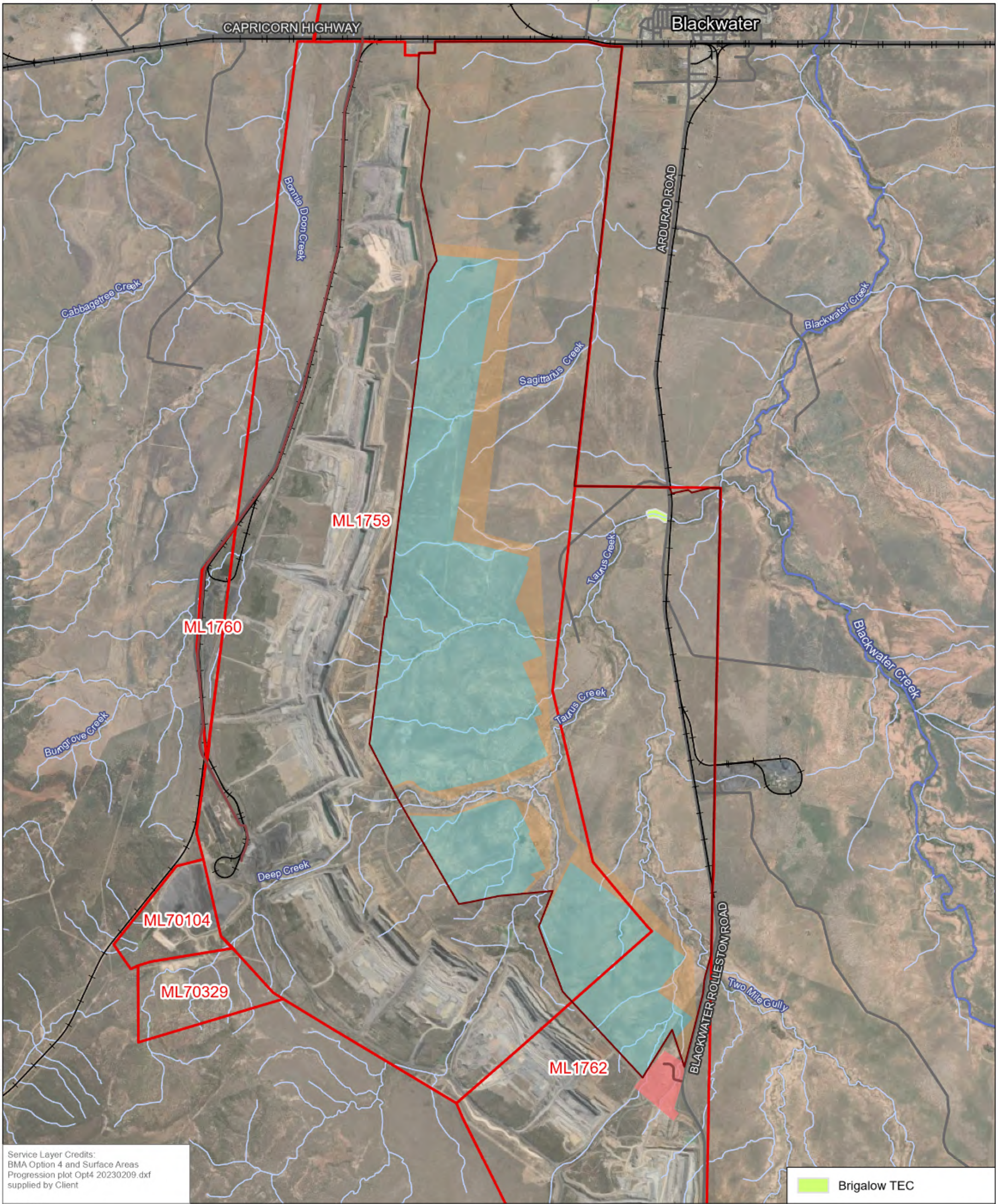
Threatened and CEEVNT flora species surveys were completed at a number of locations across the Project area over three seasons. One threatened flora species, *Solanum elachophyllum*, listed as Endangered under the NC Act was recorded. The species was most frequently recorded on clay or loamy soils in fragmented non-remnant vegetation in association with Brigalow, Hooker's Bauhinia (*Lysiphyllum hookeri*) or Red Lancewood (*Archidendropsis basaltica*), as well as areas fringing remnant patches of RE 11.3.1/11.3.6. Over 1,480 individuals at 31 separate sites were recorded within the Project area (**Figure 12-4**).

No threatened flora species listed under the EPBC Act were recorded and the likelihood of those species occurring with the Project area was considered low (**Appendices G and H**).

12.4.1.4 Pest flora species

Weed species were widespread across the Project area. Seven Category 3 species listed under the *Biosecurity Act 2014* were recorded including Mother of Millions, Rubber Vine, Harrisia Cactus, Parkinsonia Weed, Parthenium, Prickly Pear and Velvety Tree Pear.

Other non-listed introduced flora species were also recorded with the most numerous and widespread being the pastoral species of Buffel Grass which formed vast monoculture-like communities through cleared areas and invaded almost all remaining patches of native vegetation, degrading flora and fauna species' habitats.



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Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	11-Dec-2023
Drawn by:	NT

LEGEND

- Railway
- Road
- Mine Acces Road
- Minor Watercourse
- Major Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

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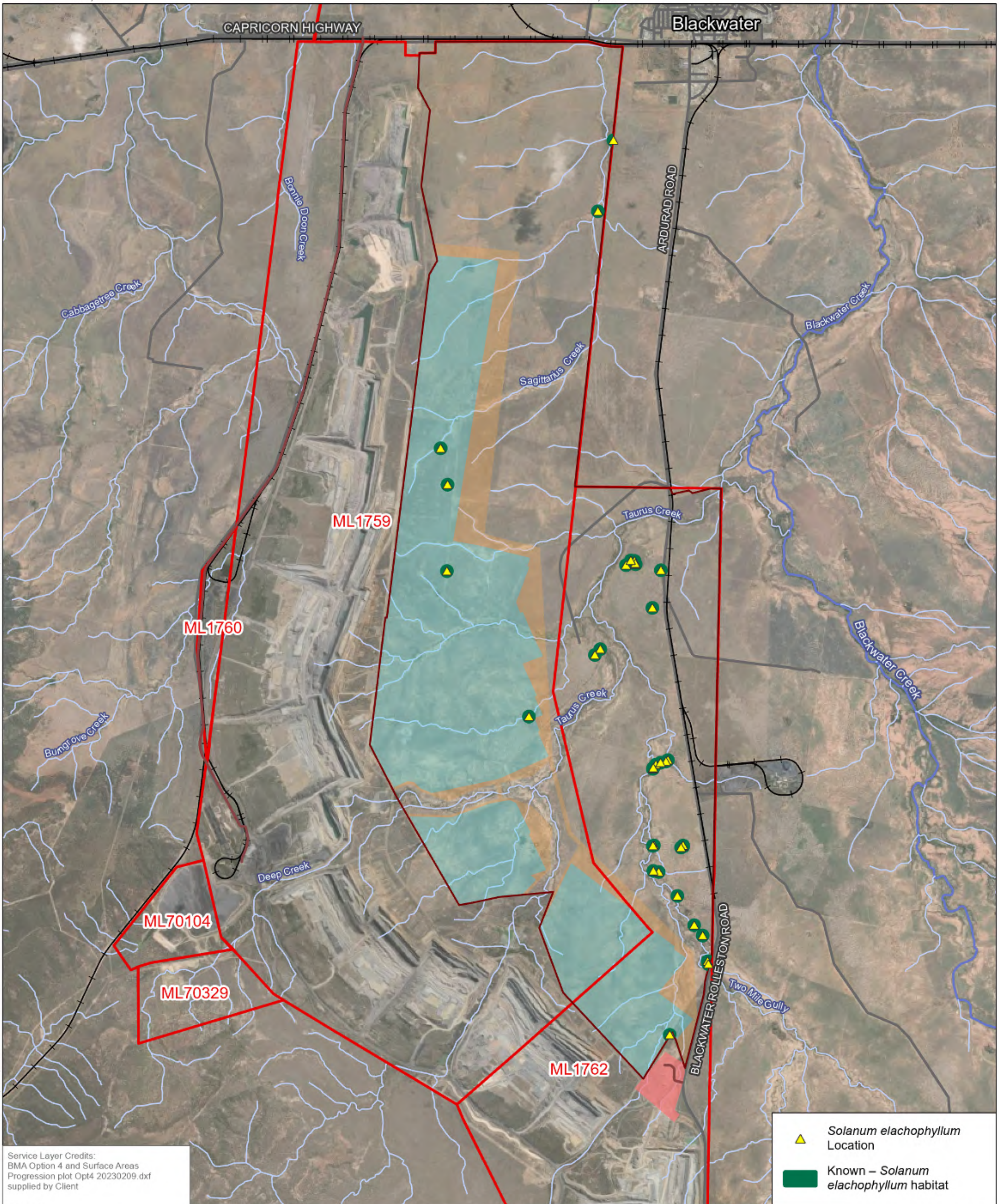
BLACKWATER MINE - NORTH EXTENSION PROJECT

BRIGALOW TEC

FIGURE 12-3

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_TE_CH_F12_03_TEC



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	13-Dec-2023
Drawn by:	NT

LEGEND

- Railway
- Road
- Mine Acces Road
- Minor Watercourse
- Minor Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

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BLACKWATER MINE - NORTH EXTENSION PROJECT

THREATENED FLORA – *Solanum elachophyllum*

FIGURE 12-4

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_TE_CH_F12_04_Theatened Flora

12.4.1.5 Potential Terrestrial Groundwater Dependent Ecosystems

Potential terrestrial GDEs identified within the Project area and surrounds by government mapping is shown on **Figure 11-8** and includes potential terrestrial GDE areas derived with low and moderate confidence.

RDM Hydro Pty Ltd (RDM Hydro) et al (2023) undertook a desktop assessment to identify the distribution of potential terrestrial groundwater-dependent ecosystems (TGDEs) at the BWM. A hydrogeological review was undertaken by the desktop assessment to gain an understanding of the groundwater regime with consideration of TGDEs. The focus of the review was on shallow groundwater within the rooting depth of the government mapped vegetation, specifically the water table depth, presence of perched aquifers and the salinity of the shallow groundwater (RDM Hydro et al, 2023). The study produced a continuous depth to water table map for the BWM area. The water table is a subdued reflection of topography. It is generally in excess of 25 m below ground except in the vicinity of drainage lines and topographic lows.

Groundwater quality data from the BWM monitoring data was also assessed by RDM Hydro et al. (2023) to identify whether salinity is likely to constrain the distribution of TGDEs in the landscape. The data indicated that the Rangal Coal Measures have the highest salinities, and the Tertiary Sediments generally the lowest. Electrical conductivities are typically less than 30,000 µS/cm and are therefore unlikely to significantly affect the distribution of TGDEs based on this threshold (RDM Hydro et. al., 2023).

RDM Hydro et al. (2023) presents conceptual ecohydrological models (TGDE types and functions) which are likely to be found in the BWM area and the wider Bowen Basin based on the findings of the desktop study and previous field assessments of other GDE studies in the Bowen Basin. The conceptual ecohydrological models include perched aquifers in alluvium (Types A and B) and systems exhibiting interactions with Tertiary and Permo-Triassic sediments (coal seams and alluvium) (Types C and D). A description of the types and function of the conceptual ecohydrological models summarised from RDM Hydro et al (2023) is included in the Groundwater Impact Assessment (Appendix F).

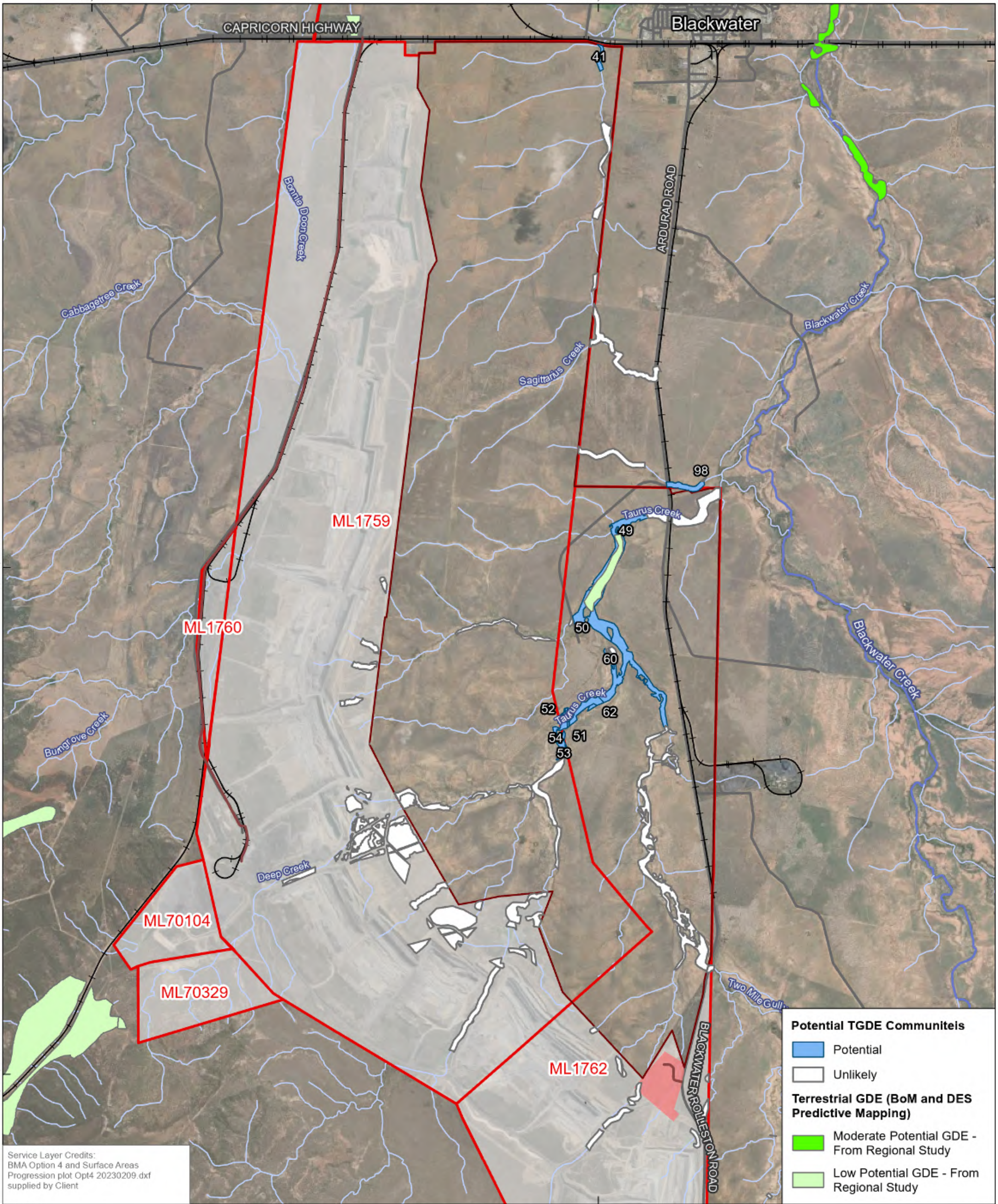
The potential of the ground-truthed vegetation within the Project area to be a TGDE was assessed based on the groundwater table mapping prepared by RDM Hydro et al (2023) and the vegetation likely reliance on access to groundwater through known rooting depth and vegetation characteristics of the ground-truthed REs. The ground-truthed REs were either categorised as:

- **Unlikely TGDE**, where the groundwater depth to water table range was below the known rooting depth, or
- **Potential TGDE**, where the groundwater depth to water table range was within known rooting depth.

The rooting depths applied are detailed in **Appendix G**.

Where the RDM Hydro depth to water table did not fully account for existing BWM activities, these were considered in the likelihood of the relevant RE having access to groundwater, and the probability that the vegetation would be a TGDE.

The potential TGDE are identified in **Figure 12-5.**



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	13-Dec-2023
Drawn by:	NT

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LEGEND

- Railway
- Road
- Mine Acces Road
- Minor Watercourse
- Major Watercourse
- Existing Blackwater Mine
- BWM Mining Lease
- BWM North Extension Project Area
- Existing Mine Infrastructure Area

BLACKWATER MINE - NORTH EXTENSION PROJECT

POTENTIAL TERRESTRIAL GDE COMMUNITIES IN AND ADJACENT TO THE PROJECT AREA (EMM, 2023)

FIGURE 12-5

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_TE_CH_F12_05_Potential GDE

12.4.2 Terrestrial Fauna

12.4.2.1 Fauna species and habitats

A total of 212 fauna species were recorded during the field surveys including 14 amphibians, 31 reptiles, 15 non-volant mammals, 15 bats and 137 birds. A full list of fauna species recorded is provided in **Appendices G and H**.

Most habitat observed across the Project area is considered of relative low quality due to broad-scale vegetation clearing, cattle grazing, weed encroachment and fragmentation. The areas of non-remnant vegetation are now largely dominated by introduced Buffel Grass, have been raked of woody debris and rocks, and continue to be grazed by livestock. Areas of good quality habitat are limited and usually constrained to small vegetation fragments or as narrow corridors fringing creek and drainage lines.

Broad habitat groups have been identified within the Project area and their features and ecological values are described in **Table 12-4**.

Table 12-4: Broad Habitat Groups within the Project area – Features and Ecological Values

Broad Habitat Group	Features and Ecological Values
Riparian vegetation	• Riparian vegetation comprises the entirety of the remnant vegetation within the Project area. • Vegetation along watercourses such as Taurus Creek and Two Mile Gully consist of narrow linear patches that fringe the creeks. • Vegetation types in riparian zones consisted primarily of Brigalow dominated communities such as RE 11.3.1 and 11.4.9, with some patches supporting large eucalypt species such as Coolibah, Queensland Blue Gum and Silver-leaved Ironbark. • Other riparian vegetation includes RE 11.3.2 dominated by Poplar Box. • Eucalypt woodlands provide seasonal food resources and nest/roost sites. • Remnant woodland vegetation showed the most value as it occasionally exhibited large hollow bearing trees, representing potential fauna breeding places. However, the abundance of tree hollows was noted to be low throughout. • There is limited potential for Koala to occur in these habitats as riparian vegetation is generally sparse and of low quality. • Shrubs were relatively sparse, but a grassy ground layer occurs providing cover for ground fauna. • Many areas of this habitat were fragmented and degraded from clearing activity to the top of bank and within the channel in some areas. In some sections, the creek line vegetation was extremely reduced and patchy, with limited value for fauna. • Grazing practices and weed encroachment further reduced the quality of these riparian corridors. There is evidence of weed invasion in these areas (including occurrences of Prickly Pear and Rubber Vine.
Acacia regrowth communities	• Acacia regrowth communities were widespread across the Project area (primarily Brigalow dominated communities where this community had been previously cleared for grazing). • Most of these areas were characterised as small fragmented areas of regrowth surrounded by grazing land or restricted to creek lines and drainage lines. • Habitat value was generally low in these areas as they frequently showed limited groundcover and shrub-layers with exotic understoreys, and a lack of hollow bearing

Broad Habitat Group	Features and Ecological Values
	trees. However, leaf litter and fallen woody debris was recorded at some sites, providing microhabitat features for small reptiles and terrestrial mammals. • Sites possessing abundant coarse woody debris and leaf litter, cracking clays or gilgai are considered potential habitat for the Ornamental Snake.
Areas of gilgai	• Areas of gilgai are widespread across the Project area, particularly on clay soils but vary significantly in state of degradation. • Most areas exhibit shallow, open gilgai with little remaining vegetation. • Some patches remain in relatively good health exhibiting vegetated areas of Umbrella Canegrass and Nutgrass, generating cover for frog, bird and reptile species. • Areas of gilgai in the Project area are considered potential habitat for the Ornamental Snake with deeper, more heavily vegetated and deeper cracking areas most preferred. Gilgai areas also provide suitable habitat for the Australian Painted Snipe and Latham's Snipe (*Gallinago hardwickii*) during suitably wet conditions.
Other wetland habitats	• Other wetland habitats across the Project area consisted of constructed farm dams. • There were several dams in the north of the site, which provided shallow margins, areas of fringing grasses and reeds and were fenced to cattle. These dams held waterbirds such as Cotton Pygmy Goose, Comb-crested Jacana and various duck species. These dams likely provide year-round access to wetland habitats for several bird species, including Australian Painted Snipe and Latham's Snipe. • The quality of farm dams varied across the Project area. Some dams were unfenced and open to livestock, and the margins were bare due to overgrazing and trampling, with extensive soil erosion and reduced water quality. Some farm dams were fenced, but had steep sides and were generally of low value for waterbirds with limited shallow margins or fringing aquatic vegetation.
Non-remnant vegetation	• Previously cleared areas dominate much of the Project area with a large proportion recently or currently utilised for cattle grazing activities. • Vast areas are completely dominated by Buffel Grass with some expanses supporting no other species of grasses. • Small areas continue to support native grass species such as Queensland Bluegrass and Mitchell Grass but these were recorded in very low densities. • With limited structural and floristic diversity, non-remnant grassland habitats supported limited fauna diversity in comparison to remnant habitats, but provide habitat for certain grassland-dependent species such as Eastern Grey Kangaroo. • Much of these areas of non-remnant vegetation are considered of low ecological value but some species may occasionally use these areas. • Open country bird species such as Australasian Pipit, Horsfield's Bushlark and Red-chested Buttonquail being the most frequently observed. Other species observed in these habitats included Stripe-faced Dunnart, Desert Mouse and introduced House Mouse.

12.4.3 Threatened and CEEVNT Fauna

Four threatened and CEEVNT fauna species were recorded during field surveys:

- Australian Painted Snipe.
- Ornamental Snake.
- Squatter Pigeon (Geophaps scripta scripta).
- Koala.

All species are listed under both the EPBC Act and NC Act.

Known and potential habitat for the Australian Painted Snipe, Ornamental Snake, Squatter Pigeon and Koala have been mapped across the Project area. The habitat mapping for these species is shown on, **Figure 12-6, Figure 12-7, Figure 12-8 and Figure 12-9,** respectively**.** The habitat mapping for each species is consistent with Kerswell et al. (2020) "*Central Queensland Threatened Species Habitat Descriptions*" and details of the basis of the mapping is provided in **Appendices G and H**.

The Australian Painted Snipe was recorded via direct observations in an area of gilgai on ML1762 to the east of Taurus Creek and on two dams in the west of the Project area **(Figure 12-6**)**.** Records of the nomadic species, Australian Painted Snipe, suggest it may occur on any natural or artificial wetland habitat within the Project area when conditions are suitable. Habitat mapping for the Australian Painted Snipe is shown on **Figure 12-6**.

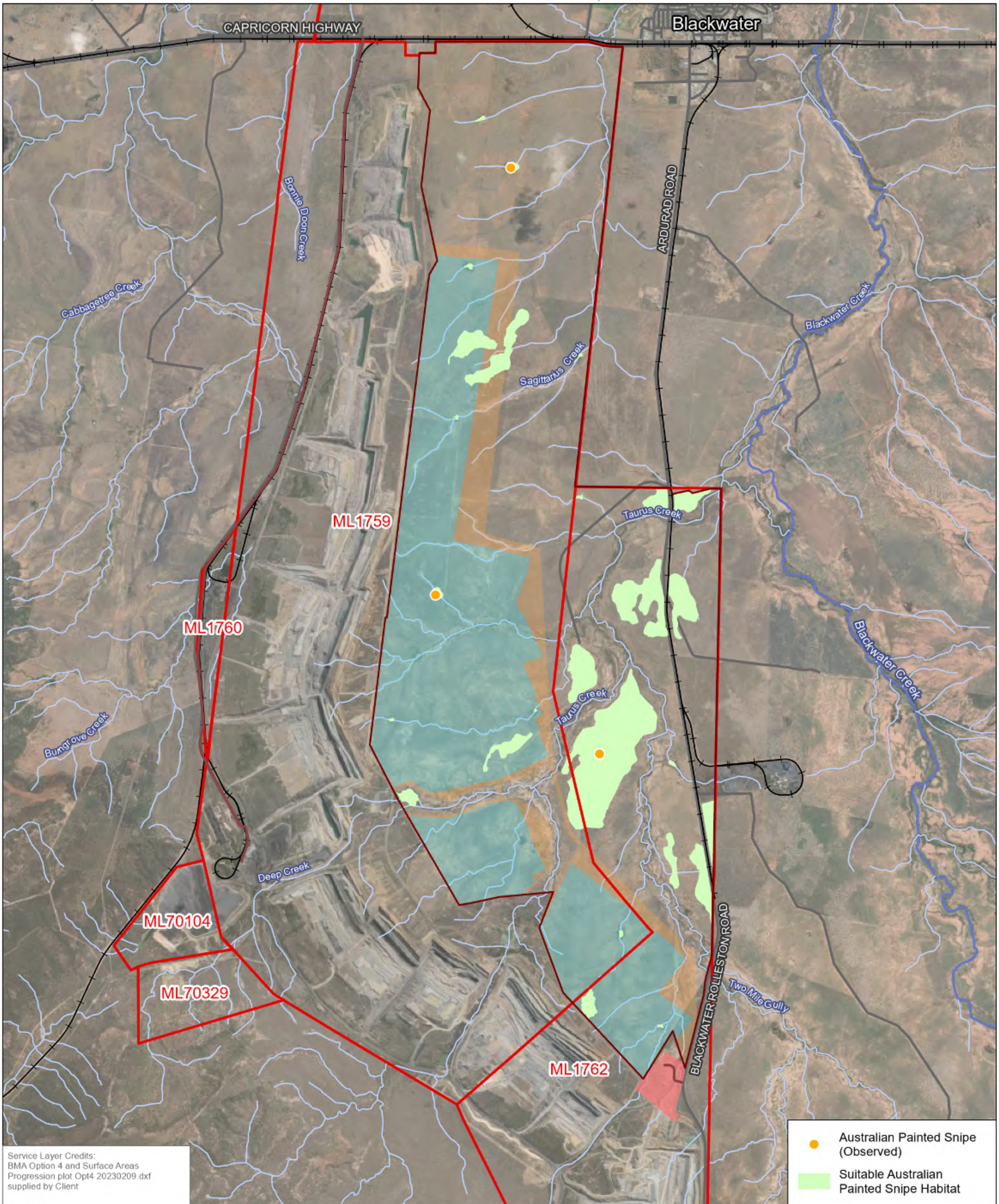
The Ornamental Snake was recorded in an area of gilgai on ML1762 to the east of Taurus Creek. Ornamental Snakes were found in close proximity to each other in an area of gilgai between Taurus Creek and the Blackwater-Rolleston Road on ML1762 **(Figure 12-7)**. It is likely that Ornamental Snake is scarce in the Project area, as only three were found during three nights of searching during March 2020, despite good conditions. Some of the gilgai areas in the Project area are heavily degraded or isolated and are not considered likely to hold this species. Habitat mapping for the Ornamental Snake is shown on **Figure 12-7**.

The Squatter Pigeon was recorded on two occasions in the general vicinity of dams around Taurus Road in supplementary ecology surveys commissioned in June-August 2023 - despite not being recorded in over 600 hours in the earlier baseline surveys (**Figure 12-8)**. The individuals were recorded in the vicinity of two dams around Taurus Road and are likely to be scarce in the Project area, reflective of the degraded nature of the habitat and extensive Buffel Grass areas. Habitat mapping for the Squatter Pigeon is shown on **Figure 12-8**.

Signs of Koala were recorded via indirect observation of old scratches on Queensland Blue Gums along Taurus Creek as well as old scratches and scat on an unnamed creek **(Figure 12-9)**. The scratches on Taurus Creek were present in a small backwater of the main creek line, which was fringed by Queensland Blue Gum which is a preferred foraging resource. Despite extensive transects along creek lines across the remainder of the Project area, no other signs of Koalas were observed. Habitat mapping for the Koala is shown on **Figure 12-9**.

While the White-throated Needletail (*Hirundopus caudacutus*) has not been recorded in the Project area, it has been recorded in surveys further to the south and is considered likely to occur in the Project area.

The White-throated Needletail is predominantly aerial, and although it occurs over most types of habitat, the species is recorded most often above wooded areas. However, the White-throated Needletail forages over a wide range of habitats including cleared areas. Habitat mapping is not provided for the White-throated Needletail as this species may occur in any of the airspace over the site, and its potential presence above the site is assumed across the Project area (**Appendix G** and **Appendix H**).



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Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	11-Dec-2023
Drawn by:	NT

BMA
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LEGEND

- Railway
- Road
- Mine Acces Road
- Major Watercourse
- Minor Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Existing Mine Infrastructure Area

Indicative Project Footprint

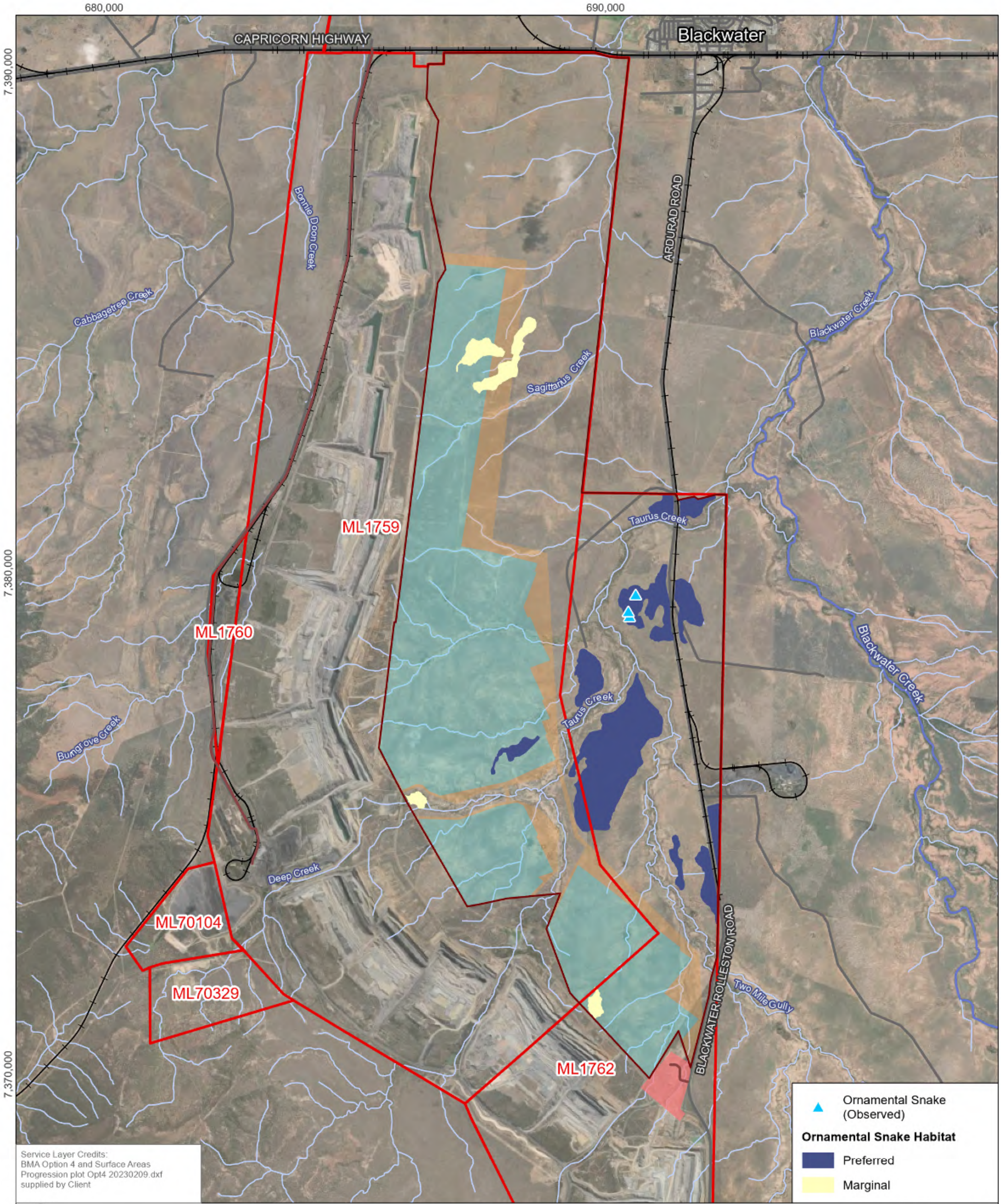
- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

HABITAT MAPPING - AUSTRALIAN PAINTED SNIPE

FIGURE 12-6

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_TE_CH_F12_06_Habitat Australian Painted Snipe



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Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	11-Dec-2023
Drawn by:	NT

BMA
BHP Mitsubishi Alliance

LEGEND

- Railway
- Road
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- Major Watercourse
- Minor Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
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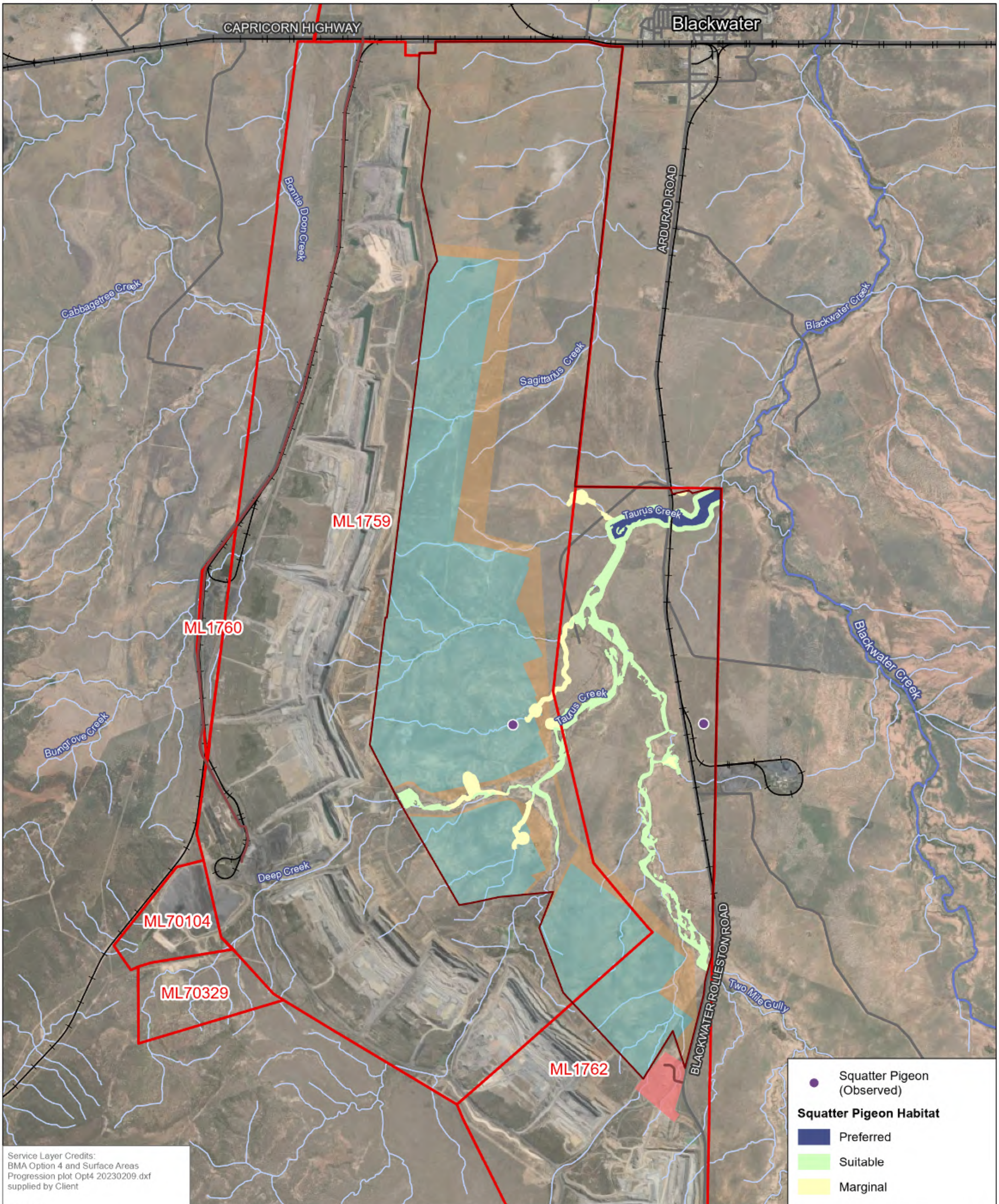
Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

HABITAT MAPPING - ORNAMENTAL SNAKE

FIGURE 12-7



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Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	11-Dec-2023
Drawn by:	NT

LEGEND

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Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

HABITAT MAPPING - SQUATTER PIGEON

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FIGURE 12-8

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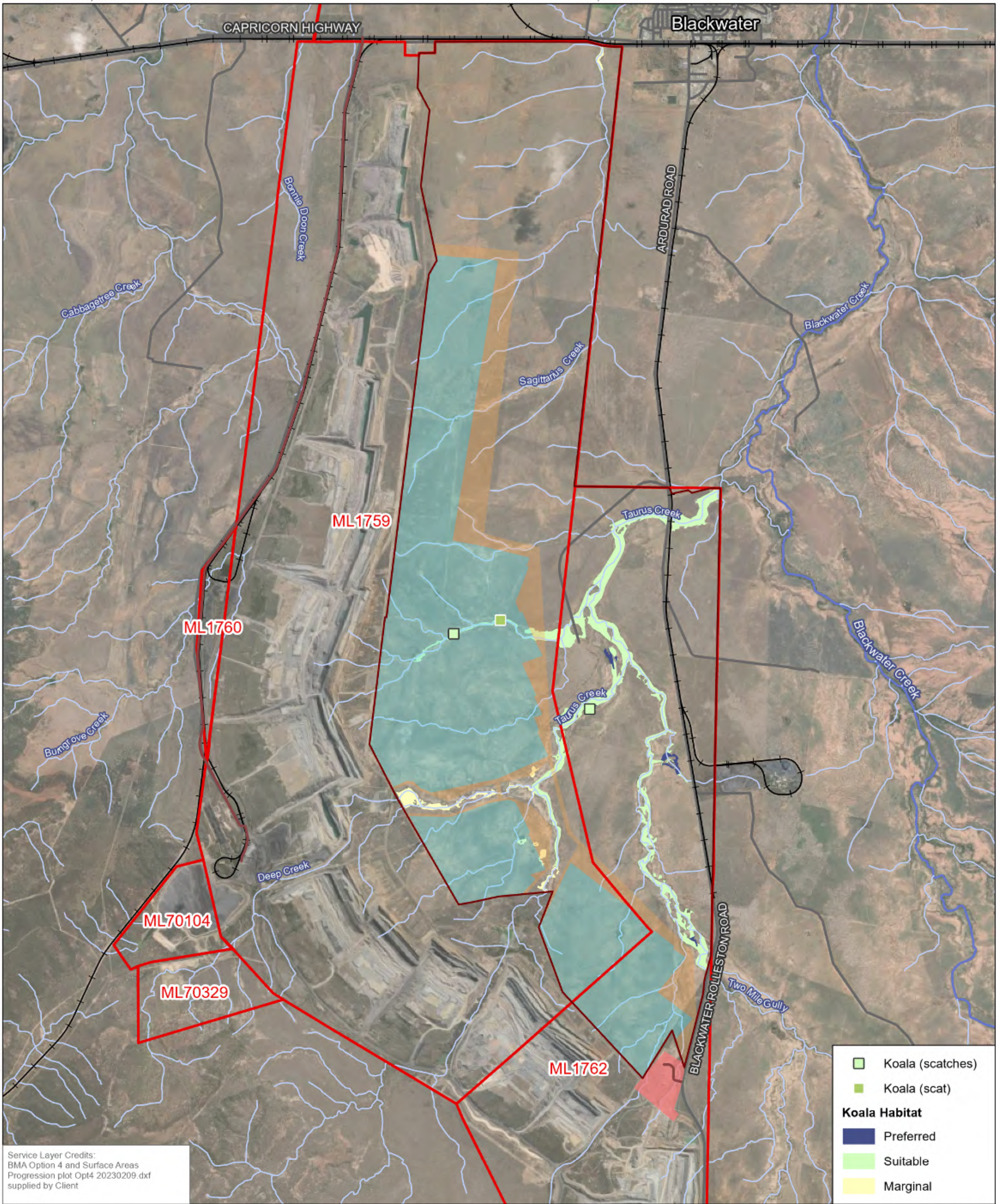

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Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	11-Dec-2023
Drawn by:	NT

BHP Mitsubishi Alliance

LEGEND

- Railway
- Road
- Mine Acces Road
- Minor Watercourse
- Minor Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
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Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

HABITAT MAPPING - KOALA

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FIGURE 12-9

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_TE_CH_F12_09_Habitat Koala

12.4.3.1 Special Least Concern Species

This Short-beaked Echidna is a widespread monotreme that is listed as special least concern under the NC Act. Habitat preferences are broad with anywhere offering groundcover and an ample supply of ants or termites considered potential habitat (**Appendix H**).

The Short-beaked Echidna was not recorded by the extensive field surveys of the Project area. No habitat mapping has been undertaken as the species could occur throughout the Project area, although the likelihood is reduced in dense Buffel Grass areas due to the lack of microhabitat. The Short-beaked Echidna is most likely to occur in remnant vegetation in the Project area (**Appendix H**) shown on **Figure 12-2a, Figure 12-2b** and **Figure 12-2c**.

12.4.3.2 EPBC Act Listed Migratory Species

Three migratory (EPBC Act listed) species were recorded during the Project surveys, namely, Latham's Snipe Fork-tailed Swift (*Apus pacificus)* and Glossy Ibis (*Plegadis falcinellus)* **(Figure 12-10)**.

Latham's Snipe occurs widely across eastern Australia, although does not breed in the country. Important habitat for the species is defined (DoE 2017) as being areas that have been identified as internationally important for the species, or areas that support at least 18 individuals of the species. Surveys by EMM encountered occasional individuals in gilgai areas (three observations over the surveys). This species was recorded once during the autumn 2019 surveys in an area of gilgai on ML1762. During the March 2020 supplementary surveys, the Latham's Snipe was recorded twice more in gilgai on ML1762 to the east of Taurus Road. The Project area is unlikely to constitute important habitat for the species (**Appendix G**).

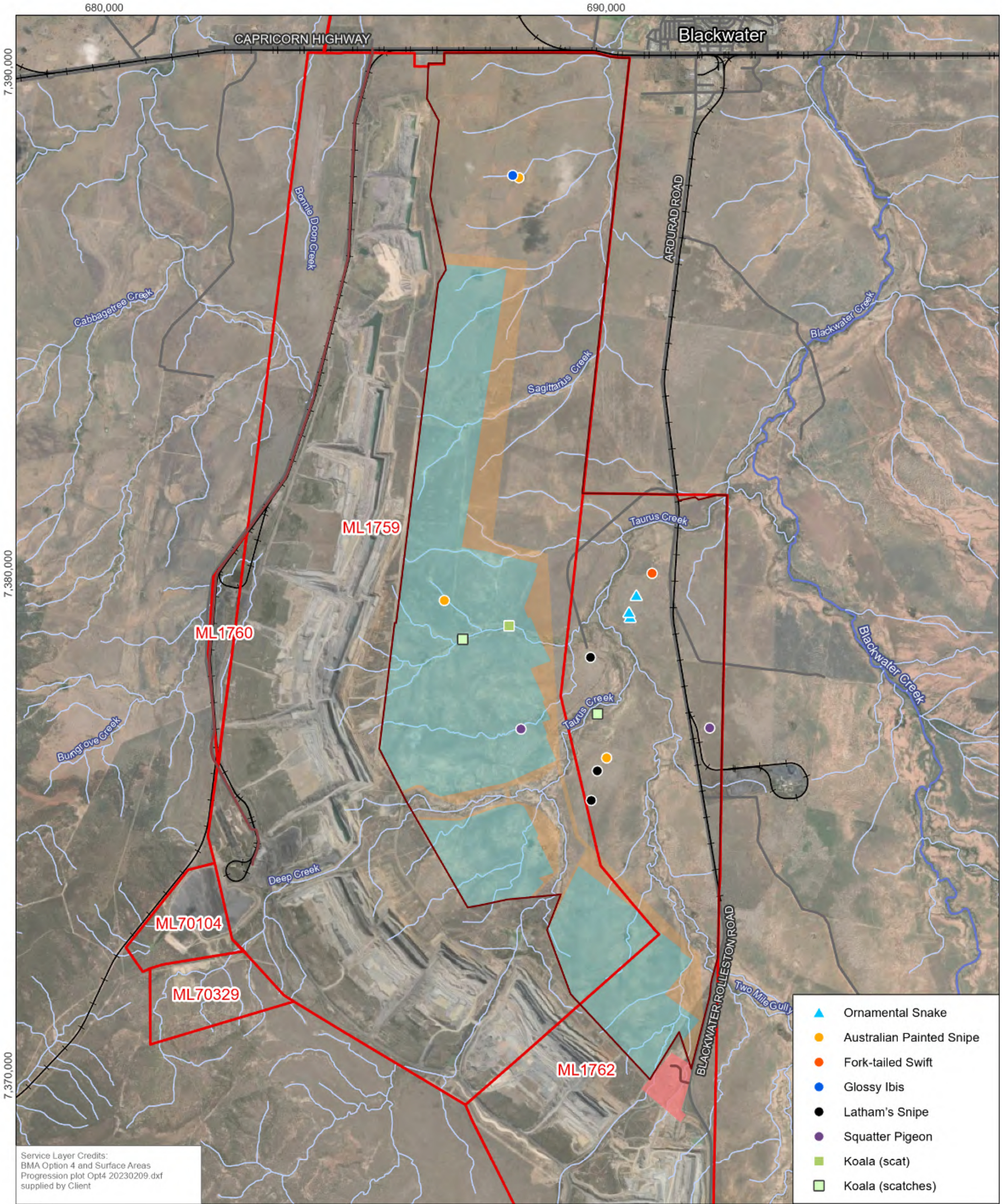
The Fork-tailed Swift is a non-breeding visitor to all states and territories of Australia. In Australia, the Fork-tailed Swift is almost exclusively aerial, occurring from heights of less than 1 m up to more than 1,000 m above the ground. The Fork-tailed Swift was observed incidentally over ML1762 during April 2019 surveys. A direct count of six was recorded in a feeding flock. The Project area is unlikely to constitute important habitat for the species (**Appendix G**).

The Glossy Ibis occurs widely across Australia. The Glossy Ibis was recorded once during autumn surveys on a farm dam in the north of the Project area. Individuals of the species are expected to only to be sporadic visitors to the Project area.

12.4.3.3 Pest fauna species

Seven introduced terrestrial vertebrate fauna species were recorded within the Project area, including the Cane Toad (*Rhinella marina*), Common Myna (Acridotheres tristis), Rabbit (*Oryctolagus cuniculus*), Brown Hare (*Lepus capensis*), Wild Dog (*Canis lupus familiaris*), House Mouse (*Mus musculus*) and Feral Pig (*Sus scrofa*).

Three of these species (Rabbit, Wild Dog and Feral Pig) are listed as 'restricted matters' under the *Biosecurity Act, 2014*.



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Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
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Drawn by:	NT

LEGEND

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Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

THREATENED AND MIGRATORY FAUNA OBSERVATIONS

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FIGURE 12-10

12.4.4 Matters of National Environmental Significance

An assessment of the occurrence of MNES in relation to the Project is provided in **Table 12-5** and detailed in **Appendix G**.

Table 12-5: Summary of MNES Occurrence in relation to the Project

MNES	Summary
World Heritage Properties	• There are no World Heritage properties in the vicinity of the Project area. • The nearest World Heritage property is the Great Barrier Reef, located approximately 200 km east of the Project area. • The Project is located within the catchment of Blackwater Creek, which is a tributary of the Mackenzie River. The Mackenzie River catchment drains to the Fitzroy River, which ultimately terminates at the Coral Sea/Great Barrier Reef, south-east of Rockhampton, near Port Alma.
National Heritage Places	• There are no National Heritage properties in the vicinity of the Project area. • The nearest National Heritage place is the Great Barrier Reef, which is described for World Heritage properties above.
Wetlands of International Importance	• No Wetlands of International Importance occur within the Project area or surrounds. • The nearest Ramsar Wetland is the Shoalwater and Corio Bays Area, located approximately 200 km north-east of the Project area. • The Project is located within the Mackenzie River catchment, which drains to the Fitzroy River, which ultimately terminates at the Coral Sea, south-east of Rockhampton, near Port Alma. The mouth of the Fitzroy River is more than 50 km south of the Shoalwater and Corio Bays Area Ramsar wetland.
Threated Species and Ecological Communities	• Threatened species with known or likely habitat in the Project area include the Australian Painted Snipe, Ornamental Snake, Squatter Pigeon, Koala and White-throated Needletail. • One patch of Brigalow TEC occurs within the Project area as riparian vegetation along Taurus Creek on ML1762.
Migratory Species	• Three migratory species were recorded during field surveys within the Project area - Latham's Snipe, Fork-tailed Swift and Glossy Ibis.
Nuclear action	• The Project does not represent a nuclear action.
Commonwealth Marine Area	• No areas of Commonwealth Marine Area occur within the Project area or surrounds. The nearest Commonwealth marine area is situated over 250 km east of the Project area.
Great Barrier Reef	• The Project area is located approximately 200 km west of the Great Barrier Reef, as described for World Heritage properties and National Heritage places above.
Water resource in relation to large coal mining development or coal seam gas	• The Project represents a large coal mining development.
Commonwealth land	• No areas of Commonwealth Land occur within the Project area or surrounds.

12.4.5 Matters of State Environmental Significance

Assessment of the occurrence of MSES within the Project area, as well as the Project disturbance footprint is provided in **Table 12-6** and detailed in **Appendix H**.

Table 12-6: Summary of MSES within the Project area

MSES	Description of MSES	Present /Absent in Project area	Area within Project footprint (ha)
Regulated vegetation - Endangered RE	Endangered remnant RE (VM Act status) present within the Project area. One Endangered remnant RE (VM Act status) was ground-truthed within the Project footprint - RE11.3.1 - *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains.	Present	10.53
Regulated vegetation - Of Concern RE	Of Concern remnant RE (VM Act status) present within the Project area. No Of Concern remnant REs occur within the Project footprint.	Present	0.00
Regulated vegetation that lies within a mapped wetland	RE that lies within a mapped wetland.	Absent	-
Essential habitat	Essential habitat for Ornamental Snake is mapped by DES in the Project area. The essential habitat has been considered as part of the broader habitat mapping completed for the species.	Present	0.05
RE within a defined distance of a watercourse	RE within set buffer distances of a stream order. Watercourse vegetation was mapped based on stream order mapping, ground truthed remnant vegetation and applying relevant buffer widths based on stream order classification. Up to 8.51 ha of remnant watercourse vegetation will be disturbed by the Project (associated with the Endangered RE vegetation mapped along the tributary of Taurus Creek.	Present	8.51
Connectivity	The Landscape Fragmentation and Connectivity (LFC) tool to be used as a decision support tool to assist to identify and quantify any significant impact on connectivity for an individual impact area.	Remnant vegetation is present	Remnant vegetation is present
Wetlands and watercourses	Wetlands in a wetland protection area or wetlands of high ecological significance shown on the map of referable wetlands under the Environmental Protection Regulation 2008 (note this has been replaced with the map of Queensland wetland environmental values under the Environmental Protection Regulation 2019). Wetlands and watercourses in high ecological value waters identified in the Environmental Protection (Water) Policy 2009, schedule 1.	Absent	-

MSES	Description of MSES	Present /Absent in Project area	Area within Project footprint (ha)
Protected Wildlife Habitat	Endangered, Vulnerable and Special Least Concern (SLC) species listed under the NC Act. *SLC are defined under the Env Offset Regulation as the echidna and platypus.*	Australian Painted Snipe	94.31
		Ornamental Snake	85.69
		Koala	26.9
		White-throated Needletail	No habitat calculated as could occur above whole Project disturbance footprint
		Squatter Pigeon	36.2
		Short-beaked Echidna	Potential habitat is present within Project footprint
		Solanum elachophyllum	14.57
Koala habitat in South East Queensland	Mapped Koala habitat in the South East Queensland planning area – as identified in the South East Queensland Regional Plan.	Absent	-
Designated precinct in a strategic environmental area	There are no Strategic Environmental Areas (SEA) within the desktop search area. SEAs include Cape York Peninsula, the Gulf Country, the Channel Country, Fraser Island and Hinchinbrook Island	Absent	-
Protected Areas	Protected areas (including all classes of protected area except coordinated conservation areas) under the NC Act.	Absent	-

MSES	Description of MSES	Present /Absent in Project area	Area within Project footprint (ha)
Fish Habitat Areas and Highly Protected Zones of State Marine Parks	Areas within declared fish habitat areas that are management A areas or management B areas under the *Fisheries Regulation 2008*. Marine parks declared under the *Marine Parks Act 2004* over Queensland state waters.	Absent	-
Waterway providing for fish passage	Waterway that provides for passage of fish (excluding waterways within an urban area).	Present	Present
Marine Plants	Marine plants under the *Fisheries Act 1994* (excluding marine plants in an urban area).	Absent	-
Legally secured offset area	Legally secured offset areas as defined under the *Environmental Offsets Act 2014*.	Absent	-

12.5 Potential Impacts

12.5.1 Vegetation Clearing and Habitat Disturbance

The Project area supports small tracts of remnant vegetation and regrowth dominated by Acacia. Eucalypt woodlands are typically limited to creek lines and the majority of the Project area is non-remnant habitat.

Project disturbance will reduce breeding, foraging and sheltering habitat for fauna and flora species, and the process of clearing has potential to result in injury or mortality of native fauna species. Some species which are more sedentary are more prone to impact than others, such as Ornamental Snake. Conversely, migratory birds are unlikely to be impacted from vegetation clearing as they are more mobile and can disperse more easily.

Ecological surveys of the Project area commenced at an early stage during Project design, and as such the results of the surveys have been able to inform the Project layout. This has resulted in areas of higher ecological significance being avoided to the greatest practical extent, such as avoidance of riparian corridors along Taurus Creek (recognising the limitations around the coal resource requirements). The location of the mine and pits is informed by geological surveys and testing, and limited by the extent of the resource, however where possible riparian areas have been avoided.

The Project layout has been designed to minimise vegetation clearing and impacts on flora and fauna habitats. This has included:

- Making use of existing BWM infrastructure on site to avoid additional disturbance.
- Avoiding the patch of Brigalow TEC and minimising clearing of riparian vegetation.
- Avoiding vegetation clearance along the higher order watercourses of Two Mile Gully and Taurus Creek.
- Minimising creek crossings (number and width) and selecting locations to minimise disturbance.

The Project would require the clearance of approximately 14.32 ha of vegetation over the life of the Project, including 10.53 ha of remnant vegetation and 3.79 ha of high value regrowth vegetation.

Remnant and regrowth vegetation communities within the Project footprint are shown in **Figure 12-2a**, **Figure 12-2b** and **Figure 12-2c** and listed in **Table 12-7**.

Mitigation and management measures are described in **Section 12.6**.

Table 12-7: Impacted Ground truthed Regional Ecosystems

RE code	RE occurrence and community percentage	Area (ha)		
		HVR	Remnant	Total
11.3.1	11.3.1	0.0	10.53	10.53
	11.3.1/11.3.6 (90/10)	3.16	0.0	3.16
			Subtotal:	**13.69**
11.3.2	11.3.2/11.4.9 (50/50)	0.63	0.0	0.63
			Subtotal:	**0.63**
			Total:	**14.32**

12.5.2 Fragmentation

Terrestrial habitat connectivity may be reduced as a result of the Project as clearing has the potential to reduce fauna movement between areas of retained habitats. Such habitat fragmentation will be more prominent where clearing widths are larger, such as over 100 m. Clearing linear widths through habitats also has the potential to increase edge effects (additional light entering forest, weed encroachment, feral animal abundance may increase and increased risk of bushfire) which can have a negative impact on ecological functions.

As described in **Section 12.6**, weed management, pest animal management and bushfire management measures will be implemented to minimise potential impacts from the Project on native species and their habitats.

Large areas of habitat will remain, including riparian corridors and areas of gilgai habitat. This will ensure the threatened and CEEVNT species that are known or likely to utilise the Project area still have large areas they can utilise and move through, including to habitats outside the Project area.

12.5.3 Erosion and Sedimentation

Without adequate controls in place, Project activities have the potential to result in erosion and sedimentation and leaks or spills.

Erosion and sedimentation and the accidental release of pollutants (including leaks and other uncontrolled releases) into the surrounding environment and waterways has the potential to degrade aquatic habitat quality in the Project area and impact vegetation communities and terrestrial fauna utilising these areas.

The Surface Water Resources Assessment (**Appendix E**) concludes that the existing BWM surface water management measures are suitable to manage potential erosion and sedimentation and mitigate potential water quality impacts. Management and mitigation measures are currently conditioned in the existing BWM EA or managed through elements such as the Water Management Plan, REMP/FRREMP, Erosion and Sediment Control Plan and Regulated Structures Design and Inspection Conditions.

The measures that will be implemented to mitigate and manage potential impacts from erosion and sedimentation and leaks and spills, which have the potential to impact on flora and fauna habitats are detailed in **Section 12.6**. It is anticipated that based on implementation of management measures that potential impacts on surrounding habitats will be minimised.

The Project will not require amendments to the conditions of the existing EA and existing release points will be maintained.

12.5.4 Bushfire

Fire is a natural part of the Australian landscape, and most vegetation communities are adapted to periodic fires. However, changes in the natural fire regime may result in changes in the species composition and / or structure of the vegetation. Potential for increased fire risk as a result of edge effects is discussed in **Section 12.5.3**. In addition, the increased presence of construction vehicles and personnel in the Project area may increase fire risk through use of machinery that may generate sparks, use of flammable liquids and idling vehicles being present in areas of ground vegetation.

Given the management controls that will be put in place, it is unlikely the Project would increase the bushfire potential within the surrounding landscape (**Appendices G and H**).

12.5.5 Noise, Dust and Lighting

Noise, dust and lighting emissions are associated with the existing BWM, and the landscape around the mine including the proposed Project footprint is heavily cleared - therefore these impacts are already in effect across the Project area. The extension of mining at BWM into SA10 (ML1759) and SA7 (ML1762) will result in ongoing and localised noise and vibration, dust and lighting disturbance in habitats directly adjacent to the Project.

Noise may adversely affect fauna by interfering with communication (eg territorial bird song), masking the sound of predators and prey, causing avoidance reactions and displacement from habitat. Noise will be generated by the Project through the use of machinery, plant, vehicles, and equipment. The generation of noise may be in areas which have the potential to support threatened and CEEVNT fauna species. Individuals that occur on or near the Project may leave the affected area. The extent of impacts will depend on the level of noise, the type of habitat and distance involved. Some species may be more susceptible to this disturbance. However, many species are likely to become habituated to background noise from routine mining operations, aside from the low level of impulsive noise occurring.

Artificial lighting from infrastructure and machinery may impact fauna within the Project area. Artificial lighting can have a range of impacts which vary between species. Artificial light can disrupt patterns of both nocturnal and diurnal species by eliciting responses. Some species may avoid brightly lit areas, potentially due to the perception of being increased risk of predation. Other potential adverse impacts include disruption of breeding and migratory patterns, disorientation and potential collision with structures. Conversely, some species such as nocturnal reptiles, frogs and bats may congregate at artificial light sources to feed on insects attracted to light.

Dust emissions from the Project have the potential to temporarily and locally impact flora and fauna values in the vicinity of the Project. Excess generation of dust and subsequent deposition on leaves can impair plant photosynthesis and productivity (also resulting in reduced habitat quality for fauna), impact on respiratory systems of fauna, alter soil properties impacting on plant species assemblages. It is likely that such impacts will be restricted to the immediate vicinity of the Project, and the landscape and vegetation communities of the Project area is already adapted to a degree, to impacts from dust from the existing mine.

12.5.6 Weeds and Pests

Project activities have the potential to increase the abundance of weed species in the Project area and facilitate dispersal of weed species. Uncontrolled movement of vehicles, equipment and personnel throughout the Project area is the key vector of transmission, in particular vehicles and equipment sourced from regions beyond the Project area which may introduce new species. Many weed species thrive on ground disturbance and will rapidly colonise disturbed areas in advance of native species recolonisation. Increased weed species abundance has the potential to adversely impacts on native vegetation and biodiversity.

If not managed, Project related activities also have the potential to increase pest fauna abundance. This can lead to increased competition with, and predation of native fauna. In addition, habitat degradation may occur through vegetation trampling (e.g. Feral Pig wallowing). Creation of new access points into areas of intact vegetation may create pathways for feral fauna species to disperse. In addition, the creation of artificial water sources may increase the capacity of the area to support feral species such as Cane Toads. Uncontained waste sources may also attract feral fauna such as Wild Dog.

Most habitat observed across the Project area is considered of relative low quality due to broad-scale vegetation clearing, cattle grazing, weed encroachment and fragmentation. Feral fauna was abundant across the Project area. With appropriate management, the Project is unlikely to significantly worsen existing baseline conditions.

12.5.7 Fauna Mortality

Direct fauna mortality may occur as a result of a Project during vegetation clearing (e.g. through removal of mature trees containing hollows), earthworks, vehicle collision, or through entrapment in trenches.

Excavation will be required to remove topsoil for pits to be extracted. This will involve removal of ground vegetation, soil and rock which provide fauna habitat (e.g. fallen timber). Removal of ground timber, and the layer of topsoil in gilgai areas has the potential to impact on Ornamental Snake.

Vehicle movements has the potential to kill or injure fauna on impact. Some species may be particularly susceptible to these impacts mainly ground dwelling or slow-moving species.

Were there to be trenching activities, there is potential for fauna to fall into and become trapped in open trenches, where they may perish or become subject to increased predation risk. Particularly susceptible species groups include reptiles, frogs and small mammals.

12.5.8 Groundwater Drawdown

The 90th percentile of the predicted 1 m water table drawdown curve from the Uncertainty Analysis from the Groundwater Impact Assessment (Appendix F) was provided as an outer boundary to ensure all potential TGDEs were captured in the assessment.

The change in groundwater depths using the predicted groundwater drawdown at each patch of potential TGDE vegetation was assessed to determine the likelihood of impact this change would have on the mapped potential TGDE. The scale of impact was classified as:

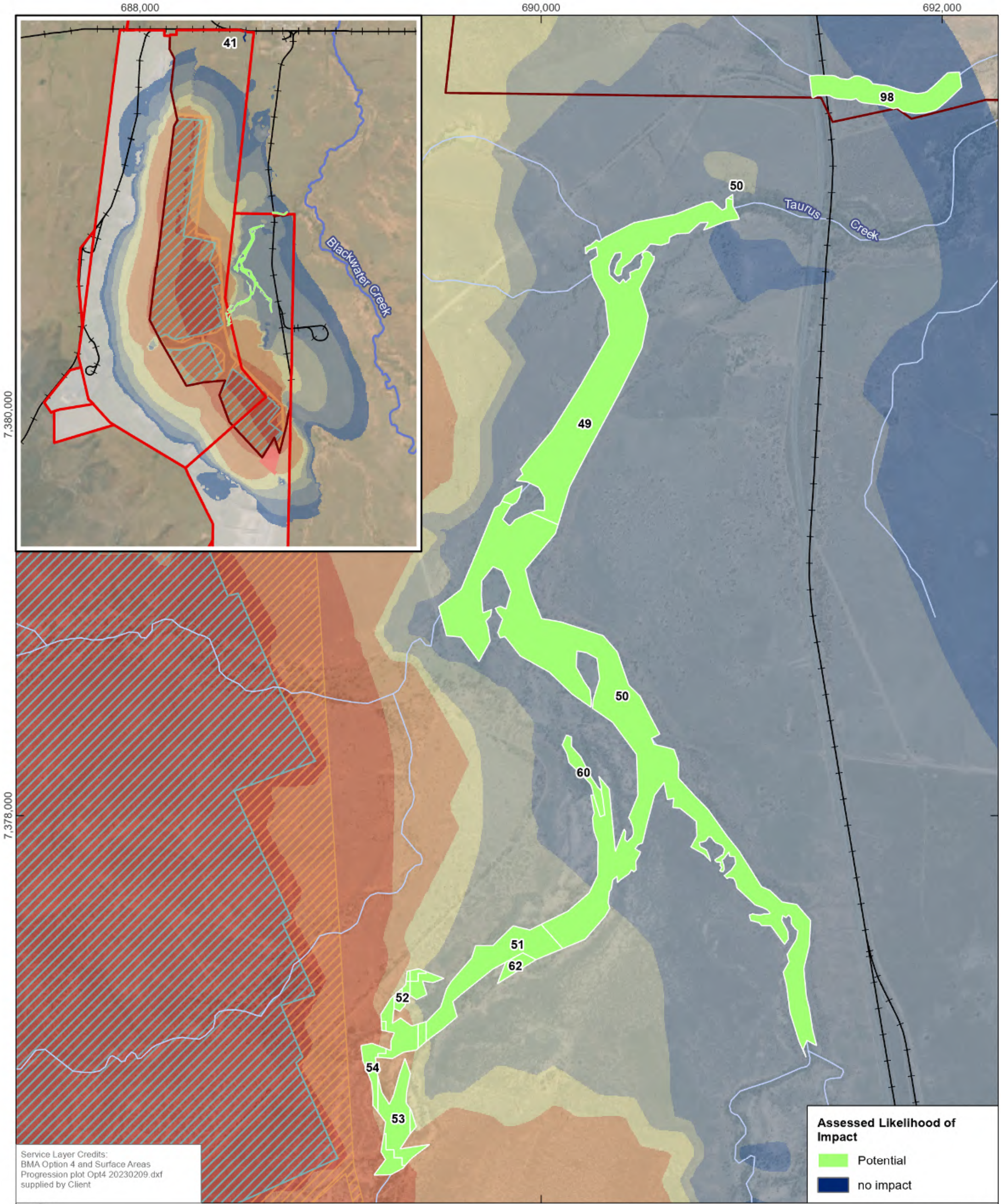
- No impact, or
- Potential impact

The results of the assessment are presented in **Figure 12-11** and indicate:

- One patch of RE11.3.1/11.3.2 (polygon ID 41) vegetation near the northern boundary of ML1759 is outside the predicted drawdown extent and therefore not be impacted.
- The patch of RE 11.3.1/11.3.25/11.3.2 (polygon ID 98) vegetation mapped by the Queensland Government as regrowth vegetation adjacent to the northern boundary of ML1762 is considered a potential impact however the drawdown is anticipated to range from 1-2 metres over the area of that patch predicted drawdown. While the impact is identified as Potential impact, the drawdown in this area ranged from mostly 1-2 m and remains within the rooting depth of potential TGDE vegetation.
- Two patches of dominant RE 11.3.25 (polygon ID 60 and 62) occur along Taurus Creek near the confluence with Two Mile Gully. The drawdown at these locations is predicted to exceed the 15 m rooting depth used for the assessment, however the use of groundwater by the vegetation requires site-specific assessment.
- The patches of RE 11.3.1/11.3.25 (polygon ID 49 and 50) contain the DES and the National identified potential GDEs (identified on **Figure 12-5**).
- Polygons 49-54 are part of a contiguous patch of RE 11.3.1/11.3.25 that is identified as having the potential to be impacted. The predicted groundwater drawdown is greater further upstream along Taurus Creek (south and closer to mining). This patch also aligns with the identified Koala habitat in the Study area.

Potential terrestrial GDEs within the predicted drawdown extent are associated with riparian corridors, including RE 11.3.25, 11.3.1/11.3.25 and 11.3.1/11.3.25/11.3.2 (**Figure 12-5).** All potential TGDE communities are likely to be facultative, and not solely reliant on groundwater.

As the potential TGDEs are likely to be facultative, species may not necessarily be adversely impacted by a change in the depth to groundwater. Further site-specific investigation of groundwater linkages to the potential TGDEs will be completed to determine whether the vegetation is a TGDE and if so, the likelihood and extent of impact. Depending on the outcomes of the site-specific assessment, a monitoring plan to identify the nature and extent of an impact (should it be realised) and facilitate application of targeted management actions, may be required.



0 250 500 m

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:25,000 at A4
Project Number:	620.014601
Date Drawn:	11-Dec-2023
Drawn by:	NT

BMA
BHP Mitsubishi Alliance

LEGEND

- Railway
- Minor Watercourse
- Major Watercourse
- BWM North Extension Project Area
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

Modelled Maximum Water Table Drawdown (m)

- 1 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 50
- 50- 100
- > 100

BLACKWATER MINE - NORTH EXTENSION PROJECT

ASSESSED LIKELIHOOD OF IMPACT IF IDENTIFIED POTENTIAL GDEs

FIGURE 12-11

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_TE_F12_11 Potential GDE impact

12.6 Mitigation and Management Measures

The Commonwealth and State offset assessment frameworks prescribe an 'avoid, mitigate, offset' approach to managing environmental impact. Avoiding an environmental impact is typically achieved through planning and site selection; however, where avoidance cannot be reasonably achieved, environmental impact mitigation and management measures are required to minimise impacts.

Further to the Project layout and design measures described in **Section 12.5**, the measures outlined in **Table 12-8** will be implemented to minimise potential impacts on flora, fauna and their habitats.

Table 12-8: Terrestrial ecology mitigation and management measures

Potential Impact	Mitigation Measures
Impacts on flora, fauna and their habitats	<u>General Measures</u> • Vegetation clearing will be limited to those areas required for the Project. The disturbance area will be clearly demarcated prior to clearing to avoid unnecessary clearing of vegetation and/or habitats. Clearing will only occur within the area approved via the site's Permit to Disturb process. • Project infrastructure has been co-located with the planned pit extent footprint area to minimise additional clearing impacts and potential fragmentation impacts. • Where practicable, ancillary infrastructure has been sited in existing cleared areas or more disturbed areas to minimise impacts on habitat values and connectivity. • Sequential clearing will occur to minimise impacts on native fauna, particularly arboreal fauna which may utilise tree hollows that may be present. • Areas which are not required for the ongoing operation of the Project will be rehabilitated as soon as practicable.
Vegetation clearance/habitat disturbance	• Land clearing would be carried out progressively over the life of the Project to allow mobile fauna species the opportunity to disperse away from clearing areas. • Pre-clearance fauna surveys will be undertaken by suitably experienced and qualified persons to identify individual fauna at direct risk from clearing activities. • A suitably qualified fauna spotter-catcher will be present during clearing of MNES and MSES habitat areas, working under the appropriate permits. • Sequential clearing will occur in areas where remnant vegetation is to be cleared. • Clearing will be done in such a way that arboreal fauna is given the opportunity to disperse from the area once clearing has commenced under their own volition. • BWM procedures for managing injured wildlife will be followed. • In the (unlikely) event any Koalas are observed, the habitat tree will be identified by flagging tape and/or marking spray on the tree, and nearby trees with overlapping crowns or trees that may impact the Koala's tree during felling will not be cleared until the Koala has moved from the area under its own volition. In most situations the Koala will move from the area overnight. As noted earlier in this report, no Koalas have been observed within the Project area despite 570 plus hours of survey. • Felling of trees away from retained areas of vegetation where practicable. Where trees unavoidably fall into retained areas, they will be left in-situ to mimic natural tree fall and provide habitat for ground-dwelling fauna. • Select micro-habitat features such as fallen logs and rocks will be salvaged and moved into adjacent habitat or collected and stored for use in rehabilitation areas.

Potential Impact	Mitigation Measures
Fragmentation (and edge effects)	• Weed management, pest animal management and bushfire management measures will be implemented to minimise potential impacts from the Project on native species and their habitats. • Fencing on site will give consideration to the movement of fauna. • Clearing widths at creek crossings will be minimised. • Clearing of native vegetation will be staged, and in out-of-pit disturbance areas habitat trees that can be retained, without compromising safety will be retained to minimise impacts to native fauna species. • Weed and pest control measures will be implemented in accordance with the BWM procedures (BWM Land and Biodiversity Management Plan) to minimise degradation of habitats and edge effects as a result of the Project.
Erosion and sedimentation	• The BWM Water Management Plan and BWM Erosion and Sediment Control Plan (ESCP) will be reviewed and updated, where necessary, to include the Project to manage water on site and erosion and sedimentation. • Vehicles and equipment will be maintained to minimise risk of spill or leakage. • Refuelling facilities, or storage facilities for hydrocarbons and chemicals will be in appropriately designed sites and comply with Australian Standards (e.g. AS 1940: The storage and handling of flammable and combustible liquids). • Hazardous materials are to be provided and stored in sealed, labelled containers, without leaks. • Fuels and chemicals will not be stored or handled within 200 m of waterbodies. • Personnel will receive appropriate spill clean-up training. • All vehicles and equipment to be cleaned in designated wash bays fitted with suitable pollution control equipment.
Bushfire	The *BWM Fire Management Plan and Standard Operating Procedure – Action to be taken on outbreak of Fire* will be reviewed and updated, where necessary, to include the Project. The intent of the *BWM Fire Management Plan* is to ensure appropriate resources, systems and infrastructure are in place for the prevention and control of fire at BWM, including: • Fire prevention and control. • Effective firefighting capability. • Safety of personnel fighting fires. • A Workplace Risk Assessment Control (WRAC) to identify all potential fire hazards at the mine. • Availability at the mine, at all times, of equipment that is appropriate and sufficient to extinguish any potential fire identified by the WRAC. • Location of portable fire extinguishers on or near equipment and installations identified as potential fire hazards by the WRAC. Bush fire management strategies for planned burns are developed according to vegetation communities. No hazard reduction burns will be undertaken by BWM within the patch of Brigalow TEC..
Noise, Dust and Lighting	• Site lighting will be kept to the minimum needed for safety during operation of the Project. • Dust management measures will continue to be implemented at the BWM and dust suppression implemented such as wetting down dirt roads. • Areas which are not required for the ongoing operation of the Project will be rehabilitated as soon as practicable.

Potential Impact	Mitigation Measures
Weeds and Pests	• BWM's weed and pest management procedures will be reviewed and where necessary, updated to incorporate the Project. The procedures support the BWM Land and Biodiversity Management Plan to manage the risks that weeds and feral animals pose to biodiversity by: – preventing the introduction of new weeds through the early detection of, and rapid response to new weeds; – identifying and controlling the spread of weeds and feral animal populations at BWM; – raising awareness and understanding of the risks associated with weeds and feral animals; and – ensuring compliance with regulatory and company requirements. • Weed hygiene protocols will continue to be implemented using the dedicated vehicle and machinery cleaning bay located at the mine infrastructure area. • Onsite waste disposal (especially food waste) to discourage presence of pest fauna. Waste will be stored in covered bins/skips to prevent fauna access. • Rehabilitation materials (e.g. seed and hay) brought to site to be certified as weed free. • Any herbicides used on site to be dispensed by an appropriately trained and qualified weed sprayer.
Fauna mortality	• All personnel will be required to follow speed restrictions to minimise the chance of any fauna strikes occurring. • Suitably qualified personnel (e.g., fauna spotter-catcher) will undertake a pre-clearance survey of the permitted impact area, prior to the commencement of clearing and monitor all clearing works in known habitat. • Personnel will be educated on the presence of native fauna including threatened and CEEVNT species and the need to travel slowly and look out for fauna when driving. • BWM procedures for managing injured wildlife will be followed. • For any trenching activities, if trenches remain open after daily site works have been completed, escape ramps or planks and/or shelter (e.g., sawdust filled bags) for trapped fauna will be put in place. The amount of open trench will be minimised.
Groundwater Drawdown	• BWM will complete further site-specific investigation of groundwater linkages to the potential TGDEs to determine whether the vegetation is a TGDE and if so, the likelihood and extent of impact. • Depending on the outcomes of the site-specific assessment, a monitoring plan to identify the nature and extent of an impact (should it be realised) and facilitate application of targeted management actions, may be required.

12.7 Significant Impact Assessments

Significant impacts to MNES and MSES that remain after avoidance and mitigation measures have been applied are required to be offset under the EPBC Act or the Queensland *Environmental Offsets Act 2014*.

This section describes the significant impacts to MNES and significant residual impacts to MSES based on the assessments provided in **Appendix G** and **Appendix H,** respectively.

12.7.1 Matters of National Environmental Significance

Significant impact assessments have been carried out for MNES that are known or likely to occur in the Project area in accordance with the *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (DoEE, 2013). Significant impact assessments for MNES potentially impacted by the Project are summarised in **Table 12-9**. The detailed significant impact assessments are provided in the Terrestrial Ecology Matters of National Environmental Significance Assessment (**Appendix G)**.

Significant impacts on Ornamental Snake, listed as Vulnerable under the EPBC Act, was considered likely to result from the Project. No other significant impacts to MNES are anticipated. Offsets will be assessed and proposed for this species in accordance with the EPBC Act Environmental Offsets Policy. An Offset Area Management Plan (OAMP) will be prepared to meet the offset requirements under the EPBC Act Environmental Offsets Policy. The OAMP will provide details of the management actions and monitoring requirements necessary to achieve a conservation outcome for the MNES matters required to be offset for the Project. The OAMP will be submitted for DCCEEW approval prior to Project commencement.

Table 12-9: MNES Significant Impact Assessment Summary

MNES	EPBC Act status	Assessment Summary	Significant Impact
Brigalow TEC	Endangered	No clearing or disturbance to Brigalow TEC will occur. The Brigalow TEC patch is >2km from any proposed clearing or infrastructure and surrounding vegetation on Taurus Creek will remain. Fire management measures will be implemented to minimise the risk of fires occurring and resulting in a loss of or reducing ecological condition of the community. Weed hygiene protocols and other management measures will be implemented to minimise the risk of Project activities facilitating the spread of weeds. The Project will not have a significant impact on the Brigalow TEC.	No
Australian Painted Snipe	Endangered	The Project footprint will result in the loss of approximately 94.31 ha of suitable habitat. Although habitat in which the species is known to have occurred, and/or is likely to occur in the future, there is negligible impact on the area of occupancy of the species. A total of 689 ha of suitable habitat is present in the Project area (total clearing area 94.3 ha) and suitable gilgai habitat and man-made farm dams occur in the wider region. The species is not present in the Project area on a regular basis, but habitat mapping criteria applies for when this nomadic species is present in the region, which is likely to be infrequent at best and sporadic. As such no significant impacts are predicted on this species.	Unlikely
Ornamental Snake	Vulnerable	The Project will require the clearing of approximately 85.79 ha of Ornamental Snake habitat. The occurrence of the Ornamental Snake in the Project area is considered to constitute an important population. Although Ornamental Snake has not been recorded in gilgai areas to be cleared by the Project, the species' occurrence in the area of preferred gilgai habitat is	Likely

MNES	EPBC Act status	Assessment Summary	Significant Impact
		assumed. The Project is considered likely to have a significant impact on the Ornamental Snake.	
Koala	Endangered	The Project footprint will result in the direct loss of 20.28 ha of suitable habitat and 6.62 ha of marginal habitat, totalling 26.9 ha. This comprises predominantly Brigalow dominated woodland along the riparian corridors, with sparse emergent eucalypts, or areas of patchy regrowth. Preferred habitats are located within riparian corridors which support preferred foraging tree species including Queensland Blue Gum and these areas will not be disturbed by the Project. This species has not been recorded (despite nearly 600 hours of field survey) within the Project area although old scratches and a scat were present confirming previous utilisation by the species. Through the identified mitigation measures such as staged clearing, retaining Koala habitat on site including riparian corridors, and implementation of management measures, the Project will minimise potential impacts on any local Koala population were one to utilise the Project area. The Project area does not contain extensive areas of contiguous eucalypt woodland, or retain connectivity to such areas. As such, the habitat mapped has been assessed as marginal for the species as it is highly fragmented and limited in extent, and the likelihood of the species occurring on a regular basis is low. The Project area is already heavily fragmented as a result of historical and more contemporary clearing for agriculture, predominantly grazing. The Project layout maintains linkages to surrounding habitat (including riparian corridors associated with Taurus Creek and Two Mile Gully). The Project is not expected to have a significant impact on the Koala. Based on existing controls and mitigation measures, as well as the lack of utilisation of retained habitat closest to proposed infrastructure, indirect impacts from the Project have the potential to increase the significant impact on other areas of vegetation that may support this species. The level of risk however requires confirmation. Further site-specific information is required to determine whether the vegetation represents a TGDE and if so, the likelihood and extent of the impact to the preferred and suitable Koala habitat. Depending on the outcomes of the site-specific assessment, a monitoring plan for identifying change in vegetation condition may be required.	Unlikely
White-throated Needletail	Vulnerable	As the species is almost exclusively aerial, direct impacts to their habitat are not expected to occur as a result of vegetation clearance for the Project. There is limited potential the species could roost in an area of woodland across the Project area, although this use will be sporadic, temporary and across a broad area (i.e. not involving regular or repeated roost sites). The majority of suitable roost trees (larger more mature trees) are located within riparian corridors, which are largely avoided by the Project.	Unlikely

MNES	EPBC Act status	Assessment Summary	Significant Impact
		Although vegetation clearing will occur for the Project, there are extensive areas of vegetation within the Project area that would remain and cleared habitats are still utilised by the species. The majority of the Project area will remain as suitable foraging and roosting habitat for the species. Since White-throated Needletails do not breed in Australia, the Project will not disrupt their breeding cycle. The Project will not have a significant impact on the White-throated Needletail.	
Squatter Pigeon	Vulnerable	The Project will result in the loss of up 0.63 ha of suitable habitat and 35.57 ha of marginal habitat totalling 36.2 ha (though no important populations are present on site). North of the Carnarvon Ranges the species is relatively common and is considered to be a single, continuous sub-population. As such, the population in the Project area is not considered to be an important population. Squatter Pigeons were observed on two different occasions while traversing the Project area in June 2023 and August 2023, despite not being seen in approximately 500 hours of survey effort at various times of day and season previously. The species is considered to be scarce in the Project area due to habitat degradation rendering the Project area largely unsuitable. The species has potential to occur in the Project area (especially near water sources) although the likelihood is significantly reduced by the dominance of Buffel Grass and clay soils (as the species favours sandy soils and a mosaic of open woodland and native grasses). Extensive areas of grassy woodland and open grassland occurs to the east of the Project disturbance footprint along Taurus Creek which is likely to form the core of habitat for the species in the Project area. The Project area is already heavily fragmented as a result of historical and contemporary clearing for agriculture, predominantly in form of cattle grazing. The Project layout maintains linkages to surrounding habitat, particularly the maintenance of connectivity along Taurus Creek. The Project is considered unlikely to have a significant impact on the Squatter Pigeon.	Unlikely
Latham's Snipe	Migratory	Latham's Snipe occurs widely across eastern Australia, although does not breed in the country. Important habitat for the species is defined (DoE 2017) as being areas that have been identified as internationally important for the species, or areas that support at least 18 individuals of the species. Surveys by EMM encountered occasional individuals in gilgai areas (three observations over the surveys). The Project area is unlikely to constitute important habitat for the species. Although habitat will be cleared for the Project, the loss of this habitat will not have a significant impact on Latham's Snipe and the risk of an impact on an ecologically significant proportion of the population is considered to be low.	Unlikely
Fork-tailed Swift	Migratory	The Fork-tailed Swift is a non-breeding visitor to all states and territories of Australia. In Australia, the Fork-tailed	Unlikely

MNES	EPBC Act status	Assessment Summary	Significant Impact
		Swift is almost exclusively aerial, occurring from heights of less than 1 m up to more than 1,000 m above the ground. The Project area is unlikely to constitute important habitat for the species. The risk of an impact on an ecologically significant proportion of the population is considered to be low. The Project will not have a significant impact on the Fork-tailed Swift.	
Glossy Ibis	Migratory	The Glossy Ibis occurs widely across Australia and the Project area is unlikely to constitute important habitat for the species. Individuals of the species are expected to only to be sporadic visitors to the Project area. A number of suitable farm dams at which the species may forage will remain in the Project area and the risk of an impact on an ecologically significant proportion of the population is considered to be low. The Project will not have a significant impact on Glossy Ibis	Unlikely

12.7.2 Matters of State Environmental Significance

Based on mapping of MSES across the Project area and significant residual impacts assessment for MSES values following the *Queensland Environmental Offsets Policy Significant Residual Impact Guideline* (SRI Guideline) (DEHP 2014a), it has been identified the Project may result in a significant residual impact to the following MSES values:

- Endangered RE11.3.1 – 10.55 ha.
- REs within a defined distance of a watercourse – 8.51 ha.
- Protected wildlife habitat for Ornamental Snake (including Essential Habitat).

Environmental offsets under the Queensland Environmental Offsets Policy will be assessed and delivered for these MSES values, with the exception of Ornamental Snake, for which offsets will be provided under the EPBC Act.

Detailed assessments against SRI Guideline criteria are provided in **Appendix H.**

13 Aquatic Ecology and Stygofauna

13.1 Introduction

An aquatic ecology baseline assessment was completed for the Project by EMM (2023c) to describe the aquatic values of the Project area as relevant to Commonwealth and State legislation, based on desktop review of available information and seasonal field surveys completed in December 2019 and May 2020.

A stygofauna pilot survey was also completed for the Project by Freshwater Ecology (2021) over two sampling events in November 2020 and May 2021.

An Aquatic Ecology Impact Assessment was prepared for the Project by Ecological Service Professionals (2023) to summarise the results of the baseline aquatic ecology assessment (EMM 2023c), the stygofauna pilot study (Freshwater Ecology, 2021) and available desktop information to evaluate the existing aquatic ecological values and stygofauna communities relevant to the Project. The Aquatic Ecology Impact Assessment also assesses the potential impacts associated with the Project on aquatic ecological values and stygofauna communities and outlines proposed mitigation and management measures to minimise potential adverse impacts. The Aquatic Ecology Impact Assessment is provided in **Appendix I**.

13.2 Regional and Local Setting

Waterways and wetlands within the Project area are situated within the Mackenzie River sub-basin, which is part of the wider Fitzroy River basin (**Figure 10-1**). An overview of the regional and local hydrology is provided in Chapter 10.

An overview of the regional and local groundwater regime is provided in Chapter 11 and provides a description of environmental values relevant to aquatic GDEs, stygofauna communities and subterranean GDEs.

The *Queensland Wetlands Program* (DES 2015) delineates wetlands throughout Queensland. The three main types of wetland systems for surface freshwater environments (DES 2015; EPA 2005) are palustrine wetlands (e.g. billabongs, swamps, bogs, springs, soaks), lacustrine wetlands (e.g. lakes and dams) and riverine wetlands (wetlands and deep-water habitats within a channel).

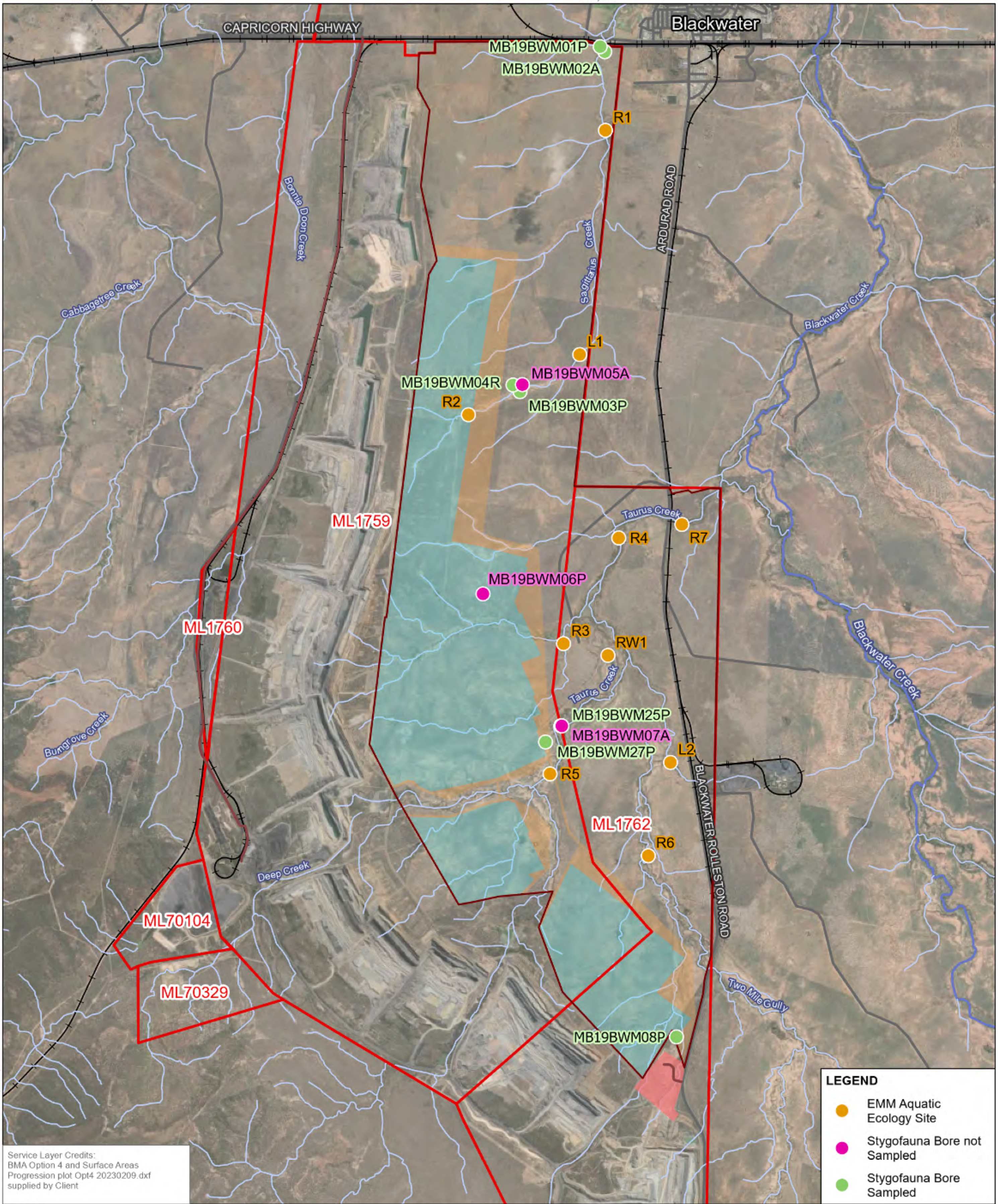
13.3 Methodology

13.3.1 Baseline Surveys

13.3.1.1 Aquatic Ecology

Aquatic ecology surveys for the Project were completed by EMM in December 2019, aligning with the AUSRIVAS ‘early wet’ sampling season (October to December), and follow-up AUSRIVAS ‘late wet’ season surveys (May to July) were completed in May 2020.

A total of ten sites were sampled within the Project area, as shown in **Figure 13-1** including seven riverine, two lacustrine wetland and one riverine wetland sites (with the latter riverine wetland site only surveyed in May 2020).



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	11-Dec-2023
Drawn by:	NT

LEGEND

- Railway
- Road
- Mine Acces Road
- Minor Watercourse
- Major Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

AQUATIC ECOLOGY SITES AND STYGOFAUNA BORES SURVEYED IN THE BASELINE MONITORING FOR THE PROJECT

BHP Mitsubishi Alliance

FIGURE 13-1

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_AE_F13_1_Aquatic Sites and Stygofauna1

Approximately 15.4 mm of rain fell in the three months preceding the December 2019 survey, representative of dry season/drought conditions. Combined rainfall of 270.2 mm was recorded in January and February 2020, with periods of intense rainfall resulting in flooding at each riverine site. However, only 3.2 mm of rain was recorded in the three months preceding the May 2020 survey (BoM 2023b), leading to dry conditions at most riverine sites.

Given the dry conditions, comprehensive surveys (fish, turtles, macroinvertebrates, water quality, aquatic habitat, and aquatic plants) were completed at one riverine site (site R4) that contained isolated pools during both surveys. Aquatic habitat and plant surveys (only) were completed at the remaining riverine sites (sites R1, R2, R3, R5, R6 and R7) that were dry during both survey events. Comprehensive surveys were also completed at one lacustrine wetland (site L1) and the riverine wetland site (site RW1). Water quality, aquatic habitat and aquatic plant surveys (only) were completed at the other lacustrine wetland site (site L2).

A detailed description of the aquatic ecology methods used to survey aquatic habitats; surface water quality; fish, turtles, Platypus, macroinvertebrates and aquatic flora is provided in the Aquatic Ecology Baseline Assessment (EMM, 2023c) provided in **Attachment A** of the Aquatic Ecology Impact Assessment (**Appendix I)**.

13.3.1.2 Stygofauna

A stygofauna (i.e. subterranean aquatic fauna) pilot study has been competed for the Project by Freshwater Ecology (2021) over two sampling events in November 2020 and May 2021. Bores surveyed for stygofauna are shown on **Figure 13-1**. Two bores were intended to be surveyed, however were not surveyed as they were dry during both sampling events. As such, a total of eight bores were sampled in the pilot study.

A detailed description of the stygofauna sampling methods is provided in the Stygofauna Assessment (Freshwater Ecology, 2021) provided in **Attachment B** of the Aquatic Ecology Impact Assessment (**Appendix I)**.

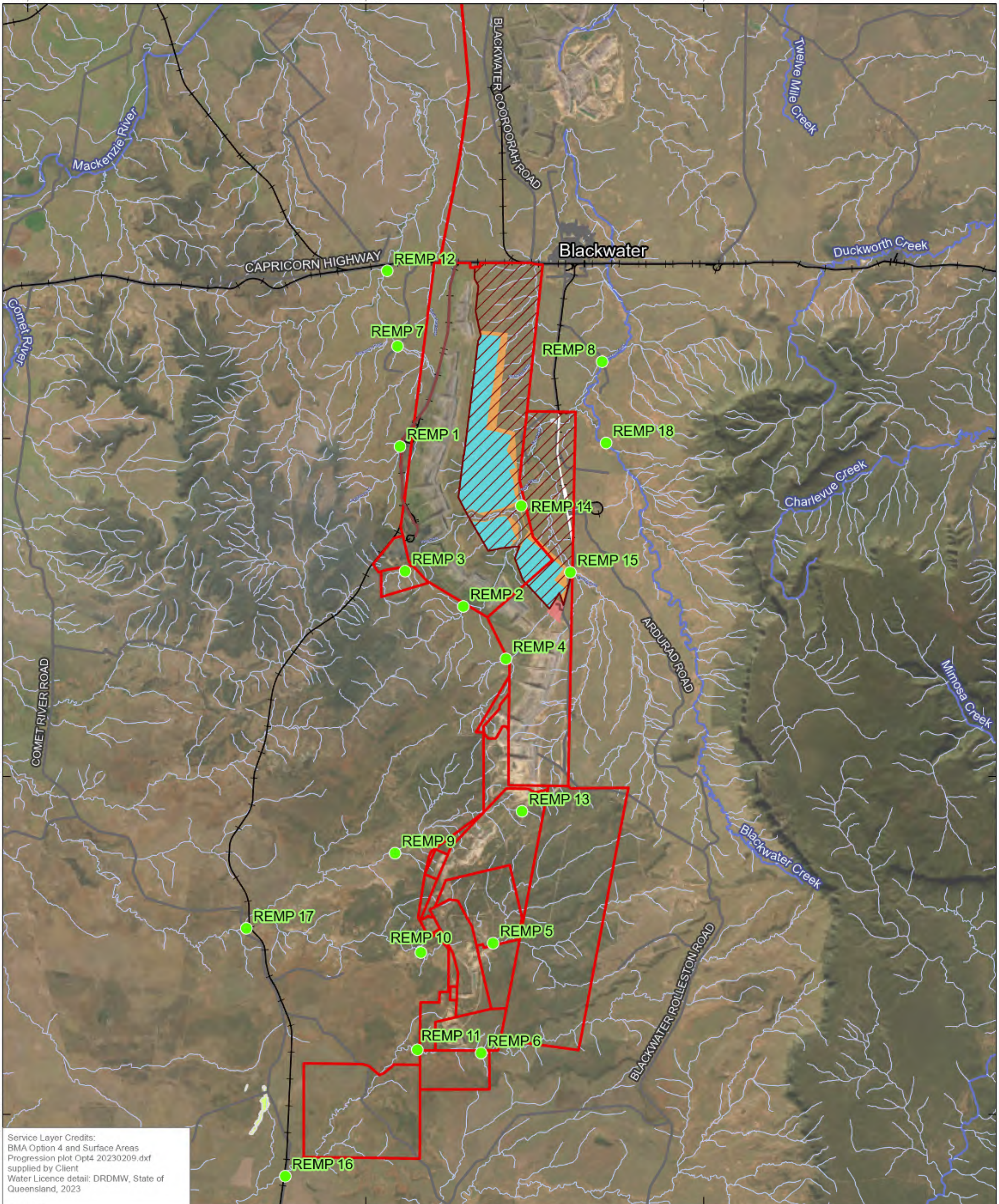
The results of the pilot study have been used to summarise stygofauna communities of the Project area and surrounds, along with a desktop assessment (described in Section 13.3.2).

13.3.2 Desktop Assessment

13.3.2.1 Aquatic Ecology

A comprehensive desktop assessment was completed to summarise the aquatic ecological values of the Project area and surrounds (**Appendix I)**. The following sources were reviewed:

- REMP annual reports for BWM from 2012 (Gauge Industrial & Environmental 2013), 2013 (Gauge Industrial & Environmental 2014), 2014 / 2015 (Hydrobiology 2016), 2015 / 2016 (Gauge Industrial & Environmental 2017), 2017 / 2018 (Hydrobiology 2019), 2019 / 2020 (Gauge Industrial & Environmental 2020), 2020 / 2021 (Gauge Industrial & Environmental 2021) and 2021 / 2022 (Gauge Industrial & Environmental 2023). The BWM REMP sampling locations are shown in **Figure 13-2**.
- Aquatic Conservation Assessment for the riverine (Inglis and Howell 2009) and non-riverine (Rollason & Howell 2012) wetlands of the Great Barrier Reef catchment.
- Queensland Government surface *Water Monitoring Information Portal* (WMIP) (State of Queensland 2023).



0 5 10 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:300,000 at A4
Project Number:	620.014601
Date Drawn:	11-Dec-2023
Drawn by:	NT

BMA
BHP Mitsubishi Alliance

LEGEND

- Railway
- Road
- Mine Acces Road
- Minor Watercourse
- Major Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent
- BWM REMP Site

BLACKWATER MINE - NORTH EXTENSION PROJECT

BWM REMP SITES

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 13-2

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_AE_F13_2_REMP

- *EPBC Act Protected Matters Search Tool* for both 20 km and 50 km search radius around the Project area (DCCEEW 2023a), and the Queensland *WildNet* database for both 20 km and 50 km search radius around the Project area (DES 2023a) to determine the aquatic species (including listed threatened species) that are known or are likely to occur in the vicinity of the Project.
- Database searches of the species occurring in the area, including the *Atlas of Living Australia* (ALA 2023) and the Queensland Government *Wetland Info* species lists for the Mackenzie River sub-basin and Fitzroy River basin (DES 2013a: DES 2013b).
- Existing mapping of the aquatic ecological values in the vicinity of the Project, including Queensland *Wetland Maps* (DES 2023b), *Waterways for Waterway Barrier Works* (DAF 2023) and *Queensland Globe*, including the *Watercourse Identification Map* (Queensland Government 2023).
- Publicly available reports from aquatic ecology assessments completed in the region.
- Other relevant published information from the region.

13.3.2.2 Stygofauna

A desktop assessment of stygofauna in accordance with the *Guideline for the Environmental Assessment of Subterranean Aquatic Fauna* (DSITI 2015) was conducted by ESP (**Appendix I**) to:

- assess the suitability of local habitat for stygofauna based on the hydrogeology in the vicinity of the Project; and
- assess the likely presence and composition of stygofauna in the vicinity of the Project.

The desktop review summarised existing general information available on stygofauna and habitat preference in Australia and Queensland, including:

- the Queensland Subterranean Aquatic Fauna Database curated by the Queensland Herbarium (DES 2023b);
- results from stygofauna assessments completed as part of EIS projects for other coal mines in the region, including Caval Ridge Mine Horse Pit Extension Project (ESP 2021), Ensham Life of Mine Extension Project (frc environmental 2020), Minyango Project (State of Queensland 2014), and Washpool Coal Mine Project (State of Queensland 2012);
- scientific publications, including the CSIRO report to ACARP on the extent of knowledge of Stygofauna in Australian Groundwater Systems (Hose et al 2015); and
- groundwater assessments completed for the Project, including the Groundwater Modelling Technical Report and Groundwater Impact Assessment (**Appendix F**).

13.4 Environmental Values

13.4.1 Waterways

Natural waterways in the region are typically temporary or ephemeral streams, which are dry for most of the year and flow for a short time following rainfall events that are more common in the wet season. The wet season also has the highest evaporation rates and potential evaporation consistently far exceeds rainfall during all seasons (**Appendix E**), leading to dry conditions.

The condition of freshwater habitats in the Mackenzie River sub-basin is monitored through the Ecosystem Health Index Reports coordinated by the Fitzroy Partnership for River Health (FPRH).

Monitoring results are scored from ‘A’ to ‘E’ - in 2021 – 2022 the condition of freshwater habitat was ‘C’ (i.e., fair) due to the following (FPRH, 2023):

- Good to excellent physicochemical water quality, except for turbidity which was fair.
- Good nutrient concentrations.
- Good to excellent concentrations of most metals and metalloids, except for concentrations of copper and aluminium which were fair.
- Poor to very poor (fail) condition of macroinvertebrate communities with low taxonomic richness and richness of sensitive taxa.

These results are consistent with the desktop Aquatic Conservation Assessment for the riverine wetlands of the Great Barrier Reef catchment (Inglis & Howell 2009), which classified most waterways within the sub-basin as ‘moderate’ conservation significance in accordance with the Aquatic Biodiversity Assessment and Mapping Method (AquaBAMM) (Clayton et al 2006). Within the Project area and downstream, waterways were classified as either ‘very low’ (Taurus Creek and its tributaries, as well as lacustrine waterbodies, where mapped) or ‘moderate’ (Sagittarius and Blackwater creeks and most of their tributaries) conservation significance.

The waterways within the Project area (**Figure 10-2**) are predominantly first and second order tributaries, however, there are sections of waterways ranging up to the fourth order including Two Mile Gully and Taurus Creek. Taurus Creek flows north into Blackwater Creek (**Figure 10-2**) as a fifth order stream.

The physical habitat is monitored as part of the BWM REMP, although sites are often dry due to the ephemeral nature of waterways in the region. There was no notable difference in physical habitat conditions between sites upstream and downstream of BWM and most sites had moderate bank stability, substrate dominated by fine silts and sands, and riparian zone consisting largely of shrubs and grasses (with few mature trees) (Hydrobiology 2019). The results from the REMP indicated that all waterways surveyed in the vicinity of BWM contained sufficient structural complexity to provide moderately diverse biological (macroinvertebrate) communities in the presence of sufficient water.

Aquatic habitat assessments completed at sites within the Project area for the baseline surveys showed that physical habitat conditions were generally poor to fair (EMM 2023c) and the availability of bottom substrates was poor to fair (mostly fine sediments with a lack of pebbles, cobbles and boulders). Most sites had some instream structural complexity which provided habitat and refuge for aquatic fauna, such as detritus and woody debris. Although most sites were impacted by cattle grazing, the riparian zone was typically in good condition, with vegetation dominated by trees covering at least 50% of the banks at most sites. Some areas of erosion were evident on the banks. Most sites were dry or consisted of disconnected pools during the field survey. This is reflective of the ephemeral nature of waterways in the region, which typically flow for short periods during high rainfall events, before receding to shallow pools. The overall aquatic habitat was assessed as low to moderate for riverine sites (EMM 2023c).

13.4.2 Lacustrine Wetlands and Farm Dams

There are several State mapped lacustrine wetlands within the Project area in the vicinity of the Project, with most of these lacustrine wetlands associated with farm dams and BWM water storages upstream of the Project area (**Appendix I**). Several farm dams that are unmapped by the State that may provide aquatic habitat are also located upstream, within and downstream of the Project area.

One mapped lacustrine wetland on a tributary of Two Mile Gully (site L2 on **Figure 13-1**) and one unmapped farm dam on Sagittarius Creek (site L1 on **Figure 13-1**) was assessed by EMM (2023c) as providing moderate value habitat during surveys. All wetlands in the vicinity of the Project (including one of those assessed by EMM 2023c) were classified as having "very low" conservation value in the Aquatic Conservation Assessment of non-riverine wetlands (in accordance with the AquaBAMM; Clayton et al 2006, Rollason and Howell 2012). This was due to low diversity, richness, and naturalness criteria.

13.4.3 Palustrine Wetlands

There are two small State mapped palustrine wetlands in the vicinity of the Project, one upstream of the Project area on Two Mile Gully, approximately 1.5 km east of the Project, and one upstream of the Project area on Deep Creek, approximately 6 km west of the Project. These were classified as having "moderate" conservation value in the Aquatic Conservation Assessment of non-riverine wetlands (in accordance with the AquaBAMM; Clayton et al 2006, Rollason and Howell 2012) due to low aquatic naturalness; moderate catchment naturalness, diversity and richness criteria; and high threatened species / priority species and ecosystems criteria. No palustrine wetlands are mapped within the Project area.

13.4.4 High Ecological Significance Wetlands and Wetlands of International or National Importance

There are no High Ecological Significance (HES) wetlands within the Project area and the closest downstream HES wetland is more than 75 km away on the Mackenzie River. The closest HES wetland that is not downstream is located >20 km to the south-east. No wetlands of International or National importance occur in the Mackenzie River sub-basin (DES 2013b).

13.4.5 Water Quality

Water quality in waterways and wetlands in the vicinity of the Project was highly variable, which is typical of ephemeral systems in the region. Overall, water quality measured *in situ* in the REMP was characterised by neutral pH, low electrical conductivity and variable saturation of dissolved oxygen. Laboratory-analysed results also indicated moderate to high concentrations of nutrients and total suspended solids, but a low concentration of ions and metals (although concentrations of dissolved copper, and total aluminium, iron and manganese can be high).

Water quality measured in the farm dam and wetland sites during the baseline assessment were mildly to strongly alkaline, had a relatively high electrical conductivity, variable dissolved oxygen concentration and moderate to high turbidity. Hardness generally indicated moderate to extremely hard waters, and ion concentrations generally indicative of bicarbonate waters.

13.4.6 Sediment Quality

Sediment quality in the vicinity of BWM (including Blackwater, Burngrove, Rockland, Deep and Sirius Creeks) is routinely monitored as part of the REMP. Sediment quality was generally good in the vicinity of the Project. Concentrations of metals were typically suitable to protect the moderate aquatic ecosystem value, and likely influenced to some degree by surrounding land use and local geomorphology (**Appendix I**).

13.4.7 Aquatic Biota

Biological communities (including aquatic plants, macroinvertebrates, macrocrustaceans, fish and turtles) recorded at sites in the Project area were typical of ephemeral systems in central Queensland. All taxa recorded were common in the broader region, and no listed threatened species known from the catchment (or potential habitat for these species) were identified.

A total of 21 native aquatic plant species were recorded within the Project area. Emergent growth forms dominated aquatic plant communities, with few submerged and floating species, indicating that water is not likely to persist for the majority of the year (except at farm dams). Three species listed as priority flora have been recorded in low cover on Taurus Creek (stream order 4) – Tall Flatsedge (*Cyperus exaltatus*), Water Snowflake (*Nymphoides indica*) and Swamp Lily (*Ottelia ovalifolia*). Four introduced aquatic plants are known from the sub-basin and two of these have been recorded in the vicinity of the Project, namely White Eclipta (*Eclipta prostrata*) and Awnless Barnyard Grass (*Echinochloa colona*).

Macroinvertebrate communities sampled in the baseline surveys were in poor to moderate condition relative to those expected in the broader region, with few sensitive taxa. Results indicated unfavourable physical conditions and / or reduced habitat quality, likely reflecting seasonality and the ephemeral nature of waterways in the region, rather than catchment impacts. Long-term monitoring as part of the REMP indicated communities are typically dominated by common taxa that are tolerant of harsh physical conditions. There has been no indication from the REMP results that mining has had a negative influence on the health of macroinvertebrate communities. Macroinvertebrate communities at sites downstream of BWM on higher stream orders were often in better condition than those upstream (**Appendix I**).

During the baseline surveys, nine species of common native fish were caught. Fish communities were dominated by small bodied species, with the lack of large-bodied fish likely due to the paucity of deep pool habitat. Two restricted noxious fish under the *Biosecurity Act 2014* have been recorded in the region, namely Tilapia (*Oreochromus mossambicus*) and Mosquitofish (*Gambusia holbrooki*).

Turtles were not particularly abundant or widespread in the vicinity of the Project and were only caught in one of the farm dams on Sagittarius Creek. The species captured (Eastern Snake-necked Turtle, *Chelodina longicollis*) is widespread and common throughout waterways in Queensland. Six other species of freshwater turtles occur in the sub-basin.

There was no suitable habitat for Platypus found in the Project area, and the nearest record is approximately 30 km to the east of the Project area.

13.4.7.1 Threatened and CEEVNT Species

Two species of fish listed as potentially occurring in the vicinity of the Project are threatened under the EPBC Act: Silver Perch (*Bidyanus bidyanus*, listed as critically endangered) and Murray Cod (*Maccullochella peelii peelii,* listed as vulnerable). Neither species was listed in the EPBC Act Protected Matters Search Tool Report or the Wildlife Online database as occurring within 20 km or 50 km search radius of the Project area (DCCEEW 2023a, DES 2023a).

The natural distribution of the Silver Perch and Muray Cod is limited to the Murray-Darling basin, although both species have been translocated in Queensland (**Appendix I**). The preferred habitat of the Silver Perch is high flowing rivers, while the Murray Cod is frequently found in main channels of rivers and larger tributaries, preferring deep pools and channels with structurally complex features. The Project area does not provide the preferred habitat of these species and they are considered highly unlikely to occur in the vicinity of the Project.

Two species of turtle are listed as potentially occurring within 20 km and 50 km of the Project area: Fitzroy River Turtle (*Rheodytes leukops,* listed as vulnerable under the EPBC Act and NC Act) and White-throated Snapping Turtle (*Elseya albagula,* listed as critically endangered under the EPBC Act and endangered under the NC Act). Based on desktop review of known distribution, habitat preferences, and field assessments by EMM (2023c), these species are unlikely to occur within or in the vicinity of the Project.

13.4.8 Special Least Concern Species

Platypus are protected as Special Least Concern under the NC Act. There are no records of Platypus from within 20 km of the Project, and no Platypus or potential habitat for this species were recorded during the field surveys for the Project (EMM, 2023c). The closest record of Platypus to the Project is from the Blackdown Tablelands National Park, approximately 40 km southeast of the Project (**Appendix I**). Platypus is considered highly unlikely to occur in the vicinity of the Project.

13.4.9 Surface Expression GDEs

There are no known surface expression GDEs mapped within the Project area. The baseline survey results indicated there was no obvious groundwater influence within the Project area, including no flows, salt seeps, hydrophytes, or other aquatic GDE indicators following prolonged dry conditions, and no obvious groundwater influence on the concentrations of major anions and cations in surface water.

One aquatic system, Blackwater Creek (located outside of the Project area to the north-east and downstream) is mapped as having moderate potential for groundwater interaction **(Figure 11-9)**.

13.4.10 Stygofauna and Subterranean GDEs

As discussed in Chapter 11, no known or potential subterranean GDEs are mapped within the Project area or surrounds (BoM, 2023a; DES, 2023c).

There are no known records of stygofauna (stygobitic or stygophilic fauna) in the vicinity of the Project, and they were not recorded during the pilot study for the Project from eight bores sampled across two sampling events in December 2020 and May 2021 (DES 2023b, Freshwater Ecology 2021, frc environmental 2020, State of Queensland 2014, State of Queensland 2012).

Stygoxenes (i.e., not obligate inhabitants of groundwater systems) were recorded from six of the ten bores sampled during the pilot study, including termites (Isoptera), one soil mite (Oribatida), thrips (Thysanoptera) and springtails (Collembola) (Freshwater Ecology 2021). Overall, aquifers within the Project area are considered to have a low likelihood of supporting stygofauna communities due to the limited saturation, connectivity, depth, and suitability of groundwater quality (electrical conductivity levels outside the preferred range for stygofauna). Habitat is limited in the vicinity of the Project, particularly given the alluvium (where stygofauna are most common) is limited and is typically dry (**Appendix I**).

13.4.11 Matters of National Environmental Significance

Two threatened fish species (Silver Perch and Murray Cod) and two threatened turtle species (Fitzroy River Turtle and White-throated Snapping Turtle) listed under the EPBC Act were identified in the desktop assessment as having known records from the broader region, however, these species are unlikely to occur within the Project or surrounds as described in Section 13.4.4.1.

As the Project represents a large coal mining development, water resources (e.g. surface water, groundwater, and organisms and ecosystems that add to the physical state and environmental value of the water resource) are also a relevant MNES (as described in Chapter 10 – Surface Water, Chapter 11 – Groundwater, Chapter 12 – Terrestrial Ecology and Chapter 13 – Aquatic Ecology and Stygofauna).

13.4.12 Matters of State Environmental Significance

An assessment of the occurrence of MSES within the Project area, as well as the Project disturbance footprint is provided in **Chapter 12**, **Table 12-6** and detailed in **Appendix H**.

Two turtle species (Fitzroy River Turtle and White-throated Snapping Turtle) listed under the NC Act were identified in the desktop assessment as having known records from the broader region, however, these species are unlikely to occur within the Project or surrounds as described in Section 13.4.4.1.

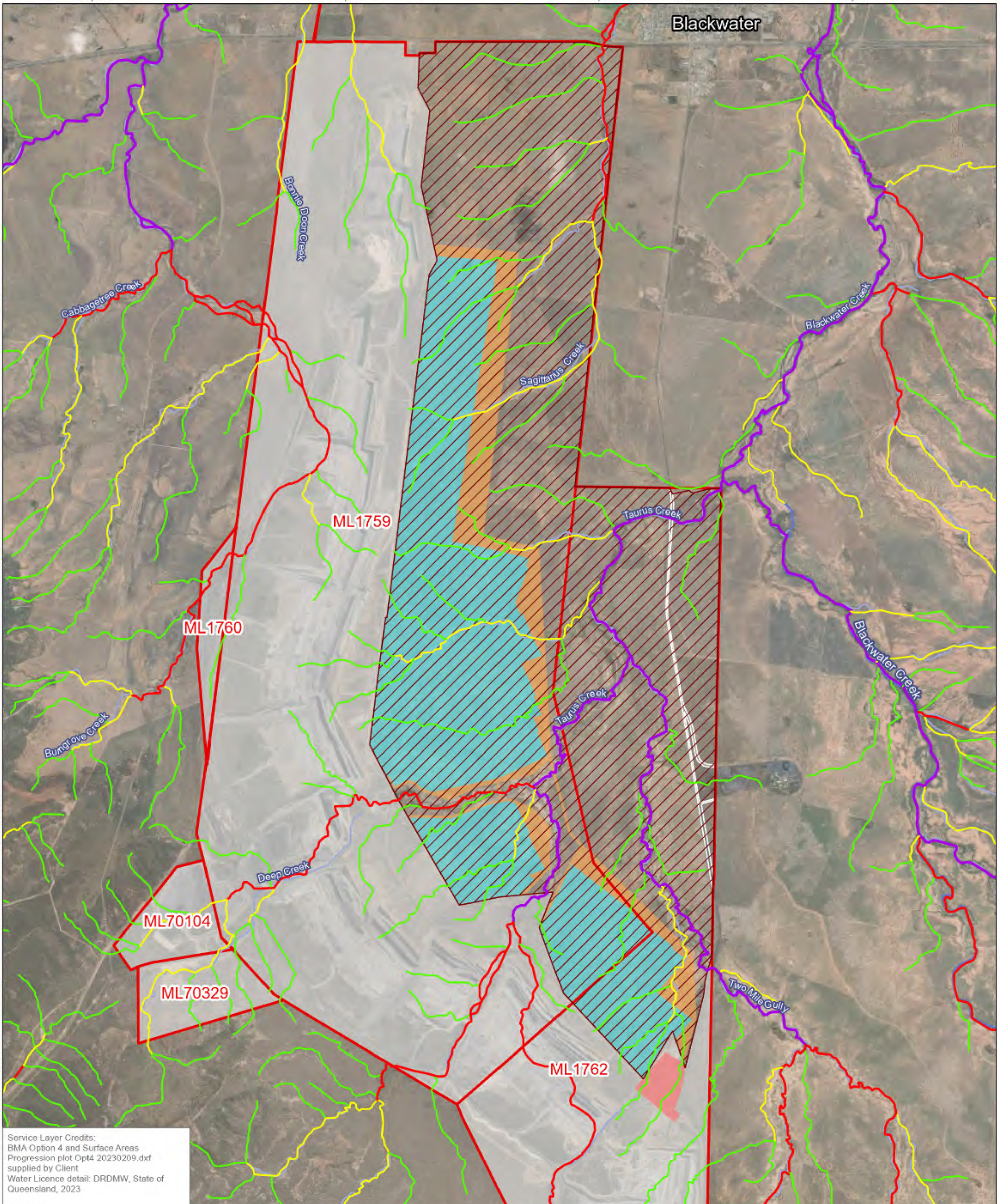
No wetlands in a Wetland Protection Area or Wetlands of High Ecological Significance occur within the Project area or surrounds (**Appendix H**).

Waterways that provide for fish passage under the *Fisheries Act 1994* are also considered MSES. Many species of native fish known from the region migrate upstream and downstream, and between different aquatic habitats, at different stages of their life cycle (Marsden & Power 2007). The waterways in the vicinity of the Project provide temporary habitat and aquatic fauna movement corridors during flow events.

The Department of Agriculture and Fisheries (DAF) *Queensland Waterways for Waterway Barrier Works* mapping indicates the level of 'risk' associated with undertaking waterway barrier works within Queensland waterways with regards to fish passage (DAF, 2023). This dataset represents pre-development conditions and shows waterways which have been affected by mining activities in the region (and therefore does not reflect the current locations of waterways in the area in some instances).

Within and in the vicinity of the Project area (**Figure 13-3)**:

- Two Mile Gully, Taurus Creek and Blackwater Creek are mapped as major risk (purple).
- Deep Creek and Sagittarius Creeks are mapped as moderate risk (amber) to high risk (red).
- Other mapped upstream waterways within the Project area are low (green) to moderate (amber).



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	13-Dec-2023
Drawn by:	NT

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LEGEND

Waterway Barrier Works
- 1 - Low
- 2 - Moderate
- 3 - High
- 4 - Major

- BWM North Extension Project Area
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint
- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

WATERWAY BARRIER WORKS MAPPING IN THE VICINITY OF THE PROJECT

FIGURE 13-3

13.5 Potential Impacts

13.5.1 Aquatic Habitat Modification and Loss

As described in Section 5.2.3, the Project mine plan and footprint have been designed to minimise impacts on aquatic biota and their habitats. This has included avoiding and/or minimising disturbance to the riparian vegetation associated with Deep Creek, Taurus Creek and Two Mile Gully and including a buffer to the riparian vegetation from open cut mining activities. The Project has also minimised creek crossings (number and width) and has selected locations to minimise disturbance.

Notwithstanding, the Project would remove or modify stream order 1 and 2 waterways (**Figure 10-2**) and lacustrine wetlands (i.e. farm dams) located within the Project footprint . The upper tributaries (stream orders 1 and 2) were rated as having low aquatic ecosystem value, while the farm dams were assessed as moderate aquatic ecosystem value as they provide dry season refugia for aquatic flora and fauna (**Appendix I**).

All aquatic habitat and species within this area were considered common to the region, with no aquatic species listed under the EPBC Act or NC Act detected or considered likely to occur (EMM 2023c). While their removal will mean a direct loss of available aquatic habitat, this is not expected to impact aquatic ecology on a regional scale, but rather on a localised scale within the Project footprint.

Removal of waterways and wetlands in the upper catchment also has the potential to reduce or limit aquatic habitat available to fauna (e.g. woody debris, tree roots or undercut banks) in downstream areas (as the source of habitat material is removed), indirectly impacting aquatic fauna. However, while these aquatic habitats (e.g. woody debris and detritus) occur in some areas in the Project area (EMM 2023c), they are generally limited and would likely result in minor impacts to downstream waterways (**Appendix I**).

13.5.2 Fish Passage

The Project will result in the removal of some tributaries within the Project footprint. Waterways within the Project footprint provide low aquatic ecological value and are low stream-order. These waterways are ephemeral, and as such fish habitat and passage is restricted to periods during and immediately following rainfall. During these times, there are several moderate ecological value farm dams in the Project footprint that they provide connectivity to, with the level of connectivity varying for each e.g. on stream and off stream waterbodies. However, these waterways do not connect to important fish habitat upstream, given upstream reaches are within existing active mining areas. As such, the Project would remove these waterways and farm dams providing fish habitat within the Project footprint but would not fragment fish habitat in these waterways as they do not connect to fish habitat further upstream. Mitigation and management measures for the removal waterways and farm dams within the Project footprint are detailed in **Section 13.6**.

There are two waterway crossings associated with the Project:

- A dragline crossing (up to 50 m wide) of Deep Creek, where it is mapped a high (red) waterway barrier works risk waterway.
- An infrastructure crossing of Taurus Creek, where it is mapped a major (purple) waterway barrier works risk waterway.

These waterway crossings have been designed to allow for fish passage.

13.5.3 Water Management Strategy and MAW Releases

As described in Chapter 10, the water management strategy developed for the Project is a continuation of the existing water management strategy, with various water supply upgrades. Clean water captured on site in clean water storages and released to adjacent waterways is expected to have the same water quality as the receiving environment waterways, and therefore, is not expected to pose a significant adverse impact on surface water quality in the receiving environment (**Appendix I**).

No changes to the existing authorised surface water release points or release conditions defined in the EA are proposed (**Appendix E**). The BWM REMP has been developed and implemented to monitor and assess the potential impacts that releases of MAW and associated contaminants have on the receiving environment. Previous REMP results generally indicate water quality is within acceptable limits for slightly to moderately disturbed systems, and sediment and the macroinvertebrate indicators do not show changes downstream of mining that would warrant investigation (Gauge Industrial & Environmental 2013; 2014; 2017; 2021; 2022; Hydrobiology 2016; 2019). Given there are no proposed changes to Schedule F: Water of the EA, changes to water quality from MAW releases are expected within acceptable levels for moderately disturbed systems.

In accordance with the *Environmental Protection Regulation 2019*, the Project has been assessed against Great Barrier Reef discharge standards for industrial activities (**Appendix E**). Under the guideline the release of dissolved inorganic nitrogen (DIN) and fine sediment within waterways that ultimately drain to the Great Barrier Reef must be considered. Overall, DIN load from the system associated with releases is expected to be minimal (**Appendix E**).

Given there are no proposed changes to the existing release points or EA conditions for releases and where the mitigation, management strategies and monitoring for surface water are implemented, potential adverse impacts on surface water quality (and therefore aquatic ecology) of the receiving environment are expected to be low risk (**Appendix I)**.

13.5.4 Surface Water Quality

Without adequate controls in place, potential impacts to surface water quality as a result of the Project include:

- Vegetation clearing and earthworks (e.g. topsoil stripping) may influence bank stability and erosion, which, in turn, can impact water surface quality (particularly turbidity and sedimentation) downstream waterways. Risks are greater during times of high flow (when there is a greater risk of erosion and / or stormwater runoff), and close to the disturbed area, decreasing with distance downstream.
- Surface water runoff from mine affected areas may release contaminants into downstream waterways.
- Dust from mining activities may enter waterways and increase turbidity, sedimentation, nutrients and contaminants (e.g. from mining waste) in downstream and / or adjacent waterways.
- Fuels, oils and other chemicals required for vehicles and equipment used during the Project (including chemicals for blasting) may spill and enter waterways, impacting water quality.
- Uncontrolled release of MAW, which may adversely impact on receiving water quality.

The risk of adverse impacts to the water quality downstream of the Project is minimal where the above management strategies for surface water management are implemented (**Appendix E**). Given this, the risk of potential impacts to aquatic ecological values of the receiving environment as a result of changes to water quality are predicted to be low (**Appendix I**).

13.5.5 Surface Water Run-off of Seepage from Spoil

Where saline or acid mine drainage surface water run-off or seepage during mining activities reaches the receiving environment, potential impacts to aquatic ecology can include (Commonwealth of Australia 2016, Dunlop et al 2005):

- Contamination of water quality and sediment quality.
- Poor health and possible death of fish and other aquatic organisms.
- Reduction of in-stream and riparian vegetation.
- Promotion of noxious plant growth.
- Visual changes to waterways: waterways can become red coloured or unnaturally clear, or introduce precipitates on the surface or water or bank edges.
- Loss of EVs associated with the waterways.

With the implementation of the spoil management and mitigation measures, spoil is regarded as posing a low risk of environmental harm (Terrenus Earth Sciences 2022). As such, adverse impacts to downstream aquatic ecology are not expected.

13.5.6 Flow Regime

Changes to the flood regime, and the timing and magnitude of flows in watercourses, have the potential to directly and indirectly impact aquatic ecosystems (Bunn and Arthington 2002, Poff and Zimmerman 2010, Rolls et al 2012).

The Project has the potential to impact on stream flows due to loss of catchment area draining to local waterways. Catchment area to these waterways is reduced through the Project's activities as disturbed catchment areas are directed to the MAW management or ESC system for capture, treatment, and reuse. The captured catchment will change as the mine develops and has the potential to influence flows in downstream sections of Sagittarius Creek, Taurus Creek, Deep Creek and Blackwater Creek.

Due to the ephemeral nature of the creeks, flows are minimal and infrequent, and as such changes in flow due to catchment loss are minimal (**Appendix E**). The potential impact on water flow in Blackwater Creek at the confluence with Taurus Creek and further downstream at the town of Blackwater is likely to be undetectable (**Appendix E**). Adverse impacts to aquatic ecology from changes in flow as a result of the Project are expected to be low risk (**Appendix I**).

13.5.7 Flood Regimes

Protecting the pits from flood ingress will require the construction of flood protection levees and/or flood protection landforms during operations. The outcomes of the flood modelling are described in Chapter 10.

Potential impacts to aquatic flora and fauna are likely to be restricted to changes in flood levels during rare significant flood events (i.e. when the flood protection levees/ landforms influence stream levels). Given changes in flood regimes are restricted to localised changes in flood levels during rare significant flood events, adverse impacts on aquatic ecology are expected to be minor.

13.5.8 Litter and Waste

Where litter and waste associated with pre-mining activities, vehicle maintenance and mining operations enter aquatic ecosystems they have the potential to directly impact aquatic fauna due to entanglement. They can also indirectly impact aquatic flora and fauna by contributing to the degradation of water and sediment quality.

Where appropriate controls are in place, including the existing BWM Waste Management Plan, Erosion and Sediment Control Plan and EA requirements, the risk to aquatic ecology from litter and spilt waste from the Project is likely to be low.

13.5.9 Proliferation of Aquatic Pests

Increases in invasive species can lead to significant indirect impacts to the community structure and health of aquatic ecosystems through:

- Out-competing native species for resources and space.
- Degrading habitat conditions as a result of feeding behaviors (fish) and growth patterns (plants).
- Reducing water quality (e.g. changing dissolved oxygen levels or increasing turbidity).
- Resulting in the decline and/or displacement of species reducing the overall diversity of the community.

The Project is unlikely to result in the addition of new invasive species of aquatic flora or fauna, or the growth and spread of aquatic pest species as it does not involve the diversion of waterways into adjacent catchments; nor result in additional habitat for invasive species. Given the weed management controls that will be in place, risks are expected to be low.

13.5.10 Aquatic GDEs

Aquatic GDEs have the potential to be impacted by changes in groundwater quality, quantity, and interactions. One aquatic system, Blackwater Creek, (located outside of the Project area to the north-east and downstream) is mapped as an aquatic GDE, having moderate potential for groundwater interaction. While surveys have not been completed in this watercourse, which occurs to the east of the Project area, desktop assessments indicate a moderate aquatic ecological value.

Interference of the alluvial groundwater can occur due to reduced upward leakage from Permian coal measures that are depressurised because of mining activities. Over the extent of Quaternary alluvium along Blackwater Creek, there is a maximum flow reduction of 0.23 ML/day from underlying formation to alluvium as a result of the Project. The scale of change in the alluvium is considered to be very minor (**Appendix F**).

The change in groundwater flow to Blackwater Creek due to the Project was calculated to be approximately 0.01 ML/day over the life of mine. Given the Blackwater Creek is highly ephemeral, the alluvium is not contributing large amounts of water and this reduction due to the Project was considered insignificant and within the bounds of model error (**Appendix F).**

As described in **Chapter 10**, the Project has the potential to impact on streamflow due to loss of catchment area draining to local waterways. The potential impact on water flow in Blackwater Creek at the confluence with Taurus Creek and further downstream at the town of Blackwater is likely to be undetectable (**Appendix E**).

Potential impacts to the aquatic ecology and moderate potential aquatic GDE of Blackwater Creek are expected to be minor.

13.5.10.1 Stygofauna

There are no potential subterranean GDEs mapped within the Project area and no true stygofauna have been found in the vicinity of the Project (with only stygoxenes recorded). Alluvium (where stygofauna are most common) is limited and generally dry in the vicinity of the Project, and water quality (particularly electrical conductivity) is generally outside the range known to support stygofauna communities. As such, aquifers in the Project area have a low likelihood of supporting stygofauna communities, and potential impacts to stygofauna are unlikely (**Appendix I**).

13.5.11 Matters of National Environmental Significance

Direct impacts to waterway and wetland water resources from the Project are restricted to the Project footprint, which includes low stream order and low value waterways and wetlands (farm dams). This is not expected to impact aquatic ecology on a regional scale, but rather on a localised scale within the Project footprint. Potential adverse impacts to downstream waterways, wetlands and aquatic ecosystem function are expected to be low risk as a result of the Project.

No surface expression GDEs occur in the Project area (SLR 2023d). Further downstream, Blackwater Creek is a mapped moderate potential aquatic GDE, however changes to surface water and groundwater from the Project (as described in the sections above) are expected to minor (**Appendix E** and **Appendix F**).

There are no known records of true stygofauna (stygobitic or stygophilic fauna) within or in the vicinity of the Project. Groundwater units in the Project area provide limited suitable habitat for stygofauna due to the limited saturation, limited connectivity, and either unsuitable or only potentially suitable groundwater quality (electrical conductivity levels outside the preferred range for stygofauna). As such, potential impacts to stygofauna are unlikely.

There were no aquatic MNES flora or fauna species recorded within the Project area, and they are highly unlikely to occur given the lack of suitable habitat available.

13.5.12 Matters of State Environmental Significance

The character, resilience and values of waterways and wetlands will be managed and monitored to protect EVs of the receiving environment. Waterways that would be directly removed for mining within the Project footprint are mapped as having low and moderate risk of impact to fish passage in the *Waterway Barrier Works* mapping layer. While the Project would remove these ephemeral low value waterways and moderate value wetlands (i.e. farm dams) providing fish habitat within the Project footprint, it would not fragment fish habitat as they do not connect to fish habitat further upstream.

A dragline crossing over Deep Creek (mapped as high impact to fish passage) will be constructed at bed level to allow fish passage, and crossings will only occur in the dry. The infrastructure crossing of Taurus Creek, which will include a Back Access Road, is located where it is mapped as a major risk of impact to fish passage. The waterway at this crossing is ephemeral, moderate ecological value (with fauna common in the region) and there are existing limitations to fish passage further upstream (onstream dams). Fish passage at this crossing will be maintained by designing culverts in general accordance with the ADR for high-risk waterway barrier works (DAF 2020) and the Department of Transport and Main Roads Drainage Manual (TMR 2023).

The MSES Significant Residual Impact (SRI) assessment for waterways providing fish passage in accordance with the *Queensland Environmental Offsets Policy, Significant Residual Impact Guideline* (DEHP 2014a) concludes the Project will not have a significant impact on fish passage where the appropriate design, management and mitigation measures are effectively implemented (**Appendix I**).

No HES wetlands or HEV waterways are present within the Project area or in the vicinity of the Project. There were no aquatic MSES flora or fauna species recorded within the Project area, and they are highly unlikely to occur given the lack of suitable aquatic habitat. Therefore, no direct or indirect impacts to these species as a result of the Project are expected.

13.6 Mitigation and Management Measures

Further to the Project layout and design measures described in Section 12.5, the measures outlined in **Table 13-1** will be implemented to minimise potential impacts on aquatic biota on aquatic ecology.

Table 13-1: Aquatic ecology mitigation and management measures

Impact	Mitigation Measures
Aquatic Habitat Modification and loss	• Avoiding disturbance to major waterways (stream order 3 and above) of Deep Creek, Sagittarius Creek, Two Mile Gully and Taurus Creek; the Project will also avoid disturbance to riparian areas. • Salvage and translocate large native aquatic fauna (e.g. fish and turtles) from wetlands (i.e. farms dams) prior to removal, where possible. • Limiting the area disturbed at any one time by careful mine stage planning, which minimises the area of the overall disturbed landform (notably the area of the operating pits). • Progressive and timely re-instatement and rehabilitation of the disturbed landform consistent with the rehabilitation criteria in the BWM EA.
Fish passage	• Mitigation and management measures for the removal waterways and farm dams within the Project footprint, as described above. • Taurus Creek Back Access Road crossing will be designed in general accordance with the ADR for high (red) risk Operational Work that is Constructing or Raising Waterway Barrier Works (DAF 2020) and will be consistent with the Department of Transport and Main Roads Drainage Manual (TMR 2023). • Construction of the dragline crossing will be at bed level (with no culverts) and will allow for fish passage. Construction and crossing events will not be scheduled to occur during wet weather or stream flow. • When equipment is required to cross creeks, temporary ‘bed and banks’ disturbance permits are issued by the BWM site environment team, which outline the requirements to minimise impacts to environmental values associated with the particular creek and its surrounds. • Key management plans will be implemented to manage waterways, including the BWM Water Management Plan and BWM Erosion and Sediment Control Plan, and impacts to downstream water quality and aquatic ecology will be monitored in accordance with the BWM EA REMP conditions. • Progressive rehabilitation of the disturbed landform, with a final landform that will be stable and flood flows will be free draining (**Appendix E**).
Water management strategy and MAW releases	• The existing water management strategy includes the separation and management of clean and MAW/sediment-laden water catchments (**Appendix E**): - Where possible, stormwater runoff from undisturbed areas both on and surrounding the mine site is diverted away from disturbed areas into adjacent waterways as part of normal overland flow.

Impact	Mitigation Measures
	- Disturbed area runoff is captured and treated in sediment/environmental dams and used preferentially for dust suppression and coal processing to minimise the likelihood of offsite water discharges. - MAW is captured and treated in the BWM water management system where it is then transferred to be preferentially used for process water or dust suppression. If required, it is discharged off-site in compliance with the BWM EA. • The existing Mine Water Management Plan will be expanded to incorporate the Project. • The current REMP/FRREMP and associated water quality monitoring program will continue for the Project in accordance with the EA. The program is designed to ensure the water management plan is effective, to demonstrate compliance with the discharge limits in the EA, and to ensure the downstream water quality is not being adversely impacted. • Progressive rehabilitation will be undertaken to reduce the amount of disturbed area.
Surface water quality	• The BWM Water Management Plan and BWM Erosion and Sediment Control Plan will be reviewed and updated, where necessary, to include the Project to manage water on site and erosion and sedimentation. Appropriate sediment control measures (e.g., sediment fences and sediment filters) will be established as required to reduce the amount of runoff from disturbed areas in accordance with the BWM Water Management Plan and BWM Erosion and Sediment Control Plan. • Construction of any temporary waterway crossings will occur over the dry season to minimise soil disturbance on adjacent waterways. • Areas which are not required for the ongoing operation of the Project will be rehabilitated as soon as practicable to reduce exposed soils. • Fuel, dangerous goods and hazardous chemicals will be managed as outlined by current standards, guidelines and in compliance with statutory requirements. Refuelling facilities, bunding or storage facilities for hydrocarbons and chemicals will be in appropriately designed sites and comply with Australian Standards (e.g. AS 1940: The storage and handling of flammable and combustible liquids). • The existing BWM spills and emergency response procedures will be implemented for the Project. Spill recovery and containment equipment will be available when working adjacent to sensitive drainage paths and within other areas, such as workshops. Fuels and chemicals will not be stored or handled within 200 m of waterbodies. Personnel will receive appropriate spill clean-up training. Vehicles and equipment will be maintained to minimise risk of spill or leakage. • Dust management measures will continue to be implemented at the BWM and dust suppression implemented such as wetting down dirt roads. Release of dust and / or particulate matter from the mining activities at BWM will be managed under the EA and BWM Air Emissions Management Plan. • Continued water quality monitoring in accordance with the EA REMP/FRREMP condition to ensure downstream water quality is not being adversely impacted. • Following mine closure, the BWM Progressive Rehabilitation Closure Plan (to be developed) will incorporate management measures to reduce the impacts on receiving environment water quality.

Impact	Mitigation Measures
Flow regime	• Limiting the area disturbed at any one time by careful mine stage planning, which minimises the area of catchment loss. • Progressive and timely re-instatement and rehabilitation of the disturbed landform, with a final landform that will be stable and flood flows will be free draining. • Design and construct the levee and waterway crossings to minimise impacts to water flow and surface water hydrology.
Litter and waste	• The existing BWM Waste Management Plan will be reviewed and updated as required to manage waste produced by the Project.
Proliferation of aquatic pests	• Weed management (prevention, monitoring and control) will be undertaken to mitigate the abundance and species of weeds. Weed hygiene protocols will continue to be implemented using the dedicated vehicle and machinery cleaning bay located at the mine infrastructure area.
Changes to Groundwater	• Groundwater quality will continue to be managed in accordance with the existing EA (management of MAW and seepage). • A routine groundwater monitoring program and criteria to protect environmental values is implemented in accordance with the existing EA. The groundwater monitoring program will continue for the life of the Project.
Final landform	• The final landform will be safe, stable and non-polluting.

14 Waste Management

14.1 Introduction

Waste generated by the Project will be managed as per Schedule D: Waste of the EA and the existing BWM Waste Management Plan (WstMP). The BWM WstMP was prepared in accordance with Condition D1 of the EA.

The objective of the BWM WstMP is to minimise adverse impacts on environmental values such as, the health and wellbeing of site personnel, the diversity of ecological processes and associated ecosystems surrounding the BWM and other environmental factors including land, surface water, groundwater and air quality. Waste generated by the Project will be managed in the same way. As such the existing BWM WstMP is adequate to continue management of waste streams at the BWM and the Project, as provided by Condition D2 of the EA.

The following subsections provide an assessment of the waste management aspects for the Project, including the identification of waste streams, regulatory framework and outlines existing waste management strategies employed under the BWM WstMP.

14.2 Waste Management Objectives

The following waste management objectives have been established for BWM and these will apply to the Project:

- Minimise waste-related adverse effects for the integrity and function of the air, land and water environmental values.
- Minimise the generation of waste through applying the avoidance, minimisation, and mitigation principles to reduce, reuse, recycle, treat, and dispose of waste.
- Ensure safe management and disposal of waste that cannot be reused or recycled.

14.3 Waste Management Strategy

Environmental harm may occur if wastes are not managed properly, especially where there is the potential for waste to cause land, surface water, and/or groundwater contamination. The waste management strategy proposed for the Project will be consistent with Schedule D: Waste of the EA and the BWM WstMP and will incorporate the continued operation, decommissioning and closure phases. Waste planning for the Project will allow for flexibility in the management of all wastes likely to be generated.

Under Schedule D of the EA, disposal of certain waste streams is permitted within specified features and/or on relevant MLs. Under EA conditions D6, D7 and D8, disposal per waste type is permitted as follows:

- In spoil emplacements, in regulated structures in accordance with Schedule G: Structures of the EA, in pits or voids, and in dedicated rejects emplacements:
  - Rejects and sediment containing hydrocarbons.
- In regulated structures in accordance with Schedule G: Structures of the EA, and in pits or voids that are not regulated structures, provided a consequence category assessment in accordance with condition G1 has been completed:
  - Tailings and water or sediment containing hydrocarbons.

- In pits or voids, in spoil emplacements, and left in situ below ground level within MLs listed on the EA:
  - Bulk rubber.
  - Inert waste.
  - Poly-pipe and other plastic.
  - Fibreglass.
  - Treated and untreated timber.
  - Asphalt.
  - Asbestos.
- The disposal of general waste on the site (within the MLs listed on the EA) with the location of the disposed inert waste recorded (inGDA94 coordinates).

In addition, Condition D4, Schedule D of the EA provides for waste reprocessing of:

- Spoil or overburden.
- Vegetation.
- Water or sediment containing hydrocarbons.
- Fuels, oils, lubricants and coolants.
- Bulk rubber.
- Inert waste.
- Poly-pipe and other plastic.
- Fibreglass.
- Treated and untreated timber.
- Asphalt.

Condition D5, Schedule D of the EA requires that unless otherwise specified in Conditions D6 to D8 (inclusive), waste, other than spoil or overburden or vegetation removed as part of the mining activity, must not be disposed of within the MLs listed on the EA and must be taken to a facility that is lawfully allowed to accept such waste under the provisions of the EP Act. Accordingly, waste that cannot be reprocessed or disposed of as per the EA will be transported off-site by a licenced waste management contractor to a licenced waste disposal facility.

14.4 Waste Management Plan

The BWM WstMP uses the waste management hierarchy as a framework for prioritising waste management practices to achieve the best environmental outcome. The production of waste is avoided where practicable on-site. However, where the production of waste is unavoidable, waste re-use is the preferred option, followed by waste recycling and finally disposal. The waste management hierarchy is presented in **Figure 14-1**.

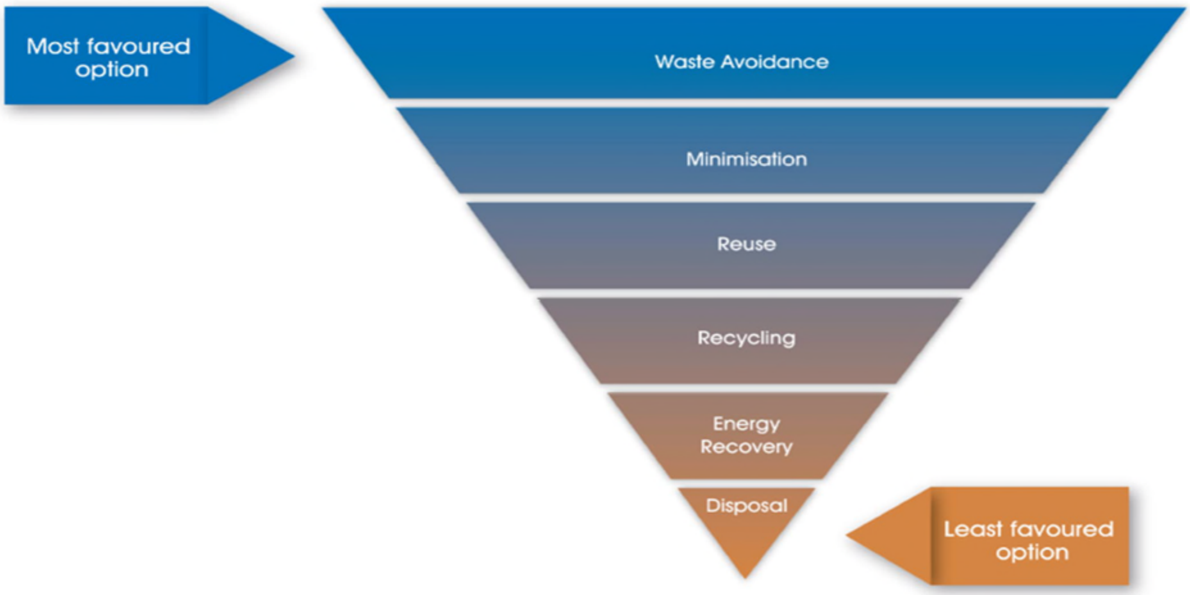

Figure 14-1: Waste management hierarchy

14.4.1 Waste Avoidance and Minimisation

The BWM WstMP avoids and reduces wastes at BWM in a variety of ways as outlined below:

- Bulking up – materials such as lubricants, chemicals and other high use materials are purchased and stored in bulk to reduce associated packaging waste.
- Rationalisation Programs – where product varieties are restricted and consequently the number of different waste streams reduced.
- Materials Tracking Programs – enables the tracking of material usage and distribution to assist with the identification of inefficiencies and development of strategies to reduce material usage.
- Compaction – most general waste produced on-site is compacted prior to disposal by the waste contractor.

One of the largest sources of waste is the various packing materials, which accompany equipment and material shipped to site. Shipping and packing specifications at BWM require packing materials to be minimised and, where unavoidable, the use of environmentally responsible packaging materials. Additionally, the choice of returnable containers, reusable packing material and biodegradable materials is preferred over synthetic, non-recyclable packing material.

14.4.2 Waste Segregation

Waste segregation will apply to the management of all waste streams for the Project, as per the existing BWM WstMP. Segregation will occur at the point of generation and will cover the handling and removal of a variety of wastes. For example, paper, cardboard, metal cans and plastics carrying the recycle symbol will be segregated for recycling. Maintaining segregation of different types of waste during generation, storage or transportation, makes recovery achievable.

The waste that is generated can be separated into the following main groups: general waste, recycled waste, regulated waste, scrap metal and used scrap tyres. Segregation of these waste streams at BWM involves the use of colour-coded and signed bins and waste storage locations. Separate skips are provided to maintain segregation and maximise economic reuse and recycling, in preference to disposal to landfill. Additionally, BWM's waste contractors also operate an on-site waste transfer station which facilitates the *in-situ* sorting of waste prior to disposal off-site.

14.4.3 Waste Reuse, Recycle and Recovery

Waste reuse, recycling and recovery measures at BWM include water conservation, treatment and reuse, efficient energy usage and classification and sorting of general wastes. General wastes are classified and sorted into the following categories:

- Timber, lumber and wood.
- Steel/iron.
- Plastics labelled for recycling.
- Tyres.
- Paper and carton.
- Used oil.

BWM also has several disposal processes in place which assist with waste recycling and recovery. These include:

- Used oil filters are taken to an off-site licenced waste management facility, where they are shredded.
- Excess oil is recovered and sold as waste oil.
- Waste oil, transported by a licenced waste management contractor, is put through filtering and dehydration processes and partially recycled as fuel oil.
- Grease, oily rags and blackjack is consolidated on-site in 205L drums and transported to an off-site licenced waste management facility.
- Segregated regulated waste is transported to an off-site licenced waste management facility where it is buried in bioreactor landfill cells which accelerate the decomposition process. Degrading waste produces methane which is captured through a network of pipes and fed to the power station. Specially designed engines utilise the gas as a fuel source, generating electricity which is used to power homes and businesses in the region.
- Scrap metal is stored on-site and sold to scrap metal merchants under the supervision of the waste contractor.
- Recycled waste is transported to an off-site licenced waste management facility located in Rockhampton for consolidation and processing.
- Use of reject rock within ramp access roads as road base (with cap placed on top).

14.4.4 Waste Disposal

Waste generated on-site during the operational and decommissioning phases that cannot be recycled, reused or disposed of at BWM under the EA will be transported off-site to an alternate licenced waste disposal facility. All wastes transported from the site will be transported by licensed waste transport carriers.

14.5 Waste Production

Waste generated from the Project will be managed under the BWM WstMP and will generally comprise waste from vegetation clearing and site preparation activities such as stripping, general waste streams and regulated wastes. Key waste producing activities, potential waste produced, potential impacts and disposal/control methods are summarised in **Table 14-1**.

14.6 Summary of Mitigation Measures and Commitments

A summary of the waste management mitigation measures and commitments is provided below:

- Waste streams will be identified and minimised.
- All waste generated on-site will be disposed of in accordance with the EA and BWM WstMP.
- The BWM WstMP will be revised and updated, if required, in accordance with the conditions of the EA.
- Contracts with external companies will place responsibility on all contractors to adopt best practice waste minimisation procedures.
- Waste monitoring and auditing will be undertaken.
- Training will be provided to personnel and contractors in relation to waste management requirements and practices.

14.7 Conclusion

Waste will be managed to avoid adverse impacts on the life, health and wellbeing of people and the diversity of ecological processes and associated ecosystems surrounding the Project. Wastes will be managed as per Schedule D of the EA and the BWM WstMP.

The current EA, and specifically the conditions relevant to the management of waste at BWM, is appropriately conditioned for management of the current operations. In addition, these conditions are also appropriate to management the potential impacts from the Project. Further, the BWM WstMP will be reviewed and updated, as required, to capture changes to waste streams and waste management requirements.

BWM will continue to maintain segregation of different types of waste during generation, storage and transportation. The appropriate management and storage of wastes will prevent on-site and off-site pollution and enhance opportunities for reuse and/or recycling. All waste streams will be assessed for potential reuse, prior to transport to an approved waste disposal facility.

Table 14-1: Waste generation and potential impacts

Mining activity	Waste type	Potential impacts	Disposal/Control measures
Ancillary infrastructure (roads, landscaping, fencing, buildings, power lines).	Asbestos.	Contamination of soil / water. Impact on aquatic ecosystems and risks to human health and safety.	Disposal - managed by a licenced waste management contractor. The waste contractor will provide skips for the purpose of removing the material from site to a licensed waste facility. Disposal is required to be undertaken as per the *BWM Coal Standard Operating Procedure Asbestos* which references the *How to Safely Remove Asbestos Code of Practice 2011* as well as the *Safe Removal of Asbestos 2nd Edition (NOHSC: 2018 (2005)), National Codes of Practice.*
	Contaminated soil.	Pollution of soil, groundwater, or surface water. Increased costs to manage the clean-up of incorrect disposal.	Contaminated soil is collected immediately and stored in drums or other containers (ensure these are labelled). These containers / drums are transported to the designated waste management compound (or similar) which are then taken off-site by the licenced waste management contractor. Alternately, contaminated soil may be disposed of on-site in a designated location in consultation with BWM's Health Safety and Environment (HSE) Department.
Ancillary infrastructure (roads, landscaping, fencing, buildings, power lines). Maintenance activities (equipment and infrastructure). Site facilities (offices, cribs, kitchens, bathhouse,	Chemicals (e.g. Solvents and paints).	Spill to land and/or water resulting in contamination. Impact on aquatic ecosystems. Risks to human health and safety.	Disposal - labelled and disposed of as per the Safety Data Sheet (SDS) disposal requirements. Chemicals are stored in the designated area within the site's waste management compound (or similar) prior to disposal by a licenced waste management contractor at a licensed waste management facility.

Mining activity	Waste type	Potential impacts	Disposal/Control measures
treatment plants, cleaning).			
Ancillary infrastructure (roads, landscaping, fencing, buildings, power lines). Coal mining. Maintenance activities (equipment and infrastructure).	Scrap steel.	Increased volume of waste going to landfill instead of being recycled. Lost opportunity for resource reuse/recycling if product is disposed.	Reprocessing - placed in the designated scrap steel skip bins outside workshop facilities. Bulk steel is placed in a designated area until a licenced waste management contractor can remove the material.
Maintenance activities (equipment and infrastructure). Pre-strip / overburden removal.	Water or sediment containing hydrocarbons.	Pollution of soil, groundwater, or surface water (e.g., through accidental spills or releases). Increased costs to manage the clean-up of accidental spills.	Contaminated water captured via drains, sumps and bunds are pumped out by a licenced waste management contractor and passed through an oil water separator system and water reused via the mine water management system. Silt / sediment removed from sediment basins regularly by a licenced waste management contractor and disposed of in consultation with the HSE Department on-site in designated facility. Contaminated soil is to be collected immediately and stored in drums or other containers (ensure these are labelled). These containers / drums are to be transported to the designated waste management compound (or similar) which are then taken off-site by a licenced waste management contractor. Alternately, contaminated soil may be disposed of on-site in a designated location in consultation with the HSE Department.
Maintenance activities	Regulated waste - oily rags, hoses, gloves, hydraulic hoses.	Pollution of soil, groundwater, or surface water.	Disposal - Placed in designated regulated waste bins and transported off-site by a licenced waste management contractor.

Mining activity	Waste type	Potential impacts	Disposal/Control measures
(equipment and infrastructure).	Ozone depleting substances (ODS). Applicable examples of ODS include chemical refrigerants and fire extinguishers (e.g., Halons, CFCs and HCFCs).	Depletion of the ozone. Contamination of air. Risks to human health or safety.	Disposal - in accordance with the *Environmental Protection Regulation 2019*, all ODS are to be captured by a qualified person and disposed of at a licenced facility. Equipment containing ODS is to be labelled with a sticker identifying the specific substance.
	Polychlorinated biphenyls (PCB).	Bioaccumulation in fauna. Spill to land and/or water resulting in contamination. Incorrect disposal. Potential non-compliance. Risks to human health or safety.	Disposal - if waste containing PCBs is verified, disposal will be arranged by a licenced waste management contractor. All sources of PCBs have been removed where known from the BWM, for example old transformers. However, if it is suspected that PCBs may be present in any materials the HSE Department will be notified. The HSE Department will investigate and manage each reported location of PCBs on a case-by case basis.
	Bulk rubber (tyres).	Increased volume of waste going to landfill. Groundwater aquifer impediment.	Disposal - taken to the designated on-site tyre disposal area. Refer to the BWM QLD Coal Tyre Storage and Disposal Procedure.
	Grease, oil, coolant, oil filters.	Spill to land and/or water resulting in contamination. Potential non-compliance Impact on aquatic ecosystems. Risks to human health or safety. Increased volume of waste going to landfill instead of being recycled. Increased volume of waste being disposed of as regulated waste.	Reprocessing – collected / stored in designated containers at waste management compound and transported off-site by a licenced waste management contractor. Alternatively transferred into the MIA's bulk waste oil tank for use on-site in blasting operations. Oil filters - reprocessing - following draining of excess fluid used oil filters are placed in designated blue bins located at workshops and service bays. These bins are collected by a licenced waste management contractor and disposed of at a licensed waste management facility.
	Vehicle batteries.	Contamination of soil / water. Risks to human health or safety.	Reprocessing - placed in the designated areas, collected by a licenced waste management contractor and recycled/disposed of at a licensed waste management facility.

Mining activity	Waste type	Potential impacts	Disposal/Control measures
Maintenance activities (equipment and infrastructure)	Polypipe.	Consumption of landfill space.	Reuse or disposal - On-site reuse or removed from site by a licenced waste management contractor for disposal at a licensed waste management facility.
Pre-strip / overburden removal	Spoil/overburden.	Contamination of soil and/or water.	The preferred management of saline spoil is sufficient encapsulation within suitable inert spoil within a waste landform. The preferred management of dispersive spoil is sufficient encapsulation within suitable inert spoil within a waste landform. Areas subject to erosion and sedimentation are to be managed in accordance with the requirements of the EA and the BWM Erosion and Sediment Control Plan.
Coal rejects	Coal rejects.	Contamination of soil and/or water.	Coal rejects are managed in accordance with the EA.
Receiving goods / warehouse.	Other non-recyclable packaging.	Impact/harm to fauna from ingestion. Increased volume of waste going to landfill.	Disposal - disposed in designated bins. The contents of the bins are transferred to the industrial bins which are then emptied by a licenced waste management contractor directly to the designated landfill on-site.
	Timber packaging.	Increased volume of waste going to landfill instead of being recycled. Lost opportunity for resource reuse/recycling if product is disposed.	Disposal - collected in the designated skip bins and taken to the designated waste timber disposal area (which includes disposal of other waste timber).
	Recyclable packaging.	Increased volume of waste going to landfill instead of being recycled. Lost opportunity for resource reuse/recycling if product is disposed.	Reprocessing - disposed of in the designated bins which are taken off-site by a licenced waste management contractor to a licensed waste management facility.
Site facilities (offices, cribs, kitchens, bathhouse,	Clinical waste (regulated waste).	Risks to human health or safety.	Disposal - used medical supplies stored in lockable bins which are taken off-site by a licenced waste management contractor.
	Food scraps, non-recyclable plastics.	Attracts feral animals.	Disposal - disposed of in designated bins. The contents of the bins are transferred to the industrial bins which are

Mining activity	Waste type	Potential impacts	Disposal/Control measures
treatment plants, cleaning).		Encourages non-natural feeding patterns in native animals. Consumption of landfill space. Pollution of soil, groundwater, or surface water.	emptied by a licenced waste management contractor directly to the designated landfill on-site.
	Sewage/sludge.	Pollution of soil and surface water (e.g., through accidental spills or releases). Risks to human health or safety.	Disposal - treated at the on-site sewerage treatment plant. Treated sludge is removed off-site by a licenced waste management contractor. Sludge or septic waste that is generated in-field shall be pumped out by the licenced waste management contractor and taken to the on-site sewage treatment plant for processing.
	Batteries.	Contamination of soil / water. Potential harming of wildlife.	Reprocessing - office batteries are placed in battery boxes which are recycled/disposed of at a licensed waste facility.
	Recyclables – paper, cardboard, plastic, glass.	Increased volume of waste going to landfill instead of being recycled. Lost opportunity for resource re-use/recycling if product is disposed.	Reprocessing - disposed of in designated bins which are taken off-site by a licenced waste management contractor to a licensed waste management facility.
Wash plant / CHPP.	Bulk rubber (conveyors).	Groundwater aquifer impediment. Risk of tyres re-surfacing if not disposed of as deep in the spoil as possible.	Disposal - taken to the designated tyre disposal area. Refer to BWM QLD Coal Tyre Storage and Disposal Procedure.

15 Environmental Authority Amendments

This chapter sets out the proposed amendments to the BWM EA conditions.

15.1 EA Condition E23

EA Condition E23 currently states:

Mining activities other than the following are prohibited within SA 10 on ML1759 and SA 7 on ML1762.

a) detailed resource drilling and infill seismic work;

b) watercourse diversion and associated works as per Figure 1 (Deep Creek Diversion Staging);

c) access track as per Figure 2 (Access Track on ML1759 (SA10)); and

d) access roads, fences, above-ground pipelines, low-impact telecommunications facilities, transmission grid works and supply network works, laydown, environmental monitoring, soil testing, and other similar minor disturbance.

This condition was originally drafted when Surface Area rights were secured for SA10 on ML1759 and SA7 on ML1762 in 2014 under the MR Act – for exploration activities only, noting a minor amendment to the condition was made subsequently to allow for other minor activities as conditioned in E23. BMA now seeks to start mining in these areas.

This EA Amendment application seeks to authorise the extension of open cut mining and related activities to within SA10 (ML1759) and SA7(ML1762) under the EP Act.

It is proposed the EA be amended through the deletion of Condition E23.

15.2 EA Condition I1

EA Condition I1 (Groundwater) currently states:

Groundwater, affected by the mining activities, must be monitored at the locations and frequencies defined in Table I1 (Groundwater Monitoring Locations and Frequencies).

As described in Chapter 11, the groundwater monitoring locations in Table I1, Schedule I of the EA are in the process of being revised in consultation with DES for the existing BWM. The currently proposed monitoring locations and frequency are provided in **Table 11-4** (**Chapter 11**, Groundwater). It is proposed that Table I1 be reviewed and revised to incorporate the Project if necessary.

15.3 EA Condition I2

EA Condition I2 currently states:

If the groundwater investigation trigger levels defined in Table I2 (Groundwater Contaminant Trigger Levels) are exceeded, the environmental authority holder must complete an investigation into the potential for environmental harm and notify the administering authority with twenty-eight (28) days of receiving the analysis results.

Table I2 (Groundwater Level and Contaminant Trigger Levels) are in the process of being developed in consultation with DES for the existing BWM. It is proposed that Table I2 be reviewed and revised to incorporate any additional bores to monitor impacts from the Project, if necessary.

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Glossary

Glossary of terms	
General Terms	
BMA	BM Alliance Coal Operations Pty Ltd (BMA) (entity) BMA operates seven Bowen Basin mines (Goonyella Riverside, Broadmeadow, Daunia, Peak Downs, Saraji, Blackwater and Caval Ridge) and the Hay Point Coal Terminal near Mackay on behalf of the Central Queensland Coal Associates Joint Venture (CQCA JV). The Project proponent is BMA, as manager and agent on behalf of the Central Queensland Coal Associates Joint Venture (CQCA JV) and South Blackwater Coal Pty Limited.
BWM	The Blackwater Mine located on Mining Leases (ML) 1759, ML1760, ML1761, ML1762, ML1767, ML1771, ML1772, ML1773, ML1792, ML1800, ML1812, ML1829, ML1860, ML1862, ML1907, ML70091, ML70103, ML70104, ML70139, ML70167 and ML70329.
Location	The main infrastructure requirements for the BWM are located approximately 20 kilometre-s (km) south of Blackwater in the Bowen Basin, Queensland. The northern boundary of the BWM is located approximately six (6) km west of Blackwater.
Drainage feature	Determined by the Department of Natural Resources, Mines and Energy under the *Water Act 2000* (Qld) as 'not a watercourse.'
The EA	The Environmental Authority for the BWM (No. EPML00717813, current version dated 29 June 2023).
EA Amendment	Environmental Authority Amendment – Major Amendment under the *Environmental Protection Act 1994* (Qld).
ERA	Environmentally Relevant Activity for which the Environmental Authority authorises under the *Environmental Protection Act 1994* (Qld).
ML	Approved Mining Lease under the *Central Queensland Coal Associates Agreement Act 1968* (Qld) or the *Mineral Resources Act 1989* (Qld).
MNES	Matters of National Environmental Significance are prescribed under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth).
MSES	Matters of State Environmental Significance are defined by Schedule 2 of the *Environmental Offsets Regulation 2014* (Qld) and include multiple prescribed environmental matters under Queensland legislation (and associated subordinate legislation and policies) including: *Nature Conservation Act 1992* (Qld)*, Vegetation Management Act 1999* (Qld), *Environmental Protection Act 1994* (Qld), *Regional Planning Interests Act 2014* (Qld), *Marine Parks Act 2004* (Qld), *and Fisheries Act 1994* (Qld).
The Project	The **Blackwater Mine - North Extension Project (the Project)** is located in the eastern extent of ML 1759 and northern extent of ML 1762.
Project area	The 'Project area' is defined as the area which encompasses the Project and its immediate surrounds.
PMST	Protected Matters Search Tool used to identify matters protected under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) that have the potential to occur in the Project area or surrounds.

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Prescribed environmental matter	A prescribed environmental matter is either a MNES, MSES and/or a matter of local environmental significance.
RE	A Regional Ecosystem is a vegetation community in a bioregion that is consistently associated with a particular combination of geology, landform and soil. Regional Ecosystems are described in the Regional Ecosystem Description Database, produced by the Queensland Herbarium.
Regulated vegetation	Vegetation that is mapped within the regulated vegetation management map produced by DNRME. Regulated Vegetation is managed under the *Vegetation Management Act 1999* (Qld).
Rejects	Rejects means: a) breaker rejects; or b) coarse rejects; or c) mid/fine size rejects; or d) tailings that have been dewatered; or e) any combination of rejects (under any of paragraphs a to d).
Tailings	Tailings means fines from mineral processing that have not been dewatered.
SA	Approved Surface Area, authorising mining activities within a Mining Lease, under the *Central Queensland Coal Associates Agreement Act 1968* (Qld) or *Mineral Resources Act 1989* (Qld).
SPRAT	Species Profile and Threats database provides information about species and ecological communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth).
The study area	The study area is defined by the geographic limits of the environmental impact assessments. The study area for each technical study is defined within the relevant technical report.
TEC	Threatened Ecological Community listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth).
Threatened species	Critically Endangered, Endangered and Vulnerable species under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) and Endangered, Vulnerable or Near Threatened (EVNT) species under the *Nature Conservation Act 1992* (Qld).
Watercourse	As defined under section 5 of the *Water Act 2000* (Qld).
LA1	The A-weighted noise level exceeded for 1% during any given measurement period
LAeq	The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.
Uncertain UC	In the context of classifying a material (sample) as NAF or PAF. An ‘Uncertain’ classification (UC) applies when there is an apparent conflict in results such that neither NAF nor PAF classification can be given, or there is insufficient information to unequivocally classify as NAF or PAF. Uncertain samples are sometimes given a tentative

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	sub-classification, such as UC(NAF) or UC(PAF) where preliminary data suggests the sample may be NAF or PAF, respectively.

Appendices